BETTER CROPS V

The Pocket Bo

TABLE OF CONTENTS

JANUARY 1949

FEBRUARY 1949

MARCH 1949

APRIL 1949

MAY 1949

H PLANT FOOD

ıf Agriculture

January 1949 to December 1949

JUNE–JULY 1949

AUGUST–SEPTEMBER 1949

OCTOBER 1949

NOVEMBER 1949

DECEMBER 1949

Better Crops with PLANT FOOD

January 1949 — 10 Cents

The Pocket Book of Agriculture

Better Crops *with* PLANT FOOD

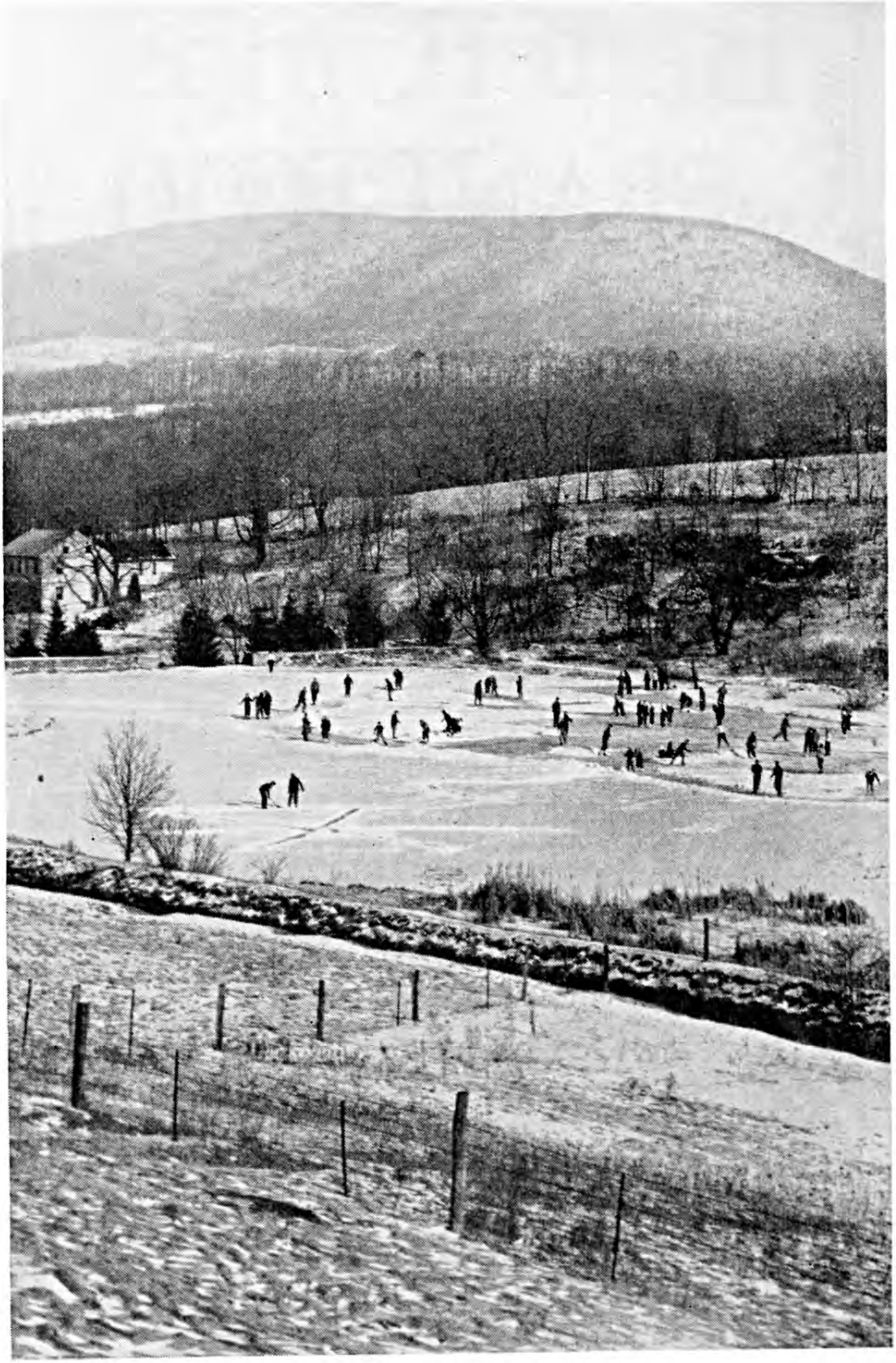
The Whole Truth—Not Selected Truth
R. H. Stinchfield, *Editor*
Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 1

Table of Contents, January 1949

The American Potash Institute, Inc.
1155 16th Street, N. W., Washington 6, D. C.

**Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America**



A country pond provides good skating.

Better Crops with PLANT FOOD

Published by the American Potash Institute, Inc., 1155 Sixteenth Street, N.W., Washington 6, D. C., Subscription, $1.00 for 12 Issues; 10¢ per Copy.

Vol. XXXIII WASHINGTON, D. C., JANUARY 1949 No. 1

A Tribute to . . . .

Farm Listening Posts

Jeff McDermid

FAR less publicity has been given through the years to agriculture's constructive "spies and informers" than to the nation's traitorous and subversive ones. Yet there is room for such an "investigation" when we are celebrating the completion of the greatest production of field crops and fruits in the history of the country.

From the volunteer farmer's note-book of neighborhood observations to the final signature of the Secretary of Agriculture behind locked doors and sealed windows in Washington runs a vital chain of monthly crop information, the like of which and the promptness and volume of which exist nowhere else in the world. The facts served up regularly to 148,000,000 food consumers in the United States are the work of only about 250,000 persons, or 1 in every 592 individuals of the population.

The year 1949 marks the 86th anniversary of the first United States official crop report, put out by Isaac Newton, chum and chess companion of Abraham Lincoln; and also of the no less important 32nd anniversary of the origin of the State-Federal cooperative crop reporting service, begun in Madison, Wisconsin, and now embracing 41 state or area offices linked to the Bureau of Agricultural Economics and its Crop Reporting Board.

The first national crop report of 1863 was a meager one of eight pages. It merely recited in a sketchy way the appearance or condition of the crops and estimated their acreage in fractions more or less compared with the year before. Contrast that humble little document with the average monthly turnout of today, cooperatively prepared by state and federal specialists, with detailed state and regional tables and discussions covering 70 pages or more. What would Uncle Isaac have said about the 1948 annual U. S. crop review wherein the cereals harvested amounted to about 180 million tons? Probably they couldn't count up to a million in those days, either in fact or imagination, and the mathematical chore of totaling such monstrous weights and measures would have been utterly beyond their capacity. Moreover, nobody would have believed them, had they done it.

This modern trust and reliance upon the factual data dished up by the knowing sleuths of the fields are just as remarkable in their way as the gathering of the data. But if there is any criticism heard as the crop report echoes die away, it usually pertains to the understatement aspects of a crop failure or a record harvest. That is, there will be grumbling that the good news wasn't made good enough or the bad news wasn't overstated, rather than the reverse.

RIGHT here it's fair enough to paraphrase a familiar quotation of some sage about foods. It has been said that "digestion waits on appetite and health on both." Just as truly might it be recited that "good judgment waits on information and success on both." The cycle of good judgment runs from the single farmer or groups of farmers scanning the stubble fields and the haylands through the mazes of the crop estimate right down to its publication—and then, of course, such facts aid the farmer again to use the sound judgment in planting and harvesting which spells his season's results, barring accident or natural disaster. Thus there is a chain of wisdom and experience hitched to the drive wheels of agricultural industry, ready to receive oil or fuel, and ready to slow down or accelerate. If we had no crop report there would be something far greater missing than jobs for so-called "bureaucrats."

One criticism of the far-flung crop reports which we used to hear bruited about is something that seldom "crops up" today. I refer to the remark by one of my old Germanic farmer friends of the Midwest in days of considerable yore that "we don't need them there farm staticks any longer and should quit putting them out. They joost give them darn middlemen and speculators a chance to gamble mit our profits."

Today with agriculture connected firmly to industry, commerce, labor, and consuming households, as well as starving foreigners, we know that blind guesswork is a menace. We need only to dig up that historic statement that went with the nation's first crop report:

"Ignorance of the state of our crops," said Uncle Isaac, "invariably leads to speculation, in which oftentimes, the farmer does not obtain just prices and by which the consumer is not benefited." But it was not until many years later that prices became an integral part of the Government's farm information schedule, thanks to the nerve and persistence of Nat Murray, pioneer fieldman. And now, bear in mind, the monthly agricultural price report issued each 29th day is eagerly watched and used as the basis of legislation as well as organized farm merchandising. If we had no price lists and income estimates, or lacked facts as to the value of things farmers use to keep their operations running, all this "parity" talk would be a far greater problem than it is—and that's saying a mouthful.

YET had it not been for the volunteer services of a host of everyday farmers, doing their "figgerin" sometimes after a hard day's work and on Sundays, neither crop nor price estimates would have a ghost of a show to exist. No set of "hired hands" sent afield briefly to make hurried surveys can ever expect to reflect the facts and conditions, the opinions and the trends, like the fellows who make their homes on the land. They are the root of its vigor.

But the best way to get the proper slant on the contribution these unsung and obscure farm correspondents make to crop and livestock reporting is to realize what kind of fellows they usually are.

Some of the up-and-coming leaders of agriculture have been too much engrossed with cooperative or personal undertakings to spare any time to un-

paid and often "thankless" duties. We can dismiss these men from the crop picture, even though they probably contributed well to other noteworthy programs affecting farm life.

The types of farmers I have in mind as ideal examples of the regular contributors to national crop intelligence may best be understood by personal mention, without apologies to anybody or permission to make them Exhibit A.

Come with me to visit Uncle Everett Martin, a southeastern Wisconsin farmer. He has resided on the old homestead for a lifetime. He has not been the hero of any drama wherein a girl is rescued in the nick of time by "Uncle Josh" from a miserable scoundrel who holds a vicious mortgage on the ancestral acres. No, there has been no mortgage to disturb the serenity of Uncle Everett's career, and his debts are paid out of the income from a splendid Holstein herd and a maple sugar camp.

In his wall-papered "study" off the kitchen he keeps a drawer or two filled with ancient records. He brings them to the oil-cloth table top and lays them down. Therein are rows of patient figures for every day of every year since 1875. He uses them to refresh his memory of deals in town and goods bought and well used, of long summer days afield with the larks and the bees, of snappy winter nights in the stable, and fresh spring days down in the sugar bush beside his sap pans. If you really want an index of "parity" he has it.

Not only is he a hard-headed economist hatched in the times before colleges granted any such degrees, but he is a sentimentalist also. In the midst of his reams of records and basic factual data, he will brush aside a stray tear for the days that are gone and the triumphs of fair seasons achieved. Life has been serious with him and also precious and thrilling, although most of his experiences have been among old friends and familiar places.

Needless to add, during many of those years he has been a faithful crop reporter. For awhile he sent his "dope" to Washington direct, but after World War I a system was perfected so that his reports went first to the statehouse and were tabulated and revised and pooled with those from several hundred reporters like him before an estimate for the state was submitted to national headquarters.

ANOTHER and a younger farmer comes to mind. He was one of the first "pig club" boys back before 4-H contests were rampant. He was proud of his farmstead and his community, but technical agriculture came first in his dreams ahead of all group endeavors—and so he made an ideal crop observer to turn loose on local gleanings.

Then there was Samuel Webster who began making crop reports for the Government in 1885 and was hard at it on his 85th birthday. He made monthly and sometimes extra special

(*Turn to page* 49)

Fig. 1. A crop of rye, sweet clover, alfalfa, or grass plowed under gives new life to worn and depleted soils. Nitrogen fertilizer plowed under with rye or grass crops will hasten the rotting process.

Organic Matter Puts New Life in Old Soils

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

LAST fall as I was walking over a farm with the owner, we came to a field where the hired man was plowing under a tremendous growth of mixed sweet clover, alfalfa, and timothy. The owner told me that he had not harvested even the first crop of hay but had saved it for plowing under in the fall as a source of organic matter and humus. We stood there and watched the tractor make several rounds. The plows were doing a marvelous job of turning under this tangled mass of vegetation. It was a good sight to see; it made me feel that here at least was one farmer who really appreciated the importance of restoring his soil with this life-renewing substance—organic matter.

I know that most farmers would have taken this crop for hay. To make hay out of such a fine growth of legumes and grasses and store it in the barn for winter feed is an almost irresistible temptation. Such a crop, harvested and mowed away in the barn is the equivalent of money deposited in the bank. But to me, this

Fig. 2. Liberal applications of fertilizer at the time of seeding down will result in larger yields of grain, more straw, and larger crops of legume hay the year following. More organic matter is added to the soil.

crop of organic matter being plowed under was "money in the bank," too. Here was a good farmer, with practices in line with the teachings of such soil scientists as Professor Emil Truog and Dr. Firman E. Bear, both of whom have repeatedly stated that organic matter is a by-product of good farming.

We have been buying and applying a great deal of commercial plant food in the last five or six years. We have poured on millions of tons of lime and hundreds of thousands of tons of fertilizers, and the supply of fertilizer is still short of meeting the demand and need. Our chief objective in recent years has been to grow more feed for more cattle, hogs, and sheep. Most farmers have been harvesting "the last straw." We have been "cashing in," and I am glad that farmers have been making some money. They are entitled to this period of prosperity and good times—we have only to think back to those lean years of the early 30's when farmers literally lived up their capital investment of buildings, farm equipment, and soils as well.

But we have been drawing heavily on our soil resources during the past 6 or 7 years, not only drawing on the plant-food bank account, but burning up the organic matter. True, we have been applying great quantities of lime and fertilizer—three times the amount we were using 10 to 15 years ago! We know that the more liberal use of fertilizers and lime has resulted in bigger crops of hay and grain, more corn fodder, more straw, and more crop residues to plow under. However, we are still "cashing in" on the organic matter reserves of our soils, and have been ever since we started cropping them 75 to 100 years ago.

Just how important is organic matter in a program of long-time crop production and soil fertility maintenance? It has been said that organic matter is the life of the soil—that it is the mainspring to productive, fertile soils; and in more recent years we have been hearing a lot about its importance. A bulletin published some 3 or 4 years ago by the National Fertilizer Association, entitled "Organic Matter—the Life of the Soil," presents an excellent discussion of this subject.

Dr. G. N. Hoffer, with his articles

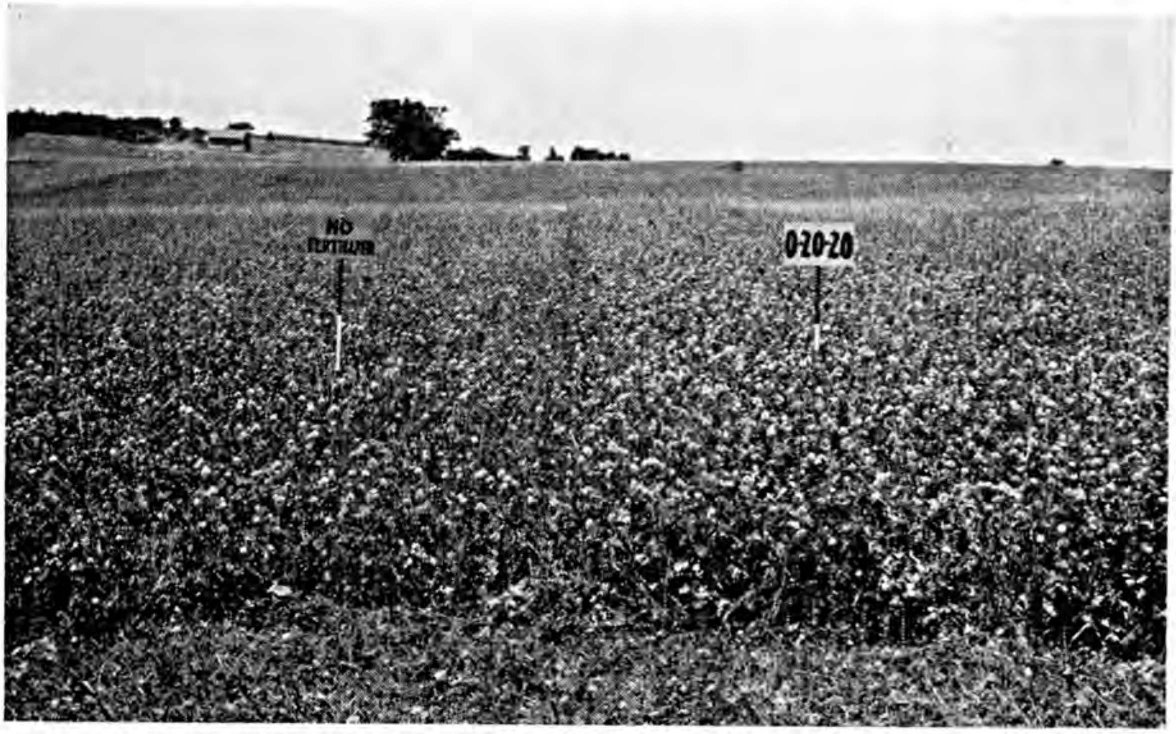


Fig. 3. Three hundred pounds of 0-20-20 fertilizer applied at the time of seeding nearly doubled the yield of grain and straw, more than doubled the yield of clover hay, doubled the amount of "fixed" nitrogen gathered from the air, and has no doubt doubled the stores of organic matter left in the soil by the roots of the grain and hay crops. In addition, a good portion of the harvested crops of grain and hay will be returned to the farm in the extra manures produced from the straw and feed.

dealing with soil ventilation, the damaging effects of soil compaction, and the depletion of organic matter supplies, and in his urging of farmers to grow a larger acreage of deep-rooted legumes which will penetrate these tight subsoils and thus improve their physical condition, has become a nationally recognized authority in this and related fields of soil fertility maintenance.

Just what is the function of organic matter? We all know that it aids in improving the physical properties of soils. Soils abundantly supplied with humus and organic matter are more friable and easier to work. There is probably no task on a farm which gives the farmer more genuine satisfaction than the plowing of land that is mellow, free-working, and friable. Certainly it is true that a soil well supplied with humus will not clod, crust, or bake so badly, and in turn, germinating seeds are better able to push through the soil in the spring.

The water-holding capacity of the soil is increased, and by increasing water intake we are reducing water runoff, thereby indirectly helping to control soil erosion.

In the decomposition of organic matter and humus we are releasing essential elements of plant food. In the rotting process, carbon dioxide is released, and this carbon dioxide combined with water forms a weak acid which helps to dissolve from the mineral constituents of our soils other plant-food elements making them available.

Authorities tell us that a soil well supplied with humus and organic matter responds more generously to treatment with commercial fertilizers. In more recent years there has been talk about "hormones" and the relationship of organic matter to these so-called growth factors which are released in the decomposition of vegetable matter in the soil.

Nitrogen, one of the most important plant-food nutrients needed in the growth of crops, is released through the decomposition of organic matter. The supply of soil nitrogen is almost completely in organic form. Most farmers know that a dark-colored soil will usually produce a more abundant growth of crops that are darker green in color. It used to be thought that the darker the soil, the richer the soil; and this is true from the standpoint of the potential supplies of nitrogen.

What can we do to restore our worn and depleted soils with this substance we call humus and organic matter? This is a good time to start because farmers are now in a better position financially to plow in some "bank account reserves" and because we are producing more abundant crops with the present heavy use of fertilizers and lime and we really have something to plow under.

This matter of building back and maintaining a good supply of organic matter in our soils is a program we should keep at continuously over a period of years. Nevertheless, anything that we do now will have lasting effects. It is true that the organic matter we plow under decomposes rather quickly and does release most of the nitrogen and minerals it contains in a relatively short period; however, there is a residue of rather resistant material called humus, composed largely of organic carbon, that remains in the soil for long periods. The more mature the crop we plow under, the more of this resistant and long-lasting type of lignin-containing humus we add.

Here are a few suggestions for such a program: First, we must apply the plant-food elements needed to grow abundant crops. We should lime every acre of acid soil on our farms. We should take good care of stable manure, using plenty of bedding to absorb the liquid portion, and get this manure back onto the land.

Second, we should rotate our crops and follow through on soil and crop management that will hold down to a minimum losses of soil by wind and water erosion. Such management entails strip cropping, contour cultivation, crop cover, and liberal fertilization.

Third, we need to grow crops not only for the purpose of feeding our livestock but for the purpose of plowing under to restore and energize our soils. Let's not think we must harvest every blade of grass; rather, occasionally plow down a second crop of clover

Fig. 4. Manure is an excellent source of organic matter. Under most conditions it is best to haul it directly from the barn and spread it on the fields in order that the full value of its plant-food and organic matter may be added to the soil.

or alfalfa. Better yet, grow sweet clover or other deep-rooted legumes for the sole purpose of plowing under. Whenever possible, sow catch crops such as rye, oats, or buckwheat that will serve first as protection against wind and water erosion in the fall and during the winter months, and which can be plowed under the following spring as a source of humus and organic matter.

I wish now to give expression to what I think are some common sense ideas of how far farmers should go in this matter of organic matter restoration. It's true that the average farmer will have to settle for something in between the extremes of virgin organic matter levels and complete exhaustion.

Virgin soils lose organic matter rapidly after they are broken and cropping practices started. A large part of the accumulation of humus over the period of thousands of years in our virgin prairies can be burned up within a period of relatively few years. When a virgin soil is broken and cropped, the process of decay and rotting takes place at an accelerated rate. In the words of Dr. A. G. Norman, "Bacterial fires burn very rapidly." In other words, we greatly stimulate biological activities by plowing and cultivating. "That organic matter depletion occurs," says Dr. Norman, "is not the result of poor farming but because the annual balance of organic matter in crops over expenditure is so much higher under grass than when land is under cultivation."

We should not hope to restore our soils to their virgin content of organic matter, nor is it necessary that we do so. The soils of Europe have been cultivated for over a thousand years and they are still producing good crops, that is, where given adequate amounts of lime and commercial plant foods and a program of good soil and crop management is followed. There are thousands of well-managed farms in Wisconsin where crop production is being maintained at high levels, and yet the organic-matter content of soils on these farms has been reduced a good 40% under that which they contained when the land was virgin.

At the other extreme, there are soils on farms where the organic matter has been completely burned out as a result of the combined effects of plant-food depletion and bad cropping practices.

Fig. 5. Larger crops of legumes, grasses, grain, and corn are made possible by the liming of acid soils.

Fig. 6. Jake Voegli and his son of Lodi, Wisconsin, are holding the soils of their farm in place by this system of contour farming. They have limed every acre and have applied fertilizer at liberal rates for many years. Organic matter is being restored in the soils of their farm.

Such farms with any appreciable degree of slope have suffered heavy losses by soil erosion, too.

However, farmers are doing a better job of managing and handling their soils than they did 15 years ago. The Soil Conservation Service and the Extension Service of our colleges have been preaching and demonstrating the better practices of soil conservation and fertility maintenance. The AAA (now known as the Production and Marketing Administration) has made a tremendous contribution toward a program of soil conservation. The Federal government has made a capital investment in the future welfare of the country by this program—an investment that will pay big dividends in years to come.

A recent letter from a relative who has lived the 62 years of his life on the black prairies of central Iowa, tells me of the great interest farmers are now taking in better soil-saving practices. "Yes," he wrote, "we have farmed her hard out here in Iowa. These old soils aren't what they used to be; and you know it's hard to believe it, but the soils out here are really responding to fertilizer. We've got to come to it." He went on to say that in more recent years he and his neighbors had been plowing down clover for their corn crops.

These vaunted prairie soils of Iowa —soils which the natives used to say would never wear out—are now responding to treatment with fertilizer. Farmers are finding that fertilizers are producing substantial increases in yields of corn, grain, and hay.

We have "farmed her hard" throughout this Middle West, and the time has come when we must pour back some of the fertility that has been pumped out over the past 70 to 100 years. Evidence that farmers have drawn heavily on their soil bank account is seen in the fact that they do get these big increases in crop yields from the use of commercial fertilizers. New factories are being built all over the Middle West—7 new plants in Wisconsin, 6 or 7 new plants in the State of Iowa, and several new plants in Minnesota, Illinois, and other Midwestern states.

The great movement toward a grass-

(*Turn to page* 45)

Handling Quantities of Data with Business Machines[1]

By Ivan E. Miles[2]

State Department of Agriculture, Raleigh, North Carolina

IN testing soils and making lime and fertilizer recommendations as is done in a well-planned and efficiently operated soil-testing program, there are at least 20 major points of consideration that should be met and handled. These points of consideration cover such things as soil type, type of sample, past rotation, lime and fertilizer history, recent cover crops used, relative yield, pH, calcium, magnesium, phosphorus, potassium, exchangeable hydrogen, organic matter content, crop and rotation to be grown next, plant food and lime that will be needed, recommendations to be made as to lime and fertilizer application, management, etc. A very definite effort is being made to handle the situation along these lines in North Carolina.

When these 20 things are multiplied by a large number of samples, it requires but little imagination to realize what a task it is to handle this material in a way so as to permit the data to be computed, analyzed, and organized or arranged in any systematic way so that it can be studied, published, summarized, or otherwise helpfully used by anyone other than the farmer who received it as an individual letter.

With one year's results, it appears that the International Business Machines may be of great help in handling this situation. Attention is invited to a sample card (Fig. 1) representing an actual situation. There are not just 20 items of consideration but 45 instead. This is due to the fact that in many instances the information available is not sufficiently complete so as to definitely categorize it into the 20 major

(*Turn to page* 46)

[1] Presented to the Fertilizer Section of American Chemical Society in Washington, D. C., September 1, 1948.

[2] Now, Extension Agronomist in Mississippi.

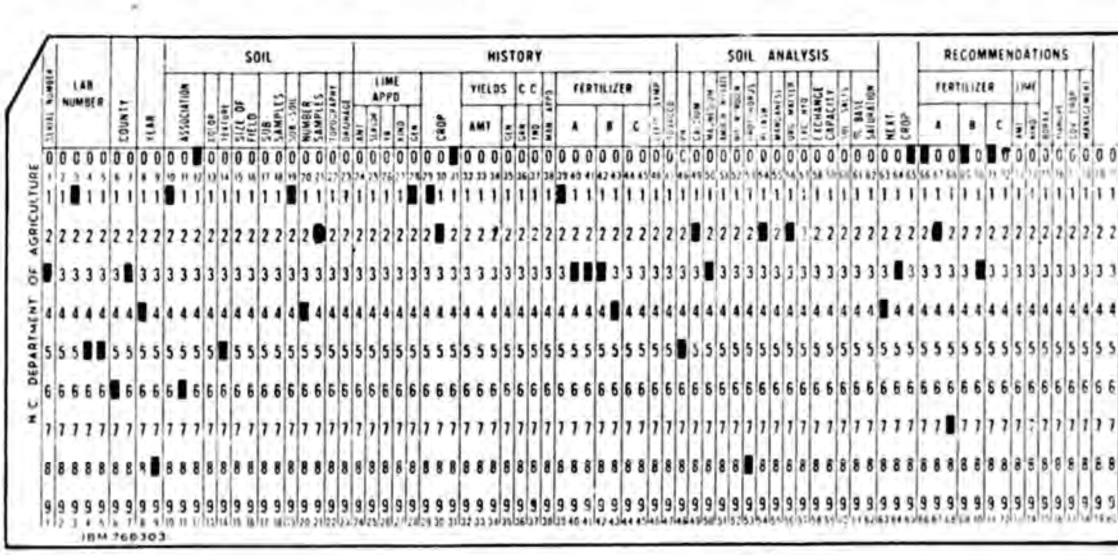


Fig. 1. A sample card showing information on 45 items regarding a soil sample from one grower.

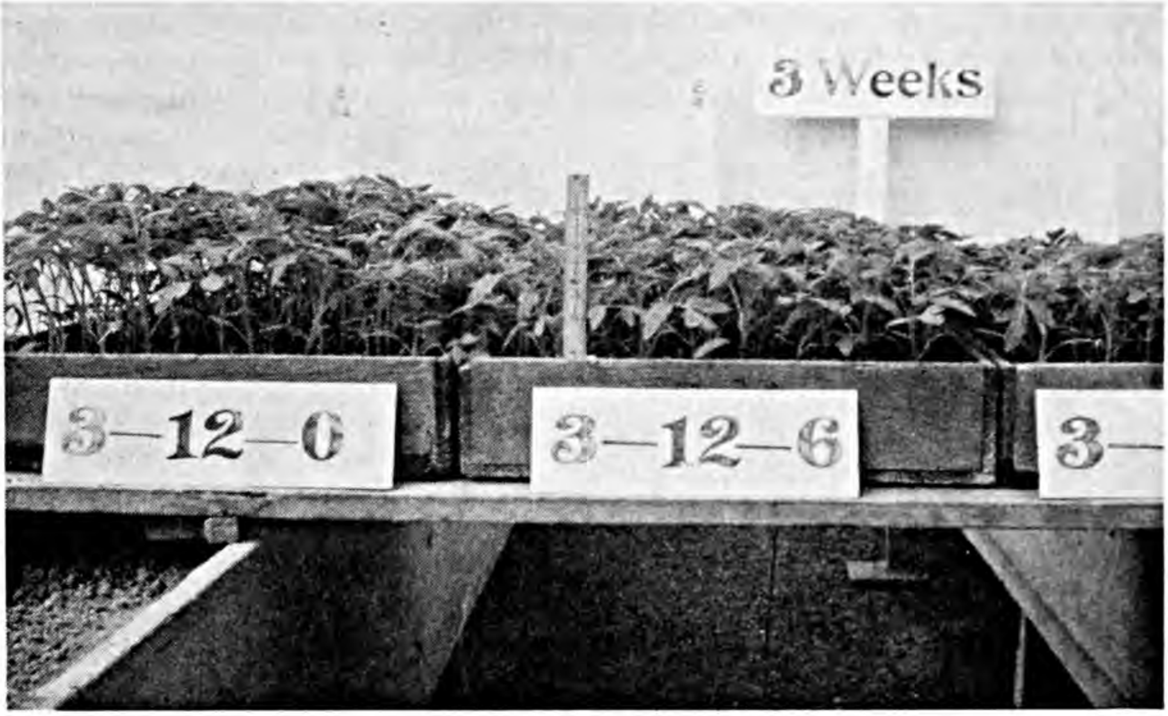


Fig. 1. Increasing amounts of potash makes firmer, stockier plants.

Hardening Plants with Potash

(Reprinted from Farm Research, October 1948)

By Charles B. Sayre

Division of Vegetable Crops, New York State Agricultural Experiment Station, Geneva, New York

IT IS well known that nitrogen fertilizers will make plants grow rapidly, and all plant growers make extensive use of nitrogen. While a rapid growth is usually desirable, especially with vegetables, there are circumstances when too rapid growth may result in plants that are too soft and tender, especially if they are to be transplanted. Also, with some crops such as tomatoes an excessive vegetative growth may delay fruit setting. Under such circumstances "hardening" the plants or checking the soft vegetative growth is desirable.

Moreover, if plants such as late cabbage plants are grown in outdoor beds, the temperature and often the water, cannot be regulated. Under such conditions one good way to "harden" plants is to fertilize them with potash. Because of the greater activity of the potash ion in the soil solution, this will balance or inhibit somewhat the uptake of nitrogen and produce plants with firmer, stiffer stems and higher carbohydrate content that will stand transplanting better.

This was illustrated in some experiments in growing tomato plants at Geneva. These plants were all grown under uniform conditions in the greenhouse and coldframes, using a regular greenhouse composted soil to which was added various ratios of nitrogen, phosphorus, and potash. Tomato seedlings of uniform size were transplanted to flats containing different ratios of these fertilizers.

Shorter Stiffer Seedlings

Figure 1 shows three of these different treatments three weeks after the seedlings had been transplanted. Each of these flats received the same amount of nitrogen and phosphorus, but varying amounts of potash. The flat on the left received no potash. These seedlings were the largest and were very dark green and had made a soft, succulent growth. The center flat received a complete fertilizer containing 6 per cent potash. These seedlings were shorter and stiffer. The flat on the right received the same amount of nitrogen and phosphorus plus 12 per cent potash. These seedlings grew stockier and had stiffer stems and the foliage was olive green in color.

When these plants were eight weeks old (Fig. 2), at which time they were transplanted to the field, the plants without potash were 16 inches tall, dark green and had green, soft, succulent stems. Those receiving 6 per cent potash in the fertilizer mixture were 16½ inches tall and medium green in color with firm stems with some purple coloring (a sign of hardening) in the stems. The plants receiving 12 per cent potash in the fertilizer were 1 inch shorter with olive green foliage and stiff, firm stems. Expert plant growers, who were asked to judge the different lots, rated this lot as the most desirable type for transplanting to the field. Their judgment was verified by the results when these various lots were transplanted to the field. The plants that received the high-potash fertilizer required fewer replants and produced a larger crop of early tomatoes.

Success With Cabbage Plants

At the time these tomato plants were in the coldframe an extensive grower of field-grown cabbage plants came to the Experiment Station seeking advice as to how he could salvage several million cabbage plants that he feared would soon become too large and soft for transplanting before his customers would be ready for them. His predicament was this. His plants were grow-

(*Turn to page* 45)

Fig. 2. H, no fertilizer; C, 6-12-0; F, 6-12-6; and J, 6-12-12.

Fig. 1. There is still serious active erosion on military lands. This picture was taken before the area was planted to kudzu April 1948.

Military Kudzu

By T. C. Mauer

Soil Conservation Service, Spartanburg, South Carolina

KUDZU was selected and drafted to control serious erosion on military installations, and this fast-growing leguminous vine did its usual good job.

On the few installations where kudzu was accepted and planted properly under competent supervision, it is now providing excellent grazing and high-quality hay. It will continue to control erosion and provide feed for livestock if grazing is properly controlled, hay is cut at the proper time, and fertilizer is applied generously and regularly.

Time of completion was the one important factor during the construction days of 1940-43. The runoff water from bare ground, roofs, roads, parking areas, runways, aprons, and other impervious surfaces was of greater volume than usual. The topography and soil type in and around the construction sites usually added to the problems of handling these large quantities of runoff water. Much damage was done by concentrating the runoff rather than dispersing it. Even kudzu, as good as it is, should not be expected to do the impossible. A full flow through three 38-inch pipes at the top of a highly erodible plateau will cause a gully the first heavy rain. Kudzu needs help and time to overcome such a head start.

The time required to establish a complete protective cover was cut down by increasing the usual number of crowns from 500 to 1,000 per acre and using one pound of 4-12-4 fertilizer per crown. With good crowns, careful planting,

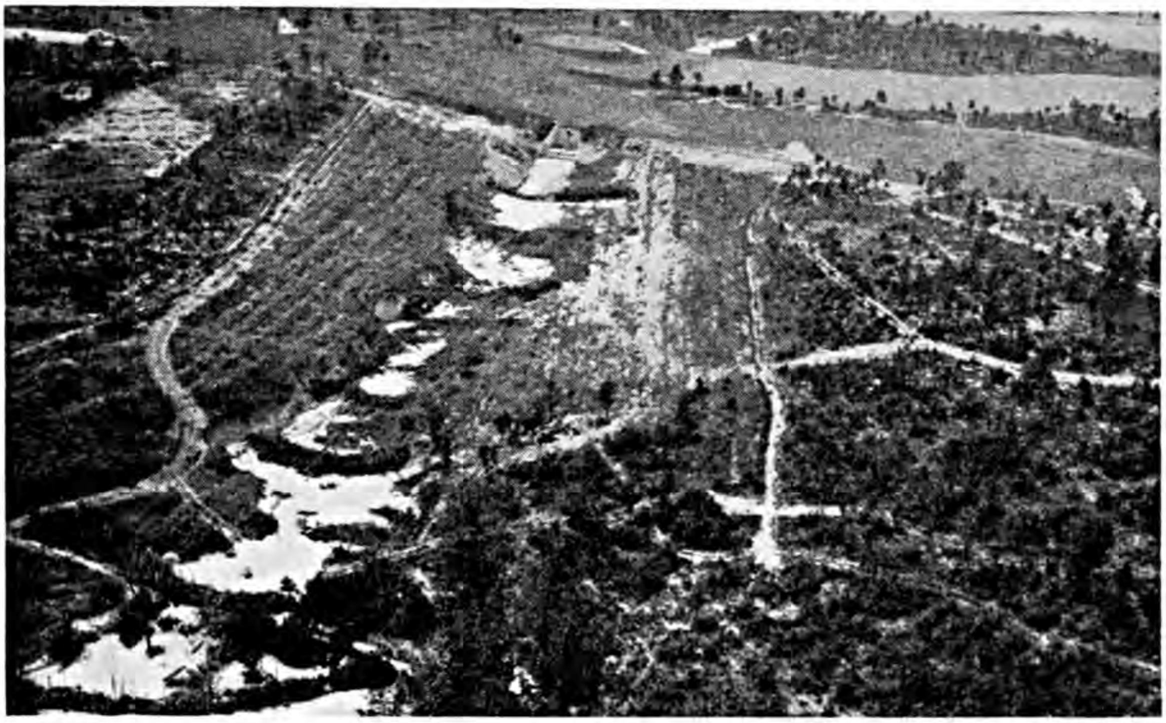


Photo by U. S. Army Signal Corps

Fig. 2. A main ditch protected by growing barriers of kudzu.

and needed cultivation a good protective cover was obtained in one growing season. Since then these same plantings, when undisturbed, have continued to provide adequate protection for which the planting was made.

Not all of the kudzu plantings were a success. Many plantings were made haphazardly, with poor preparation, no fertilizer, and no cultivation. Then, too, some of the untrained supervisory personnel looked at a kudzu crown for the first time and decided that the bud end should go down in the ground. As a result, many thousands of crowns were planted upside down. Many of the people who learned the hard way are gone. The last upside down kudzu crown planting was seen in the spring of 1948. The 5½ miles of Army road banks that would have been covered will have to be planted again next season.

In spite of the many adversities of soil, planting methods, and lack of fertilization, the estimated 5,000,000 kudzu crowns planted have done more than was expected of this erosion control crop. The lack of any maintenance is beginning to take its toll. If the original plantings had covered all the erosion problems, that part of the work would now be completed. Such is not the case. Only a few of the installations had accomplished a complete erosion control program by the end of the war in 1945. Unfortunately, these posts have now been declared surplus or are on an inactive status.

Camp Croft, Spartanburg, South Carolina, was fortunate in several respects. It was only 3 miles from the Southeastern Regional Office of the Soil Conservation Service. Many trips were made by regional technicians to help work out erosion control problems. The post engineer turned over the erosion control program to a competent and experienced conservationist who went to work at once. A half million kudzu crowns were planted on road banks, cut and fill slopes around drill fields, and on dikes between rifle ranges in the spring of 1942. The good planting methods and high rates of fertilization (1 pound of 4-12-4 per crown) gave this crop a start and kept it going.

Additional plantings of kudzu were made in 1943 and 1944 on the few remaining bare banks or ditches at Camp Croft. Where kudzu was not needed to stop severe erosion, Bermuda-grass and annual lespedeza were used for lawns and lespedeza sericea was used on fields around the camp proper.

One of the very interesting things that resulted from the complete vegetative program established was the comment of a chaplain who spent several years at this post. "In 1942 the hospital was filled with soldiers suffering from dust colds. In 1943 there was hardly a single hospitalization for dust colds. They really kept me busy going to the hospital until the dust was settled." Soldiers can't get any training in the hospital. So vegetation was a time-saver at a critical period of the war.

Camp Rucker, Ozark, Alabama, also did a good job of erosion control. Kudzu was not accepted as readily there in the early days. One of the officers at Rucker had been in a cavalry unit. At some time in his training he was compelled to dismount and maneuver through an established stand of kudzu with his spurs still on. In spite of such an upsetting experience, kudzu was well planted and controlled erosion on many deep gullies, steep banks, and fills.

Railroad fills, built rather narrow and steep, under constant heavy use and subjected to the usual rains, made considerable extra dirt digging and hauling for filling until these banks were stabilized with kudzu. It is rather surprising that there has been no evidence of dirt slippage under the kudzu on some of the steeper fills of highly erodible soil. Kudzu has tied the soil in place with deep roots and a protective top cover.

Since many of these railroads have been out of use for some time now, the kudzu has easily grown across the top, covering ties and rails completely. This is of grave concern to those who see only the kudzu on the tracks. The good job of holding the steep banks for the last 6 years is not considered. It would seem that one engine with plenty of sand could push a boxcar through and clear the tracks. Plenty of sand will prevent slippage until the kudzu is worn off.

There are many railroad cuts and fills covered with kudzu on and off of military installations. The same good management practices should apply to both.

Anniston Ordnance Depot, Anniston, Alabama, is another military installation that has had a continuously good erosion control program. Most of the serious erosion spots were planted to kudzu in the spring of 1943. Five

Fig. 3. Cows grazing Bermuda-grass and kudzu on an "igloo."

hundred thousand crowns were planted that year. In the spring of 1948 it was arranged to pasture cattle in the "igloo" area. This arrangement has two distinct advantages. It makes practical use of the high quality feed and the cattle graze off the excess vegetative growth that would otherwise have to be mowed. Such a practical arrangement provides high-quality feed for food production and eliminates most of the need for maintenance mowing. Some mowing will have to be done around the "igloos." Doors and ventilators have to be kept free of kudzu so they can function properly. The cows are not trained to clean out such places. It might be surprising to a lot of skeptics what can be done to make the cattle graze such places more closely.

Fertilized vegetation is more palatable to cattle than that which is unfertilized. Cattle have their own way of finding such fertilized areas. So, in order to get certain areas grazed down it is only necessary to apply additional amounts of fertilizer.

Observations were made on some kudzu fertilizer plots where the applications were made at the rates of 300 pounds of phosphate and 100 pounds of potash on one plot; another plot received 600 pounds of phosphate and 200 pounds of potash. On two different farms the cattle found the plots of the higher rates and grazed them first, and then those of the lower rate.

Controlled grazing with fertilizer is a distinct possibility, particularly where there is an abundance of kudzu that is available.

In the restricted area at Anniston Ordnance Depot, there are approximately 500 acres of kudzu around and over igloos, road shoulders and banks, and borrow pits and fill slopes. Most of it is in good, thrifty growing condition. It was well fertilized when planted in 1943 but most of it has not been fertilized since. To maintain the kudzu for erosion control and provide feed for the cattle, at least one acre of kudzu should be fertilized for each animal unit to be grazed each season. Since this kudzu was fertilized 5 years ago, it is very likely that 300 pounds of phosphate and 100 pounds of potash per acre will be sufficient to attract the cattle. As a start on such a program,

(*Turn to page* 44)

Photo by U. S. Army Signal Corps

Fig. 4. There is complete erosion control on this bank since kudzu has taken over. Note the scattering of lespedeza sericea and one patch of annual lespedeza. Maintenance of ditches and culverts is reduced to a minimum.

Fig. 1. Tall Alta fescue seeded with Ladino clover. This combination will greatly supplement permanent pasture grazing.

Permanent Pastures in South Carolina

By W. H. Craven

Agricultural Extension Service, Clemson College, Clemson, South Carolina

THE permanent pasture program of the Extension Department in South Carolina is planned each year so as to have a uniform pasture demonstration throughout the State. Eighty-seven such demonstrations have been conducted by farmers through the aid of the Extension Service from 1945 through 1947.

The results of these demonstrations clearly show that pastures have a greater animal unit-carrying capacity when a complete fertilizer is applied. The average animal unit-carrying capacity on pastures that received a complete fertilizer was 1.6 per acre.

Once a good legume sod has been established and not overgrazed, the nitrogen requirement becomes of less importance. The phosphorus, potash, and calcium requirements for optimum legume and grass growth must be supplied at least once a year and preferably twice yearly. Best results in South Carolina have been obtained from the application of 500 pounds of a 3-12-12 fertilizer in the early spring and a like amount in September, making a total application of 1,000 pounds of a 3-12-12 per acre yearly. The fall fertilization will take up when the spring application has been exhausted by the grass and legume growth. It must be remembered that plant nutrients are essential for legume growth during the fall months.

During the past few years, farmers in South Carolina have become greatly interested in establishing and maintaining good permanent pastures. It is now a realization on their part that a good permanent pasture does not just happen, but requires adapted soils, good firm seedbed preparation, liberal fertilization including lime and basic slag, proper seeding, and good management. This realization has resulted to a large extent from the lessons taught by these pasture result demonstrations. The adage "seeing is believing" has been clearly illustrated when invariably the livestock will graze the fertilized plots constantly and leave the unfertilized check plots untouched.

These observations have also emphasized the fact that permanent pasture plants require plant nutrients the same as field-grown crops. Unfortunately, the total feed taken from an acre of good permanent pasture cannot be measured by observation as can bushels of corn or pounds of cotton per acre. The harvest from the pasture is not made in a single operation, but rather is extended over a period of 6 to 7 months. The plant-food requirements therefore become much greater when the pasture plants are constantly striving to maintain a growth toward maturity while at the same time being grazed off by the livestock.

In addition to these results from the 3-year average of the 87 permanent pasture demonstrations, farmers conducted in 1947 a total of 167 pasture demonstrations, which included 6,945 acres. This acreage furnished an average animal unit-carrying capacity of 1.68 per acre. The average number of days grazed was 209. With this long period of grazing together with supplementary grazing crops, such as our fescues, sudan grass, pearl millet, combination of velvet beans and corn or grain sorghum, annual lespedeza, kudzu, and sericea lespedeza, a year-round grazing system can be had on every farm in South Carolina.

County agents have held a large number of county tours at which farmers from all parts of the State have had an opportunity to observe the effects of

(*Turn to page* 47)

Fig. 2. A well-established permanent pasture which has resulted from proper fertilization and good pasture management over a period of 10 years.

Fig. 1. One corner of the 1948 State Muck Crop Show held at Walkerton, Indiana.

Indiana's Muck Crops Program

By Thomas W. Higgins

Senior Student in Vegetable Crops, Purdue University, Lafayette, Indiana

"THE crops grown on the muck soils of Indiana are an important factor in Indiana agriculture," says Kent Ellis, Purdue's muck crop specialist. Mr. Ellis should know, because he has been working with Roscoe Fraser, another of Purdue's vegetable crops specialists, on the various phases of muck crop production for many years.

Indiana has 300,000 acres of drained and developed muck land at the present time. It has been a long, hard job for the muck farmer to drain and clear the swamps of northern Indiana.

Many men who saw the light in the late 1920's were looked upon with pity by other people who thought these men had lost all sense of economic stability when they began buying swamp land, which was considered absolutely useless as far as farming was concerned. Muck land could be purchased for as little as $10 an acre in those days, but today the only muck lands for sale are of estates which are being settled or acreage opened to sale by an occasional well-earned retirement of a muck land farmer. When this rich black soil is offered for sale today the average purchase price is $300 per acre.

Muck farming is work; there is more

back-breaking work in producing vegetable crops on an acre of muck than many men care to do, and for this reason most muck farmers are considered men of iron. Besides the continuous battle with the ever-present weeds, there are many other problems that arise with every crop, such as insects, pathogenic diseases, physiological diseases, nematodes, soil structure, soil fertility, varietal adaption to the land, and varietal acceptance by the consumer. All of these, plus the problems of harvesting, storing, packaging, and selling, are facing the muck land farmer yet today.

When the first vegetable crops were planted in this new soil, there were some very disappointed farmers when harvest time came. The finished product in many cases was not in demand; the cooking quality was far below the standards of vegetables that were produced on the sandy loam soils in the same areas. The yields were not above average. Many people marked muck land off the list as a soil type to produce a good crop of vegetables.

The average muck land farmer was not the kind that became discouraged easily; there were many college-trained men who were in this new business, and vast research projects, both private and public, were started. From these projects came the answer that all the muck areas of the United States were looking for.

The answer for high yields with better than average quality came with the intensive use of phosphate and potash fertilizers along with new varieties that were developed specifically for this new type of soil. The farmers are finding out for themselves that there is a direct relationship between the amount of potash they use and the yield they receive.

In the 1930's when these development projects were just beginning, there was a mutual feeling of the need of an organization where new ideas and experiences, both good and bad, could be brought together. This need was realized by Purdue University and by Roscoe Fraser, a graduate of the agricultural education division at Purdue, who had just been placed on the extension staff of the Indiana Experiment Station.

The Northern Indiana Muck Growers' Association was organized under the able leadership of Fraser cooperating with the growers of the counties that had the major muck land areas. This new association provided the type of thing that the farmers wanted.

To assemble the facts and experiences, and to provide an annual meeting for the growers, the Annual Muck Crop show was started. The show does all the things it was organized to do and has been growing bigger and better each year. It serves to stimulate increased interest in one of northern Indiana's most important natural resources—muck soil. It brings together products from this soil and gives growers a meeting place where they can see what industry is developing in the way of the latest in agricultural materials and machinery.

The Growers' Program

In 1948 the Association under the guidance of Fraser outlined a 10-point Muck Crops program for the growers as follows:

1. Grow crops adapted to your muck land and farming program; analyze each field as to soil acidity, phosphorus, and potash content, planting such crops as harmonize with the reaction and physical condition of the soil.

2. Conserve soil and maintain fertility balance by using cover crops and balanced rotations, supplemented by commercial fertilizers and soil amendments as determined by soil analyses and crop requirements.

3. Use approved varieties determined by production performance and market demands.

4. Control diseases by the use of disease-free seed or treated seed, plus the

(*Turn to page* 47)

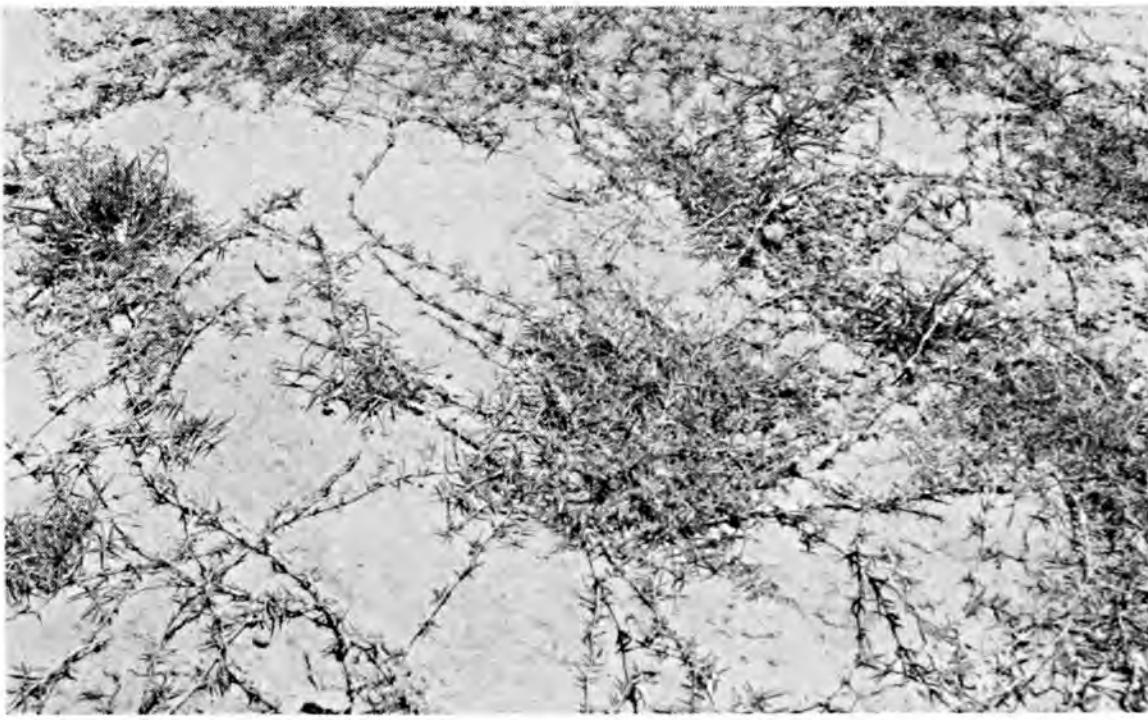


Fig. 1. Bermuda-grass spreads from a central root planting. Runners reach out in all directions and soon will have the soil solidly grassed. These runners have spread in spite of the extreme dryness of the year in which they were planted.

Establishing Bermuda-grass

By W. M. Nixon and Paul T. Gillett

Soil Conservation Service, Fort Worth, Texas

THE proper use and treatment of at least 20 million acres of land in Arkansas, Oklahoma, Louisiana, and Texas require planting Bermuda-grass. East of the native grass prairies, Bermuda is the primary base grass for permanent pastures and in addition is useful in permanent meadows, gullies, waterways, channels, farmyards and in the stabilization of highway and other embankments.

Soil Conservation Service technicians assisting soil conservation districts throughout this territory find Bermuda-grass planting the biggest conservation job in almost every conservation group. Though large amounts have already been done, the lion's share has not yet been touched. It has been estimated that to establish all of this grass needed in the Crooked Creek Soil Conservation District in North Arkansas would increase farm income there by a million dollars a year. Regional value of this one conservation job should exceed 400 million dollars a year.

Once Bermuda-grass was considered a pest. Today, many farmers have learned its value as a conservation and pasture crop. Though it is a "furriner" —a native of the Bengal region in India —it has acclimated itself here to become a benefactor of Southern agriculture and a mainstay of conservation and permanent pastures.

Bermuda-grass Is Adaptable

Bermuda-grass is a tenacious perennial. It produces aboveground runners —stolons—that root and form crowns of new plants at nodes when in good contact with the soil, and fleshy, underground runners called rhizomes that also develop into new plants. Seed is produced too, but in most of the Western Gulf Region it is not of high quality.

Bermuda-grass produces a large amount of forage, palatable to all kinds of livestock. It is fairly nutritious in protein, phosphoric acid, and lime, particularly when fertilized properly and overseeded with legumes. It is primarily a green grazing crop; however, livestock do well on reserved winter pasturage when supplemental concentrates are fed.

Bermuda-grass prefers ample moisture and fertile soil, but it tolerates a wide range of conditions. It grows best when temperatures are high and soil moisture is good. Stolons, and sometimes rhizomes, may be killed by below-freezing temperatures; yet, under good management a dense mat of dead vegetation usually will protect the stolons, and ample soil moisture will seal the rhizomes from killing air temperatures. Sometimes, in north Oklahoma and Arkansas, close grazing, dry soil, and low temperatures combine to produce "freeze-out" spots. Most of these could be prevented by maintaining high fertility levels and by conservative use.

Other pasture plants grow well with Bermuda-grass, although because of Bermuda-grass' turfing habits, the sod may need to be torn apart occasionally to keep the desired ratio of legumes and winter-growing grasses in the stand.

Sodding and Sprigging with Companion Crops

Sodding (planting chunks of turf) and sprigging (planting dirt-free portions of rhizomes and stolons) are the surest methods of getting a stand of Bermuda-grass established. Stands established in these ways are past the vulnerable seedling stage and can re-establish themselves, if need be, from the originally planted rhizomes and stolons.

Knowing that cultivation of row crops often has spread Bermuda-grass completely over fields, many farmers have allowed row crop cultivation to sod or sprig Bermuda-grass economically.

Good Jobs of Sodding and Sprigging Require Care

Recommendations in using Bermuda include the following:

1. Prepare soil well, to encourage growth and crowning.
2. See that sod or sprigs are pressed firmly into soil to eliminate air spaces.
3. Cover deeply enough with soil to protect from drying or freezing.
4. Use enough fertilizer or soil-improving crops to support vigorous growth of the newly planted grass.
5. Keep the planting clean to eliminate moisture competition and allow stolons to crown.
6. Cultivate to cover stolons so that they will crown if soils are not naturally loose and sandy. Light grazing helps, too.

Many fields to be planted to Bermuda-grass have been depleted in fertility by years of cropping and erosion. Very poor sites should be built up for a year or two by planting legumes. Better sites can have fertilizer applied with the planting.

Harvesting Sod and Sprigs

Harvesting sod and sprigs always has been a relatively costly and time-consuming part of establishing Bermuda-grass as a conservation and permanent pasture crop.

The most common method for harvesting chunks of turf for sodding has been ordinary plowing. From time to time numerous types of sod-cutters,

Fig. 2. This highway crew is sodding Bermuda-grass for erosion control near Minden, Louisiana.

largely of the sled type, have been developed. These have had their biggest value, however, in producing slabs of turf of a uniform nature for developing a complete covering of sod for areas where large amounts of water have been concentrated, such as channels, embankments, and terrace outlets. For ordinary sodding, the turf chunks secured by plowing are most economical to get and are entirely satisfactory.

Now-outmoded hand methods of extracting sprigs from established patches of grass required nearly twice as much labor for sprig harvest as for planting, exclusive of site preparation. It was necessary to locate sources for sprig planting material in sandy areas so that the soil could be shaken easily from the sprigs. Revolving chicken-wire drums to speed up production of soil-free sprigs were devised by CCC employes and WPA crews working on erosion control work.

Recently, soil pulverizers and mulch tillers have been used effectively where there are not too many rocks or other obstructions. These machines leave the soil and grass mixed, and a side-delivery rake or other implement must be used to separate the sprigs and bunch them for loading. Some of these are large machines with their own power units; others are of garden tractor size.

Seeding Bermuda-grass

Until recently, few attempts have been made to establish Bermuda-grass by seeding. Most local seed has not germinated well. High quality seed is now produced, however, under dry-land conditions in South Texas and under irrigation in Arizona. Good seeding methods have been developed.

Bermuda-grass seeds are tiny, numbering nearly two million per pound. Successful planting requires special care and methods and suitable equipment.

Broadcast Seedings

Some of the earliest and best seedings were made by broadcasting seed in the cooled ashes, following the burning of contour windrows of brush or of well-distributed brush piles. Abundant potash, loose soil condition, freedom from choking vegetation, and warmer soil temperatures produce vigorous growth of seedlings on these ash beds. This method of seeding is especially suited to new ground and old pasture areas where there is considerable brush to be removed.

Broadcast seeding has been successful on new ground or highly fertile soils when made on firm, prepared seedbeds. Light soils, either sandy or high in organic matter, are necessary.

Broadcast seeding is not recommended for tight or poor soils.

Row Seedings and Row Seeding Equipment

By all odds, the safest way of making Bermuda-grass seedings is in rows. Soil Conservation Service Nursery Manager David H. Foster devised an attachment for any kind of smooth plate planter that makes it possible to plant small quantities of very small seed. There have been numerous field adaptations of this. Plans for the best of these are available from S.C.S. regional headquarters at Fort Worth.

Essentially, the small seed are conducted directly to one of the holes in the planting plate as it lines up with the planting slot. Thus, the seed are not ground up and jammed between plate and plate-holder. In some adaptations the funnel is replaced with a section of car radiator hose. The number and size of holes in the planting plate have to be bored in a blank plate to seed the desired quantity of seed per acre. The attachment is inexpensive. Because of the large number of different types of plate planters it is usually best to equip one particular planter with the attachment, rather than to figure on using it interchangeably on several different ones, even though they be of the same type.

In the last couple of years there have been many successful seedings made with calibrated fertilizer distributors in good condition. Seed and fertilizer are mixed thoroughly in the ratio desired, say ¾ pound of seed and 150 pounds of 4-8-12 fertilizer. This mixture is then planted through the fertilizer distributor with the distributor set for shallow soil coverage.

This method is simple, requires no special equipment, and assures fertilizer application with each seeding. Considerably more weed growth can be expected, because of the fertilizer, but no permanent damage should result unless a severe drouth develops.

A few cooperators with soil conservation districts in the cotton country have mixed small amounts of Bermuda-grass seed with linty cotton seed and have planted the mixture with an ordinary cotton planter. The cotton must be planted shallow. Satisfactory stands have been secured in this manner, and the subsequent cultivation of the cotton crop has been beneficial to the Bermuda-grass. The cotton crop raised more than offsets the small cost of grass establishment.

Essentials of Successful Seeding

To get successful seedings, the following measures are necessary:

1. Improve fertility of poor soils. Poor soils should be improved before seeding to a level that will support good grass growth. One or more years of vetch, crotalaria, or other legume green manure, with ample amounts of phosphate or complete fertilizer, may be necessary before seeding; or very poor sites may need to be planted with sod or sprigs.

2. Provide well-prepared, firm seedbed. Preparation should be well in advance of seeding time, to allow the soil to become firm. If weather permits, seeding should not be done until one or more early weed crops have come up and been destroyed by shallow tillage or harrowing. If this process has loosened the soil much, it should be firmed again by rains, rolling, or cultipacking before seeding.

3. Use light seeding rates of hulled seed. Good stands are consistently produced from one pound or less of good, hulled seed, planted in rows. Stolon growth and crowning are better where light seeding rates are used.

4. Plant Bermuda-grass seed shallow. A half-inch or less coverage is best.

5. Fertilize. Use a normal amount of nitrogenous or complete fertilizer.

(*Turn to page* 42)

Soil Conservation Chief H. H. Bennett finds that M. M. Morris of Hope, Arkansas, not only has established a good stand of Bermuda-grass but also has raised a crop of corn on the same land. Sod or sprigs were scattered between corn rows and covered with the last cultivation. Contour tillage was used. Crops that are laid-by early are the best to use because the grass has a longer time to get set before winter. Many acres, good enough to make a useful row crop, can be set to grass economically in this way.

Above: **Farmers around Waldron, Arkansas, have developed this method of planting Bermuda-grass by feeding sod through pipes in front of wagon wheels. The wheels firmly press each chunk into the soil. Sod was plowed out and loaded on wagon by hand. Sodding is more laborious than sprigging but is usually a surer way. Although seasons with good moisture are best, with care when the ground is not frozen, sodding can be done any time of the year.**

Below: **Lon Statham, Caney Valley Soil Conservation District in Oklahoma, has put sod planting on an assembly-line basis which results in a minimum of exposure of sod or sprigs. Though rhizomes and stolons are hardy, care needs to be taken in any sodding operation to keep them from drying, freezing, heating, or molding, depending upon the weather. If the plants are not actually killed by these factors, they will be weakened and heavy losses will occur later on.**

Above: **This Bermuda-grass pasture supports fine, high-producing Jerseys. It is owned by Orrin D. Stevens, Clarksville, Texas, a cooperator in the Red River Soil Conservation District. Some farmers have used crotalaria as the soil improvement crop in conjunction with grass planting and have found that their livestock graze Bermuda-grass and refuse the volunteer crotalaria. Dallis grass and white Dutch and Persian clover also have been used in mixture.**

Below: **This Bermuda-grass waterway which receives terrace water from two sides was established by Everett Bass, a cooperator in the Soil Conservation District at Elk City, Oklahoma. He uses this waterway as a permanent pasture area. Bermuda-grass was used at the lower end of the waterway to stabilize a flume, carrying water safely to the road culvert. Some farmers use waterways for hay production.**

Above: The first season's growth of Bermuda-grass from a seeding made in May 1944, by J. D. Bogard, cooperator with the Gaines Creek Soil Conservation District in Oklahoma.

Below: The Moore Brothers, cooperators in the Brazos-Robertson Soil Conservation District of Bryan, Texas, have established sound land use on a large acreage that cannot be safely row-cropped.

AMERICAN POTASH INSTITUTE

Appoints New President

WITH the advent of the new year, the American Potash Institute named Dr. H. B. Mann as its new President and Chairman of the Board of Directors, following the retirement of Dr. J. W. Turrentine from those positions on January 1. Since the announcement proved of much interest in the agricultural circles where these men are well known, it seems fitting to present here brief biographies for others of our readers who may have known them only through the pages of this magazine.

H. B. MANN

Harvey Blount Mann was born in Hyde County, North Carolina, the son of T. J. and the late Ella Gibbs Mann. He attended the Lake Landing High School; received his B.S. degree in Agriculture in 1920 and his M.S. in Soils in 1925, both at the North Carolina State College. A Ph.D. in Agronomy was conferred upon him in 1929 by Cornell University. He served as Assistant Agronomist at North Carolina State College from 1920 to 1929 and as Agronomist from 1929 to 1936, when he left to become Assistant Southern Manager for the American Potash Institute. That same year, upon the death of J. N. Harper, he was made Southern Manager, in which position he served until becoming Vice-president of the Institute in 1948.

Regarding his scientific background, Dr. R. Y. Winters, Research Coordinator of the U. S. Department of Agriculture, has this to say: "As Director of the North Carolina Agricultural Experiment Station, I had occasion to review and approve Dr. Mann's research projects, to observe his work in the field, and to read his reports on soil fertility and plant nutrition studies during the period of 1923 to 1936. Dr. Mann was engaged in early studies of the more concentrated fertilizers, the influence of mineral supplements, and the relation of fertilizer placement to crop stand, growth, and production. The success of this work in North Carolina was due in large measure to Dr. Mann's careful planning and execution of the work. His careful notes during the season made possible more accurate analyses of results and contributed to more positive conclusions.

"Dr. Mann demonstrated his ability to do original research in his studies of calcium and magnesium relationships to the availability of manganese and iron. His controlled studies of the use of calcium by peanuts helped explain differences in response of peanuts to gypsum and calcium. His findings in this field have changed the practice of supplying lime to peanuts in North Carolina.

"As Manager of the Southern Territory of the American Potash Institute, Dr. Mann conducted the promotional program in strict accordance with fertilizer recommendations of the State Experiment Stations and the U. S. Department of Agriculture. In the administration of this program, he has been generous and discreet in the promotion of plant nutritional research in the Southern region through research fellowship grants to agricultural colleges of the region. He has maintained the respect and confidence of the State and Federal agricultural agencies of the region."

Dr. Mann is author or co-author of 35 Federal and State bulletins and articles presenting the result of original work. Included among these are some 20 publications based on original agronomic work with such crops as wheat, cotton,

H. B. MANN

corn, cow-peas, oats, rye, vetch, crimson clover, alfalfa, soybeans, peanuts, sweet potatoes, Irish potatoes, forage crops, beans, tobacco, truck crops, and peaches and their response to various plant nutrients such as nitrogen, phosphorus, potassium, lime, manganese, iron, etc. in varying combinations, ratios, and methods of application and as influenced by soil types, rotations, etc.

As Southern Manager for the American Potash Institute, he was in charge of Institute activities in the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Louisiana, Mississippi, Arkansas, Texas, Oklahoma, and Tennessee. In this work he directed a staff of six field agronomists in the planning and supervision of numerous agronomic research projects and demonstrations with a wide diversity of crops as grown on many varying soil types under the several climatic conditions of that great agricultural area.

Dr. Mann is a member of the American Society of Agronomy; Soil Science Society of America; Fertilizer Committee and Sub-committee on Fertilizer Ratios; National Joint Committee on Fertilizer Application, Chairman, Southern Regional Committee; National Soil Science Society of Florida; American Association for the Advancement of Science (Fellow); Southern Agricultural Workers; Sigma Xi; Sigma Pi; Alpha Zeta; Cosmos Club of Washington; Atlanta Athletic Club; and is a Scottish Rite Mason, Shriner. In 1935 he was a delegate to the Third International Soil Congress, Oxford University, England, and he has visited the universities and experiment stations of England, Scotland, Wales, Holland, Germany, and France. He is listed in American Men of Science; Rus; International Blue Book; Chemical Who's Who, Vol. 2, 1937; and America's Young Men, Vols. 2 and 3.

He is married to Margaret Emma Mann of Middletown, North Carolina, and they have one son, Harvey, Jr., now a student at North Carolina State College.

J. W. TURRENTINE

The December 13, 1948, issue of the CHEMICAL AND ENGINEERING NEWS published by the American Chemical Society paid tribute to Dr. Turrentine upon his retirement, with his picture on the front cover and the following write-up on page 3683:

"When John William Turrentine retires as President and Chairman of the Board of Directors of the American Potash Institute on December 31, he could well rest on the laurels earned in a lifetime of service to the users and producers of potash. Undoubtedly, he will not be content to do so, for the growth of the American potash industry has been too closely allied with his career.

J. W. TURRENTINE

"He was born in Burlington, North Carolina, July 5, 1880, and attended the University of North Carolina, receiving a Ph.B. in 1901 and an M.S. in 1902. After teaching chemistry at Lafayette College for the next three years, he went to Cornell University and received a Ph.D. in 1908. He was serving as an instructor in chemistry at Wesleyan University in Connecticut when . . . in 1911, he joined the Department of Agriculture as a research chemist. Just prior thereto Congress had made its first appropriation for potash research and the first assignment given Dr. Turrentine was an investigation of known potash raw materials with a view toward removing the dependence of this country on Germany for potash salts.

"With the outbreak of war in 1914, imports from Germany ceased, and the price of potash jumped 1,000%. To meet the demand all known potash raw materials were placed in production. To Dr. Turrentine fell the task of designing, constructing, and operating a plant for the extraction of potash from kelp, which his earlier investigations had shown to contain large percentages of potash salts. An important feature of the plant was the process invented by Dr. Turrentine for the vacuum cooling and crystallization of potash salts. This development revolutionized the potash industry, which had previously used vat cooling and crystallizing methods. To make the plant an economic reality, Dr. Turrentine designed operations so as to obtain iodine and decolorizing carbon as by-products. In this connection he developed the blowing-out process for recovering iodine from dilute solution, a method subsequently used commercially for iodine and bromine recovery.

"Soon after the war ended, the plant was abandoned, and in 1922 Dr. Turrentine was back in Washington to take charge of government potash studies. With the founding of the American Potash Institute in 1935, he became President and Chairman of the Board of Directors.

"The Institute was founded by American potash producers and importers as a scientific research and educational publicity organization. Its purpose, according to Dr. Turrentine, is to 'find the proper scientific place for potash in American agriculture.' The Institute, through its five branch managers and 10 field agronomists, works closely with State and Federal agricultural agencies.

"Among the facilities provided by the Institute, Dr. Turrentine takes particular pride in the funds appropriated for fundamental research, which during his presidency have amounted to approximately $500,000 applied to research fellowships and grants-in-aid to universities and agricultural colleges.

"Dr. Turrentine has been a member of the American Chemical Society since 1902 and in addition is a member of the American Institute of Chemical Engineers, American Society of Agronomy, Soil Science Society of America, and the American Planning and Civic Association. He is the author of many books and scientific publications on potash, including the ACS monograph on that topic. He has been a frequent delegate to international meetings of chemical and allied groups. A major objective of his trips to Europe was to familiarize himself with the potash industries of Germany, France, and Spain. In 1937 he was awarded the gold medal of the Academie d'Agriculture de France for his work with potash.

"Dr. Turrentine is not severing his connection with the American Potash Institute completely but will continue to serve in the capacity of a consultant with the title of president emeritus."

Climate and Vitamin Content

WHEN your bean plants have suffered from lack of water they will produce beans of higher vitamin content but lower appetite appeal than beans from plants that have received adequate moisture for good growth, horticulturists of the Florida Agricultural Experiment Station revealed recently. As the average vitamin content of beans is very good and as bean plants that receive adequate moisture produce heavier crops of much higher appetite appeal than those that manage to get along despite skimpy moisture supplies, the farmer should hope for or, if necessary and possible, provide for adequate moisture for his plants.

Dr. Byron Janes and Victor Nettles found that beans receiving no irrigation contained 22.4 milligrams of ascorbic acid or vitamin C per 100 grams and 0.44 milligrams of carotene or provitamin A per 100 grams, while beans that were heavily irrigated contained only 16 milligrams of vitamin C and 0.19 milligrams of provitamin A per 100 grams.

Dr. Janes also has found a definite relationship between vitamin content of certain vegetables and the seasons in which they are produced. For example, broccoli grown at the Experiment Station in the late spring contained approximately 50 per cent more carotene than broccoli grown in the winter on the same soil with the same fertilization. Broccoli harvested in January contained 0.81 milligrams of carotene per 100 grams, while that harvested in April had 1.20 milligrams per 100 grams.

In his research on the nutritive value of Florida vegetables, Dr. Janes has come to the conclusion that growing conditions, such as rainfall, light, and temperature, have a strong bearing on the vitamin content of crops. Climate has a much stronger influence than soil on crop composition. "The only time in which soil has much effect on the organic composition of crops is when the plant makes very poor growth from excessive acid, lime, or other substances such as fertilizer and salt," he says. "A soil which will produce a normal crop will produce one which has a composition characteristic of the particular vegetable. The fact that the plant has grown healthily indicates that it has been supplied with everything necessary for life." . . . . *Clyde Beale, Agricultural Extension Service, Gainesville, Florida.*

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July		July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1923	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
January	33.14	45.9	186.0	217.0	246.0	281.0	18.70	95.10	....
February	30.71	38.5	193.0	231.0	192.0	212.0	19.60	88.60	....
March	31.77	29.6	196.0	237.0	211.0	221.0	19.70	87.90	....
April	34.10	31.2	209.0	240.0	219.0	229.0	19.40	89.40	....
May	35.27	40.1	196.0	244.0	216.0	222.0	18.30	90.70	....
June	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August	30.41	47.4	158.0	265.0	191.0	196.0	17.80	76.60	....
September	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1923	231	190	133	137	129	105	110	183	....
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	175	249	212	209	141	319	204
1947	252	380	224	245	366	273	146	379	249
1948									
January	267	459	267	247	383	318	158	422	320
February	248	385	277	263	299	240	165	393	320
March	256	296	281	270	329	250	166	390	295
April	275	312	300	273	341	259	163	396	340
May	284	401	281	278	336	251	154	402	262
June	284	417	268	280	336	239	151	409	213
July	266	436	238	298	315	230	153	428	213
August	245	474	227	302	298	222	150	340	172
September	250	467	220	264	277	223	152	302	150
October	251	506	204	236	215	224	155	282	176
November	246	428	207	226	188	231	155	306	186
December	239	457	220	250	192	232	161	305	209

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
January	2.78	1.83	16.22	11.71	12.75	13.28
February	2.78	1.90	15.03	12.15	12.75	12.60
March	2.78	1.90	13.68	12.06	12.75	9.47
April	2.78	1.90	13.87	11.71	12.75	8.35
May	2.78	1.90	13.77	9.54	12.75	7.89
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46

Index Numbers (1910-14 = 100)

1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
January	104	64	463	332	378	377
February	104	67	429	344	378	358
March	104	67	391	342	378	269
April	104	67	396	332	378	237
May	104	67	393	270	378	224
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1939	.609	3.18	5.50	.672	.962	26.59	610
1930	542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367 [1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
January	.760	3.42	6.60	.375	.669	14.50	.200
February	.760	3.42	6.60	.375	.669	14.50	.200
March	.760	3.42	6.60	.375	.669	14.50	.200
April	.760	4.11	6.60	.375	.669	14.50	.200
May	.760	4.61	6.60	.375	.669	14.50	.200
June	.760	4.61	6.60	.330	.634 [1]	12.76 [1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
January	142	95	135	68	70	60	83
February	142	95	135	68	70	60	83
March	142	95	135	68	70	60	83
April	142	114	135	68	70	60	83
May	142	128	135	68	70	60	83
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
January	307	266	242	139	83	403	142	71
February	279	263	233	139	85	393	142	71
March	283	262	233	137	85	379	142	71
April	291	264	238	137	85	380	142	71
May	289	265	239	137	85	370	142	71
June	295	266	241	128	85	309	142	65
July	301	266	247	231	88	317	144	68
August	293	266	247	129	91	285	144	68
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	261	240	134	94	311	144	72
December	268	261	239	137	94	336	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Supplemental List Commercial Fertilizers Registrants for the Fiscal Year Ending June 30, 1949," Bu. of Chem., State Dept. of Agr., Sacramento, Calif. FM-174, Dec. 15, 1948. (Issued subsequent to list of Aug. 26, 1948).

"Supplemental List Agricultural Minerals Registrants for the Fiscal Year Ending June 30, 1949," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., Dec. 16, 1948. (Issued subsequent to list of Aug. 27, 1948).

"Nutriculture," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., S. C. 328, 1948, R. B. Withrow and A. P. Withrow.

"Commercial Fertilizers in Kentucky, 1947, Including a Report on Official Fertilizer Samples Analyzed July-December, 1947," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 65, Oct. 1948.

"Phosphate Fertilizers—Kinds and Relative Values," Agr. Ext. Div., Univ. of Ky., Lexington, Ky., Ext. Leaflet 114, Sept. 1947, P. E. Karraker and J. F. Freeman.

"A New Fertilizer for Louisiana Farmers," Agr. Ext. Div., La. State Univ., Baton Rouge, La., Ext. Leaflet 19, March 1948, Leland Morgan and Mansel Mayeux.

"Fertility Requirements of a 'Bumper' Crop," Div. of Soils, Univ. of Minn., St. Paul, Minn., C. O. Rost.

"Fertilizer Inspection and Analysis: Fall 1947," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 516, July 1948.

"New Hampshire Grade-Tonnage Survey for the Fiscal Year July 1, 1947 to June 30, 1948," Agr. Exp. Sta., Durham, N. H., Ford S. Prince.

"Commercial Fertilizers in 1947-48," Dept. of Agron., Texas A & M College, College Station, Texas, Bul. 705, Sept. 1948, J. F. Fudge and T. L. Ogier.

"The Fertilizer Situation for 1948-49," Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., Oct. 1948.

"Liquid Ammonia as a Fertilizer," Bu. of Plant Industry, Soils, and Agr. Eng., Agr. Research Admin., U.S.D.A., Beltsville, Md., 1948, M. S. Anderson.

Soils

"The Forest Soils of Connecticut," Agr. Exp. Sta., New Haven, Conn., Bul. 523, July 1948, H. A. Lunt.

"Water Management for the Farm Conserving Soil and Water for Efficient Production of Crops and Livestock," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 557, Apr. 1948, M. W. Clark and J. C. Wooley.

"Control of Soil Erosion on Long Island," College of Agr., Cornell Univ., Ithaca, N. Y., Ext. Bul. 744, May 1948, A. F. Gustafson, John Lamb, Jr., and H. M. Wilson.

"Investigations of Chloropicrin as a Soil Fumigant," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Memoir 278, Aug. 1948, F. L. Stark, Jr.

"Classification and Use South Carolina Farm Lands According to Their Capabilities," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 316, May 1948, The South Carolina Agronomy Committee.

"Soil, Soil Management and Soil Conservation—A Manual for Youth Groups," Agr. Ext. Serv., S. D. State College, Brookings, S. D., Ext. Cir. 436, June 1948, L. L. Ladd.

"Soil Survey—Jackson County, North Carolina," Agr. Research Admin., U.S.D.A., Washington, D. C., Series 1938, No. 19, Issued Sept. 1948, E. F. Goldston, W. A. Davis, and C. W. Croom.

"The Quality of Water for Irrigation Use," Agr. Research Admin., U.S.D.A., Washington, D. C., Tech. Bul. 962, Sept. 1948, L. V. Wilcox.

"Soil Classification Helps Fit Crops and Farming Methods to Individual Farms," Agr. Research Admin., U.S.D.A., Washington, D. C., R. A. S. 109 (P), Oct. 1948.

Crops

"The Home Garden," Ext. Serv., Ala. Polytechnic Institute, Auburn, Ala., Cir. 134, Feb. 1947 (Rev.), W. A. Ruffin.

"The Effect of Moisture Content, Field Exposure, and Processing on the Spinning Value of Arizona Upland Cotton," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Tech. Bul. 115, June 1948, R. S. Hawkins and W. I. Thomas.

"Oats in Canada," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., Publ. 554, Farmers' Bul. 27 (Rev.) 1948, R. A. Derick and D. G. Hamilton.

"Dominion Forest Nursery Stations—Indian Head, Sask. and Sutherland, Sask," Exp. Farms Serv., Dept. of Agr., Ottawa, Can., P. R. 1937-1946, John Walker and W. L. Kerr.

"Culture of Barley in Colorado," Agr. Exp. Sta., Colo. A & M College, Fort Collins, Colo., Tech. Bul. 39, June 1948, D. W. Robertson, Dwight Koonce, Rodney Tucker, J. F. Brandon, and T. E. Haus.

"Ten Points for Increasing Tomato Yields," Agr. Ext. Serv., Univ. of Del., Mimeo Cir. 51, April 1948, R. F. Stevens.

"Upland Permanent Pastures for the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo Paper No. 1, June 1941, (Rev. Nov. 1948).

"Soybeans," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo Paper No. 11, Feb. 1942, (Rev. Dec. 1948).

"Lowland Permanent Pastures for the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 58, Nov. 23, 1948.

"Inoculation of Legumes," Agr. Ext. Serv., Univ. of Idaho, Moscow, Idaho, Ext. Cir. 101, Oct. 1947, V. A. Cherrington and K. H. Klages.

"Irrigated Pastures," Agr. Ext. Div., Univ. of Idaho, Moscow, Idaho, Ext. Bul. 174, June 1948, K. H. Klages, R. H. Stark, G. C. Anderson, D. L. Fourt, E. W. Whitman, and T. B. Keith.

"Sixtieth Annual Report," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., 1947.

"Annual Report of the Director of Agricultural Extension, Kentucky, 1947," Agr. Ext. Div., Univ. of Ky., Lexington, Ky., Cir. 460, T. R. Bryant.

"Management of Forests in an Eastern Kentucky Area," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 518, May 1948, W. A. Duerr and R. O. Gustafson.

"Tobacco Plant-bed Management," Agr. Ext. Div., Univ. of Ky., Lexington, Ky., Leaflet 85, Feb. 1945 (Rev. Feb. 1947), R. A. Hunt.

"Fruit Varieties for Michigan," Agr. Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Folder F-116, March 1948.

"Hints on Blueberry Growing," Agr. Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Folder F-119, Apr. 1948.

"Currants and Gooseberries," Agr. Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Folder F-120, April 1948.

"Pruning Bearing Fruit Trees in the Home Orchard," Agr. Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Folder F-121, Apr. 1948.

"Pruning Young Fruit Trees," Agr. Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Folder F-122, Apr. 1948.

"Planning and Planting the Orchard," Agr. Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Folder F-123, May 1948.

"Annual Report of Mississippi Extension Service," Agr. Ext. Serv., State College, Miss., Ext. Bul. 143, June 1948.

"Crimson Clover for Better Pastures," Agr. Ext. Serv., Miss. State College, State College, Miss., Unno. Folder, W. R. Thompson.

"Varieties of Tung," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 407, Apr. 1948, W. W. Kilby.

"Sudan Grass Production in Missouri," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 558, Apr. 1948, C. A. Helm.

"A Balanced Agriculture for Missouri," Agr. Ext. Serv., Columbia, Mo., Cir. 559, Apr. 1948.

"4-H Garden Club Manual," Agr. Ext. Serv., Mont. State College, Bozeman, Mont., Bul. 252, June 1948, E. E. Isaac.

"Ladino Clover for Ohio Farms," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 684, Nov. 1948, L. E. Thatcher, D. R. Dodd, and C. J. Willard.

"Oat Variety and Cultural Tests in Oklahoma, 1925-1947," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Tech. Bul. T-33, Nov. 1948, A. M. Schlehuber, W. M. Osborn, and T. H. Johnston.

"Trials of Annual Flowers, 1948," Agr. Exp. Sta., Pa. State College, State College, Pa., Journal Series Paper No. 1483, Nov. 3, 1948, E. I. Wilde and L. T. Blaney.

"The Set of The Sails," 1947 A. R. of Ext. Serv., R. I. State College, Kingston, R. I., Bul. 118, May 1, 1948, H. O. Stuart.

"Lawns for South Carolina," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 308, March 1948, A. E. Schilletter, and H. A. Woodle.

"Gardening," Agr. Ext. Serv., Texas A & M College, College Station, Texas, Bul. B-70, J. F. Rosborough and C. R. Heaton.

"The Possibilities of Growing Flax in North Central Texas," Agr. Exp. Sta., Texas A & M College, College Station, Texas, P. R. 1129, Aug. 10, 1948, I. M. Atkins.

"Report of the Chief of the Office of Experiment Stations, Agricultural Research Administration, 1948," U.S.D.A., Washington, D. C.

"New Varieties of Oats from Bond Crosses Resistant to Victoria Blight," U.S.D.A., Washington, D. C., Cir. 795, Oct. 1948, T. R. Stanton.

"Raspberry Culture," U.S.D.A., Washington, D. C., Farmers' Bul. 887, Issued June 1926 (Rev. Sept. 1948), G. M. Darrow and G. F. Waldo.

Economics

"Annual Report of the Statistics Branch, 1947," Ont. Dept. of Agr., Toronto, Ont., Can., Sessional Paper No. 22, 1948.

"The Louisiana Strawberry Marketing System," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo Cir. 78, March 1948, M. D. Woodin and R. B. Johnson.

"Marketing Farm Products in Monroe, La.," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo Cir. 79, Apr. 1948, M. D. Woodin and R. B. Johnson.

"Financial Results of the Operation of Large Sugar Cane Farms in Louisiana in 1946," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo Cir. 80, May 1948, F. E. Stanley and J. N. Efferson.

"Trends in the Sweet Potato Industry with Special Reference to Acreage, Yield, Production, Shipments, Price, Utilization," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo Cir. 83, July 1948, R. B. Johnson, M. E. Miller, and M. D. Woodin.

"Montana Farmer Cooperatives 1941 and 1946," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 449, Jan. 1948, H. F. Hollands.

"Use Recommended Practices to Increase Income," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 318, June 1948, C. B. Ratchford.

"Suggested Plan for the Small Southern Piedmont Cotton Farms," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 319, June 1948, C. B. Ratchford.

"Suggested Plan for the Medium Southern Piedmont Cotton Farms," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 320, July 1948, C. B. Ratchford.

"North Dakota Wheat Yields," Agr. Exp. Sta., N. Dak. Agr. College, Fargo, N. Dak., Bul. 350, May 1948, H. L. Walster and P. A. Nystuen.

"Dairy Farm Earnings in Tillamook County, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 450, Jan. 1948, G. W. Kuhlman, A. L. Pulliam, and D. C. Mumford.

"Cost of Producing Pole Beans in the Willamette Valley, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 452, April 1948, G. B. Davis and D. C. Mumford.

"Cost of Producing Sweet Cherries for Processing in the Willamette Valley and the Dalles Area," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 454, July 1948, G. W. Kuhlman and D. C. Mumford.

"Trend of Taxes on Farm and Ranch Real Estate in Texas, 1890-1946," Agr. Exp. Sta., Texas A & M, College Station, Texas, Bul. 702, July 1948, L. P. Gabbard and R. G. Cherry.

"Texas Farm Commodity Prices," Agr. Exp. Sta., Texas A & M, College Station, Texas, Bul. 700, July 1948, J. G. McNeely, E. O. Schlotzhauer, and V. C. Childs.

"Trends in the Texas Farm Population, 1948," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1128, Aug. 10, 1948, J. R. Motheral.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 127, Nov. 19, 1948, Karl Hobson.

"Methods of Harvesting Hay Fields and Pastures in Northwestern Washington (North Coast Area), 1945," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Bul. 502, April 1948, H. H. Stippler, M. T. Buchanan, and A. G. Law.

"What Makes the Market for Dairy Products?" Agr. Exp. Sta., Univ., of Wis., Madison, Wis., Bul. 477, Sept. 1948.

"Delivery Notices in Cotton Futures Markets," U.S.D.A., Washington, D. C., Cir. 794, July, 1948, R. C. Callander.

"Managing Farm Finances," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Misc. Publ. 652, Sept. 1948, H. C. Larsen and N. W. Johnson.

"Inventory of Major Land Uses, United States," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Misc. Publ. 663, L. A. Reuss, H. H. Wooten, and F. J. Marschner.

"Efficient Use of Food Resources in the United States," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Tech. Bul. 963, Oct. 1948, R. P. Christensen.

"Soybeans in American Farming," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Tech. Bul. 966, Nov. 1948, E. G. Strand.

"Workers in Subjects Pertaining to Agriculture in Land-grant Colleges and Experiment Stations, 1947-48," Office of Exp. Stations, Agr. Research Admin., U.S.D.A., Washington, D. C., Misc. Publ. 649, June 1948.

"Handbook of Cooperatives Processing Horticultural Products, 1945-46 & 1946-47," Coop. Research and Serv. Div., Farm Credit Admin., U.S.D.A., Washington, D. C., Misc. Publ. 120, June 1948, A. L. Gessner.

"Statistics of Farmers' Marketing and Purchasing Cooperatives, 1945-46," Farm Credit Admin., U. S. D. A., Washington, D. C., Misc. Rpt. 119, June 1948, Grace Wanstall.

"Some Landmarks in the History of the Department of Agriculture," U. S. D. A., Washington, D. C., Agr. History Series No. 2, Rev. July 1948, T. S. Harding.

ALL WRONG

A man who doesn't like his son-in-law confided in a friend, "He can't drink and he can't play cards."

"Fine," said the friend, "that's the kind of a son-in-law to have."

"No siree," objected the man. "He can't play cards—and he plays. He can't drink—and he drinks."

NO FOOLING

The prisoner was worried when he saw twelve women in the jury box. He asked his lawyer, "Do I have to be tried by a woman jury?"

"Be still," whispered his attorney.

"I won't be still," replied the man. "If I can't fool my own wife, how in the h - - - can I fool twelve strange women?"

Establishing Bermuda-grass

(*From page* 25)

Bermuda-grass usually responds to a supply of potash in the fertilizer. Manure is good, but generally causes unusually heavy weed competition.

6. Seed after warm weather starts. Seeding after mean daily temperatures reach 65 degrees F. is most successful in Arkansas.

7. Keep new seeding as weed-free as possible. Cultivation may be necessary, and a limited amount of grazing after stolons have started to run will help keep competing vegetation down and encourage crowning. Cultivation and grazing should be discontinued, however, when the stolons have completed most of their first season's growth to allow plenty of time for top growth and other vegetation to develop for winter protection.

8. Provide winter protection for first-year stolons. First-year seedlings normally have developed no rhizomes; therefore, stolons are the only source of the next year's growth. Where winter temperatures are likely to be much below freezing, special emphasis needs to be placed on keeping Bermuda-grass stolons from being killed. In milder parts of the Western Gulf Region the maintenance of a large amount of fall vegetation that will mat over the stolons and protect them may be sufficient. A month's or six weeks' deferment before frost may suffice.

In northern Arkansas and Oklahoma, stolons should receive a light covering of soil for protection. This can be done any time before hard, killing frosts. It will be more successful if done early enough to let settling and soil moisture eliminate air spaces that could carry killing air temperatures to the covered stolons. The last cultivation of the grass can be done in a way to provide the necessary stolon protection.

9. Rhizome growth should be induced as soon as possible. Bermuda-grass rhizomes resist drouth or low temperatures better than do stolons. They naturally are better protected from the elements. Disking will loosen the soil and encourage rhizome growth. This should be done the spring following the first growing season, after stolons have started growing. Disking also will uncover some stolons so that they will develop early, and will smooth the land surface for easy mowing. It will help to apply a nitrogenous fertilizer just before the rhizomes bud. This suddenly throws a large amount of plant nutrients into building these plant-food storage reservoirs. Apply this treatment the first fall and the second summer at times indicated by the beginning of seed stalk formation.

Building Permanent Pastures on a Bermuda-grass Base

It is desirable to build up Bermuda-grass pastures to produce a large amount of beef, milk, and other livestock products. The introduction of legumes and winter-growing grasses, continued application of fertilizers and, where needed, lime, and attention to the other management needs, such as mowing, occasional tillage, proper degree of utilization, and prevention of burning will make Bermuda-grass high-producing.

Before other kinds of plants are overseeded onto it, the Bermuda-grass should be well established. The desired density of the grass should have been attained and rhizome growth should have started. Plants that are seeded in the fall usually can be overseeded safely after the first growing season if sod or sprigs were used to establish the grass. Unless rhizome growth is secured the first growing season on Bermuda-grass seedings, fall overseedings should be delayed until after the second growing season. Spring overseedings usually can be made safely the second growing season on both sodded and seeded stands.

Bermuda-grass Is Used for Many Conservation Jobs

As a necessary part of farm conservation development, thousands of stock-water ponds have been constructed. Many more will be built. Most of these require the building of a dam of earth and the excavation of a spillway for excess water. Bermuda-grass is the major plant used for stabilizing both dams and spillways. Raw subsoil usually is exposed in construction, and enough fertility must be applied to get good grass growth. Topsoil often is placed on the surface to support the vegetation. Fertilizer should be applied.

Waterways

The concentrated flow from field terraces must be carried safely to areas of stable grade. Whenever terraces can be emptied onto broad vegetated waterways it can be led slowly and safely to stable natural drains.

Channels

Occasionally terrace water must be taken to stable grades through designed channels, rather than preferred broad meadow or pasture waterways. Bermuda-grass is the chief vegetative stabilizer for channels. It is very important that it be kept closely cropped, since then it is considerably more efficient in protecting soil against rapid surface flow.

Highway Erosion Control and Safety

The Soil Conservation Service, soil conservation districts, and state highway departments have been developing effective means of stopping the large amount of erosion on road right-of-ways. Erosion control, highway beautification, and highway safety all require widespread use of Bermuda-grass. The application of a generous mulch of sprigs, mixed with good topsoil, is an economical and effective way of establishing Bermuda-grass along highways. The mulch is rolled and kept watered, if necessary.

Useful Figures about Bermuda-grass

Approx. Number Unhulled Seed (florets) per pound 1,500,000
Approx. Number Hulled Seed (caryopses) per pound 2,000,000
Average Purity of Seed 94.35%
Average Germination of Seed 73.2%
Average Longevity of Seed 2-3 years
Approx. Weight of Seed per bushel 25 lbs.
Seeding Rate, Hulled Seed, 100% purity, 100% germination to secure 20 live, pure seed per square foot—per acre 0.6 lbs. (Add 1/10 lb. for each 10% drop in either purity or germination, to 70%)
Sprigs, without Soil or Top Growth, to Plant 1 acre, firmed 8-10 bu.
Fat Content (from Texas Agricultural Experiment Station) 1.5%
Phosphoric Acid, before July 1,—on Phosphated Soils 0.55%
Phosphoric Acid, before July 1,—Phosphate not applied 0.41%
Phosphoric Acid, after September 1,—on Phosphated Soils 0.47%
Phosphoric Acid, after September 1,—Phosphate not applied 0.34% (Foregoing data from Texas Agricultural Experiment Station)
Crude Protein—without Winter Clovers in Mixture 5.19%
Crude Protein—with White Clover 5.38%
Crude Protein—with Persian Clover 6.38%
Crude Protein—with Hop Clover 7.31%
Crude Protein—with Cluster Clover 8.31% (Foregoing protein data from Georgia Agricultural Experiment Station)
Calcium Content (from regional data) 0.48%
Dry Weight Annual Production, without Winter Clover 1,629 lbs.
Dry Weight Annual Production, with Winter Clover 3,238 lbs. (Foregoing data from Georgia

Agricultural Experiment Station)
Annual Yield of Hay (from regional data) .... 1-2 tons
Annual Production, 4% Milk, per acre .... from 7,404 lbs. to 11,434 lbs. (From South Carolina Agricultural Experiment Station)
Annual Production of Beef, per acre .... from 266 lbs. to 381 lbs. (Experiment Station Averages, Arkansas)
Rainfall Lost Annually, per acre, from Bermuda-grass Sod (Batesville, Arkansas) .... 0.89 in.
Soil Lost Annually, per acre, from Bermuda-grass Sod (15-year period at Guthrie, Oklahoma) .016 tons

Military Kudzu

(*From page* 18)

400 pounds of 0-14-10 or 300 pounds of 0-20-20, if available, would be suitable. As the number of animal units on such an area increases, a general fertilization will have to be given and an additional application made on those areas where intensive grazing is desired. The cattle will find the more highly fertilized areas and graze them intensively.

This same program of controlled grazing with fertilizer can be extended to other grasses and legumes and mixtures.

Fort Bragg, North Carolina, has an unusual situation. A lot of kudzu has been planted for erosion control, but only a small part of the plantings have developed sufficient growth to control erosion. On the ranges practically all of the road-bank plantings have been overgrazed by deer. Under such conditions there are two alternatives: (1) Maintain the status quo; or (2) plant enough kudzu to control erosion and provide sufficient deer feed. There is enough severe erosion to be controlled over the entire reservation to require sufficient kudzu to supply both summer and winter feed for the deer population.

Under these conditions kudzu has

Fig. 5. The kudzu which stabilized the banks of this railroad has covered the rails and roadbed. If the tracks are used again, the kudzu will be more easily cleared than the soil eroded from the steep cut banks.

two outstanding characteristics: (1) complete erosion control; (2) high quality feed for cattle and deer.

Another long-range value is its soil-building as well as soil-holding ability. The time may come when the productive capacity of this soil may be a matter of importance. Right now erosion control will reduce road maintenance costs and prevent the complete silting of ponds. With enough kudzu planted to do a complete job of erosion control, the deer will be healthier, fatter, and probably more contented to stay on the reservation. These present benefits are sufficient to warrant the necessary plantings.

As the kudzu develops, its roots will be growing and expanding into long tubers where plant food is stored. One acre of live roots has weighed as much as 56,000 pounds. An average is 26,000 pounds, or 13 tons of organic matter per acre underground. This accounts largely for the tremendous soil building that kudzu accomplishes underground while holding the surface soil in place.

The food and feed needs are increasing. The military reservations are of sufficient size to add materially to the needed feed supplies by establishing a complete erosion control program. This will reduce maintenance costs and build soil for our future needs without curtailing present military use.

Organic Matter . . . . Old Soils

(*From page* 11)

land type of agriculture has become a part of the thinking of farmers in the Middle West. "More land in grass more of the time; some land in grass all of the time" is the slogan we use here in Wisconsin. Our Government is encouraging farmers to practice a soil-saving type of agriculture by making incentive payments for practices of fertilizing, liming, the seeding of grass and legume crops, soil-conserving tillage practices, and other control measures.

How important is organic matter? I hope that every farmer will decide upon and then carry out some improved practices on his farm that will add to the supply of humus and organic matter. Such procedure will make his land more productive, add to its capital value, and make for future prosperity for him, his family, his community, his state, and the Nation.

Hardening Plants with Potash

(*From page* 14)

ing in an extensive outdoor bed. The early part of the season had been unusually cold and rainy. As a result the plants grew very slowly, and he feared the nitrates had been leached from the soil. Consequently he applied a heavy sidedressing of nitrate of soda. Shortly thereafter the weather became unseasonably warm and his plants grew very rapidly but were making such a soft, succulent growth they would not be satisfactory for transplanting.

He was shown the previously mentioned series of tomato plants in the coldframe and noted how the high-potash fertilizer was "hardening" the plants. He was much impressed with the firm, stiff stems and stocky plants, and was advised to apply a sidedressing of muriate of potash to his cabbage plants to "harden" them. In order to get a more prompt response, because time was an essential factor, he was advised to apply the potash in solution.

Since he was equipped with a large mounted tank with tubes to apply calomel solution to his cabbage plant rows to control cabbage maggot, it was suggested that he use this equipment to apply the muriate of potash in solution directly on his cabbage rows. This was applied at the rate of 10 lbs. of 60 per cent muriate of potash per 50 gallons of water, using 750 gallons per acre.

The result was that very satisfactory plants were produced by this treatment. A few rows were left as an untreated check for comparison. The cabbage plants receiving the potash sidedressing made a stockier growth with firm stiff stems that stood transplanting well, whereas the untreated plants made such a rank soft growth they were discarded.

Similarly, plants in the field, if they are making too soft and rank a vegetative growth, can be hardened by applying potash fertilizer. If too much potash is applied an apparent nitrogen deficiency may occur.

Handling Quantities of Data

(*From page* 12)

items. Under such conditions many more minor items than customary are used in reaching the ultimate conclusion.

When all available information is punched upon the card as here shown for Bill Smith, the machine can rapidly handle most of the work necessary in making numerous studies, comparisons, calculations, or summaries.

Some computations which have already been made on the 42,000 samples tested the last fiscal year in North Carolina reveal some interesting things. For instance, using the data obtained to represent the counties and State, it was found that:

1. Ninty-three and three-tenths per cent of the topsoils submitted for analysis were accompanied with subsoil and 88.3 per cent of the topsoils were accompanied with data or history sheets from the farmer.

2. Soils were analyzed and lime and fertilizer recommendations were made for 7,526 different farmers.

3. In one county 21.6 per cent of the soils had a pH above 6.5; while in another county 29.4 per cent of the soils had a pH below 5.0.

4. In one county 17.1 per cent of the soils were very low in potassium; in another county 14.1 per cent were very high in potassium.

5. In one county 38 per cent of the soils were very high in phosphorus; in another 61.6 were very low in phosphorus.

6. In one county 44 per cent of the soils had more than 3.5 per cent organic matter; in another county 55.5 per cent of the soils had less than 1 per cent organic matter.

7. There were 2,223 farmers who submitted only one sample of soil; 3,498 who submitted two samples; and 6,890 who submitted three samples. The average for the entire state was three samples per farmer.

8. Recommendations were made for 92 different types of crops on 120 soil types.

9. There were 1,567 composite samples of soils collected according to instructions in detail, with 9,179 made up of less than five sub-samples.

10. There were 6,954 fields that had been limed, and 4,262 fields with unknown lime history.

11. More samples of soils were tested for alfalfa than for any other crop, with pasture, tobacco, and corn following in the order named.

These data emphasize the great necessity of proper sampling and should definitely stimulate those working in the education field to do more effective teaching in proper sampling. On the other hand, the data show that most of the farmers now realize the necessity for a subsoil and data sheet with each sample of topsoil; therefore, it probably will not be necessary to place much emphasis on this part of the program in the future.

If there were not enough of any plant food available to supply all needs, then a major effort should be made to get ample quantities of that plant food to the county which is low in it rather than to the county which is reasonably high in that plant food.

The foregoing material should suffice to show the broad application of these machines in handling great masses of data.

Permanent Pastures in South Carolina

(*From page* 20)

a complete fertilizer on these pastures as compared to the untreated plots. The State Pasture Committee also visits a representative number of these demonstrations each year. Many of the present permanent pasture recommendations have been made based on studies of these demonstrations.

Notwithstanding the fact that permanent pastures furnish the cheapest feed on the farm, it must be remembered that there is no compromise for following through with the required steps in establishing a good pasture. Failure to sufficiently inoculate clover seed and to protect the inoculant with a cultipacker when seeding will usually result in failure to obtain a satisfactory stand of clover.

Patience is very necessary in establishing a permanent pasture. Good sods of grasses and legumes require several years. Once the pasture has been established, the job is not done. At this stage the proper maintenance and management begin. Neglected use of the mowing machine to control noxious weeds, overgrazing, undergrazing (although seldom occurring), and the inadequate use of plant nutrients will not contribute to keeping a pasture of high quality and production.

Indiana's Muck Crops Program

(*From page* 22)

use of such fertilizer elements as will help in the control of specific diseases.

5. Control insects by the proper use of recommended insecticides.

6. Cooperate with growers and others in the promotion of your county muck crops association, advertising the quality of northern Indiana muck crops.

7. Standardize product to meet U. S. grades, and mark accordingly.

8. Use new, clean containers for top grades, with approved identifying brands.

9. Consult your county agricultural agent when planning a muck crops program; study recommended practices and follow those fitted to crop production on your farm.

10. Market your quality products efficiently. Your produce loaded in refrigerator cars, protected against heat and cold, can reach any market in the United States in excellent condition at a minimum cost and maximum speed, and will secure the attention of the buying public.

With such a program the value of the Association can easily be recognized. The results have paid off very well for the efforts of these men who

10 years ago were up against great odds.

The 400-Bushel Potato Club is a product of the Association which was formed when very little was known of the relation of potash to the yield of potato crops. The production records of this club have been going higher each year as more experience is gained by the growers, along with better potato varieties that are developed and the added use of the all-important potash. When these things are put together with a working production program, it means only one thing and that is success.

Fig. 2. Louis Ruderman, 1948 Indiana Potato Champion, produced 717.12 bushels of U. S. No. 1's on his champion acre.

The 1948 yields of the 400-Bushel Potato Club were record-breaking; several are reported here with a few of the reasons why they were so high.

The 1948 Indiana Potato Champion is Louis Ruderman, who lives near Huntertown in Allen County. Ruderman had 35 acres of potatoes on black muck which has a pH of 5.6. He broke all records in Indiana by producing 717.12 bushels of Katahdins per acre. The previous record was set in 1947 by another muck farmer with 712.33 bushels per acre.

Ruderman's land is valued at over $300 per acre but is not for sale. It is well drained, with 235 acres in the entire field. The water level in the sub-soil is maintained at 36 to 40 inches below the surface. He used 35 bushels of certified Katahdin seed potato stock per acre.

Mr. Ruderman is a strong believer in plenty of fertilizer to insure a good crop. In 1947 he grew potatoes in the same plot and used 1,200 pounds of 0-9-27, and in spite of poor growing conditions he produced over 400 bushels per acre. This year to produce his record-breaking crop he applied 1,200 pounds of 0-8-24 per acre under the rows. A heavy green manure crop of rye four feet high was plowed under in April to aid in growing this fine crop of high quality potatoes.

Arthur Troyer of LaOtto in Noble County produced the second highest yield in the club this year, with 659.65 bushels per acre. Troyer produced his good crop by plowing under a green manure crop of rye early in the spring and applying 800 pounds of 0-9-27 fertilizer in bands on each side of the row. He maintained a water level in his soil 30 inches below the surface.

Mr. Troyer maintains that there are three major factors that can not be overlooked in producing potatoes on muck land:

1. Use good seed.
2. Apply enough high-potash fertilizer.
3. Practice an intensive spray schedule.

Joe Glancy held fifth place among the winners of the club with a yield of 632.42 bushels. Mr. Glancy manages the Indiana State Prison farm at Westville in Porter County and, like all other muck crop men, is a strong believer in the three things Troyer listed above.

There are other stories which are equally interesting that could be told but they are all similar to those of the "400-Bushel Potato Club."

Farm Listening Posts

(*From page* 5)

reports on request. In discussing his customary methods, Mr. Webster once stated:

"We watch the crops from planting time to harvest. As I get around and meet my friends at church or in town, we usually talk crops and yields and prices. Even though I am pretty old, I get out on the farm every day, so that I get a close picture of what's doing. In milk production figuring I spend much time with my son, who is manager of a creamery. He runs our farm now and when I get too old to work I'll probably turn this crop reporting duty over to him. It ought to stay in the family."

ANOTHER element of the rural population who have had much to do with correct surveys of crops and farm statistics are the elected assessors. Not all the states make use of their services in the same degree as others. Yet without extra pay these officers fill county by county record files that are sent on to the state estimators for substantial basic use.

What happens to all these individual accounts and estimates when they are dumped onto the desks of the state people?

Each day's mail around the first of each month is heavy with these uniform reports. Clerks who supervise this work get familiar with the names and contributions of the farm fieldmen. The envelopes are run through a mechanical opening machine, and the contents of them are sorted out by counties. When all the reports for all the counties are footed up on separate sheets, the "editor" and "checker" get busy. Even the best of authorities has to stand for having his copy edited. Then when these advisable adjustments are made the totals are cast up for each crop and each livestock item in the respective counties.

By putting in some extra overtime and having skilled and trained workers on the job, most of the states handle the monthly crop reports in at least four days. Like newspapers, these offices work against a time limit deadline. Certain specified dates are fixed for such data to reach national headquarters, ready to be merged and blended with the records and estimates from all the states into the final consensus of opinion. Crop panels of expert estimators scan the state reports and finally come forth with the famous release at "3 p. m. Eastern Standard time," invariably on the 10th of each month. The verbal trimmings attached thereto mean no small task either, so the pencils fly and the stencils hum, while a myriad of newshawks sit on the fence like buzzards anxious for the "kill."

NO doubt the influence of the local farmers club has waned. Its place has been largely taken by up-an-at-'em cooperatives. Yet these same social and technical farm clubs were the places where early crop reporting began. Mr. Allen Farquhar of Montgomery county, Maryland, on the celebration of the seventy-fifth anniversary of the Civil War crop report gave an insight into the invaluable help which such neighborhood assemblies provided.

He said flatly that he relied largely on the conversations and discussions of the farmers clubs for his crop estimates. It was the custom of such gatherings to have a light (?) lunch and a brief business meeting and then to walk around afield with the host of the day. He said that some of the members doubted the value of estimated crops by a scattering system of reports which was then in vogue. The same man added, however, that if it could be arranged so that a large number of similar estimates could be collected at a central point, there might be something good come of it. And there has!

THERE was a period between the seventies and the dawn of the modern era when farm papers encouraged some of their subscribers to send in regular crop estimates and summer season condition reports. The editors mailed these volunteers plenty of paper and stamped return envelopes, and then credited them personally with their contributions when printed. I recall opening and arranging these pencil-written letters and writing suitable headlines to grab reader attention. I believe that they boasted excellent readability scores, too, because no other crop system then approached them for reliability and directness and the use of personal names induced more careful reading. But we abandoned the custom over 20 years ago, and like the wearisome detailed reports of fair awards, the crop report as such by subscribers has vanished from the farm journal index.

It was the early conclusion of farm editors and other leaders of advanced hopes on crop reporting that only the Government itself could hope to work out and perfect a good, lasting, and reliable system of crop and livestock reporting. Their belief proved true.

From time to time private agencies and grain houses have issued their own independent cereal and cotton reports. That they have been done well and represent excellent service are not debated here. Yet for downright confidence and unbiased attitude, the populace as a whole looks to the U. S. Department of Agriculture and its State crop estimating agencies for the right answer.

The confidential forecast is one thing and the public statement is another quite apart. Sometimes the trade really gets the facts faster and perhaps more accurately to inform its own clientele than the public agency, but the official estimate from Washington and the state capitals remains the "daddy of them all."

Your technical crop report reviser is a shark for work and a demon for adjustments. He takes the raw materials sent in by the working farm informers and subjects them to his craftsmanship. This means using slide rules, calipers, calculating machines, and adding mechanisms, reading dot charts, and consuming much scratch paper. The eye-shades, briar pipes, and armbands that have been worn to shreds at this mighty business of the nation would make a big rummage sale.

I boast many good friends in this polishing off of farm figures. When they are hard at it behind closed doors I do not enter, because they speak only in statistical jargon that I cannot (and care not to) understand. Neither would the loyal farm reporter quite see the light amid all this encircling haze. Yet it is advisable and necessary to the farrowing of a litter of useful information.

BUT when all is clear and the smoke lifts from the conference room, and after the well-qualified words are written and the tables stenciled, an ordinary inquiring mortal can sidle into the presence of these crop correctors and get an earful.

Here results depend on the knowledge of the farm craft displayed by the news or radio boy who enters the sanctum. If he has to have all explained to him, such as the difference between winter and spring wheat, shorn and pulled wool, fluid milk and manufactured milk, or field peas and canned peas—he won't get a scoop or a reliable feature story.

Forecasting, the "soothsaying" side of crop statistics, is another new venture begun as late as 1927 in this country.

During the first world war some army officers prevailed on the U. S. Department of Agriculture to obtain answers from farmers on intentions to sow their spring wheat. So well were these reports returned, and so closely did the results finally match the expressed intentions, that the decision to experiment further in this field was made.

It must be noted that the basic data behind the forecasts are made possible mostly by volunteer fact gathering by the rural letter carriers. Hence we must add these unsung aides to the list of persons whose public spirit enables our citizens to enjoy the best crop-reporting service there is.

BUT thanks to the continued existence of these regular crop announcements and the importance of the information they carry to many urban communities, your active news gatherer is becoming responsive and alert to what it all means. I firmly believe that the world food shortage and export boom since the end of World War II have resulted in more mass interest by newspaper and radio workers in food and farm production facts. Some of us who have them at our heels constantly can well testify to that, and then some.

At any rate, the value and confidence folks have in all these reports trace, as I have said, clear back to the farmers who use stub-pencils to give the goings on at the grass-roots. I would dislike to see them shifted over into professional economists or trained statisticians, or have the expert revisers go out after the original dope. Somehow, it would spoil this vestige of romance and individual integrity of men on the land being responsible for what comes from the land and what is reported about the land's bounty.

So I wish all of them and their busy revisers a happy New Year—a nice challenging one, not too full of figures, but with just enough to add zest and pepper to those who are the "salt of the earth."

A tall cowboy, wearing a 10-gallon hat, was sauntering around in a large department store and the salesgirl asked if she might help him. He replied:

"No ma'am, I reckon not. I ain't never seen so many things I could do without."

★ ★ ★

Teacher: "Yes, Johnny, what is it?"

Johnny: "I don't want to scare you, Miss Jones, but my father says if I don't get better grades, someone is due for a licking!"

★ ★ ★

Lovers, like all people who are blind, develop a wonderful sense of touch.

★ ★ ★

FORESIGHT

Pat was thought to be dying. A friend at the bedside asked:

"Have you made peace with God and renounced the devil?"

"I've made peace with God," Pat answered, "but I'm in no position to antagonize anybody!"

★ ★ ★

An irate master censured his servant by saying:

Master—"Rastus, I thought I told you to get a domestic turkey. This one has shot in it."

Rastus—"But I done got a domestic turkey, sir."

Master — "Domestic? Then how come this one has shot in it?"

Rastus—" 'Cause, I don't think that shot was intended for the turkey."

Taken from a patent medicine testimonial: "Since taking your tablets regularly, I am another woman. Needless to say, my husband is delighted."

★ ★ ★

Visitor: "Do you know, there's a baby born every minute in New York?"

Friend: "Don't look at me. I live in Cincinnati."

★ ★ ★

A clergyman about to start a lecture tour asked a young reporter not to publish any of the lecture, as it might spoil the attendance at other meetings.

The following morning he read in the local paper:

"Our vicar told some excellent stories, but, unfortunately, they cannot be printed."

★ ★ ★

Maybe it is good that men don't understand women. Women understand women, and don't like them.

★ ★ ★

She was sick in bed, and her husband, who was fixing her a cup of tea, called out that he couldn't find the tea. "I don't know what could be easier to find," she answered. "It's right in front on the pantry shelf in a cocoa tin marked matches."

★ ★ ★

"Captain, is this a good ship?"

"Madam, this is her maiden voyage."

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
II-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
TT-10-45 Kudzu Responds to Potash
ZZ-11-45 First Things First in Soil Fertility
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
NN-10-46 Soil Testing—A Practical Aid to the Grower & Industry
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
G-2-47 Research Points the Way for Higher Corn Yields in North Carolina
I-2-47 Fertilizers and Human Health
N-3-47 Efficient Management for Abundant Pastures
P-3-47 Year-round Grazing
S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
Y-5-47 Increasing Grain Production in Mississippi
AA-5-47 The Potassium Content of Farm Crops
DD-6-47 Profitable Soybean Yields in North Carolina
GG-6-47 Corrective Measures for the Salinity Problem in Southwestern Soils
SS-10-47 Soil Fertility and Management Govern Cotton Profits
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
BBB-12-47 The Management of Mint Soils
DDD-12-47 Florida Grows Good Pasture on Coastal Plain Soils
A-1-48 Let's Foster Fertility
C-1-48 Fertilizers Double and Treble Grain Yields in Northern Wisconsin
D-1-48 A Good Combination: Lespedeza Sericea and Crimson Clover
E-2-48 Root Rot of Sweet Clover Reduced by Soil Fertility
F-2-48 Swapping Plant Food for Corn
H-2-48 Soil Testing and Soil Conservation
I-2-48 Success with Alfalfa in Alabama
J-2-48 The New Frontier for Midwestern Farmers
K-3-48 Peanut Land and What It Needs
L-3-48 Radioisotopes: An Indispensable Aid to Agricultural Research
M-3-48 Hitting the Target: 100 Bu. Corn Per A.
N-3-48 Ground Cover
O-4-48 Legumes Improve Drainage and Reduce Erosion
P-4-48 Farm Problems of the Cotton Belt
R-4-48 Needs of the Corn Crop
T-4-48 Winter Grazing Increases Southern Livestock Profits
U-5-48 Fertilizer Consumption and Supply in the North Central States
V-5-48 More Abundant Living with Soil Conservation
W-5-48 Will These New Tools Help Solve Some of Our Soil Problems?
X-6-48 Applying Fertilizers in Solution
Y-6-48 Response and Tolerance of Various Legumes to Borax and Critical Levels of Boron in Soils and Plants
Z-6-48 The Development of Irrigation in Georgia
AA-6-48 The Chemical Composition of Agricultural Potash Salts
BB-8-48 Growing Alfalfa in North Carolina
CC-8-48 Soil Analysis—Western Soils
DD-8-48 How Much Lime Should We Use?
EE-8-48 A Soil Management for Penn Tobacco Farmers
FF-8-48 Soil Conservation Raises Midwest Crop Potentials
GG-10-48 Starved Plants Show Their Hunger
HH-10-48 Weeping Lovegrass Stills Vermont's Sandblows
II-10-48 The Need for Grassland Husbandry
JJ-10-48 Four P's in Progress
KK-10-48 Some Rates of Fertility Decline
LL-10-48 All At One Lick
MM-11-48 Better Hay with Potash
NN-11-48 Ladino Clover—Italian Gift to North Carolina Pastures
OO-11-48 The Use of Soil Sampling Tubes
PP-11-48 Applying Soil Conservation Through Local Contract

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)
Borax From Desert to Farm (All)

IMPORTANT

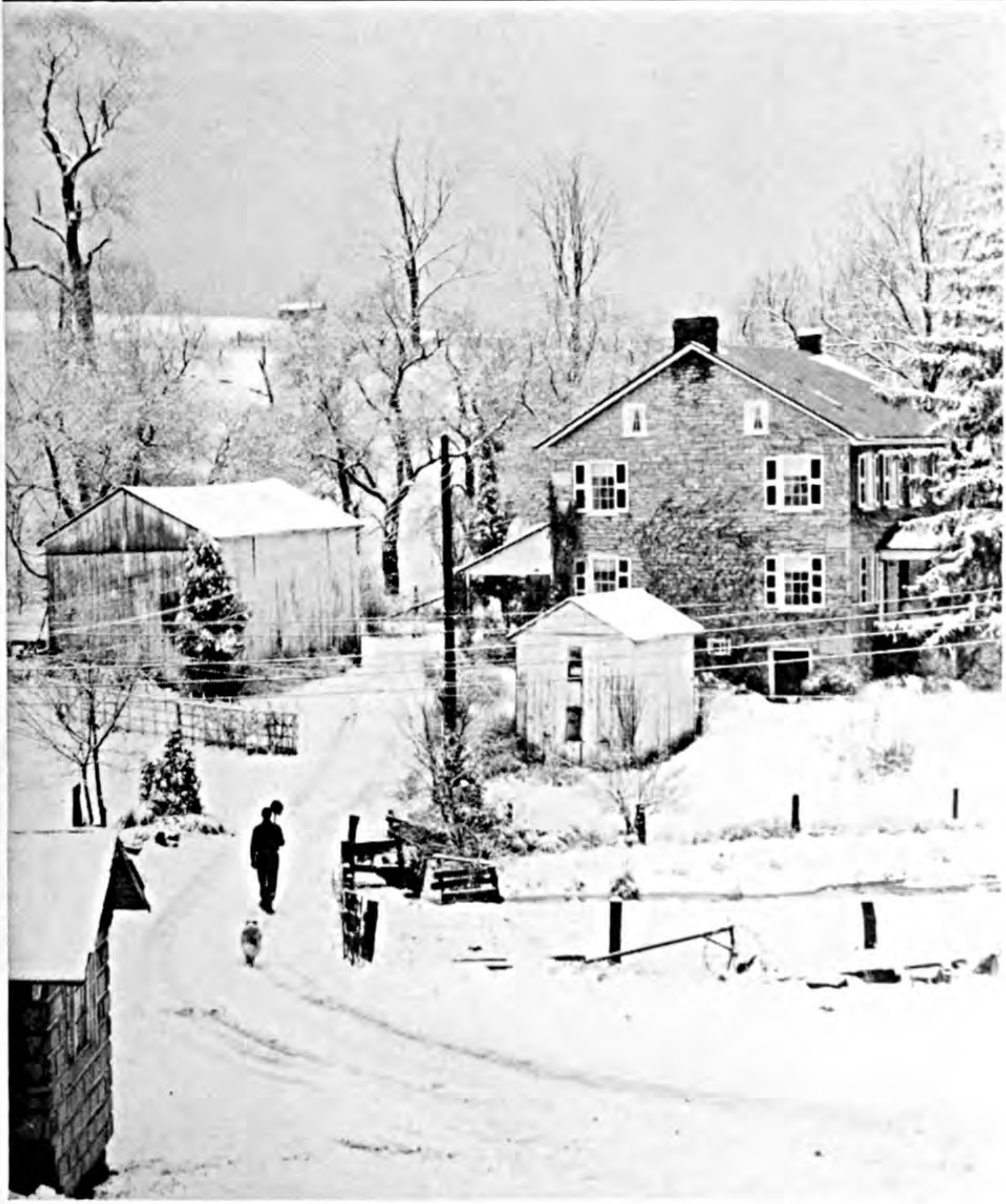
Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

American Potash Institute
1155 Sixteenth Street
Washington 6, D. C.

Printed in U.S.A.

Better Crops WITH PLANT FOOD

February 1949 10 Cents



The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 2

TABLE OF CONTENTS, FEBRUARY 1949

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America

When the sap begins to run

Better Crops with Plant Food

Published by the American Potash Institute, Inc., 1155 Sixteenth Street, N.W., Washington 6, D. C., Subscription, $1.00 for 12 Issues; 10¢ per Copy.

Vol. XXXIII WASHINGTON, D. C., FEBRUARY 1949 No. 2

Remembering . . . .

Outmoded Bygones

Jeff McDermid

I HAVE reached a stage of life where "remembering out loud" exposes me to instant placement among the patriarchs and the elders. We of the generation that was young in the days I shall dwell upon must be cautious about displaying old notions with youngish neckties or giving advice on youth's duties while quoting ancient incidents.

This danger is relatively more acute than it was in bygone days of parental admonition. The experiences then drawn upon by our astute advisers were not greatly removed from those common to the era in which we sprouted our wings for flight. That is, the change from the candle to the lamp or from the oxcart to the buggy was not so revolutionary as the transformation through which our own generation has since emerged to exert its directing influence.

Yet as I scan the scroll of time that has really shifted so imperceptibly, I regret that some of the youngsters of today cannot return even in some dream or vision to partake of the thrills we had over things that have passed away—outmoded and obsolete, discarded and almost forgotten. Sometimes they attempt it in the "gay nineties" movies and light operas, and we sometimes see a flickering return of women's fashion foibles to grace the modern moment—always barring the ironclad corset and the bustle at the stern.

The trouble about all this is that, when I begin to air my memories in public, my terminal facilities run out. The same old thing happens when I start yapping about the good old times before a select group of kids. So in order to relieve myself of a load of accumulated nostalgia, I shall use this medium for a surplus diversion program at your expense. Readers who are under thirty have now had fair warning and may retire at this point to study the latest report of the Atomic Energy Commission.

I SHOULD like to take incidents of the streets and of the town where I was fetched up by hand. If you can remember any of the moldiest of these recollections of mine it means that we both belong to the cult of the oldsters, and can look backward, we trust, without reproach or without regret.

Of these shadowy filaments, my friends, are fashioned these vanished things which we have seen and heard, and often loved; and which, methinks, our land shall see no more.

Across the village street at a board sidewalk's edge at Uncle Goodrich's corner stood an iron pole surmounted by a gas burner caged within a thick glass frame. Each evening in winter when outdoor play had ceased, the kids used to watch for the lamplighter. He was an old man who carried a wick lighter on a short pole, with a wrench attached. I can see him yet fumbling with his gadget and reaching up to turn on the gas and ignite it. To us who burned kerosene lamps this blue glare of the street light seemed a modern marvel.

For many years on this same street the horses and rigs went bumping over a pavement made of wooden blocks set down edgewise. Timber was cheap in those days and few cared for smooth riding, being so close to the ups and downs of a pioneer terrain. When I was ten years old, the city fathers got a mandate from the citizens to improve the streets with crushed granite macadam. It was great sport to stand on the walks and watch the men shovel out the red gravel or lift the wagon beds to let it drop by gravity. Then the heavy rollers pulled by two span of horses or a steam traction engine crushed it flat. Next to the frequent house-moving jobs that passed our lot, this activity made us all want to be engineers. Many of us who later on couldn't pass our high school algebra dropped the ambitious notion.

The circus parade has been discussed so much that we'll pass it this time to mention an entertainment feature that gets somewhat less attention. In those days the local opr'y house billed several blackface minstrel troupes every year. Lew Dockstader never came our way. Beach & Bowers stick tightest in my memory. They always had a lively band and augmented their string fellows behind the music-makers with recruits from among the town kids. We burnt corked our faces and donned some loose fitting uniforms, which spoiled our fun a little because nobody ever recognized us at this hour of our triumph. We longed to be "end men" and be able to tell jokes so readily and sing jolly songs.

ANOTHER road classic of those innocent times was the "rube" show. I recall one they billed frequently as Uncle Josh Spruceby. In this case also there was a band, but the ensemble marching after it was a long line of actors and extras in overalls, boots, and straw hats. The main theme of the drama, of course, was the "villain who still pursued her." There was a mortgage and a snow scene, and a final thrill climax wherein the heroine in a coma was seized by Uncle Josh from where she lay prone on the slow-moving carriage that fed the buzzing log saw.

Inspired by these herculean histrionics, our town kids got chummy with the young son of the opr'y house manager. He fixed it so we could go up there Saturday afternoons when the house was empty of troupers and stage our own amateur gymnastics and stunt acts. I spent most of these hours as the "audience" because the older boys did not want us infants to come back into the mysterious dressing rooms and wings. Not until I played a minor role in the high school class play did I get a chance to swagger behind the footlights, facing what seemed to me like a cavernous auditorium —actual seating capacity about 650.

One of my droopiest memories relates to a neighbor who went to the Chicago world's fair of 1893 and returned with a spidery, big-wheel bike; and I have a vague picture of him trundling along the sidewalk just a few years before our town went loony over "scorchers and crackerjacks" who were mounted on much the same general style of bicycle as we have today, but in dwindling numbers.

We had bicycle clubs and annual bike races. The clubs paraded down the street, as the constable had forbidden them to push folks off the rough brick walks, which were none too nice going anyhow. The riders were decked out in what they considered appropriate finery, the men in knickerbockers and floppy Alpine hats with feathers, and the girls in bloomers and tight waists, some with the balloon sleeves so fashionable then. We had a judging stand erected on the court-house square, and the wheelers glided by with heads erect and colors flying. Prizes were donated by enterprising merchants, and there was often a grand ball in the armory hall where winners were acclaimed. I suppose the only real replica of those outings on wheels is found across the ocean in Denmark or Holland. But our folks now scorn such muscular transportation.

I recall a county bike race we had that ended in the midtown section after running a course of six miles around the outskirts, involving a few stiff hills and rough terrain. In one of these races my cousin made entry and he rode in a weirdly tinted union suit baggy of knees, in lieu of athletic shorts. He was pretty fat and worked up a mighty lather, finally falling off in exhaustion just as he rounded the last turn at the corner saloon known as Mike's Place. Here they carried him in unconscious, which was the first time he had ever entered that place in such fashion, albeit he had made many a belated exit therefrom in a worse state.

THE races were usually won by a dapper blade who owned a tandem machine as well as a racer, and gave him his choice at the picnics, where fair companions brought the lunch boxes. He was later the first owner of a "horseless carriage" in our bailiwick, thereby enlarging his ego and his circle of female adorers. Alas, the poor lad was a casualty in the Spanish War, so his brief period of bliss seems justified.

Winter snows put an end to cycling, whereupon our best diversion was catching rides on farmers' bobsleds as they drove into town with cordwood

(*Turn to page* 49)

Fig. 1. The eastern half of a field of tomatoes grown in 1947 by G. Romanko, Scarboro Junction. In 1946, this field was in cucumbers and cabbage. The above portion was manured and ploughed in the fall of 1946.

Fertilizing Tomatoes for Earliness and Quality

By C. E. Mighton[1] and J. H. Osborn[2]

Campbell Soup Company, New Toronto, Ontario

THE growing of processing tomatoes in Ontario is limited to those districts adjoining the southern boundaries of the Province where the climate is tempered by the Great Lakes. Even here, there are many years when a sizeable portion of the crop may be lost through early fall frost. In years when early frosts do not occur, the quality of late season deliveries is usually markedly lowered by the climatic conditions characteristic of the latter part of September and early October. Lower temperatures, together with decreased hours of sunshine, slow down the natural ripening processes and both colour and flavour suffer. In short, the processing tomato crop in Ontario is being grown on the northern boundary of the climatically suited territory. It is, therefore, perfectly obvious that we must do everything possible to encourage earlier production so that the bulk of the crop can be harvested by the 20th of September.

[1] Manager, Agricultural Department.
[2] Manager, Agricultural Research Department.

Logically enough, one is likely to think first of earlier varieties as one approach to this problem. Plant breeders, both in government and commercial employ, are devoting a great deal of time to this search. Another approach is to be sure the plants set in the field are well grown so they will get about the business of producing a crop with the minimum amount of delay. Of course, the physical condition of the soil, thoroughness of preparation, and subsequent cultivation can influence the rapidity of growth and development in the field. Figures 1 and 2 illustrate the effect land preparation can produce. While we recognize that all these factors command attention, it is not our purpose to consider them further in this discussion. We shall assume that they have been taken care of and that none of them is limiting in attaining our goal of early production.

Instead, we wish to consider here the remaining important factor over which we have control, which is the plant nutrient supply. Not only must there be sufficient plant food available to make sure that no delay is caused by lack of any one element, but also we should apply that food in such a manner that it will be used with the greatest efficiency. With this thought in mind, let us examine results that have been obtained from experimental records which indicate how much we have been able to accomplish along this line.

The generally low level of phosphorus in Ontario soils makes the phosphorus supply extremely important, particularly because of the prominent role this element plays in early root growth and development. In addition, the temperature of Ontario soils, during late May and early June, is not sufficiently high to bring about rapid release of phosphorus from the soil. The use of high-phosphorus-content transplanting solution has been most helpful in supplying the early demands of the tomato plant. But, phosphorus deficiency could be found in many of our fields, even where transplanting solution was used. Most of the fertilizers at present available do not have a sufficiently high phosphorus content to take care of the tomato crop requirements. As a result, it is becoming a common practice for growers to sup-

Fig. 2. The western half of the field shown in Figure 1. This portion was manured and ploughed in the spring of 1947. All other treatment was the same for both portions.

Fig. 3. Typical tomato plant where complete fertilizer was applied in bands at planting time. Photographed 3 weeks after planting.

Fig. 4. Typical tomato plant where 1,000 lbs. superphosphate were applied under row and N and K sidedressed 2 weeks after planting. Photographed 3 weeks after planting.

plement their fertilizer applications with superphosphate under the row or, in some cases, to apply the total phosphorus requirement in the form of superphosphate placed under the row.

These practices have come about as the result of fertilizer recommendations based on soil tests and also from the supporting evidence we have gathered over a period of years from our own experimental plots. Representative results of these trials are presented in Table I. The trials chosen cover different soil types in three widely separated areas and in different years. As mentioned, the results are typical of practically all trials of this nature which we have conducted. In all cases, the trials were laid out on a randomized block plan with four being the minimum number of replications.

The 1947 tomato season was one of the poorest on record in Ontario. Heavy spring rains delayed planting until mid-June and the first frost occurred on September 26.

Figures 3 and 4 show the increased early growth resulting from placing phosphorus under the row. These pictures were taken on the Hagerman plot three weeks after setting.

TABLE I

Hagerman Plot—Prince Edward County—1939

Treatment	Total yield in tons/acre	% Yield by September 20
1,000 lbs. Superphosphate under row + 400 lbs. 10–0–25 as sidedressing.	21.8	90.0
Above materials mixed together and applied as complete fertilizer in bands at planting time.	15.0	67.0
No fertilizer..........	9.9	51.0
Silverthorn Plot—York County—1947		
1,000 lbs. 3–12–15 broadcast before planting and disked into soil.	5.4	52.0
Equivalent of above fertilizer with P_2O_5 under row, N and K_2O sidedressed.	9.4	42.0
No fertilizer..........	3.4	44.0
Beck Plot—Kent County—1948		
1,000 lbs. 3–12–15 broadcast before planting and disked into soil.	15.52	24.0
Equivalent of above fertilizer with P_2O_5 under row, N and K_2O sidedressed.	17.63	47.0
No fertilizer..........	12.43	28.0

(*Turn to page* 43)

The "Put and Take" in Grassland Farming

By E. K. Walrath

Eastern States Farmers' Exchange, West Springfield, Massachusetts

COUNTY Agent Paul Browne, Hampden County, Massachusetts, learned from his roughage improvement demonstrations that in topdressing grass sods with 500 pounds of 10-10-10, more nitrogen and potash were taken to the barn in the hay than was applied in the fertilizer. The opportunities for increased yields from intensive fertilization cannot be offset by losses from soil depletion unless the increased amounts of plant nutrients taken to the barn and not used by the cows are so handled as to get back to the field.

Twelve dairymen cooperated with County Agent Browne in 1945, 1946, and 1947 in topdressing two acres each of well-manured hay and pasture sods with 900 pounds of 7-7-7 fertilizer. The 12 soils were representative of the dairy farm soils in the county. On 10 of these farms where records were secured, in 1945 and 1946 the first cutting of hay averaged 2.4 tons per acre compared with 1.5 tons for adjacent manured areas which were not topdressed with the 7-7-7. The rowen or second crops were grazed. The over-all average yield for three years from these two-acre tests was an extra ton of hay per acre from the commercial fertilizer used on manured land.

Three other cooperators topdressed their grass sods with 500 pounds of 10-10-10, and two of these men also made a double application to see what would happen. One field had a very productive soil that had been well manured or fertilized annually for many years. The second was an old timothy mowing that had been topdressed the previous year with manure and superphosphate. The third was an old, run-out hayfield that had been mowed once a year for the hay for a long time. This sod was largely of redtop, Kentucky bluegrass, and some weak timothy. Two cuttings were made on June 12 and August 23. The Fertilizer Service of the Eastern States Farmers' Exchange, West Springfield, Massachusetts, cooperated in the project by making chemical analyses of 36 hay samples for feed and fertilizer constituents.

What Did the 10-10-10 Do That Could Be Seen and Weighed?

The 500 pounds produced around a ton and a half of hay per acre. One

TABLE I—POUNDS OF HAY PER ACRE—TWO CUTTINGS

Soil Fertility Rating	Fertilized 500 Pounds 10-10-10	Unfertilized	Increase Pounds	Increase Per cent
Good	7,272	4,037	3,235	80
Fair	6,787	4,019	2,768	69
Poor	5,946	2,600	3,346	129

TABLE II—NITROGEN PERCENTAGE IN DRY MATTER OF GRASS HAY

Soil Fertility Rating	First Cutting—June 12		Second Cutting—August 23	
	500 pounds 10–10–10	Unfertilized	500 pounds 10–10–10	Unfertilized
Good	1.52	1.28	2.46	2.34
Fair	1.31	1.45	1.84	2.00
Poor	1.64	1.53	2.00	2.09

thousand pounds of 10-10-10 added another half ton, but the farmers considered the heavier growth that lodged unsatisfactory for hay but not so for pasture.

What the Chemists Found in the Grass

Nitrogen. The percentage of nitrogen in the dry matter in the first cutting was the highest on the poor soils. These grasses were less mature when cut on June 12 than the hay on the better soils. The order was reversed in the second cutting. These nitrogen data emphasize the need to consider the stage of maturity if high quality grass hay is to be harvested.

Phosphoric Acid. The grass hay grown on these three sandy loam soils had a desirable content of phosphoric acid, ranging from 0.52 per cent to 0.92 per cent P_2O_5. As with nitrogen, the unfertilized hay cut at the same time had the highest content. It was only on the best sod that the fertilization increased the phosphoric acid content of these grass hays.

Potash. The big surprise to Browne and these dairymen was the evidence of the high potash content of grass hay.

The results have these men thinking of the dollar and cents need to get more of the potash that the cows do not use back to the fields. This need was even more evident when it was learned from the yields and composition how much plant food the fertilized grass recovered from the applied fertilizer above that found in the unfertilized hay. These grass hays recovered from 59 to 120 per cent of the applied nitrogen, 26 to 50 per cent of the phosphoric acid, and 97 to 170 per cent of the potash put on these sods.

The high potash content of these grass hays fertilized with 500 pounds of 10-10-10 can well be shown in terms of complete fertilizer with 10 per cent nitrogen and the number of pounds of such a fertilizer that the hay from these fields took to the barn. This was equivalent in whole units of complete fertilizer to 1,220 pounds of 10-4-16 per acre for the best soil and 1,050

(*Turn to page* 44)

TABLE III—POTASH PERCENTAGE IN DRY MATTER OF GRASS HAY

Soil Fertility Rating	First Cutting—June 12		Second Cutting—August 23	
	500 pounds 10–10–10	Unfertilized	500 pounds 10–10–10	Unfertilized
Good	2.56	2.93	3.88	3.03
Fair	1.69	1.49	1.86	1.26
Poor	2.17	1.67	2.40	1.27

Fig. 1. Empty houses stand in memory of a past type of farming. Share-croppers once occupied these buildings and produced cotton; now the families are gone and the land is utilized for hays and pasture. Some erosion can be seen as a result of clean-cultivated crops.

Wise Land Use Increases Farm Income in the South

By H. B. Vanderford

Agronomy Department, Mississippi State College, State College, Mississippi

MANY changes that have affected the economy and over-all conditions of the South have taken place during the past eight years. Among these, none is more significant than the change that has occurred in the field of Agriculture.

The once abundant supply of relatively cheap farm labor of the South has migrated to other fields of employment, and the farmers of many sections have changed their methods of farming. The pattern of land utilization observed in many sections now gives the farms a new look indicative of a more efficient type of farming. As a result, farmers are producing more cash crops than ever before on considerably less acreage, as well as producing a great quantity of forage crops and protecting the land from the ravages of soil erosion. All of these tend toward a higher level of farm efficiency and higher farm incomes.

TABLE I. CHANGES IN COTTON PRODUCTION IN MISSISSIPPI *

Item	1928–32	1935–39	1940–45
Acreage	4,018,000	2,901,000	2,847,000
Bales produced (500#)	1,559,000	1,830,000	1,684,000
Yields per acre (lbs. lint)	185	301	324

* Reports of B. A. E.

More Cotton on Less Acres

A good illustration of better land use and farm efficiency is observed in the changes that have occurred in the production of the No. 1 crop of the South, "King Cotton." Using Mississippi as a representative state of the cotton belt, the acreage planted to cotton has decreased consistently since 1933, but the volume of production has increased. The changes in cotton acreage, production, and yields per acre for Mississippi are given in Table I.

From the data presented in Table I, it should be noted that over 4,000,000 acres of cotton were planted during 1928-32 and 1,559,000 bales were produced. By 1945 the acreage had been reduced to 2,847,000 and 1,684,000 bales were produced, which means that the farmers of the State were producing more cotton on approximately 30 per cent less land. This is further emphasized by the yields per acre which increased from 185 pounds of lint in 1932 to 324 pounds in 1945.

The reduction in acres of cotton gave the farmers extra land for the production of other crops and at the same time the volume of cotton produced was also increased. This came about because the farmers kept the land best suited for cotton production in cotton and used more fertilizer and better varieties and cultural methods. The land that produced the low cotton yields has in most cases been utilized for the produc-

Fig. 2. One hundred bushels of corn per acre enables the farmer to produce his necessary corn on a few acres, thereby releasing land for production of hays and pastures. The efficient farmer plants his crops according to soil adaptations and then response to treatments is good.

Fig. 3. Some land that was once in cotton and corn is now utilized for pastures. The vigorous growth of this forage is indicative of the fertility that has been added to the soil.

tion of forage crops which have added considerably to the farm income in Mississippi.

Corn Production Is Following Same Trend

More efficient use of land is also seen in the present trends in corn production. Yields equivalent to those obtained in the corn belt are now being obtained on many acres in the South. Much has been learned in the last few years about producing high yields of corn on land low in natural fertility, and several articles have been written on the extension of the corn belt to the South. The acreage on which extremely high corn yields have been obtained is still small in Mississippi, and the State average has been increased very little, but the trend is upward. There were about 2,254,000 acres of corn planted in the State in 1947, and the average yield reported by the census was 16.5 bushels per acre. This is a slight increase over the average yield per acre during the last 10 years. The estimated average yield of the State for 1948 is more than 20 bushels per acre, which indicates that the number of acres producing near or 100 bushels of corn is still too small to greatly influence the average yield for 2,254,000 acres.

By producing a yield of 16.5 bushels per acre it would require approximately six acres of land to produce 100 bushels of corn. On most farms there is usually one acre that can be made to pro-

Table II. Corn Production in the State of Mississippi *

Item	1928–32	1936–45	1947
Acres harvested	2,177,000	2,824,000	2,254,000
Bushels produced	32,192,000	45,046,000	37,191,000
Yield per acre	14.7	16.0	16.5

* Reports of B. A. E.

duce approximately this amount of corn. By making proper application of research information, the farmer can produce his corn on one acre and release five acres for the production of other crops.

More than a million acres were removed from the cotton fields, and there is a possibility of another million being released from the corn patches. One doesn't generally think of increasing the volume of production of any crop by decreasing acreage, but that is the situation in the case of cotton and corn in the South. The acreage, production, and yields per acre of corn are shown in Table II.

The Pasture Situation

The reduction in acres planted to cotton and corn sets an excellent stage for the development of a program involving the production of forage and pasture crops. The significant changes in the land utilized for pasture that have taken place during the last few years in Mississippi are seen in the number of acres of improved pastures growing high quality feed. This increased acreage of improved pastures and feed crops is one reason why the South has been able to produce more livestock. Good pastures serve as one of the best kinds of livestock feed and at the same time furnish good protection for the land.

By fertilization and good management, many farmers have been producing profitable forage crops on some of the acres once in cotton or corn. The production of high quality forage crops which are utilized for the production of livestock and livestock products is now a general practice on many farms. To do this, the soils must contain sufficient minerals.

Some farmers have shifted completely from a row crop type of farming to a broadcast system. The mild climate which prevails generally over the South makes it possible for farmers to produce two crops per year on a part of the land without serious loss from accelerated soil erosion. This adds considerably to the over-all efficiency of the farm operation and expresses itself in the total farm income, as can be seen in the production data presented in Table III. The variation in prices makes it difficult to compare farm incomes for different periods, but the volume of production serves as a good basis.

More Fertilizer Needed

The only sad part of this important agricultural development is that adequate fertilizer supplies have not always been easy to obtain during the past few years. The more efficient methods naturally require the use of more fertilizers and minerals in the production of all important crops. The reduction in acreage of some of the major crops did not reduce the amount of commercial nutrients needed. Instead, in order to produce high yields, more fertilizer was and will be used on the land remaining in the major cash crop. Likewise, the production of nutritious forage and pasture crops, which are necessary for healthy livestock, is dependent upon an adequate supply of fertilizers and minerals. Most of the agricultural programs sponsored by the various agricultural agencies are framed around the use of more minerals and fertilizers on the farm land.

This all adds up to the fact that the farmers of the South will be needing larger quantities of commercial nutrients during the next few years and may not be able to get as much as they desire. Therefore, the fertilizers obtained should be used wisely on all farms. Soil-testing laboratories are in position to aid and assist farmers and operators in this important task.

Variations in the fertility levels of different fields should make it possible to vary the fertilizer applications so that more land can be treated. The fertility level of some fields as a result of previous treatments may be high enough to justify for a few years smaller applications of commercial fer-

(*Turn to page* 39)

Maintaining the Productivity of Irrigated Lands

By C. A. Rechenthin

Soil Conservation Service, Fort Worth, Texas

MAINTAINING the productivity of the soil is perhaps the most important—certainly the most common—problem encountered by the irrigation farmer. Accumulation of harmful salts in the soil, rising water tables, and shortage of water supplies are other chief considerations in some areas, but loss of soil fertility has been a problem in all irrigated areas.

There is a large amount of information from experiment stations and field observations pertaining to methods of maintaining soil fertility. Some of the methods are well known; others are not generally understood. Many of the farmers who have started irrigation in the last few years have little or no knowledge of irrigation practices. It seems opportune at this time to present some of the available information, pointing out some of the things that can and should be done.

Declining soil fertility has been a problem quickly encountered in all irrigated areas. Decrease in soil fertility may be due to one or several reasons, some of which are:

1. Irrigation of soils unsuitable for irrigation.
2. Reduction of the organic matter in the soil.
3. Removal by crops of large amounts of plant nutrients which are not replaced in the soils.
4. Leaching of valuable plant foods from the soil by overirrigation.
5. Accumulation of harmful salts.
6. Rising water tables.

It is recognized that the selection of land suitable for irrigation is a primary requisite. Many factors influence the suitability, such as character of the soil, topography, and quality and quantity of water. To determine the suitability of an area requires exhaustive study and careful analysis of the conditions.

The accumulation of harmful salts and rising water tables are subjects on which much has been said and written. However, only the causes of reduced soil fertility dealing largely with cropping systems will be discussed at this time.

The great importance of organic matter in the soil is well known. It makes heavy soils lighter; light soils heavier. It promotes favorable chemical and biological activity. It is the natural source of nitrogen. It improves the soil-plant-water relationship. In short, it is an essential constituent of all normally productive soils.

The maintenance of soil organic matter is of major importance to the irrigation farmer. Many of the soils in irrigated areas have been formed under low rainfall and are naturally low in organic matter content. Under irrigation, moisture conditions are highly favorable for biological activity, and rapid breakdown of organic matter occurs. Severe crusting, or puddling, of irrigated soils is quite common in soils heavily cropped.

Studies at the Utah Agricultural Experiment Station show how rapid the breakdown of organic matter may be. They disclosed an average annual de-

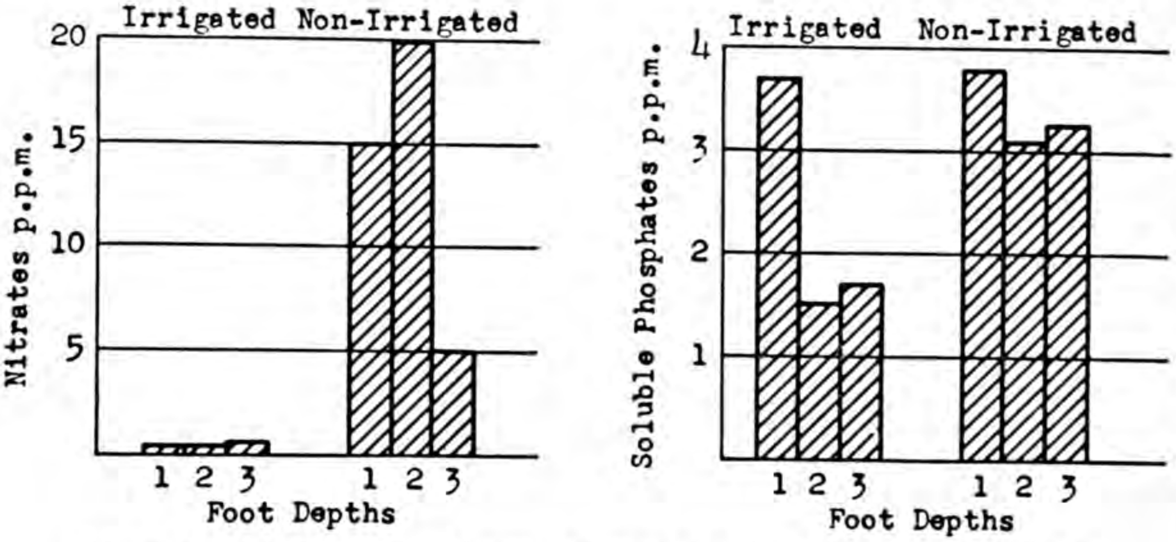


Fig. 1. Content of nitrates and soluble phosphates in irrigated and nonirrigated soils.

crease of 3,391 pounds of organic matter under continuous oats, but an average annual increase of 1,470 pounds under continuous alfalfa. (1)

The removal of large amounts of plant food in crop products without replacing them has been an important cause of reduced soil productivity. Many farmers in newly irrigated areas, such as the High Plains of Texas, have noticed a quick reduction in yields. In other parts of the State, lands have been abandoned after a period because of uneconomical returns.

Studies at the Panhandle, Oklahoma, Agricultural Experiment Station give some insight into why yields have declined so rapidly. Figure 1 shows the parts per million of nitrates and soluble phosphates in irrigated and nonirrigated soils after sudan grass was grown two years. (2)

The reduced yields on irrigated soils were believed due to overwatering, failure to rotate crops, and because the soil is somewhat shallow.

A very important cause of reduced yields that is generally not recognized by the farmer is overirrigation of lands. Overirrigation may result in waterlogging of the soils if heavy, or leaching from the soils large amounts of valuable plant nutrients if the soils are readily penetrated by water.

Studies conducted by the Texas State Board of Water Engineers and the U. S. Department of Agriculture in the lower Rio Grande Valley of Texas have

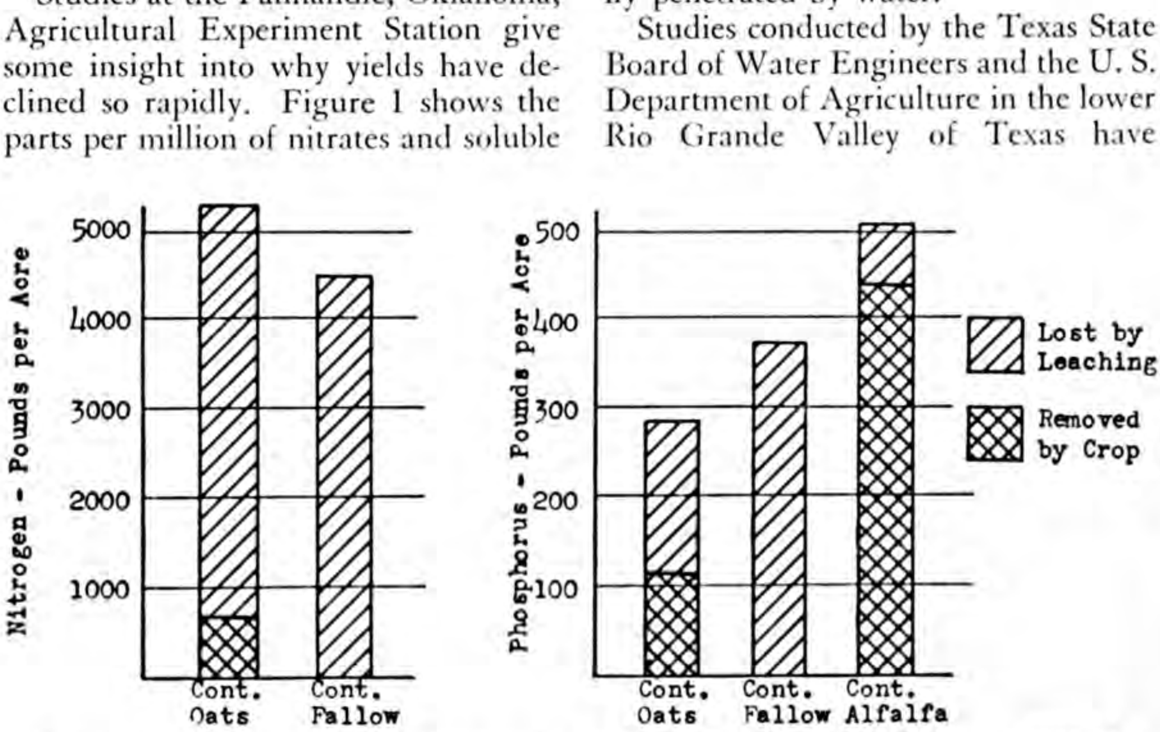


Fig. 2. Total loss per acre of nitrogen and phosphorus from soils under irrigation, 1916-34.

shown that under certain conditions a large amount of water may be lost through deep percolation. Of 6 inches of water added to a clay soil, about 2½ inches were lost by deep percolation and 3½ were used by the crop and lost by evaporation. On a sandy soil with 4 inches of water added, about 1½ inches were lost by deep percolation and 2½ by the crop and evaporation.

Studies at the Utah Agricultural Experiment Station give an indication of plant-food losses due partly or wholly to leaching. Figure 2 presents some of their data. (1)

For comparison, the soil under continuous alfalfa gained a total of 2,324 pounds of nitrogen per acre.

Figures 3 and 4 give some examples of reduced yields under irrigation at Huntley, Montana, and Scotts Bluff, Nebraska, Agricultural Experiment Stations.

The soil conservation districts in irrigated areas have recognized reduced soil fertility as a very important problem. With the assistance of the Soil Conservation Service and other agencies, they have developed a conservation plan for the districts that will maintain soil productivity as well as control erosion and conserve water supplies, and thereby provide for a permanent agriculture.

A conservation plan that will provide for a permanent agriculture includes the adapted practices applied to each acre according to its needs. No single practice will do this. The following practices need to be considered for developing a conservation plan for irrigated areas, with adaptations made to local conditions:

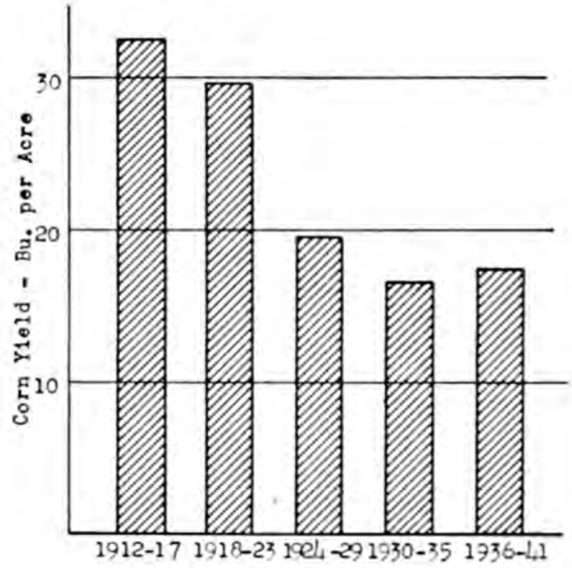


Fig. 3. Yields of corn grown continuously at Huntley, Montana. (4)

1. Addition of barnyard manures and organic residues.
2. Use of soil-improving crops such as green manures in rotation.
3. Application of commercial fertilizers.
4. Control of salt accumulations.
5. Application of the water according to the needs of the crops and soils.

Barnyard manure is a valuable source of plant food and organic matter. Its beneficial effect upon the soil in im-

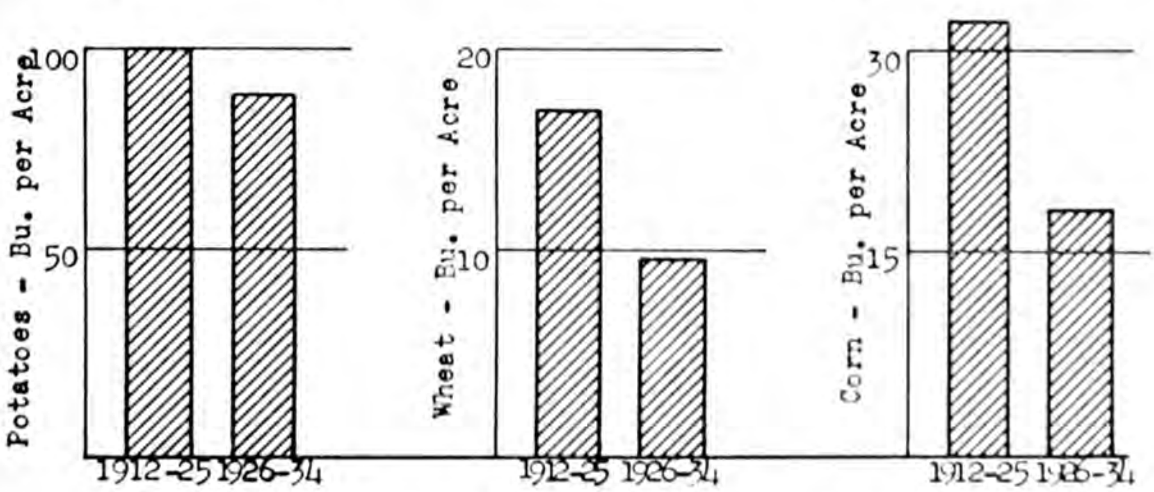


Fig. 4. Yields of various crops grown continuously at Scotts Bluff, Nebraska. (5)

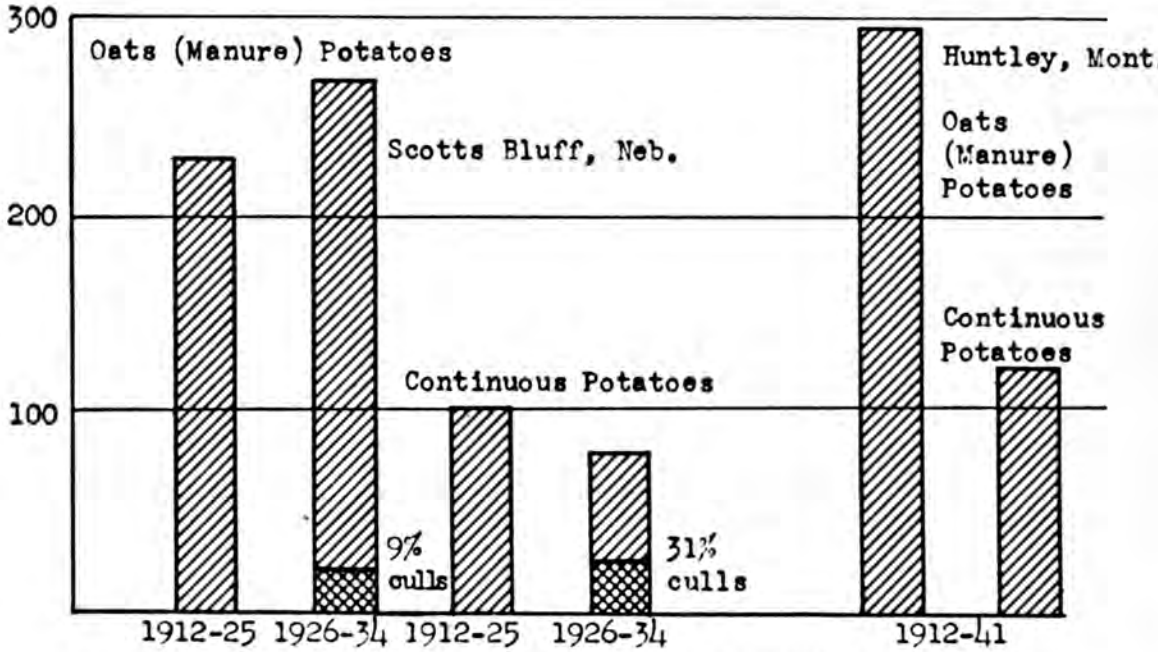


Fig. 5. Yields of potatoes at Scotts Bluff, Nebraska, and Huntley, Montana. (4 & 5)

proving aeration and biological activity, and in improving the tilth of the soil, exceeds its value for the plant foods it adds. Its value as a fertilizer is so well known that little needs to be said.

Figures 5, 6, and 7 show some results obtained from adding manure to the soil.

It is unfortunate that in most of our irrigated area little if any barnyard manure is available. An intensive type of agriculture as citrus orcharding, truck gardening, or cotton farming is practiced, and few livestock are found on the farms. The small amount of manure available from dairies or feed lots in nearby towns is far short of the amount needed. Farmers must, of

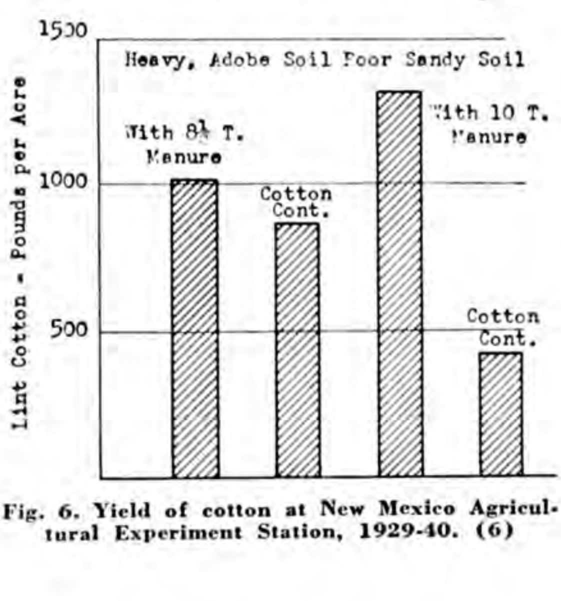


Fig. 6. Yield of cotton at New Mexico Agricultural Experiment Station, 1929-40. (6)

necessity, resort to other means of improving and maintaining the soil productivity.

Green manure crops, and other soil-improving crops in rotation with soil-depleting crops, are often the most practical means of improving and maintaining soil fertility. There is a wide variety of crops that may be utilized as green manure and soil-improving crops in Texas. The principal ones are: alfalfa, biennial and annual sweetclovers, Ladino and white Dutch clovers, vetch, winter peas, crotalaria, sesbania, and improved pastures of mixtures of legumes and grasses.

Alfalfa is a crop that is widely used as a soil-improving crop, as well as to produce an excellent hay crop. It has a very beneficial effect upon the physical condition of the soil, promoting better tilth and permeability, and increases the organic matter of the soil. The Utah Agricultural Experiment Station reports an average annual increase of 1,470 pounds of organic matter per acre under continuous alfalfa. (1)

Yields of crops grown in rotation with alfalfa are increased in most cases. A cooperator with the Swisher County Soil Conservation District in the South High Plains of Texas reported that

(*Turn to page* 45)

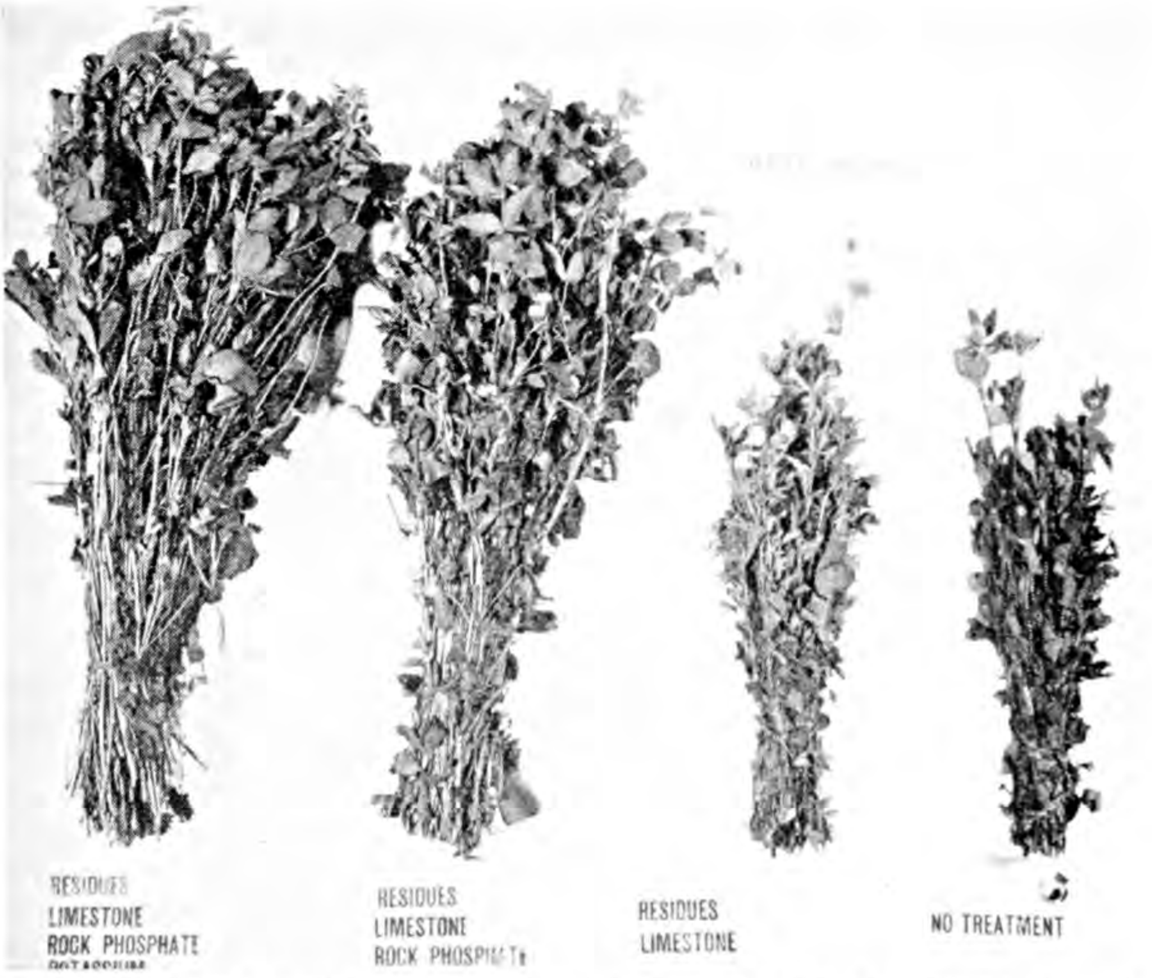


Fig. 1. Red clover-alfalfa from the Joliet experiment field. Each bundle represents the growth from a 4-sq.-ft. area. When fertilizer applications are adjusted to meet the need of the crop, there are satisfactory crop yields.

Lime Is Needed to Maintain Fertility

By H. J. Snider

Agronomy Department, University of Illinois, Urbana, Illinois

"THE relatively large quantity of calcium in the cation exchange complex is one of the controlling factors in soil fertility." This statement by Dr. H. P. Cooper is basically sound and applies especially to Illinois soils. Generally speaking, the most productive soils in Illinois are relatively high in available calcium and the less productive are relatively low in this element. Available calcium is that "calcium in the cation exchange complex."

Under field conditions in the Midwest, low calcium in unlimed soils is generally accompanied by rather high acidity. This acid condition is frequently sufficient to prohibit the growth of most legumes. With the growth of legumes precluded, these soils are robbed of the possibility of replenishment of active nitrogenous organic matter. This loss is reflected by relatively low total nitrogen and organic matter and also low producing power of these soils.

A large supply of available calcium in soils is usually accompanied by a higher total nitrogen and organic matter content. An abundance of the latter means good tilth and high water-holding capacity in addition to other advantages. Improved tilth and moisture aid materially in pulling crops through the short drouth periods which are frequent in the Midwest and which create havoc with the yields of forage and grain crops. Moisture and tilth aid also in the availability of nutritive elements in the soil and their uptake by the plant.

Relatively large amounts of calcium in the cation exchange complex do not necessarily mean that the production of crops may not be benefited by additions of finely ground limestone. Soils of a high productive level, untreated, were found to contain an average of 7,700 pounds available calcium in the topsoil and had a reaction of pH 5.5 (Table 1). Untreated land averaged 51 bushels of corn and 3,000 pounds hay an acre. This soil, after liming, contained 10,000 pounds available calcium and had a reaction of pH 6.4. With lime and higher pH, the legume growth conditions were improved; consequently, the corn yield rose to 73 bushels and the hay yield rose to 5,200 pounds an acre. This was a 43% increase in corn yield and 73% increase in hay yield. These crop yields are not maximum for this land because many of these limed soils are yet deficient in other elements, mainly phosphorus and potassium, deficiencies that are usually sufficient to limit crop yields.

Hay grown on highly productive soils varies in its makeup on limed and unlimed land. Hay on experiment fields was usually seeded as a mixture of timothy-red clover-alfalfa. In some recent tests the hay from limed plots was approximately 75% legumes (red clover-alfalfa) and 25% timothy. Hay from the unlimed land was found to be made up of approximately 85% timothy and 15% red clover on the dry-weight basis. Hay from untreated, low productive soils was made up largely of wild grass and weeds, with a very small amount of timothy.

(*Turn to page* 48)

TABLE I—COMPARISON OF SOILS OF HIGH AND LOW PRODUCTIVE LEVELS. REACTION, REPLACEABLE CALCIUM, TOTAL ORGANIC MATTER IN THE SOIL ALONG WITH CORN AND HAY YIELDS

Soil Productive Level	pH	Pounds an Acre		Corn bu/A	Hay lbs/A
		Replaceable Ca	Organic Matter		
		Untreated Soil			
High	5.5	7,700	96,000	51	3,000
Low	4.7	730	31,000	11	500
		Limed Soil			
High	6.4	10,000	106,000	73	5,200
Low	6.5	3,000	33,000	30	3,200

Each value an average of five experiment fields. Corn and hay yields represent the rotation average (1944-47) from the various fields.

Increasing Tung Profits with Potassium

By Benjamin G. Sitton, John H. Painter, Ralph T. Brown, Seymour G. Gilbert, and Matthew Drosdoff[1]

U. S. Department of Agriculture

PREVIOUS reports of experiments of the U. S. Department of Agriculture have shown that yields of tung oil are greatly increased by the application of nitrogenous fertilizers. The practice of applying liberal amounts of a nitrogen fertilizer, such as ammonium nitrate, has been very generally adopted in the tung industry, at least to the extent of its availability. Wherever used in conjunction with a reasonable application of phosphorus to the cover crop, it has proved very profitable to the growers. Further progress of our experiments, however, indicates that phosphorus on the cover crop and a heavy application of the nitrogen directly to the trees are not enough. In the long run, in order to maintain health of the trees and high oil content of the fruit, one also must apply potassium.

In an experiment at Bush, Louisiana, trees in plots to which no fertilizer is applied excepting phosphorus at the rate of 40 pounds of P_2O_5 and potassium at the rate of 20 pounds of K_2O per acre annually, on the cover crop at seeding time, have produced about 1 ton per acre per year for the period 1943-1947 inclusive (Table I). The fruits contain approximately 1.5 per cent of potassium or 30 pounds K_2O per ton of fruit, which means that nearly as much K_2O was removed by the crop from these plots as that applied to the cover crop. Analyses of the leaves show that with production at 1 ton per acre the potassium is rapidly being depleted; probably on that account the percentage oil content of the fruit has declined steadily from 19.9 to 17.8 in the period 1943 to 1946.

Trees in plots that have received nitrogen at the rate of 0.16 pound N per tree per year of attained age, supplementary to the cover-crop fertilizers, have produced very heavily, the yields increasing steadily from about 0.8 ton per acre in 1943 to approximately 2.0 tons per acre in 1946. However, leaf analyses indicate that potassium has been depleted even more rapidly than where no supplementary nitrogen was used; and although the nitrogen at first increased the percentage of oil in the whole fruit to 21.0 per cent, it declined

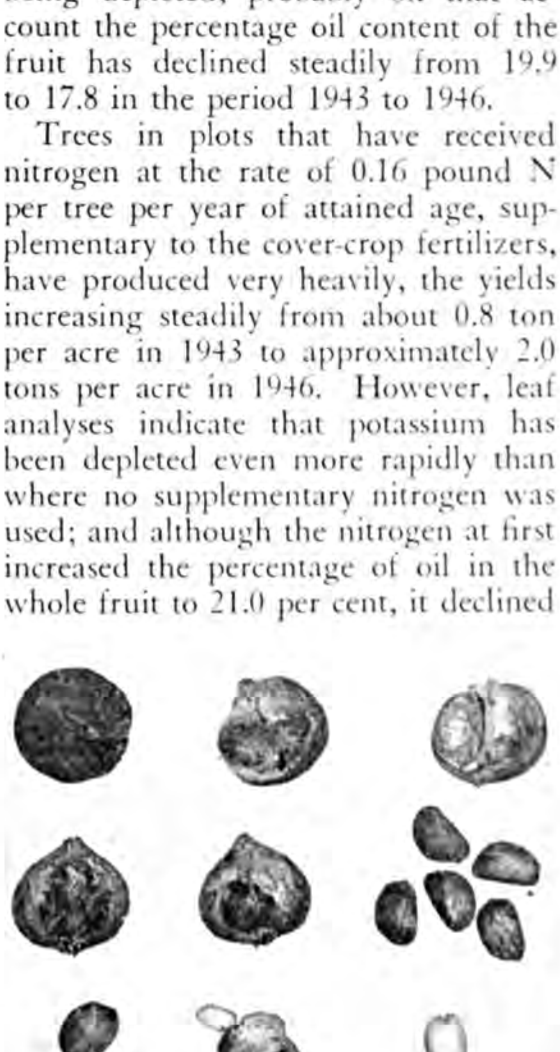


Fig. 1. Parts of the tung fruit.

[1] Horticulturist, pomologist, assistant horticulturist, plant physiologist, and soil technologist, respectively, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Bogalusa, La., Cairo, Ga., Spring Hill, Ala. and Gainesville, Fla., respectively.

steadily to 20.3 per cent in 1944, 18.9 in 1945, and 18.4 in 1946 (Table I).

Certain other plots have received not only the supplementary nitrogen but also potassium at the rate of ¾ pound of K_2O applied directly to the trees, for every pound of supplementary nitrogen. This is roughly a ratio of 1 pound of 50% muriate of potash to 2 pounds of ammonium nitrate. Here the yields have been only slightly greater than where the supplementary nitrogen was used; but the potassium content of the leaves has declined only slightly and the oil content of the fruit has been maintained at nearly the original rather high level of approximately 21.0 per cent on the basis of 15.0 per cent moisture in the whole fruit.

By using the 1947 scale of $72 per ton for fruit having 20 per cent of oil, with increases of $4.50 per ton for each percentage unit of oil above 20 per cent and decreases of $3.60 for each percentage unit of oil below 20 per cent, it is found that a ton of fruit from trees receiving the supplemental nitrogen and potassium fertilizer was worth $0.90, $3.15, $5.31, and $8.91 more per ton in 1943, 1944, 1945, and 1946, respectively, than the fruit from trees receiving only supplemental nitrogen. The cost of harvesting and delivering to the mill a ton of fruit of the higher oil content is the same as for a ton of fruit of the lower oil content. Therefore the increase in value of fruit was obtained for the cost of the muriate of potash and the labor for applying it to the trees. The value of the fruit produced per acre, obtained from the product of the yield and the value per

TABLE I.—EFFECT OF NITROGEN AND POTASSIUM ON YIELD, OIL CONTENT, AND VALUE OF THE CROP OF TUNG TREES IN AN ORCHARD NEAR BUSH, LOUISIANA, PLANTED IN 1938.

Treatment	Year	Yield air-dry fruit per acre	Potassium in leaves dry basis	Oil content whole fruit 15 per cent moisture	Value per ton of fruit 1947 scale[1]	Value per ton acre 1947 scale
		Tons	*Per cent*	*Per cent*		
No fertilizer other than 500# basic slag and 40# muriate of potash applied to the cover crop at seeding	1943[2]	1.17	.86	19.9	$71.64	$83.82
	1944	0.83	.82	18.9	68.04	56.47
	1945	1.36	.78	18.4	66.24	90.09
	1946	1.19	.58	17.8	64.08	76.26
	1947	1.16				
A high level of nitrogen (0.16# per year of attained age of tree) supplementary to the basic cover-crop fertilizers	1943	0.76	.85	21.0	76.50	58.14
	1944	1.19	.70	20.3	73.35	87.29
	1945	1.36	.62	18.9	68.04	92.53
	1946	1.97	.56	18.4	66.24	130.49
	1947	1.67				
A high level of both nitrogen and potassium (0.16# N and 0.12# K_2O per year of attained age of tree) supplementary to the basic cover-crop fertilizers	1943	0.80	.96	21.2	77.40	61.92
	1944	1.19	.95	21.0	76.50	91.04
	1945	1.38	.89	20.3	73.35	101.22
	1946	2.23	.76	20.7	75.15	167.58
	1947	1.62				

[1] $72.00 per ton, less $3.60 for each percentage unit of oil under 20.0, or plus $4.50 for each percentage unit of oil above 20.0.
[2] Differential fertilizer first applied in 1943. Composition of the fruit was affected that season but not yields, which were determined by buds set in 1942.

ton of fruit, was $30.82, $2.44, and $54.23 greater in 1944, 1945, and 1946, respectively, from trees receiving the supplemental nitrogen than from trees receiving only the basic cover-crop fertilizers. The per-acre value of the crop from trees receiving both supplemental nitrogen and potassium was $3.75, $8.69, and $37.09 more in the same respective years than the crop from trees receiving only the supplemental nitrogen. At $63.00 per ton the ammonium nitrate used for the four years, 1943 to 1946 inclusive, cost $28.67 per acre and resulted in $87.49 increased value of the 1944-1946 crops at 1947 prices. At $53.30 per ton, muriate of potash for the same four years cost $11.65 per acre and resulted in $49.53 increased value of the crops.

The results described above were obtained in an orchard on a soil that analyzes 0.55 per cent available (exchangeable) potassium in the top 6 inches, which is about the maximum for soils on which tung is planted. Somewhat similar experiments have been conducted since 1945 in an orchard near Monticello, Florida, on soil that analyzes only 0.12 per cent available potassium in the surface 6 inches. There potassium has proved necessary, not only to improve oil content of the fruit, but also to obtain the maximum yield.

Plots that had 3 pounds of a 3-8-6 commercial fertilizer in 1945, 3 pounds of 6-8-9 in 1946, and 3 pounds of 6-8-12 in 1947 produced 1.13 tons of fruit in 1946 and 0.70 tons in 1947 (Table II). Analyses of the leaves show that the potassium content remained at a low level of approximately 0.60 per cent and the oil content of the fruit was 18.9 and 17.5, respectively, in 1945 and 1946.

Trees that were fertilized with 1 pound of N in addition to the basic rates of P_2O_5 and K_2O produced 1.50 and 0.93 tons of fruit in 1946 and 1947; and although the percentage of oil in the fruit was about the same as for fruit from trees on the low level of nitrogen, the percentage of potassium in the leaves decreased sharply to 0.46 and 0.47 per cent in 1945 and 1946 respectively.

Fig. 2. Potash-deficiency symptoms in tung leaves; interveinal necrosis above, and chlorosis below.

Trees fertilized with 1 pound of N and 2 pounds of K_2O per tree in addition to the basic P_2O_5 application produced 1.84 and 1.34 tons per acre in 1946 and 1947, respectively, with an oil content of the whole fruit of 20.6 and 20.4 per cent for the two crops. The percentage of potassium in the leaves was increased from 0.60 in 1944 to 0.73 in 1945 and 0.91 in 1946. The increase in percentage of oil in the whole fruit resulted in an increased value per ton of fruit of $3.87 and $10.98 in 1945 and 1946 over that of fruit from trees not receiving the high level of potassium.

A serious depletion of potassium in the tung orchard causes the leaves to scorch and in extreme cases premature defoliation occurs. Foliage on the trees in the experiment at Monticello and in another experiment at Irvington, Ala-

TABLE II.—EFFECT OF NITROGEN AND POTASSIUM ON YIELD, OIL CONTENT, AND VALUE OF THE CROP OF TUNG TREES IN AN ORCHARD NEAR MONTICELLO, FLORIDA, PLANTED IN 1938.

Treatment	Year	Yield air-dry fruit per acre	Potassium in leaves dry basis	Oil content whole fruit 15 per cent moisture	Value per ton of fruit 1947 scale [1]
		Tons	*Per cent*	*Per cent*	
3 pounds 3-8-6	1945 [2]	.59	.56	18.9	$68.04
3 pounds 6-8-9	1946	1.13	.63	17.5	63.00
3 pounds 6-8-12	1947	.70			
A high level of nitrogen (1# N per tree) supplementary to basic rates for phosphorus and potassium	1945	.58	.46	19.0	68.40
	1946	1.50	.47	17.0	61.20
	1947	.93			
A high level of both nitrogen and potassium (1# N and 2# K_2O per tree) supplementary to basic rate of phosphorus	1945	.61	.73	20.6	72.27
	1946	1.84	.91	20.4	72.18
	1947	1.34			

[1] $72.00 per ton, less $3.60 for each percentage unit of oil under 20.0, or plus $4.50 for each percentage unit of oil above 20.0.
[2] Differential fertilizer first applied in 1945. Composition of the fruit was affected that season but not yields, which were determined by buds set in 1944.

bama, which received the low level of potassium fertilization, had a marginal scorch which was aggravated by applying only nitrogen. The high level of potassium nearly or completely corrected the marginal scorch in 1947. This same scorch has commenced to appear on some of the plots in the experiment at Bush, Louisiana, previously described, namely, some of those that receive a heavy application of nitrogen but no potassium other than the small amount applied to the cover crop.

From time to time it has been observed that the application of a high level of nitrogen tends to delay maturity of tung fruit. In the experiment at Irvington, Alabama, it was found that in addition such trees dropped their leaves earlier. On November 17, 1947, it was found that 17 per cent of the fruit and 49 per cent of the leaves were on the ground under trees that had received a high level of nitrogen without supplementary potassium. Trees that had received a high level of potassium with the high level of nitrogen had approximately 85 per cent of the fruit and 12 per cent of the leaves on the ground at that time. Every grower will appreciate the advantage in harvest operations if most of the fruit and few of the leaves are on the ground.

Summary

(1) On soils in the western part of the tung belt that are relatively rich in potassium, high yields have been attained by applying 0.16 pound of nitrogen per tree per year of attained age; but after 3 to 5 years, the oil content of the fruit has declined seriously.

(2) The application of potassium at the rate of 0.75 pound of K_2O for each pound of nitrogen used has maintained oil content at approximately 21.0 per cent in whole fruit having a 15 per cent moisture content. At the 1947 scale of prices such fruit is worth $8.91 per ton more than that from plots fertilized with nitrogen only.

(3) On soils in the eastern tung-growing areas, which are low in available potassium, the application of both potassium and nitrogen was necessary, not only to maintain oil content, but also to attain maximum yields.

Fig. 1. A comparison of size of the ears of corn on the plot grown by Albert Post. The pile on Post's right was taken from a section of the field that had an application of 600 lbs. fertilizer; the pile on his left had 1,200 lbs. There was a difference of 65 bushels in the yield by weight.

Four West Virginia Veterans Top 100-bushel Corn Yield

By L. Glenn Zinn

Instructor of Veterans in Agriculture, Grafton, West Virginia

IN a discussion on the use of fertilizer by the Veterans' On-the-Farm Training Class in Taylor County, West Virginia, the results of heavy applications of fertilizers used in other states in the effort to grow 100 bushels of corn per acre were cited as evidence that most farmers, especially those with limited amounts of tillable land, would be better off to plant less corn and use enough plant food to produce the maximum yield. Four of the group were persuaded to try an acre using a sufficient amount of commercial fertilizer to supply plant food above that which the soil might already contain so as to yield 100 bushels.

This is the story of their achievements. The decisions to make these trial tests were made too late to select the best soil, which these growers would have liked to do, and so they just planted part of the land that they were planning to plant in their regular rotation. The results in some cases would have been better if they had made a better selection, as the story will point out.

All four of the boys reached their

Fig. 2. Seven of the class coming in with the last load from the test plot on the farm of Bill Houghton (extreme left). Notice the size of the ears. From the 82 bushels of corn on this truck, there were only 6 baskets of short corn when it all was sorted.

goal of 100 bushels; in fact, all of them went over it. The yields ran 121, 115, 111, and 100.5 bushels. James Kerns had a yield of 121 bushels, the highest of the four, and he probably had the best land. He used an old sod that had not been plowed for several years, but it had been grazed. He put a heavy application of lime and 600 pounds of 4-12-8 fertilizer per acre on the sod, and turned this down just before planting time. Next he applied 200 pounds of 4-12-8 in the row at planting time and side-dressed with 200 pounds nitrate of soda at the last working.

They all used approved hybrid seed and aimed to plant to get a stand of about 14,000 stalks per acre, but none of them got over 11,000. That, according to all information we could get, was not enough stalks for the maximum yield, and was borne out by the large ears obtained in all the fields in several weight checks. On a dry basis the ears averaged 12 ounces.

Howard Kines, who made the second best yield, had what we thought the poorest land of the four. It was hilly land that had been badly worn in the past, but it had been idle for three years just growing weeds with nothing being taken off. It had been limed in the past but not recently. He applied about 700 pounds of 5-10-10 fertilizer with the corn drill as deep as it could be put down. He then drilled 100 pounds of nitrate along with the seed and used 200 pounds as a side-dressing. Putting this amount too close to the seed was a mistake as he did not get a good stand and had to replant. Replants usually do not make much corn, but we were surprised to find a good ear on each stalk and only a few days later than the other, but not as good as the first planting.

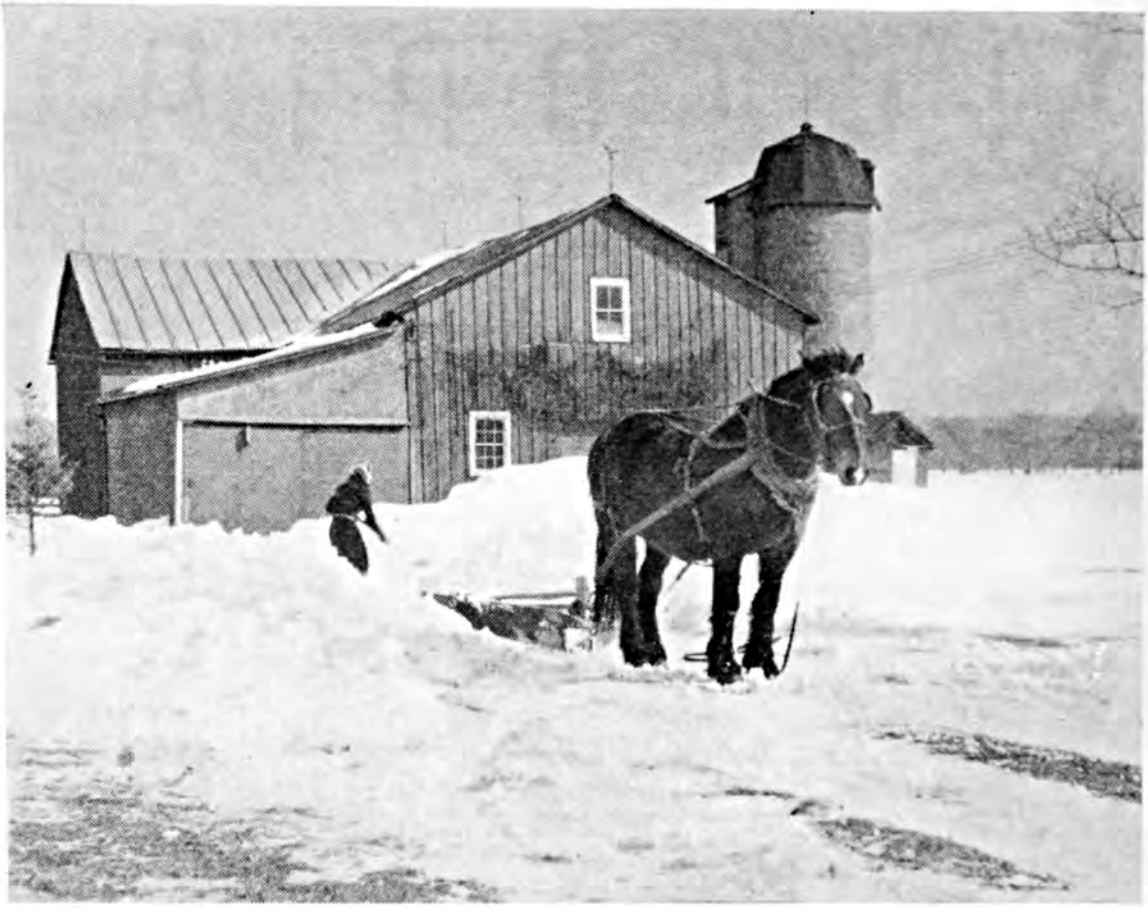
We had the wettest season on record in this section, and Howard's corn got very little cultivation. Part of it was never cultivated but had the weeds cut out by hand once. Yet there was very little difference in the yield—not enough to notice. There were just more weeds. None of the trial plots was cultivated as much as is the common practice, due to the wet season.

Why did this land, which a few years

(*Turn to page* 41)

PICTORIAL

Not very inviting.



Above: **The last dig-out?**

Below: **Back on the land.**

Above: **When shade is sparse.**

Below: **The time to prime.**

Above: **A white macadam.**

Below: **Return to "bubbling."**

The Editors Talk

A National Land Policy

On December 9, 10, and 11, 1948, the Soil Conservation Society of America held its annual meeting in Cincinnati, Ohio. From this meeting came a statement, adopted by the Society and proposed as a "National Land Policy." We are indebted to T. S. Buie, President of the Society, for a copy of this statement and the suggestion that we give it the widest distribution possible. This we are glad to do on these pages, since nothing could be of more importance to the future of our American civilization than the wise use and care of our land.

"The conservation and wise utilization of natural resources are fundamental to the economic and social welfare of all people.

"Land, including soil, water, and the dependent living resources, (cultivated crops, forests, wildlife, range lands, etc.) is recognized as basic wealth and it must be treated in such a way that it will be made secure for permanent high productivity.

"It is essential, therefore, that a National Land Policy be developed and supported by the American people, and the Soil Conservation Society of America recommends that such a policy be declared as:

> ALL LAND SHOULD BE USED IN A MANNER WHICH WILL INSURE ITS CONTINUED AND PERMANENT MAXIMUM PRODUCTIVITY AND VALUES.

"To adopt and effect such a policy, the following requirements must be recognized nationally:

> The conservation of soil, water, and interdependent renewable resources involves scientific study and guidance, necessitating the bringing together as a single function many facets of a vast number of scientific fields; therefore, the science of soil and water conservation is intricate and complex.
>
> An inventory of all physical land resources and their condition is of primary importance to serve as the proper guide to the utilization and treatment of these resources.
>
> Specifically the widespread adoption of a sound land policy should comprehend the need for conservation, development, and utilization of land and water resources for: (1) sustained and improved agricultural production, (2) forest protection, re-growth, and sustained yield, (3) prevention of erosion and flood damages to safeguard land from overflow and siltation, (4) protection of community and industrial water supplies, (5) maintenance of underground water sources, (6) development and installation of irrigation and drainage as needed to extend appropriate land use and conservation, (7) protection and maintenance of fish and wildlife in accordance with proper land use, (8) development and utilization of areas most appropriately suited for needed recreational purposes, and (9) protection, and in certain cases, revegetation of areas suited to range utilization.

"The ultimate goal in land use is a complete soil and water conservation program on every farm, ranch, forest, and watershed throughout the country.

"To functionalize the above land policy and the specific principles involved, the Soil Conservation Society of America recognizes that:

> The conservation of soil and water by efforts of the individual landowners and operators is the most important contribution that can be made to the carrying out of this land policy. Locally and democratically organized groups of landowners and users are the best known vehicles for carrying out soil and water conservation programs designed to improve and perpetuate the productivity of our basic natural wealth—the land.
>
> Private ownership of land is, for the most part, the most suitable system under which a National Land Policy can be effective. It is recognized, however, that good management, public interest, and welfare necessitate public ownership and administration of certain land areas.
>
> The technical, educational, financial, and other services necessary to the adoption of a fully coordinated land use program should be thoroughly integrated and cooperatively performed, to carry out this land policy and all its principles.
>
> Private, corporate, and allied groups have a major responsibility in obtaining adoption of this land policy and in the conservation of soil and water.
>
> A workable method of carrying out coordinated programs of land use, soil and water conservation requires the joint and cooperative efforts of the federal, state, and local governments which are, or may become, engaged in these endeavors. It is also necessary that the administrative forces charged with such activities be given explicit responsibilities for contributions to such coordinated programs.

"In a great measure, our national economy, our democratic process, and our national security are dependent on the future conservation and use of our basic natural resources. These proposals, therefore, are made in the interest of the public health, safety, and general welfare of all the American people."

Southern Agriculture's Annual Meeting

Despite an unusual storm which covered many of the Southern States with ice and snow, more than 1,100 agriculturists convened in Baton Rouge, Louisiana, January 31–February 2 for the 46th annual meeting of the Association of Southern Agricultural Workers. Several large delegations, particularly from the Southwest, were turned back because of the storm, but the drop in anticipated registrations did not lessen intensity of interest in the general and sectional sessions in which the present status and future plans for all phases of the South's agriculture were projected.

The Association, largest of its kind in the United States, had picked as the theme for this meeting, "Progress in the South Through a Balanced Agricultural-Industrial Economy." Nineteen different sections scheduled their sessions throughout the three busy days so as to tie in with those of groups in the more closely related fields. Thus the whole had a broadening effect which is not always to be found in a convention of such proportions. There is stimulation in the recognition of the problems of others working for the same goal and this interchange of interest and realization of interdependence bespeak the popularity of this Association's conventions and the success for the continued advancement of Southern agriculture in line with constantly changing economic pressures.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1923	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
February	30.71	38.5	193.0	231.0	192.0	212.0	19.60	88.60	....
March	31.77	29.6	196.0	237.0	211.0	221.0	19.70	87.90	....
April	34.10	31.2	209.0	240.0	219.0	229.0	19.40	89.40	....
May	35.27	40.1	196.0	244.0	216.0	222.0	18.30	90.70	....
June	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August	30.41	47.4	158.0	265.0	191.0	196.0	17.80	76.60	....
September	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1923	231	190	133	137	129	105	110	183	....
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	175	249	212	209	141	319	204
1947	252	380	224	245	366	273	146	379	249
1948									
February	248	385	277	263	299	240	165	393	320
March	256	296	281	270	329	250	166	390	295
April	275	312	300	273	341	259	163	396	340
May	284	401	281	278	336	251	154	402	262
June	284	417	268	280	336	239	151	409	213
July	266	436	238	298	315	230	153	428	213
August	245	474	227	302	298	222	150	340	172
September	250	467	220	264	277	223	152	302	150
October	251	506	204	236	215	224	155	282	176
November	246	428	207	226	188	231	155	306	186
December	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
February	2.78	1.90	15.03	12.15	12.75	12.60
March	2.78	1.90	13.68	12.06	12.75	9.47
April	2.78	1.90	13.87	11.71	12.75	8.35
May	2.78	1.90	13.77	9.54	12.75	7.89
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53

Index Numbers (1910-14 = 100)

1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
February	104	67	429	344	378	358
March	104	67	391	342	378	269
April	104	67	396	332	378	237
May	104	67	393	270	378	224
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367 [1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
February	.760	3.42	6.60	.375	.669	14.50	.200
March	.760	3.42	6.60	.375	.669	14.50	.200
April	.760	4.11	6.60	.375	.669	14.50	.200
May	.760	4.61	6.60	.375	.669	14.50	.200
June	.760	4.61	6.60	.330	.634 [1]	12.76 [1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
February	142	95	135	68	70	60	83
March	142	95	135	68	70	60	83
April	142	114	135	68	70	60	83
May	142	128	135	68	70	60	83
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
February	279	263	233	139	85	393	142	71
March	283	262	233	137	85	379	142	71
April	291	264	238	137	85	380	142	71
May	289	265	239	137	85	370	142	71
June	295	266	241	128	85	309	142	65
July	301	266	247	231	88	317	144	68
August	293	266	247	129	91	285	144	68
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Nutrient Interrelations in Lime-induced Chlorosis as Revealed by Seedling Tests and Field Experiments," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Tech. Bul. 116, Nov. 1948, W. T. McGeorge.

"Guide for the Use of Borax on Common Crops," The Maritime Fertilizer Council, Moncton, N. B., Can., Issued Jan. 1949.

"Fertilizing Flue-cured Tobacco," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 16, Dec. 1942 (Rev. Dec. 1948).

"Fertilizers for Field Crops," Agr. Ext. Serv., Agr. Exp. Sta., Iowa State College, Ames, Iowa, Agron. 111, Dec. 1948.

"Inspection of Commercial Fertilizers and Agricultural Lime Products," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. 137, July 1948.

"Use of Commercial Plant Foods on Missouri Farms," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 519, Oct. 1948, J. H. Longwell, A. W. Klemme, H. J. L'Hote, and J. R. Breuer.

"Phosphorus Needs of New Jersey Soils," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 744, Oct. 1948, A. L. Prince and F. E. Bear.

"Fertilizer Recommendations for Oklahoma Crops," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Bul. B-326, Jan. 1949, H. J. Harper, H. F. Murphy, F. B. Cross, and H. B. Cordner.

"The Inspection of Commercial Fertilizers and Agricultural Lime Products for 1948," Related Services Div., Univ. of Vt., Burlington, Vt., Rpt. 10, Nov. 1948, L. S. Walker and E. F. Boyce.

"Fertilizer Recommendations for Vermont 1949," Ext. Serv., Univ. of Vt., Burlington, Vt., M-4048.

"Commercial Fertilizers for Canning and Freezing Peas in Western Washington," Agr. Exp. Stations, State College of Wash., Pullman, Wash., Bul. 503, July 1948, Karl Baur and F. T. Tremblay.

Soils

"Sprinkling for Irrigation," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 388, Nov. 1948, F. J. Veihmeyer.

"Organic Matter—The Life of the Soil," Ont. Agr. College, Guelph, Ont., Can., Bul. 459, June 1948, G. N. Ruhnke.

"Soil Testing and Plant Growth," Agr. Ext. Serv., Miss. State College, State College, Miss., Leaflet 92, Oct. 1948, L. E. Miles.

"Soil Testing," Agr. Educ. Dept., Miss. State College, State College, Miss., Vet. Farm Training Publ. No. 6, Nov. 1948.

"Cropping Systems for Soil Conservation," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 518, Sept. 1948, D. D. Smith, D. M. Whitt, and M. F. Miller.

"Let's Look at the Soil," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 330, July 1948, M. F. Miller.

"Test Your Soil," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Mo. 24E, Aug. 1948.

"Soil Fumigation for Nematode and Disease Control," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Sta. Bul. 850, Sept. 1948, A. G. Newhall and Bert Lear.

"Irrigation for Oklahoma," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Cir. C-131, Dec. 1948.

Crops

"Field Roots," Div. of Forage Plants, Field Husbandry and Animal Husbandry, Exp. Farms Serv., Ottawa, Can., Publ. 672, Farmers' Bul. 88, Oct. 1948 (Rev.), F. S. Nowosad, R. M. MacVicar, P. O. Ripley, and S. B. Williams.

"Better Pastures in Eastern Canada," Exp. Farms Serv., Dept. of Agr., Ottawa, Can., Publ. 809, Farmer's Bul. 150, Oct. 1948.

"The Cranberry," Dom. Dept. of Agr., Ottawa, Can., Publ. 810, Farmers' Bul. 151, Sept. 1948, E. L. Eaton, K. A. Harrison, C. W. Maxwell, and A. D. Pickett.

"Report of the Minister of Agriculture, Province of Ontario, for the Year Ending March 31st, 1948," Ont. Dept. of Agr., Ont., Can., Sessional Paper No. 21, 1948.

"Field Corn Trials—Mt. Carmel and Windsor, Connecticut, 1948," Agr. Exp. Sta., New Haven 4, Conn., P. R. 48G1, Jan. 15, 1949, D. F. Jones and H. L. Everett.

"Research and Investigational Activities for the Fiscal Year Ending June 30, 1948," College of Agr., Univ. of Ga., Athens, Ga., Annual Report, Vol. XLVII, No. 10, June 1948.

"Fifteenth Biennial Report," State Dept. of Agr., Boise, Idaho, 1948.

"Effect of Time of Cutting Red Clover on Forage Yields, Seed Setting and Chemical Composition," Agr. Exp. Sta., Iowa State College, Ames, Iowa., Res. Bul. 357, June 1948, C. P. Wilsie and E. A. Hollowell.

"Point Your Farm to Balanced Production," Agr. Ext. Serv., Kansas State College, Manhatten, Kansas, Cir. 200, July 1948.

"White Clover for Mississippi Pastures," Agr. Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 1, Sept. 1948, W. R. Thompson.

"Kentucky 31 Fescue for Mississippi in Mixture with White Clover," Agr. Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 2, Sept. 1948, W. R. Thompson.

"Dallis Grass for Mississippi Pastures," Agr. Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 3, Sept. 1948, W. R. Thompson.

"7 Steps to More Cotton, More Money," Agr. Ext. Serv., Miss. State College, State College, Miss., Ext. Leaflet 89, Sept. 1948, T. M. Waller.

"Double Mississippi's Corn Yield in 1948—A Contest for 4-H Club Members," Agr. Ext. Serv., Miss State College, State College, Miss., W. R. Thompson and T. M. Waller.

"Diseases of Truck Crops and their Control in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 453, April 1948.

"The Multiflora Rose as a Living Hedge Fence," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 517, Sept. 1948, T. J. Talbert and J. E. Smith, Jr.

"Growing Gooseberries and Currants," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 327, April 1948, H. G. Swartwout.

"Plant Late for Fall Vegetables," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 331, July 1948, A. D. Hibbard and R. A. Schroeder.

"Report of the Nevada State Department of Agriculture for the Fiscal Years Ending June 30, 1947-1948," Carson City, Nev.

"Growing Winter Wheat in New Jersey," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 743, Oct. 1948, R. S. Snell, C. S. Garrison, G. H. Ahlgren, and J. E. Baylor.

"The New Jersey State Seed Law," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 520, Sept. 1948.

"Field Crop Recommendations, 1949," Agr. Ext. Serv., Rutgers Univ., New Brunswick, N. J., Leaflet 23, Nov. 1948, J. E. Baylor and C. S. Garrison.

"Strawberry Culture," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 404, March 1939 (Rev. Sept. 1948), M. B. Hoffman.

"Nut Growing," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 701, Sept. 1946 (Rev. June 1948), L. H. MacDaniels.

"Profitable Soybean Yields," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Rev. Ext. Cir. 295, Sept. 1948, E. R. Collins, W. L. Nelson, and E. E. Hartwig.

"Medicinal Plant Culture in Ohio," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 677, Oct. 1948, Alex Laurie, E. N. Stillings, and W. R. Brewer.

"The Lespedezas in Ohio Agriculture," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Bul. 300, July 1948, D. R. Dodd, L. E. Thatcher, and C. J. Willard.

"A Forest Industries Survey of Oklahoma," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Exp. Sta. Bul. B-325, Dec. 1948, E. R. Linn.

"Science for the Farmer," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 502, June 1948, 61st A. R.

"Informe Anual 1946," Servicio de Extension Agricola, Universidad de Puerto Rico.

"Fifty-ninth Annual Report—1946," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn.

"Effects of Several Winter Cover Crops on the Yield of Cotton," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 100, Nov. 1948, B. P. Hazlewood and E. J. Chapman.

"Brush Problems on Texas Ranges," Agr. Exp. Sta., Texas A & M, College Station, Texas, Misc. Publ. 21, Oct. 1948.

"Report, July 1946—June 1948," College of Agr., Univ. of Vt., Burlington, Vt., A. R. No. 3, Jan. 1949.

"Twenty-fourth Biennial Report of the Commissioner of Agriculture," State Dept. of Agr., Montpelier, Vermont.

"Inoculants for Legumes," Agr. Exp. Stations, State College of Wash., Pullman, Wash., Popular Bul. 191, Sept. 1948, C. D. Moodie.

"Pruning Apple and Pear Trees," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 381, Jan. 1949, J. C. Snyder and W. A. Luce.

"Development of Wisconsin 55 Tomato," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 478, Sept. 1948, J. C. Walker, G. S. Pound, and J. E. Kuntz.

"Agricultural Extension in Wisconsin—Report for 1947," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 380, July 1948.

"Plant the Right Wheat Varieties for Wyoming," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Cir. 31, Feb. 1948, Dayton Klingman.

"Plant These Oat and Barley Varieties in Wyoming," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Cir. 32, March 1948, Dayton Klingman.

"Report of Cooperative Extension Work in Agriculture and Home Economics, 1948," Ext. Serv., U.S.D.A., Washington, D. C.

"Report of the Chief of the Forest Service, 1948," Forest Serv., U.S.D.A., Washington, D. C.

"Report of the Federal Experiment Station in Puerto Rico, 1947," Office of Exp. Stations, U.S.D.A., Washington, D. C.

Economics

"Connecticut Crop, Livestock and Marketing Review for 1947," Dept. of Farms and Markets, Hartford, Conn., Bul. 101, Oct. 1948.

"Georgia Sweet Potato Production, Disposition, and Price," Ga. Exp. Sta., Univ. of Ga., Experiment, Ga., Bul. 258, Nov. 1948, K. E. Ford.

"Systems of Farming for the Lower-Ohio-Valley Crop-Livestock Region of Kentucky," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 521, June 1948, G. B. Byers.

"Modernization of World Agriculture," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Ext. Bul. 384, Sept. 1948, A. B. Lewis.

"The Nature of an Efficient Agriculture in the Brown Loam Area of Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 455, June 1948, D. W. Parvin.

"Ohio Farm Leases," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 683, Dec. 1948, J. I. Falconer.

"Costs of Producing Milk in Ohio, 1945-1946," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 687, Dec. 1948, R. H. Baker and J. I. Falconer.

"Farm Costs and Returns, 1945-47, Commercial Family-operated Farms in 6 Major Farming Regions," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., F. M. 70, Sept. 1938, W. D. Goodsell.

Wise Land Use Increases Farm Income

(*From page* 14)

tilizer than formerly used, without decreasing yields. This would make it possible to apply more nutrients to fields lower in fertility and would increase the over-all production on the farms with the minimum amount of fertilizers.

Efficient Land Use Increases Farm Income

Making land produce high profitable yields over a long period of time is a major problem involved in a long-range agricultural program. Experience has taught farmers, as well as scientists, that soils are not indestructible, but must be protected and their fertility maintained while they are producing; otherwise, the production will decrease after a period of time. This period of time is very short in some parts of the country, especially the South.

It is well for scientists and farmers to give some serious thought to the actual time the natural fertility of the soils will last under the prevailing type of agriculture. Experiments have shown that the supply of fertility in the native prairie soils of Northeast Missouri has a life span of 40 to 50 years when managed under continuous wheat crops or under continuous grazing. It must be remembered, however, that the soils of Northeast Missouri developed under less intensive climatic conditions than did the soils of the Southeastern states. A period of 40 years, although short to the people of the Midwest, is longer than we could hope for the natural

TABLE III. VALUE OF FARM PRODUCTS EVALUATED AT A CONSTANT PRICE LEVEL *
(AVERAGE PRICE OF 1935-39 USED)

Item	1928–32	1935–39	1940–45
Crops	$105,480,000	$124,915,000	$125,973,000
Cotton and Seed	94,184,000	110,458,000	101,902,000
Corn	413,000	1,417,000	2,122,000
Oats	20,000	55,000	875,000
Hay	599,000	716,000	1,015,000
Livestock and Products	25,330,000	29,744,000	41,188,000

* Reports of B. A. E.

Fig. 4. This photo shows an untreated pasture from which hay was cut and stacked for the cows in winter. They refused the hay from the untreated area and some of them died during the winter.

fertility of Southern soils to produce profitable yields without commercial fertilizers.

The process of cultivation fans the fire (oxidation) that rapidly burns up the organic matter in the soils of the South. Therefore, in order for these soils to deliver adequate fertility into the growing plants, the nutrient ailments must be ministered to quite often. This applies to the pasture and meadows as well as the land utilized for row crops.

Because of these handicaps, the Southern farmer, in order to do a job that will reflect credit on himself and bless future generations, must plan every acre and treat it according to soil needs. Although the farms are limited in size, if every acre of land is planted to adapted crops and treated according to fertility needs, the volume of production and income are usually high.

The volume of production for part of the farm products produced in Mississippi from 1928 to 1940 is expressed in Table III. In order to eliminate price variations, the average price received during the 1935-39 period was used for all the periods. These data indicate the increase in the total volume of production by the farmers of Mississippi. The increases in livestock and hay have been especially great and reflect a wise use of land that was once in row crops.

TABLE IV. CHANGES IN FARMS AND FARM POPULATION IN MISSISSIPPI *

Item	1930	1935	1940	1945
Farmers	313,000	312,000	291,000	264,000
Owners	87,000	94,000	98,000	107,000
Tenants	226,000	218,000	193,000	156,000
Farm Population	1,361,000	1,333,000	1,400,000	1,050,000

* Reports of B. A. E.

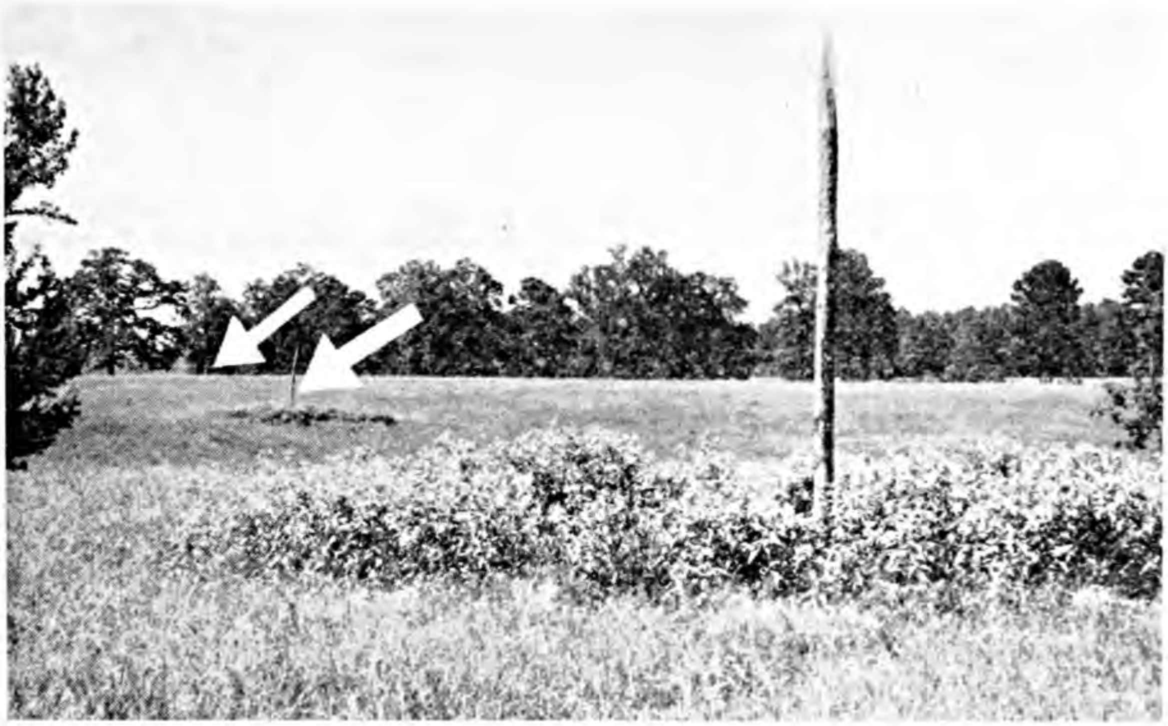


Fig. 5. This photo is a pasture treated with minerals. The hay was stacked the same as that in Figure 4. The cows ate all of the hay in the stacks from this pasture.

Efficient farmers are protecting the land with soil-conserving crops which are being marketed through livestock. The volume of livestock and products sold during 1940-45 was 63 per cent greater than during 1928-32.

Evidence of a higher farm efficiency is seen in the number of farmers and the ownership relation. Table IV shows the number of farmers, owners, tenants, and the farm population from 1930 to 1945. It is to be noted that the number of farmers has decreased consistently since 1930, while the number of farm owners has increased. This indicates that the larger volume of production was accomplished by fewer workers and that the output or production per worker has increased, which in turn indicate more agronomic efficiency and proper use of land on the farms throughout the State. Many of the farmers now have more than one major cash crop. This diversification has made more opportunities on the farms of the South, and many college-trained young people are now returning to the farm to further help develop a well-balanced agriculture and industry in their native land.

Veterans Top 100-bushel Corn Yield

(*From page* 26)

before would not have yielded 25 bushels of corn, this year go to 115 bushels? First, plenty of plant food was supplied; second, there had been a heavy crop of weeds decaying on the ground for three years and this was well mixed with the soil when it was prepared for planting.

William Houghton, who placed third with 111 bushels, planted his test acre in part of a 5-acre field, not making any effort to use the best land, just average. In fact, his yield was cut down by a roadway crossing the land the year before and leaving it hard. This strip could be seen all summer in the growth of the corn. He used about the same fertilizer as Kerns, putting it in the row, but he did not apply the side-dressing.

Albert Post, who placed fourth with a half bushel over his goal, would have been near the top if the season had not been against him. His corn was on low ground and several spots were so wet that the corn on them almost drowned out. In a test of a small plot where it was not wet, the corn yielded at the rate of 135 bushels per acre. Post used about 1,200 pounds on his test acre, putting 1,000 in the row and side-dressing with 200 pounds of nitrate of soda.

The average yield in West Virginia this year, according to the State Department of Agriculture Crop Reporting Service, was 43 bushels of shelled corn. Let's compare that with the above yields:

	Yield Per Acre	Above Average	Cost of Fertilizer	Profit Above Fertilizer Cost
James Kerns	121	78	$25	$131
Howard Kines	115	72	35	109
William Houghton	111	68	36	100
Albert Post	100.5	57.5	36	79

We computed the price of corn at the local selling price of $2.00 per bushel for local corn.

Suppose we compare these yields with what the same land would have done with less fertilizer. We had the chance to do this in two of the trials, as stated above. Houghton and Post used part of their regular fields to make this trial and we checked on both farms. On the Houghton farm, with about half as much fertilizer, we had a yield of 87 bushels of shelled corn; on Post's field, 67 with half as much, less the side-dressing of 200 pounds of nitrate.

Fig. 3. Howard Kines in his field. Note the density of the fodder and immense size of the ears. Kines used the same application on his entire field, and on 2.38 acres husked out 591 bushels of ears.

	Test Acre	Check Plot	Increase	Additional Fert. Cost	Profit Above Add. Fert. Cost
Houghton	111	87	24	$18.00	$30.00
Post	100	67	33	24.00	42.00
Kerns	121	87	34	12.50	55.50
Kines	115	87	28	17.50	38.50

We made no check on the last two plots but used the highest yield in the other check. However, there are very few farmers who use as much fertilizer as these two did in their regular fields, which was about 500 pounds per acre.

What does this mean to farmers in this State if they follow the example of these four boys and some other farmers over the State? In the first place, it means cutting to less than half the plowing of our hill lands in order to produce the corn we need, or else we can grow more of our own grain. It means less erosion on our hill lands and more land left in grass for a longer period to insure future prosperity for the State. It also means much less labor used in producing a bushel of corn. In the fields of these boys it means larger crops of grain and corn to come, for all of them left the fodder to be turned down to add organic matter.

These boys are going to try to produce 150 bushels shelled corn next year and several more of the class will join them.

Fertilizing Tomatoes for . . . Quality

(*From page* 8)

Earliness in itself, however, is not the only goal in producing a tomato crop. Quality is equally important and the influence of proper fertilization on quality can be most marked. The favourable effect of potash on quality in tomatoes is well founded. Hester has shown that the puree yield, per cent of total solids, and sugars are closely related to the amount of potash per acre, provided the potash was properly applied so that it became available and showed an increasing effect on yield. When one realizes that the sugar-acid ratio in tomatoes is lower in Ontario than in other tomato-producing areas, the necessity of adequate potash becomes much more important. But, unfortunately, there are other inherent characters in Ontario soils which make the problem of K_2O fertilization more complex.

In the January 1948 issue of Soil Science, Bear and Toth report on the "Influence of Calcium on Availability of other Soil Cations." The results of their investigations on 20 of New Jersey's most important agricultural soils led them to publish the following statement: "For the ideal soil, it is suggested that 65 per cent of the exchange complex should be occupied by calcium, 10 per cent by magnesium, 5 per cent by potassium and 20 per cent by hydrogen." This suggests that a calcium-potassium ratio of 13:1 is ideal.

In some of our Ontario soils, this ratio runs to 115:1 and ratios of 35:1 and 50:1 are common. In cases such as these, the efficiency of the K_2O applied is notably decreased. The result is that we have been recommending to most of our growers a fertilizer programme which alone would supply about 180 lbs. of K_2O per acre. These recommendations are, of course, based

Table II

Treatment	Yield in Tons/Acre
1,000 lbs./a 3-12-15	14.6
1,000 lbs./a 0-12-20	15.3
1,000 lbs./a 2-12-16	10.7
1,000 lbs./a 2-12-10	11.7

on soil tests and there is only a small percentage of the soils on which our tomatoes are grown that requires less than these amounts. The results have justified these applications and growers have had marked improvement in colour when the K_2O level was raised to 200 lbs. per acre. Effects on yield have also been favourable. Typical are the results obtained from a replicated trial located on a Beverly fine sandy loam at Chatham in 1947. These results are given in Table II.

The increased yield at the 15 and 20 per cent levels of K_2O is quite significant. These results have been verified by other trials.

The data presented indicate clearly that proper fertilization can be one of the major factors in inducing earliness and quality in the processing tomato crop in Ontario. Sufficient phosphorus properly applied can advance the crop as much as two weeks. Adequate supplies of potash are essential for proper maturing of quality fruit.

"Put and Take" in Grassland Farming

(*From page* 10)

pounds of 10-4-13 for the poorest soil.

That the dairyman is gambling with his soil bank account in grass fertilization unless he takes care of his potash assets is shown in the last table—"Put and Take."

The hay from the soil with the highest fertility rating removed the equivalent of 100 pounds of a 10-0-33 more than was applied in the topdressing. For the poor soil the deficit was equal to 70 pounds of a 10-0-53.

For the good producing soil that put 3 per cent of potash in unfertilized hay, the deficit of 33 pounds of potash did not nick the revolving fund of plant food to and from the field very much. For such good grass sods the 1-1-1 fertilizer ratio was considered a good choice. But to take 37 pounds of potash from the soil that could produce but 2,600 pounds of hay per acre is another matter. This plus and minus study certainly gave Browne more confidence in the emphasis by New England Extension Services and farmer usage on fertilizers with a 1-2-2, 1-3-2, or 1-3-3 ratio in starting roughage improvement on land that has not been well manured or fertilized. The results of the 1948 Green Pasture Contest in Hampden County did not change the

Table IV—Recovery of Plant Food—Pounds Per Acre

Soil Fertility Rating	From 500# 10-10-10			From 1,000# 10-10-10		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Good	60	25	83	86	33	132
Fair	35	16	57	59	26	97
Poor	57	20	87			

TABLE V—PUT AND TAKE—PLANT-FOOD CONTENT OF GRASS HAY IN TERMS OF MIXED FERTILIZER

	Lbs. Plant Food Removed			Equivalent to Fertilizer Grade			At Pounds per Acre
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	
Good soil—fertilized	122	49	202	10–	4.1–	16.5	1,220#
Good soil—unfertilized	62	24	119	10–	3.9–	19.2	620#
Recovery from 500# 10–10–10	60	25	83	10–	4–	13.8	600#
Removed from soil	10	......	33	10–	0–	33.0	100#
Poor soil—fertilized	105	40	134	10–	3.8–	12.8	1,050#
Poor soil—unfertilized	48	20	47	10–	4.2–	9.6	480#
Recovery from 500# 10–10–10	57	20	87	10–	3.5–	15.2	570#
Removed from soil	7	......	37	10–	0–	53.0	70#

emphasis. County Agent Browne sorted the records of the 60 entrants in this county into groups according to the scores. The 34 dairymen who made a score of 70 to 89 per cent (there were none higher) had an average use of plant food, exclusive of stable manure, *per cow* equivalent to 320 pounds of a 10-35-22 or 640 pounds of a 5-18-11 mixture.

The conclusion that Browne has reached from this grassland fertilization work is that whatever is done with lime, nitrogen, and phosphorus to grow more grass needs to be kept in step with the capacity of grass to take in potash and the ease with which the potash can be lost in the field-barn-field cycle. If you take more off, more must be put back for prosperity and posterity.

Maintaining Productivity of Irrigated Lands

(*From page* 18)

grain sorghums grown continuously for nine years yielded 55 bushels per acre, but following alfalfa, produced 75 bushels.

Figures 8 and 9 show yields of crops in rotation with alfalfa.

Winter green manure crops are proving very helpful in maintaining soil productivity. A cooperator with the Swisher County Soil Conservation District reported a yield of 61 bushels of grain sorghums following a green manure crop of vetch, as compared to 45 bushels on an adjacent field not following vetch. These yields are from land that has been under irrigation only a relatively short time, and soils which are inherently very fertile.

Figures 10 and 11 show yield increases following soil-improving crops at some experiment stations.

Improved irrigation pastures of mixtures of legumes and grasses are becoming of value in the agriculture of the West. These pastures produce excellent forage for livestock, and carrying capacities of more than one cow per acre for 8 to 9 months are being reported.

The mixtures of grasses and legumes have a very beneficial effect upon the soil. The dense ground cover prevents soil erosion on sloping lands. The dense root system of the mixture improves the structure of the soil and increases its capacity to absorb water. The grass roots, because of their volume, density, and fibrous character, have a binding effect on loose soils and a loosening effect on heavy soils. The legume in the mixture assimilates nitrogen from the air and, through the decaying roots high in protein, contributes nitrogen to the soil. The combination of rapidly decaying legume roots with slowly decomposing grass roots results

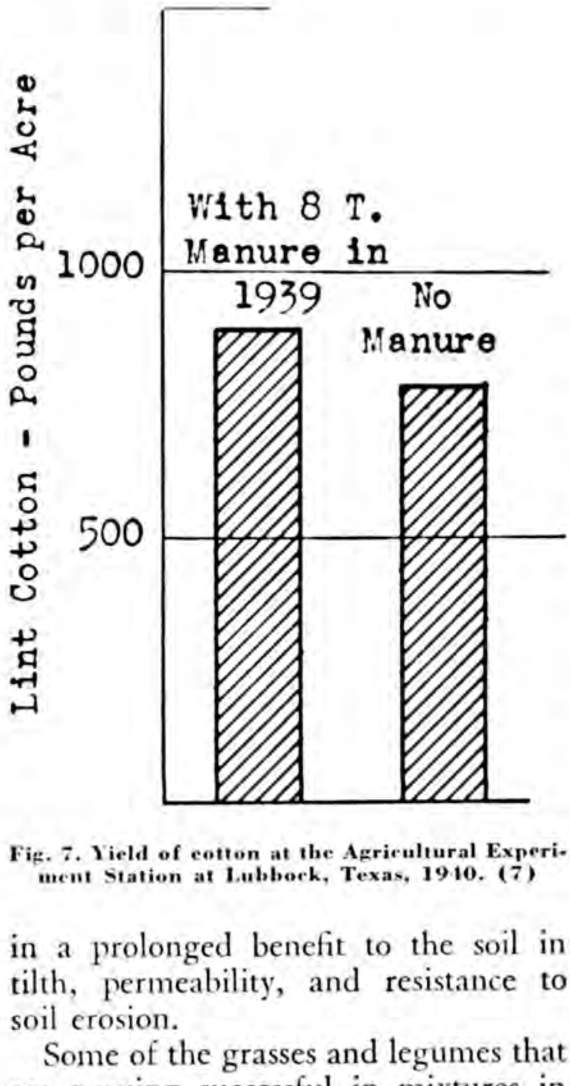


Fig. 7. Yield of cotton at the Agricultural Experiment Station at Lubbock, Texas, 1940. (7)

in a prolonged benefit to the soil in tilth, permeability, and resistance to soil erosion.

Some of the grasses and legumes that are proving successful in mixtures in the High Plains and other areas are perennial rye grass, crested wheat grass, smooth brome, orchard grass, Dallis grass, and alfalfa, biennial sweetclover, vetch, Ladino, and white Dutch clover. Others are very successful in other parts of the country.

Crops grown in rotation with and following the pasture benefit materially from the improved condition of the soil.

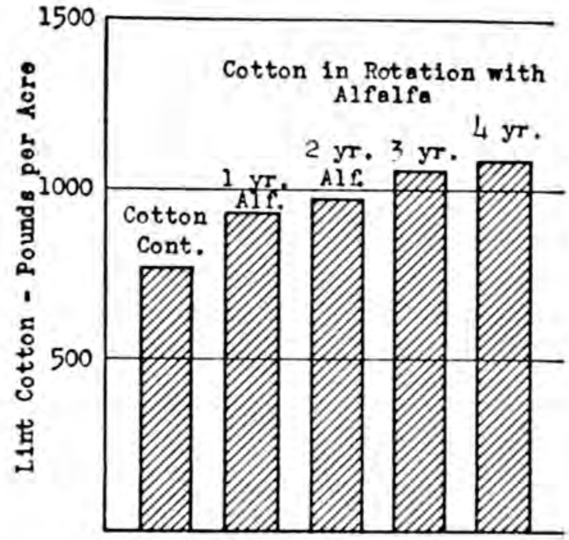


Fig. 8. Yield of cotton at New Mexico Agricultural Experiment Station. (6)

Observations on improved pastures have shown that the soil improvement progresses most rapidly during the first few years after the pasture has been established. The best rotation in order to take full advantage of the soil-improving capacity of a pasture crop is to grow about 3 to 4 years of pasture followed with 3 to 4 years of soil-depleting crops.

Commercial fertilizers are used in large quantities in almost all of the irrigated areas. From analyses of soil samples and results obtained in field and experimental trials, it appears that nitrogen and phosphorus are the plant nutrients most commonly deficient.

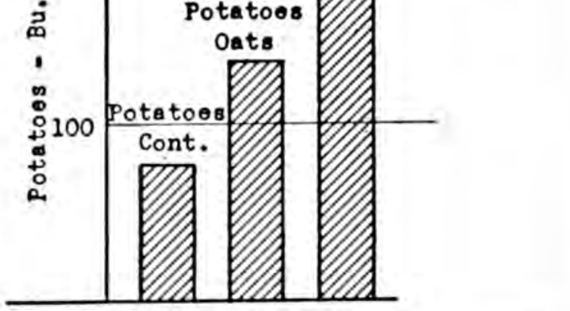


Fig. 9. Yield of potatoes at Scotts Bluff, Nebraska. (5)

Potash is deficient in the more sandy soils in some areas.

Recommendations for the kinds and amounts of fertilizers depend largely upon the needs of the soils and the crops to be grown. Commercial fertilizers alone will not solve soil fertility problems. They should be used as needed to supplement a program of maintaining the soil organic matter through manures and other soil-improving measures.

Too many farmers do not realize the importance of getting a uniform application of water in the amounts required by the crops. Lack of even penetration may permit the accumulation of salts in spots, or leaching of plant foods in other places.

Crops vary widely in their water requirement. Alfalfa and improved pastures require large amounts of water, whereas quick-maturing crops as vegetables and grain sorghums require lesser amounts. On sandy soils having low water-holding capacities and of open porous nature, frequent light irrigations are more efficient, whereas larger amounts of water at longer intervals can be applied on fine-textured soils as clay loams. The irrigation water requirement of crops varies with climatic conditions, such as rainfall and temperatures. Soils with saline accumulations may require special treatment such as heavy leaching to remove the salts.

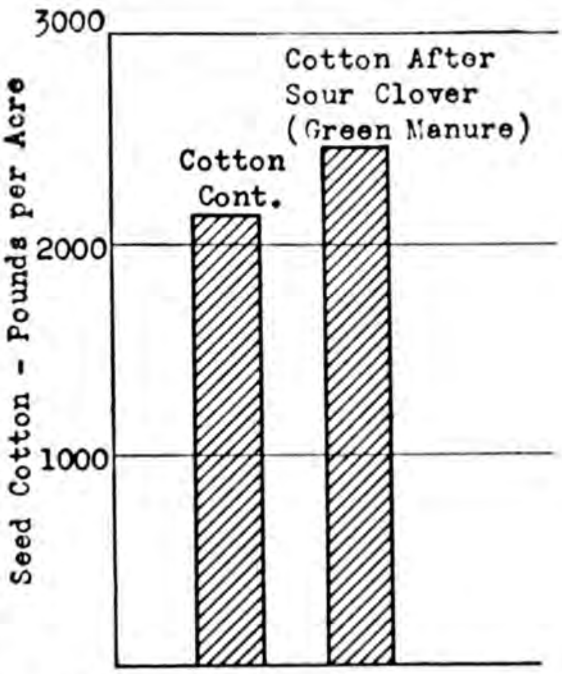


Fig. 10. Yield of seed cotton at New Mexico Agricultural Experiment Station. (6)

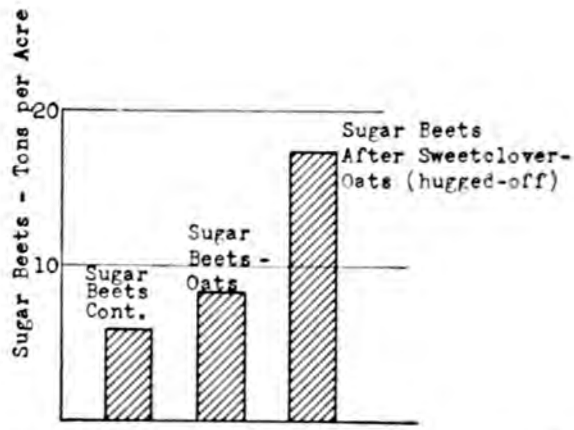


Fig. 11. Yield of sugar beets at Scotts Bluff, Nebraska. (5)

The problems connected with proper application of water are many. The problems of a particular area must be studied and measures adopted to fit that area.

The El Paso-Hudspeth Soil Conservation District in West Texas, realizing the importance of getting water applied properly, has developed a plan which includes the following:

1. Leveling.
2. Designing and establishing a distribution system.
3. Laying out the method of applying water.
4. Floating.
5. Soil-improving practices.
6. Applying water when needed and in the amounts needed.

The soil conservation districts have recognized the need for a coordinated plan designed to fit the land. Almost all of the irrigated land in Texas is now in an organized soil conservation district. These districts have recognized the need for doing something and are doing it with the assistance of the Soil Conservation Service and other agricultural agencies.

References

1. The Influence of Cropping on the Nitrogen, Phosphorus and Organic Matter of the Soil Under Irrigation Farming. J. E. Greaves

and C. T. Hirst. Bulletin 310, Agricultural Experiment Station, Utah State Agricultural College.

2. Deep Well Irrigation in the Oklahoma Panhandle. The Panhandle Bulletin No. 64, Panhandle Agricultural and Mechanical College.

3. A Study of the Movement of Moisture in Soils. Report by U. S. Department of Agriculture and Texas State Board of Water Engineers.

4. Irrigated Crop Rotations. Bulletin 414, Montana State College, Agricultural Experiment Station.

5. Irrigated Crop Rotations in Western Nebraska, 1912-34. Tech. Bulletin No. 512, U. S. Department of Agriculture.

6. Summary of Cotton Fertilizer Tests. Report from New Mexico Agricultural Experiment Station.

7. Lubbock, Texas, Agricultural Experiment Station Annual Report, 1940.

Lime Needed to Maintain Fertility

(*From page* 20)

Low productive soils to a considerable extent have lost their capacity to retain large amounts of replaceable calcium (Tables 1 and 2). Liming low productive soils raised the pH to a point equal to that of the high productive level pH 6.5. The available calciums in the two were by no means equal. The low productive soils were increased in calcium from 730 pounds up to 3,000 pounds an acre by liming. High productive soils increased from 7,700 pounds up to 10,000 pounds calcium an acre by liming (Table 1).

Limestone applied to both high and low productive soils gave a substantial build-up in total organic matter (Table 1). This build-up was due in a large part to improved legume growth on limed land. The experiment fields considered have been in operation for more than 30 years, and the cropping system has usually been a four-year rotation in which considerable legume growth has been provided for plow-under material.

The soybean is a legume which will produce abundantly on soils having considerable acidity. However, under Midwest field conditions when soils become too acid, even the sturdy soybean plant fails to give a satisfactory yield and the beans may be deficient in nitrogen. Soybeans grown on untreated soil of the Oblong experiment

TABLE II—REACTION, REPLACEABLE CALCIUM, AND TOTAL ORGANIC MATTER IN UNTREATED AND LIMED SOILS ALONG WITH SOYBEAN YIELDS AND NITROGEN CONTENT OF THE BEANS

Experiment Field	pH	Pounds an Acre		Soybeans	
		Replaceable Ca	Organic Matter	Beans bu/A	N Per cent
		Untreated Soil			
Joliet	5.5	5,000	96,000	24	6.4
Oblong	4.8	1,000	44,000	14	5.7
		Limed Soil			
Joliet	6.4	7,000	96,500	26	6.4
Oblong	6.1	2,800	47,300	16	6.8

Fig. 2. Red clover on the Ewing experiment field. The limed land on the left had a reaction of pH 6.2 and contained 3,000 pounds of replaceable calcium and 38,000 pounds of organic matter in the topsoil. The unlimed land on the right had a reaction of pH 4.5 and contained 520 pounds of replaceable calcium and 32,000 pounds of organic matter in the topsoil.

field averaged only 14 bushels and the beans contained only 5.7% nitrogen (Table 2). Where the soil was limed and the reaction raised to pH 6.1, the bean yield was 16 bushels an acre and the beans contained 6.8% nitrogen. The Oblong field soil was also deficient in both phosphorus and potassium; and when these elements were supplied to the soil, the soybean yield was 24 bushels and the nitrogen content of the beans was 6.5%.

It is apparent that when field soils become too acid this condition limits the capacity to produce crops which are satisfactory in both quantity and quality. The answer to this is sufficient limestone and an attempt to supply all other elements which may be deficient. On moderately acid soils, pH 5.5, additions of limestone may prove profitable by creating in the soil conditions for better legume growth and other desirable biological and chemical functions. When fertilizer applications are adjusted to meet the needs of all crops, there need be very little concern about overliming.

Outmoded Bygones

(*From page* 5)

for the central market. It was either a rear runner ride or a sled attaching venture, the big loads of wood concealing our presence from the drivers. Our parents scolded us for it and hinted at injuries, but I paid no heed until a little girl in my grade fell off a bob and received a nasty clip from the hoofs of a horse close behind. She was carried into our cottage and laid on the "sofa" where I used to read my Henty books. Effie recovered all right, but I needed only to look at a tiny blood spot on the old, brown head rest to turn me toward safer sports—like skating on thin ice or stealing melons.

Gone also forever are the wooden hitching racks in front of the stores and along two sides of the market square.

"Cribbing" horses (and hungry ones) would gnaw the posts and look with yearning at the iron watering troughs while their masters were quenching their thirst in the taverns—or maybe at the old town pump.

There's a dead bygone for you, if there ever was one—the town pump! The battered tin cup fastened to the pump by a dog chain was a symbol of "all for one and one for all." On hot summer days and stifling nights the creak of the handle and the clatter of the cup sounded forth as regularly as the town clock's strokes.

WE never paused to think of the germs which this common quaffing custom spread among us in democratic fashion. No, for the air was hot, the water was cool and refreshing, and our parched toes curled in glee as the drippings splashed upon them. And the most of us lived through it anyhow, to finally stand in wonder along about 1900 when the first bubble fountain in our town was placed right where the ancient aqua pura plunger had laved the throats of many generations without benefit of hygienic laboratory.

Oh yes, and before I quit the street scenes for other flashes backwards, let's pay parting tribute to the "carriage blocks" which stood before so many of our homes. They were about four or five feet square, with about four short steps on the side toward the house; and they stood at the curb. Often an effigy of an urchin with outstretched arm was mounted on a post near the carriage block, to which a team might be tied while the family prepared to sally forth in the high-pitched buggy. I recall how some of the big kids used to switch these blocks around on Halloween nights—even putting them where the modest privies stood and dragging the backhouses to the street locations.

Always in my dreams I see those stores again, almost as real and entrancing to me as they were along back then. We liked the drug store best. It had colored liquids in glass globes in the show windows and rows of labeled drawers and medicines, herbs, and roots on many shelves. The big, hot stove in the rear always had mechanical figures of pasteboard above it that sawed wood or cobbled shoes or rode horses in the upward draft of warm currents. The department store had a cash carrier and tracks which fascinated all the urchins when their mothers waited for change. In the drug store you could buy slippery elm bark to chew in school, or lozenges for the girls, or liniment for Ma's sore knee; and there you often saw Old Doc Gorton in solemn conference with John Gresham, the master of the pharmacopoeia. It was there, alack, that the doughty Doc got all those villainous nostrums with which he bullied you into submission when you fancied you had a fever that should keep you from school on a cold day.

I also take kindly in retrospect to the charm of the bake shop. Those rolls for ten cents a dozen, with one extra for old times' sake, and the fancy bridal cakes and the little silvery bell that rang when you opened the front door. Down at Kiser's butcher shop, with sawdust floor and red-knuckled clerks, they gave you a ring of bologna when you paid for a mess of steak or spareribs, and handed you pig bladders which could be scoured and partly dried and inflated for footballs. Their abattoir (locally known as the slaughterhouse) supplied all the community with its fresh meat without any purple stamps or inspection folderol.

REMEMBER the grocery too, with its open bean barrel for the cats to hide in, the rumbling coffee grinders run by hand, and the jugs of vinegar and cans of kerosene with potato-corked spouts which you had filled there?

Our old-time saloons were not the open-faced, everyday free-for-alls which libation spots assume today. They bore no dignified or lyric names. They hid behind curtained doors and screened windows, and women almost never entered there unless they had wayward husbands or were rather that way themselves. I cannot exactly speak from personal enjoyment of the piece de resistance which those drinking places featured, known as the "free lunch." Yet they rivaled one another in the bounty and variety of the cold repasts served on a small counter at the rear, of which all customers were free to partake regardless of the state of their purse or sobriety.

OUTSIDE of the stores were other points to remember. The harness shop kept a neat but weatherworn pony standing on a block, on which in summer the boss spread fancy new flynets and again in the fall, a gaudy woolen blanket. Next door was the shoe store and town cobbler's shop. It also advertised its stand with a huge gilded boot hanging on a beam. Then, of course, that relic of museum fame—the Indian cigar clutcher—held out his fistful of stogies to remind your Father that he should get a box of cheroots in time to treat his friends on natal days and for election bets. Along with the dodo, the steam calliope, and the backyard "specialty," the chieftain of the cigar store emblem has been gathered to the everlasting boneyard.

Speaking of election bets reminds me of the eventful evenings we spent at the court-house auditorium waiting for the returns or attending county party conventions. The radio and television addicts of today may have missed some of the fun after all.

The crowd assembled along about nine o'clock on election night. The county chairman or some other dignitary held the floor and read all the telegrams which were fetched in every once in awhile from the local telegraph office by errand boys. It was rather slow business sometimes, but we had a fiddler on hand and a few roaring fellows who had been doing electioneering too close to the bartenders. We seldom were sure of what the final outcome would be when we dutifully went home to roost before midnight struck in the town clock chime.

To leave that scene and get a breath of fresh air, how many of you recall the numerous bands of wandering horse-traders and gypsies who toured the countryside each season? This surely is a thing almost never seen today. Rural Americans of my time loved the equine species and delighted to test their acumen as judges of fillies against the best that came along. They even took some pleasure in being shamefully deceived and flatly swindled, because they expected to be and took it in their natural stride. I presume that there is equal chance to get a shellacking in a car deal nowadays, but there isn't the carnival spirit about it like there used to be when a dozen wagonloads of shrewd gangsters and their feminine cohorts invaded the town.

You see, the legends of Europe followed in the wake of all these sinister and Bohemian caravans of fortune-tellers and nag hostlers. They camped near the outskirts and us kids received due warning from parents not to fraternize too much with these vicious strangers, especially after sundown. That only lent a zip and zest to the adventure and gave the gypsy crews a glory that they hardly deserved.

IN summer evenings when we were young the streets were strolling places. Today they are just convenient avenues for going to work or distant recreation. In those older and simpler times the streets were show places for finery and thoroughfares by means of which you greeted neighbors as they sat on their front porches in the twilight. You courted your gal thereon and used the street to escort her to the drug store for a five-cent (I said five-cent) ice cream sundae.

Everything from politics to religion and rents got its innings on the porches that overhung those quiet, shady streets. When you approached to pass a house with your best girl at your side, there would be a slight pause in the murmur of evening speculation and gossip indulged in by the observing rocking-chair brigade. Greetings would be exchanged, smiles flung back and forth, and then you passed on out of earshot. Thereupon the chatter of the porch sitters would be resumed and both of you just knew that *somebody* was getting discussed in frank debate.

MAYBE you fooled them and went to a movie instead of hunting for a private bench in the dark park. In that case it only cost you a nickel to pass the portal and be led to a seat by a kid you called by his first name. The shifty, flickering screen shadows of the silent movies helped you forget what snippy gossips might be saying. John Bunny, Flora Finch, and Francis X. Bushman soon regaled you with the best that films could furnish. You thought how smart and public-spirited Hank Jones had been, to transform an old livery stable into this palace of pleasure. You squeezed her hand and felt happy.

I might also rave betimes about livery stables too, and the drummers who patronized them, the funerals that depended upon them for solemn style, and the weddings that likewise relied on the hired carriages to make them high-toned affairs. But the hour is late and we have but a moment to dawdle on old and forgotten things like these.

I could tell you about Dad's gilt mustache cup and his shaving mug that Barber Kirk kept in that cabinet with the lather cups of other civic leaders. I could speak in fun after all these years of the asafetida bag that Ma made for me to wear tied around my neck in winter—to ward off the germs, she claimed. I could retell the story of my heavy knitted wool socks that Ma made for me under some protest. They bulged in the wrong places just as I was becoming conscious of my appearance before the tender sex. I could speak of haircuts for a quarter, patent-leather shoes for three dollars, neckties thrown in with every suit, and eggs for thirty cents a dozen.

But I'd be obliged to tell the other side too—a dollar a day in wages for twelve hours' toil and plenty of discomforts to those who earned their bread in factories. So if we ever yearn to return to those obsolete days because they were cheap and simple, we'd have a penalty to pay for all the privilege.

No, we won't go back in the flesh, much as we dwell upon it in the spirit. Yet I often wish that along with a pace like ours—including four hours' flying time from coast to coast—we could figure out some better social and economic gadgets to make lives longer and more sublime.

It often seems to me that there must be some unchanging thing about humanity in both its morals and its mistakes, whereas in mechanics we can force issues and shift gears and get results that seem nicer and more convenient and pleasant. I suppose that's it—because our folks away back in the period I spoke about had the same basic good and bad mixtures in their make-up as folks have now. You can regulate and adjust a machine or get up a new invention and throw out the old implement, but somehow that doesn't work at all with human beings. They'll rebel or outvote you!

BUT hush me up! I must stop this sermonizing because it doesn't fit my style. Just because a geezer lived in the rough-road days and marveled at smoky magic-lanterns and cylinder phonographs is no reason why he needs to set up as a prophet or a directing genius.

Anyhow, now you know where I was brought up and when, and anytime you care to match memories with mine leave your name with the publishers.

"Paw," said the farmer's boy, "I want to go to college and learn to be a doctor. Think I'll study obstetrics."

"Likely you'll be wastin' your time, son. Soon as you learn all about this obstetrics, somebody'll find a cure for it."

★ ★ ★

Floridian (picking up a melon): "Is this the largest apple you can grow in your state?"

Californian: "Stop fingering that grape."

★ ★ ★

Inquiry received by Society Editor of a large newspaper:

"I would like to ask for a little information concerning a birthday party I am to give. There will be six couples. I would like to know if it is proper for the hostess to take the gentlemen's clothing upon entering the house, or to take them into the bedroom and let them deposit their clothing where they wish."

★ ★ ★

JUST HAPPENED

Insurance Agent: "What did your grandparents die of?"

Ezra: "I don't recollect; but twarn't nothing serious."

★ ★ ★

"And see this bear on the floor," said the garrulous explorer. "I shot it in Alaska. It was a case of me or him."

"Well," yawned the weary listener, "the bear certainly makes a better rug."

Negro Undertaker (over telephone): "Rastus, your mother-in-law just died."

Rastus: "Is you sure 'bout dat?"

Undertaker: "Shall I bury her or embalm her?"

Rastus: "Don't let's take any chances, brother. Cremate her."

★ ★ ★

EXCUSABLE

Johnny came rushing in one afternoon and told his father that he had seen two lions and a tiger fighting in the street.

After several futile attempts to get Johnny to change the story his father finally said, "Johnny, you know you are fibbing and I want you to kneel down and tell God your story and ask Him to forgive you."

In a short while Johnny came back beaming. "It's all right," he announced cheerfully. "God said that those big dogs had Him fooled at first, too."

★ ★ ★

Jones: "Look at that bunch of cows."

Smith: "Not bunch, herd!"

Jones: "Heard what?"

Smith: "Herd of cows!"

Jones: "Sure, I've heard of cows."

Smith: "I mean a cow herd."

Jones: "What do I care if a cow heard? I didn't say anything I shouldn't have!"

★ ★ ★

"A hick town," it is said, "is one where, if you see a girl dining with a man old enough to be her father, he is."

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
II-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
TT-10-45 Kudzu Responds to Potash
ZZ-11-45 First Things First in Soil Fertility
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
NN-10-46 Soil Testing—A Practical Aid to the Grower & Industry
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
G-2-47 Research Points the Way for Higher Corn Yields in North Carolina
I-2-47 Fertilizers and Human Health
N-3-47 Efficient Management for Abundant Pastures
P-3-47 Year-round Grazing
S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
Y-5-47 Increasing Grain Production in Mississippi
AA-5-47 The Potassium Content of Farm Crops
DD-6-47 Profitable Soybean Yields in North Carolina
GG-6-47 Correcting Measures for the Salinity Problem in Southwestern Soils
SS-10-47 Soil Fertility and Management Govern Cotton Profits
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
BBB-12-47 The Management of Mint Soils
DDD-12-47 Florida Grows Good Pasture on Coastal Plain Soils
D-1-48 A Good Combination: Lespedeza Sericea and Crimson Clover
E-2-48 Root Rot of Sweet Clover Reduced by Soil Fertility
F-2-48 Swapping Plant Food for Corn
H-2-48 Soil Testing and Soil Conservation
J-2-48 The New Frontier for Midwestern Farmers
K-3-48 Peanut Land and What It Needs
L-3-48 Radioisotopes: An Indispensable Aid to Agricultural Research
N-3-48 Ground Cover
O-4-48 Legumes Improve Drainage and Reduce Erosion
R-4-48 Needs of the Corn Crop
T-4-48 Winter Grazing Increases Southern Livestock Profits
U-5-48 Fertilizer Consumption and Supply in the North Central States
V-5-48 More Abundant Living with Soil Conservation
W-5-48 Will These New Tools Help Solve Some of Our Soil Problems?
X-6-48 Applying Fertilizers in Solution
Y-6-48 Response and Tolerance of Various Legumes to Borax and Critical Levels of Boron in Soils and Plants
Z-6-48 The Development of Irrigation in Georgia
AA-6-48 The Chemical Composition of Agricultural Potash Salts
BB-8-48 Growing Alfalfa in North Carolina
CC-8-48 Soil Analysis—Western Soils
DD-8-48 How Much Lime Should We Use?
EE-8-48 A Soil Management for Penn Tobacco Farmers
FF-8-48 Soil Conservation Raises Midwest Crop Potentials
GG-10-48 Starved Plants Show Their Hunger
HH-10-48 Weeping Lovegrass Stills Vermont's Sandblows
II-10-48 The Need for Grassland Husbandry
JJ-10-48 Four P's in Progress
KK-10-48 Some Rates of Fertility Decline
LL-10-48 All At One Lick
MM-11-48 Better Hay with Potash
NN-11-48 Ladino Clover—Italian Gift to North Carolina Pastures
OO-11-48 The Use of Soil Sampling Tubes
PP-11-48 Applying Soil Conservation Through Local Contract
QQ-12-48 Legumes Supply Organic Matter
RR-12-48 Increasing Corn Yields in Union Parish, La.
SS-12-48 Hubam Sweetclover
TT-12-48 Season-long Pasture for New England
UU-12-48 The Relation of Credit to Soil Conservation

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

- Potash in Southern Agriculture (South)
- In the Clover (Northeast)
- Bringing Citrus Quality to Market (West)
- Machine Placement of Fertilizer (West)
- Ladino Clover Pastures (West)
- Potash from Soil to Plant (West)
- Potash Deficiency in Grapes and Prunes (West)
- New Soils from Old (Midwest)
- Potash Production in America (All)
- Save That Soil (All)
- Borax From Desert to Farm (All)

IMPORTANT

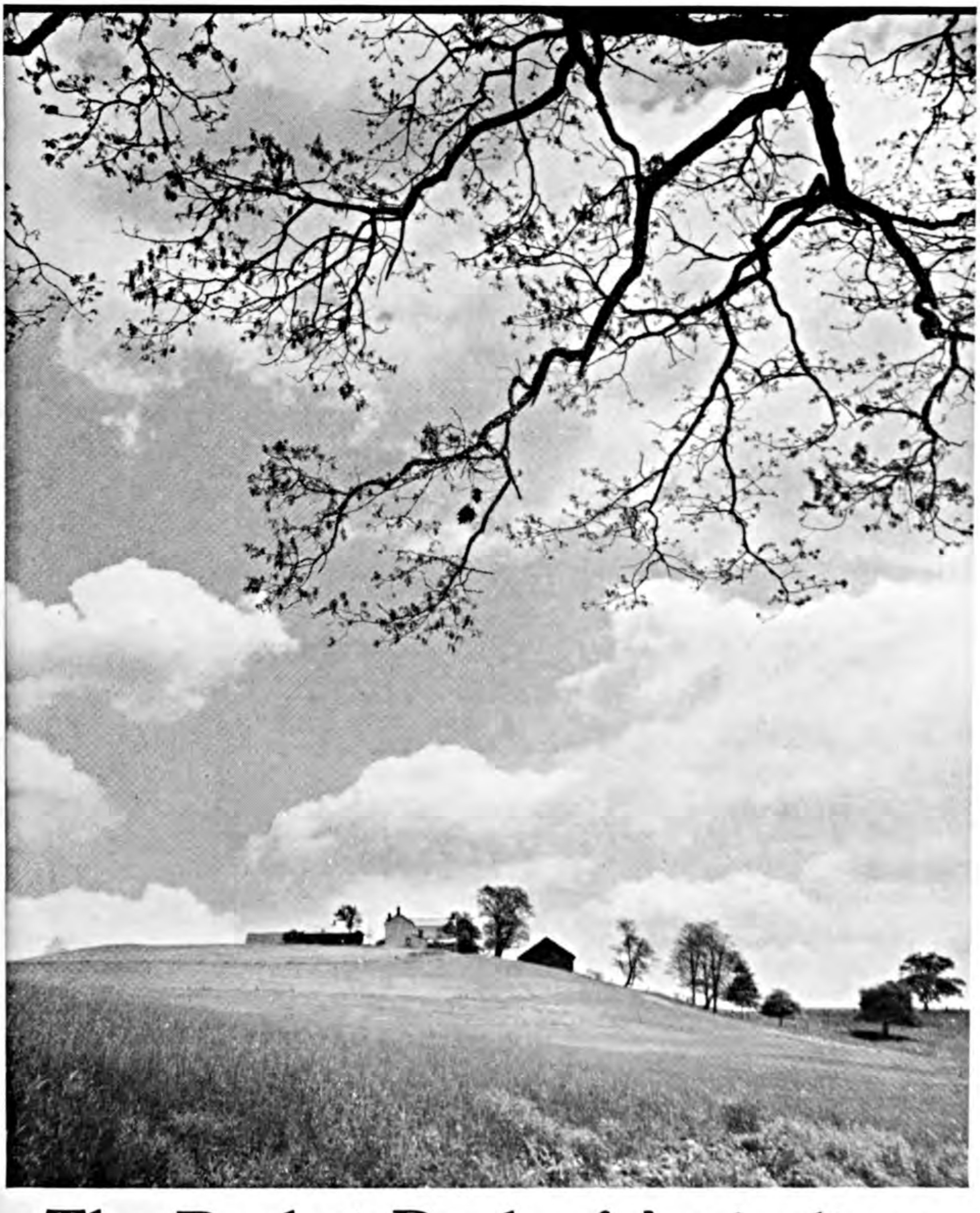
Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

American Potash Institute
1155 Sixteenth Street
Washington 6, D. C.

Printed in U.S.A.

Better Crops WITH PLANT FOOD

March 1949 10 Cents



The Pocket Book of Agriculture

Better Crops *with* PLANT FOOD

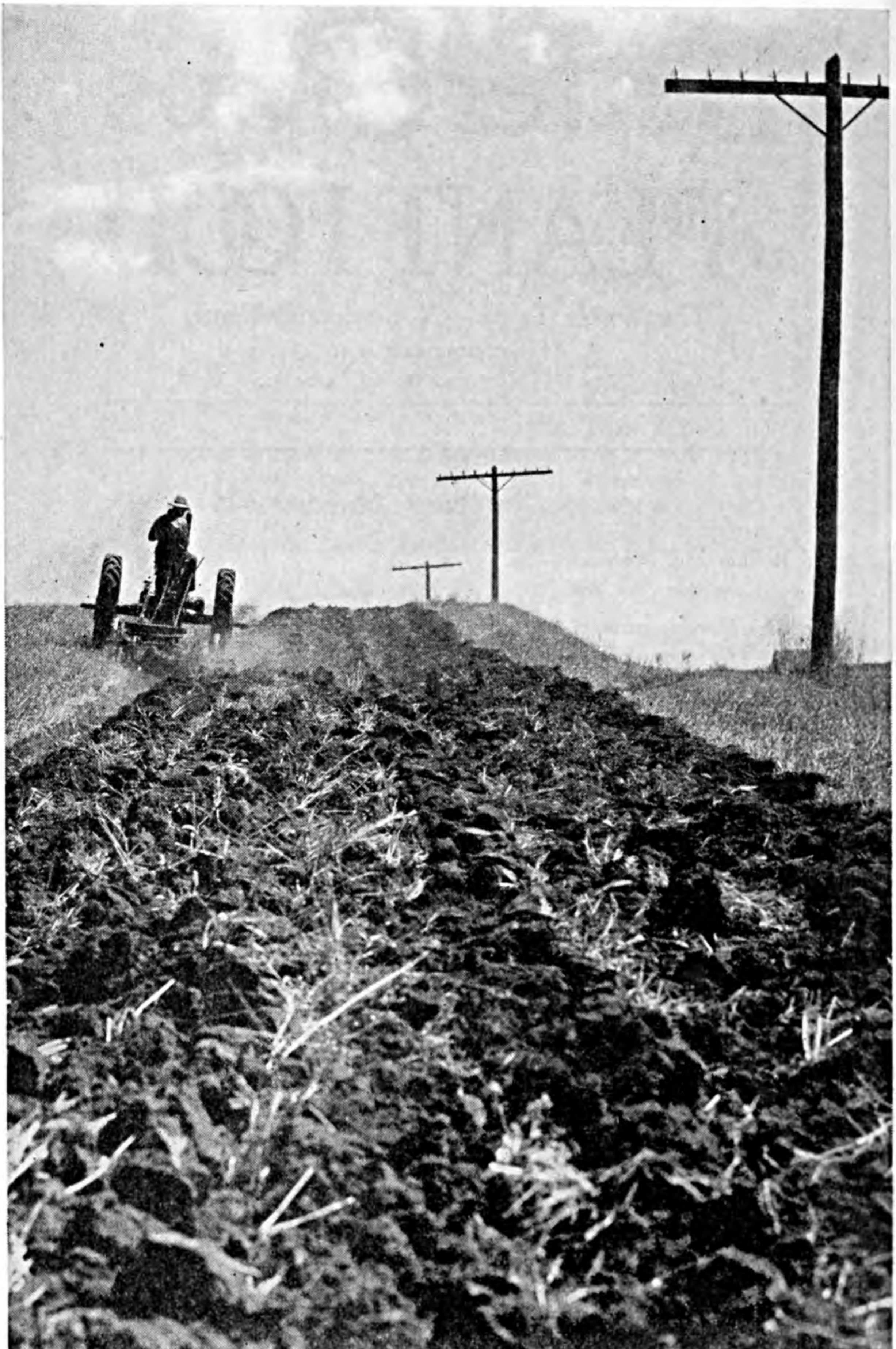
The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 3

Table of Contents, March 1949



An Early Spring Landscape

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII   WASHINGTON, D. C., MARCH 1949   NO. 3

For panoramic parodies . . . .

Pardon Me, Professor!

Jeff McDermid

IN case you prefer strict dictionary terms, a "professor" is one who professes and teaches any branch of science or learning, with special reference to established schools, colleges, and seminaries. Yet out our way in "them good old days" the important persons who bore the prefix of "prof" were teachers of many, many things—far more than was ever dreamt of in your philosophy, Horatio. Some of these individuals possessed greater right to the title than others, but few of us questioned the formula of local usage.

Whereas modern educational lingo dubs a gent a "doctor" after he has penetrated beyond the outer rim of learning, no such title belonged to the tutors of my youth. In those days doctors took care of human and livestock ailments, and only incidentally engaged in educational effort. So if you have any erudite friends with doctors' degrees, let's leave them out of this present discussion.

I detect a reluctance and withdrawal on the part of many noble high-brows to tack "professor" onto their cognomens. I have an inkling of the cause of this disavowal. Some even refuse to put a string to their kite by adding such fairly acquired degree letters as M.A., B.S., and Ph.D., almost as vehemently as though the letters were S.O.B.

My earliest awareness of a professor dates back to long gone days in the old town. Each day, to and from his job as principal of the high school, there walked a dignified, red-haired, frock-coated, middle-aged man—a man who never seemed to age perceptibly, contrary to the experience of teachers in general. He was red-faced and bald on the days when I halted my marble game to watch him pass; and the flushed cheeks and shiny pate still persisted during the terms I sat bewildered in assembly hall hearing him discourse on physics and geometry.

YES, Professor Hough was a town institution just as much as the steel water reservoir on Prospect Hill or the volunteer fire department that used it. We common folks without much background in bookish lore or academic roots marked the presence of Professor Hough with due reverence and respect. Nobody ever thought of addressing him as "Mister" Hough. He was always spoken to and spoken of as Professor Hough, even by those who really knew young Bill when he was struggling through the university in the next county and supporting his widowed mother by doing odd jobs and summer farm work.

This natural admiration that the simple ones in our town held for this gentle fellow who grew old so easily was not as much reflected by the go-getters among our solid business and banking group. I doubt if they regarded Professor Hough as anything more than a guy who borrowed on a personal note, with his civic job and a friendly cosigner as security. He was not keeping step with the rising tide of ambition and progress, and he could not compare as a founder of prosperity with several young lawyers and insurance agents who quit formal learning with high school diplomas.

Financial standing did not affect our own outlook toward prominent citizens. Although we observed that Mrs. Hough worked daily in the city clerk's office and the older daughter had employment as librarian, this did not cloud our esteem for the Professor and his scholastic sway. I am glad for that evidence of our poise and good judgment.

Perhaps if I saw him in action now, or my youngsters had seen him from a newer viewpoint, Professor Hough might be called somewhat fuddy-duddy. He always smelled of peppermint lozenges, moth balls, and fresh shoe polish. His sense of humor was not remarkable and his imagination was not keen and soaring. But we did not doubt his innate honesty and upright character, nor his desire to inculcate us callow scholars with feeble sparks that might blow into a blaze of achievement—if the wind from the river was right.

His record shows that he opposed starting a school periodical, and was against a domestic science class and a manual training course in that era when both were luxuries. But he cooperated fervently with the women's book clubs and the old soldiers' post whenever a program was staged for juvenile benefit. I daresay he was a man who would run a good average with boss teachers today.

MY folks never had much to do socially with Professor Hough and there was little contact between them except the casual bowing salutations on the street. This is why, upon my return to the old town ten years after school days ended to attend the funeral of my mother, that I felt doubly surprised and touched when Professor Hough silently took a seat among a small circle of our oldest friends. It was the last time I ever saw him. But his presence there indicated some kindred feeling among that passing generation, of which we younger ones were largely unaware.

He lived a humdrum life of dull routine and was never known to raise a voice over the current issues of free silver vs. the gold standard, women's suffrage, or foreign immigration—pet subjects for evening debates by the high school's forensic amateurs. He was hired to be circumspect, conservative, and neutral, and to make facts, not opinions, his constant rule.

But wherever you are, professor, you

really left something for us to remember you by that wasn't set down there formally in the old contract with the board of education and the common council. You are therefore no longer bound by precedent and prejudice, and your shadow casts a better picture than you hoped it might.

Quite a different personality wore the prefix of dignity when Professor

Bernadino stepped off the train from California and set up a "polka palace" in the old armory hall. Most of us had inherited such lore of Terpsichorean kind confined to the all-hands-round and do-si-do of the pioneer square dance and rollicking reel. The waltz and the two-step came to our town with a vengeance that winter, thanks to the graceful, debonair, and polished finesse of this hot-blooded scion of some Spanish grandee. He was the beau ideal who taught us gangling kids to hold a handkerchief in our moist right hands as we clasped the silken bodices of our fair and fluttering partners and to make the courtly bow from the waist upon presenting ourselves for the dance. With his wife treadling on the plumping player piano, we counted out our "one, two, three" and clumsily fought our way across the waxed floor until the last measures of Hiawatha were stilled by the town clock's curfew strokes of ten.

I still argue that this adventure we had with the gorgeous outer world of spit-and-polish probably did us some lasting good. I know that I got to know a lot of nice girls at an age when my bashful shyness could have got me into what they now call a "fixation" of some mysterious sort. Whether any of those fair ones, now sedate and motherly, recall the fancy footwork in any similar romantic way is not for me ever to know. I haven't seen any of them for almost twenty years.

Next I recall Professor Pedley, a gray, soft-spoken, kindly man of the old gentility. His right to the title rested on skill at the parlor organ and deftness with the tuning fork. By the time I grew up, however, the community singing school had gone into total eclipse. So instead of holding customary classes, Professor Pedley took charge of a church choir and spent his week days tuning pianos for the favored few who owned them, sometimes annexing a stray pupil on his rounds. He had three lively, charming girls—all very much my seniors, but with whom I was very much in love. Dad did not recognize the true symptoms when he invested five dollars to pay for my ten music lessons in the Pedleys' Victorian parlor.

LINKED in luteful memory with the shade of Pedley is the more glamorous and flamboyant picture I retain of Professor Maurice Morrison—bumptious leader of our own local silver cornet concert band. On certain balmy, cricket-haunted summer nights; on grave and decorous Decoration Days; on brassy, humid July celebrations; and in between when time and funds permitted, the melody and beating rhythm of those enterprising entertainers gave us all something to be proud about. Although I never trumpeted or thumped under Morrison's tutelage, I sat on curbstones and fought mosquitoes and felt grandly lifted and enchanted while the Professor waved his baton over the tooters of the town. Bands are far more plentiful today, so that perhaps even my small talent

(*Turn to page* 48)

The Development of the

American Potash Industry

By J. W. Turrentine

Washington, D. C.

IN tracing the development of the American potash industry, the logical place to start would seem to be the beginning even though the story has often been told; and the beginning may be described as that point in our agricultural history when we first realized our state of utter dependence on a single foreign source for our supplies of potash salts which we had been taught to use and which we had learned were essential in scientific crop nutrition.

The date was 1910 and the single source of commercial potash salts was Germany. There the potash industry had been over-expanded to the point where surplus production and competitive selling were reducing to near bankruptcy many of the factors except the lowest cost producers, with resulting chaos. To save the industry the German government organized a trust, closed down the less profitable mines, assigned production to the more profitable mines and fixed the prices at which potash salts could be sold.

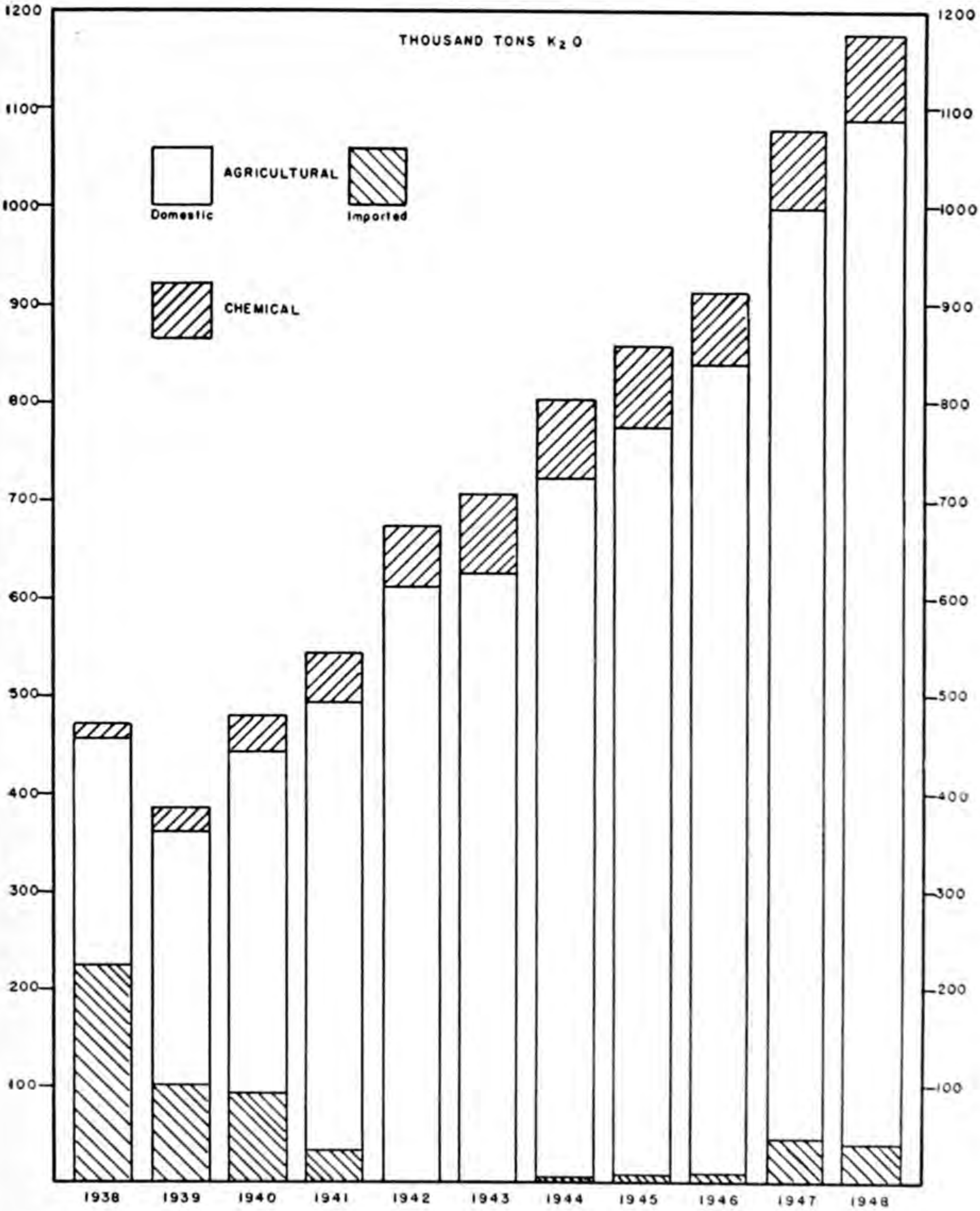
This resulted in the cancellation of favorable contracts with the American buyers, who brought their troubles to Washington after the good, old, traditional manner and were told that the proper solution of the problem was the severance of dependence on Germany through the establishment of domestic sources of potash—if such could be found and developed. Subsequently a Congressional appropriation became available in 1911 for exploration in the United States for occurrences of minerals, salines, brines, and seaweeds from which potash could be produced.

Those explorations and surveys were most opportune, for in 1914, with the outbreak of World War I, German importations were abruptly terminated and we were left deprived of all potash supplies. Thereupon, under the impetus of a price increase from $35 to $500 per ton of 50% muriate, practically all of the potash-bearing raw materials (and industrial wastes) listed as the result of Federal surveys were placed under industrial development, resulting in the construction of 128 production units, with an output of 209,000 tons of salts containing 54,800 tons K_2O by 1918, and a rated but unrealized capacity considerably in excess of that.

The critical nature of the emergency did not admit of technological research. On the contrary, potash was being extracted in many instances "by main force and awkwardness." As a result, with the reappearance of German potash on the American market at a carefully regulated descending scale of prices, the wartime domestic industry faded away with only three units surviving to recent years.

But potash research continued and one of the enterprises that survived the post-war deflation in potash interest developed its processes to the competitive basis and became a major factor in potash production—the American Potash and Chemical Corporation, the American Trona Corporation of World War I. Since that time, beginning with the extraction of potassium chloride from the complex brines of Searles Lake, California, through dint of continuous and persistent research it has undergone de-

POTASH DELIVERIES – AGRICULTURAL & CHEMICAL NORTH AMERICA



velopment after development, added product after product from the raw material processed, to reach its present state of constituting one of the outstanding chemical achievements of this country. Here is to be found phase-rule chemistry in its most intricate form applied on the plantwide scale and mechanized with the greatest precision.

It was in this plant that occurred the first large-scale application of the vacuum-cooling crystallization of potassium chloride yielding a product of 97% purity which established the now well-known "60% muriate" as the standard potash grade.

Prior to 1926, surveys for the search for potash resources had been restricted to what might be called surface aspects of the problem, outcroppings of potash minerals, the less pure strata of sodium chloride in salt mines already opened, and subterranean brines from salt springs and oil wells. No funds had been provided for the exploration otherwise of the Nation's great saline deposits with which it was well known from German explorations that potash deposits were associated. Conspicuous and least explored among these salt deposits was that of the vast Permian Basin underlying parts of Texas, New Mexico, and the states to the north.

It was in this area of Texas that in the examination of the natural brines from oil-well drillings potash salts were found in solution. Then followed the discovery of fragments of crystalline potash minerals, indicating the occurrence of potash segregations in the saline strata penetrated by the borings.

On the basis of such evidence, meager at best, a bill was introduced in the Congress in 1924, "Authorizing Investigation by the United States Geological Survey to Determine Location and Extent of Potash Deposits in the United States," which by dint of much perseverance on the part of its proponents and after drastic amendments including the designation of the U. S. Bureau of Mines as a participating agency, became law in 1926.

Under this authorization between 1926 and 1931, 24 core tests were drilled, 10 in Texas, 13 in New Mexico, and 1 in Utah. Beds of potash salts described as "of possible commercial interest" were encountered at depths of from 373 to 2,737 feet, varying in thickness from 1 ft. 6 in. to 8 ft. 10 in. and in potash content of from 9.12 to 13.94 per cent K_2O.

The drilling procedure made use of the plunger type of drill through the overlying rock strata until the saline strata were encountered, whereupon the diamond core drill was substituted. With the use of saturated saline solutions as lubricants, complete cores of the saline strata were recovered and their content of potash minerals identified and analyzed. This activity and the related publicity which preceded it

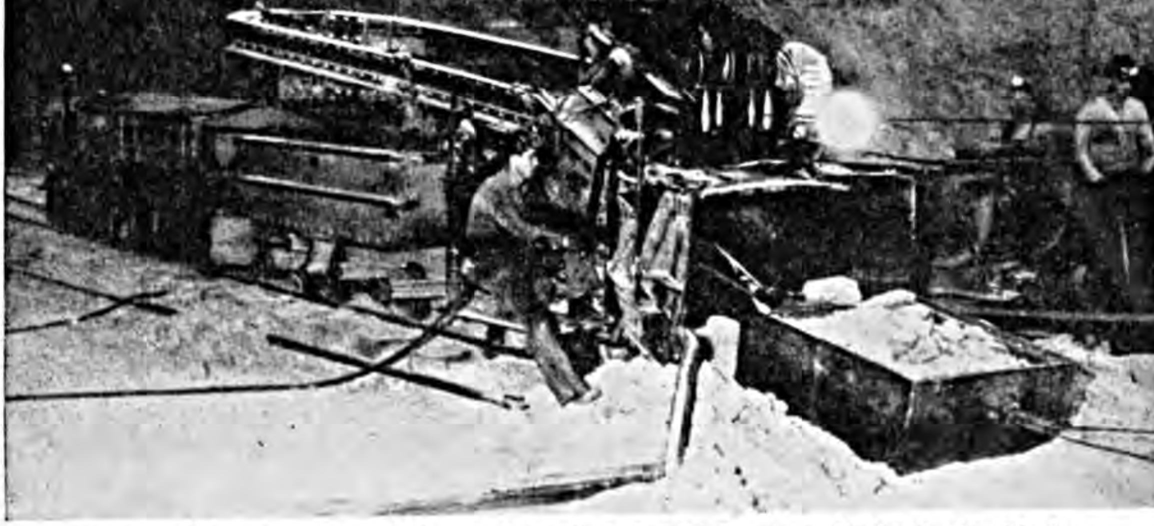


Fig. 1. Subsurface view of Mines of the U. S. Potash Company, Carlsbad, New Mexico.

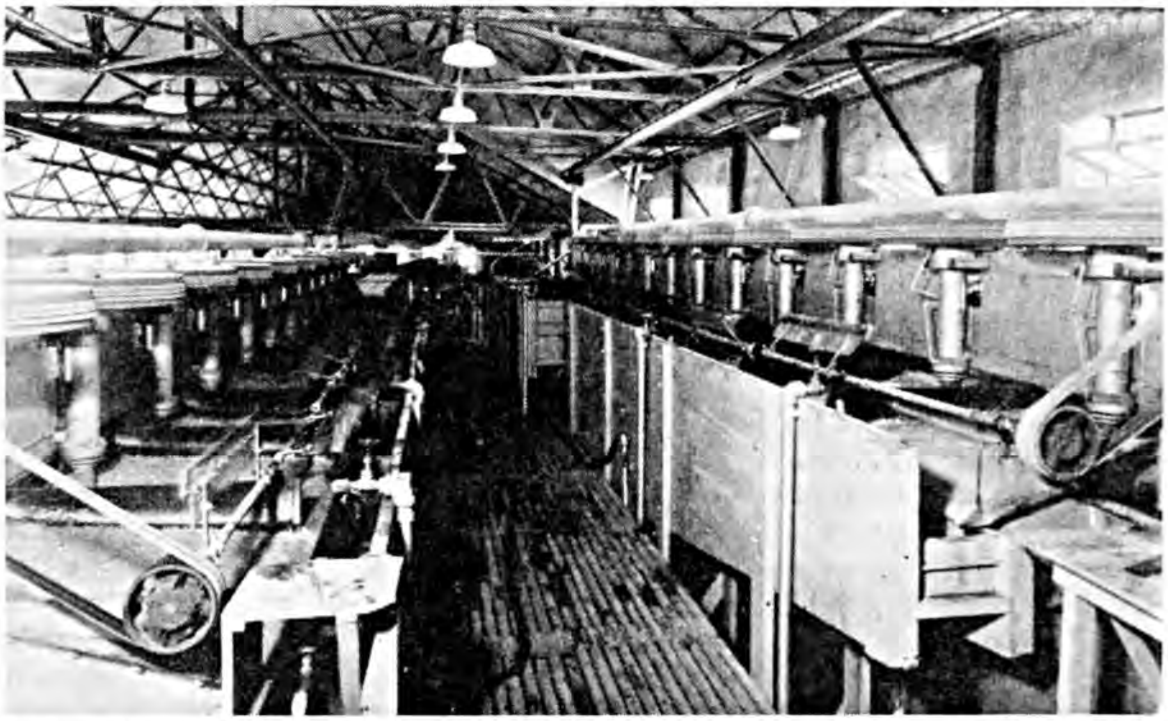


Fig. 2. Concentrating raw potash by flotation process in Potash Company of America plant, Carlsbad, New Mexico.

alerted the oil-drillers exploring for oil in the Permian Basin to the possibility of discovering potash deposits and taught the technique of identifying such deposits if encountered.

Accordingly and concurrently the Snowden and McSweeney Oil Company exploring for oil in the neighborhood of Carlsbad in Eddy County of southeast New Mexico discovered a potash deposit as the result of the first core test for potash beginning April 14, 1926. This deposit proved of such richness and thickness and at a depth of only 1,000 feet as to leave no doubt as to its entire commercial value—a deposit which with further exploration to determine its lateral dimensions was recognized as equal to the best of the European deposits. Among the several strata of water-soluble potash minerals penetrated was the bed of sylvinite (a natural mixture of sylvite, potassium chloride, and halite, sodium chloride) containing 21% K_2O, which was destined to become the major source of potash for American agriculture.

In the development of a potash industry based on this deposit, the United States Potash Company organized by the aforementioned oil company was the first to enter this field and with production beginning in 1931 became the American pioneer in the mining and refining of a raw material from such a source. Its mine was equipped with the latest mechanical devices and its refinery in accordance with the best technology then developed. Thus was realized for the first time the dream of an American potash industry similar to that of Europe, long recognized as the ideal.

Then followed in the same field the Potash Company of America (organized in 1936) with a mine thoroughly mechanized and a refinery built to apply the flotation process, the first industrial application of the familiar flotation principles to a water-soluble ore. This was followed in turn by the mine and refinery of the former Union Potash and Chemical Corporation, subsequently to be amalgamated with the International Minerals and Chemical Corporation, again with a mechanized mine and a refinery employing flotation methods in part at least. Including the aforementioned American Potash and Chemical Corporation, these four companies are the major factors of the American potash industry.

Intermediate in scale of production is the plant of Bonneville, Ltd., near Wendover, Utah, where the raw material is a brine found in the clay stratum underlying the salt crust covering the Bonneville Flats or Salduro Marsh of the Salt Lake Basin. Here solar evaporation is employed to yield a mixture of crystalline potassium and sodium chlorides, subsequently separated by flotation.*

In more recent years, the Dow Chemical Company of Midland, Michigan, has become a relatively minor producer of high-grade potassium chloride as a by-product of its processes employing the natural brines of that State as the raw material.

While steadily increasing their capacities, the major producers have added other chemicals to their list of products and thus have effected a diversification and full utilization of the constituents of their raw materials. Outstanding in this respect is the American Potash and Chemical Corporation with a list of products that includes potassium chloride of some 98% purity designed for the fertilizer trade and a product further refined for the chemical trade, as well as potassium sulfate, sodium sulfate, sodium carbonate, sodium borate decahydrate, sodium metaborate, boric acid, bromine, potassium, sodium, and ammonium bromides, and lithium salts.

The potash ores of the Carlsbad area are too free from impurities to admit of such an array of products; yet under production are potassium chloride of several degrees of purity and crystal size, 60% muriate, 50% muriate, and 22% run-of-mine salts, potassium sulfate, sulfate of potash-magnesia, and potassium chlorate.

In tracing the development of the American potash industry, mention of an occurrence of 1935 may be warranted. The industry by then had reached those production levels where it felt itself justified in participating in the scientific research and educational activities long supported by the potash importers with enviable success. Accordingly, in that year the American Potash Institute was organized with an experienced staff designed to conduct the agronomic, editorial, chemical, and economic purposes and activities in the agricultural field for which it was organized,—namely, consumer service in the scientific and therefore profitable use of potash in crop production. To this end, supported by the American Potash and Chemical Corporation, the Potash Company of America, and the United States Potash Company, there are maintained research fellowships in the leading agricultural research centers of the Continent, and headed by the Agronomic Journal, "Better Crops With Plant Food," there is disseminated a large volume and diversity of educational literature dealing with the many aspects of the profitable use of potash in agriculture.

With these developments, the advent of World War II in 1939 found the Nation in a radically different situation with respect to potash supplies as compared to that former situation of critical and near-disastrous dearth of supplies in 1914. On the later occasion the interested public greeted with considerable skepticism the announcement that the American potash industry was then prepared to take care of the Nation's potash requirements, for it was known that up to September of that year we still had been importing a considerable percentage of our potash requirements. What was not so generally known was that we had been exporting a substantial proportion of our production, which could and would be diverted back immediately into the domestic market; that we had large expansions in production capacity underway; that we had great reserves of unrefined run-of-mine salts readily available to equal any deficit in the refined salts that might develop; and that production of potassium

* The operations of these five potash production units including their processes are described in detail in the book, "Potash In North America" (Reinhold Publishing Company, 330 West 42nd Street, New York 18, N. Y.).

sulfate, formerly largely imported, could and would be promptly expanded.

As recently as 1938 we still imported 65,000 long tons of potassium sulfate from Europe. At that time we already had some production from the interaction of potassium chloride and sulfuric acid. This conversion was promoted by the Potash Company of America in collaboration with producers of salt cake, potassium chloride being substituted for sodium chloride in that process. Later the American Potash and Chemical Corporation entered upon this production through the interaction of potassium chloride and burkeite, another practical application of the phase rule. In 1939 this company announced its willingness to expand initial production to provide the essential requirements of agriculture, and proceeded to do so. This was followed in short order by the completion of the refinery of the International Minerals and Chemical Corporation with the production of potassium sulfate from langbeinite (a natural potassium-magnesium sulfate) by interaction with potassium chloride. As the result of these activities, keen apprehension as to the adequacy of wartime supplies of this form of potash so essential in the growing of quality tobacco promptly subsided.

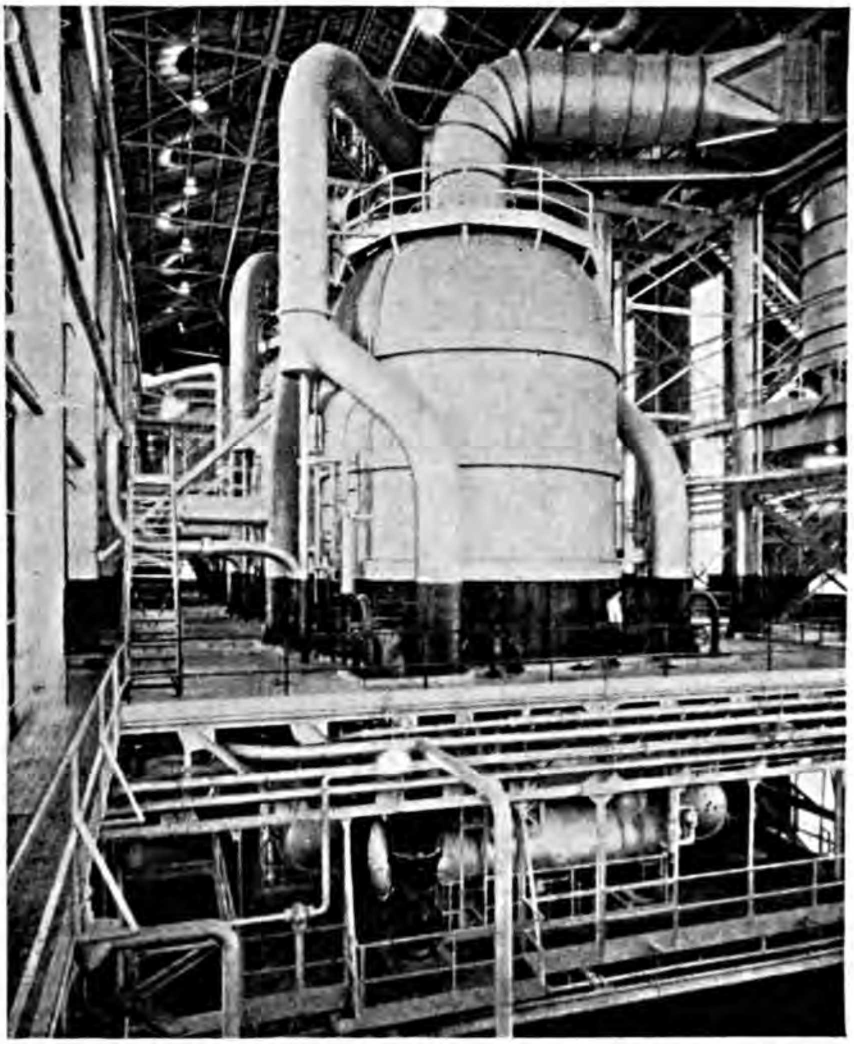


Fig. 3. Evaporator unit in the plant of the American Potash and Chemical Corporation's plant on Searles Lake, California.

Likewise, the interruption of European exports deprived us of our accustomed source of agricultural water-soluble "magnesia" and magnesium sulfate and sulfate of potash-magnesia, both of German origin. This situation was adjusted by the last-named company in production of "washed langbeinite," an acceptable substitute for the formerly popular sulfate of potash-magnesia.

As the war progressed, drew to a victorious close, and the Nation entered upon its reconstruction period of ever-increasing demand for agricultural products, calling for more and more potash wherewith to grow them, there was no let-up in the potash industry's efforts to meet the requirements. Thus from an output of 535,000 tons of potash salts, equivalent to 317,000 tons K_2O in 1938, the last normal prewar year, production has increased each succeeding year, reaching a volume allowing a total of deliveries in 1948 of 2,132,512 tons of salts, equivalent to 1,133,773 tons K_2O. (See Chart.) This potash was produced on an ever-expanding scale under the many wartime handicaps that confronted the production industries in general but without the special Federal dispensations of capital and other aids so liberally provided other industries whose products were regarded as more intimately tied in with the war effort. The chart, therefore, presents a picture of performance and of voluntary response to a national demand.

Superimposed was the task, voluntarily assumed by the producers, of supplying Canada with its requirements on terms of exact equality with our own. Added thereto were the requirements of Puerto Rico and Hawaii, of course, Cuba and the "good neighbors" to the south of us. Even "lend-lease" came to us for its quota.

Then the chemical industries, in 1938 consuming some 14,903 tons K_2O in their numerous manufactures, under the impetus of wartime demands had increased their estimated requirements to 100,000 tons K_2O by the war's end, dropping back to a peace-time requirement of 88,026 tons K_2O in 1948.

This record of performance was achieved without a price increase for the major grade, 60% muriate, making up some 90% of the total. In fact, during the period covered in this outline of the development of the American potash industry, prices have decreased. Prior to 1947 potash prices were quoted C.I.F. Atlantic and Gulf ports. Since that date, they have been quoted F.O.B. point of origin. Applied is a maximum seasonal discount of 12% from the list price under which some 90% of total sales are made. On the old C.I.F. basis, the per-unit price of 1910-14 was 71.4 cents for muriate. By 1946 this price had been reduced to 47.1 cents (with the 12% discount applied), a reduction of 24.3 cents per unit. The 1914 price of $35 per ton for 50% muriate is comparable to the 1946 price of $28.26 per ton for 60% muriate. The increase in concentration from 50% to 60% represents a corresponding decrease in transportation charges per unit K_2O. The current F.O.B. price under the 12% discount is 33 cents per unit for the 60% grade of muriate. As compared to the former C.I.F. price this is a further reduction at many points of delivery.

Thus, on the basis of the production and price records, it would appear that the claim that the American potash industry has shown its entire competence to meet all of the Nation's more essen-

TABLE I. NORTH AMERICAN DELIVERIES OF DOMESTIC POTASH SALTS FOR THE CALENDAR YEARS, 1947 AND 1948

(United States, Canada, Cuba, Puerto Rico, and Hawaii)

Short Tons K_2O

Salts	1947 Tons K_2O		1948 Tons K_2O	
Muriate	831,400		885,885	
Manure Salts	46,235		68,439	
Sulfate and sulfate potash-magnesia	72,955		77,791	
Total Agricultural		950,590		1,032,115
Chemical	82,707		88,026	
Other Exports	11,920	94,627	13,631	101,657
Grand Total		1,045,217		1,133,773

Fig. 4. Storage facilities and refinery of U. S. Potash Company, Carlsbad, New Mexico.

tial needs for potash salts for the agricultural and chemical industries, during not only the critical period of World War II but also subsequent years, is justified.

The Continental distribution of the 1948 output of potash salts is shown in the tabulation of Table I together with that of 1947 introduced for the sake of comparison.

For total supplies available, there should be added to the foregoing 45,000 tons K_2O imported in North America in 1947 and 40,000 tons in 1948. The item "Other Exports" relates to shipments to countries other than those mentioned in the title of the above tabulation.

With further reference to potash importations from Europe, it was expected that they would reappear with the progress of reconstruction in the European areas of production. Imports have reappeared in limited tonnages but at prices so far above the domestic prices as to provide little evidence as to whether the low volume is due to such price differential or the absence here of any great unfulfilled demand. Further, since potash prices in the United States are the lowest of all world markets, it is apparent that only unsold surpluses abroad, which do not exist, or the quest of dollar credits here would be a sufficient incentive for exports to this country in any great volume.

As to the distribution of the American output within the Continental United States, during 1948 potash salts were distributed by the primary producers to 45 states and the District of Columbia, which may be taken as the prevailing pattern. In that year, Georgia and Ohio practically tied for first place with deliveries of some 88,550 tons K_2O, followed in order by Illinois, Virginia, North Carolina, and Florida. State deliveries, however, cannot be taken as synonymous with state consumption, for the following reasons: Currently, potash salts are sold wholesale and in carlots to the fertilizer mixing industry which functions as the retail agency distributing the potash to the ultimate consumer, the farmer, principally as a constituent of mixed goods, some 95% of the total being so distributed. From the larger mixing plants, the products frequently are shipped across state borders into neighboring and sometimes quite distant states where the potash contained therein finds its ultimate consumption in the fertilization of crops. In such situations, therefore, state consumption may vary widely from state deliveries.

These mixtures, commercial fertilizers, as is well known, are carriers principally of the major crop nutrients, compounds of nitrogen, phosphorus, and potassium, to which frequently are added the minor, but still essential, nutrients such as magnesium, boron, and others. These mixtures are compounded in various ratios as determined by such factors as crop requirements as indicated by official state recommendations, the nutritive status of the soils on which grown (as determined by soil tests), the availability of supplies, and in too many situations habit and tradition. Under this system the potash content may vary from 0 to 27% K_2O.

Yet, despite the record of production and distribution, as herein related, there are potash demands that remain unfilled, articulate from those who want more and silence from those who have enough, providing no basis whatever for gauging the dimensions of the deficit in supply. Surprise that the market has increased as it has in view of the increased production that has taken place is frequently expressed.

Several factors are responsible. Foremost is the phenomenal increase in gross farm income, in 1948 reaching the record total of $31 billion. To provide contrast, this is to be compared to the gross farm income of $9.4 billion in 1938. It is a matter of statistical record that the farmer's expenditures for fertilizers rise and fall with his income and in a close ratio thereto, which is to say that he habitually spends for fertilizers so many cents out of each dollar of income, varying widely between agricultural areas such as for example, 16 cents in the Southeast and 3 cents in the Midwest. With an income of such dimensions resulting from the increasing demands and sustained high prices for farm products since the beginning of World War II, the farmer has had funds wherewith to purchase plant-food material more nearly in the quantities and of the grades he has been taught to use by his agronomic advisers.

In recognition of this economic rule other segments of the fertilizer industry, notably the phosphate producers, have greatly expanded their output and have applied an increased percentage of that output to the preparation of mixed goods for which, of course, potash is needed.

Thus education has become a further important factor accounting for this phenomenal increase in potash consumption—education based on research and field demonstration imparted to the farmer by many zealous Federal and state agricultural agencies.

(*Turn to page* 40)

Fig. 5. Heavy equipment for removing potash salts from large stock piles in storage, American Potash and Chemical Corporation's plant on Searles Lake, California.

Fig. 1. There are too many such cornfields in the South.

Better Louisiana Corn

By R. A. Wasson

Extension Agronomist, Louisiana State University, Baton Rouge, Louisiana

THE corn acreage in Louisiana is holding steady at about one million acres. In 1945, and for a considerable period prior to that time, the State average production was about 15 bushels per acre. The average yield has been increased since 1945 and is now around 20 bushels per acre. This increase has been largely due to a greater planting of adapted hybrids, higher rates of fertilization, and improved cultural practices.

Since 1945 a summary of the records on 1,487 demonstrations conducted by county agents comparing adapted hybrids with leading open-pollinated varieties reveals that the hybrids have averaged 41.2 bushels per acre as against 29.4 bushels for the open-pollinated corns. Also since 1945, a summary of the records on 504 corn fertilizer demonstrations reveals that an average yield of 45 bushels per acre has been made where the corn was fertilized according to recommendations as against 28 bushels per acre where the corn was fertilized according to methods commonly used on the farms. We are convinced that cultural practices can and do have equally as much influence on yields as either variety or fertilization.

We believe that the production of a good corn crop depends, to a very large extent, on five factors. These factors, listed as to the time element rather than their relative importance, are: (1) Fertility, (2) seedbed preparation, (3)

Fig. 2. Corn like this shows the results of proper methods.

good seed, (4) thorough cultivation, and (5) weather. All of these are largely controlled by the farmer except the weather; and, if the other four factors are well cared for, the weather will be very much less important than is usually thought.

Good Land and Fertility

Corn, due to its extensive though comparatively shallow root system, requires a good, deep, well-drained, and mellow soil to produce heavy yields of grain. Thin, eroded, and poorly drained land will not produce profitable yields. Corn is a crop that requires an ample supply of plant food for good yields and if this food is not already in the soil, it must be supplied by the grower. In most of Louisiana this means the application of nitrogen, phosphorus, and potash. On river bottom soils (delta or alluvial), nitrogen alone is usually sufficient.

On heavier and more fertile alluvial soils, sidedress with 48 to 96 pounds of nitrogen per acre. For corn on lighter, alluvial soils such as very fine sandy loams, use 300 to 400 pounds per acre of an 8-8-8, 6-8-8, or 4-8-8 before planting and sidedress with 32 to 48 pounds of nitrogen.

On the soils of the Coastal Plain, Coastal Prairies, and Mississippi Terraces use 300 to 400 pounds per acre of an 8-8-8, 6-8-8 or 4-8-8 and sidedress with 32 to 48 pounds of nitrogen.

Where recommended mixed fertilizers plus a sidedressing with nitrogen have been used, the average of most research over the past 3 years has given a return of approximately 1 bushel increase for each 2.5 pounds of nitrogen used, or approximately 20 bushels increase over the checks receiving no fertilizer. The total nitrogen in most cases varied from 45 to 60 pounds per acre. The mixtures used supplied from 24 to 30 pounds of phosphoric acid (P_2O_5) per acre and the same amount of potassium oxide (K_2O). For best average results the application should be 30 pounds each of phosphoric acid and potash (K_2O) and a total of 60 pounds nitrogen per acre with about 15 to 20 pounds of the nitrogen (N) applied before planting.

On fertile alluvial soils where nitrogen only was used, the increased yield has averaged about 1 bushel for each 2 pounds of plant-food nitrogen (N) applied. Under ideal conditions the increase has reached 1½ bushels for each 2 pounds of nitrogen used.

Recent experiments and farmer demonstrations have shown that on fertile alluvial soils, with an ample supply of organic matter, the applications of nitrogen can be profitably increased up to 100 pounds (N) per acre. Where 48 or more pounds of nitrogen are used, it is a good practice to put at least one-third of the nitrogen under the corn and use the remainder as a sidedressing when the corn is about 10 to 12 inches tall.

Plant-food Deficiency Symptoms in Corn

Nitrogen—When the plants are nitrogen-starved the leaves will first turn yellow in the center along the midrib. Following this the leaves shrivel and fire.

Phosphorus—Where there is a phosphorus deficiency the young plants often have a purplish cast and the tips of the leaves may die.

Potash—If the plants are starved for potash the leaves will first turn brown along the edges or margins. The edges will appear to be scorched.

Moisture—When there is ample plant food present in the soil and the plants are starving for moisture, the leaves will roll or twist without losing their green color. If moisture conditions improve in time, the leaves will unfold and resume normal functions.

Excess Phosphorus—Where there is an excess of phosphorus as related to the available supply of nitrogen and potash, particularly on hybrid varieties, the tendency for "suckering" is greatly increased.

Spacing

The number of plants per acre and the amount of fertilizer to use should be decided together. If there is not enough plant food for the stand of corn, both yield and quality will suffer. If the stand is too thin to use up the plant food available, this too will be a source of loss. The proper combinations of nitrogen and spacing are shown in Table I. In setting up this table it was assumed: (1) That the land is fertile enough to make 20 bushels of corn per acre without additional fertilizer; (2) that each stalk would produce .6 of a pound of ear corn; and (3) that each extra bushel of corn would require 2 pounds of plant-food nitrogen. These assumptions are in line with experimental results.

Table I is based on an average of 1 stalk per hill for the spacings indicated. Where calcium cyanamid is used as a source of nitrogen, use the rates as shown for sulphate of ammonia since the amount of plant-food nitrogen is approximately the same in both materials.

Nitrate of soda, ammonium nitrate, and sulphate of ammonia can be applied either under the corn before planting or as a sidedressing. When sulphate of ammonia is used as a sidedressing, it must be covered with at least an inch of moist soil. If it is not covered with soil, much of the nitrogen will be lost

TABLE I

Spacing on 3½-ft rows (in inches)	Nitrogen Lbs. per acre	Nitrate of soda Lbs. per acre	Ammonium nitrate Lbs. per acre	Sulphate of Ammonia Lbs. per acre	Approximate plants per acre	Estimated yield (bushels per acre)
12	160	1,000	500	800	12,000	100
18	100	600	300	500	8,000	70
24	60	400	200	300	6,000	50
30	40	250	125	200	4,800	40
36	30	190	95	140	4,150	35

as ammonia gas. Cyanamid is always applied under the corn before planting, preferably 10 to 14 days.

Thick spacing of corn (8 to 16 inches between hills) should be restricted to corn planted before April 1. Use a somewhat wider spacing for corn planted during April (10 to 20 inches). Corn planted in May should be spaced 16 to 24 inches. On upland hill soils the safest spacing will range from 16 to 24 inches for early and medium early plantings and 24 to 30 inches for late April and May plantings. Remember that it takes from 14 to 20 tons of soil water to produce 1 bushel of mature corn. Late planted corn almost invariably meets with moisture difficulties and that is the reason why it is not safe to space it as thick as corn planted early. It is doubtful if corn growers on upland hill soils are ever justified in spacing closer than is shown in this table for a 40- to 50-bushel yield per acre.

Amount of Seed

One of the main reasons for low corn yields, in many cases, is that uniform stands are not obtained. It is usually considered that 1 gallon of corn will plant 1 acre (or 8 acres to the bushel), but the amount of seed will vary according to the size of kernels and the spacing. It is better to plant plenty of seed than to "skimp" on the seeding rate, since it is more economical to thin the stand than to replant or to leave a poor stand. Where budworms and birds usually damage young corn, it is even more important to get up a heavy stand. As a rule, the seed should be covered about 1¼ inches deep.

Fig. 3. Left, complete fertilizer; center, starved for nitrogen; right, starved for potash.

Seedbed Preparation

The second factor in good corn production, seedbed preparation, is very frequently under-valued in Louisiana. With corn, especially, this is a matter of the utmost importance. To be good the seedbed should be deep, well-pulverized, and very thoroughly cultivated before the planter goes into the field. An ample supply of organic matter worked into the soil and thoroughly mixed with it is also very important. This is one of the ways by which bad weather conditions, sure to come later in the season, may be overcome. To a much larger extent than most farmers realize, the yield of corn is determined at this time.

On hill soils, slightly higher yields have been obtained from plantings made in the "water furrow" than from plantings made on ridges and on the level.

On flat alluvial or other flat or nearly flat land, as a general rule, slightly higher yields have resulted from planting on low ridges.

Water Requirements

Corn planted on poor soil requires more water to produce a given amount of corn grain than does corn growing on fertile soil. In other words, a liberal supply of fertilizer makes corn plants more efficient in using available water. It is, of course, possible for water to be a limiting factor in producing corn on any soil. Often when corn begins to "fire," dry weather is blamed when

Fig. 4. Potash deficiency on corn following a bur clover seed patch.

actually the "firing" is a sign of nitrogen starvation. On the Delta Experiment Station in 1947 in the nitrogen test on corn, pronounced "firing" of the leaves took place on the lower half of the plants until the rate of nitrogen application reached 64 pounds (N) per acre. No firing occurred at nitrogen rates above 64 pounds (N) per acre. This corn was planted on May 6, and had only one light shower of rain from planting time to maturity.

Good Seed

Good seed is the third factor to be considered for best corn yields. In selecting a variety to plant it must be kept in mind that production between varieties varies as much as does the production of milk between cows. This factor of good-producing seed is of much more importance than is usually realized by Louisiana farmers.

It takes several years to develop a good hybrid. After this is done it then takes 3 years to produce the planting seed. All corn growers should buy new hybrid seed each year. Seed saved and replanted from a crop of hybrid corn is not likely to produce yields as high as the original hybrid seed.

Time of Planting

Date of planting tests at the Northeast Louisiana Delta Station have shown that, when seasons permit, corn should be planted as early as possible. March planting has given somewhat higher yields than plantings in late April and May. This early planting also, to a large extent, eliminates conflict between cultivation of corn and cotton, since the corn is laid by before the rush of cotton cultivation begins. Where high fertilization and hybrid seed are used, the corn should be spaced so as to give 6,000 to 12,000 plants per acre, depending upon the producing capacity of the soil.

Date of planting tests at the North Louisiana Hill Land Station at Calhoun have shown that the best period is from March 15 to April 5. The recommended average spacing on ordinary rows is 1 plant every 24 inches or 6,000 stalks per acre.

Cultivation

Cultivation is the fourth step in corn production and could be called the most important factor in profitable production. It is estimated that more corn is

Fig. 5. The corn at the left received no fertilizer; that at the right, 400 lbs. of 6-8-8 per acre.

lost each year in Louisiana from poor, or lack of, cultivation than from any other one cause. After the thorough seedbed preparation previously mentioned, cultivation should begin by the time the corn is 1 inch high. The first cultivation, due to the small size of the corn, will necessarily have to be shallow. This early cultivation is very important, however, as it destroys the first crop of weeds and grasses and also creates a mulch for promoting growth of the corn and for the conservation of moisture. Following this, the corn should be thoroughly cultivated each week, weather permitting. The second and third cultivations may, and probably should be, fairly deep. After the third weekly cultivation, however, the corn should receive weekly shallow cultivations until the plants reach a height of about 4 feet. If the work has been properly done up to this time, the crop is now ready to be laid by. It is not considered profitable, and may even be injurious, to cultivate up to the time the corn bunches to tassel. The lay-by plowing should leave the corn row almost level with the rest of the field. This will not cut off or expose many essential feed roots and it will greatly reduce the surface area of the soil exposed to evaporation of life-giving moisture. It cannot be emphasized too strongly that the fate of the crop depends upon the treatment it receives during the first three weeks of its life.

Weather

The fifth factor in producing a good corn yield is the weather. It is impossible to change the weather, but when the other four steps described have been well and fully carried out, it will be found that adverse weather conditions are not so important as they are sometimes claimed to be. Generally speaking, it never rains enough to make a good corn crop on thin or poor soil, but the weather is generally favorable on good soil, if other things are done well.

Up until the last few years corn has been more or less the "stepchild" of Louisiana agriculture, but recently it has moved into a position of recognized economic importance. A considerable portion of the grain is going into commercial grain markets at satisfactory profits to producers. A rather large volume of the production is now being

(*Turn to page* 46)

Expand As You Learn Say Person Farmers

By F. H. Jeter

Agricultural Extension Service, North Carolina State College, Raleigh, North Carolina

PERSON County farmers have been doing a lot of pioneering in these last three or four years. Person is one of the old North Carolina tobacco counties, but many new enterprises are developing alongside those tobacco fields and barns. The sum total of these is bringing about a sizable increase in farm income.

Most of these farmers start in a small way and expand with experience and knowledge. There is the case of Umstead Laws who owns a place on the outskirts of Roxboro. Ten years ago, Mr. Laws began to fatten a few broilers for the local trade. The chicks were brooded in a small frame house to get the enterprise started in a modest way. Mr. Laws is now in the midst of erecting a two-story, concrete-block, broiler house so that he can brood and fatten between 9,000 and 10,000 chicks at a time. The house is so designed that the work may be done conveniently and with the least amount of labor necessary.

Alfalfa growing likewise started in Person in a small way with a few men planting an acre or two in trial patches. This winter, there are at least 150 farms on which alfalfa is growing. The folks who have it, tested their soils before planting, limed the land as needed, used borax with a good fertilizer to keep down yellows, planted seed that were well inoculated, and otherwise handled the crop according to the latest findings of science.

Even so, some of the alfalfa has not done so well. That was to be expected. R. E. Talley and W. R. Barker of the Senora section, as well as J. D. Winstead, Jr. of the Concord section, had some die this winter. They were mystified as to the cause. County Agent H. K. Sanders says that a part of the trouble with some old alfalfa on the Talley farm was due to frost. On the Barker farm, the trouble was due to an impervious clay subsoil, through which the taproots of the alfalfa plants could not pierce. On the Winstead farm it developed that there were two acres where the seed had not been thoroughly inoculated at planting. Mr. Winstead made plans to re-inoculate this alfalfa immediately, and he expected to have no more trouble after that had been done. Most of those who have the crop well established are making plans to topdress their fields this spring.

Person farmers are fast learning that they must use the proper amounts of fertilizer per acre if they are to get the best yields of all crops. All general crops, of course, require nitrogen, phosphate, and potash, along with, perhaps, some of the so-called minor elements, where the land has been long in cultivation. If any one of these is deficient in the soil, then the land will yield only up to that point where this deficiency permits.

F. L. Moore of Hurdle Mills is recognized as one of the best farmers in the county. In fact, he and his wife were nominated by their neighbors last summer to be the master farm family of the county. Twenty-two years ago, Mr. Moore began to realize that his old blackjack soils needed more potash in the fertilizer mixture. He says now

(*Turn to page 42*)

These chicks can be depended on to develop into heavy egg producers. They are the result of selective breeding under the National Poultry Improvement Plan, sponsored by the Department of Agriculture.

Egg Crop Has Surprises

By C. B. Sherman

Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

ALONG with the greater farm production from fewer farms and fewer farm workers that we hear so much about, we are having more eggs from fewer hens. Not only that, but this production is being evened out over the year so that, before long, the time-honored flush and slack seasons for fresh eggs may be a thing of the past.

A few figures indicate this trend. They are very revealing. At the beginning of this year our farms had 20 per cent fewer hens and pullets than at their high point in 1944 and the estimators say that the decline will not be broken until next year. Yet egg production keeps up remarkably well. At the beginning of three sample years —1928, 1942, and 1947—there were nearly the same number of hens and pullets; but in 1947 there were 14 per cent more eggs than in 1942 and 43 per cent more than in 1928.

Laying Speeded Up

An astonishing advance in the "rate of lay" is the immediate explanation. We are having an annual average of 127 eggs per bird, whereas in 1942 we had 114, and in the late 1920's only

(*Turn to page* 47)

Are You Shortchanging Your Corn Crop?

By P. H. DeHart

Agricultural Extension Service, Virginia Polytechnic Institute, Blacksburg, Virginia

WITHIN the next few weeks the majority of the corn will be planted. Corn growers will determine the yield per acre and to a certain extent the returns for their labor, rent of land, and other investments necessary in corn production prior to or at time of planting. County agents, vocational agricultural instructors, and other agricultural workers will be asked by many farmers for information on corn production. No doubt, there will be thousands of meetings held throughout the country, at which time corn production will be discussed.

The results of many years of research work have definitely shown that the combination of thick planting, use of an adapted hybrid, adequate plant food, and other good cultural practices will, if given an opportunity to work together, result in higher corn yields and a lower cost per bushel. In addition to the research work, this has been demonstrated in a practical way by many farmers in most every county and neighborhood. The above is simply a statement of facts with which most of us will agree. Now, if you are a fertilizer dealer, county agent, or other agricultural worker, what will be your recommendations on corn production? Will you advise the use of a recommended hybrid and planting a little thicker than normal and then fail to include enough plant food to make a good yield and a profitable corn crop? If the joint recommendation of the Experiment Station and the Extension Service is 600-800 pounds of a complete fertilizer per acre, plus 30-80 pounds of nitrogen per acre or whatever amount recommended, do you compromise on less plant food?

When you know that the fertility level of the soil where the corn is to be grown is low, that is 20- to 30-bushel corn land, do you give minimum or maximum recommendations for plant food? Are you guilty or not guilty of giving recommendations that can result only in a starved crop, low yield, and high cost per bushel? I think we all should ask ourselves the question, "Am I guilty or not guilty of compromising with the plant-food needs of the crops?" The plant-food requirements of a corn crop were determined by nature and I do not think we can change this.

When you recommend less plant food than is required to produce a 100-bushel corn crop, a limitation is placed on the farmer's income or salary. When a farmer fails to follow your recommendation, the farmer is limiting his own income, which he has the right to do. However, I do not think agricultural workers should limit a farmer's production per acre and his income by the indirect method of limiting the plant food recommended to produce the crop.

The change-over during the past 20 years from a plant-food recommendation of 200 pounds of superphosphate in a 3-year rotation to 1,500 pounds of a complete fertilizer, high in potash or its equivalent in manure or crop residue plus additional nitrogen to meet the crop needs, has been a drastic change when considered alone. However, when other changes that have taken place, such as hybrid corn, use of mechanized equipment, hay driers, methods of marketing, new higher-yielding varieties of most crop and pasture plants, and many other similar changes are considered, the change in plant-food recommendations does not appear to be so drastic. Are you guilty or not guilty of holding on to the "mule and plow" age when plant-food recommendations are made?

It requires about 140 pounds of nitrogen, 56 pounds of phosphoric acid, and 130 pounds of potash to make 100 bushels of corn. This amount of plant food must be present and available to make 100 bushels of corn per acre. The recommendation should be to provide the quantity of plant food needed for high yields, either in the form of manure, crop residue, basic fertility of the soil, or commercial fertilizer. There should never be a compromise in the amount of plant food recommended. The method of providing the quantity of plant food needed will vary and will depend upon each individual situation.

Very often, agricultural workers will say that they do not recommend the amount of plant food a farmer needs because he will not use that quantity or he cannot afford to buy the amount recommended. The answer to the first reason is the farmer's own choice. If he chooses to spend his labor over a larger acreage to get the same returns, that is his privilege, but that should not change the recommendation. The answer to the second reason is that he may think he cannot afford to use adequate plant food, but really, he cannot afford to leave it off. It should be remembered that there is always a certain fixed cost to meet regardless of the yield.

If the plant food is restricted too much, the per-acre yield will never be high enough to "pay out" and have very much left. For example, a 20-bu. per-acre corn crop will not pay the fixed costs; whereas, the use of a good hybrid, thick planting, and $25 to $30 worth of plant food on soil with this fertility level should result in a yield of 80 to 100 bushels per acre if the soil type is suitable for corn and adequate moisture is available. With present corn prices and a yield of only 80 bushels, the use of this quantity of plant food would be a profitable investment. In addition, the fertility level of the land will be raised and the yields of all crops grown in the rotation will be higher. In fact, the increased yield of small grain and hay will usually pay for the increased plant food used on the corn crop. A production loan that does not provide for adequate plant food will keep both lender and borrower behind the 8-ball.

Guilty or not guilty—what is the verdict? This same principle on plant food is equally applicable to pastures and most other crops requiring fertilization.

Suggestions for Producing 100 Bushels of Corn Per Acre in Virginia

1. Have soil tested to determine lime needs, prepare a good seedbed, and use adapted hybrid seed.

2. Apply plant food to meet the needs for 100 bushels of corn. The following suggestions are for soil fertile enough to make 20 to 30 bushels per acre with very little, if any fertilizer. For soils of lower fertility, additional plant food must be added; and for soils of higher fertility, the suggested amount of fertilizer may be reduced.

Where Manure Is Used: Broadcast 10 to 15 tons of good quality, unleached stable manure reinforced with the equivalent of 500 lbs. of 20% superphosphate per acre and disc or plow it in before planting. Apply 200 to 300 lbs. of a complete fertilizer per acre in the rows at planting. Watch the growth of the corn, and if it begins to turn yellow at any time before last cultivation, apply 100 to 200 lbs. of nitrate of soda or its equivalent between the rows and cultivate in.

(*Turn to page* 45)

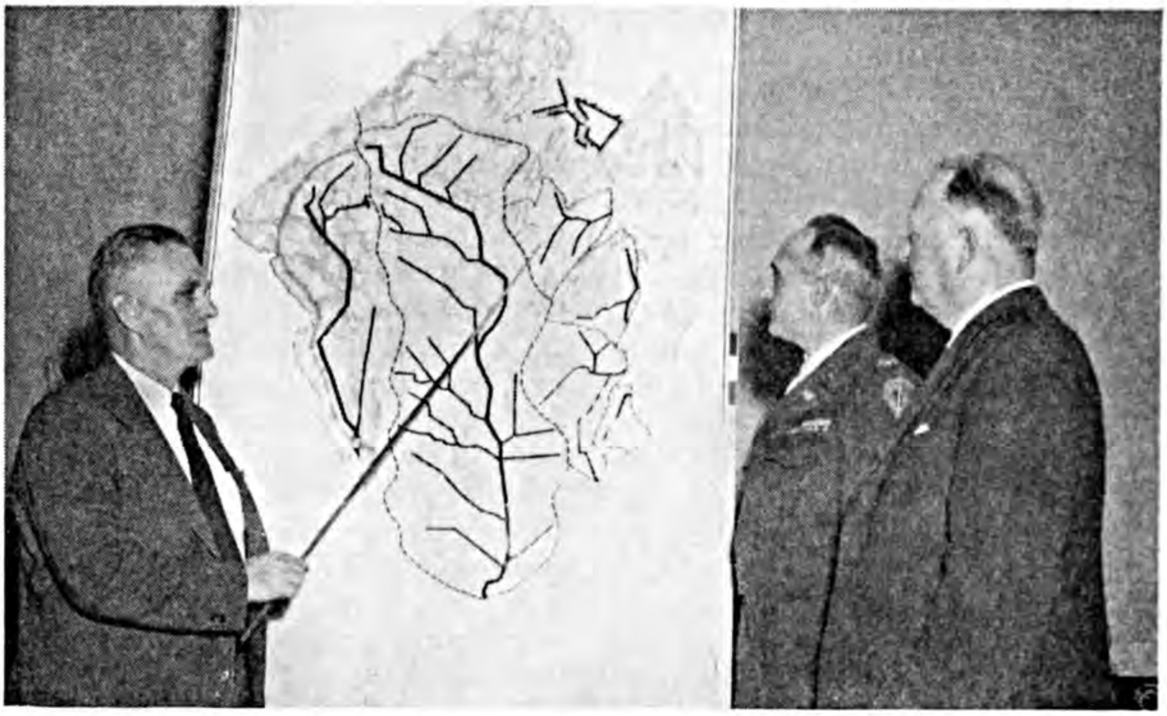


Fig. 1. E. A. Schlaudt, Regional Drainage Engineer, Soil Conservation Service, discusses drainage possibilities of 246,000-acre area in the Jasper Soil Conservation District with Col. E. G. Daly, Corps of Engineers, Charleston, and Dr. R. F. Poole, President of Clemson College.

Undeveloped Soil Resources of the Southeastern Atlantic Coastal Plain

By T. S. Buie

Regional Conservator, Soil Conservation Service, Spartanburg, South Carolina

THE people of America, along with those of other countries, are becoming concerned about the world's diminishing soil resources. As we look to the future in this country, with no new geographical frontiers to the west as there were in the past, we are beginning to realize that the land already settled must be used more effectively.

Farmers in soil conservation districts throughout the country are finding that they can increase production—as much as 30 per cent on the average—by using all their land in accordance with its capabilities and treating it in accordance with its needs. In carrying out complete farm soil conservation programs, they are bringing into production much land that was formerly idle or little used.

The same principle can be applied to much larger areas of undeveloped or partially developed land. This may mean the planning and application of drainage, irrigation, and other large-scale improvement projects for the area as a whole. But the needs of our expanding population make it essential to take stock of all such substantial areas throughout the country and consider the economic feasibility of their development.

One such area of several million acres lies along the southeastern Atlantic coast. For nearly 300 years, pioneer settlers and their descendants literally walked over this strip of coastal territory, "passing up" much of it for what they considered to be better land to the west.

There are various reasons why this land along the Atlantic seaboard was not more fully developed. For one thing, it was an unhealthy section. Malaria took its annual toll and plantation owners had their summer homes in the "high hills of the Santee" or in the mountains to avoid malaria's scourge.

Fig. 2. Soil surveys are made to determine the capabilities of the land before drainage is undertaken. This area is on the C. C. Geraty farm, Johns Island, South Carolina.

Colonial agriculture developed along the immediate coast, where first indigo and later rice were grown. With the development of larger areas to the west where more economical methods could be employed, rice culture in this section was abandoned.

Under existing conditions, even the land lying further inland than the rice fields was not suitable for row crops. Cotton, corn, tobacco, and peanuts—the principal crops of the Southern Coastal Plain—require well-drained soil. Some farmers drained isolated tracts and obtained very favorable results. But the cost of drainage generally was prohibitive.

For many years, much of this land has been used intensively for truck crops. But when the entire coastal section is considered, these truck farms represent a relatively small part. They are readily accessible and it has been possible to develop drainage outlets economically.

The expansion of livestock throughout the South in recent years has given great impetus to the more complete development of this seaboard section. Until comparatively recent years, it was thought that the better breeds of cattle would not do well in the deep South, but now this is not necessarily the case. First-quality beef cattle, dairy cattle, hogs, and other livestock can be produced if there is sufficient feed of a nutritious kind for them.

Newly introduced grasses and legumes, properly fertilized and managed, have revolutionized the production of livestock in this region, where year-round grazing is the rule. Even in old rice fields and other areas where complete drainage necessary for row crops is too expensive, partial drainage may suffice for pasture.

Another important factor in making possible the more effective utilization of land in this section has been the development and use of heavy equip-

(*Turn to page* 43)

Above: **Dragline excavating a main canal on the Cypress Woods plantation in Jasper County.**

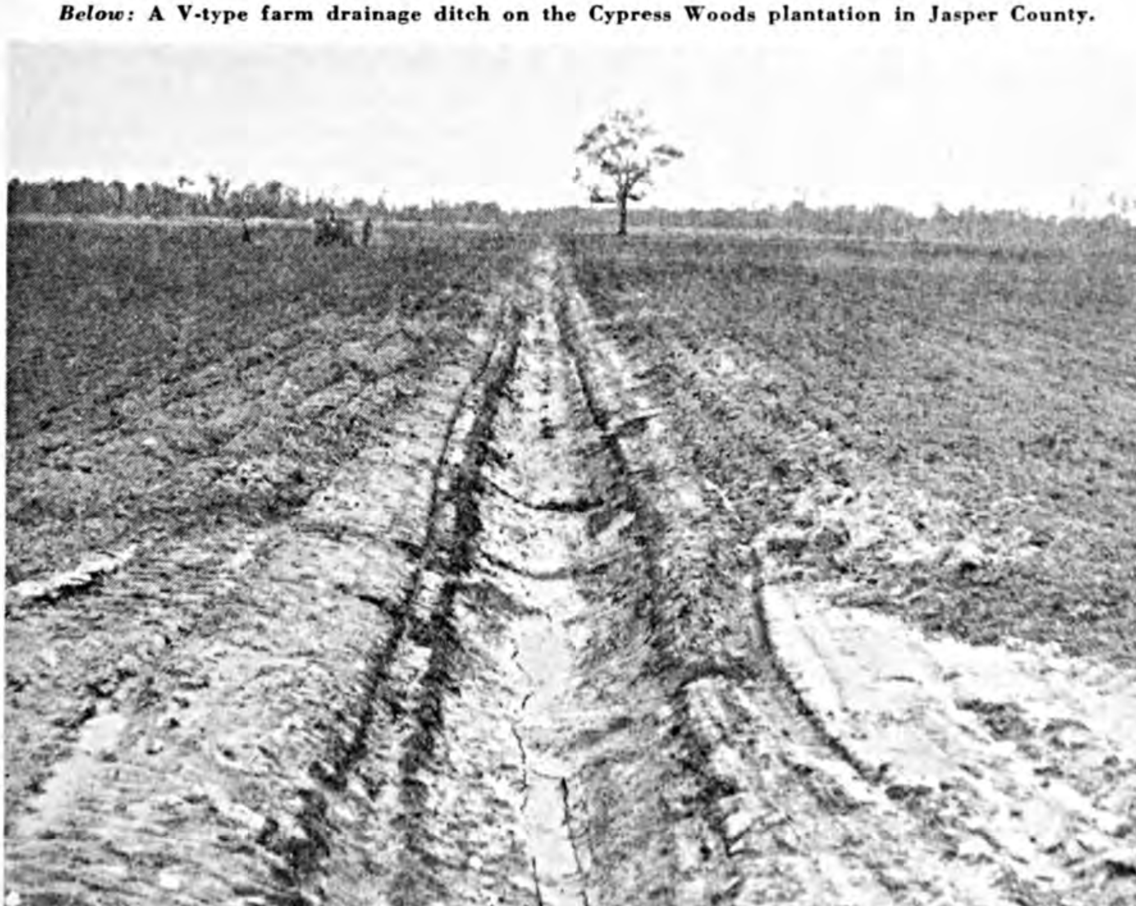
Below: **Clearing thin stand of pines and other growth on the T. W. Thornhill farm in Charleston County before construction of drainage system.**

Above: **This main canal on Cypress Woods plantation takes water from 2,000 acres of fertile land not previously cultivated.**

Below: **Part of a 35-bale cotton crop was lost here because of poor drainage. SCS technician planning the drainage system is appropriately clad in hip boots.**

Above: **This land prepared for cultivation in Berkeley County shows the need for irrigation.**

Below: **A V-type farm drainage ditch on the Cypress Woods plantation in Jasper County.**



Above: This 2-year-old bicolor lespedeza strip in an idle field on the C. P. Key farm near Lodge provides ideal food for quail and other small game.

Below: Harvesting beets on the C. C. Geraty farm, Johns Island. The fields are drained by open ditches, and supplemental irrigation is provided during dry periods by pumping water from wells through portable sprinkler systems.

The Editors Talk

Reclamation Eastern Version

When we hear the word "Reclamation" we usually think of the West. To most of us the word suggests desert areas with many miles of irrigation canals carrying water to parched land from reservoirs backed up behind huge dams, all constructed with the expenditure of tens, maybe hundreds, of millions of dollars. We think of isolated areas, largely uninhabited where all the facilities of living—transportation, highways, public utilities, schools, churches—are lacking and have to be provided if those who take up the newly irrigated lands are to get anything more out of life than just growing their crops. These added costs, of course, are not included with that of the original installation. Yet, we can easily visualize the enthusiasm with which such areas are occupied by the thousands whose aspiration it is to own a farm of their own, undaunted by the labor and privations which they must endure before they can enjoy the full benefits of their pioneering. There is something in the word—Reclamation—that seems typical of America and its great works to make this country a better place in which to live and work and enjoy the products of our labor.

It is a bit startling, therefore, to be told that for such national projects one does not have to go west, nor consider desert areas, isolated and lacking the facilities to which we have grown accustomed and come to regard as essential, nor build great dams, nor spend great sums of money. Canals, yes—but in the reverse, so to speak, to drain instead of to irrigate.

Such a reclamation project is illustrated in convincing detail in the report issued by the U. S. Department of Agriculture, Soil Conservation Service, under the title, "Preliminary Report of Land Conditions and the Possibilities of Development Through Drainage, Flood Control, and Land Use Adjustments, in a Portion of Jasper Soil Conservation District, South Carolina." Here is a document that should be read by all of those who get a thrill from the thought of converting waste into profit, of utilizing our land and water resources for the maximum benefit to the maximum number of our fellow citizens—and who doesn't get such a thrill!

This report is a detailed study of 246,000 acres typical of an area of 5.25 million acres stretching along the coastal plains of North Carolina, South Carolina, and Georgia, which to be appreciated as to its extent and obvious project of reclamation should be viewed from the air. In flying over it, one naturally thinks of the lands reclaimed by the Dutch from the sea at the expenditure of so much money and labor and is bound to conclude that here is a vastly simpler problem with vastly greater rewards. The area here subject to reclamation and thus brought into more intensive agricultural production is equal to approximately the total cropland in the State of South Carolina in 1945. In other words, here potentially is the addition of the equivalent of another agricultural state—in terms of humanity, the equivalent of 21,000 farm families each with a 250-acre farm!

From the engineering viewpoint all that is required is drainage ditches to lower the water table to the desired and controlled levels and the construction of low dykes to prevent the flooding of the lower areas, a simple job with our modern machines.

Here are soils eroded from the upland areas during past centuries and deposited as the streams approached sea level, the topsoils whose erosion we have lamented but which now await our utilization whenever we get around to it. In the report cited, these soils have been surveyed and classified as to their varied adaptabilities, showing the diversified agriculture which they can support.

The report includes estimates of costs and profits which are highly illuminating particularly in contrast with comparable costs in desert areas. For example, costs including construction, land clearing, pasture development, contingencies, and technical assistance amounting in one area to $6.5 million would yield an annual *increase* in gross income of $1.27 million; in another a cost of $9.5 million would yield an annual increase of $3.57 million; and in a third, $3.6 million to yield $1.4 million per annum.

But of particular importance is the fact that once these reclamation projects are accomplished, practically all the other collateral facilities for the enjoyment of farm life to the full are already close at hand—transportation, markets, public utilities, and schools.

In addition there is an ideal climate with no extremes of temperature, short winters, and long growing seasons with abundant rainfall equably distributed, facilitating the growing of a wide diversity of vegetables, berries, and fruits for market or for the home table. And for the enjoyment of leisure there are close-by bays and rivers providing fishing and boating, and on land there is abundant game that make the region a sportsman's paradise.

The article by Dr. T. S. Buie and its many fine illustrations to be found in this issue further describe this region. Here is a reclamation project too long overlooked. What better return is to be found anywhere for our reclamation dollar?

Fertilizer Records

For the tenth successive year fertilizer consumption in the United States is setting a new season record. U. S. Department of Agriculture reports indicate that the supply that will become available up to June 30 this year will permit farmers to use about 7% more nitrogen, 5% more phosphoric acid, and 10% more potash than in the year ending June 30, 1948. This year for the first time plant-food supply of the three principal elements is expected to top 4 million tons. This is 2¾ times as much as for the average of the prewar years, 1935-39. During the war there was an annual increase in production of each of these three principal plant foods—nitrogen, phosphoric acid, and potash—with the exception of 1942 when nitrogen for fertilizer was less than in 1941. Its use in agriculture had to be limited in favor of its use in ammunition.

The Production and Marketing Administration notes that for the 1948-49 fertilizer year, as last year, farmers are likely to find it easier to buy mixed fertilizers than the straight run materials. For this year there will be an increase of an eighth—from 37,000 to 45,000 tons—in the nitrogen content of ammonia manufactured for direct application as a fertilizer. The report on the fertilizer situation says that the Department continues to urge that aggressive steps be taken to provide farmers with fertilizers having increased average plant-food content. The object of this is to reduce transportation and handling costs.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924...........	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941...........	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947...........	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
March........	31.77	29.6	196.0	237.0	211.0	221.0	19.70	87.90	....
April.........	34.10	31.2	209.0	240.0	219.0	229.0	19.40	89.40	....
May..........	35.27	40.1	196.0	244.0	216.0	222.0	18.30	90.70	....
June.........	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July..........	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August.......	30.41	47.4	158.0	265.0	191.0	196.0	17.80	76.60	....
September...	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October......	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November....	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December....	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January......	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February.....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1924...........	185	190	98	170	166	141	107	147	143
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	93	81	109	74	87	110
1938...........	69	196	80	83	76	64	57	97	88
1939...........	73	154	100	85	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	107	117	107	81	211	129
1942...........	153	369	168	136	143	124	91	202	163
1943...........	160	405	188	232	174	154	125	231	245
1944...........	167	420	214	219	170	160	138	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	175	249	212	209	141	319	204
1947...........	252	380	224	245	366	273	146	379	249
1948									
March........	256	296	281	270	329	250	166	390	295
April.........	275	312	300	273	341	259	163	396	340
May..........	284	401	281	278	336	251	154	402	262
June.........	284	417	268	280	336	239	151	409	213
July..........	266	436	238	298	315	230	153	428	213
August.......	245	474	227	302	298	222	150	340	172
September...	250	467	220	264	277	223	152	302	150
October......	251	506	204	236	215	224	155	282	176
November....	246	428	207	226	188	231	155	306	186
December....	239	457	220	250	192	232	161	305	209
1949									
January......	236	429	238	269	195	229	169	291	282
February.....	235	295	249	279	174	219	173	237	285

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
March	2.78	1.90	13.68	12.06	12.75	9.47
April	2.78	1.90	13.87	11.71	12.75	8.35
May	2.78	1.90	13.77	9.54	12.75	7.89
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70

Index Numbers (1910-14 = 100)

1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
March	104	67	391	342	378	269
April	104	67	396	332	378	237
May	104	67	393	270	378	224
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304

Wholesale Prices of Phosphates and Potash * *

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367 [1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
March	.760	3.42	6.60	.375	.669	14.50	.200
April	.760	4.11	6.60	.375	.669	14.50	200
May	.760	4.61	6.60	.375	.669	14.50	.200
June	.760	4.61	6.60	.330	.634 [1]	12.76 [1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
March	142	95	135	68	70	60	83
April	142	114	135	68	70	60	83
May	142	128	135	68	70	60	83
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
March	283	262	233	137	85	379	142	71
April	291	264	238	137	85	380	142	71
May	289	265	239	137	85	370	142	71
June	295	266	241	128	85	309	142	65
July	301	266	247	231	88	317	144	68
August	293	266	247	129	91	285	144	68
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Maryland Fertilizer Facts for 1948," State of Md. Inspection and Regulatory Service, College Park, Md., Mar. 4, 1949.

"Plant Nutrient Deficiencies Diagnosed by Plant Symptoms, Tissue Tests, and Soil Tests," Agr. Exp. Sta., Section of Soil Science, Mich. State College, East Lansing, Mich., Spec. Bul. 353, Jan. 1949, R. L. Cook and C. E. Millar.

"1948 Fertilizer Analyses and Registrations," Div. of Feed and Fert. Control, State Dept. of Agr., St. Paul, Minn., H. A. Halvorson.

"Effect of Ammonium Nitrate on Corn Production in Oklahoma, 1948," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Mimeo Cir. M-178, Jan. 1949, H. J. Harper and O. H. Brensing.

"Report of Inspection Work—Commercial Fertilizers and Limes," State Dept. of Agr., Charleston, W. Va., Bul. (n.s.) 58, June 30, 1947.

Soils

"Summary of Contour Farming Study, Urbana, Illinois," Agr. Exp. Sta. and Soil Conservation Service, Agronomy South Farm, Urbana, Ill., May 1948, C. A. Van Doren, E. H. Kidder, and R. S. Stauffer.

"A Key to the Soils of Ohio," Agr. Exp. Sta., Wooster, Ohio, Spec. Cir. 78, 1948, G. W. Conrey, A. H. Paschall, and E. M. Burrage.

"A Legume for Acid Soils, Lotus Uliginosus (L. major)," Astoria Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 456, July 1948, H. B. Howell.

"Identification and Productivity of Western Oregon Soil Types," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. 175, July 1948, W. L. Powers, E. F. Torgerson, and E. V. Dannen.

"Drainage Districts in Utah—Their Actvities and Needs," Agr. Exp. Sta., Logan, Utah, Bul. 333, Jan. 1949, J. H. Maughan, O. W. Israelsen, and E. G. Hanson.

"Reclamation of Saline-Alkali Soils by Leaching, Delta Area, Utah," Agr. Exp. Sta., Logan, Utah, Bul. 335, Dec. 1948, R. C. Reeve, L. E. Allison, and D. F. Peterson, Jr.

"Preliminary Report of Land Conditions and the Possibilities of Development through Drainage, Flood Control and Land Use Adjustments in a Portion of Jasper Soil Conservation District, South Carolina," Soil Conservation Service, U.S.D.A., Washington, D. C., Oct. 1948.

"Report of the Chief of the Soil Conservation Service, 1948," U.S.D.A., Washington, D. C., Oct. 11, 1948, H. H. Bennett.

Crops

"Rose Culture in California," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 148, Nov. 1948, H. M. Butterfield.

"Progress Report, 1937-1947—District Experiment Substation, Fort William, and Illustration Stations at Dryden and Emo, Ontario," Can. Dept. of Agr., Exp. Farms Serv., Ottawa, Can.

"Agricultural Research—Preserves, Food & Feed," Agr. Exp. Sta., Colo. A & M College, Fort Collins, Colo., 61st A.R., July 1, 1948.

"Propagation of Ornamental Plants," Agr. Ext. Serv., Gainesville, Fla., Bul. 137, Aug. 1948, J. V. Watkins.

"Sixtieth Annual Report, 1947-48," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga.

"Performance Tests of Corn Hybrids and Varieties, 1943-1948," Ga. Exp. Sta. and Ga. Mountain Exp. Sta., Univ. System of Ga., Experiment, Ga., Cir. 158, Jan. 1949, G. A. Lebedeff and O. L. Brooks.

"Planting Black Locust Trees for Fence Posts," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 606, Feb. 10, 1949, R. D. Dixon and M. M. Murphy.

"Pruning Muscadine Grape Vines," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 607, Revised Feb. 8, 1949, M. M. Murphy.

"A. E. S. in Hawaii—Twenty Years of Rural Service," 1946-48 Rept. of the Agr. Ext. Serv., Univ. of Hawaii, Honolulu, Hawaii, Bul. 49, Jan. 1949.

"Illinois Experimental Hybrid Corn Tests—1946," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1331, Apr. 1947, R. W. Jugenheimer, E. R. Leng, and C. M. Woodworth.

"Performance of Inbred Lines and Single Crosses of Corn—1946," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1334, Apr. 1947, R. W.

Jugenheimer, E. R. Leng, and C. M. Woodworth.

"Investigations on Agronomy Pasture Plots," Ext. Serv. in Agr. and Home Econ., Univ. of Ill., Urbana, Ill., AG 1335, June 1947, R. F. Fuelleman, W. L. Burlison, and W. G. Kammlade.

"Guide of Agronomy Experiments on the South Farm, University of Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1336, 1947.

"Illinois Experimental Hybrid Corn Tests—1947," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1354, Jan. 1948, R. W. Jugenheimer, L. F. Bauman, E. R. Leng, and C. M. Woodworth.

"Investigations on Agronomy Pasture Plots," Ext. Serv. in Agr. and Home Econ., Univ. of Ill., Urbana, Ill., AG 1365, May 1948, R. F. Fuelleman, W. L. Burlison, and W. G. Kammlade.

"Indiana Summary 1947 Corn Demonstrations," Div. of Agron., West Lafayette, Ind., Mimeo AY 118.

"Certified Corn Hybrids for Indiana," Div. of Agron., West Lafayette, Ind., Agron. Mimeo AY 119, Feb. 1948, S. R. Miles.

"Breeding Behavior at Successive Generations following Hybridization in Soybeans," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Res. Bul. 358, Dec. 1948, R. R. Kalton.

"Progress in Farm Research—1947," Agr. Exp. Sta., Univ. of Md., College Park, Md., 60th A. R., 1946-1947.

"Effect of Variety, Maturity and Canning Procedures on Quality and Nutritive Value of Lima Beans," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. No. A47, Aug. 1947, Amihud Kramer and H. R. Smith.

"Winter Grazing in South Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 134 (Rev.), Sept. 1948, J. B. Gill.

"Sweet Corn Variety Testing Program in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 142, Sept. 1948.

"Sixtieth Annual Report—1947," College of Agr. and Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y.

"Landscape Steep Slopes," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 749, Aug. 1948, D. J. Bushey.

"Research and Farming, 1947—Seventieth Annual Report," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Vol. VI, No. 3, April 1948.

"1948 Hybrid Corn Field Trials," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Agron. Mimeo. Cir. 80, Released Jan. 1949, W. Wiidakas and R. B. Widdifield.

"Monroe—A Pre-Wheat Soybean Variety for Northern Ohio," Agr. Exp. Sta., Wooster, Ohio, Spec. Cir. 79, Feb. 1949, L. C. Saboe.

"Protein Content in Varieties of Hard, Red Winter Wheat, 1946-47," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Mimeo. Cir. M-173, Jan. 1948, R. M. Oswalt and A. M. Schlehuber.

"Relationship of Maturing and Weathering to Yield and Quality of Peppermint Oil," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 458, Aug. 1948, D. E. Bullis, F. E. Price, and D. E. Kirk.

"Cotton Production and Insect Control, South Carolina, 1949," Agr. Ext. Serv., Clemson College, Clemson, S. C., Cir. 324, Jan. 1949.

"Farming and Progress, 1947-1948," State Dept. of Agr., Nashville, Tenn., 37th A. R.

"Tennessee Prolific Red Raspberry," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 101, Dec. 1948, B. D. Drain.

"Extension Service Work in 1947," Utah State Agr. College, Logan, Utah, Ext. Bul. 160, June 1948.

"Biennial Report, 1946-1948," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 336, Jan. 1949.

"Research Powers the Farm," W. Va. Agr. Exp. Sta., Morgantown, W. Va., Bul. 334, Biennial Rpt., 1946-48.

"Agricultural Progress in West Virginia," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Ann. Rpt. 1948.

"18th Biennial Report—July 1, 1946 to June 30, 1948," State Dept. of Agr., Charleston, W. Va.

"Results of Hybrid Corn Yield and Fertilizer Trials in West Virginia for 1948," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Mimeo. Cir. 60, Feb. 1949, J. L. Cartledge, E. H. Tyner, R. J. Friant, and B. M. Ritter.

"Report of the Secretary of Agriculture, 1948," U.S.D.A., Washington, D. C.

Economics

"Arizona Agriculture, 1949," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 220, Jan. 1949, G. W. Barr.

"California Early Potatoes, Situation and Outlook, 1948," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 390, Nov. 1948, I. M. Lee.

"Connecticut Vegetable Acreages 1946-1947-1948," State Dept. of Farms and Markets, Hartford, Conn., Bul. 102, Dec. 1948.

"Factors in the Outlook for Connecticut Valley Tobacco," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., Bul. 256, June 1948, R. G. Wheeler, F. A. Clarenbach, and A. W. Dewey.

"An Economic Study of Celery Marketing," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 445, July 1948, M. E. Brunk.

"1948 Honolulu Unloads, Oahu Estimated Production, Shipments, and Wholesale Prices of Specified Agricultural Products," Agr. Ext. Serv., Univ. of Hawaii, Honolulu, Hawaii, Ext. Cir. 261, Feb. 1949, Shiro Takei and Ralph Elliott.

"A Study of Major and Minor Factors Affecting Management and Returns on Family Farms in the Sugar Cane Area of Louisiana, 1946," Dept. of Agr. Econ., La. State Univ.,

Baton Rouge, La., Mimeo. Cir. 86, Sept. 1948, J. P. Gaines.

"Farm Real Estate Trends in Maryland," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. A45, Aug. 1947, L. B. Bohanan and S. H. DeVault.

"Planning my Farm Business," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Ext. Bul. 211, Rev. March 1947, J. H. Sitterley.

"A Statistical Handbook of Oklahoma Agriculture," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Misc. Publ. MP 14, Jan. 1949.

"Oregon's Capacity to Produce," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 459, Oct. 1948, M. L. Upchurch.

"Trial Shipments of Oregon Late-crop Potatoes," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 460, Oct. 1948, D. B. DeLoach and J. C. Moore.

"Improving Incomes of Small Farms in Area 6, West Tennessee," Agr. Econ. and Rural Sociology Dept., Univ. of Tenn., Knoxville, Tenn., Mono. 237, Aug. 30, 1948, B. D. Raskopf.

"Costs and Returns from Peach Production, Selected Areas, Utah, 1947," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 334, Oct. 1948, E. M. Morrison.

"Vermont 1949 Farm Outlook," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Feb. 1949.

"Keeping Up on the Farm Outlook," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 128, Dec. 24, 1948, Karl Hobson.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cirs. 129 and 130, Jan. and Feb. 1949, Karl Hobson.

"Fruits and Nuts, Bearing Acreage 1919-1946," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., CS-32, Jan. 1949.

"Report of the Administrator of the Production and Marketing Administration, 1948," U.S.D.A., Washington, D. C.

"Report of the Chief of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, 1948," U.S.D.A., Washington, D. C.

"Agricultural Geography of Europe and the Near East," Office of Foreign Agr. Relations, U.S.D.A., Washington, D. C., Misc. Publ. 665, Issued June 1948.

"Report of the Administrator of the Commodity Exchange Authority, 1948," U.S.D.A., Washington, D. C.

"Report of the Federal Crop Insurance Corporation for 1948," U.S.D.A., Washington, D. C.

The Fruit of Science

"I FERTILIZED it all," says J. Herb Johnson, Ft. Branch, Gibson County, Indiana, area champion 1947 ten-acre wheat improvement contest. Mr. Johnson, veteran wheat grower of southwestern Indiana, followed "the book" as far as good farming practices are concerned, using a rotation of corn, soybeans, and wheat seeded to Ladino clover. Vigo, a soft red winter wheat, newly released from Purdue, was planted and yielded 46 bushels per acre.

Mr. Johnson sampling champion wheat.

"Vigo is the best wheat that I have ever sown," Mr. Johnson declares. "It stands well and is a good combining wheat. Vigo is resistant to loose smut and leaf rust, and I have discarded all other soft wheats in favor of Vigo."

In fertilizing his wheat, Champion Johnson used 400 lbs. of 3-12-12 per acre in the fall of 1946 and top-dressed in the early spring of 1947 with 100 lbs. of ammonium nitrate per acre. The wheat was combined about the 10th of July, and the 46-bushel yield was verified by S. R. Miles, G. H. Enfield, and H. H. Kramer, all of Purdue University, who judged the 10-acre wheat improvement contest and awarded the championship. Twenty-four samples of wheat, cut 30 inches wide across a drill width, from the Johnson 15-acre field, were taken to Purdue, threshed, and the yields computed. Test weight on the Vigo was 59.6 lbs. per bushel.

Earl Heseman, President of Igleheart Brothers, Incorporated, awarded Mr. Johnson a $100 gold watch for his outstanding achievement in producing the highest yield in the "Pocket Area" since the beginning of the soft red winter wheat improvement program in 1930.

In crowning him area champion, Austin Tomey, President of the Southwestern Indiana Wheat Improvement Association, warned Mr. Johnson that hundreds of wheat producers would be seeking to take the championship away from him next year. "Maybe they'll do it," he replied, "but I'll sure give them a run for their money." Johnson won the 10-acre contest with Rudy wheat in 1942. There were 274 entries in the 1947 contest.

Mr. Johnson owns 300 acres and rents an additional 140 in Union Township, Gibson County. Graduating from high school and Lockyear's business college 41 years ago, he kept books for an agricultural concern for two years and then decided to engage in farming. He has farmed for 39 years continuously on the home farm near Ft. Branch and now uses hybrid corn, McCoupen soybeans, Vigo wheat (certified), sweet clover, alfalfa and Ladino clover in his rotation. For many years Mr. Johnson grew Rudy wheat but discarded it in favor of Vigo in 1947. All seed wheat is cleaned and treated every year on his farm.

Mr. Johnson is a director in the Gibson County Farm Bureau and an important cog in the wheels of Better Agriculture in his community and his county. He cooperates closely with his County Agent, Al Gessell of Princeton, Indiana.

. . . . H. R. LATHROPE, *Extension Agronomist, Purdue University.*

Development of American Potash Industry

(*From page* 14)

Among the most effective educational devices has been the widespread adoption of diagnostic techniques for determining the fertility status of soils and the nutritional status of the crops growing thereon. Principal among these are the soil tests provided largely by state laboratories to which farmers can send their soil samples for analysis. These reveal the presence, or more frequently the absence, of potash in adequate supply in forms available for crop nutrition, thus providing authentic information for the farmer's guidance.

Related thereto is our growing knowledge of what constitutes the balanced nutrition of the major crops. In applying this knowledge as a diagnostic technique, the crop is "sampled" by the collection of leaves or other parts which are analyzed for their plant-food content. This procedure is resulting, with respect to potash, in the establishment of the so-called "critical levels" of potash content characteristic of the respective crops below which potash deficiency is indicated as determined by crop yields.

Contributing also to this increase in

potash consumption has been the changing pattern of American agriculture. The great expansion of interest in soil conservation and in the adoption of the various practices that enter into that fundamentally important program have been conspicuous in this respect. Somewhat related thereto is the fertilized pasture, a revolutionary new development, particularly in the South where the potentialities of a livestock industry are being so widely demonstrated through actual practice. In addition, this program is being promoted there as an important phase of diversification to relieve dependence on cotton and the one-crop system which its growing so extensively represents. For the fertilized pasture, legume-grass mixtures are prescribed, with liberal applications of high-potash fertilizer grades. For grazing and hay the legumes are being increasingly grown with emphasis in the South on alfalfa where its successful growing has now been made possible with adequate high-potash fertilization, provided borax is included. High-potash mixtures are in great demand and when unobtainable create the impression of inadequate potash supplies.

Among the changing patterns mention should be made of the radical new practices in the growing of the corn crop, it now having been demonstrated that with greatly increased fertilization applied to the adaptable hybrids, closely planted, yields can be more than doubled over the averages obtained by the old practices.

In this new development increased applications of compounds of nitrogen are the major feature, although the balanced ratio of potash is likewise essential. With the prevailing high wages for farm labor, yields per acre take on added importance in determining farm profits, the adequate use of fertilizers to this end having been demonstrated as yielding a handsome profit on the money so invested.

Mention should be made likewise of the sensational new results in the development of chemical pesticides, enabling the farmer more effectively to resist the inroads of the multifarious organisms that infest his crops, reduce his yields, and thereby his profits. As a striking illustration of this changing pattern, mention need be made only of the phenomenal increase in cotton yields recently reported as resulting solely from the complete elimination of the boll-weevil. With the repetition and verification of these results, the conclusion is being drawn that once the boll-weevil hazard is eliminated, the cotton farmer can greatly increase his fertilizer applications on that crop with assurance of a profitable return on the investment.

All these and other phases of the changing pattern, while currently increasing his income, enhance the economic stability of the American farmer as a lasting result, rendering him less vulnerable to unfavorable changes in the economic pattern and by that route lending stability to the industries dependent upon him as the ultimate consumer of their products.

Witnessing the rapid strides being made in potash production, the question arose among conservationists as to the dimensions of the Nation's potash reserves and their life expectancy at the current rate of production—a pertinent question worthy of mature consideration. Estimates of reserves had been made earlier by competent Federal agencies, but were based on earlier surveys predating the later and more detailed surveys conducted by the potash industry itself whose data had not been made public. To make these data available for the information of the interested public, a survey of reserves was financed by the four major producers, it being conducted by the eminent consulting mining engineer and geologist, Samuel H. Dolbear, whose findings were presented in the report, "Potash Reserves of the United States," issued by the American Potash Institute in 1945.

Summarizing in part, this report states:

"Known resources of potash in brines and in highly soluble salts of deposits now under production amount to 107 million tons of actual potash (K_2O) of which 73 million tons are estimated to be recoverable.

"Possible reserves of sylvite yet undeveloped in the New Mexico field may add as much as 400 million tons to these reserves.

"Polyhalite, a mineral containing soluble potash, has been encountered in the Permian Basin over an area of 40,000 square miles. Beds explored by drilling and underground work in the Carlsbad area of New Mexico contain huge proved reserves. Proved reserves are estimated at 140 million tons of K_2O and there is in addition over 100 million tons of K_2O in probable reserves, with possible reserves several times these figures. The total gross potash (K_2O) content of proved and probable polyhalite is therefore over 240 million tons in and adjacent to the present potash operations in the Carlsbad area. The degree of probability in this case is of such character that the proved and probable figures have been combined in estimating reserves."

Expand As You Learn

(*From page* 21)

that when he added extra potash to his corn, for instance, the ears were heavy and well-filled instead of being nubby and shriveled.

H. Roy Rogers of the Bushy Fork section saw this result on the Moore farm and, when he learned what made the difference in yield, he tried out the same fertilizing plan with his corn. He owned one field on which he had applied liberal amounts of manure for years. He grew corn and red clover on that tract but he was never satisfied with the yields secured. He felt that with the clover stubble plowed under and the manure scattered over the field, each year, he should really make lots of corn. But he didn't. There was something lacking. So when he saw what Mr. Moore was doing, he added more potash in his fertilizer and his acre yields began to jump. In 1945, Mr. Rogers became the first man in Person County to produce 100 bushels of corn on an acre of ground.

J. T. Horton of the Bushy Fork section began to use a 3-8-5 fertilizer under his corn more than 15 years ago. At that time, this was considered a high analysis and a rather expensive fertilizer to use under corn. But Mr. Horton says it has always paid him well because the increased yields, on his kind of soil, more than paid for the high-analysis mixture applied.

Probably J. H. Shotwell of Roxboro, Route 2, proved the case of better fertilizer for corn in a more positive fashion than anyone else in the county. He had three acres on which he could not seem to get a good crop, no matter what he tried. Six years ago, he planted the three acres to corn, fertilized it in his usual way; but, on one acre, he applied an additional early topdressing of 100 pounds of muriate of potash. This one acre, so treated, produced 50 bushels of corn an acre. The production on the other two adjoining acres was so trashy and so sorry that Mr. Shotwell made no effort to harvest it. He has another six-acre field that has not been producing as it should; and now, since it has come time in the rotation to put this field back into corn, the owner will fertilize it with a 3-12-6 or a 3-12-10 mixture and then sidedress with muriate of potash. If he cannot get the muriate, he plans to buy some kind of topdressing material rich in potash and use that.

The GI trainees around the Helena High School community made some excellent yields this past year. Fifteen of them produced an average of 113.7 bushels at a cost of only 16.4 cents a bushel for fertilizer. Most of this corn was grown on land where legumes had been turned under and which was well fertilized with phosphates and potash. The group is not satisfied with what it did in 1948 and will make an effort to get 50 men in the Helena community this year to attempt the production of at least 100 bushels an acre on the 50 farms. The veterans say they can have a part in meeting that corn-growing challenge sent to Governor W. Kerr Scott by Governor William Tuck of Virginia.

Undeveloped Soil Resources

(*From page* 26)

ment. For the first time since the days of slavery, when labor was available at very low cost, many landowners are finding it economically feasible to construct drainage ditches and outlets. Some of the drainage ditches being rehabilitated at the present time were originally built by slave labor and had fallen into disuse and disrepair during the decades. With improved drainage conditions, malaria is fast becoming a thing of the past and is no longer a menace to year-round residence.

Farmer-organized soil conservation districts in this coastal area have made available to landowners technical assistance in planning and laying out sound drainage programs and have provided the mechanism for large-scale drainage undertakings on a community basis. Opportunity for individual action on drainage problems was limited to small local areas. Facilities available through the districts make possible extensive surveys to determine the feasibility of drainage projects and the development and application of detailed plans for construction and maintenance of drainage systems of several thousand acres, representing a number of landowners.

Preliminary studies by the Soil Conservation Service over a period of years indicated that there was much productive land which could be drained or given more adequate drainage. In determining the location of such areas, two factors are given consideration. First, the economic feasibility from an engineering standpoint for constructing major outlets; and second, the capability of the land proposed to be drained. It is senseless, of course, to undertake a large drainage project and then discover that the capabilities of the land make it unproductive. Likewise, there is a limit to the amount of money which may be justifiably spent in draining land, regardless of how good it may be. Therefore the two considerations—engineering practicability and soil capability—go hand in hand.

In order to obtain more definite information, the Soil Conservation Service made a fairly complete study of a part of Jasper Soil Conservation District, embracing Jasper and a part of Beaufort County, South Carolina. This area is typical of the Lower Coastal Plain of the Carolinas and Georgia. The study showed that of these 246,000 acres, more than 160,000 not now cultivated could be used for row crops or first-class pasture if protected from floods, drained, cleared, seeded, fertilized, or otherwise developed as needed. This is nearly five times the amount of land in the area now being cultivated. The study indicated that some three dollars would be returned for every dollar invested in the drainage system and in clearing and developing the drained land.

This study, made by the Soil Conservation Service as a technical assistance to the district, indicated that it would be entirely practical to undertake the development of a drainage program for the Lower Coastal Plain of the South Atlantic States. Already more than 275,000 acres have been drained in North Carolina, South Carolina, and Georgia and the work is advancing as fast as equipment and technical assistance are available. It is essential that this type of work be guided and directed so that there will be no disappointments as a result of unwise action.

What seems to be the logical course would be for the appropriate public agency to provide the major drainage outlets and for the individual landowners to develop the smaller laterals and farm drains. Thus the public at large as well as the individual farmers would make a contribution to this large-scale undertaking for increased agricultural production.

It is significant to note that Governor J. Strom Thurmond in a recent message to the South Carolina Legislature urged the complete revision of the State's drainage laws to permit the more adequate development of the South Carolina portion of this area. Similar interest along this line is being developed in other states.

Soil conservation district supervisors in the Lower Coastal Plain of South Carolina are taking the lead in seeking ways of developing these latent land resources. T. W. Thornhill of Charleston is chairman of an action committee, consisting of one member from each board of supervisors in the area. This committee is serving as a nucleus around which further activities are being organized.

The action committee came into being in March 1948 at a meeting in Charleston called by Dr. R. F. Poole, President of Clemson College, for landowners, soil conservation district supervisors, and business and industrial leaders. This large group studied the problem of the land and its use in the Lower Coastal Plain.

Dr. Poole expressed the sentiment of the group when he said, "There is a great opportunity here in South Carolina, not only to protect what we have left, but also to develop other resources."

Dr. H. P. Cooper, director of the South Carolina Experiment Station, commented that, "The individual has done practically everything he could . . . the job remaining is for civic or other large groups interested in the development of areas as a whole."

The information available from the Jasper survey indicates that three million acres of potential cropland are available in South Carolina, and comparable tracts in each of the adjoining states of North Carolina and Georgia. Probably all of this land will not be needed for the production of crops at an early date, but certainly much of it can be used to good advantage for the immediate production of increased numbers of livestock.

There are many related advantages that will enter into the profitable use of this land. One is the increased markets that will inevitably develop in the near future. Another is the proper processing of the food products raised. As industries develop, there will be greater and greater opportunity not only for the local processing of food products, but for their distribution and sale as well.

Two important factors will facilitate the effective development of the area. These are the use of larger equipment for drainage, clearing, and other types of land preparation, and the adequate fertilization of crops grown. Potentially, much of this land is highly productive, but a great deal of it is low in fertility and will require adequate applications of fertilizer if it is to produce to the fullest extent.

Drainage and clearing operations will

Fig. 3. Pick-up hay baler in operation on drained field on the Cypress Woods plantation in Jasper County, South Carolina.

reduce to some extent the present acreage devoted to forest. This could be compensated for, however, by the improvement in conditions for forest growth that would result from the partial drainage of other sites, where profitable woodland production is not now possible, and by taking the proper steps to reduce the fire hazard.

The wildlife population need not be adversely affected by these operations. Large areas will remain undrained because of the cost of drainage or because they are not suitable for intensive use. By recognizing the place of wildlife in the farm economy the numbers of quail and other small game could actually be materially increased.

As we consider the future needs for productive land, it might be well to focus our sight upon this strip of coastal territory that has lain so long only partially developed. With the principle of good land use as a guide, this vast area can be developed to its maximum capacity for production of crops, livestock, forests, and wildlife. The facilities are at hand to do the job.

Shortchanging Your Corn Crop?

(*From page* 24)

Legume Crop Turned: A 12- to 18-inch growth of crimson clover, vetch, or red clover turned under will usually supply the major part of the nitrogen needs. However, the other plant-food requirements must be met with commercial fertilizer. Broadcast 500 to 600 pounds of a complete fertilizer such as 3-12-6 or 2-12-12 (without borax) and disc in or drill it in the seedbed before planting. Then, use 200 to 300 pounds of the same analysis in the row at planting to give the corn a quick start. If a good growth of legume, that is 12- to 18-inch growth, is not turned, apply

25 to 60 pounds of nitrogen per acre.

No Legume and No Manure: Broadcast 500 to 600 pounds of a complete fertilizer such as 3-12-6 or 2-12-12 (without borax) and disc or plow it in or drill the fertilizer in the seedbed with grain drill before planting. Apply 200 to 300 pounds of same analysis fertilizer in the row at planting. Apply 100 to 125 pounds of nitrogen per acre in some form of nitrogen fertilizer, such as 700 to 800 pounds of 16% nitrogen material, 500 to 600 pounds of a 20% nitrogen material, or 300 to 400 pounds of a 33% nitrogen material, or the equivalent. On heavy limestone or similar soils, broadcast and disc the nitrogen fertilizer in the seedbed before planting or apply full amount as a sidedressing when the corn is 12 inches high. In Eastern Virginia or on other light, sandy soils, apply one-half of the nitrogen when the corn is knee-high and the balance at last cultivation.

3. Plant Thick. Plant the corn so as to have a final stand of 12,000 to 14,000 stalks per acre—3½-ft. rows with plants 10 to 12 inches apart in the row, or 3-ft. rows with plants 12 to 14 inches apart in the row.

4. Cultivate Shallow. Use spike-tooth harrow, peanut weeder, or rotary hoe on corn from the time it comes up until it is 2 to 3 inches tall. Then, two or three shallow and flat cultivations should be sufficient. Stop cultivation when the corn is 2½ to 3 feet tall.

Suggest to all your neighbors that they grow a small acreage on this plan. STATE GOAL—50 Bushels State Average Yield by 1950—LET'S ALL DO OUR PART!

Better Louisiana Corn

(*From page* 20)

hogged-off and this enterprise is increasing as rapidly as supplies of desirable type feeder pigs become available. Each 7 to 8 bushels of corn, where there is a good stand of interplanted soybeans, will produce an average of 100 pounds of pork. At present prices of corn and pork, hogging-off the corn and selling it as pork just about doubles the cash corn price.

Insects of Stored Corn

Corn in storage has as many or more insect enemies as does the growing crop. In fact, the losses to a corn crop after it is placed in the crib are very often greater than those sustained by the growing plants. Of these pests, the rice weevil is probably the most important. There is also the granary weevil which is almost identical in size, shape, etc. to the rice weevil; but it is less numerous and destructive, due largely to the fact that it cannot fly.

Other pests on stored corn include the angoumois grain moth, broad-nosed grain weevil, the Cadelle, saw-toothed grain beetle, flat grain bettle, rust-red flour beetle, and a number of other insects.

The same control measures recommended for the rice weevil will control all of these other pests, consequently the same measures are recommended which are given below for "Weevils."

Weevil Control in Storage

The corn should be harvested as soon as it is fully mature and dry enough to store without heating. Early harvesting prevents weevil breeding in the field.

Clean out corn cribs as soon as emptied of old corn or by the middle of

July. Sweep thoroughly and dust floors, walls, and ceilings with a 10% DDT dust or spray with a 5% DDT spray. DDT should not be placed directly on grain to be used as feed. If there is any carry-over of corn on the farm, it should be fumigated with carbon disulphide (carbon-oil) or with a commercial mixture containing three parts ethylenedichloride and one part carbon tetrachloride. Killing the weevils at this time prevents movement to the field and provides weevil-free cribs for storage.

Make the cribs as nearly airtight as possible by covering the floors and walls with one layer of heavy tar paper. Start at the bottom of the wall and work up. Overlap the strips about three inches. It is not necessary to seal over the top. Dust or spray the crib again after sealing.

When the corn has been stored in the crib and has had a few days to finish drying out, it should be fumigated with carbon disulphide at the rate of 1 to 1½ gallons for each 1,000 cubic feet of space. Best results are obtained when temperatures are at least 70°. After using the carbon disulphide, do not open the crib for at least 3 days. *Carbon disulphide is highly inflammable and therefore dangerous.* Take every precaution to keep matches, cigarettes, pipes, lanterns, cars, trucks, electric and gasoline motors away from the crib during fumigation.

A commercially prepared mixture of 3 parts ethylenedichloride and 1 part carbon tetrachloride, which does not have the fire hazards of carbon disulphide, can be used for fumigation. Use for this mixture at following rates:

100 bu. of corn—1 gallon
500 bu. of corn—4 gallons
1,000 bu. of corn—6 gallons

The two fumigants described above do not affect the feeding qualities of the corn. They may be used again in the spring if weevils are doing damage.

Louisiana, and all the other southern states, can produce 40 or more bushels of corn per acre by simply following research and extension recommendations. All doubts are behind us and the facts are before us. Corn in the South can, and eventually will, come into its own.

Egg Crop Has Surprises

(*From page* 22)

91, as an average. Ten years earlier the rate of lay usually showed few changes from one year to another. Signs point toward a continuation of this upward trend.

Reasons back of this big advance are akin to the reasons back of increased farm production *per*. Better breeding is evident, better management methods are in more general use, and better feeding has its influence. Then there is the decided shift from farm to commercial hatchings which means a more rapid dissemination of improved strains.

Reasons for the decline in poultry numbers are similar to the reasons for changes in livestock numbers. The declines are a part of the over-all adjustment that has been taking place between animals to be fed on the one hand and the small supplies and the higher prices of feed on the other hand. Last feeding year the supply of feed concentrates per grain-consuming animal unit was 11 per cent lower than it was in 1946-47. Of course the supply of feeds is increasing now.

Leveling the Seasons

Leveling-off production so that the lay comes more evenly throughout the year is a promising development to be watched. Twenty years ago more than half of the eggs laid in a year on the farms in this country were laid within four months—March through June. Today the figure is down to 46 per cent and further progress in this direction seems assured.

Many farmers are hatching chicks earlier than they used to and are feeding the laying flocks better, so they will get more eggs in the early winter when the prices for eggs are higher. They are managing to belie the complaint of the hired man who moaned that chickens were contrary things for "seems like hens just won't lay when eggs is high."

Regions Differ

Adjustments have taken on a pronounced regional aspect. In the North Atlantic region the number of layers has been increasing, whereas in the South Central, East North Central, and Western regions the number of layers has remained about the same. In contrast, in the West North Central region where the droughts of the 1930's were so severe, there are now fewer layers than in the 1920's although the number has fluctuated sharply with war and weather.

Changes among the regions in rate of lay are more pronounced. In 20 years the West North Central, the East North Central, and the North Atlantic regions have had increases of 40, 42, and 48 per cent respectively, while the other regions have had increases that average around 20 per cent. If all the regions increased the rate as the North Atlantic has, the result would be truly startling.

A Glimpse Ahead

Total supplies of all feed concentrates for the 1948-49 season will be considerably above those of 1947-48, according to the Agricultural Outlook Report. For the year as a whole therefrom, the relation between egg prices and feed prices will be more favorable to egg producers than they have been recently. Meanwhile, farm prices for eggs are likely to average almost as high in 1949 as in 1948, according to the Outlook, as consumer demand gives evidence of remaining strong.

Remarkable growth in the commercial broiler industry in the past decade or so and the tremendous improvement in the efficiency in unit output are beckoning topics when poultry and eggs are being considered but—that really is another story.

Pardon Me, Professor!

(*From page* 5)

for "blowing" could now be utilized.

Professor Maurice Morrison may have been a hard-drinking, caustic, and rebellious fellow in his time; but he certainly knew his instruments and eked out a slender income selling popular songs and sheet music in one corner of the stationery store. With his background as a former army band member and later boss of a small circus band, he brought something tough and fibrous to our town along with the strains of culture he wafted to the breeze.

The closest imitation we ever saw in our parts to the redoubtable Morrison was when the traveling pitchmen for the fake medicine vendors set up their platforms on the town square. Invariably they referred to each other as "the Professor," and if skill in psychology and oratory be the cue, then most of that peculiar gentry were fully entitled to bear it. Their skill in persuasion and salesmenship was unmatched.

Word quickly swept through the wards that the medicine carnival had arrived, which brought young and old pell-mell to swell the crowd and swallow the buncombe. Two or three tents with a pine-board platform having uprights on which gasoline flares were lighted constituted the stage around which yokels and young'uns clustered.

The "wandering minstrels" played overtures and several lively intermissions, featuring a tramp comic and the traditional blackface banjo boy, with maybe an old-time fiddler or a mouth-organ virtuoso. When all the encores were exhausted, up came the Professor Himself, lugging a battered suitcase and chanting his superlingo out of the corner of a thin, weasel-shaped mouth. His stock of cleansers, menders, and cure-alls was only equalled by his fluency and nerve.

"Here, gent'mun and fair ladies, I wantcha to draw nigh to the rostrum so's I can demonstrate to you the greatest soap for absolute ablutions which civilized man has adapted from the secrets of the Aztecs of the Andes. After long and perilous journeys in the fastness of the jungle, a learned professor of our company has obtained for you this great boon to beauty and death to dirt. He calls it Alabus, after the pure white alabaster of ancient temples, and I will now lather this greasy shirt worn by our obliging banjo artist, and then apply a few drops of the wonder suds to his curly locks. After you see the wondrous transformation, our agents will pass out among you with a marvelous introductory offer of six bars of white and gleaming Alabus for only to-wenty-five cents, the price of five good see-gars."

WHEN the flares died down and the vocal flood had ebbed about three hours later, many of our trustful citizens had acquired fresh knowledge about "caveat emptor" and flasks of our own river water, well colored and flavored, a powerful glue that refused to flow from the can, and astringent soap that put blisters on your hands and holes in your socks.

Another kind of professor, for whose acquaintance I was beholden to my Mother, was the noted spiritualistic medium and mental necromancer, Professor Leland Cartright Haversham, who for a few days intrigued us with uncanny and creepy manifestations. He was imported to our town by a close neighbor of ours, Andrew Meaney, who was a devout believer in the cult.

OUR neighbor often played around with the astral bodies himself in a nonprofessional way. On one memorable occasion he caused a series of sharp raps on the tin pans in our "buttery" while we were sitting in the next room talking about cheerful incidents like haunted houses and messages from Beyond. Because of that weird event Mother had quite a time to get me in a receptive mood to go with her to the seance when Professor Haversham arrived.

Lest we succeed in raising too many ancient and long forgotten ghosts, I hereby renounce my original intention to carry you through the session with the spooks. It is sufficient to say that the noble professor went into a trance for once without the aid of his old friend, John Barleycorn, and got himself into the skin of a first-rate Injun chief. Amid considerable guttural abjurations and some war whoops, he convinced sundry dismal observers that all was very serene and saintly with their departed relations—indeed that they were far better off than the old towners themselves, what with the bad winter we were having and the high cost of living. (For months afterwards whenever anyone rapped at our front door I crawled under the table.)

Other similar kindred of the occult, who called themselves professors too, came to our town now and then. We enjoyed seeing and pondering upon mesmerists, hypnotists, and clairvoyants, faith-healers and magicians. One such mystery man wore a turban and was called Professor Abdullah. He put a confederate sound asleep and left him prostrate on a none too clean cot in the show window of our weekly newspaper. He remained there for a week, and there were no signs that he ever arose on the sly to refresh himself or do anything else, although we hung around both late at night and bright and early. I recall likewise the ironic fact that one hypnotist of renown failed miserably in attempts to control the biggest fool we had in town, a nitwit whose mind was evidently too vacant for experimental research—like some of the weak plots we have in soil testing.

For several years Mother had among our keepsakes a small brown pamphlet with a diagram of a Greek head having various segments of the brain box partitioned off into areas alleged to be the seats of different directing forces of the mind. At the bottom it had the title, Phrenological Reading of — with my own name added in fancy flourishing script.

THIS was a memento of a visit to our house by Professor Horace Tomkins, a traveling head feeler, then following the current craze of phrenology. I was plenty scared, but as he did not try to pull my teeth or give me a shampoo, I submitted to his digital inspection for half an hour. He had lists of the attributes and mental peculiarities set down in the booklet, and with a pencil he checked the ones that dominated my ego. There were combativeness, acquisitiveness, secretiveness, aggressiveness, conjunctiveness, and a few more which I have forgotten.

Thinking that such a going-over by a brain specialist was a mark of real distinction, I bragged about what the professor did in my next recess at school. I recall how "Red" Smithers scoffed and said, "Just keep up that bunk much longer, kid, and I'll give you so many fresh bumps on your noodle that it will take six more darn professors to feel 'em over."

Some of the humbler and less pretentious characters in our community just came by the "professor" degree naturally. That is, they developed a keen practical skill and by degrees folks got into the habit of crediting them with attainments above the ordinary.

ONE such person was Professor Thompson, who owned a big livery stable and blacksmith shop combination. He also cared for a few race horses which made the pumpkin show circuit in the summer. I suppose he had acquired more actual knowledge of and ability in handling and judging horses than any other man I ever met—not excluding animal husbandry specialists.

Those were the heydays of the fancy teams and the slick turnouts, and "hoss-traders" often came along to catch the unwary and untaught. Whenever any prominent citizen decided to buy himself a new nag and a fine buggy, he usually consulted Thompson; and even the local veterinarian dropped in to swap technical dope with him and relied on the old liveryman when somebody's pet filly suffered from fistula, azoturia, or plain bellyache. Thompson could handle almost any rebellious colt or savage stallion; and in spite of the fact that he was the hero of a runaway hearse affair, he lived beyond his era and was finally laid to rest by a motorized mortuary.

Of less deserved renown and trust, but nonetheless a native wearer of the professorial title, was a gent among us who posed as a "water professor." By this he meant that he could guarantee to locate a well for you, even if you believed there was none in sight—up, down, or sideways. His water-witch tactics were erratic and uncertain. He tried to work a rain-making scheme out west later on, but the only thunder that occurred was that of the horsemen who chased him out of town.

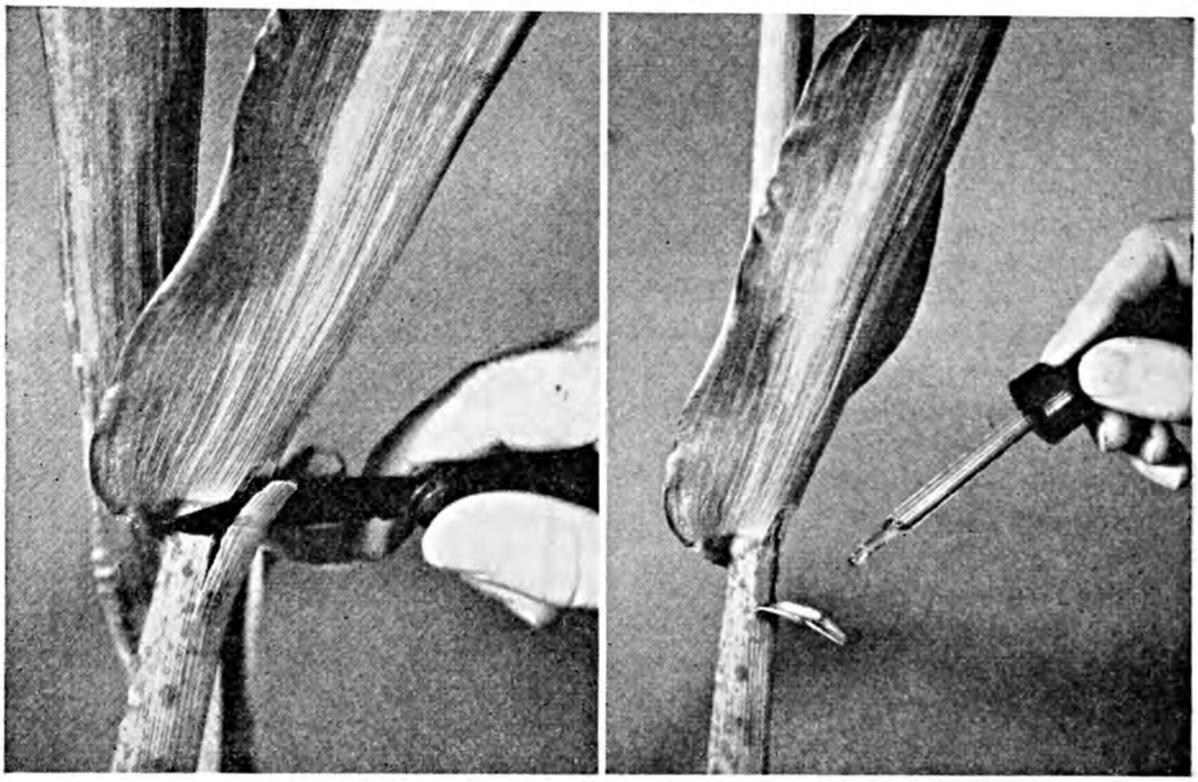
Finally, we come to the victim of our

review, one who rightfully won the academic prefix and used it ably in the early days of agricultural education. In fact, they were a legion—not in the singular. Agricultural colleges in the early 1900's had not built up quite the complex and rigid system of official nomenclature and standing we boast of today. Teaching farmers "how to farm" by use of books and laboratories and chemicals and microscopes was just well-started on its career.

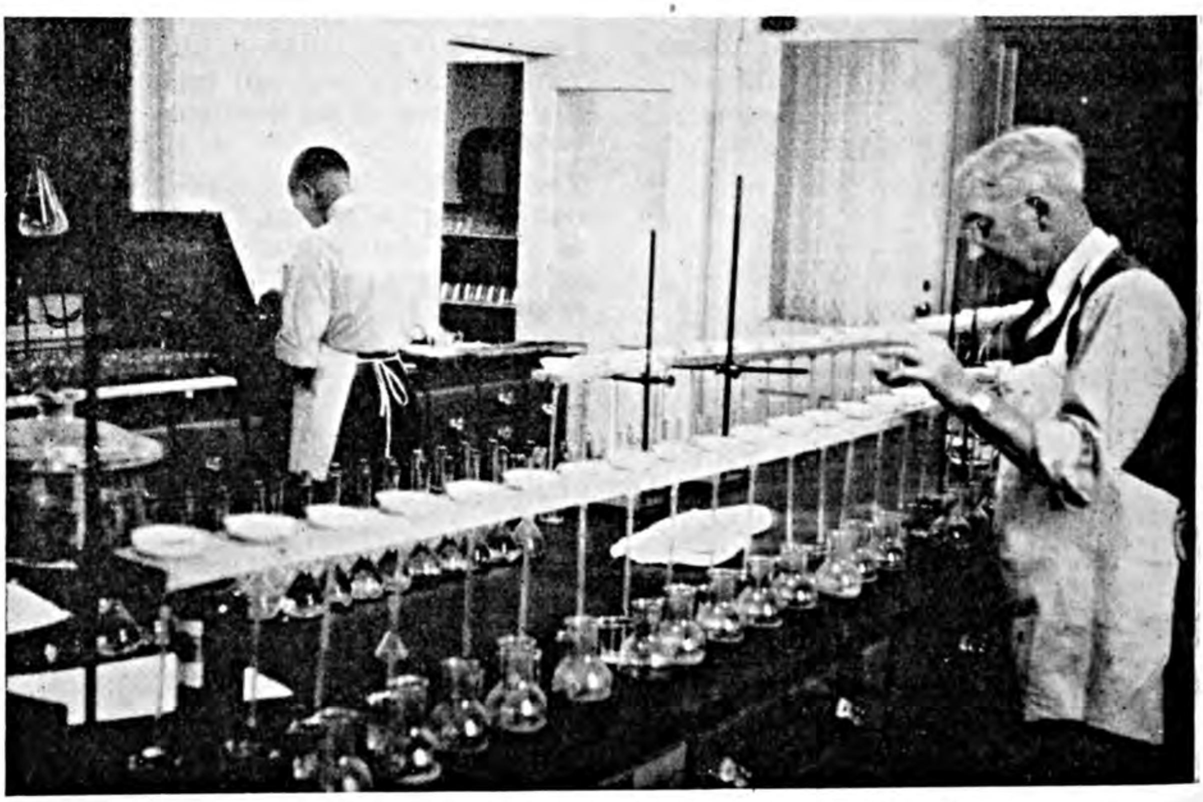
So in order to get proper recognition and support from the farmer legislatures, these state-operated colleges of agriculture scouted high and low for men who combined real practical experience with good personality and teaching sense. We had at least two such leaders who made big names for themselves—one in field crops and cereal breeding and another in sheep husbandry. Both were regular czars in their own realms, ran things with a high hand, and kept mighty close touch with the chairmen of the appropriation committees. Yet they were honest and refreshing souls, begetters of better things to come and without peer as public relations "experts." Note this, however, you never heard such newly made professors deny themselves the right to be called by that name. By using it early and often in addressing them, you never risked their anger.

BUT all this reminiscence makes me feel rather lonesome now because we possess so few professors. The best ones have graduated to the doctor level, the middle ones refuse to answer when you call them that, and the beginners often get sidetracked and plunge off base into some alluring commercial field before their "prof" title gets certified.

Yet, on the other hand, if I have unwittingly overlooked a few erudite ones among you by failing to respect formalities, I'm sure you'll be satisfied when I say, "Oh, pardon me, Professor."



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

"I shall now illustrate what I have in mind," said the professor as he erased the blackboard.

★ ★ ★

An officer of ancient Rome, called away to the wars, locked his beautiful wife in armor, gave the key to his best friend, with the admonition, "If I don't return in six months, use this key. To you my dear friend I entrust it." He then galloped off to the wars. About 10 miles from home, he saw a cloud of dust approaching, and waited. His trusted friend, on horseback, galloped up and said, "You gave me the wrong key."

★ ★ ★

NEARLY THE TRUTH

"Do you say your prayers every night, Trudy?" asked the minister.

"Oh, no; Mummy says them for me," answered Trudy.

"Indeed; and what does she say?" he queried.

"Thank God you're in bed!" was the prompt reply.

★ ★ ★

Girl: "Why does it take a woman longer to dress than a man?"

Sailor: "Because a woman has to slow down for the curves."

★ ★ ★

While driving through a strange community the motorist observed the following traffic sign, "Go slow. Beware school children crossing here. Wait for the teacher."

A pretty airline hostess buzzed among the passengers as the plane taxied toward the runway. "Fasten your safety belts, please," she chirped.

The passengers snapped to, all except one portly old gentleman.

Thinking the man was deaf, she spoke directly to him: "Fasten your safety belt, please, sir."

"Why little lady!" he gasped, shocked. "Why (gulp) I don't have to, I wear suspenders."

★ ★ ★

In a school in one of the poorer districts of a big city, a questionnaire was sent home with a new pupil, requesting information regarding the home environment, number of brothers and sisters, father's occupation and so on.

The next day the child returned with a scrap of paper on which was the following:

"We have 18 children. My husband can also do plumbing and carpentry work."

★ ★ ★

"Rastus, what make dis bump on yo' haid?"

"I tell you Liza, I'se got dandruff an' dey tol' me to put toilet water on ma haid an' de fust t'ing you know dat ol' seat flap right down on me, yes, sah!"

★ ★ ★

Spinsters: "The girls who live and yearn."

FREE-FLOWING

Printed in U.S.A.

Better Crops with PLANT FOOD

April 1949 | 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

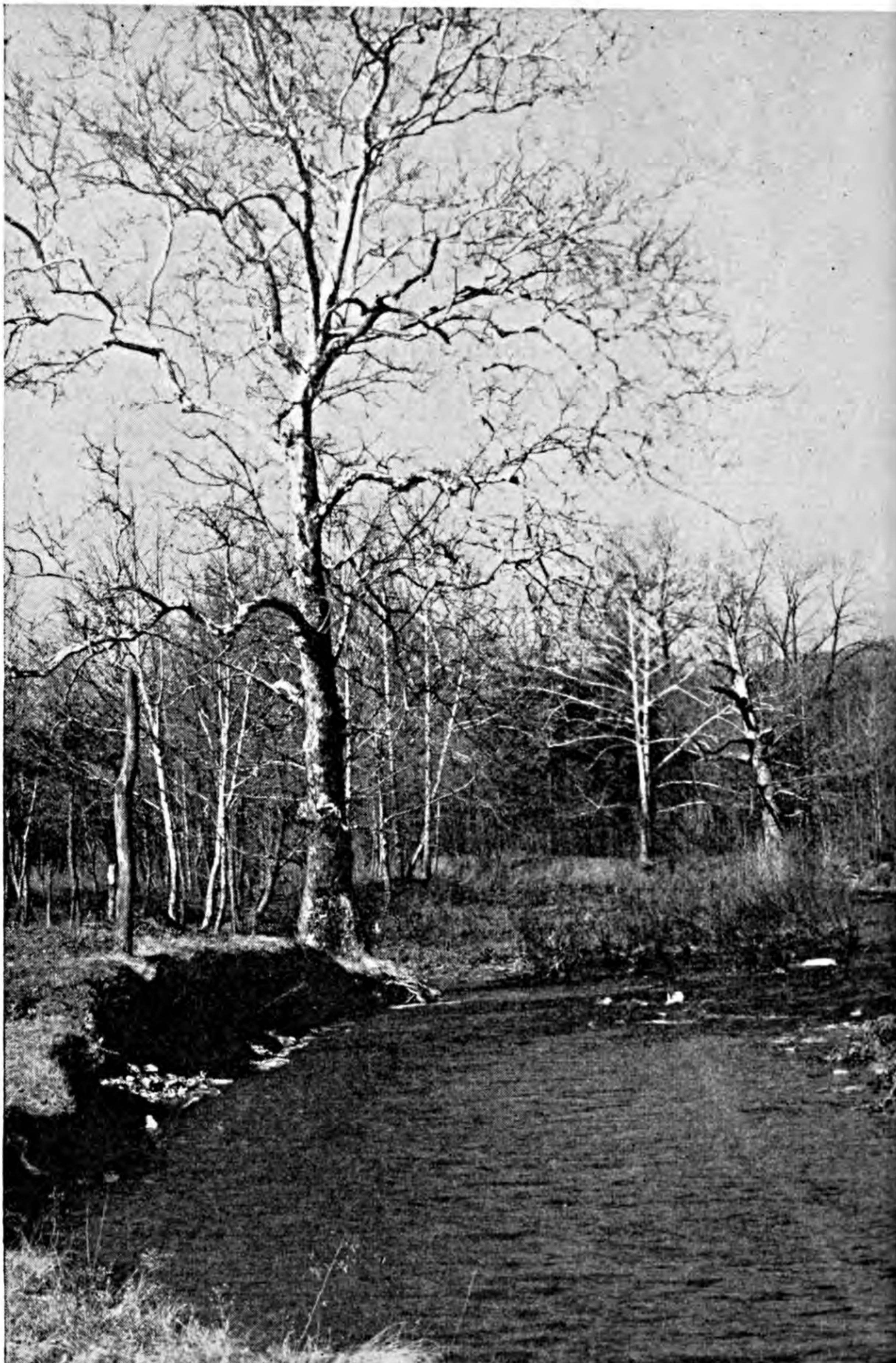
VOLUME XXXIII NO. 4

TABLE OF CONTENTS, APRIL 1949

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America



The Old Swimming Hole Opens Up

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON, D. C., APRIL 1949 No. 4

But not with . . . .

Covered Wagons

Jeff McDermid

ROLLING heavily over prairie sod and mountain meadows, the mammoth "O" of the covered wagon wheel in overland migrations stood for Opportunity—just as the big "S" in Savings today means Security. You and I can travel faster; see, hear, and talk farther, and live better than our ancestors; but we're just as anxious to hold up our heads and be useful, thrifty, and independent as they were. Sure 'nough, the old Wild West is mostly gone, but we've got new and strange Frontiers that call for a grubstake, pardner!

To tell adequately about the countless caravans in covered wagons that went West in 1849 to seek gold, fertile farms, or other emblems of Opportunity, I'd only be repeating all the standard chronicles of Francis Parkman, Prof. Archer Hulbert, and H. H. Bancroft. My present "yen" is to link the lonely wagon-borne family of 1849 in its search for Security with the complex, bustling, modernized American's organized way of getting it.

Two uncles of mine were among the Argonauts of the Gold Rush who helped swell California's population from a reputed 6,000 to a hustling 260,000 in four short years. One was a drover, the other a mule skinner; and neither one got any more bonanza out of the diggings than Jim Marshall himself, who found the first gold flakes at Sutter's Fort in 1848—and died dirt poor and crazy as a loon. They reckoned in the heyday of their youth that they would rather be duped by a Pacific Eldorado than to stay near the Atlantic, to be made suckers of by stony farms, gouging mortgage rates, the Know-Nothing party, and P. T. Barnum.

In time the older uncle got his fill of prairie cholera, camp-fire chilblains, burnt biscuits, buffalo trail bunions, "Injun" hysteria, alkali asthma, raging floods, hell-diving mudholes, and murderous mules. So he came limping back to dig his "pay dirt" with a plow in Illinois. But the younger one was more romantic and pliable. He found himself a native California wife and got his fill of Opportunity and Security by raising 14 children and a creditable set of pioneer whiskers.

Now to be right honest about it, I never saw my Uncles Hiram and Charley, or "fabulous Frisco" for that matter. But that doesn't hurt my imagination any or stop me from looking back through the hindsights to see what a lot of ambitious farm folks had to put up with, all the way from St. Louis, Independence, and Ft. Leavenworth, clear up through Platte Valley, Ft. Hall, the Salt Lake trail, and Carson Sink to reach Sacramento and "Security." Yet I came myself with another wayfaring outfit into the rattlesnake and tumbleweed country sixty years afterward, only we didn't spell Opportunity with the big bull wheels of the prairie schooner any longer.

IT WAS the Pennsylvania Dutchmen of Lancaster County's rich garden spot who built and greased the wheels of Opportunity with the original granddaddy of the prairie schooner in 1750 or thereabouts. Those 3,500-pound, ponderous, six-horse tumbrels of hewn timber and bowed canvas tops were dubbed "Conestogas." The name came from the Conestoga Valley and a tribe of Indians who were offshoots of the Susquehannas. Of course, other big wagons of similar style were made for the overland journey at Pittsburgh, Cincinnati, and St. Louis.

Loaded to the "gunwales" with rations—salt pork, bacon, ham, flour, and coffee—plus shooting irons and ammunition to help live off the country and resist enemies, those huge wagons marked the last link with old homes and the main hope for the future.

Trappers, speculators, traders, gamblers, adventurers, miners, and restless, disgruntled farmers moved across the trails first blazed in a covered wagon by Marcus Whitman, to reach a land of unsettled and uncertain economy. Get this main thought as contrast with our frontiers today—the farmers had only three reliances for investment. They wagered their *land, their livestock, and their lives.* They threw in those stakes because they stood alone with no dependable form of organized society or government stability to lean upon. Their best form of mutual security was the defensive ring of wagons circling a community campfire. Even that was not always proof from quarreling, dishonesty, and desertion.

THE U. S. Government was not looking for creditors to any extent in those times. The Mexican war was a push-over, and there were not many heavy public obligations to finance. (Nobody imagined what 15 years more would bring.) To the tune of "O, Susannah," and with the dubious exploits of John C. Fremont in mind, the public was ripe for a plunge. Added to the already clamorous Oregon settlement urge, my uncles and their ilk could see no more beds of ease in the East, heavily blanketed with mortgages. Turning to the setting sun was their idea of a new dawn of enterprise and investment. So when first news of the gold strike on the Sacramento came to eastern communities via the Sandwich (Hawaiian) Islands and Cape Horn, the risky goal of "easy money" found thousands ready to wager land, livestock, and lives to find it.

Thus, on top of a fleeting and unreliable form of collateral our numerous kinsfolk took on another hazard—digging for treasure in an unknown land where they faced extravagance, speculation, and the wildest form of inflated values. I don't know which one to admire the most—the uncle who got his fingers burned and came home admitting defeat, or the younger one who finally found Security beyond the Sierras. They both went through some of the tribulations of that feverish boom era, unprotected by stabilized investment. Let's look at a few.

Take incredulity first. Folks were ready to believe anything about sudden wealth possibilities and fixed up utterly impossible equipment with which to

win those buried fortunes. A book called Three Weeks in the Gold Mines, written by a mendacious adventurer who had never been west of the Hudson, told how the author picked up $50,000 in gold dust in 10 days with no other implement than a penknife! Hundreds of raw inventions for washing out the nuggets from "pay dirt" were shipped to San Francisco by men who never engaged in mining, and these crazy trappings rotted on the beach. Ergo, you can't get either Opportunity or Security through misinformation. Not even today, when the public is largely safeguarded from fake investments.

Second, it was a game for hardy youngsters. The physical life was extremely hard, and only the most fit survived. The best mining was done by young men, and they usually stuck the longest and got the most—if they escaped loan sharks and gamblers. In modern times the rewards of a settled agriculture belong to the old and the middle-aged as well, provided the safest form of investments are relied upon.

It was an era of exploitation. Each man sought treasure and welfare for himself and his family, and devil take the rest! Natural riches of mine and soil were alike seized and borne to more congenial climes. There was no thought of anybody else's private comforts or of the public good. I presume my two uncles were just as indifferent and greedy as the rest. Naturally, you don't build prosperity or lasting Opportunity and safe investments on any such a shaky foundation. Certainly we pursue a better course today, with countless State and Federal projects afoot and sound industrial progress usually connected with safe rather than speculative ends.

Inflation and speculation ruled in 1849-50. In one year 50,000 persons swarmed into San Francisco's crude outpost built to accommodate 1,000. Aside from the regular wide-open gambling, which was the gaudiest luxury of the age, the new settlers in "them thar hills" played a "pyramid club" game of kiting values. Storekeepers in rough shacks paid $3,000 per month rent; picks and shovels often cost $20 each; good boots were $100 a pair; the smallest circulating coin was a quarter; and bread was fifty cents a loaf—such as it was and when you could get it. If we imagine ourselves in a pickle over current prices, all I can say is we were born a century too late! But, unfortunately, such unseemly pioneer risks and price levels were the best kind of investment that the country afforded—until the bubble broke. Lets thank our stars we can find better places to refrigerate our nest eggs today.

PUBLIC improvements, public safety, and police protection—forms of activity deemed essential to stability and sound investment today—were unknown to the Argonauts of the Gold Rush, and only added as necessity or convenience required. Our

(*Turn to page* 49)

Nothing Like Nodules for Nitrogen in Forage Production[1]

By A. R. Midgley and K. E. Varney

Agronomy Department, University of Vermont, Burlington, Vermont

NITROGEN is needed for proper growth of all plants and for the production of valuable protein for animal feeds. However, protein is the most expensive part of feed for livestock—in fact, farmers find that nitrogen is the most expensive constituent in both feeds and fertilizers. The dairyman's problem is to obtain nitrogen in his cattle feed at the lowest possible cost. Since nitrogen costs more than the same weight of phosphorus and potash combined in fertilizers, considerable emphasis should be placed on using minerals to indirectly supply the needed nitrogen and protein in forage production. Legumes have this power because they are able to get large amounts of nitrogen from the air.

[1] Printed by permission of the Vermont Agricultural Experiment Station. Journal Series Paper No. 5.

Fig. 1. This is a typical broadleaf birdsfoot trefoil plant, *Lotus corniculatus*. Note the extensive tap root and rounded leaflets. Compare this with the narrowleaf type in Fig. 2.

Nitrogen-gathering Value of Birdsfoot Trefoil

Birdsfoot trefoil is a long-lived, triple-purpose legume because it is good for pasture, hay, and grass silage. The technical name for the broad-leafed variety is *Lotus corniculatus*. While it is not even closely related to yellow trefoil or black medic, *Medicago lupulina*, the two are sometimes confused. For simplicity, birdsfoot trefoil will merely be called "Lotus" in this paper.

In the early spring of 1948, Lotus was seeded on a heavy clay soil that was so devoid of nitrogen that grasses and most weeds made practically no growth even when minerals and lime were applied. Lotus under similar conditions made a very good growth because it was able to supply its own nitrogen. During the fall of the first year the tops, roots, and nodules were obtained separately from several representative areas. The yield and nitrogen content of each were calculated to an acre basis and are presented in Table I.

As previously stated, this land was so low in nitrogen that grass and weeds

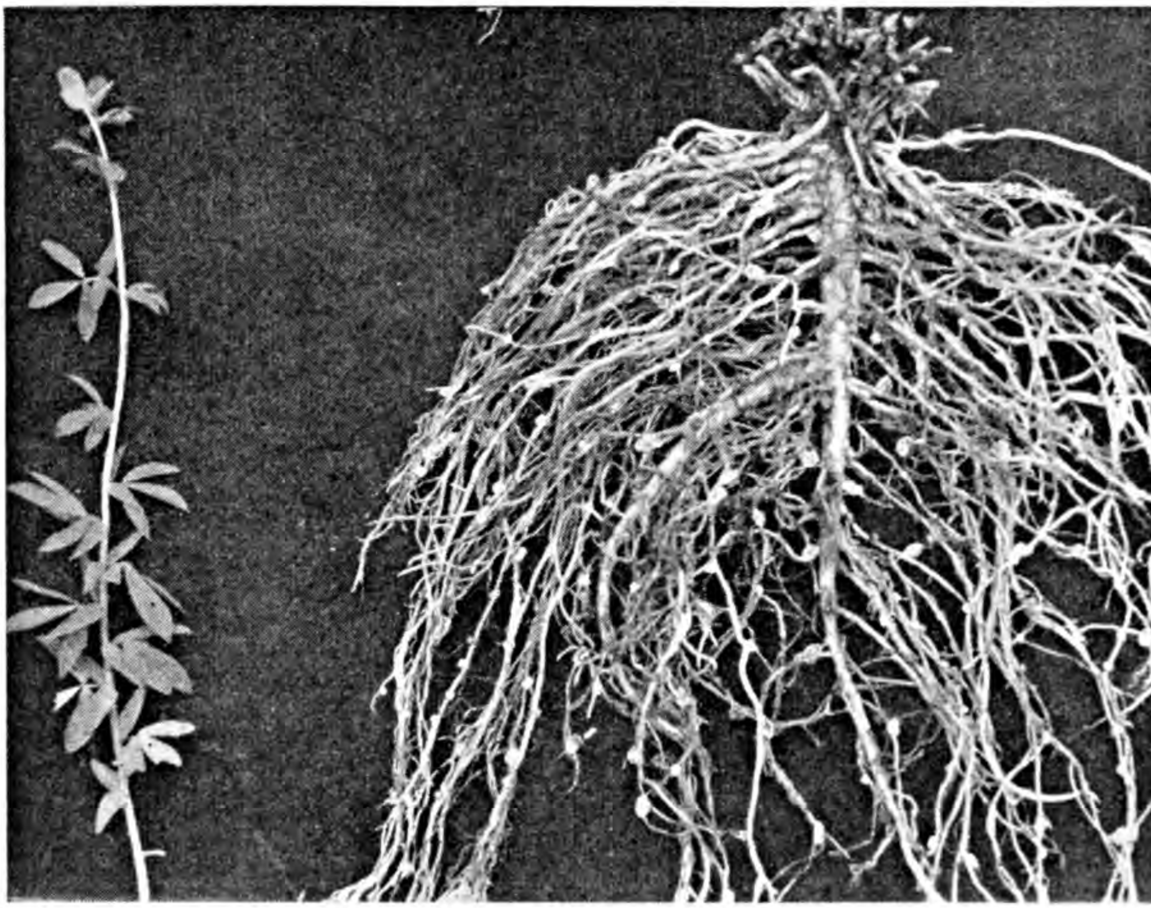


Fig. 2. Narrowleaf birdsfoot trefoil, *Lotus corniculatus*, var. *tenuifolius*. This strain usually has a more extensive fibrous root system and more pointed leaves than the broadleaf type. This may explain why the narrowleaf type does better than broadleaf on wet soils. One-year-old plant. Compare with Fig. 1.

made practically no growth even with lime and minerals, yet this legume produced more than a ton of dry matter and nearly 58 pounds of nitrogen the first year. This amount of nitrogen purchased in the fertilizer bag would cost over $12 at present prices. It is admitted, however, that this land seems to be ideal for this legume and that it made a better growth than is usually expected for Lotus.

TABLE I.—YIELD AND NITROGEN CONTENT PER ACRE OF TOPS, ROOTS, AND NODULES OF ONE-YEAR-OLD LOTUS PLANTS.

Part of plant	Per cent nitrogen	Lbs. of dry matter	Lbs. of nitrogen
Top (stems & leaves)	2.56	1,100	28.2
Lateral roots	2.17	282	6.1
Taproots	2.24	476	10.7
Nodules	6.50	193	12.5
Total		2,051	57.5

The data also show that the nodules contain a higher percentage of nitrogen than any other part of the plant. The actual amount of nitrogen in them depends greatly on their age and size. Large nodules usually contain more because they have less surface-supporting tissue. While the amount of nitrogen in the nodules may appear high, it is actually about two per cent lower than that reported for the Lotus plant by other workers.

In another study the root and top growth of some two-year-old Birdsfoot trefoil plants grown on good soil conditions were studied. These were found to produce about 6,000 pounds of air-dried top growth and 2,800 pounds of roots per acre. These plots were well limed and mineralized, but in spite of the fact that no nitrogen was used, they contained 120 pounds of nitrogen in the tops and 53 pounds in the roots and nodules. At present fertilizer prices, the cost to purchase this nitrogen would be about $35.

Grasses Versus Legume (Lotus) on a Heavy Clay Soil

It is relatively easy to grow such legumes as alfalfa, red clover, and ladino clover on good soils with adequate moisture, drainage, and fertility; but on the poorly drained, heavy Panton clay soils in the Champlain Valley these legumes grow poorly and seldom live over two years. Without nitrogen either from the fertilizer bag or from legumes, grasses grow poorly. In fact, much of this soil area is so void of good vegetation that it is frequently called "poverty flats." Field experiments were conducted on this area to see if a legume (Lotus) could be successfully grown and thus supply needed nitrogen for the soil. On an adjoining area, an experiment using grasses with high-nitrogen fertilizers also was carried on, because it was feared no legume would grow. Part of the information sought, therefore, was to determine whether grasses or legumes would produce the most efficient and economical forage on this soil when each was properly fertilized and managed.

One half acre of this land was limed, seeded to reed canary grass, and then treated with various rates of high-nitrogen fertilizer. Another half acre was similarly limed, seeded to a mixture of Lotus and reed canary grass, and given different mineral fertilizers. No potash was used in the grass fertilizer, because previous experiments had shown that this particular clay soil contained adequate amounts for grass. The yield, protein content, and fertilizer cost for each treatment on the grass and legume-grass fields are given in Table II.

A study of these results shows that good forage yields can be obtained from this soil if properly fertilized. Even though purchased nitrogen was expensive, it still produced considerable feed when used on grass. However, much greater yields and better quality of feed were produced at lower cost when the legume was used. In fact, the fertilizer cost per ton of legume hay was only about one third as much as that needed to produce grass. Furthermore, the

(*Turn to page* 44)

TABLE II.—COMPARATIVE YIELD, PROTEIN CONTENT, AND FERTILIZER COST IN GROWING GRASS VERSUS LEGUMES ON PANTON CLAY. TWO-YEAR AVERAGE, 1947-48.

Fertilizer lbs. per acre $N-P_2O_5-K_2O$	Pounds per acre		Cost of fertilizer used [1]	Fertilizer cost per ton of hay [2]
	Hay	Protein		
	(Reed Canary Grass)			
15-15-0	3,184	252	$ 4.50	$ 2.83
30-30-0	3,802	304	9.00	4.73
45-45-0	5,114	428	13.50	5.28
30-15-0	2,944	249	7.50	5.10
60-30-0	4,916	391	15.00	6.10
	(Lotus & Reed Canary)			
0-45-0	5,176	659	4.50	1.74
0-45-15	5,865	747	5.25	1.79
0-60-15	7,546	960	6.75	1.79
15-45-15	5,677	723	8.25	2.90

[1] Fertilizer cost based on following: nitrogen, 20¢; P_2O_5, 10¢; and K_2O, 5¢ per pound.
[2] The amount of hay produced without fertilizer was not considered here. No treatment produced 1,291 and 3,775 lbs. respectively.

Keys to Abundance

O. W. Willcox

Ridgewood, New Jersey

AMONG the inexorable facts of nature that confront humanity is the law of diminishing returns in agriculture. This "law," developed from the experience of agriculturists everywhere, states that although an increase in the fertility of a poor soil will be followed by an increased yield of plant substance, the *increase* becomes less and less as more and more fertilizer is added, until the plants finally cease to respond to more plant food. The evident conclusion is that it is impossible to produce an unlimited amount of vegetable substance on a limited area of land in one cycle of plant life.

On the other hand, humanity is confronted by the fact that the area of arable land on this earth is limited. The limits on the area of arable land and on the productivity of that area combine to put an upper limit on the number of people who may comfortably exist in a given region. As population increases, the land becomes saturated and oversaturated with people, with all the social and political consequences to which Malthus was the first to call attention.

The first essential thing to do with a problem that involves a limit is to define and quantitatively assess the limit. In the food-and-population problem, the limit might be described as the maximum capacity of land to produce food. However, the modern agrobiologist prefers to state the problem thus: The ultimate limit on food production depends on the capacities of plants to make use of the materials which the soil and its surroundings afford them. It is the plants themselves that set the final limit on food production. The agrobiologist phrases it this way: An unlimited quantity of vegetable substance cannot be produced on a limited area of land because every kind of plant, by its nature, possesses only a limited "quantity of life." The problem is thus a matter of determining the quantity of life that is or may be possessed by plants.

Quantity of life as a genetic character of a plant species is measured by the quantity of dry vegetable substance the species can produce when it is grown on a unit area of perfertile soil at the agrobiologic maximum density of stand. A definition of perfertile soil will appear farther on.

The problem of measuring the quantities of life possessed by plants was started on the way to its solution 40 years ago when Mitscherlich (1) discovered what he called the "effect law of the factors of plant growth" and found that he could express it by the equation

$$dy/dx = (A - y) \cdot c$$

Mitscherlich's law and its equation have become the base of a new quantitative science of plant life. They have been the means of uncovering quantitative and stoichiometric evidence of the identity of the protoplasmic bases of all rooted and green-leaved plants, thus providing the evolutionists with additional evidence that such plants have been derived from one original stock. They have enabled the agrobiologists to bring to the practical art of crop nutrition a definiteness that heretofore has been lacking in this subject. In conjunction with the newly recognized inverse yield-nitrogen law they have brought to notice quantitative relations between plants and their growth factors by which man, if he will, may provide himself with a superabundance of vegetable products for a very long time to come. In view of present knowledge of the real dimensions of the power of plants for growth and yield it may be said that, in principle, the race against increasing world hunger has already been won.

Before Mitscherlich, no one had essayed to define the quantitative relation between rate of increase of the factors of plant growth and the diminishing rate of increase of yield, and there was no conception, in a quantitative sense, of what final result that process might eventually reach. The effect law replaces this indefiniteness with concreteness. In words, the Mitscherlich yield equation says that the increase of any crop under the action of increasing amounts of any growth factor x is proportional to the difference between a yield y obtained at any stage and a certain maximum yield A; c represents a constant number which depends on the nature of the growth factor and is independent of the nature of the crop.

The Constant c

The constant c has a unique significance which is best explained in connection with Fig. 1. In this Figure the three continuous curves represent the yields of three common crop plants: soybean, corn, sugar beet. The vertical axis represents quantity of dry vegetable substance produced on a unit area of normal soil. The horizontal axis shows units a, b, c, d . . . p of any particular factor of plant growth. In this example the independent variable x is supposed to be assimilable nitrogen in the soil. All other factors are supposed to be present in adequate amount, and all hostile influences are supposed to be absent.

Fig. 1 is to be contemplated in view of two commonly known facts. One is that soybean, corn, and sugar beet are very different kinds of plants; botanists assign them to different plant families. The other fact is that when soybean, corn, and sugar beet are grown under the same normal conditions they give very different yields of total dry substance, soybean consistently yielding the least and sugar beet the most. The agrobiologist expresses this by saying that these species have different quantities of life.

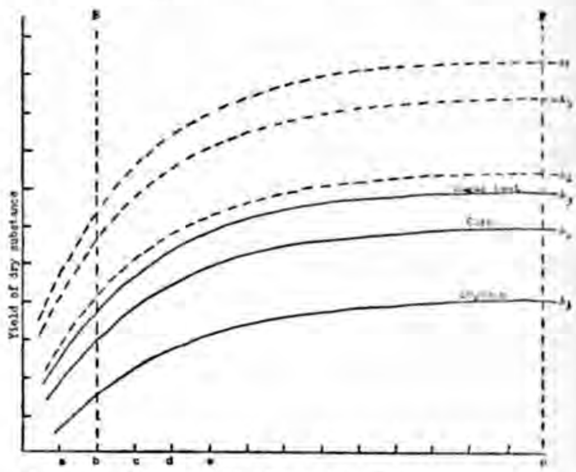


Fig. 1. Nitrogen in the soil. Diagrammatic illustration of the uniform nutrition pressures of the same growth factor on different kinds of plants.

With these particulars in mind, observe the three continuous curves in Fig. 1. They rise as more and more nitrogen is added to the soil and gradually flatten out as they approach the maximum yields, A_1, A_2, A_3, that are possible under the prevailing circumstances. These curves are typical representations of the law of diminishing returns. Observe also that the curve for soybean reaches the lowest and the curve for sugar beet the greatest height. Next, observe the broken perpendicular line B at the point on the horizontal axis representing b units of soil nitrogen, and note that this line intersects all three curves.

The situation along the line B introduces us to one of the crucial points of the agrobiologic approach to quantitative plant nutrition. Here we see that soybean, corn, and sugar beet are each being nourished (on separate but similar plots) by the same quantities, *b* units, of soil nitrogen and are using identical quantities of nitrogen to produce different yields of dry substance.

Consider then the perpendicular line *P* erected on the horizontal axis at *p*, which intersects the three curves at the points where they have flattened and the three crops are giving the maximum yields that are possible under the circumstances of the case. Here we see that, even to the end, the three species give different yields from the same quantities of soil nitrogen.

Nitrogen is one of several essential plant nutrients. In place of nitrogen we may repeat the operation with phosphate or potash, and with any other kinds of crops, and we shall see the same relationships repeated: Different kinds of plants require identical quantities of any particular plant nutrient or any combination of plant nutrients to produce maximum yields or proportional parts of these maximum yields. The resulting differences of yield are directly proportional to the quantities of life possessed by the species in question and have no dependence on the soil as such. That is the meaning of the factor *c* in the yield equation.

The immediate bearing of this principle on the practical art of plant nutrition is that all plants, regardless of their frequently enormously different abilities to produce vegetable substance, are comparably nourished by the same quantity of a plant nutrient. Otherwise expressed: It takes just as much nitrogen, phosphorus, potassium, etc. to produce a maximum yield of one crop as of any other crop. Or to put it another way: All soils of normal maximum fertility have identical composition in regard to the common plant nutrients.

It should be understood that this simple relation between plants and the mineral factors of their nutrition holds only in healthy, normal soils; this relation can be disturbed by any one of a host of hostile factors.

Perfertile Soil, Perultimate Yield

To understand the full scientific and social-economic import of the law of yield requires further consideration of the quantity *A*. (2)

As the fertility of the soil is improved by increases in the amount of a deficient factor *x*, the yield *y* approaches a maximum, Am. It may occur that besides *x* another factor *z* is deficient. If both deficiencies are repaired, a higher maximum yield, An, may be approached. Referring again to Fig. 1, let it be supposed that after the operations with nitrogen that resulted in the three continuous curves, A_1, A_2, A_3, it is discovered that the soil is also deficient in potash. A quantity of potash is incorporated in the original soil and the operation of increasing the nitrogen component is repeated with the same three species. Under the stimulus of additional potash, all three crops respond with greater yields at every stage and trace the three broken-line yield curves. These new curves are homologous with the first ones; they lie higher in the diagram and approach greater maximum yields, A_4, A_5, A_6. As other deficiencies of the soil are discovered and made good, the curves will again move higher up.

Here is an agrobiologic progression to excite scientific curiosity. To what final limit does *A* approach when all deficiencies of the soil have been made good? The problem here posed transcends the gratification of scientific curiosity. The future and indeed the present welfare of the human race hangs heavily on the final location of *A*. When breeders have produced crop plants with the largest possible quantity of life, and when the agronomists and the soil experts have learned how to evoke the full quantity of this life in the fields, man will have at his disposal the maximum quantity of food and materials for clothing that he can possibly produce on his arable land. Man may well pray that when the final limit of *A* has been determined it will be found to lie so high that he can satisfy to the full not only his immediate needs but also the needs of oncoming generations far into the future. But if the ultimate productivity of land turns out to be little above what farmers are now obtaining, man must continue to face a Malthusism that has already involved much of the earth's people.

To this vastly important problem the law of yield provides a positive answer, and the answer is encouraging.

In this connection it should be kept in mind that since it is impossible to produce an unlimited amount of vegetable substance on a unit area of land in one growth cycle, only a limited amount of the factors of plant growth need be assembled on that area. In other words, it is necessary only to make the soil just rich enough to evoke all the life there is in the plants. A perfertile soil (a soil of maximum necessary fertility) being a physical (non-living) concept, it must have definite parameters which may be expressed in concrete numbers. The Mitscherlich yield equation affords a means of deriving these parameters.

For this purpose the differential equation given above is transformed into its logarithmic form

$$\log (100 - y) = 2 - 0.301 \cdot x$$

in which 100 represents 100% of any value of *A;* the numeral 0.301 reduces the values of all the specific effect factors *c* of all growth factors to a common denominator, and *x* is measured in a new kind of unit as will presently appear. The graph of this equation is shown in Fig. 2 when *x* is assigned successive numerical values 1, 2, 3, 4, etc.

The first point of interest in Fig. 2 is the ordinate corresponding to $x = 1$. This ordinate crosses the curve at the point that represents exactly half (50%) of the total possible yield. That is to say, one unit (x_1) of any growth factor is sufficient to produce one half (50%) of the yield that any kind of plant can produce on any normal soil whether perfertile or subperfertile. Then note that as *x* is increased by multiple units along the horizontal axis the curve merges with its asymtote when the soil contains about 8 units of *x*, which correspond to 99.61% of the maximum possible yield under the circumstances of the case.

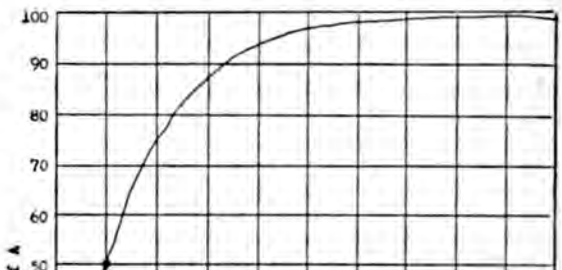


Fig. 2. Units of growth factor. Graph of the Mitscherlich-Baule form of the yield equation: $\log (100 - y) = 2 - 0.301 \cdot x$.

This description of the Mitscherlich-Baule yield curve may be condensed in the statement that there is a certain quantity of any growth factor (*x*) that will produce half (50%) of the maximum possible (*perultimate*) yield of any kind of crop. This quantity of growth factor is called the Baule unit, or simply the *baule*, of that growth factor. While one baule will produce half of the total effect, the action of the law of diminishing returns is such that 7 additional baules are required to bring the yield up to 99.61%. From there on it is a matter of experimental routine to ascertain the value of the baule of any factor of plant growth, whether warmth, light, water, carbon dioxide, or any chemical plant nutrient. For instance, the baule of nitrogen has been found to be 223 pounds to the acre, of phosphoric acid (P_2O_5) 45 pounds.

Thus one condition for attaining the maximum productivity of land is to furnish the soil and its surroundings with at least *8 baules of every factor of plant growth,* taking care, of course, to exclude all hostile influences. A soil thus furnished is a perfetile soil.

To that point did Mitscherlich uncover the meaning of his yield equation. He performed the priceless service of determining the parameters of a perfertile soil. But he did not arrive at a measure of the decisive factor in the maximum productivity of land. That decisive factor is the inner capability—the quantity of life—of the plant itself, to which the fertility of the soil is at most ancillary.

To repeat: There are enormous differences in the yielding abilities of many crop plants; yet no matter how great may be the quantities of life possessed by different species the same perfertile soil will impartially assist every one of them to attain its perultimate yield. Since on a perfertile soil every kind of plant has access to the same quantity of any growth factor, or rather is exposed to the same nutrition pressure from every growth factor, the differences in yield must come from differences in the abilities of the plants to avail themselves of the same quantities of growth factors available to them.

The Nitrogen Constant 318

But how does it come about that sugar beet can accept the nutrition pressure of one baule of soil nitrogen and produce more vegetable substance than corn, and corn more than soybean, when the roots of all are bathed by the same soil solution in which the concentration of nitrogen is one baule?

We may approach this question by way of one or the other of two hypotheses. Either the sugar beet draws more heavily on the one baule of nitrogen and thus can fabricate more nitrogenous protoplasm with which to effect the synthesis of more nonnitrogenous plant substance than corn or soybean or they all draw equally on the one baule of nitrogen and all fabricate the same amount of protoplasm, the differences in yield being accounted for by differences in the specific activities of the protoplasms of the three species for synthesizing nonnitrogenous plant substance.

The inverse yield-nitrogen law leaves us in no doubt as to which hypothesis to accept. This law is to the effect that the yields of plant species are inversely as their percentage contents of nitrogen. Applying this to our three species, the nitrogen of soybean averages around 2.3%, corn 1.25%, sugar beet 0.80%. The average yields of total dry substance of these crops under normal conditions are inversely in that order. As the nitrogen percentage comes down, the total yield goes up, and vice versa.

Some if not most wheat breeders are aware of this principle; they find it impossible to obtain new varieties that under normal conditions will have more protein (nitrogen) in the grain and give more bushels to the acre than the parent strains. The breeders of sugar beets encounter a similar difficulty. The yield of sugar cannot be genetically increased without an inverse change in the nitrogen percentage of the whole plant. (*Cf.* the EE, E, N, Z, and ZZ strains of beets.)

The upshot of the yield-nitrogen law is that no matter how much or how little dry substance they produce, all crop plants remove identical amounts of nitrogen from the soil. That is to say, when different kinds of plants are cultured on a unit area of the same normal soil the product of their gross yields multiplied by their percentage contents of nitrogen is a constant. It is now a matter of finding the value of this constant in pounds of nitrogen per acre which all plants resorb from the soil when they have deployed their full quantity of life on an acre of perfertile soil. For this we turn again to the Mitscherlich-Baule form of the yield equation (3) which we now write as

$$\log (100 - y) = 2 - 0.122.x$$

Here 0.122 is the specific effect factor of the growth factor nitrogen, and in this form the equation describes the

Fig. 3. Part of a field of 12 months' old POJ 2878 cane at the Ingenio de Calipam, Mexico. The yield of 147.1 tons of millable stalks per acre contained enough carbohydrate material to make 14,720 pounds of protein, which would be sufficient to supply the protein needs of 259 persons for one year. For comparison, a 20-bushel average yield of wheat would meet the annual protein needs of only 3 persons.

irreversible mass action (nutrition pressure) of soil nitrogen upon the plants. When rearranged to

$$x = \frac{2 - \log (100 - y)}{0.122}$$

x now represents the quantity of nitrogen that has passed out of the soil into the tissues of the plants, and it turns out to be 356 kilograms (hectare basis) or 318 pounds (acre basis).

The inexorable fact that it is impossible to produce an unlimited amount of vegetable substance on a unit area of land in one growth cycle now begins to concretize in definite numbers. We obtain the information that any kind of plant grown at the agrobiologic maximum density of stand can metabolize, in one growth cycle on one acre of normal perfertile soil, 318 pounds of soil nitrogen, and no more. These 318 pounds of nitrogen represent about 2,000 pounds of protein to the acre, and they have a twofold significance.

First, it is evident that nature has placed a definite limit on the direct production of protein on a unit area of land. Since protein is indispensable in the nutrition of man and since every person must have a minimum daily supply of protein, the natural law which fixes the amount of protein that can be produced also fixes a limit on the number of persons who can subsist on the produce of one square mile of arable land. The sociologists, the population experts, the politico-economists and the planners for a more comfortable world may carry on from there.

Secondly, the common possession of a quantitatively identical proteinous base is fair presumptive evidence that all rooted and green-leaved plants have been derived from one original stock, the "protophyte." However, the new evidence lies not so much in the fact that this base amounts to 2,000 pounds as it does in the complicated but very neatly balanced system of mass nutrition pressure which nature has organized in the same fashion for all plants. It will be recalled that one baule of any plant nutrient exerts exactly as much nutrition pressure as any other, and that it takes the combined pressures of somewhat more than 8 baules of every factor to force the plants to complete the fabrication of their allotted base. A perfertile soil, as a natural instrument for the complete nutrition of plants, has a very definite stoichiometric structure (fixed amounts and proportions of all nutrients). It is the common subjection of all plants to this marvelously proportioned agrobiologic mass action system that is among the best evidence of their common kinship.

The outstanding fact in the present-day world of plants is that while they are all on the same footing as regards the amount of protein they can synthesize, they differ enormously in their abilities to synthesize nonnitrogenous substance. Their gross yields are the sums of their nitrogenous and nonnitrogenous substances, and by virtue of the inverse yield-nitrogen law are equal to their percentages of nitrogen divided into the agrobiologic nitrogen constant 318.

We are now in a position to address the question raised in connection with Fig. 1: To what final upper limit does *A* approach? In the cases of our three representative crops the calculated perultimate yields (limit values of *A*) are as shown in Table 1.

This series shows the enormous effect of decreasing nitrogen percentage on the value of *A*. So far as this writer knows the lowest percentage of nitrogen in a major crop plant is 0.285 in the sugar cane variety POJ 2878, which has a calculated perultimate yield of 111,579 lbs./acre and has been known to yield more than 140 tons of fresh millable stalks.

TABLE 1. PERULTIMATE YIELDS OF SOYBEAN, CORN, SUGAR BEET.

Crop	% of nitrogen in dry substance (whole plant)	Perultimate yield of dry substance, lbs./acre
Soybean....	2.60	$A = 318/0.026 = 12{,}230$
Corn........	1.20	$A = 318/0.012 = 26{,}500$
Sugar beet..	0.80	$A = 318/0.008 = 39{,}740$

Note. There are appreciable differences in the nitrogen percentages of different varieties of these species; the figures are for median varieties.

And More to Come?

However, it is by no means certain that POJ 2878 with its low nitrogen and great yield is the last word on the maximum productivity of land. POJ 2878 is merely the latest in a succession of varieties that have been bred to contain smaller percentages of nitrogen and greater quantities of life; a similar succession has been found with corn and the sugar beet (4). In general, while discovery of the inverse yield-nitrogen law and the agrobiologic nitrogen constant 318 have put plant breeders on notice that it is hopeless to expect the creation of new varieties that will produce more than about 2,000 pounds of protein to the acre in one growth cycle, they are also informed that if they want greater yields of nonnitrogenous vegetable substance they have only to set about lowering the nitrogen percentage of their breeding stock. The breeders of such crops as wheat cannot conveniently take advantage of this because they must maintain a high percentage of protein in the grain. The breeders of carbohydrate-rich crops are not necessarily under this limitation, and it is in this department that we find crop plants with the largest quantities of life.

So it turns out that we are not yet in a position to say, definitely, what is the ultimate limit on the productivity of land. We must wait and see how far the breeders may go in reducing the nitrogen percentages of their new varieties. POJ 2878 now has 0.285%. Suppose that the breeders come up with a new variety with 0.1% of nitrogen; we would then have $318/0.001 = 318{,}000$ pounds of dry substance per acre. Even 0.1 may not be the lowest possible percentage of nitrogen for a normally functioning plant. Here is a wide open

(*Turn to page* 46)

Corn Reflects Potash Supply

By N. C. Smith

Soils Department, University of Missouri, Columbia, Missouri

AS our soil fertility declines, the problem of producing corn of both high quality and yield is of increasing importance. In an effort to meet this problem, fertilizer is being widely used. New methods in its application are changing its usage, especially on summer-growing crops. The amount applied is still governed by economic considerations as well as undeterminable plant needs.

Lime deficiency has become well recognized as one need that must be satisfied. Phosphorus also is accepted widely as a soil treatment. In the greater removal of other elements of fertility as influenced by these additions of lime and phosphate, potassium is the first that should receive more consideration. The advent of lespedeza as a summer crop in our already exploitive cropping systems makes the need for additional potassium more apparent.

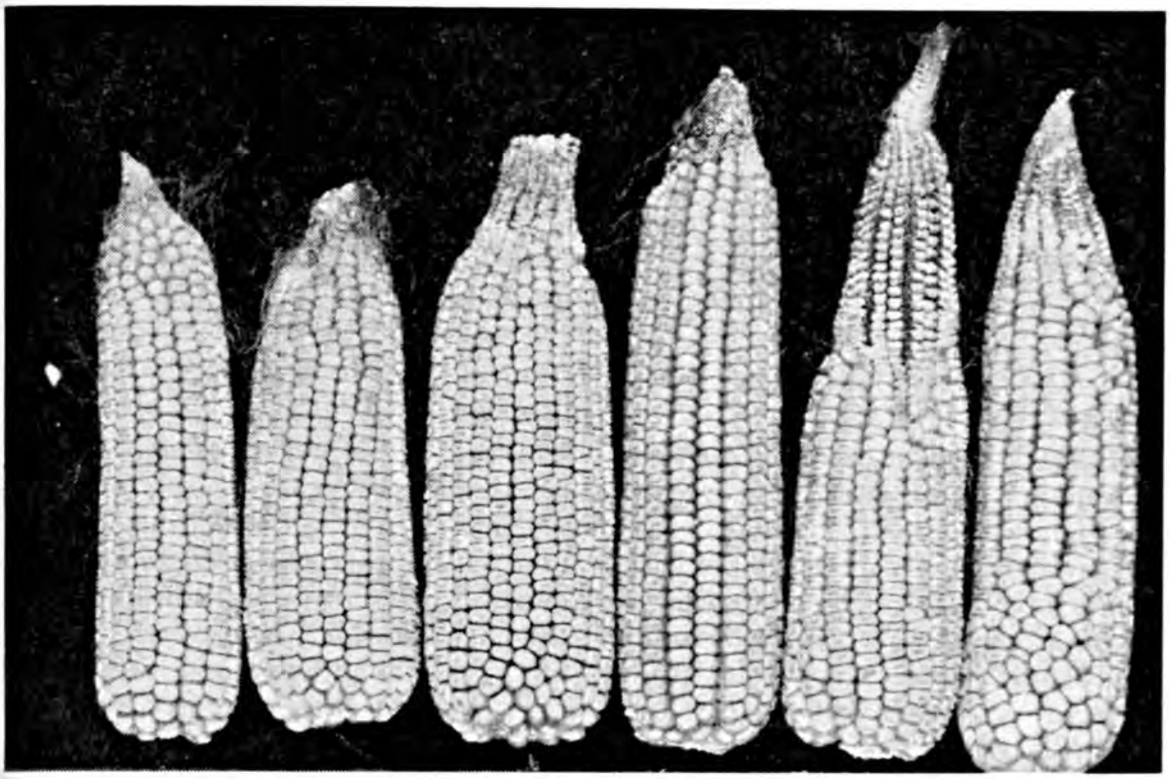
An experiment was established at the Missouri Station in 1936, using a 4-year rotation with lespedeza as the legume, with all the forages removed for hay. Deficiency symptoms pointing to the potassium as in question were soon apparent in the lespedeza plants, especially in the drier seasons. During the summer of 1947 these were especially severe on the lespedeza in this rotation. These symptoms appeared on the plants growing on the plots fertilized with potash, as well as on the plots given no potash.

It seemed possible that lack of magnesium might be the cause of the plant irregularities, rather than the lack of potassium. As a result, a fertilizer test was carried out to determine by alternative applications whether potassium or magnesium was the specific deficiency. The two elements, potassium and magnesium, were applied as salts in solution on separate small areas of the plots. Another area was included where no nutrients were added. Instead of fertilizer additions, the plants were shaded there as a means of reducing the rate of photosynthesis and of lessening the incidence of any deficiency in the fertility needed for this performance.

On the shaded area the deficiency symptoms manifested by the plant leaves disappeared entirely and they disappeared only partially from the potash-treated plants. No change could be observed in the plants on the magnesium-treated area. These observations indicated that potassium was the major limiting nutrient element or the one causing the deficiency symptoms in the lespedeza plants.

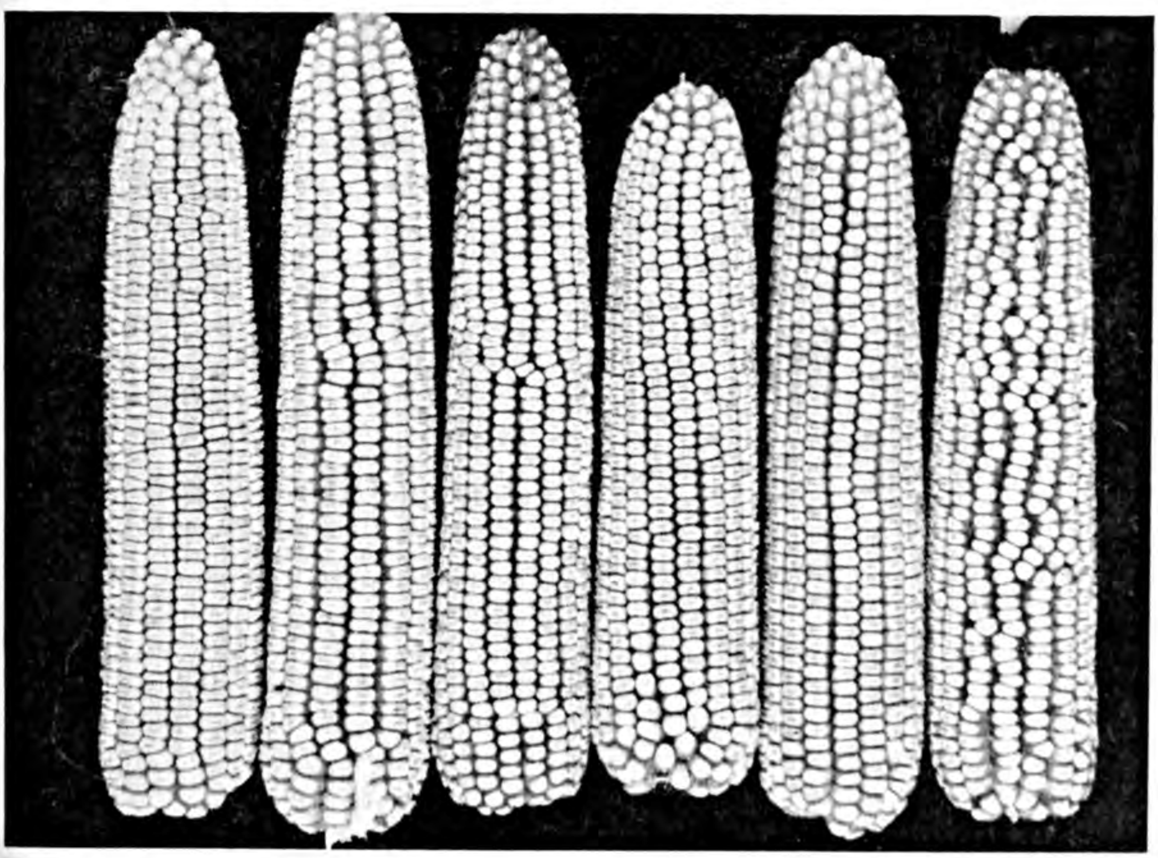
Corn was the crop following in 1948. It was given the same soil management as in previous years. The corn on the small area which had received the special application of the potassium solution on the lespedeza in 1947 was conspicuous for its greater growth and vigor from the early stages onward during the season.

Because of the continued differences in plant growth, numerous plant-tissue tests were made throughout the summer months. These tests showed a high potassium content at all times in the plants growing on the potash-treated soil. In the corn growing adjacent to this area, the tissue test did not show this abundance of potassium and at



Above: **Potash-deficient corn following sick lespedeza that was not treated with potash.**

Below: **Potash-rich corn following sick lespedeza that was treated with potash.**



times indicated very low potassium content.

Tests also indicated the soil's supply of potassium available on the two areas according to the data in Table I for sample taken July 13, 1948:

At harvest time representative one-

(*Turn to page 48*)

Potassium in the Oregon Soil Fertility Program

By R. E. Stephenson

Soils Department, Oregon State College, Corvallis, Oregon

PLANTS require a relatively large amount of potassium for growth and high production. The bulk of the potassium in the plant is in the form of inorganic salts and is not, so far as is known, built into organic tissue as part of the physiology of the plant. Potassium in the plant, therefore, appears to have chiefly a regulatory function, common to all catalysts. No other element in the soil can take the place of potassium in the functions which it serves, not even sodium which is nearest potassium in its properties.

Potassium is most abundant in the young and growing tissues of the plant, in the buds, young leaves, root tips, and other growing parts. There is little in the woody portion. Potassium salts are relatively soluble and are easily moved from the older to the younger tissue as plant growth progresses. The older, lower leaves suffering from potassium deficiency will contain little of the element because the potassium has been moved out to points where it is most needed.

Potassium Has Several Important Functions in the Plant

Potassium is especially important in the manufacture of carbohydrates. It functions in the change of sugar to starch and in the reconversion of starch to sugar. It is necessary also for the plant to transport the sugar from one part to another. Proteins cannot be synthesized, and therefore there can be no growth without the presence of potassium. In potassium deficiency cells may elongate, but they do not divide, a process which is necessary for growth to occur.

When present in the soil in combination with nitrate, the potassium moves into the plant readily, furnishing both the potassium and the nitrogen needed for growth. Nitrate must be reduced after entering the plant to form an amino acid, and the amino acids combine to form proteins. Potassium is necessary for the reduction of the nitrate, which appears to take place soon after the nitrate enters the root system.

Potassium has been credited with stiffening the straw of small grains and with imparting disease resistance to plants. Since abundance of potassium favors carbohydrate synthesis, and the thickness of the cell wall depends upon abundant synthesis of cellulose and hemicelluloses, which are deposited on the cell wall, the stiffer straw and greater disease resistance would appear to be the natural consequence of an adequate supply of potassium.

Potassium Deficiency May Be Observed in the Plant Foliage

Potassium deficiency results in stunted plants that turn brown and dry up prematurely. The older leaves show the deficiency first, due to the tendency for the limited supply of potassium to move to the growing points and thus maintain life in the plant. Likewise, the tendency of potassium to move to the growing tips in deficiency causes a slender weak growth without much enlarging in diameter, which should occur simultaneously with elongation in a well-nourished plant. Seeds may not mature or are small in size due to the incapacity of the plant to manufacture food for storage where potassium is lacking.

Potassium deficiency is especially noticeable in the behavior of the leaves, which first show marginal scorch and necrotic spots. The leaves also are usually contorted and cupped or puckered in shape. Finally the older leaves die or may drop prematurely. By contrast, well-nourished leaves of most crops are flat, smooth, and dark green, exposing their surfaces to the sunlight to utilize the sun's energy for manufacturing carbohydrate.

Crops frequently respond to potassium with increased growth when there are no visible symptoms of deficiency in the unfertilized plants. Other deficiencies and also excesses of some elements produce symptoms that closely resemble potassium deficiency. For these reasons visible symptoms are not always reliable for diagnosing the need for potassium fertilization unless the observer is experienced. A field trial if only on a few rows or even on a few plants is a safer test for the need for potassium.

The Potassium Requirement of Plants Is High

Although all crops require considerable potassium, those grown for their sugar or starch, such as potatoes and sugar beets, may have a higher requirement. Crops which make big yields of vegetative growth, such as alfalfa with three cuttings in a season, also take much potassium from the soil. Some of the vegetables, cabbage, lettuce, spinach, celery, and others, have rather high requirements.

When available potassium is abundant, plants are guilty of "luxury consumption," which means that they take in more potassium than is necessary for growth because it is readily available, or because of some other uncorrected nutrient deficiency which leads to an unbalanced nutrition of the plant. Potassium contents as high as 7 per cent in tobacco, clover, lettuce, and sugar beet leaves and 9 per cent in spinach, young corn, and cabbage leaves have been reported. On the other hand, lows of less than 1 per cent are frequently found where there is a deficiency. The percentage found depends in part upon the age of the plant and the portion of the plant analyzed. Young plants are likely to be richer in potassium, and the foliage usually contains more than other parts.

The Potassium Content of the Soil Varies

Perhaps the most important original source of potassium in the soil was orthoclase feldspar, which contains 14 per cent of the element. The potassium content of the soil is governed in part by the type of material from which the soil was formed. Shale formations usually contain more than twice the potassium found in sandstone formations, and the potassium content of soils of any large area would vary according to the formation from which they were derived. Lava rocks are relatively high in potassium and are likely to weather down to produce high-potassium soils.

The average good soil varies in potassium content from 1 to 1½ per cent, with peats and sandy soils running quite low, while some of the best soils have nearly twice this amount. A large portion of the potassium in the soil is insoluble and unavailable to plants. Another portion is slowly available as the crop roots make contact with moist soil surfaces. A small part is in solution in the soil moisture and, of course, readily available to crops. The clay fraction of the soil holds considerable potassium and the sand comparatively little. The heavier textured clayey soils are therefore likely to be best supplied with potassium.

Humus Renewal Improves Potassium Availability

Adequate humus renewal is important in maintaining available potassium in the soil. Since vegetative materials that go to make humus may carry relatively large quantities of this plant food, which is liberated in the soil, these materials themselves contribute available potassium. The rotting organic materials produce solvents and carriers of potassium that are effective in improving the potassium nutrition of the plant.

Some Oregon Soils Are Deficient in Potassium

Present knowledge indicates that Oregon soils are generally well-supplied with potassium, except for the peaty areas, sandy soils, and some old strongly-leached formations. A large portion of the potassium is fairly readily available to growing crops. On most of the farming area, therefore, there is no acute shortage.

Use of fertilizers in Oregon is confined to Western Oregon soils or to special crops in Eastern Oregon. The muriate is the principal form of potassium used, either as such or as part of a complete mixture. Other elements, particularly nitrogen and sometimes phosphorus, sulfur, or boron, are so much more limiting factors in plant growth that response to potassium is unlikely unless these other deficiencies are first corrected.

On Aiken clay loam, an old leached soil, a cover crop of barley and vetch showed an increased growth of 162 per cent from nitrogen alone, 218 per cent from nitrogen and sulfur, and 324 per cent from nitrogen, sulfur, and phosphorus. When muriate of potash at the rate of 200 pounds an acre was added to the nitrogen, phosphorus, and sulfur, the yield increase was 384 per cent. This was from liberal rates of fertilization. The essentiality of correcting nitrogen or other severe deficiencies before response could be expected from additional treatments is indicated by an increase of only 9 per cent in yield from phosphorus alone compared to 106 per cent gain over nitrogen and sulfur from phosphorus added to a nitrogen and sulfur combination.

All Limiting Deficiencies Must Be Corrected

In greenhouse studies where it was attempted to supply sufficient nutrients for maximum growth by adequately correcting all deficiencies, use of potassium always gave added growth, even on the best soils, if other deficiencies were first corrected. These results indicate that lack of response to any particular added nutrient element might be due not so much to an adequacy of that element as to a deficiency of some other element which so limited growth that no other treatment was of any avail until the one or more major deficiencies were corrected.

In some early work on samples of soil taken at considerable depth using sunflower as an indicator plant, boron was so deficient that the plants nearly refused to grow with or without other treatments until the boron deficiency was first corrected. When boron was provided, there was a nice response to the regular treatment supplying the necessary nutrient elements, and growth became satisfactory. In another trial with lima beans, the yield with boron added to N-P-K-S was nearly doubled over that of the N-P-K-S alone, indicating that boron was a rather severe limiting factor in fertilizer response.

Horticultural Crops Respond to Liberal Fertilization

The experiment station in recent years has given special study to the fertilizer program for horticultural crops of which Oregon produces a great variety. On all such crops as vegetables, small fruits, gladioli, daffodils, and lilies, a complete fertilizer including the N-P-K-S formula is recommended. On some soils and for some crops, boron must be added to the above formula. Every deficiency

(*Turn to page* 42)

Fig. 1. Pendleton Farmers' Society Hall, erected 1826-28, is claimed to be the oldest such building in the United States. Begun as a courthouse for old Pendleton District, it was not completed because the District was divided into three counties and Pendleton was not a suitable location for any courthouse. The Pendleton Society took it over and made it into the building as it now appears, using the upper floor as a regular meeting place continuously since that time. The lower floor has been in use for many years as a U. S. Post Office.

Some Farming Societies and Farming Science

By A. B. Bryan

Clemson, South Carolina

IN South Carolina for more than a century farmers' societies have played an important role, through the intelligent leadership of their members, in the promotion of better farming ideas and practices. The relation between the work of these farm groups and the advancement of farming science is direct and evident.

One of these societies—the Charleston Agricultural Society—is the second oldest farmers' society in the United States. This society, officially the Agricultural Society of South Carolina, was organized in the fall of 1785 and is therefore only a few months junior to the Philadelphia Society for the Promotion of Agriculture, which was organized February 11, 1785.

Another of these South Carolina farmers' societies, the Pendleton Farmers' Society, is the fourth oldest in the Nation, having been organized in 1815, and is therefore antedated by the Massachusetts Society for the Promotion of Agriculture, which came into being in 1792.

Two other century-old South Carolina farmers' groups are the Darlington Agricultural Society and the Beech Island Farmers' Society, both organized in 1846. Several other such groups in the State are 60 to 80 years old. All are still active and efficient agencies in promoting farming science and improved practices.

Lighting the Way

A hundred and fifty years or even a hundred years is no brief period in the life of a State or Nation. It is a long time in the life of a voluntary organization, such as these farmers' clubs, held together not by necessity but by a desire to serve their members and the public in the common good. Their age is some proof that they have filled a real need in the agricultural, economic, and social life of their sections. They have remained true in principle and are still dedicated to their original purpose as typified in the words of the constitution of the Pendleton Farmers' Society—"The object of the society shall be the promotion and improvement of agriculture and rural affairs."

A noteworthy thing in the records of these groups is the clear and unmistakable idea of independence of thought and action and a spirit of self-help and courage as well as fine group cooperation. A farmer discovering a new method or technique did not hide the light of his discovery under a bushel; he revealed it gladly to his fellow farmers, offering them the benefit of his experience.

Another noteworthy fact about these organizations is the able and distinguished men among their officers and members. Just to illustrate: In the Charleston Society there were Thomas Heyward, a signer of the Declaration of Independence; John Rutledge, a Chief Justice of the Nation, and others. In the Beech Island Society one example is James Henry Hammond, governor and U. S. Senator and originator of the term "King Cotton." In the Darlington Society examples are Chancellor G. W. Dargan and Governor David Rogerson Williams. In the Pendleton Society were Thomas Pinckney, Jr., John C. Calhoun, and Thomas G. Clemson.

These and many other notables of early and later years in these groups were not only jurists, statesmen, soldiers, and civic leaders but also *farmers*, to whom farmers of today owe much in the arts of farming and even in the science underlying. For example again: St. Julien Ravenel of Charleston is responsible for developing the phosphate beds around Charleston and the process of making ammoniated fertilizer. Calhoun of Pendleton was first to advocate and practice hillside ditching against erosion and subsoil plowing. Of Clemson of Pendleton we shall have more to say later as a promoter of science in farming and the need of agricultural education.

These four farmers' societies, in short, have rendered long and honorable service to their members and to the public welfare. And their interests are still primarily agricultural and educational. They represent, in fact, about the first organized efforts in agricultural education, as we shall see. Furthermore, these societies have helped to develop many leaders in science and education, because they have encouraged their members to conduct trials and experiments, offered premiums for superior products, agitated for better agricultural training, and even purchased and deeded land to the State for agricultural experimentation.

We must forego the temptation to tell in detail what these several farmers' societies have done to advance the art and science of farming and confine ourselves chiefly to some account of the Pendleton Farmers' Society and of one of its members in particular who has loomed large in the field of agricultural science.

We pause briefly, however, to say a word about how the Darlington Society has advanced the knowledge of cotton farming especially. Darlington is the heart of South Carolina's great Pee Dee section, a rich cotton-

Fig. 2. The W. W. Long Hall at Clemson College, headquarters of the agricultural teaching, research, and extension activities of the institution founded on the Calhoun estate by Thomas G. Clemson.

producing area in the Coastal Plain of the State. It is but natural, therefore, that members of this group should study to improve cotton production. Throughout its hundred-year history they have worked efficiently toward finding through research and practice a knowledge of cotton that proved to be forerunner of things wrought later by the agricultural experiment stations in scientific research. These include:

Development of better varieties or strains of cotton.

Early know-how on spacing cotton plants for maximum yields and better lint.

Pioneering use of lime or marl, Peruvian guano, and commercial fertilizer.

Unsurpassed records for cash returns from cotton per acre.

Methods of fighting the boll-weevil and other cotton pests.

Establishment of local cotton factories and oil mills to process lint and seed.

Chancellor Dargan's championing of the value of commercial fertilizer, be it said, was at the risk of ridicule, for some of his friends are said to have warned: "You are a fool to use that stuff; it will ruin your land and bankrupt you."

This Darlington Society, recognizing the importance of agricultural education, urged in 1869 "training in practical agriculture and mechanic arts" as the Pendleton Society had done some two years earlier. A resolution unanimously passed by the Darlington Society said:

"Resolved: That one of the most pressing wants of the State at the present time is the establishment of institutions of learning for our youth, in connection with training in practical agriculture and the mechanic arts as will enable pupils by their own industry to defray the expenses of their education.

"Resolved: That the establishment of such an institution under the care and patronage of the South Carolina Agricultural and Mechanical Society would be one of the surest and most effective means of developing and promoting the material interest of the State, and giving intelligence, respectability, and efficiency to labor in its most important department."

Pendleton Society Outstanding

Outstanding among these farmers' societies, especially in the promotion of farming science, has been the Pendleton Farmers' Society, and most conspicuous among its many notable members on preaching the gospel of science as the basis of real progress in agriculture and rural life was Thomas Green Clemson, founder of Clemson College.

The Pendleton Farmers' Society, established in the village of Pendleton in 1815, was promoted and fostered by leading men of education and culture who were farmers in the surrounding area. Many of them were low-country plantation owners from the Charleston area who were summer residents, a number of whom became permanent residents. They were thinkers as well as doers in the field of farming.

Early leaders included Thomas Pinckney, Jr., the society's first president. The early and mid-century rolls included many important names: Andersons, Adgers, Cherrys, Hugers, Hunters, Porchers, Pickenses, Maxwells, Simpsons, Calhouns, Thomas G. Clemson, and others.

John C. Calhoun, South Carolina's great statesman of the Calhoun-Clay-Webster era, was president of the society in 1839. Thomas G. Clemson, son-in-law of the great Calhoun, was president in 1866 and for two decades a powerful influence in its affairs.

The Society's Scientific Spirit of Inquiry

The records of the Pendleton Society offer ample evidence through the years of its scientific spirit of inquiry and experimentation. Some of this evidence we present as briefly as possible.

A report of the Committee on Grasses in 1818 discusses among other things—"Dog foot" or orchard grass, *dactylis glomerata*—found valuable for grazing. "Lucerne (alfalfa to us), which has been found very valuable for soiling. A gentleman of great responsibility sowed a quarter of an acre

(*Turn to page* 38)

Fig. 3. Historic Fort Hill, home of John C. Calhoun for many years until his death in 1850, was later the home of Thomas G. Clemson from 1872 until his death in 1888. Located in the heart of the Clemson College campus in sight of Tillman Hall, the Administration Building of the College, it was restored jointly by the College authorities and the John C. Calhoun Chapter, United Daughters of the Confederacy, and has been kept as a Calhoun-Clemson shrine.

Vermont's Agricultural Conservation Program

By Thomas H. Blow

Production and Marketing Administration, U. S. Department of Agriculture, Burlington, Vermont

SIX hundred ACP farmer committeemen serve Vermont's 26,490 * farms scattered throughout the length and breadth of the State's 14 counties. This means that for every 45 to 50 farms one committeeman is available to give assistance to the farm operator for a better understanding of the Agricultural Conservation Program and thus direct the various practices which it offers.

That a "back to the grass roots" plan serves Vermont farmers well is evidenced by the strong farmer participation in the program down through the years. 'Tis true that the number taking part in the various practices fluctuates from year to year, but this is to be expected in such a program.

Vermont is a small State, and agriculture provides its major source of income. The 1945 census shows 95,000 people living on farms, or approximately 1 out of every 4 persons in the State directly dependent on the farm operator for a living.

The Vermont Agricultural Conservation Program has grown into a strong organization. It has done so because it has built the program around a community's needs as known by the committeeman who is right back at the grass roots. With 600 committeemen and 188 communities, the rural areas are being well served by the community committee system as it now operates.

Down through the years Vermont has been very proud of its record of ACP cooperation with other agencies. Very close relations have always existed between the Agricultural Conservation Program and the Vermont Agricultural Extension Service, which has been responsible for much of the publicity and education in Extension and ACP work. The county agent in several of the counties also has used the conservation practices as the basis of his soils and crops program.

Use of Materials

Lime—The use of lime, one of the basic needs of the State's soils and crops, has grown from a low of 3,500 tons in 1936 to a high of 118,000 tons in 1944. In 1944 it was supplied at no direct cost to the farmer.

While this increase may seem quite favorable, the amount now used is still a far cry from the estimated amount needed. Based on acreage, the cropland requiring lime totals 1,200,000 acres. In addition, 400,000 acres of non-crop pasture show the same need. Assuming that one ton of lime should be applied every four years, the annual need in such a rotation becomes 500 lbs. per acre per year, as a maintenance application for the State's 1,600,000 acres of cropland and non-crop pasture.

Superphosphate—With superphosphate the trend is much the same—from a low of 3,300 tons prior to the start of the program to over 50,000 tons during the war years. Even today, the tonnage of super used will be 10 times that used before the program got under way.

Superphosphate usage is based on the

* Census figure used. For all practical purposes, the number of actual farm units in the State is usually considered to be approximately two-thirds of the census figure.

need for a 300-pound-per-acre application annually to cover an initial and maintenance need of the State's 1,478,000 acres of pasture, new seedings, and the present hay stand acreage.

Potash—It has been necessary to depend on the use of complete fertilizer or such grades as 0-14-14 or 0-20-20 to supply potash through the program. Only in a couple of earlier years was a straight potash payment practice available to the farmer. This is unfortunate because soil tests, sound land use, and crop needs in practically every county point to a very definite potash deficiency. In some counties, such as Caledonia in the northeastern part of the State, the need for potash has been shown by soil tests to be as great as the need for phosphorus. However, through the medium of mixed grades, it has been possible partially to meet the potash needs through the use of the program and thus assist materially in converting a greater acreage to legume roughage and improved pasture throughout the State.

In breaking down the State acreage, we find 483,000 acres of total pasture, 60,000 acres of new seedings of grasses or legumes, and 650,000 acres of hay. To satisfy the crop needs on these 1,193,000 acres, it is estimated that an average annual application of 150 lbs. of muriate of potash per acre for initial and maintenance needs should take care of the potash requirements. This represents a total annual need of 89,475 tons annually.

Under the 1949 program a small start will be made in supplying some of the much needed potash, because of a special allotment of some 8,500 tons of 0-14-14. This will, however, be only a very small proportion of the amount really needed for maximum roughage production throughout the State.

Public Relations Program

In January of this year the Vermont State Committee approved a 1949 public relations program that would tie in at least once each month with some important phase of the State's agriculture. The monthly meetings scheduled by the Committee call for the following subject matter presentations throughout the year:

1. Public relations (Over-all Program).
2. Milk marketing.
3. Marketing agreements.
4. Price levels, parity, and price support.
5. Cooperation with State Department of Agriculture and a meeting with the Commissioner of Agriculture.
6. Meeting with representatives of Grange and Farm Bureau.
7. Meeting with representatives of the Extension Service.
8. Research and Marketing Administration meeting.
9. Agricultural research meeting, including PMA and land use.
10. Poultry and turkey marketing.
11. Forestry and its products.
12. Vermont Development Commission.

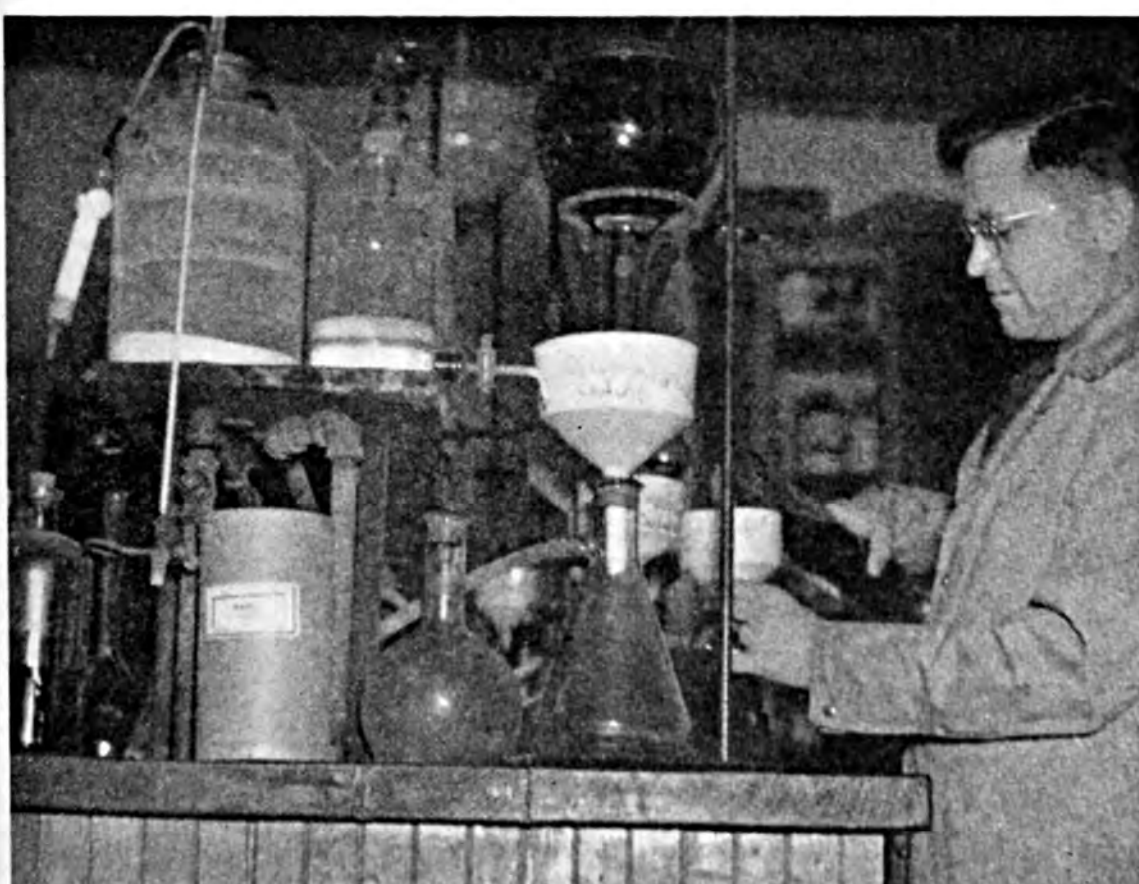
To these meetings the Committee invites members of the University and State Agricultural College and Experiment Station, Soil Conservation Service, State Department of Agriculture and Forest Service, Department of Education, State Farm Bureau, Grange, Vermont Development Commission and Vermont Cooperative Council, etc. As a result of this broad program, the State PMA hopes to reach such groups as agricultural organizations, milk companies, feed dealers, veterans, labor organizations, bankers' association, credit agencies, chambers of commerce, the rural church, the schools, all the various inter-related agencies and, in particular, the individual.

Looking Ahead

Vermont's program is a long-time program. It is based on the agricul-

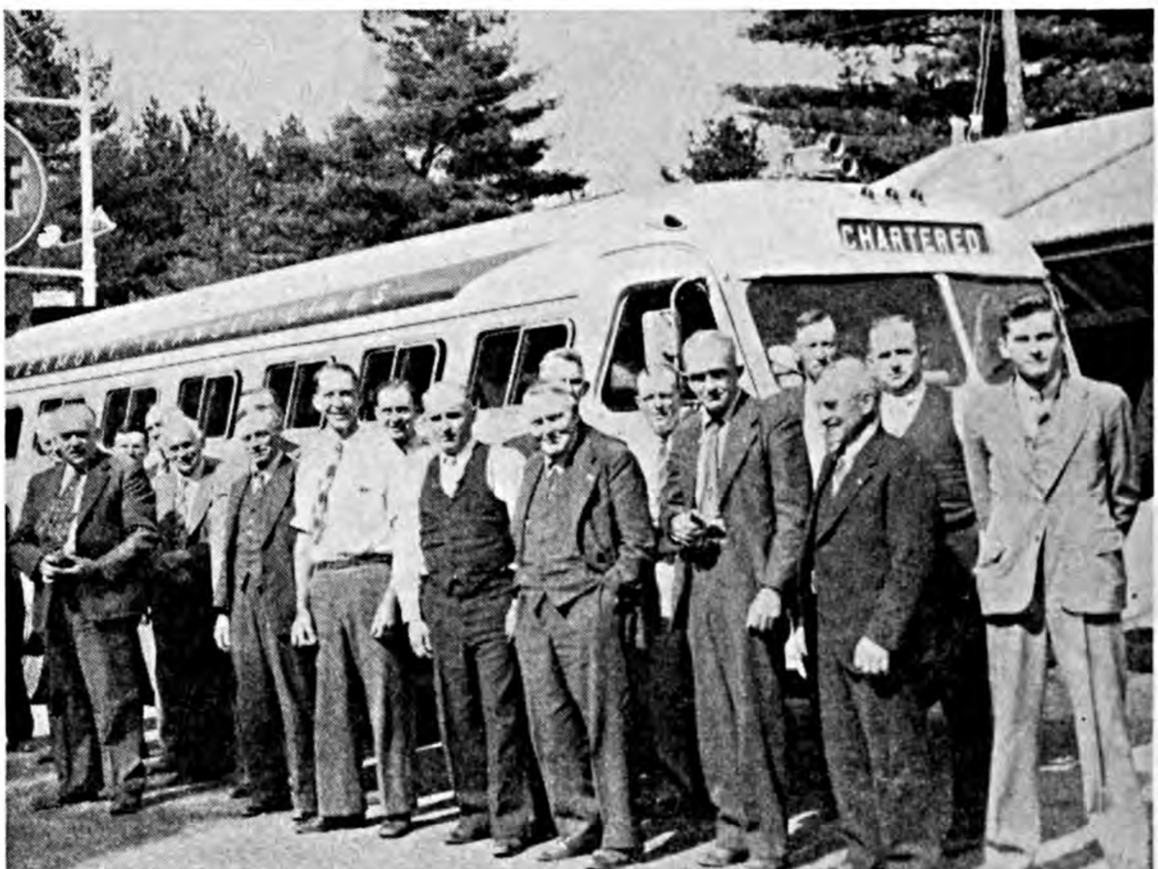
(*Turn to page* 38)

The county agent plays a major part in the Vermont soils and roughage program. Roger Whitcomb, County Agent, Orleans County, discusses "Better Crops" with Vermont's Senator Aiken.



Soil tests provide a guide to better soil management. Dr. A. R. Midgley in the Soils Laboratory, University of Vermont.

In the early days of Vermont's "ACP" program, county, state, and national leaders met to draft plans at the State level.



Vermont Committeemen keep posted on ACP work in other states. The Caledonia County farmer committeemen visit Maine.

The farmer committee system at work in Vermont results in spirited meetings to consider urgent problems.

A typical Vermont farm setting where the Committeeman serves the folks of his community in program cooperation.

Vermont's hills and valleys provide a variety of roughage and grazing for its "more cattle than people."

Cows and milk are the Vermont farmer's major sources of income. Soils must be strong to maintain the dairy industry.

The Editors Talk

What Is Required of a Program?

The editorial policy of this magazine is expressed in our slogan—"The Whole Truth—Not Selected Truth"—a policy which we trust is recognized by our readers. Under this policy, the editors have no inclination to deal in their own comments on controversial subjects, that prerogative being left to our contributors.

Accordingly, in presenting the following excerpts from the statement of Secretary of Agriculture Charles F. Brannan at a joint hearing of the House Committee on Agriculture and the Senate Committee on Agriculture and Forestry, we adhere to this policy. Nevertheless, we are confident that the quotations to follow will be universally recognized as The Truth, impressively stated, regardless of what the Congress within its prerogatives may think, say, and do with respect to the Brannan program for agricultural stabilization. The requirements for a program were eloquently stated. It is our hope that they will inspire our legislators and their advisers to provide the Nation with basic agricultural laws which will effect the fulfillment of these requirements:

"First, the program must effectively serve the farmer and his family. As an isolated individual, the farmer has no control over the prices he will receive, and no adequate way of adjusting the total market volume of his commodities to changing demand. After he has planted a crop, he is at the mercy of weather, price, and many other forces with which he is powerless to cope. On many occasions in the past, he has labored all season and produced a good crop only to find that, because of circumstances beyond his control, his labor would go uncompensated and sometimes his cash investment in seed, fertilizer, and other operating costs would be only partially recovered. A program to help him meet those basic difficulties is the very minimum for which we should strive.

"Second, in serving the farmer the program must not discriminate unfairly against any group. It should be fair to consumers and to processors, shippers, wholesalers, retailers, and others in the distribution system. There is no real conflict between farmers and either consumers or business people. The customers of agriculture want plentiful and steady supplies, and they have a right to expect that a program supported by the public will help meet this need. Farmers want to furnish plentiful supplies regularly.

"Third, the program must be efficiently operated and the cost must be commensurate with the benefits to the Nation.

"Fourth, it must serve general policy objectives, including national security, the maintenance of high-level employment, and cooperation with other nations in the interests of peace and prosperity. It can do this by conserving and strengthening our basic productive resources, providing reserves against national emergencies, and encouraging free-flowing world trade by reasonably assuring sufficient products for export."

J. FIELDING REED

THE American Potash Institute is pleased to announce the appointment of Dr. J. Fielding Reed as manager of its Southern territory, the position left vacant upon the election of Dr. H. B. Mann as president. Dr. Reed will assume his duties on July 1 with offices in the Mortgage Guarantee Bldg., Atlanta, Ga.

A native of Louisiana, Dr. Reed attended the Louisiana State University, receiving a B.S. degree in chemical engineering in 1933, his M.S. in 1934, and a Ph.D. degree in 1937. In 1939-40 he held a Rockefeller Foundation post-doctorate fellowship at Cornell University. Returning to L. S. U., he served as Assistant Agronomist and Professor of Soils until 1942 when he accepted a position as Agronomist with the North Carolina Department of Agriculture and North Carolina State College. For two years he was in charge of soil fertility investigations with peanuts and in 1948 was co-winner of the $1,000 award of the National Peanut Council for contributions to the peanut industry. He has been teaching courses in soil fertility and soil chemistry at N. C. State College and his research in the field of soil chemistry has included studies of the importance of type of colloid considerations and the effect of cation-exchange properties of the soil on the cation uptake and composition of plants. Since July 1948, he has been Director of the Soil-testing Division of the N. C. Department of Agriculture as well as Professor of Agronomy at N. C. State College.

Dr. Reed is a member of the Soil Science Society of America, American Society of Agronomy, American Chemical Society, American Association for the Advancement of Science, and the American Society of Plant Physiologists. His fraternities include Sigma Chi, Alpha Chi Sigma, Sigma Xi, Phi Kappa Phi, and Tau Beta Pi, and he is a member of Lion's International.

He is married to Olive Mae MacDonald of Reserve, Louisiana, and they have two daughters—Martha, age 11, and Jeannie, 7.

The Farmer Holds the Key

Agricultural workers in laboratory, classroom, and field investigations will do well to bear constantly in mind that the farmer himself is the KEY MAN in agricultural improvements.

The fruits of agricultural research are only of academic interest if the farmer does not avail himself of them. No matter how excellent the medicine, it effects no cure if the patient fails to take it.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924...........	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941...........	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947...........	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
April.........	34.10	31.2	209.0	240.0	219.0	229.0	19.40	89.40	....
May.........	35.27	40.1	196.0	244.0	216.0	222.0	18.30	90.70	....
June.........	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July.........	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August......	30.41	47.4	158.0	265.0	191.0	196.0	17.80	76.60	....
September...	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October......	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November....	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December....	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January......	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February.....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March.......	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1924...........	185	190	98	170	166	141	107	147	143
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	93	81	109	74	87	110
1938...........	69	196	80	83	76	64	57	97	88
1939...........	73	154	100	85	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	107	117	107	81	211	129
1942...........	153	369	168	136	143	124	91	202	163
1943...........	160	405	188	232	174	154	125	231	245
1944...........	167	420	214	219	170	160	138	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	175	249	212	209	141	319	204
1947...........	252	380	224	245	366	273	146	379	249
1948									
April........	275	312	300	273	341	259	163	396	340
May.........	284	401	281	278	336	251	154	402	262
June.........	284	417	268	280	336	239	151	409	213
July.........	266	436	238	298	315	230	153	428	213
August......	245	474	227	302	298	222	150	340	172
September...	250	467	220	264	277	223	152	302	150
October......	251	506	204	236	215	224	155	282	176
November....	246	428	207	226	188	231	155	306	186
December....	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282
February.....	235	295	249	279	174	219	173	237	285
March.......	232	319	250	290	184	224	168	228	263

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
April	2.78	1.90	13.87	11.71	12.75	8.35
May	2.78	1.90	13.77	9.54	12.75	7.89
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	11.46

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
April	104	67	396	332	378	237
May	104	67	393	270	378	224
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	326

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367[1]
1942	600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
April	.760	4.11	6.60	.375	.669	14.50	200
May	.760	4.61	6.60	.375	.669	14.50	.200
June	.760	4.61	6.60	.330	.634[1]	12.76[1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
Index Numbers (1910-14 = 100)							
1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
April	142	114	135	68	70	60	83
May	142	128	135	68	70	60	83
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
April	291	264	238	137	85	380	142	71
May	289	265	239	137	85	370	142	71
June	295	266	241	128	85	309	142	65
July	301	266	247	231	88	317	144	68
August	293	266	247	129	91	285	144	68
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended December 31, 1948," Bu. of Chem., State Dept. of Agr., Sacramento 14, Calif., FM-177, Feb. 17, 1949.

"Supplemental List Commercial Fertilizers Registrants for the Fiscal Year Ending June 30, 1949 (Issued subsequent to list of December 15, 1948)," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-178, Mar. 17, 1949.

"Supplemental List Agricultural Minerals Registrants for the Fiscal Year Ending June 30, 1949 (Issued subsequent to list of December 16, 1948)," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-179, Mar. 18, 1949.

"Commercial Fertilizers Inspected and Analyzed in the State of Georgia, Year 1948," State Dept. of Agr., Atlanta, Ga., Serial No. 133, Jan. 1949.

"More Nitrogen for Sugar Cane," La. Agr. Exp. Sta., Unno. mimeo., Feb. 1949, V. E. Green, D. S. Byrnside, and M. B. Sturgis.

Soils

"Save Your Soil," Ext. Serv., Kans. State College, Manhattan, Kans., Cir. 204, June 1948, R. C. Lind and H. B. Harper.

"Gravel Culture for Growing Ornamental Greenhouse Crops," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 679, Dec. 1948, D. C. Kiplinger and Alex Laurie.

"Suggestions for Improving Slick-spot Soils," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Bul. B-329, Feb. 1949, H. J. Harper and M. J. Plice.

"Soil Moisture and Wheat Yields on the High Plains," U.S.D.A., Washington, D. C., Leaf. 247, H. H. Finnell.

"Manage Farm Ponds for Bass and Bluegills," Soil Con ervation Service, U.S.D.A., Washington, D. C., P. A. 65, 1948.

"Conservation and Use of Agricultural Land Resources," Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., Jan. 1949.

Crops

"Growth and Diseases of Guar," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 216, July 1948, R. L. Matlock and D. C. Aepli.

"Home Vegetable Gardening," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 26, Rev. Nov. 1948, J. H. MacGillivray.

"Vegetable Growing," Div. of Horticulture, Central Exp. Farm, Dominion Dept. of Agr., Ottawa, Ont., Can., Publ. 816, Farmers' Bul. 154, Oct. 1948, W. Ferguson.

"Oat and Rye Recommendations for Northern Florida for 1948-1949," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 653, Sept. 1948, S. C. Litzenberger, W. H. Chapman, and W. A. Carver.

"Winter Clovers for South Florida Flatwoods," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 654, Sept. 1948, E. M. Hodges, D. W. Jones, and W. G. Kirk.

"Pimiento Production in Georgia," Exp. Sta., Univ. System of Ga., Experiment, Ga., Bul. 259, March 1949, F. F. Cowart and A. H. Dempsey.

"Agricultural Research in Idaho," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 270, A. R. 55, July 1948.

"Protein in Open-Pollinated and Hybrid Corn," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1340, Aug. 1947, H. J. Snider.

"Three Years of Sunflower Seed Production in Piatt County, Illinois," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1341, Sept. 1947.

"Spring Oats," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1355, Feb. 1948, J. F. Rundquist, G. H. Dungan, and O. T. Bonnett.

"Ladino Clover," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1358, Mar. 1948, R. F. Fuelleman.

"Pasture Renovation," Dept. of Agr. Ext., Div. of Agron., Purdue Univ., Lafayette, Ind., AY #112 (Rev.), 1948.

"Requirements for Seed Potato Production and Certification," Ext. Serv., Univ. of Md., College Park, Md., Bul. 119, May 1948, R. A. Jehle.

"1948 Extension Work in Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul 1, Minn., A. R. 1948.

"Lespedeza," Ext. Serv., Miss. State College,

State College, Miss., Ext. Agron. Folder No. 5, Feb. 1949, W. R. Thompson.

"Science Serving Agriculture," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Part I, Biennial Rpt., 1946-48.

"Science Serving Agriculture," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Part II, Biennial Rpt., 1946-1948.

"Fall Gardening," Ext. Serv., Okla. A & M College, Stillwater, Okla., Cir. 486, E. L. Whitehead.

Economics

"Land Tenure in the Southwestern States—A Summary of Significant Findings of the Regional Land Tenure Research Project," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 482, Oct. 1948.

"Ventura County Citrus Orchard Management Study—Valencia Oranges and Lemons, 1947," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"Economic Aspects of Farm Pastures in the Mississippi River Delta Cotton Area of Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo. Cir. 85, Sept. 1948, A. R. Cheshire and F. D. Barlow, Jr.

"Farm Property Ownership and Disposition of Estates in Maryland," Ext. Serv., Univ. of Md., Bul. 121, Sept. 1948, G. M. Beal.

Vermont's Agricultural Conservation Program

(*From page* 26)

tural historical background of the State. The farmer of today knows all too well that the Vermont hills and valleys have seen the era of beef cattle and sheep come and go. He has seen in recent years what has happened to the production of butter as a source of income and he has seen many times how meager were the returns from other side lines in the developing of his business. With 85 per cent or more of the Boston milkshed supplies of milk coming from Vermont, and with current prices for his product in a good relationship with production costs, the Vermont farmer should be and is vitally concerned with what is ahead.

The Extension Service is in a strong position to do the educational job that is so necessary in our present-day economy. With it, along with the help of such agencies as the Production and Marketing Administration through its community and county committee system to assist in the field, much material help can be given in maintaining the agricultural production of the State.

There is no desire, nor should there be, on the part of any one agency to do all that needs to be done. Rather, the situation calls for making the best use of those "tools" that have been provided by our nation's foremost thinkers in giving to agriculture a more satisfying rural life, and the maintaining and improving of "that top six inches of soil." These are absolutely necessary, if our states and nation are to continue strong.

Some Farming Societies

(*From page* 24)

on a stiff red clay hill—this was well manured—and in common years he has cut it seven times, but this last summer being unusually seasonable, it was cut nine times and kept six horses."

To stimulate active discussion and accumulate information, the Society at its meeting September 8, 1819, listed a hundred queries on which members were urged to write their experiences and opinions. A score of these will show the wide range of inquiry:

Have you ever used ashes as a manure?

Have you ever applied lime to your land?

Do you know anything of marl?

How deep ought lands to be plowed?

Do you fallow your land?

Do you lay your fields in ridges or lands?

What is the best method of fattening cattle?

Do you know the disorder in cattle called milk sick?

What breeds of hogs are best?

What are the causes of smut, mildew, and blast? The remedies?

Do our soils and climate suit barley?

What grasses make best pasture? What best hay?

What facts have you on cultivation and value of lucerne, clover, orchard grass?

Cannot some of our native grasses be improved by culture?

What kind of apples afford best cider?

What is the best method of grafting, inoculating, and planting orchards?

How do you destroy moles?

Have you any improvement in management of bees?

In the 1840's, the records show, the Pendleton Society made an effort "to introduce silk culture. Cocoons might be found in an outhouse of nearly every home, and Multicaulis trees, the leaves of which were to supply food for the silkworms, were rapidly and widely set; but the venture came to naught."

On May 7, 1883, "The club met at the residence of Mr. D. K. Norris. We saw his underground drains, simply two boards nailed together and inverted. One drain, doing its work well by the copious flow of water, Mr. Norris said, had been down for five years."

A most interesting item of the Society's records is the report of a meeting in October, 1843, listing toasts proposed by members at the dinner. Some of the toasts:

W. B. Seabrook—"The cause of agriculture throughout the world."

John C. Calhoun—"Agriculture, most important but most oppressed branch of industry."

C. C. Pinckney—"The pursuit of agriculture, the most useful, most honorable, most ennobling of all pursuits."

Dr. F. W. Symmes—"Pendleton agriculture, to be improved and made profitable only by economy and manure."

O. R. Broyles—"A judicious rotation of crops, most important practice of agriculture."

F. Burt—"The agricultural survey of the State, the first recognition of farming interest by our legislative authorities."

R. F. Simpson—"South Carolina, if behind her sisters in anything it is in agriculture."

Thomas G. Clemson—"In the absence of marl, permit me to propose a more familiar acquaintance with the effects—of potash, soda, and magnesia."

A. H. Seabrook—"Commerce, manufactures, and agriculture, but the greatest of these is agriculture."

J. O. Lewis—"Marl, may it add as much energy to the men as it has added fertility to the soil."

Some 40 years later, an extract from the minutes of the meeting January 24, 1883, shows—"The club met at Mr. J. C. Stribling's place. Inspected Mr. Stribling's silo. It exhibits very satisfactory and instructive results." Stribling, practically a lifetime member of the Society, built the first silo in the South. He was a pioneer dairyman and breeder of Jersey cattle and in 1882 he sold a pedigreed Jersey cow for the then fabulous sum of $1,000.

For Agricultural Education

In many deliberations before the War Between the States the members of the Pendleton Society discussed better education and scientific training for farmers. It was as early as 1825 that "a labor school" for practical farming and mechanical work was established a few miles from Pendleton and fostered by the Society—probably the first effort of this kind of training for farmers in the United States.

But even more definite and direct thinking and planning for education in the science of agriculture sprang up among the members of the Society immediately after the war. In 1867, Thomas G. Clemson, while president of the Society, urged the establishment of "an institution for the education of our people in the sciences," thus projecting the agitation which in time led to the establishment of what is now Clemson Agricultural College. President Clemson named a committee to appeal for funds for such an institution—R. F. Simpson, W. A. Hayne, and himself—and William Henry Trescot, another distinguished member of the society, wrote the appeal, which was widely distributed. But the time seemed not yet ripe for accomplishment.

Nevertheless, when one member of the Society in later years called the Pendleton Farmers' Society "the mother of Clemson College," he was not too wide the mark. Certainly with its Calhoun, its Clemson, its efforts to establish a farm labor school, its constant work in promoting soil improvement, better seeds, diversified crops, purebred livestock, experiments with fertilizers and new implements, and its movement toward establishing an agricultural college, the Pendleton Society has wrought worthily and well for more intelligent farming and better rural life.

Thomas Green Clemson and Clemson College

Since it is now apparent that the Pendleton Farmers' Society has always fostered educational efforts toward more intelligent and more successful farming, and that Thomas G. Clemson was the society's most outstanding protagonist for scientific training for farmers, we turn our attention to him and the birth of Clemson College.

Briefly, Thomas Green Clemson was a Pennsylvania Quaker, born in Philadelphia July 1, 1807; educated in Philadelphia, then in France in mining engineering and chemistry. Back in the United States, he met Anna Maria, daughter of John C. Calhoun and married her in 1838. A strong bond was soon established between the statesman and the scientist; and shortly the Clemsons came to South Carolina, Clemson to have supervision of farming on Calhoun's Fort Hill Plantation near Pendleton and of Calhoun's north Georgia gold-mining ventures.

Clemson's definite turn toward scientific agriculture is indicated in his toast at the Pendleton Society's dinner in 1843 on "better knowledge of mineral fertilizers," which showed his trend toward agricultural chemistry. At this time also he bought "Canebrake Farm" in Abbeville county and made his own venture into farming.

A diplomatic service career covering eight years, 1844-52, included several years as minister to Belgium. Returning to the United States in 1852, he bought a farm in Maryland, was active in promoting scientific agriculture, and was helpful in the establishment of Maryland Agricultural College. Then in 1860 he was appointed Superintendent of Agricultural Affairs, which was then an office in the Patent Office, U. S. Department of Interior; and through his work there and otherwise he had no little influence in the establishment later of the U. S. Department of Agriculture. But for war and political contingencies, he perhaps would have been the first Secretary of Agriculture in the United States.

Came the War Between the States, and Clemson cast his lot with the Confederate States, serving patriotically and efficiently as a chemist in mining engineering. Then, returning to South Carolina in 1866, the family lived in Pendleton. Clemson was soon president of the Pendleton Farmers' Society, and he began his agitation for scientific education to better the farming conditions then existing. Hear the record speak:

"January 1867: At a previous meeting held November 24, 1866, Hon. R. F. Simpson, Col. W. A. Hayne, and Hon. Thomas G. Clemson were appointed a committee to appeal for aid to found an institution for educating our people in the sciences to the end that our agriculture may be improved, our worn-out and impoverished lands be recuperated, and the great natural resources of the South be developed. —The Hon. Thomas G. Clemson addressed the Society in an interesting and a most able and instructive discourse and submitted the following appeal in the form of a circular, which by direction of the Society was printed and fully circulated both at home and abroad."

The following extracts are from the circular, which was drafted by William Henry Trescot on request of the committee:

"Considering that our lands are so impoverished by the growth and exportation of cotton that much of them will not pay the cost of cultivation, and that our agriculture generally is in a wretched condition; that legislation has failed to protect the agricultural resources of the Commonwealth from unnecessary and wholesale despoliation;—that avenues of wealth and honor are restricted for want of science, upon which the arts are based and without which civilization cannot advance; and that ignorance is the cause of our destitution and the parent of crime, misery, and death—

"We, the committee, on behalf of the Agricultural Society and our fellow citizens now make this earnest appeal to the well disposed of all classes and sects for aid to found an institution for the diffusion of scientific knowledge, that our civilization may advance and we may once more become a prosperous and happy people.

"If this our prayer meets with sufficient response, an institution will go into operation from whence science of the highest order in all its forms will be gratuitously dispensed to unborn millions. The upper region of South Carolina would appear, above all others, adapted for the location of such an institution.—

"Donations of funds, books, apparatus are earnestly solicited."—

But, sad to say, "funds, books, apparatus" were not forthcoming for this great educational dream to become a reality. Not yet; the time was not ripe.

A Dream Comes Alive

But the dream did not vanish. In 1856 Thomas G. Clemson had written: "The only hope we have for the advancement of agriculture is through the sciences." In 1869 he caused to be passed a resolution by the South Carolina Agricultural and Mechanical Society applying for U. S. Land Grant funds to establish a school for technical education. He kept on dreaming and working to make his dream come true.

In 1871 Clemson bought at a foreclosure sale the Fort Hill home and estate of John C. Calhoun, his father-in-law, who had died in 1850, and the Clemsons moved from Pendleton to Fort Hill four miles away in 1872. Upon the death of their children Calhoun Clemson and Floride Clemson in 1871, Mr. and Mrs. Clemson made plans and mutual agreements to leave their property to the people for scientific education. In 1874 Clemson offered free land on which to establish a school; but to no avail.

Mrs. Clemson died in 1875, and Thomas Clemson was left alone to brood over his dream of scientific education as "the only hope for the advancement of agriculture." Then, in the early 1880's Clemson conferred from time to time with Col. R. W. Simpson, able Pendleton lawyer, on his plans to donate the Fort Hill property and certain funds for the promotion of agricultural education. A first draft of the Clemson will would have called the school "Calhoun-Clemson College"; a second draft would have named it

"Fort Hill Scientific Institute"; the final draft, made by Col. Simpson, specified the name "The Clemson Agricultural College," at Col. Simpson's suggestion.

On December 6, 1886, Thomas G. Clemson invited to a conference Col. R. W. Simpson and Col. D. K. Norris, close friends of Clemson, and B. R. Tillman, afterwards Governor and U. S. Senator, who had taken up the agitation for better education of farmers, to discuss ideas regarding agricultural education.

At Clemson's death, April 6, 1888, Col. R. W. Simpson, who had been named one of the life trustees provided in the Clemson will, called a meeting of the seven life trustees to be held at Fort Hill May 2, 1888, to consider ways and means of carrying out the provisions of the will regarding "The Clemson Agricultural College." Through these trustees Clemson's bequest to the State was presented to the South Carolina Legislature December 4, 1888. A bill accepting the bequest was passed by the Legislature in December 1888 and was signed after considerable delay by Governor Richardson November 27, 1889.

Thus was born "The Clemson Agricultural College of South Carolina," which became in due time the Land Grant college of the State, which opened its doors to students in 1893, and which has in its 55 years of operation trained thousands of men to serve the State and the Nation and has otherwise blessed the people through teaching, research, and extension of scientific knowledge.

The thirst for knowledge and the spirit of inquiry of the historic agricultural societies and especially the Pendleton Farmers' Society, and the spirit of Thomas Green Clemson, have become the spirit of Clemson College. That spirit is the spirit of progress and service, and that spirit is marching on to bless the State, the Nation, and the world.

The motto of these societies and the motto of Thomas G. Clemson might well have been, and the motto of Clemson College might well be, the words at the base of the Statue of Liberty in New York harbor—"I lift my lamp beside the open door."

Potassium in Oregon Soil Fertility

(*From page* 20)

must be corrected and humus renewal must be provided to get best results.

A good formula for general use on average soils in horticultural crops is 500 pounds of sulfate of ammonia, 225 pounds of treble superphosphate, and 200 pounds of muriate of potash an acre. This is equivalent to 1,000 pounds of 10-10-10 an acre. On the better soils or where too much vegetative growth is undesirable, the nitrogen application may be cut down perhaps to one half the above rate. Sulfate of ammonia used as a source of nitrogen supplies adequate sulfur as well as nitrogen.

On tree fruits the need for potassium is not great and additional response from providing potassium on most orchard soils has not been demonstrated. If potassium is needed for growing the cover crop, however, its use in the orchard is probably justified. Humus renewal is so important in the orchard soil that whatever treatment will help to grow more humus material in the form of a cover crop deserves consideration.

The Potassium-Nitrogen Balance Is Important

Adequate use of potassium helps provide better balance in the nutrition of the plant. The relationship between available potassium and available nitrogen is especially important. Nitrogen stimulates rapid growth and potassium stimulates carbohydrate production. Both nitrogen and carbohydrate are used in the formation of proteins which are essential in the growth process. Too much nitrogen leads to excessive growth and exhaustion of carbohydrate which may reduce fruiting. Lack of nitrogen for growth may result in excess of carbohydrate, and this likewise is unfavorable to fruiting. Thus is seen the importance of a favorable balance between nitrogen and potassium to produce a plant that is vigorous and fruitful but not over vegetative.

Oregon soils are more likely to be deficient in nitrogen than in potassium. Due to heavy winter precipitation, the soils come into the spring thoroughly leached of soluble nitrogen. Then comes a period of warm weather while the soil is moist and available nitrogen is produced in the soil. This is a good growth period. Soon lack of summer rains and low humidity produce a dry topsoil and nitrogen ceases to become available at an appreciable rate. Growth then slows as much from lack of available nitrogen as from lack of moisture.

Potassium Is Not Readily Lost from the Soil

Potassium is not leached as severely as the nitrogen and does not become so completely unavailable in dry weather. Therefore there is the urgent need for providing nitrogen by fertilizing at the right time so that the plant can absorb and store a nitrogen supply in its tissue to carry over the drouth period. This enables the plant to make better use of the available potassium or perhaps to respond to an application of potassium fertilizer assuming, of course, that no other limiting deficiency is present.

Some potassium is lost from the soil by leaching, but a considerable loss is by crop removal, and much of the crop removal loss is unnecessary with good management. In grain production there are 2 to 4 times as much potassium removed in the straw as in the grain. The straw should return to the soil, which would therefore return most of the potassium. In small fruit production only 4 to 8 pounds of potassium an acre are sold in the fruit with average yields. The major portion remains in the vine or foliage, which stays on the land. The sale of tree fruits takes off a little more potassium, but the major portion returns to the soil with the fall of the leaves. On the livestock farm the animal retains only about 10 per cent of the potassium in the feed. Most of the other 90 per cent should return to the soil with the manure.

Valuable Crops Need Potassium

Good management should make it possible to so conserve the potassium supply of the soil that the need for potassium fertilization is minimized. Perhaps in most cases, only crops of high acre value such as small fruits, vegetables, sugar and starchy crops, and nursery crops would need an extra potassium application. These crops are often so valuable that a little increase in yield or improvement in quality or perhaps a little increased disease resistance may justify including potassium in the fertilizer program as a means of insurance against deficiency. The more liberally fertilizer is used to force big yields, the more important the inclusion of potassium becomes. The longer land is farmed and the poorer the methods used, the greater the need for potassium fertilization to bring about improvement.

Use of Fertilizer Is Rapidly Increasing

Oregon growers are in the process of learning to use fertilizer effectively. In the 5-year period 1935-39 approximately 16,000 tons of fertilizer were used annually in the entire State. In the next 4 years the average use nearly doubled to 30,000 tons and use jumped to an average of 82,000 tons for the 2 years, 1946 and 1947. Estimates for use in 1948 run as high as 140,000 tons.

This is still a small usage compared to what might profitably be used on high-priced crops. The future will see more fertilizer, including potassium, used on Oregon farms to bring greater profits and soil improvement.

Nodules for Nitrogen in Forage Production

(*From page* 8)

Lotus plots produced nearly three times more protein than the well-fertilized grass plots. Since the protein in the legume is more digestible than that in the grass, the advantage in favor of the Lotus is even greater. (See Table IV.) The results also show that this soil is very responsive to phosphorus even for grasses, which accounts for the fact that when the same amount of nitrogen was used, a 1-1-0 ratio was better than where a smaller phosphorus ratio was used. This very high phosphorus responsive soil is the main reason that Lotus does so well and produces so much protein when limed and mineralized.

Grass Versus Legume on a Light Sandy Soil

Field experiments similar to the above were also conducted on a light sandy soil, except that brome grass was substituted for reed canary as it is better adapted to this soil. Much larger amounts of potash were also used because this light soil requires rather large amounts even for good grass development. The comparative yields and cost of fertilizing for grasses or for legumes (Lotus) are given in Table III.

Good responses were obtained from use of high-nitrogen fertilizers on grass, but the fertility cost per ton of forage

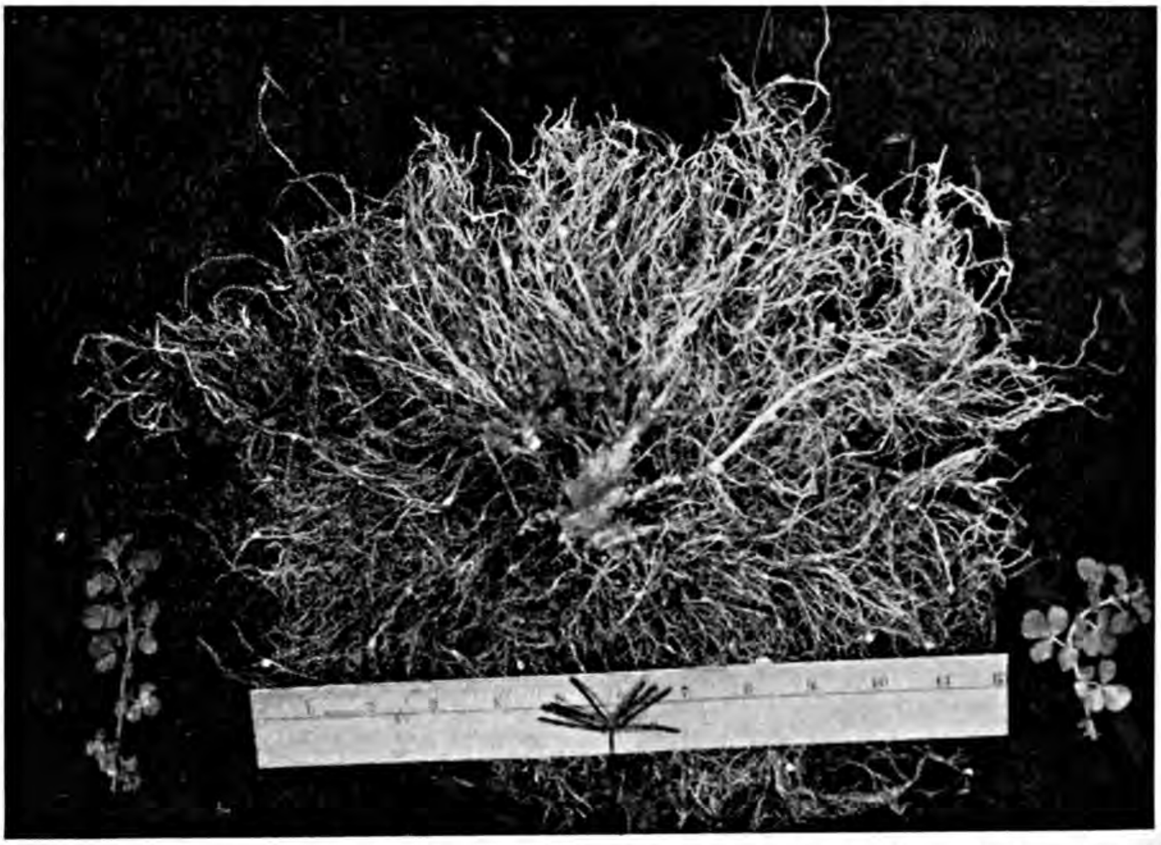


Fig. 3. Root system of a two-year-old selected broadleaf Lotus plant. Note the large, round leaves on either side and the cluster of seed pods on the rule, resembling a bird's foot.

produced was rather high on this light soil. Greater yields with higher protein content were obtained when minerals were used and a legume grown than in case of grass. The fertilizer cost was also much less. Lotus produces large amounts of nitrogen as indicated in the protein produced per acre. Lotus also produced more protein per acre than the grass plots regardless of the amount of nitrogen and fertilizer used. The fertilizer treatment containing 60 pounds of phosphoric acid (P_2O_5) and 60 pounds of potash (K_2O) produced greater yields and more protein when used on Lotus than the same amount of minerals plus 60 pounds of nitrogen when used on grass.

In these trials, 80 pounds of nitrogen per acre caused excessive lodging of grass and lower harvested yields. Usually nitrogen should not be used in excess of 60 pounds per acre, and frequently this gives trouble if grass hay is cut late. Some depressive effect resulted from use of nitrogen on the Lotus plots. This was primarily because it produced excessive grass growth which reduced the stand of Lotus.

Fig. 4. Late fall growth of a two-year-old selected broadleaf birdsfoot trefoil plant, taken from the breeding plots at the Vermont Station. The leaflets of this European type plant are large and round, but many of them had fallen off late in the year when the picture was taken. See Fig. 3 for root system.

Legumes Increase Digestible Protein

Legumes are particularly good as forage crops because they are higher than

TABLE III.—COMPARATIVE YIELD, PROTEIN CONTENT, AND FERTILIZER COST IN GROWING GRASS VERSUS LEGUME ON A SANDY SOIL.

Fertilizer lbs. per acre $N-P_2O_5-K_2O$	Pounds per acre		Cost of fertilizer used [1]	Fertilizer cost per ton of hay [2]
	Hay	Protein		
	(Brome Grass)			
20–20–20	1,693	169	$ 7.00	$ 8.36
40–40–40	2,265	259	14.00	12.35
60–60–60	3,511	444	21.00	11.95
80–80–80	3,295	440	28.00	17.00
	(Lotus & Brome Grass)			
0–60–30	3,796	483	7.50	3.95
0–60–60	4,838	616	9.00	3.72
0–60–60+B+Mg [3]	4,931	628	12.80	5.20
30–60–60	3,583	456	15.00	8.37

[1] Fertilizer cost based on following: nitrogen, 20¢; P_2O_5, 10¢; and K_2O, 5¢ per pound.
[2] The amount of hay produced without fertilizer was not considered here. No treatment produced 863 and 2,766 pounds respectively.
[3] Borax at 40 pounds and magnesium sulphate at 300 pounds were used per acre. The cost was figured over a 3-year period because the effect was expected to last for several years.

TABLE IV.—COMPARATIVE COST OF PRODUCING DIGESTIBLE PROTEIN WITH DIFFERENT FERTILIZERS ON GRASS VERSUS GRASS-LOTUS ON PANTON CLAY. TWO-YEAR AVERAGE, 1947-48.

Fertilizer lbs. per acre $N-P_2O_5-K_2O$	Digestible protein [1] lbs. per acre	Cost of fertilizer used [2]	Fertilizer cost per 100 lbs. of dig. protein
	(Reed Canary Grass)		
15-15-0	151	$ 4.50	$ 2.98
30-30-0	182	9.00	4.94
45-45-0	257	13.50	5.26
30-15-0	149	7.50	5.03
60-30-0	235	15.00	6.39
	(Lotus-Reed Canary)		
0-45-0	951	4.50	1.00
0-45-15	511	5.25	1.03
0-60-15	657	6.75	1.03
15-45-15	495	8.25	1.66

[1] This is based on the fact that this grass contained 4.6% digestible protein and the Lotus 10.08%. In the Lotus-grass plots there were 75% Lotus and 25% grass.
[2] For fertilizer cost see footnote in Table II.

grasses in digestible protein. Lotus is no exception. In fact, it approaches alfalfa because of its many leaves and fine stem. The amount of digestible protein produced and the fertilizer cost to produce this by using the best adapted grass or legume on a heavy clay soil are shown in Table IV.

These results show a marked advantage by using minerals and growing a suitable legume instead of grass alone. While forage plants need large amounts of nitrogen for good growth and protein production, it is advisable to obtain this nitrogen through legumes wherever possible. There is a place for legumes on every dairy farm, but one of the problems is to select the proper legume for the different soils involved. After this is done, these forage crop queens must be properly managed and well mineralized for the production of good dairy feed.

Keys to Abundance

(*From page* 15)

field for some very important work by plant breeders and geneticists.

It might be objected that from the standpoint of human nutrition it would be useless to push the production of nonprotein vegetable substance to such extreme limits while the direct production of protein remains under an iron-bound restriction. But the 2,000-lb. limit on protein direct from the soil may easily be by-passed by calling in certain microorganisms that have ability to convert a superabundance of carbohydrates into first-class protein food. Thus, a perultimate crop of POJ 2878 will yield enough fermentable material to produce about 25,000 pounds of edible yeast (Torula utilis) containing about 12,500 pounds of true protein, which is enough to furnish a standard protein ration (100 grams a day) to 149 persons for a year. Compare this with an average wheat crop (20 bushels), which will take care of the yearly protein needs of two persons. Should the breeders find a cane variety with 0.1% of nitrogen, one acre thereof could furnish about 420 yearly protein rations.

While we are waiting for the breeders to come up with crop plants with 0.1% of nitrogen or less and capable of approaching acre-yields of a third of a million pounds of dry substance that may be converted into protein for man and his animals, we will do very well to make full use of what is now "in the bag," as it were. We already have crop plants that contain from 3.200 down to 0.285% of nitrogen, and when selected according to their climatic requirements and grown on well-watered, perfertile soils they all may be expected to give their perultimate yields. And the perultimate yields of them are vastly greater than the average yields of these same crops obtained even by the world's best farmers who till their soil in ignorance of the law of yield. Take wheat, corn, and potatoes, which are the world's principal food crops. The agrobiologic potential of a good variety of wheat is 171 bushels, of corn 250, and of potatoes (tubers) 1,559 bushels. These potentials have been closely approached in well-controlled experiments and in the open fields where growing conditions have been exceptionally good (5). Compare these potentials with the respective averages of these crops in the United States: 20, 28, and 150 bushels. The conclusion is that the arable lands of the United States are being operated at one-tenth to one-eighth of their real capacities, or rather the capacities of the crop plants that grow on them. In some parts of the world (northwestern Europe) the coefficient of agrobiologic efficiency is a little more than one-fourth, but for the rest of the world it is no better than in the United States.

The world's food position would be greatly relieved if the world's soils were made no more than half perfertile, that is, capable of evoking half (50%) of the quantities of life inherent in the world's food plants. This would mean a general increase of about five times the current average rate of production; and even if the world's soils were no more than one-fifth perfertile, the present yield of food would at least be doubled. Deficiency of food in the world is not the fault of the food plants man now has at his disposal; "they have the goods" and will make delivery whenever their terms, which do not go beyond the cost of constituting a perfertile and well-watered soil, are met.

Conclusion

The agrobiologist can say, with confidence, that the race against world hunger has already been won in principle, so far as acquisition of the necessary basic knowledge is concerned. The life-potentials of the common crop plants have been evaluated, and they are enormous. The parameters of a perfertile soil have been determined, and the means for constituting such soils are not too formidable in view of the ends to be served. The effect law of the factors of plant growth and the inverse yield-nitrogen law supply the keys for unlocking the fabulous wealth of the kingdom of Flora that heretofore have remained invisible. To make this wealth available will require the intelligent investment of large resources and perhaps some rearrangement of the social-economic structure of agriculture. But the advantage of a comfortably fed world may well be weighed against the devastating evils that result from a mounting pressure of population against the means of subsistence.

The world desperately needs a better agriculture, which is now technologically within its reach. It will also need a statesmanship capable of supervising the transition of agriculture from its present empiric regime to a regime of agrobiologic science. In turn, the statesmen will need the orienting assistance of agrobiology-conscious plant physiologists and agronomists, of whom there are as yet not very many.

References

1. Mitscherlich, E. A., Das Gesetz des Minimums und das Gesetz des Abnehmenden Bodenertrags. *Landwirthschaftliches Jahrbuch 38*, 595 (1909).
2. Willcox, O. W. The ultimate limit to sugar production. *Facts About Sugar*, February 28, 1928. So far as the writer knows this is the first mention of the inverse yield-nitrogen law as a general principle of plant life.
3. For a recent thoroughgoing experimental verification of the Mitscherlich yield equation see Mitscherlich, E. A.: Das Ergebnis von über 27,000 Feld-Dungungsversuchen. *Zeitschrift Pflanzenernährung Dungung Bodenkunde 38*, 22 (1947); S. Gericke, *Ibid.* Untersuchungen über das Ertragsgesetz. I, *Ibid.*, 54; II, 215; III, *39*, 245 (1947). These reports give the results of more than 27,000 standard field tests on many types of soils with nitrogen, phosphate, and potash and rye, wheat, oats, barley, potato, fodder beets, sugar beets, rape, meadow hay, red clover, corn. As one example of the agreement between fact and theory the composite result of 2,151 trials with potash and the four food grains may be quoted:

K_2O (x), dz/ha.......	0.0	0.6	0.8	1.2
Yield (y), dz/ha, found.	24.5	26.2	26.7	27.6
Yield, dz/ha, calcd....	24.5	26.3	26.7	27.4

4. Cf. Willcox, O. W. Why some crop plants yield more than others, *Science, 108*, 38 (1948).
5. See the writer's books: Reshaping Agriculture (1934); A B C of Agrobiology (1937).
6. The Law of Diminishing Returns, by W. J. Spillman (1924).

Corn Reflects Potash Supply

(*From page* 17)

ear samples were gathered from six hills on the heavily potash-treated area and a similar number from the adjacent no-potash area. The difference was as illustrated by Figures 1 and 2.

After allowing the corn to dry for several months at room temperature, the calculated yields showed a production of 125 bushels per acre for the corn grown on the heavily potash-fertilized soil and 72 bushels per acre for the corn grown adjacent but not on the heavily potash-treated area. These yields show that potassium can be used in amounts heavy enough to satisfy what would appear to be the maximum needs of the growing plant.

Its use in mixed goods in smaller amounts suggests that while this is of value to the crop in its early stages of growth, it has seemingly not been sufficient to give increases over superphosphate used alone. For this reason recommendations for potash use have been on the basis of a supplementary or starter plant food in place of the equivalent of plant removal as is often true in the case of limestone and phosphate. These results show the possibility of increases in yield and quality from the use of potassium applied in sufficient dosage to supply the undetermined plant needs.

Table I.

O.M. %	Lbs. per acre				pH	M.E. Total H/100 gms.	Notes
	P_2O_5	K	Mg	Ca			
3.1	42	52	190	3,720	6.3	3.0	K-deficient
2.5	42	154	180	3,720	5.8	3.5	K-solution

Covered Wagons

(*From page* 5)

world relations were spotty and sporadic way back then, although thousands of the denizens of the Orient and all parts of Europe joined our own reckless wealth seekers in blissful ignorance of two World Wars and a United Nations to come.

Indeed, our international indifference a century ago was right in tune with our rugged individualism. Each man who went westward was living for and to himself. He was out to "get his own" and to protect what he got himself. He cared little for the hardships of others or the fate of the Nation as a whole, with a few exceptions.

THAT much of this outlook is changed today we can plainly see and be glad about. For above all things that make for safe, sound, and reliable investment, we must have cooperative enterprise and progress and a helpful relationship between all forms of government and business as well as acceptance of international responsibility.

Modern security of investment based on progress is seen in the building of highways and electric power generators. The highway deal is very properly noted here because of the terrific toll in life and savings which the covered wagon folks suffered by reason of horrid roads or none at all.

We're doing pretty well on our "main-traveled roads." The public Roads Administration in cooperation with the States has built and maintains 231,900 miles of primary and 377,600 miles of secondary highways. Moreover, there are one and a half million miles of improved highways for our eager tires to kiss in 1949. If my poor footsore Illinois uncle were living and had enough jack to buy himself a second-hand jalopv, he could do the vast road to the Eldorado in just a few days, and then have lots of time left to sponge on our native California relations.

In the Electrical World for January 1949 I note with pride that the country's public and private electric utilities possess an installed kilowatt capacity of about 55 million—about 11 million kilowatts by local and Federal projects and 44 million through private outfits. And even with that impressive outpouring of power, we face a bad stringency. Scanning the Government works now being finished to augment this flow of energy unheard of in 1849, there are names of places which meant awe or terror to the overland travelers. Among them are dams to be erected at Ft. Randall and Garrison on the old Missouri, Boysen on the Big Horn, Heart Mountain on the Shoshone, Hungry Horse in Montana, Anderson Ranch in Idaho, and McNary on the Washington-Oregon boundary. These are much safer investments, I dare say, than the ones based on inflated prices and the gambling in "future" which our kinsfolk thought were wonderful risks one hundred years ago.

ANOTHER piece of big business financed by Government revenues is the Post Office Department. In 1849 Government postage stamps were two years old. It was not until 1862 that regular railway mail service started. The "rural free delivery" came to pass in 1896. The first postal savings were laid away in 1911. The parcel post system opened in 1913, and air mail earned its wings in 1918. And so today we have 490,000 workers in the country's busy mail service, serving 42,000 post offices, and handling many times the annual "takings" of the best Gold Rush mines—fully $17 billions. Here we see a steady growth to meet popular necessity. This is just one of many things which modern people "demand" of their governments—local, state, and federal. Funds put into programs of such permanent kind may not draw as big interest as the bankers charged in Sacramento a century ago, but there won't be any absconding or defaulting.

At least four bureaus in the Interior Department and three more in the Agriculture Department tackle problems and policies and do investigating and planning about the very things which most perplexed and threatened the farmers and miners of 1849. Land patents, topographical and official maps, surveys of resources in forest and mine, and administering leasing laws therein are the jobs of the Bureau of Land Management. Irrigation, flood control, and hydroelectric power in the arid areas west of the 97th meridian are in the realm of Reclamation Bureau. Conservation of mineral resources, data on production, and aid in mine safety campaigns belong to Bureau of Mines. Education, training, and welfare of 400,000 native Americans and guidance in operating 56 million acres of their reservation lands are up to the Bureau of Indian Affairs.

ORGANIZED soil conservation districts cover over 700 million acres of land, with better farming adjustments made already on 25 million acres. Old trails of the pioneers are now improved highways stretching through 152 national forests of about 300 million acres, administered by U. S. Forest Service, fire-protected and patrolled to a growing extent. County-by-county organizations of farmers to stop erosion, grow better pastures and enrich the land are run by the Agricultural Conservation people. It's not quite too late to halt the waste which past citizens of our rich, new country so easily squandered and forgot. Lots of that waste followed right in the wake of the covered wagons, too.

As we knew a long time ago, and don't need any more lectures on, all this (and much more) in public works for private welfare costs money. So in this enlightened day and age the U. S. Government borrows to reduce the debts and pay for the current running expenses. It likes to borrow (sell U. S. Series E savings bonds) from folks like you and me, who just have a slight speaking acquaintance with a banker. The financial wizards tell me that widespread sales to everyday investors keep them from taking risks again with the old sock and the clock-shelf hideaway, and likewise helps to hold back speculative inflation.

I UNDERSTAND that the covered wagon will be featured widely and effectively in the launching of the next sales campaign in behalf of these Series E savings bonds. It is slated to start officially May 16 and will run on until July 1. They hope to sell a trifle more than one billion in these securities, mostly by payroll savings and bond-a-month plans. To farm folks who already hold six billions in Government savings bonds against about five billions in real estate mortgages, the current outlook is a little "mixed" on the income side, but pretty safe and sure on the matter of choosing reliable investments.

Unlike their roving ancestors of the western hegira, our neighbors on the farm do not intend to toss their land, livestock, and lives in the dice game. Their lives are too precious and their land and livestock values fluctuate too fast sometimes to rely upon as ultimate, reliable anchors to the windward. But "how much" they can afford to salt down in bonds is going to depend on how farm prices act this summer and fall. You can't possibly "stampede" corn-planting and weed-killing farmers into any quickie investment buying program, no matter how sound. I predict they'll take their own sweet time after listening and asking questions when the volunteer salesmen come around. Then maybe after talking it all over with the Missus some night after chore time, Mr. Average Farmer is going to step into the local bank and peel off some of his harvest roll to put right into that safe place where it will always be readily available—come hell or high water.

I guess that way from long, chummy relationships with outdoor producers, who do much and talk little—but think darn hard. They want to know first-off what the bonds mean and the interest earned and how cashable they are in an emergency. Nine times out of ten, farmers know how safe Series E savings bonds are, because they know and respect the good old "Guvmunt" no matter how much they lambast and criticize. That again links these modern farmers with the old Forty-Niners, whose speech was rude and forceful, but who really wanted law and order back again. Finally, they want to know where they can get savings bonds and how much they'll cost, money on the barrelhead. All the rest you can just safely leave with the w. k. Weather Man and the performance of the price lists. I am betting, however, that even if a bad season strikes us and some farm prices waver downward you'll not have much trouble convincing farmers where their best investments lie.

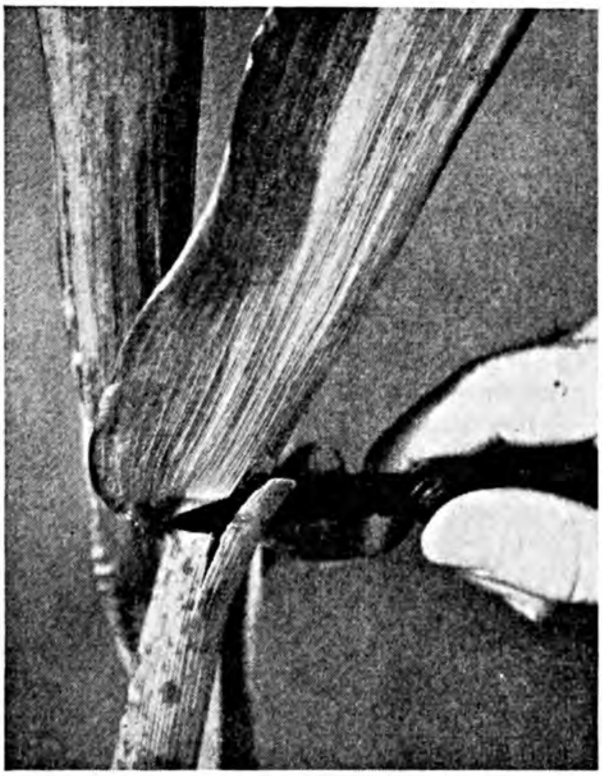
TAKE Tipton County, Indiana. That's as close to the heartbeat of the bread basket as most any place where farmers prosper. Recently I spied a little piece that said 14,000 inhabitants of Tipton county had laid away almost ten million "smackers" in U. S. savings bonds. In good times they keep what they earn, too—witness that a local banker claims there are about nine out of ten of those crackly documents left in the deposit boxes. So-called redemptions are lower in rural centers.

After all, you can brag a lot about organized programs of this and that to "save the farmers"—public and private—and it all simmers down to the same old fact; namely, that farming is hazardous and speculative owing to being a constant partner with fickle Dame Nature. There is no one cure-all for that situation—not even joining an organization or taking out crop insurance.

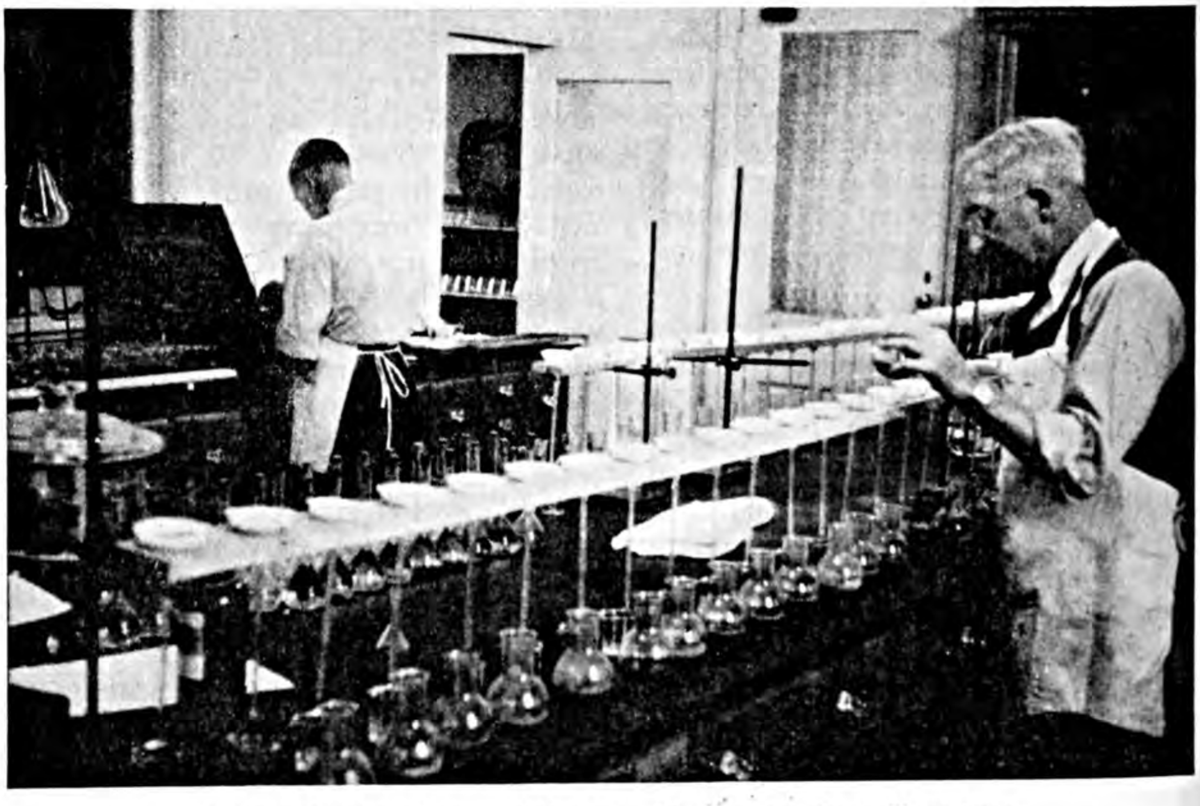
IN good times the farmer lays away some financial fat on his ribs. He and his family and business operations require such precautions against the evil day when plagues and drought and flood (or low prices) kick him in the pants. That in doing his investing the farmer will choose a real gilt-edge, fool-proof, sure-fire kind of paper has been shown in every U. S. savings bond issue since before the war.

And one more point you might forget otherwise. The average age at death in this United States today is a little over 67 years. The Public Health Service told me the other day that only as far back as 1900 the average age was well under 40 years. I shudder to think what the actual average person's age was when they all piled into the covered wagons. Anyhow, what I drive at is that a man in his prime today has a longer life to plan for, and that means increasing his estimated lifetime savings reserve. I never saw a guy yet, farmer or otherwise, who wanted to spend his grandpa days in some chimney corner as an object of charity. At this point you can page the grasshopper and the honeybee to point a moral and close a tale.

So we no longer yoke the oxen to a mammoth wagon to carry us on to the Land of Opportunity. Our new Frontiers are crowding around us closer and more complex than ever. We must meet the situation right here and now, with one eye on world peace and the other on personal security. If we're thrifty and provident we'll reach them both—but not with covered wagons!



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

Recently a number of letters were sent out to a selected list of men as to how to hold a wife. The first answer received was from a western penitentiary. It stated briefly: "I found the best way was around the neck, but it shouldn't be overdone. Please note change of address."

* * *

"As I understand the case," said his honor, "you and your husband had a drunken altercation and you were kicked in the ensuing rumpus."

"No, sah, Jedge," replied Mandy. "Ah was kicked in de stummick."

* * *

A roaring twister last Wednesday carried off Jem Benson's house and furniture, and all three of his children are missing. Neighbors donated a new bed to give Jem and his wife a fresh start.

* * *

Uncle Jake, the town character, was 80 years old.

"Don't you hate to grow old?" he was asked.

"Heck, no," says he. "If I wasn't old I'd be dead."

* * *

When the white man discovered this country, the Indians were running it. There were no taxes, there was no debt. The women did all the work. And the white man thought he could improve on a system like that!

Sally: "Does she stutter?"

Jane: "Does she? Why, once she started to tell a man about her past, and before she had finished he was part of it."

* * *

Seven-year-old Susie received a box of scented soap for her birthday. A neighbor, admiring it, told Susie that she always placed a cake of perfumed soap among her underthings to keep her clothes smelling nice.

Later, Susie complained to her mother: "I don't understand that Mrs. Ross. I keep putting a cake of soap in my underwear but when I walk around it always drops out."

* * *

Pretty Babe Buxom, who has more boy friends than any girl in town, was voted Miss Community Chest for this year.

* * *

Doc — "Your mother-in-law's condition necessitates a warmer climate."

Newlywed (After a short reflection) —"You do it Doc. I haven't the heart."

* * *

A mountaineer from North Carolina took a trip to New York—his first visit to a large city. On his return, a friend asked how he liked New York.

"Well," said the traveler, "to tell the truth, I never did get to see the town—there was so much going on around the depot!"

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

- Potash in Southern Agriculture (South)
- In the Clover (Northeast)
- Bringing Citrus Quality to Market (West)
- Machine Placement of Fertilizer (West)
- Ladino Clover Pastures (West)
- Potash from Soil to Plant (West)
- Potash Deficiency in Grapes and Prunes (West)
- New Soils from Old (Midwest)
- Potash Production in America (All)
- Save That Soil (All)
- Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

American Potash Institute
1155 Sixteenth Street
Washington 6, D. C.

Printed in U.S.A.

Better Crops WITH PLANT FOOD

May 1949 10 Cents

The Pocket Book of Agriculture


Make the Good Earth Better
THE AIM AND PURPOSE of Virginia-Carolina Chemical Corporation is to help you make the good earth better. Your profits from your farm depend on how well you conserve and improve your soil.
Terracing, contour farming and strip cropping prevent soil erosion. Plowing under organic matter improves soil structure. Proper fertilization gives the soil crop-producing power.
To you, the selection and use of the best fertilizer is only one practice essential to your success in making your farm a better-paying business.
To V-C, however, the manufacture of the best fertilizer is a full-time job. The extra crop-producing power of V-C Fertilizers is the result of over 50 years of V-C scientific research, V-C practical farm experience and V-C manufacturing skill.
Since 1895, V-C factory experts, chemists and agronomists have constantly tested and developed new methods and new materials, to produce better and better V-C Fertilizers for every crop you grow.
If you want to give your soil the power to produce abundant yields, see your V-C Agent! Tell him you want V-C Fertilizers!
VC FERTILIZERS ®
VIRGINIA-CAROLINA CHEMICAL CORPORATION
401 East Main Street, Richmond 8, Virginia
Norfolk, Va. • Greensboro, N. C. • Wilmington, N. C. • Columbia, S. C.
Atlanta, Ga. • Savannah, Ga. • Montgomery, Ala. • Birmingham, Ala.
Jackson, Miss. • Memphis, Tenn. • Shreveport, La. • Orlando, Fla.
Baltimore, Md. • Carteret, N.J. • E. St. Louis, Ill. • Cincinnati, O. • Dubuque, Ia.

Better Crops with PLANT FOOD

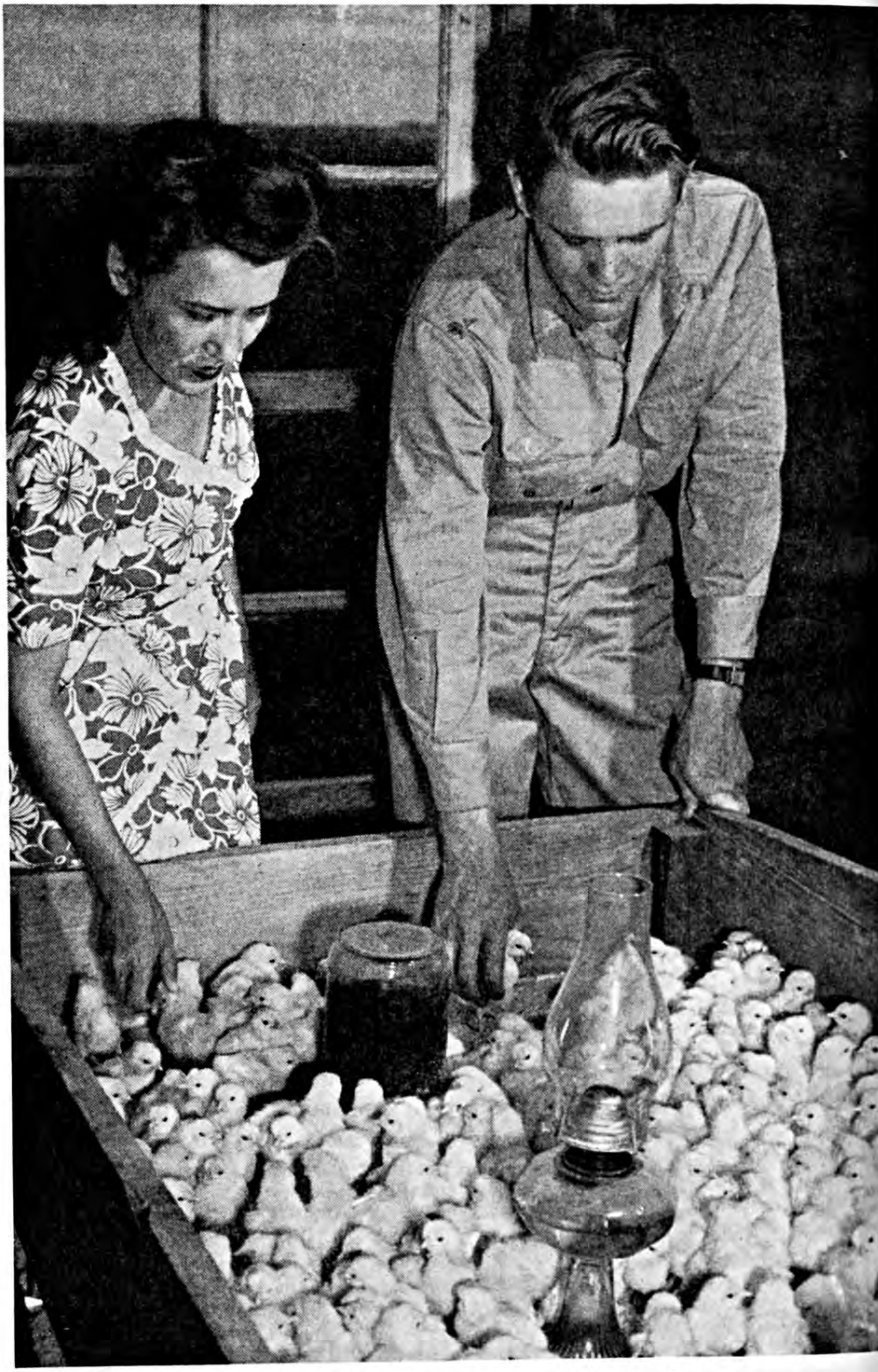
The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 5

TABLE OF CONTENTS, MAY 1949



The Care of Things Small

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON, D. C., MAY 1949 No. 5

Let's join . . . .

The Lactic Litany

Jeff McDermid

INDEED, the gentle Moo-cow has jumped over the moon without leaving her pasture. The old brindle bossy on the dairy farm of my youth was a very simple animal—just a lumpy creature with a flimsy, dish-rag bag and a "nose all over the end of her face."

Similarly, the man who owned her and those who handled her lactic flow were relatively simple folk, seeking the main chance in the shortest possible time without benefit of science or health ordinances.

The accoutrement and working gear necessary to both producer and purveyor of her sustenance were likewise very elemental. On a majority of dairy farms they consisted of a box tie-stall, timothy hay in the manger, a squirt gun full of vile-smelling creosote fly-dope, a battered 10-quart pail, a makeshift stool, a tin strainer and a cheesecloth to put in it, a cool spot in the cellar for storage, a flat tin skimmer, a rusty milk can, and a measuring cup—for the innocent consumers on the routes.

What few community cheese and butter factories we had were also meager in their facilities and indifferent to the rules of sanitation—if there were any. Farmers toted home slopping loads of skim milk and whey, redolent of varied odors and black with swarming flies. The human hand was stuck into the milk business almost up to the elbow, as it were.

Germs didn't fret us. Mister Pasteur, Dr. Koch, and Professor Bang were mere shadows on the path of progress and had but little to do with the dairy business. The diseases of childhood were largely taken for granted, and sometimes parents even deliberately saw to it that their offspring would catch the fever and the rash so as to have it over and done with.

Middle-aged and old people scorned taking a glass of milk, claiming it was infant food. I suspect now that they had other and more powerful reasons not entirely removed from the palate and appetite.

OF course, to some extent in those simple times all manner of food was distributed with reckless indifference to the quality of its standards and its protection from spoilage and waste. Yet in the intervening years more progress has been made and more exacting care has been taken with the production and the dispensing of dairy foods than in almost any other line of eatables.

Foremost reason for this rapid and widespread improvement and complex mechanization within the milk industry can be traced to research by nutrition experts and the teaching of basic food and health relationships in public schools and colleges. In many cases milk was condemned, it is true, for its part in disease epidemics; but by and large, the position which the fruit of the cow has taken at the head of the "must" list for young and old has meant a positive force to expand and enlarge the opportunity for all who hung onto the cow's tail during her leap toward the moon.

You can begin right in the home stanchion of the modern triple-named pedigreed or high-grade bovine, check along the road to the icebox, and find wonders galore in machinery and equipment. If your present-day dairy cow's great grandmother could see what has happened on this streamlined milky way, she would forsooth be surprised enough to lose her cud.

Away back then, you couldn't insult a dairyman by saying that there was water or frogs in his milk, or make him uneasy about rumors of milk-borne maladies. Yet today there is no more sensitive or touchy set of food providers in the country than our dairy farmers and milk-plant managers. Anybody who attempts to stage a campaign with any remote allusions to possible harmful or suspicious reactions from dairy foods is soon in the midst of a battle royal. This is because they know the risks they are taking in handling a perishable, vulnerable food of major value, and they have a huge investment to insure compared to the days gone by.

Your dairy cow of traditional glory is the picture of rare content and smug complacency. She stands knee-deep in lush clover and wears a mask of bland, unworried ease. Not so the ones who feed her, groom her hide, and breed and milk her; or those many others who run the gadgets and the intakes. The price of liberty and free enterprise to them spells eternal vigilance—lest the bad bacteria creep in betimes and put a limp in the leap to the moon.

INTRICATE and vast as the supply and equipment picture within our modern milk world is, its inventory value in relation to the reasonable prices paid for such foods at retail bears a ratio now of 1 to 20. That is, the annual dollar volume of the principal dairy facilities is somewhere near $400,000,000. It is a very small item indeed when set beside equipment for other major consumer goods and vanishes to a speck alongside what we pay for war and peace. On the other hand, this equipment assures your family and mine ample menus of milk dishes every day at a purchase price of $8,000,000,000. And remember, too, that one quart of 4 per cent milk equals 6½ ounces of beefsteak in protein and 11 ounces in total energy.

Let's return then to that complacent cow, whose ancestors of our youth were lucky if they got a bite in the strawstack and a musty bed in the dark barn. Our modern moo-bossy surveys her home surroundings with nonchalance, being used to coddling and balanced meals. The boss snaps her into a fine steel stanchion or puts her into a shiny milking parlor. He uses a bright, non-rust milk pail, or taps her lactic flood with a quiet pulsating machine kept in scrupulous cleanliness.

In the nearest trading town, several country storekeepers have turned themselves into ration wizards and vitamin advisers, peddling the latest lore in brilliant bags to give the "foster mother" of the race her rightful share of everything from A to Z in vitamins, minerals, and all their complexes.

Down a side street in an office that smells like a hospital you seek the counsel of a veteran veterinarian, one who is wise to all the blood counts, the titers, the agglutinations, the injections, and the concoctions which science says are vital to the cow as a mother of a calf and the wet nurse (in absentia) to scores of rosy babies who never puke or run at the nose. He is a tyrant in regard to the dangers and the losses from brucellosis, X-disease, scours, bovine tuberculosis, hemorrhagic septicemia, and kindred curses and killers. His fees run into money sometimes but his services are as essential as those of the host who take the milk and turn it into human appetizers. (In the not-too-distant past my granddad was lucky if he got a vet for himself, let alone for any of the pesky cows.)

NOW that we have produced the milk and had it delivered to the nearest receiving station or manufacturing plant via tank car or refrigerated truck, we find that the job is just begun.

Remember that all through this complex business I hold no brief for the cow herself as a wise animal or one that is aware of her destiny. Personally, after close acquaintance with hundreds of old and young cows on the farm, in the barn, and on the fair circuit, I don't mind in the least confessing that I think she is a low-grade moron. I doubt if she has developed more brain power or acumen than the wild buffalo, or that she is in any sane way responsible for the progress her kind has made in fifty years. I had a cow stand on my foot for ten minutes once—a bare foot, too—and all the lurid language I poured into her fly-bitten ear was of no avail to make her shift.

Cows are like that now, in spite of all the fancy stuff that poets have written about them. Believe me, any improvements you see around the milk circuit belong to other brains and ambition than theirs. In fact, the milk-wagon horse has actually put more intelligence into the milk trade than any dairy cow that ever lived—and see what they've done to him, won't you?

Well, now the snappy boys in the white suits and the shiny faces take a mighty heave at the residue of the cow deposited on their doorsteps. When in due time we see 5 gallons of fresh whole milk transformed at will into 20 quarts of fluid milk, or else about 10 pints of 30 per cent cream, or 21 tall cans of evaporated milk, or about 11 quarts of ice cream, or, take your choice —4 pounds of American cheese, 5 pounds of Limburger, or 28 ounces of butter. This legerdemain is something to marvel about, both in the item of time and the element of cost. You can get any of the figures you want by approaching a lactic expert, but, sad to say, not all of the volume in all of the plants is up to the rigid standards which the leaders of the industry desire and demand. But again I say, they won't get it by asking the cow to shift her foot an inch. It's got to be done by their own initiative.

(*Turn to page* 50)

Some Practical Considerations in the Addition of Micronutrients to Fertilizer*

By George H. Serviss

Cooperative G. L. F. Soil Building Service, Inc., Ithaca, New York

SOIL chemists, agronomists, and horticulturists today agree that we have a secondary and micronutrient problem. They also, with few exceptions, agree that supplying these nutrients, one way or another, will be much more important in the future than it is today. They do not agree as to how these nutrients should be supplied, how extensive the need is, or the rates of application. The ensuing discussion pertains to the problem particularly in the Northeast.

Some people seem to feel that the need for micronutrients is something new. It is the opinion of the writer that it is not and that the lack of one or more of these has been limiting crop yields on certain soils since the day they were first brought under cultivation.

Why the interest in them today? In the first place, agricultural research has progressed to the point where one can readily recognize plant abnormalities indicating a need for micronutrients. Such abnormalities formerly were attributed to the weather, plant disease, insects, or an act of God. In the second place, the need has been increased by two changes in production practices: First, by the decline in numbers, and in many cases total absence, of livestock on a high proportion of intensive cash crop farms. When there is no livestock there is no manure. Farmers have learned how to grow crops just as well without animal manures as with them, but there is no disputing the fact that animal manures provide substantial micronutrient insurance. This is especially true when a high proportion of the feed grain is produced in other areas, as is the case in the Northeast. The second change is in the greater intensiveness of agriculture. With high labor costs and high taxes, farmers strive for higher yields per acre. What was a sufficient supply of micronutrients for 5 tons of tomatoes or 100 bushels of potatoes is not enough for 15 tons of tomatoes or 400 bushels of potatoes. Farmers are applying increasing amounts of relatively pure salts of nitrogen, phosphorus, and potassium to obtain these desired, and in fact necessary, higher yields. This cannot help but increase the need for other nutrients.

Under continuous clean cultivation, leaching losses are heavier than under rotations including a grass sod. Liberal use of lime also has decreased the availability of some micronutrients, particularly manganese. One cannot overlook the fact that the present and potential needs are great enough to make it worthwhile for industry to supply them. Some manufacturers may dispute this last point since it very obviously complicates their manufacturing problems. However, most manufacturers realize that if they are to stay in business, the needs of agriculture must be met.

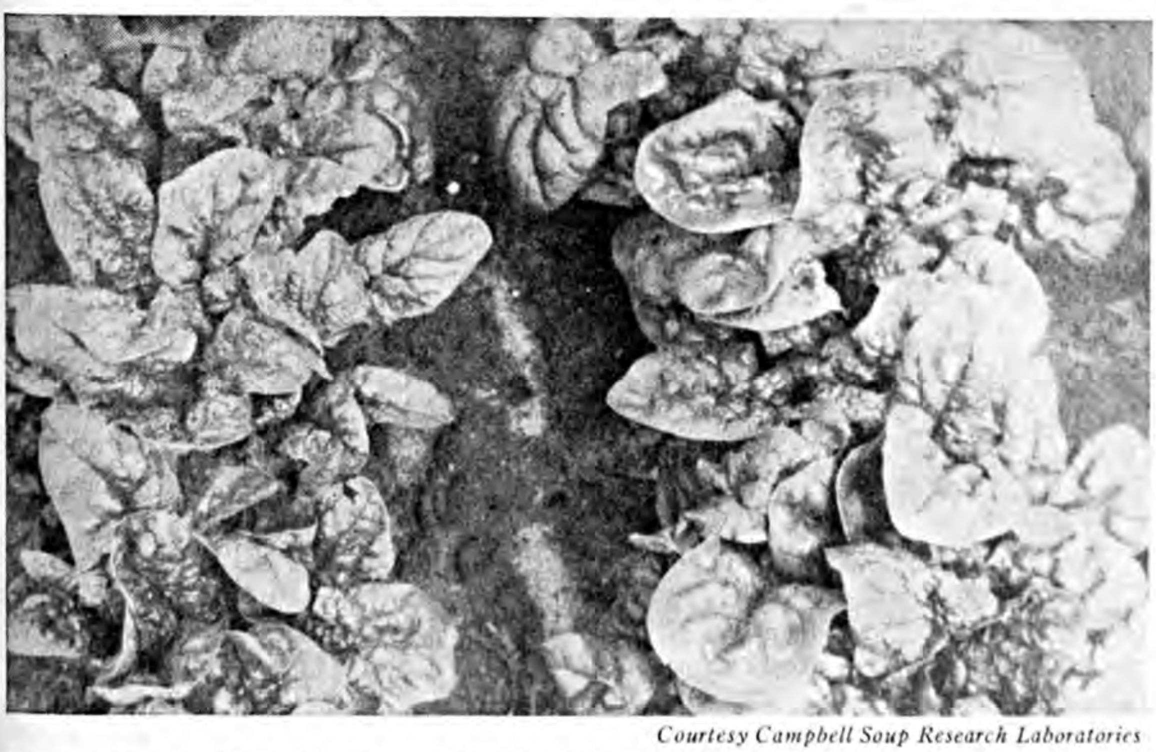
In supplying these micronutrients there seem to be three general methods. Since their use is still in the pioneering

* Presented at Washington, D. C., meeting of the Division of Chemistry, American Chemical Society, Sept. 1, 1948.

stage, this is not unusual. Probably the predominant method used by the mixed goods manufacturers in the Northeast is to keep the micronutrients out of the regular grades and supply them as separate materials. From a plant operation standpoint, this method cannot be criticized. This means, though, that the farmer must make extra trips over his land to apply them. He does not like this since the amounts are usually small and he could do a better job without extra work if they were included in his regular fertilizer.

The next method is the addition of micronutrients to regular grades at bagging. In plants where goods are cured to grade, this means a long ton which requires special tagging and extra weighing at bagging. During the peak of the shipping season it slows down production. Except during the rush period it is a very practical method. Some state laws apparently frown upon it even when everything is fully guaranteed. However, most such mixes must be used within a short time of bagging to avoid poor condition. In plants that mix several grades from bases at bagging, the long ton is not necessary, but the condition problem is even more acute.

A third procedure is the general addition of prophylactic or near prophylactic quantities of one or more micronutrients to regular grades at mixing time. From a plant operation standpoint this is the preferred procedure. Bins are not tied up with extra grades, there are no extra operations at bagging, the goods are cured, and there is no long-ton problem. A proprietary micronutrient mix or an individual's pet formula may be used. One thing is certain—no general agreement as to the make-up of such a mix or the general need for one can be obtained from Agricultural Experiment Station workers. The inclusion of micronutrients in fertilizer, backed by adequate Experiment Station research and strong Extension recommendations as is the case in Florida, and the amounts guaranteed would seem to be the best procedure. This takes care of the needs of agriculture, but presents a serious production problem in the multiplication of grades. The amounts included



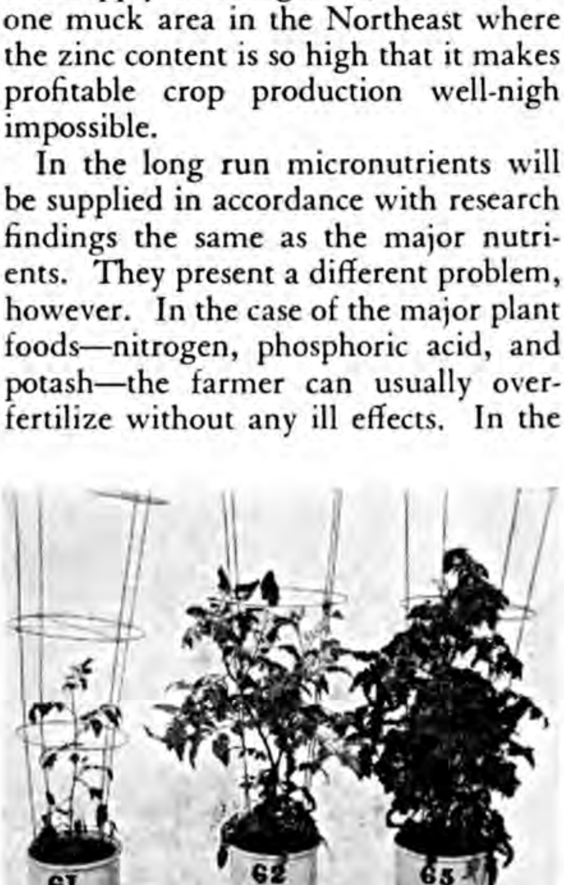
Courtesy Campbell Soup Research Laboratories

Fig. 1. This spinach was grown on freehold sand with pH 6.8. Fertilizer was 1,000 lbs. per acre of 7-7-7. For the better spinach, 20 lbs. of manganese sulphate were added to each ton of fertilizer. The poorer spinach received no manganese.

are backed by guarantees and the farmer is protected.

There must be sufficient demand, though, from farmers before such a program will work, since these nutrients cannot be supplied in the recommended amounts free of charge. It is really a different matter than the inclusion of minute quantities in a "shot-gun" mix. The amounts included are substantial. This does not mean that the general addition of a "shot-gun" mix in small quantities is valueless in all cases. However, it cannot take care of real needs, and, in the amounts likely to be added, can do no more than stave off for a very short period, if at all, the time when larger quantities will have to be used. It also is well to recognize the fact that some soils have an inexhaustible supply of manganese, and there is one muck area in the Northeast where the zinc content is so high that it makes profitable crop production well-nigh impossible.

In the long run micronutrients will be supplied in accordance with research findings the same as the major nutrients. They present a different problem, however. In the case of the major plant foods—nitrogen, phosphoric acid, and potash—the farmer can usually over-fertilize without any ill effects. In the case of some of the micronutrients, boron for instance, he cannot over-fertilize without detrimental effects as the range between enough and too much is small. Also, the proper amount for one crop may be too much for another. Since there are such wide variations in rates of application of the major plant foods, a strong educational program must accompany the use of micronutrients.



Courtesy Campbell Soup Research Laboratories

Fig. 2. The treatments for the tomatoes growing in pots were as follows: No. 61—No treatment; No. 62—3-12-12 fertilizer; No. 65—3-12-12 fertilizer plus 12 lbs. of borax and 20 lbs. of manganese sulphate per ton of fertilizer. The pH of soil is 5.8.

Some Recommendations

To illustrate the problem, consider some Experiment Station recommendations: New Jersey recommends the inclusion of 5 to 10 pounds of borax in each ton of fertilizer. Five pounds of borax costs about 15 cents, and because it is a strong recommendation, it can be easily serviced. However, the fertilizer industry is a low-margin industry, and not many 15-cent items can be added to a ton and still keep it competitive unless the farmer can easily see the value in the resulting crop. This he cannot always do with micronutrients.

For the production of canning beets in the area around Geneva, New York, the standard recommendation is 500 pounds of 5-10-10, 500 pounds of common salt, and 50 pounds of borax per acre. Since there are salt mines nearby, the salt can be obtained cheaply, and since the rate of application is high enough for even distribution with standard equipment, most farmers apply the salt separately. Some, though, want it mixed with the fertilizer, and all want the borax in the fertilizer. This means 200 pounds of borax per ton which certainly gets it out of the "shot-gun" micronutrient class. It is difficult to keep farmers from using any surplus on sensitive crops like beans.

New Jersey strongly recommends sufficient borax in an 0-1-1 ratio fertilizer to supply 20 to 30 pounds of borax per acre per year for alfalfa. New York and Pennsylvania recommend the same

(*Turn to page* 48)

Mississippi Can Grow 100-bushel-per-acre Corn

By D. L. Williams

Coordinator of Research Information, State College, Mississippi

OUTSTANDING progress in producing high yields of corn has been made in Mississippi the last few years. The same basic factors and practices advocated as essential for these high yields the past three years still apply. It seems pertinent, however, to emphasize the necessity for more careful study and consideration of the following: (1) Raising the fertility level to support the maximum expected yield; (2) deepening and conditioning the root zone area for the plants to feed; and (3) conserving for more adequate use the supply of available moisture. It is believed that when these instructions are fully inaugurated, not only will higher dividends accrue for the efforts expended, but a good many hazards in production will be alleviated.

Adequate Moisture

Moisture is still the most acute problem confronting the producers of corn in Mississippi, even though there is a surplus available during our average corn-growing season. This is due in a large measure because so little consideration and emphasis have been given toward finding a solution to it. Someone has very aptly said: "We do not accept the natural fertility of the soil, but supplement it, so why should we continually gamble on the clouds that may or may not drop the moisture that gives life to our plants."

Our leading soil scientists tell us that in a humid climate approximately 152 barrels of water are required to produce a bushel of corn. All recognize the necessity for the plant to transpire a large number of pounds of water for each pound of dry matter produced. This amount varies according to the peculiar and varying conditions of climate, soil, and plant which exist during the growing season. The University of Washington Experiment Station in Bulletin 146 states: "The results of our investigations indicate that any condition which disturbs the normal life processes, be it soil, atmospheric, or pathological, increases the water requirement to just such a degree as it depresses the normal functionings of the plant."

On the basis of 300 pounds of water being required to produce one pound of dry matter, seemingly a fair assumption based on the numerous studies reviewed, it will require approximately 18.5 acre-inches of water to be utilized, or transpired, to produce 100 bushels of corn per acre in Mississippi. During the 4½-month period from April 1 to August 15, the period during which most corn is grown in Mississippi, we receive approximately 21 acre-inches of rainfall. These 21 inches plus 10.5 inches, the estimated amount of water already existing in the first 3 feet of soil on April 1 (20% moisture), give 31.5 inches available for a crop, 13 inches more than are required to produce 100 bushels. Whether or not this adequate and surplus moisture, which is available to us during the corn-growing season, can be conserved for use is the problem.

Ways of reducing this loss of moisture must be found if high yields of corn are to be obtained. Also it seems

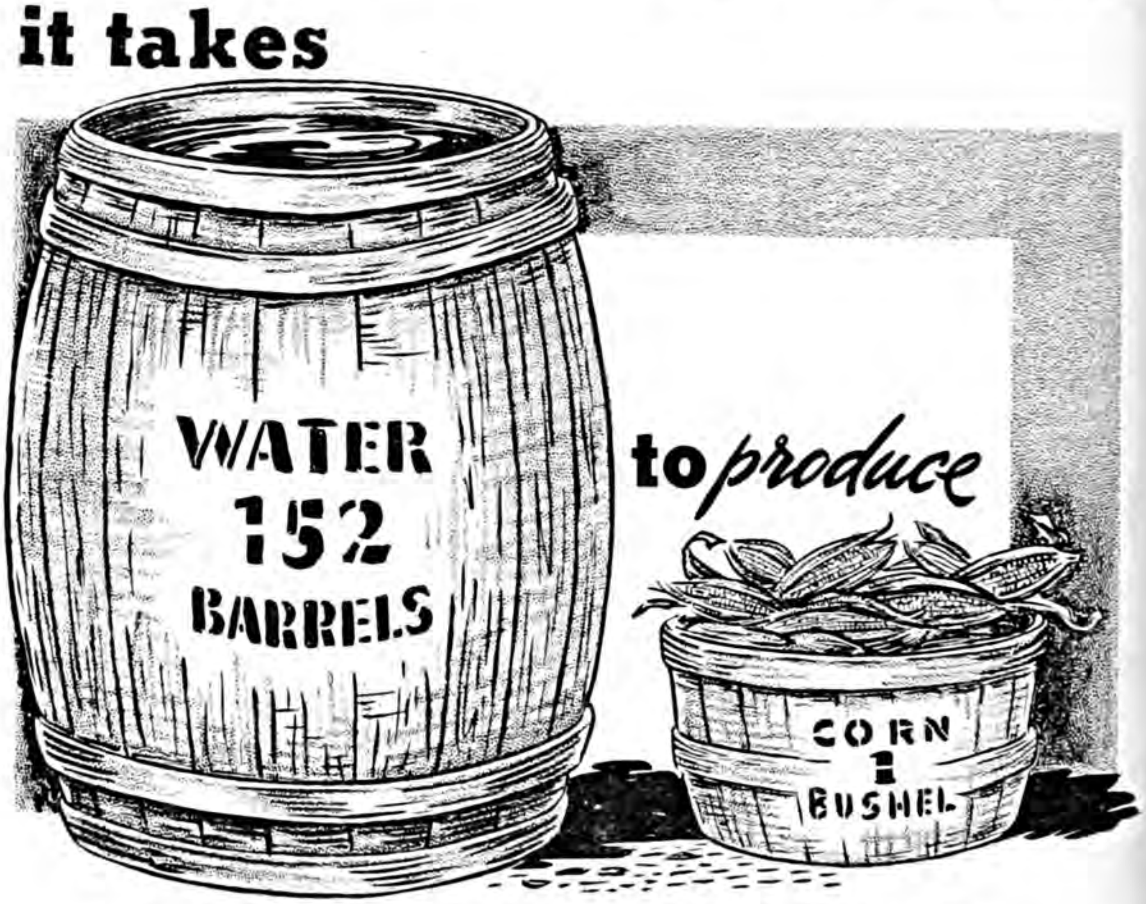


Fig. 1. The amount of water needed to produce one bushel of corn.

logical that yields far in excess of our present-day thinking may be achieved in the future if we can find a way to conserve for use a larger amount of the present moisture supply.

The Purdue University Experiment Station gives in its 60th Annual Report results of a 5-year study, 1942-46, in which an average increase of 7 bushels of corn for each inch of water saved was secured by conservation methods during the corn-growing season. It can be seen that after all other conditions are met a moisture supply may be the limiting factor. A moisture deficiency for only a short time in the most critical stage of the corn plant, which happens about the earing stage, can be disastrous.

Inasmuch as we, in Mississippi, produce corn in a surplus-moisture period, if we suffer too much, we need only charge it to poor moisture conservation and management. Table I presents suggestions which should help in the application of practices to increase the water supply of moisture for corn production. All of these practices, when properly used, have contributed substantially to the supply and more economical use of moisture.

Not overlooked here is the fact that with a thick stand of corn, plus the increased vigor due to heavy fertilization, etc., the total quantity of water required to produce a large number of pounds of dry matter actually will be stepped up, even though the requirement per unit of dry matter is much less. The heavy amount of vegetation quite often may help to add moisture as the following indicates: "Several years ago the late Professor A. R. Whitson of the Wisconsin Experiment Station told me how he was comparing the moisture content in the soil in a soybean plot with that in the uncropped plot. In August the soil moisture under the soybeans was actually higher than in the plot where no crops were growing. This did not seem reasonable, because we realized the soys were drawing heavily upon the soil water and were evaporating much of it into the air, whereas no plants were using water in the fallow plot. At that time we had no explanation for the difference.

"In 1927 the answer came from a Russian named Lebedev who had spent his life studying soil moisture. He found that when the soil cooled during the night, moisture from the air would move into the soil in the early morning and forenoon hours after sunup while the soil was cooler than the rapidly warmed air above the soil. In some tests he found that the amount of water thus entering the soil was equal to about ⅓ of the rainfall in Odessa where tests were made.

"Everyone is familiar with the wet ice-water pitcher and water glass, or knows how cold water pipes in the basement will become wet and even drip on a warm summer day. The soil under a board will be more moist than the adjacent soil. This is not due entirely to the board preventing evaporation, but is due in part to the shading effect of the board in keeping the soil underneath it a bit cooler than the surrounding atmosphere, thus permitting moisture from the air to move into the soil under the board and condense. It is difficult to maintain moisture in a hot soil but it is easy to keep a cool soil moist."—(Geo. D. Scarseth, American Farm Research Assoc., Nov. '47—Better Crops With Plant Food.)

Plant-food Requirements

The results achieved by such a large number of Mississippi farmers in using for corn production the amount per acre of plant-food elements taken from the soil by a 100-bushel crop, warrant repeating this recommendation. It is as

TABLE I.—FACTORS AFFECTING THE SOIL WATER SUPPLY.

Factors affecting soil water supply	Practices found helpful in the conservation and economical use of soil water supply					
1. Preventing rainfall run-off	Terracing	Contour tillage	Increasing depth of root zone	Increase org. matter	Good stand veg. cover	Ridged culture
2. Increasing capacity and water-retaining power	Loosen root zone when compact	Improve structure	Increase vegetation	Inc. org. matter supply		
3. Curtailing evaporation	Good stand shade	Straw-litter mulch	Manure-mulch	Minimum cultivation	Weed control	
4. Decreasing transpiration ratio	Barnyard manure	Liberal chem. fert.	Select good land over poor land	Select varieties		
5. Increasing condensation	Good stand shade	Litter-mulch	Vegetative mulch	Increase organic matter		
6. Using water more efficiently	Time of planting	Select varieties				
7. Artificial application	Irrigation					

follows: Nitrogen 140 lbs.; phosphoric acid 50 lbs.; potash 100 lbs.

It is realized that it is difficult to secure, in many instances, the fertilizers necessary to make up this treatment. It is believed, however, that with proper planning this difficulty often can be overcome. The following combinations will give the required amounts of plant food:

(1) 6 tons Stable Manure
500 lbs. 6-8-8
300 lbs. Nitrate Soda or
150 lbs. Ammonium Nitrate

(2) 6 tons Stable Manure
Excellent Cover Crop
300 lbs. Basic Slag
100 lbs. Muriate Potash
200 lbs. Soda or
100 lbs. Ammonium Nitrate

(3) 6 tons Stable Manure
100 lbs. Superphosphate
100 lbs. Muriate Potash
500 lbs. Soda or
250 lbs. Ammonium Nitrate

(4) 900 lbs. Soda or
450 lbs. Ammonium Nitrate
300 lbs. Superphosphate or
600 lbs. Slag
200 lbs. Muriate Potash

(5) 3 tons Stable Manure
400 lbs. 6-10-5
200 lbs. 25% Potash
600 lbs. Soda or
300 lbs. Ammonium Nitrate

(6) 1300 lbs. 6-8-8
400 lbs. Soda or
200 lbs. Ammonium Nitrate

Cover crop allowances for nitrogen are: Excellent 45 lbs.; good 32 lbs.; fair 16 lbs.

The enlargement of the root-feeding area through the deep application of fertilizer has no doubt paid a higher dividend in the production of corn than has any other practice. This has been especially true during the extremely dry periods. With the fertilizer placed 8 to 10 inches in depth, the roots are attracted to that zone where moisture and plant food are sufficient to sustain necessary vigorous growth for an extended period. Shallow application or sidedressing may be almost worthless in very dry periods.

At the Ohio Experiment Station, Drs. Sayre and Yoder report: "A 100-bushel yield of corn required 142 lbs. of nitrogen per acre, 68 lbs. of which were taken up during each of the months of July and August." It is noted here that 136 pounds of nitrogen were used in 60 days, a period of maximum vegetative growth and critical need. It is doubtful whether this rate of nitrogen use could be accomplished in this short period anywhere with shallow application followed by limited rainfall.

The following statements are highly significant on the value of deep placement of fertilizer to meet the needs of plants during moisture deficiency periods:

"Increased corn yields resulted from

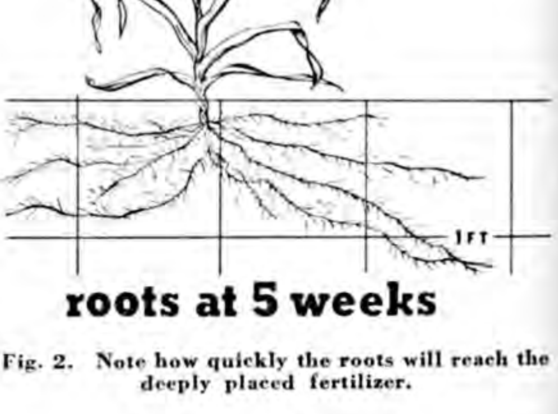


Fig. 2. Note how quickly the roots will reach the deeply placed fertilizer.

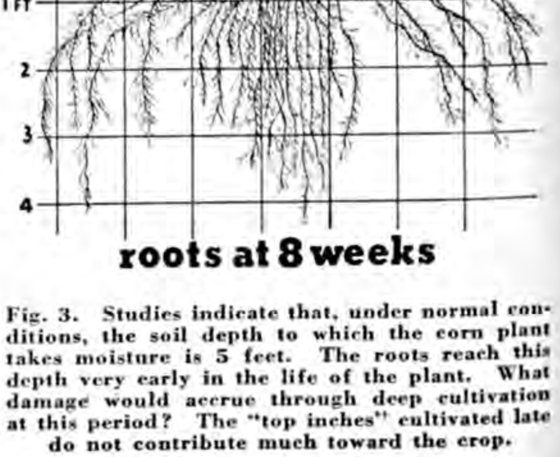


Fig. 3. Studies indicate that, under normal conditions, the soil depth to which the corn plant takes moisture is 5 feet. The roots reach this depth very early in the life of the plant. What damage would accrue through deep cultivation at this period? The "top inches" cultivated late do not contribute much toward the crop.

Fig. 4. R. B. Caldwell, Sr., farmer of Caledonia, Mississippi, discusses with his Vocational Agriculture Teacher, T. E. Ellis, whether to plant his one-acre field to corn again in 1949. During the past three years the yields have been as follows: 1946—104.5 bushels, 1947—108 bushels, 1948—116 bushels.

deep application of nitrogen with dry weather conditions. When adequate moisture was available there were no significant differences in favor of deep application."—Miss. Agr. Exp. Sta. Bull. 454.

"Recent studies have brought out certain advantages of deep application, often designated as 'plow-sole' application. By this method, the fertilizer is concentrated in hills in the bottom of the plow furrow. The fertilizer is then deep enough to be in moist soil during most of the growing season. In dry years, fertilizer is much more effective when applied deeply. The deep fertilizer may not become effective quite so early in the growth period, but it remains effective, if enough is used, until a good harvest is produced. There is also the minimum of soil fixation where the fertilizer is applied beyond the depth of cultivation. Mixing the soil and fertilizer by cultivation is a contributing cause of high fixation."—Dr. R. E. Stephenson—Oregon Agr. Exp. Sta.

"Drought damage to Missouri corn in the summer of 1947 represented a shortage of fertility because of dried, shallow surface soils overlying infertile clay subsoils and not because of a shortage of water for this crop. These facts were demonstrated by the absence of drought damage on the experimental plots given enough extra surface soil to double the normal depth of the soil. There was likewise no drought damage to the corn crop where liberal fertilizers were put down into the subsoil a few inches below the surface soil by means of the subsoiler on a TNT plow."—Dr. W. A. Albrecht, Chmn. Comm. on Soils—Univ. of Missouri.

All of the experimental evidence with which we are familiar indicates that higher yields are obtained if the corn is planted early, as early as possible after the danger of frost has passed and as soon as moisture conditions will permit. The month of June is considered too late for consistent maximum yields in Mississippi.

Land Preparation

Increasing the depth of the root zone, plus the proper placement of the needed fertility in this zone for its maximum use by the plants, should demand our closest attention in land preparation. Extreme caution should be taken in conditioning the seedbed to see that the heavy rates of fertilizer applied will be far enough below the seed, when planted, so as not to interfere with proper germination. The following statements may suggest the importance of giving more consideration to land preparation: "Turning the soil upside down to great depths accomplishes nothing, when we plow just for the sake of plowing. However, when we plow to feed our crops, deep plowing takes on added significance. When lime and fertilizer are plowed down to the zone where roots feed when the topsoil becomes dry, we make productive soils out of poor soils."—C. M. Woodruff, Soils Dept., Columbia, Missouri.

V. A. Tiedjens, Director of the Virginia Truck Experiment Station, Norfolk, Virginia, said: "I have made the statement to growers that many soils in Tidewater, Virginia, should yield 300 bushels of shelled corn per acre. I realize that we have set our sight pretty high but I hope to demonstrate that with the lime requirement properly satisfied to a depth of two feet, with plowing at least 10 inches deep, and with a ton of fertilizer plowed under, it is possible to get these high yields."

There is ample evidence available to indicate that any time spent on cultivation beyond that of controlling weeds could be more profitably spent on some other farm activity. Oftentimes the destruction of roots by excessive cultivation causes damage to the crop. Mixing the soil and fertilizer by cultivation is a contributing cause of high fixation. There is evidence to indicate that corn on poor land responds better to cultivation than does corn on good land. This can be attributed largely to increased aeration provided for the poor land. A good deal of our cultivation, no doubt, could be dispensed with, profitably, as the following would indicate:

"In the poor-land series, good cultivation resulted in yields nearly 30 per cent larger, on the average, than were obtained under no cultivation. In the rich-land series the average yields from good cultivation and no cultivation were

(*Turn to page* 42)

Fig. 5. Colored veteran Odis Lyons, Jr., shows his 100-bushel-corn project to his instructor, Harvey Rodman. This corn was planted on an acre of well-drained bottomland on April 19, 1948, and fertilized with 400 lbs. 33½% ammonium nitrate, 100 lbs. nitrate of soda, 200 lbs. 50% muriate of potash, and 300 lbs. 18% superphosphate. This acre of Dixie 17 corn has been estimated to produce over 125 bushels per acre. A total of 59 Negro vocational agriculture students exceeded the 100-bushel objective during 1948 in Mississippi.

The Soil and Human Health

By B. A. Rockwell

Pennsylvania Farm Bureau Cooperative Association, Harrisburg, Pennsylvania

IN the 1947 May issue of the *Coop. Review*, there appeared an article entitled, "Soil Is Our Life." One statement in this article read as follows: "Soil grows grass, cow eats grass, grass produces milk, baby drinks milk, baby thrives and grows, or does he?" The fact is, baby responds to the milk diet only to the degree in which the cow was able to put into her milk the growth factors which were in the grass and which the grass received from the soil. Cows have no biological apparatus to put ample levels of calcium and phosphorus in baby's milk, unless the food which the cow eats contains these elements. From this fact, the broader inference is that depleted soil could be responsible for dietary deficiencies and that food grown on such soil, even though quite abundantly consumed, could be the primary cause of a multitude of human diseases.

Since making this statement, the writer has been searching for results of authoritative research which would prove this inference. Finally, this search was rewarded by the discovery of a publication in which G. T. Wrench, M.D., of London has summarized and compiled in readable form the results of different researchers inquiring into the cause of health in contrast to the fragmentary conventional type of research—the various cause or causes of disease in general. Dr. Wrench's summary was published in 1938 and proves quite conclusively that the primary cause of disease is food.

Now to orient our thinking, let us quote the Doctor in his brief on the medical profession. "It should be clearly understood that the Doctor is one so saturated with peoples' illnesses and ailments that, if thoughtful, he is almost forced to look upon life as something burdened with these defects. One is caught in the meshes of the problems of disease from which one will not be able to free his mind for the rest of one's life. I sometimes used to walk about London with my eyes down and the question "Why" upon my lips until I saw the pictures of many maleficent objects of pathology upon the pavements, so vivid was the impression which the microscope and the post-mortem room made upon me. Here was indeed a truly prodigious opponent, the problem of disease, why man is so affected.

"After debating the question, why disease, why not health, again and again with my fellow students, I slowly came to a further question—why was it that the medical students were always presented with the sick and convalescent and never with the ultra healthy? The teaching was wholly one-sided. Moreover, the basis of our teaching was that which is dead from disease. We made no studies of the healthy, only the sick. To research in health was a complete reversal of the accustomed outlook. To propose reversing this was like asking one to stand on one's head to get the right point of view."

Dr. Wrench, with this upside down perspective, as it were, applied for scholarships in research, requesting in his applications to study the health of the healthiest people he could discover. Of course, he did not succeed in securing any such research scholarships. So, finally, he settled down as a regular practitioner, remained interested in very healthy people, and always maintained an academic interest in the old question —health, why not?

By studying the flight of birds in the air, we have made machines which will carry us through the air faster than sound travels. Therefore, by studying the healthiest people in the world, we might learn how to become healthy ourselves.

If an individual were given the choice between excellent, vibrant health, able to work and generally enjoy life without riches, or continuous poor health with its accompanying miseries but with fabulous wealth at his disposal, he, if his intellect even aproached normal, would choose health in preference to sickness and riches. Health, perhaps, is the most precious of life's gifts, greatly to be desired by everyone. So, let us flip "Old Man Conventional" upside down, reverse our approach and for a few minutes, look in upon the cause of health rather than the causes of disease. The guinea pigs in this research, which is to be related, were the people of the State of Hunza situated in the northernmost part of India. In studying the reports of various travelers, doctors, and researchers who have mingled with the Hunza people, one conclusion is very obvious. The Hunza people were, at the time these observations and experiments were made, the world's most healthy people. So why this perfect health, magnificent physiques, and untiring vigor?

To better introduce the reader to these super-duper physical beings, we shall quote from reports: Colonel R. F. Schomberg, who for eight years had occasion to visit the Gilgit Agency and saw much of the Hunza said, "It is quite a usual thing for a Hunza man to walk 60 miles to Gilgit at one stretch, do his business, and return direct." Aurel Stein, the illustrious traveler, was amazed on the morning of June 25, 1903, to see a Hunza messenger return from a trip, having walked 287 miles since June 18, or exactly seven days. The messenger was quite fresh and undisturbed and did not consider what he had done unusual. In fact, the modern American man, after having walked a few city blocks, would show more fatigue. General Bruce of Mount Everest fame recounted in 1928, "I found the Hunza people very charming and perfectly companionable. They are as active as any people can possibly be." Captain C. Y. Morris, who explored the Hunza valleys and glaciers testified, "They were, I think, the most willing set of men with whom I ever traveled. They know neither fear nor the weariness which spoils the will."

Robert McCarrison, M.D., a practicing physician in the Hunza State for a number of years, wrote in his book, "My own experience provides an example of a race unsurpassed in perfection of physique and freedom from disease in general. The seven years I spent in their midst was confined chiefly to treatment of accidental lesions. I never saw a case of asthenic dyspepsia, of gastric or duodenal ulcer, of appendicitis, of mucus inflammation of bowels, or of cancer. Among these people, the abdomen, over-sensitive to nerve impressions, to fatigue, to anxiety or cold, was unknown. The consciousness of this part of their anatomy was related solely to the feeling of hunger. Indeed, their buoyant abdominal health, since my return to the west, provided a remarkable contrast to the dyspeptic, gastro-intestinal suffering from faulty food eating and the colonic lamentation of our highly civilized communities."

Mental speculation for a plausible answer to this physical supremacy would, no doubt, consider environment, heredity, food, and perhaps soil as contributing factors. Therefore, let us consider these factors in the order mentioned.

Environment

To start the inquiry into environment, as it pertains to health and vigor, two environmental extremes and their products should be considered. Climate is frequently upheld as a cause of disease or of health. Anyone who has seen the perfect physique of a Bengal tiger in the heat of the African jungle and maybe also a polar bear in the frigid arctic will have to admit that each of these animals is a very rugged individual, even though the environment of each is very different. Those who have watched various races of man in different lands must doubt the factor of climate as of great importance in physique and health.

Now, let us turn our attention to the slum clearance project of Stockton-on-Tees in 1927, under the direction of Dr. G. M. McGonigle, local health officer. After the new housing project was completed, 152 families (710 individuals) were moved into their new homes, while 289 families (1,298 individuals) were left behind in the slum area. Here, then, were contrasting environments, the new and the old. Everyone believed that the transfer from the old to the new would be a betterment. But Dr. McGonigle watched. Much to his amazement, an odd thing was happening and the expected success did not materialize. Health instead of improving in the new area began to deteriorate, whereas that of those left behind in the slums did not. For the first five years, the death rate in the new area was 45% greater than it had been for the same group during the previous five years they were in the slums. The increase was not due to any peculiarity of infant mortality, epidemic, or other recognized cause. It was there just steadily throughout, and it represented an increase in the various age groups, from 0 to 10 and 10 to 65. There was also an increase of one third in still-births. This death rate then was real and beyond the probable extent of fortuitous variation.

To what was it due? The better housing? It seems absurd that something better should prove something worse. Finally, Dr. McGonigle came up with the answer, to wit: When the people moved from the slum area to the new area, they had to pay more for rent and had an average of 24% less cash to buy food. McGonigle was therefore, forced to the conclusion that the deterioration of food led to the deterioration of health. Here was a case where primary things were forgotten. Men live primarily by food, not by housing. The experiment emerged as an indictment of putting housing, which of course is good, prior to food in a policy of health. Both are good, but food is primary.

Schomberg, during his travels in India, not only visited the Hunza State but other areas which included the Ishkoman valley which is located about 60 miles west of Hunza. Quoting Schomberg, "The more I saw of the Ishkomanis, the more I was struck with their degeneracy; they were poor in physique and lacking in brains." So the difference of the Ishkomanis and the Hunza cannot be due to their environment, since the two people are not North and South, but East and West.

Heredity

It is now time to ponder the heredity factor and its bearing on disease. The medical faith goes back at least as far as Hippocrates and therefore, extends over a period of 23 centuries. During all this time, there has been an unfaltering belief in predestination, which means that if parents died from tuberculosis, it has been determined beforehand that the offspring is doomed to contract tuberculosis. The same sort of tradition applies to cancer and others. Certain blemishes and peculiarities, such as odd fingers or toes, albinism, mental weakness, and the inability of the blood to clot, are inherited, recurring again and again in families. Of course, the last two, feeble mindedness and haemophilia, are sex linked characters which are transmitted by mothers to sons. The point then that needs clarification is whether or not albinism, an extra toe or deformity, and mental weakness are afflictions, torments, or actual diseases. If we can correctly assume that germs, microbes, bacteria, and viruses incite disease, then how can we square our thinking with the contention that an inherited deformity or mental weakness is a disease, since a fifth toe or a feeble mind contains no disease-producing germs?

Even cancer has been considered a disease, which belief is very questionable. Until recently, scientists believed that cancer cells did not increase by nuclear division like normal cells. Just recently, Dr. Wilton Earl, National Cancer Institute, Bethesda, Maryland, produced through nuclear division, a colony of cancer cells from one original cancer cell. This discovery indicates that cancer may not be a disease at all, but a mutation of cells. Mutations are usually caused by some external stress or force which always comes from without and never from within. Therefore, an individual starts life absolutely free from any internal cause of cancer.

There is much experimental evidence the results of which just about explode the predestination bubble, but for brevity the results of only one case will be related. This case deals with the Papworth sufferers from tuberculosis, mostly in the form of consumption of the lungs. All patients at the Papworth settlement had sputum pots which they used and the infected sputum was made innocuous. In Papworth, there were many married couples. The children of these tubercular parents lived in the settlement. The children were in frequent contact with tuberculosis but were protected first by the spitting pots and flasks to prevent mass infection, and, secondly, by a wholesome diet which maintained in the children the resistance to the disease. Now comes the outstanding fact.

After the Papworth settlement had thus existed for 20 years, not one child of these married couples ever developed any form of tuberculosis. Quoting Sir Pendrill in his 1936 report, "Our experience proves that no tubercular disease need be transmitted so long as village settlement conditions of housing and employment are properly utilized."

Any question of "heredity" is generally discredited. In face of this testimony to the resistance to tuberculosis brought about by a wholesome diet and other preventive measures, the textbooks put forward "predisposition" as a widely accepted medical tenet. So, if we assume that in the absence of germs, microbes, bacteria, etc., there would be no disease, then in the sense in which "inherited" is used in biology, there are no inherited diseases. An external cause is necessary.

Another interesting sidelight is to learn of the importance of a good start at the time a life is conceived. If per chance the sperm and ova cells originate from undernourished, sickly individuals, these cells will be weak and the new life which begins from their union will be weak. If the mother is undernourished during pregnancy, the child will be born proportionally weak. Regardless of how much we try, this weakness can never be completely overcome.

The Hunza women always eat a very wholesome diet, the character of this diet to be exposed later. Their children are strong at birth. At the time the observations were made, it was discovered that the Hunza mothers had been in the past, and still were, breast feeding their children for three years to further secure the excellent start. To become pregnant during lactation was considered unfair to the suckling child and socially had attached to it a sense of indecency. Briefly then, through improper living and more especially faulty food, deficient in life-giving factors, a general weakness is handed from parents to offsprings. Weak plants or animals are always more susceptible to disease than healthy, vigorous individuals, but the parent does not doom the offspring to cancer and tuberculosis. In short, owing to one's parents one can be sickly, but one cannot inherit any specific disease. The genes or birth factors of character know nothing of disease.

Food

We now are where the third factor, Food, should be investigated in our

(*Turn to page* 45)

Fig. 1. The Grand Champion Potato Grower for Ontario in 1948 was Eric Gallagher (center) of Everett, South Simcoe County. His yield was 733 bushels per acre. He is pictured holding the trophy, while his father, Cecil Gallagher (left), looks on as R. E. Goodin congratulates him. The award is based on yield, quality, exhibit, and cooking test.

Five Years of 500-bushel Clubs

By R. E. Goodin

Potato Specialist, Ontario Department of Agriculture, Toronto, Ontario

IT was an evening in April 1943. A drizzle of rain was falling, and the air was cold and raw. A small group of potato growers met in the Agricultural Office at the Village of Alliston in Simcoe County, Ontario. Although a general meeting of growers for the area had been announced, very few attended. Perhaps the weather was not entirely to blame, for the farmers of the Alliston area had produced potatoes in large quantities, year after year, for at least a half a century.

These growers had experienced good years and some not so good. In the early Thirties they had sold high-quality potatoes at 25 cents for two 90-pound bags, loaded on cars. Some of the same growers had received six dollars a bag or more after World War I. Growers could recall when seed potato certification was introduced for the first time. They could remember when the Dooley variety was introduced and became generally grown for the late crop. As time went on, this variety was replaced by Katahdin, Chippewa, and Sebago. The growers realized that diseases, such as late blight, fusarium wilt, rhizoctonia, scab, and bacterial ring rot, had periodically taken their toll. They knew the insects such as leafhoppers and aphids had become more numerous and their depredations more costly.

But these growers were no different from growers in other potato-producing areas of Old Ontario. Their yields per acre in general had been on the decrease. With the average yield for the Province at less than 100 bushels per acre, how could anyone make money from potatoes, especially with high labour costs?

If the selling price was really substantial, the situation would be different. However, competition from areas where higher yields were obtained kept the market from reaching that desired price level. Although the meeting was called to discuss ways and means of improving the potato crop, the group easily might have broken up, because of disappointing attendance, and thus left indefinitely the situation as it was. But those present were concerned about sprayers, dusters, two-row planters, weeders, pickers, storage. They knew that almost every human being, which included the masses in our large consuming centres, would always need good potatoes; and Simcoe County soil, particularly in the vicinity of Alliston, should be capable of profitably producing high-quality tubers.

Perhaps the answer was more organic matter, more fertilizer, better seed, improved cultural methods, and protection of the growing crop. Finally, as an encouragement to adopt these modern approved methods, a 400-bushel club was suggested as a project of the local Crop Improvement Association. The idea of a crop objective seemed to appeal. Why not 500 bushels per acre? The higher objective sounded well, although most growers felt that it couldn't be achieved. A representative of a commercial company offered a solid gold watch to the winner, as the first prize. Rules and regulations were drafted for the South Simcoe Potato Growers 500-bushel Club, the first of such clubs to be organized in Canada.

The early announcement mentioned the following objective: "It is the desire of the committee to bring about as great an increase per acre as it is possible to obtain."

During the season, growers vied with each other; they enquired about methods being used by fellow competitors; they ventured on naming the prize winners; and visualized individual yields. At the same time, close observation and attention were given to their own crops. Neighbours took an interest. Visitors to the area were impressed with the friendly atmosphere and the lively attitudes of competitors. Finally, measurements and weights were taken; yields were calculated; and results made known at a well-attended potato growers' banquet. Three growers from a total of 24 had obtained yields slightly over the objective of 500 bushels.

Fame soon spread, and it carried a challenge. Enthusiasm was spontaneous. Growers in other areas were anxious to try their skills at producing maximum amounts of "Man's Greatest Food," on their own farms. As a result, growers in 11 counties and districts organized similar competitions, and 194 competitors finished off that fall with an average yield of 330 bushels per acre.

The experience gained fascinated those taking part. Winners counted their blessings, and non-winners firmly resolved "to do better next time." In the meantime, others were making preparation, and so the next year brought more competitions and more interest. Momentum increased with each succeeding year. Although statistics in this case cannot adequately convey the over-all progress in potato production, the following briefly summarizes further development.

Year	No. over 500 bu. per A.	No. over 600 bu. per A.	No. over 700 bu. per A.
1943....	3	....	....
1944....	17	4	....
1945....	3	2	....
1946....	52	6	....
1947....	41	12	1
1948....	69	18	2

The number of both clubs and competitors grew, as indicated by the following summary:

Year	No. of clubs completing contests	No. of competitors completing contests	Average yield per acre
1943....	2	36	– bu.
1944....	11	194	330 "
1945....	12	207	266 "
1946....	15	282	379 "
1947....	16	275	392 "
1948....	21	394	392 "

In addition to prizes for quantity, several clubs featured substantial awards for quality and selected exhibits. Following the product one step further towards the consumer, one club allotted a portion of their prize money last year to "condition of potatoes in storage." Cost of production records are kept by many and Individual Certificates of Merit are provided to each grower attaining the objective.

Potato growers' annual banquets have become popular features in the life of several potato-growing communities. Eleven such friendly get-togethers were held in 1947, with an attendance of approximately 1,500. These occasions provide opportunities for presentation of prizes, and the programme usually features outstanding speakers and entertainment. Top growers in county and district contests are eligible to compete for championship honours for the Province, based on yield per acre, quality, and selection of an exhibit consisting of one bushel.

As might be expected, several important improvements in cultural and fertilizer practices have been developed as a result of these competitions. Many good growers, after plowing their clover sod in preparation for the potato crop, seed it with fall rye. Usually the rye is fertilized with 200 to 300 pounds of

(*Turn to page* 41)

Fig. 2. Planting a crop in South Simcoe County at Alliston. J. Nicol Wilson, owner, is on the tractor with his son. In 1947, Mr. Wilson planted more than 500 acres on a custom basis with his two-row planter.

What Is Happening to Wisconsin Soils?

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

WISCONSIN farmers have been practicing a system of intensive cropping for a period of nearly 100 years. Our soils have been steadily losing plant food in the sale of dairy products, livestock, and cash crops. Not only have we been cashing in on our soil's fertility, but we have been losing our precious topsoil at an alarming rate. Those of us who years ago had caught a glimpse of what was happening to the soils of Wisconsin became greatly concerned. We were seriously asking the question "How long will the soil on our farms hold out at the rate we are mining and losing it?"

In the early days of my extension work in Wisconsin I used to make the statement that after another 50 years of farming at the rate at which soil fertility was being used up and the actual soil being lost, there wouldn't be any soil or farms left in the hilly areas of western Wisconsin, unless something was done about it. And yet, many of our agricultural leaders in those early days were complacently telling Wisconsin farmers that they had nothing to worry about—that our great livestock system of farming would maintain the productiveness of their farms. "Manure," "Legumes," "Crop Rotation"—all those words they thought were synonymous with a system of soil fertility maintenance and permanent agriculture.

But even where losses of soil by erosion had not been too severe, there still had been an insidious and continuous drain on the fertility of the soil. We did shift from a system of wheat farming to a system of livestock farming. But what happened as a result of this shift? Simply this: we broke up more of our hillsides; we grew more and more corn to feed our beef cattle and hogs, more and more corn to fill our silos and to feed our dairy herds. We did rotate our crops, but in the corn-grain-clover program of growing feed for our livestock, it was still true that two out of three or four years our fields were wide open to the forces of wind and water erosion.

Thirty years ago I was making such statements as this: "Something must be done to awaken Wisconsin farmers to the seriousness of their soil problems and get them started on a program of soil building and fertility maintenance." "I predict that the future prosperity of Wisconsin farmers will be measured by the extent to which they follow out a soil-improvement program." Chapman, people used to say, was an alarmist and a calamity preacher, overly excited about the need for fertilizers. His talks, they said, were about 90% enthusiasm with few facts to support his statements.

But even in those days I did have plenty of supporting evidence from our demonstrations to show that fertilizers could be used with profit; and it is certainly true that the thousands of field demonstrations which we have since carried out have given us positive proof that commercial fertilizer can be used with profit on a high percentage of the farms in Wisconsin.

Our program of whole-farm demon-

Fig. 1. The deep placement of liberal amounts of high-nitrogen fertilizer is recommended where corn or other deep-rooted crops are to be grown on land of low fertility or where little or no manure is available. Here on the Paul Bartels farm in Grant Co., Wis., the application of 800 lbs. 8-8-8 per acre with an attachment on the plow plus starter fertilizer 2-12-6 in the hill resulted in a yield of 108.7 bushels per acre as contrasted with 76.0 bushels when starter fertilizer only (2-12-6) was applied. At $1.40 per bushel, the extra 32 bushels made a profit of $25.74 over and above the cost of the fertilizer.

strations, set up in cooperation with T.V.A. in some 35 Wisconsin counties on approximately 375 farms, has given us a great bank of factual evidence to support our recommendations.

The findings of our experiment stations at Hancock, Marshfield, Spooner, and Ashland Junction, as well as the more recent results secured from experimental plots located in Clark, Barron, and Dodge Counties, have likewise given us a mass of irrefutable evidence and show conclusively that our soils are running low in their reserves of available plant food.

Not only have we been losing phosphorus in the sale of milk, livestock, and cash crops, but potash and nitrogen have been wasted and lost from our livestock farms in the careless handling of stable manure. The chemist tells us that approximately 75% of all potash and nearly 50% of the nitrogen in animal manures are contained in the urine. Loss and waste of liquid manure result in tremendous losses of potash and nitrogen. When added together, the combined loss incurred in the feeding transaction plus losses in handling of manure amount to approximately 60% of the nitrogen, 50% of the phosphorus, and 55% of the potash contained in crops harvested and fed to livestock. The organic matter reserves of our soils in Wisconsin have been and still are being depleted.

Based on the results of the hundreds and thousands of soil tests and field demonstrations, we now are recommending that potash be used in addition to phosphates for grain and legume seedings on a high percentage of Wisconsin soils.

Soil and Field Tests Show Need for Potash

The average of 166,464 soil tests made in our laboratories during the past five years showed 59% of these samples to be acid, 71% deficient in available phosphorus, and 79% deficient in available potassium. Thus it

Fig. 2. Some nitrogen can be used with profit on at least 50% of the 3¼ million acres of grain grown on Wisconsin farms, provided adequate amounts of phosphate, potash, and lime are applied. Test plots on several hundred farms during the past 4 years show that there is less danger of lodging with the new stiff-strawed, disease-resisting varieties of oats. Seedings of clover and alfalfa made a strong, vigorous start in the early part of the season on the "high level" fertility plots and were able to withstand considerable competition with the nitrogen-treated nurse crop. Pictured is a field of Clinton oats on the Green County Hospital Farm, Monroe, Wis., where with nitrogen the 0-20-20 plot yielded 124.6 bushels per acre and no lodging occurred.

Yields: 0-20-20 at 500 lbs. plus ammonium nitrate at 100 lbs. = 124.6 bu. per acre
0-20-20 at 500 lbs. only = 100.5 " " "
No fertilizer = 80.3 " " "

appears that nearly 60% of our farm lands are still in need of lime, even though Wisconsin farmers have applied over 16 million tons of liming materials during the past 15 years. Furthermore, these soil tests now indicate a relatively greater need for potash than for phosphate.

Our field demonstrations with fertilizers support the findings of our soil tests. In Table 1 we see the average of 735 grain demonstrations carried out over a period of 16 years, and here we note that even where the entire cost of the fertilizer is charged against the increase in the yield of grain, there is

TABLE 1.—AVERAGE OF 735 GRAIN DEMONSTRATIONS (16 YEARS INCL. 1948) WHERE AVERAGE YIELDS OF 0-20-0, 0-20-10 & 0-20-20 PLOTS ARE COMPARED. (YIELD DATA INCLUDE THE PLOTS FOR 1945, 46, 47 & 48 WHERE AMMONIUM NITRATE WAS APPLIED AS A TOPDRESSING IN ADDITION TO THE 0-20-0 AND 0-20-20 TREATMENTS.)

Treatment	Average rate per acre lbs.	Average yield bu.	Increase yield bu.	Average yield straw lbs.	Increase straw lbs.	Value of inc. grain, & straw	Cost of ferti- lizer	Net profit per acre
0–20–0	235	53.06	10.57	2,551	506	$10.24	$3.56	$6.68
3 (0–20–10) / (0–20–20)	235	59.12	16.63	2,760	715	15.92	5.18	10.74
Check	....	42.49	....	2,045	....	....	....	....

Fig. 3. Liberal application of fertilizer and lime has made medium red clover a dependable crop in Wisconsin. Here on the Leo Wellman farm at Marshfield, the application of 300 lbs. of 0-20-20 per acre the year this clover crop was seeded resulted in a 21-bushel increase in the field of oats and a doubling of the yield of clover hay the year following. Wisconsin farmers are now using over 400,000 tons of commercial fertilizer and over 2 million tons of lime annually.

a profit over and above the cost of the fertilizer. The combination of potash with phosphate has given by far the largest net profit.

Where the residual benefit of the fertilizer to the hay crop has been measured, the yields of this crop have been greatly increased. In fact, we note that the relative response to potash on the hay crop is greater than shown the first year on the grain. (See Table 2.) Fertilizer applied at the time of seeding gives our new seedings greater vigor and the ability to withstand severe winters.

We are now recommending the use of some nitrogen for small grain as a supplement to phosphate and potash. Opportunity for the use of nitrogen fertilizers in our system of farming in Wisconsin opens up new crop production horizons. The factories built for

TABLE 2.—RESIDUAL CARRY-OVER BENEFIT TO HAY CROP (16 YEARS INCL. 1948). SHOWING TOTAL AVERAGE VALUE OF HAY, GRAIN, AND STRAW, AND PROFIT OVER COST OF FERTILIZER (180 PLOTS).

Treatment	Rate per acre lbs.	Average yield grain bu.	Value of inc. grain & straw[1]	Average yield hay lbs.	Lbs. increase hay[2]	Value of inc. grain straw, hay	Cost of ferti-lizer	Net profit per acre
0–20–0......	235	53.6	$11.46	4,748	1,343	$26.23	$3.56	$22.67
[3](0–20–10).... (0–20–20)....	235	58.2	16.00	5,506	2,101	39.11	5.18	33.93
Check........	....	41.6	....	3,405	....	....	....	....

[1] Oats and barley figured at average value of 85¢ per bushel; straw at $5 per ton.
[2] Hay figured at $22 per ton.
[3] The yield data for the 0-20-10 and 0-20-20 plots are averaged together.

the production of gunpowder during World War II are now working overtime in the production of potential food, not only for our former enemy, but for ourselves as well. New factories for the production of synthetic nitrogen are being planned in this country. It is my belief that one of the greatest opportunities for increased production of food and fiber crops lies in the increased use of nitrogen fertilizers.

Table 3 shows the averages for 111 grain plots where a nitrogen fertilizer was used to supplement phosphate and potash.

The question now being asked is "Will Wisconsin soils hold out?" My answer is yes—I am now confident that they will, and for the reason that an entirely new concept of the role of fertilizers in soil conservation and soil fertility maintenance has become a part of the thinking of not only our soils and crops specialists, but of city people and farmers themselves. The unprecedented and spectacular increase in the use of commercial fertilizers in Wisconsin and other Midwestern states during the past few years is the best evidence that farmers now appreciate the great opportunity for crop production increases and profit through the use of fertilizers. Six new fertilizer factories have been built in Wisconsin, with three additional plants recently brought into production just across the Mississippi River on the Minnesota and Iowa side. These factories are making available thousands of tons of commercial fertilizer for use on Wisconsin farms. Tonnage figures show that 404,121 tons of commercial plant foods were purchased by Wisconsin farmers in 1948, and this is nearly 10 times the amount of fertilizer used in Wisconsin in 1939.

Along with this great increase in the use of fertilizers has been the tremendous production and use of agricultural lime. In the past 15 years a total of better than 16 million tons of liming materials have been applied to the acid soils of Wisconsin. Clover again flourishes on our farms. For a period of more than 10 years we have har-

(*Turn to page* 43)

TABLE 3.—AVERAGE YIELDS FOR 111 GRAIN PLOTS—1945, 46, 47, & 48 (TEST PLOTS CARRIED OUT IN 40 WIS. COUNTIES), WHERE A COMPARISON WAS MADE OF 0-20-0 WITH 0-20-10 AND 0-20-20, WITH AND WITHOUT AMMONIUM NITRATE. (AMMONIUM NITRATE APPLIED AS A TOPDRESSING AT AVERAGE RATE OF 95 POUNDS PER ACRE AFTER SEEDING.)

Treatment (Av. for all plots)	Yield per acre grain bu.	Yield per acre straw lbs.	Bushels increase grain	Lbs. increase straw	Value of inc. grain & straw[1]	Cost of fertilizer	Net profit per acre
310# of 0-20-0	53.0	2,299	10.3	404	$9.76	$4.96	$4.80
310# of 0-20-0 + 95# Am. Nitrate	63.4	2,812	20.7	917	19.88	8.06	11.82
310# of the average of 0-20-10 & 0-20-20 plots	57.5	2,515	14.8	620	14.63	7.75	6.88
310# of 0-20-10 & 0-20-20 plots (average) +95# of Am. Nitrate	68.2	3,171	25.5	1,276	24.86	12.85	12.01
No fertilizer	42.7	1,895					

[1] Oats figured at average value of 85¢ per bushel; straw at $5 per ton.

PICTORIAL

Flowers Afield

Left: **Prospecting for fish on the farm.**

Below: **May glamorizes rural landscapes.**

Above: **A good picture—even upside down.**

Right: **An old pump near Mercersburg, Pa.**

Above: **Bean picking time.**

Below: **Selecting quality.**

The Editors Talk

Pasture Ideals

May—and the flush of the pastures is on. Even old, worn-out pastures at this season of the year take on a deceptive bloom which belies their worth in good farm management. To those who are following the tremendously increased interest in pastures and the results of research and experimental work in them, the May flush is no deception. They will want to know the stand and nature of the herbage and the ability of the soil to prolong grazing into "cow-days" which will mean real profits. They will determine what might be expected from forage crops on these acres and will undertake steps to obtain it. There now is plenty of evidence to support such procedure. Stemming from the U. S. Department of Agriculture, the State Experiment Stations, and other reliable sources is a wealth of information both already being and awaiting being put into practice.

In a significant statement, R. E. Hodgson of the Bureau of Dairy Industry, U. S. Department of Agriculture, says, "In the past relatively less attention has been given by farmers, even those maintaining livestock as the major enterprise, to improving the yields of pasture and forage crops than to improving the yields of grains and so-called cash crops. Indeed, less research has been done in this direction, as indicated by the relatively slow progress in the development of improved varieties of grasses and legumes and in the development of improved methods of production and utilization. Farmers have used less fertilizer and manure for stimulating production of grassland crops than for grains. Yet these practices will produce as good results, in terms of increased yields, with pastures and meadows as they do with grains. Ample evidence exists to prove the economy of using improved varieties of grasses and legumes, of applying fertilizer and manure, and of using better management practices in the production of grassland crops."

"Grassland crops," he went on to say, "in addition to being soil savers, are also cheap crops to grow. It costs less to produce feed nutrients in pasture and hay than in corn and other grains. . . . Results suggest the advantage of meadow crops, both from the standpoint of the production of feed units and from the standpoint of low costs and low requirements for crop production."

The real importance of this is seen in the fact that in 1946, the latest year for which figures are available, wages of hired farm labor represented 18 per cent of total production expenses of farm operators; and the largest share of farmers' expenses, 22 per cent, went for purchases of feed.

Pasture too often has been relegated to marginal lands or given scant attention by busy, cash-crop-growing farmers. But the day is fast approaching when it will be considered a crop and will be treated as such. In addition to all the pasture work being carried on by State Experiment Stations and Extension Forces, the Soil Conservation Service, and other agencies, the Bureau of Dairy Industry for several years has been investigating at Beltsville, Maryland, methods of pasture improvement. These experiments have dealt with the testing of adapted pasture crops, ways of increasing yields by fertilization, liming and manuring, the renovation of permanent pastures, rotational grazing, and the growing of pastures in rotation with other crops.

Permanent Kentucky bluegrass pastures, as well as orchard grass—bluegrass pastures, have been renovated and the yields are being compared with unrenovated pastures. In the renovation process, the pastures were limed, manured, and then torn up with a heavily weighted disk harrow in the fall. Early the following spring 500 pounds of an 0-14-14 fertilizer per acre were broadcast, and the pastures were double disked, then harrowed again before being reseeded with a mixture of bromegrass, alfalfa, red clover, and Ladino clover. Another 500 pounds of 0-14-14 were applied the next year. The 3-year average of milk yields per acre for the renovated pasture was 21 per cent higher than for the unrenovated pastures which were limed, manured, and fertilized, but not torn up or reseeded.

The moving of pasture up into the full stature of a crop is seen in the Beltsville experiments where pasture is being tried in a 5-year rotation with other crops, as a means of providing extra grazing. The rotation consists of 1 year of corn, 1 year of wheat, and 3 years of a mixture of orchard grass, red clover, and Ladino clover (seeded in the wheat). The wheat and grass-legume stubble is pastured in the fall of the second year, and the grass-legumes are grazed in the third year. In the fourth year two crops of hay are removed and the aftermath is grazed, and in the fifth and final year the pasture is grazed in early spring, then one crop of hay is removed and the field is grazed throughout the remainder of the season. This experiment is still in progress, but from results obtained from the first four years the rotation of crops and pastures averaged 16 per cent more milk per acre than the permanent pasture with which they were compared. The crop rotation pastures produced more feed during the summer, particularly in dry seasons, than the permanent pasture.

Coming into the picture also are the increasing recognition of the importance of grassland farming in soil conservation, the necessity for returning humus and soil fertility to land overcropped during the war and post-war years, the switching in farming systems to keep in line with economic trends, and the new developments in the relationship between soils and human health. All of these will extend the May flush of our pastures. Truly, the growing of two blades of grass where only one grew before is assuming a new meaning to everyone.

Our City Cousins

In this issue we are presenting an article, "The Soil and Human Health," by B. A. Rockwell which is a little aside from our usual presentations of information on crop and soil management, but which we believe will be of interest to our readers. In sending in the story, Mr. Rockwell said, "To the city dwellers and their families, the word conservation as it applies to the soil, together with its ramifications; to wit—erosion, diversion ditches, strip-cropping, rotation, levels of N, P, & K, etc., mean very little, since the action indicated by such words is too far removed from their personal experiences and immediate interests. However, if our city cousins can be confronted with the idea that their health springs from the soil, with sufficient evidence to make such a statement convincing, their personal interests will be excited because food and health are very close to them.

"From such immediate and personal interests, they will eventually begin to realize the importance of soil conservation to their personal well-being. Then if and when legislation is needed to further soil conservation practices, these people from our more thickly populated areas, realizing the important relationship between soil and their health, will through their political influence at the polls help effect such legislation."

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924...........	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941...........	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947...........	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
May.........	35.27	40.1	196.0	244.0	216.0	222.0	18.30	90.70	....
June.........	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July.........	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August......	30.41	47.4	158.0	265.0	191.0	196.0	17.80	76.60	....
September...	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October......	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November....	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December....	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January......	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February.....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March.......	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April........	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1924...........	185	190	98	170	166	141	107	147	143
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	93	81	109	74	87	110
1938...........	69	196	80	83	76	64	57	97	88
1939...........	73	154	100	85	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	107	117	107	81	211	129
1942...........	153	369	168	136	143	124	91	202	163
1943...........	160	405	188	232	174	154	125	231	245
1944...........	167	420	214	219	170	160	138	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	175	249	212	209	141	319	204
1947...........	252	380	224	245	366	273	146	379	249
1948									
May.........	284	401	281	278	336	251	154	402	262
June.........	284	417	268	280	336	239	151	409	213
July.........	266	436	238	298	315	230	153	428	213
August......	245	474	227	302	298	222	150	340	172
September...	250	467	220	264	277	223	152	302	150
October......	251	506	204	236	215	224	155	282	176
November....	246	428	207	226	188	231	155	306	186
December....	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282
February.....	235	295	249	279	174	219	173	237	285
March.......	232	319	250	290	184	224	168	228	263
April........	241	247	260	314	190	226	160	223	236

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
May	2.78	1.90	13.77	9.54	12.75	7.89
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
May	104	67	393	270	378	224
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367[1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
May	.760	4.61	6.60	.375	.669	14.50	.200
June	.760	4.61	6.60	.330	.634[1]	12.76[1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
May	142	128	135	68	70	60	83
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
May	289	265	239	137	85	370	142	71
June	295	266	241	128	85	309	142	65
July	301	266	247	231	88	317	144	68
August	293	266	247	129	91	285	144	68
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United Sta.es Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Commercial Fertilizers Report for 1948," Conn. Agr. Exp. Sta., New Haven, Conn., Bul. 525, Dec. 1948, H. J. Fisher.

"Vegetable Fertilizer Recommendations for Delaware," Ext. Serv., Univ. of Del., Newark, Del., 1949, R. F. Stevens.

"State Laboratory Fertilizer, Feed, Seed, Lime and Ice Cream Report, July-December—1948," State Board of Agr., Dover, Del., Vol. 38, No. 4.

"Nitrogen-Fertilizers for Grain Crops," Dept. of Agron., Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Mimeo Leaflet No. 111, Feb. 1948, G. O. Baker.

"The Use of Gypsum and Sulfur Fertilizers on Sulfur Deficient Soils," Dept. of Agron., Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Mimeo Leaflet No. 113, March 1948, G. O. Baker.

"Analyses of Official Fertilizer Samples," Feed and Fertilizer Dept., Ky. Agr. Exp. Sta., Lexington, Ky., Regulatory Bul. 69, Dec. 1948, Semi-annual Report, Jan.-June 1948.

"Official Report, Maryland Inspection and Regulatory Service—Feed, Fertilizer and Lime Issue," College Park, Md., Issue No. 208, Jan. 1949.

"Fertilizer Recommendations for Mississippi, 1949," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 145, Feb. 1949, F. J. Welch.

"The Tonnage Summary of Mixed Fertilizers, Fertilizer Materials, and Limes Reported as Being Sold in New Jersey During 1948," State Agr. Exp. Sta., New Brunswick, N. J., Apr. 11, 1949, S. B. Randle.

"Fertilizer Recommendations for Texas—1948-1949," Ext. Serv., Texas A & M, College Station, Texas, B-165, 1948, M. K. Thornton.

"Fertilizers for Eastern Washington," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 385, Feb. 1949.

Soils

"Soil Management and Fertilizer Use," Statistics and Publications Branch, Ontario Dept. of Agr., Toronto, Ont., Can., Bul. 463, Jan. 1949.

"Chemical Studies on Soils from Florida Citrus Groves," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 448 (Bul. 340 Rev.), Sept. 1948, T. W. Young.

"Vermont Soils Need 400,000 Tons Lime Annually," Ext. Serv., Univ. of Vt., Burlington, Vt., Unno. Pamphlet, Feb. 1949.

"Conservation Practices for Tobacco Lands of the Flue-cured and Maryland Belts," U.S.D.A., Washington, D. C., Misc. Publ. 656, Nov. 1948, T. L. Copley, C. S. Britt, and W. B. Posey.

"Irrigation Agriculture in the West," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Misc. Publ. 670, Nov. 1948.

"Investigation in Erosion Control and the Reclamation of Eroded Land at the Missouri Valley Loess Conservation Experiment Station, Clarinda, Iowa, 1931-42," Soil Conservation Service, US.D.A., Washington, D. C., Tech. Bul. 959, Oct. 1948, G. M. Browning, R. A. Norton, A. G. McCall, and F. G. Bell.

Crops

"Controlling Diseases of Tobacco," Conn. Agr. Exp. Sta., New Haven, Conn., Bull. 527, Feb. 1949, P. J. Anderson.

"Your Freedom Garden," Ext. Serv., College of Agr., Univ. of Conn., Storrs, Conn., Ext. Folder No. 21, March 1948, W. E. Chappell.

"Grasses for Lawns, Parks and Athletic Fields," Ext. Serv., College of Agr., Univ. of Conn., Storrs, Conn., Ext. Folder No. 22, March 1948, B. A. Brown.

"Carpet Grass and Legume Pastures in Florida—Their Growth, Composition and Contribution to Beef Production," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 453, Dec. 1948, R. E. Blaser, R. S. Glasscock, G. B. Killinger, and W. E. Stokes.

"Twenty-eighth Annual Report, 1947-1948," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Bul. 46, July 1948.

"Introducing Pandora Cotton for the Georgia Coastal Plain," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Cir. No. 12, Dec. 1948, J. H. Turner, Jr.

"Cotton Variety Tests in Georgia, 1946-48," Ga. Exp. Sta., Univ. System of Ga., Experi-

ment, Ga., Cir. 159, March 1949, B. S. Hawkins, T. E. Steele, W. W. Ballard, and S. V. Stacy.

"Farming for Freedom, 1947 Annual Report," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 545, May 1948.

"Report 1946-1948 of the Agricultural Experiment Station," Univ. of Hawaii, Honolulu, Hawaii, Dec. 1948.

"Growing Raspberries in Idaho," Hort. Dept., Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Mimeo-Leaflet No. 114, July 1948, Leif Verner.

"Legumes and Grasses for Silage—A Report of Experiments," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 529, Nov. 1948, W. B. Nevens, K. E. Harshbarger, and K. A. Kendall.

"1948 Illinois Tests of Corn Hybrids in Widest Use," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 531, Feb. 1949, J. W. Pendleton, G. H. Dungan, J. H. Bigger, A. L. Lang, Benjamin Koehler, R. W. Jugenheimer, and G. E. McKibben.

"Corn Borer Control in Field Corn," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 637, Feb. 1949.

"Treating of Soybean Seed Results in Better Stands," Agr. Exp. Sta., Miss. State College, Delta Branch, Stoneville, Miss., Service Sheet 411, June 1948, H. W. Johnson.

"Winter Legume Experiments for Cotton Production," Agr. Exp. Sta., Miss. State College, Delta Branch, Stoneville, Miss., Service Sheet 414, Sept. 1948, P. H. Grissom.

"Lespedeza Sericea," Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 6, March 1949, W. R. Thompson.

"Kudzu," Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 7, March 1949, W. R. Thompson.

"Johnson Grass," Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 8, March 1949, W. R. Thompson.

"Grain Sorghum for Grain or Grazing," Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. Folder No. 9, March 1949, W. R. Thompson.

"The South Will Come Into Its Own When Pastures are Green All Year," Ext. Serv., Miss. State College, State College, Miss., Ext. Agron. L. No. 7, March 1949, W. R. Thompson.

"Grow More Corn," Ext. Serv., Miss. State College, State College, Miss., Ext. Leaflet 82 (Rev.), Feb. 1949, W. R. Thompson.

"Tomato Cultural Studies," Agr. Exp. Sta., Miss. State College, State College, Miss., Serv. Sheet 410, May 1948, L. R. Farish.

"Producing 100 Bushels of Corn per Acre," Agr. Education Dept., State College, Miss., Veterans Farm Training Publ. No. 7, Feb. 1949.

"Farm and Home Builders," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 569, Feb. 1949, A. R. 1948.

"The Management of Farm Woodlands in New Hampshire," Agr. Ext. Serv., Univ. of N. H., Durham, N. H., Ext. Bul. 88, June 1948, K. E. Barraclough.

"Tips on Growing Spring Oats," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaflet 14, March 1948, C. S. Garrison and J. E. Baylor.

"A Guide to Forest Tree Planting in New Jersey," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaflet 19, May 1948, A. N. Lentz.

"Research and Farming," Agr. Exp. Sta., Raleigh, N. C., Vol. VII, No. 3, Jan. 1949.

"Nineteenth Annual Report of the New Mexico Feed and Fertilizer Control Office, Year Ending December 31, 1948, Commercial Fertilizers," N. M. Feed and Fertilizer Control Office, State College, N. M., R. W. Ludwick and L. T. Elliott.

"Oklahoma Corn Performance Tests Summary: 1946, 1947 and 1948," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Bul. B-327, Feb. 1949, J. S. Brooks, Roy Chessmore, and Hartwill Pass.

"Cedar and Pine as Farm Trees for Oklahoma," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Bul. B-331, March 1949, Michel Afanasiev.

"Seed Treatment for Field Legumes," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Bul. B332, March 1949, A. J. Vlitos and D. A. Preston.

"A Study of Red Cedar Plantations in North Central Oklahoma," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Tech. Bul. T-34, March 1949, Michel Afanasiev.

"Better Gardens for Better Health—An Oklahoma Garden Planning Guide," Okla. A & M, Stillwater, Okla., Cir. 487, E. L. Whitehead.

"Performance Tests, 1948," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Mimeo. Cir. M-177, Dec. 1948, J. S. Brooks, Roy Chessmore, and Hartwill Pass.

"Sweet Potatoes," Federal Coop. Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Cir. 522, Sept. 1948, A. G. B. Bouquet.

"Greenhouse Vegetables—Tomatoes," Federal Coop. Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Cir. 525 (Rev. of Cir. 308), Nov. 1948, A. G. B. Bouquet.

"Science for the Farmer," Agr. Exp. Sta., Pa. State College, State College, Pa., Supplement No. 2 to Bul. 502, March 1949.

"Vegetable Gardens," Ext. Serv., R. I. State College, Kingston, R. I., Misc. Cir. 49, Rev. Apr. 1948, D. D. Dolan and E. P. Christopher.

"Agricultural Progress in South Carolina, 1947—More Income, Better Farm Living," Ext. Serv., Clemson Agr. College, Clemson, S. C., A. R., 1947.

"The 1948 Cotton Contest for Better Quality and Higher Yields," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 325, Jan. 1949, H. G. Boylston.

"Your Garden," Agr. Ext. Serv., Univ. of

Tenn., Knoxville, Tenn., Publ. 310, Feb. 1949, W. C. Pelton.

"Methods of Raising Tomatoes Profitably in East Texas," Agr. Exp. Sta., Texas A & M College, College Station, Texas, P. R. 1133, Sept. 20, 1948, P. A. Young.

"A New Method for Ripening Dates," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1139, Nov. 27, 1948, J. S. Morris, and G. H. Godfrey.

"Summary of the 1948 Texas Corn Performance Tests," Depts. of Agron. and Plant Physiology and Pathology, Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1140, Nov. 29, 1948.

"Williamson County Cotton Variety Tests, 1946-48," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1141, Dec. 1, 1948, C. W. Manning and S. H. Cain.

"Ten Years of Dairy Farming in Vermont," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 548, Jan. 1949, V. R. Houghaboom.

"Large Yields and Better Quality Tobacco," Agron. Dept., Va. Polytechnic Inst., Blacksburg, Va., Cir. 386 Rev., Jan. 1949.

"Vegetable Garden Suggestions for Virginia Farmers," Agr. Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., Cir. 475, Nov. 1948, F. S. Andrews, L. C. Beamer, and F. H. Scott.

"What's New in Farm Science," Agr. Exp. Station, Univ. of Wis., Madison, Wis., Bul. 480, Dec. 1948, A. R. of the Director, Part Two.

"Safeguarding New Seedings," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 300, (Rev. March 1948), Apr. 1940, H. L. Ahlgren and L. F. Graber.

"How to Succeed with Forest Plantations, A Planting Handbook," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 381, Conservation Dept. Publ. 506, Jan. 1949, F. B. Trenk and W. H. Brener.

"Report of the Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, 1948," U.S.D.A., Washington, D. C.

"Legume Inoculation, What It Is and What It Does," U.S.D.A., Washington, D. C., Farmer's Bul. 2003, Dec. 1948, L. W. Erdman.

"Silvicultural Management of Black Spruce in Minnesota," Lake States Forest Exp. Sta., Forest Ser., U.S.D.A., Washington, D. C., Cir. 791, Oct. 1948, R. K. LeBarron.

"Strawberry Culture — Western United States," US.D.A., Washington, D. C., Farmers' Bul. 1027, Rev. Nov. 1948, G. M. Darrow and G. F. Waldo.

"Production of Drug and Condiment Plants," U.S.D.A., Washington, D. C., Farmers' Bul. 1999, Dec. 1948, A. F. Sievers.

"Producing Cigar Tobacco in Pennsylvania," U.S.D.A., Washington, D. C., Farmers' Bul. 2001, Dec. 1948, O. E. Street.

"Factors Affecting the Nutritive Value of Foods," U.S.D.A., Washington, D. C., Misc. Publ. 664, Dec. 1948.

"Vegetable-Seed Storage as Affected by Temperature and Relative Humidity," U.S.D.A., Washington, D. C., Tech. Bul. 972, Oct. 1948, E. H. Toole, V. K. Toole, and E. A. Gorman.

"Popular Publications for the Farmer and Homemaker," Office of Information, U.S.D.A., Washington, D. C., List No. 5, 1948, E. W. Clay.

"How to Keep and Increase Black Grama on Southwestern Ranges," U.S.D.A., Washington, D. C., Leaflet No. 180, Rev. July 1948, R. S. Campbell and E. C. Crafts.

Economics

"The Walnut Situation, 1948," College of Agr., Univ. of Calif., Berkeley, Calif., Cir. 386, Sept. 1948, G. B. Alcorn.

"Second Annual Almond Efficiency Study, Sutter County, 1947," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif.

"Seasons for California Crops and Livestock," Univ. of Calif., Berkeley, Calif., Rev. April 1948, G. B. Alcorn.

"1948 Statistics of Diversified Agriculture in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Ext. Cir. 263, March 1949, Ralph Elliott.

"Law for the Illinois Farmer," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 632, Nov. 1948, H. W. Hannah.

"1949 Outlook for Farm and Home," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 635, Jan. 1949.

"Kansas Farm Management Summary & Analysis, 1947," Dept. of Agr. Econ., Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Agr. Econ. Rpt. 34, 1948.

"Probable and Suggested Adjustments in Kansas Agriculture for 1949," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Agr. Econ. Rpt. 35, Aug. 1948.

"Farm Organization and Production Requirements in Selected Irrigated Areas," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 453, Oct. 1948, R. E. Huffman and D. C. Myrick.

"Father-Son Farming—Plans and Arrangements," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 686, Feb. 1949, R. C. Headington and H. R. Moore.

"A Study of Farms in Oklahoma by Size and Economic Class," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Exp. Sta. Bul. B-330, Feb. 1949, R. T. McMillan.

"1949 Farm Production Prospects in Oklahoma," Agr. Exp. Station, Okla. A & M, Stillwater, Okla., Mimeo Cir. M-175, Oct. 1948.

"Cost of Producing Boysenberries (for Processing) in the Willamette Valley, Oregon—A Progress Report," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Information No. 437, Nov. 1948, G. W. Kuhlman and D. C. Mumford.

"Economics of Cotton Harvesting, Texas

High Plains—1947 Season," Agr. Exp. Sta., College Station, Texas, P. R. 1134, Oct. 1, 1948, M. M. Williamson and R. H. Rogers.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 132, March 31, 1949, Karl Hobson.

"Annual Report of the Farm Credit Administration, 1947-48," U.S.D.A., Washington, D. C.

"Tobaccos of the United States—Acreage, Yield per Acre, Production, Price, and Value by States, 1866-1945 and by Types and Classes, 1919-1945," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., CS-30, July 1948.

"Cotton Quality Statistics, United States 1947-48," Cotton Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., CS-33, Dec. 1948.

"Commodity Futures Statistics, July 1947-June 1948," Commodity Exchange Authority, U.S.D.A., Washington, D. C., CS-34, Nov. 1948.

"The Balance Sheet of Agriculture, 1948," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Misc. Publ. 672, 1948, N. J. Wall, A. S. Tostlebe, F. L. Garlock, R. J. Burroughs, H. C. Larsen, H. T. Lingard, L. R. Hudson, and S. L. Yarnall.

"Potatoes for Livestock Feed," Production and Marketing Admin., U.S.D.A., Washington, D. C., Misc. Publ. 676, Oct. 1948, C. R. Allender.

"People and Potatoes," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., AIS No. 76, Sept. 1948.

Complete Fertilizers for Rice

THE use of fertilizers on rice in Louisiana has increased markedly since 1942 and the farmers' interest in different fertilizers and the methods of their application has increased even more. Heavy weed infestations and the difficulty of controlling weeds in a rice field, especially one that has received a liberal application of nitrogenous fertilizer at or before planting, have limited the use of fertilizers and the benefits from them. Experience and experiments have shown that when an amount of nitrogen greater than 16 pounds per acre is applied with and at the same level as the seed the increase in weed growth tends to depress the increase in rice due to fertilizer. Since in its most efficient use, one pound of nitrogen is required for the production of one bushel of rice, methods conducive to the effective use of more nitrogen had to be developed.

Two methods for the addition of complete fertilizers to rice have been successful. One involving the application of 300 pounds per acre of 0-16-0, 3-9-6, or 3-12-12 with or under the seed at planting, followed by applications of 24 to 32 pounds per acre of nitrogen as a topdressing before the booting stage, has given good results. A modification of this scheme for water-planted rice where the phosphate or complete fertilizer is applied before planting and the extra nitrogen as a topdressing shows particular promise.

The other method, which has been more successful, involves drilling the fertilizer two inches below the seed at planting. Fertilizer experiments with this procedure have been conducted throughout the rice area. The placement of the fertilizer below the seed has increased the yield of rice 8.5 bushels per acre over the old method of drilling the fertilizer directly with the seed. The increase in the efficiency of the fertilizer has made possible better evaluation of the adaptation of various grades to the different soil conditions. The best adapted mixtures have been 6-6-6, 9-6-9, 6-9-9, 3-9-6, and 6-9-0 applied at the rate of 400 pounds per acre. The average increase due to fertilizers was 20.9 bushels per acre.

Minor elements were applied in 1948, but no significant increases were obtained.—R. K. WALKER AND M. B. STURGIS, *Louisiana Agricultural Experiment Station, Baton Rouge, Louisiana.*

Five Years of 500-bushel Clubs

(*From page* 21)

a complete fertilizer. This provides a fair amount of organic matter to be plowed or disked under the following spring. It serves also in retarding soil erosion. Numbers of farmers have reported less scab infestation with this practice.

More fertilizer per acre is being employed in reaching for these higher yields. Where 500 pounds of a 4-8-10 were thought to be adequate a few years ago, growers are now using 1,000 to 1,500 pounds. The top winner in 1947 used 3,200 pounds of fertilizer.

But farmers of Ontario were not content with 500-bushel Potato Clubs alone. For instance, large quantities of cereals were required, and Provincial yields were on the decrease. Statistics stated the 10-year average yield for oats in Ontario was 33.8 bushels per acre. Authorities claimed very excellent yields could be obtained from corn for grain. There was a growing export demand for turnips, but some farmers were not getting satisfactory yields. Peas for protein were being successfully grown by some, yet results were disappointing in other cases. At one time, fall wheat was an important cash crop, but interest had dwindled, perhaps largely because of low yields.

These factors led to objectives, and action. As in 500-bushel Potato Clubs, members of Crop Improvement Associations accepted the challenge and took the lead. Each recent year has seen an increase in organization of 100-bushel Oat Clubs, 50-bushel Barley Clubs, 1,000-bushel Turnip Clubs, 50-bushel Wheat Clubs, 30-bushel Pea Clubs, 100-bushel Corn Clubs, and recently pasture competitions have been undertaken for the first time.

The far-reaching results of these objective competitions are beyond all ex-

Fig. 3. A Potato Growers' banquet in Middlesex County.

pectations of those who originally conceived the idea. "They builded better than they knew," might well be apt.

Set objectives per acre have become a by-word in many communities. Experience has taught many that high yields of a quality product pay dividends by reducing the production cost per unit. With urgent demands for foodstuffs in general, and cereals in particular, maximum production per acre therefore serves a twofold purpose in providing food for the needy and larger profits for the grower.

Mississippi Can Grow . . . Corn

(*From page* 14)

practically identical."—Bull. 191, Tenn. Exp. Sta.

"It has generally been thought that the cultivation of corn is necessary in order to form a mulch as a means of lessening the loss of soil moisture through evaporation. This assumption leads to the belief that the drier the year, the greater the need for cultivation. There seems to be no evidence, however, to justify the conclusion that a soil mulch conserves moisture unless the water table is either permanently or temporarily near the ground surface. A dry crust is probably just as effective in checking the movement of water vapor from the deeper layers of moist soil to the open air as is a dry, granular layer serving as a mulch. The plowed layer is far more valuable as a feeding ground for the corn roots than it is as a mulch to slow down the loss of moisture through evaporation."—Cir. 597—Ext. Service, Univ. of Illinois.

Preliminary studies on use of 2,4-D in corn production indicate the folly of constantly stirring the ground. No doubt we have progressed far enough with 2,4-D on corn to justify limited demonstrations on a much wider scale in our production program. This seems to have unlimited possibilities.

It is essential, insofar as practicable and if consistent high yields are to be expected, to select a soil of good structure or tilth. This type soil is usually one in a long-term, deep-rooted legume rotation or sod, or one that otherwise has been treated to keep the organic matter well supplied. Heavy clays, loamy sands, and sands are usually considered unsafe. To play safe, a soil analysis test should be made. The subsoil as well as the topsoil should have a desirable pH. No hardpan or restriction should exist.

A healthy soil is much more likely to resist the various fungus and bacterial diseases which sometimes are prevalent causing considerable loss through poor photosynthesis, lodging, etc. If there is doubt as to a soil's needs to provide resistance to disease, (1) try stable manure, (2) rotate with a deep-rooted legume. The following statement indicating that consideration be given to structure-tilth conditions in making fertilizer recommendations is no doubt of extreme importance:

"The soil chemists should also adjust the interpretation of the commonly used soil tests for making recommendations for the use of fertilizers to include the soil structure-tilth conditions under which the crops will be grown."—G. N. Hoffer.

The proverbial "Mouse Trap" has never been more fully exemplified than in the case of R. B. Caldwell, Sr., in taking the lead in the production of corn in his community and in Mississippi. During the past three years several thousand students, farmers, veteran trainees, agricultural leaders, scientists, and editors, from the majority of counties in Mississippi and from adjoining states have visited his farm to study his method of producing corn. Many hundreds have gone back home and followed his plan. In the Caledonia community alone there has been a remarkable spread in adopting the plan for higher yields of corn. During 1948, approximately 200 farmers followed the plan. Of 139 farmers with fields covering 304 acres which were checked closely for yields, the average production was 84.2 bushels per acre. Thirty-five farmers have exceeded the 100-bushel objective.

When agricultural history is written in Mississippi it is doubtful if there will be found a more outstanding production accomplishment anywhere than that of producing corn in the Caledonia community. This project is the consummation of organized instruction, through a cooperative undertaking begun in 1945-46, under the leadership of S.C.S. Technicians assigned to Lowndes County Soil Conservation District and the Vocational Agriculture Teacher of the Caledonia Consolidated High School. Veteran Instructors made distinct contributions during 1947 and 1948.

What is Happening to Wisconsin Soils?

(*From page* 26)

vested an average of over a million acres of alfalfa.

The average yields of grain and corn have been increased a good 30% in the past 10 years. Part of this increase is, of course, due to the more extensive planting of our higher yielding strains of hybrid corn and the disease-resisting varieties of oats and other grains. But I am sure that the increased use of lime and fertilizers has played an important role in these higher average yields.

Our educational efforts have been fruitful. I am confident that even though our job in Wisconsin is far from finished, with the support and assistance that have been given through the Soil Conservation Service and the AAA (now the Production and Marketing Association), we can look forward to new achievements in the field of crop production, soil fertility maintenance, and conservation.

Here are 12 suggestions which, if followed, will result in substantial increases in crop production and as well fit into a program of soil fertility maintenance and conservation:

1. Conserve all animal manures. Use sufficient litter and absorbents so as to save all the liquid portion and get it back onto the land. To reduce losses of ammonia from fermented manure, reinforce with superphosphate at the rate of one pound per cow per day in gutters of stable or in loose or open-run barns.

2. Have your soils tested to determine lime and fertilizer requirements.

3. Apply phosphate or phosphate-potash fertilizers (according to soil test) at the time of seeding down for spring grain or legume seedings. Apply such fertilizers as 0-20-20 or 0-20-10 at rates from 300 to 400 lbs. per acre. Where straw growth is apt to be short, supplement with ammonium nitrate or other nitrogen fertilizer and apply as a topdressing at rates from 75 to 100 lbs. per acre. On fields where there

is no danger of lodging and that are only moderately short on nitrogen, apply from 300 to 400 lbs. of mixtures containing some nitrogen, such as 3-12-12, 4-12-8, or 3-18-9.

4. For fall-seeded grain (wheat or rye) apply 250 to 300 lbs. of 3-12-12, 4-12-8, or 3-18-9 per acre. On thinner fields where there is no danger of lodging, topdress winter wheat or rye in the spring with ammonium nitrate or other nitrogen fertilizers at rates of from 75 to 150 lbs. per acre. (If seedings of legumes or grasses are to be made, omit treatment with nitrogen fertilizer).

5. For corn, as a supplement to applications of stable manure, apply from 125 to 200 lbs. of starter fertilizer (3-12-12, 4-12-8, or 3-18-9) per acre with attachment on planter.

6. For corn on low fertility fields and where no manure is available, apply from 600 to 800 lbs. of 8-8-8 or similar fertilizer per acre. These heavy rate applications of high-nitrogen fertilizer should be drilled in deep ahead of planting or placed on plow-sole with attachment on plow, or plowed under.

7. Renovate old June grass pastures (apply lime and fertilizers according to soil test) and seed them to deep-rooted legumes and bromegrass or other recommended pasture mixtures.

8. Topdress timothy or other grassland hay or pasture meadows every spring with ammonium nitrate or other nitrogen fertilizers (apply ammonium nitrate at from 150 to 200 lbs. per acre, or ammonium sulphate, cyanamid, or nitrate of soda at from 200 to 275 lbs. per acre). Supplement these nitrogen fertilizers with from 200 to 250 lbs. of 0-20-20 or 0-20-10 where fields have been in sod for many years and where little or no manure or commercial fertilizer has ever been applied, and repeat treatments with 0-20-20 or 0-20-10 every three or four years.

9. On sloping fields where erosion is a serious factor, seed down to long-lasting stands of alfalfa and bromegrass and include some ladino clover where the fields are to be used for pasture.

Fig. 4. An important factor in "making sure" with alfalfa has been the 16 million tons of lime applied to Wisconsin's acid soils during the past 15 years. Wisconsin farmers are now growing more than a million acres of this "de luxe member" of the legume family. On the Charles Peterson farm at Darlington we see what happened when no lime was applied. The entire field was given a light dressing with "phosphated manure" at the time of seeding down.

10. Work erodible fields on contour and follow all recommended practices of soil erosion control.

11. Increase acreage of deep-rooted, long-lasting, drought-resisting alfalfa. Cut down acreage of corn on erodible land and use more alfalfa and brome or other grass and legume mixtures for silage.

12. Build back organic matter reserves into your soil by plowing under more crop residues and green manure. Plow under a second crop of hay occasionally.

Thousands of farmers are carrying out many of these recommended practices and their farms reflect the improvement that follows in the wake of these principles of good farming. Their prosperity is reflected in modernized and well-equipped farm homes that make for convenience, comfort, and happiness. Larger farm income makes possible greater opportunity for the boys and girls growing up in these homes. And it all adds up to more abundant living and a more permanent and lasting type of agriculture.

The Soil and Human Health

(*From page* 18)

attempt to come up with the answer of "Why Health?" A brief summary of the observations and reports of Schomberg, Skrine, Durand, and Dr. McCarrison shapes up as follows: The most conspicuous feature of the Hunza diet is the large amount of native fruit they eat, fresh in summer and dried at other times. There was at the time these observations were made such large quantities of fruit produced in Hunza that even the animals took the fruit diet. Other articles of diet were whole wheat bread, pulses and vegetables, barley and millet, fermented milk (no sweet milk), buttermilk, butter, curd cheese, and on rare occasion some fowl and meat. There also was wine, in moderation, made from fruit juices. Fundamentally then, their diet was not much different from that of other people and yet after a more complete study of their eating habits, two differences appeared.

In the first place, the Hunzas ate no sugars other than those which were contained naturally in the fruits and vegetables. Could this be the reason why a decayed tooth was a great rarity? Secondly, they ate more wholesomely than humans in the so-called super-civilized centers, if civilized is the proper word. That is, they consumed every portion of fruits, vegetables, fowls, and animals that could be chewed, swallowed, and digested.

Is there any avenue of reasoning or scientific explanation that would justify such an eating practice? The answer is yes. For example, the skin of a healthy fruit, vegetable, or chicken contains barriers which fight against skin infections. Furthermore, the essential elements and factors of growth and life are transferred to the individual by food. If humans would eat skins from potatoes, apples, or carrots, etc., or the skin of healthy fowls, then we could expect a certain amount of transfer of infection-fighting barriers to the human skin. It is generally conceded that at all times, there lurks in the mouth, nose, throat, and lungs, disease germs such as cold, pneumonia, tuberculosis, and others. But if the skin membranes in this part of the anatomy are healthy due to the presence of barriers, the disease cannot develop. Otherwise, we would be sick most of the time.

Of necessity, Dr. Robert McCarrison must re-enter this research drama, "Why Health?" Previously in this story was given a brief summary of his experiences and observations during his first seven-year association with the Hunzas. Incidentally, McCarrison observed two other groups of people, namely the Pathans and the Sikhs, who rivaled but did not quite equal the Hunzas in physical excellence. He observed, however, that the Pathans and Sikhs lived in non-fruit-producing areas. It will be important to keep this fact (non-fruit areas) in mind in order to appreciate McCarrison's sound thinking which steered his excellent scientific approach into the question, "Why Health?"

Dr. McCarrison had shown through application and action during his medical career which began in 1900 that he had the inborn mind of a research worker. Consequently, he was appointed Director of Nutritional Research for India, where he returned in 1927 and set up his laboratory at Coonoor.

During his absence from Hunza, he had never forgotten the splendid physique of the Hunzas and had long pondered—why? Now came the opportunity for which he had been waiting, to investigate the Why of the Health of the Hunzas, the Pathans, and the Sikhs. He decided upon a wholesome research procedure to determine the why of health which was a direct reversal to the fragmented research of the past to learn the direct or immediate causes of diseases.

After having observed the vibrant health of the Hunzas in contrast to the physical degeneracy and ill health in many other global localities, he wondered if by using white rats as the guinea pigs he could duplicate through food in rat colonies the two extremes of health and disease which he had observed in humans. He began to experimentally feed two colonies of white rats, all conditions being identical except the geographical origin of the two diets offered—one being food produced in the Hunza, Pathan, and Sikhs regions. Since the Pathans and Sikhs lived in non-fruit producing areas, fruit was excluded from the diet to make the experiment more comprehensive. The other diet was from areas of India where people were poor and undernourished and, of course, quite physically degenerated and sickly.

In briefing the feeding test results of the Hunza diet, we shall quote Dr. McCarrison, "During the past two and a quarter years, there has been no case of illness in this universe of albino rats, with the exception of an occasional tapeworm cyst."

The results of feeding the other rats, including 2,243 individuals, really opened the lid of Pandora's box, since diseases and miseries of many kinds flew forth. With the exception of the brain, which was not examined, just about every other organ became diseased. Freeing it of technical dressing, this group of rats fed faulty food got diseases of the respiratory system, adenoids, pneumonia, bronchitis, pleurisy, infections of the nose, ears, and eyes, ulcer and cancer of the stomach, inflammation of the small and large gut, constipation and diarrhea, disease of the urinary passage, such as Brights disease, stone abscesses, inflammation of the bladder, inflammation of womb and ovaries, death of the foetus, premature birth, hemorrhage, disease of the testicles, inflammation of the skin, loss of hair, ulcers, abscesses, gangrene of the feet and tail, anemias of the blood, enlarged lymphatic glands, inflammation of outer lining of the heart, degeneration of nervous tissues, diseased bones and teeth, dropsy, scurvy, feeble growth, lassitude, and ill-temper.

To digress a moment from McCarrison's Coonoor rat experiments, the following should have passing interest: The difficulty with early polar expeditions was the inability to carry sufficient food. A number of such expeditions perished for this reason. It was not until Stefansson, the famous polar explorer, through the aid of one of his sled dogs, made a remarkable discovery which overcame the lack of food hazard while exploring the polar regions. The dog barked at something which appeared like nothing. Investigation revealed a hole in the ice. Patient watching by Stefansson was rewarded by a seal nose appearing in the hole in the ice, kept open to get air. Thereafter, Stefansson and his men watched these holes and when a seal came there for air, he was speared and then chopped out of the ice. The writer heard Stefansson say that he and his men lived for the greater portion of two years on seal meat, and no disease from dietary deficiencies resulted.

How can we explain this amazing fact? Well, it must be remembered that about 20 times more plant nutrient essentials, through human neglect, wash into the oceans each year than are used by plants. This abundance of essential nutrients supports the lower marine forms of life which support the little fish, which support the larger fish. Consequently, seal meat thus supported was not deficient in any essential and, therefore, was nutritionally a perfect food. Such a diet would indeed be monotonous, but it proves that health can be maintained from one food if said food contains all the essentials. Eliminating one item of food in the diet, as McCarrison did in the case of fruit desirable as fruit may be, is not important provided other items of food, either few or many, contain in the aggregate all the essential food factors. When in doubt, eat salt water fish since it is probably one of our most complete foods. Generally speaking, in choosing other foods it is wise to select a variety, since a variety will be products of a wide and varied geographical area.

The Soil

After McCarrison had perfected health and also caused disease in rats in accordance with diets he gave them, there was just one more factor left to be explored for the basic reason for health, and that was the soil from which the diet of the very healthy rats originated. His investigations revealed that the Hunza people were excellent farmers, tended their crops diligently, and saw to it that no soil was lost from erosion. Previous to and at the time of his investigation, they were a self-sufficient people, consumed all the food they produced, and sold nothing. Furthermore, nothing was wasted or destroyed and everything with any plant-food value was returned to the soil. Even all human excrement was processed for this purpose. So, the nutritional cycle was complete without soil nutritional losses.

The only conclusion to be arrived at by Dr. McCarrison as the results of his extensive research is as follows: The soil, which maintained these three different peoples and more especially the Hunzas, was complete. That is, it contained all essential elements and factors to maintain perfect life. From the soil, the health-giving factors were transferred to the plants and to animals and finally to the humans who ate of these plants and animals. The results were a people of unexcelled health and physical fitness. The answer to Dr. McCarrison's question of "Why the Hunza Health" was the Hunza soil.

From this revealing bit of research, the original statement that baby thrives on cow's milk in proportion to the soil's ability to transfer to the forage and grain growth the health, which in turn is transferred to baby through the milk, seems quite true.

Quoting Frank A. Gilbert, Ph.D., a renowned scientist in the field of nutrition, "It is not possible to separate the problems of increasing the productivity of our farms, raising the biological value of our crops, keeping our domestic animals in good condition, and thus maintaining the health of our people."

Indeed the problem is large as it applies to the soil from which all new wealth is created. Wealth plus health, which adds up to happiness, stem right back to the soil. But the general public indifference caused by ignorance to soil conservation is alarming. Some group or groups of society should energetically spearhead a general educational program to the point where our citizenry will fully realize that "The Soil Is Our Life" and that soil is the answer to the question, "Why Health?"

If and when, through a very general educational campaign, our people could learn how rapidly we are losing our topsoil in this country, together with its implications, they might be aroused to a point of willingness to finance a more complete soil-conserving and rebuilding program. By so doing, such campaigns as are now being conducted for tuberculosis, cancer, heart, and the like might be unnecessary.

Bibliography

General Bruce, of Mount Everest Fame—Organizer of Sports Among Hunzas, Experiences Recounted—Vol. 71 (1928) Journal of the Royal Geographical Society.

Colonel Durand, British Expeditionary Leader to Suppress Banditry, Publication—"The Making of a Frontier" (1894).

Gilbert, Ph.D., Frank H., Pathologist—U. S. Dept. of Agriculture, Professor of Botany—Marshall College, W. Va., Member—Agricultural Science Research Division of Battelle Memorial Institute, Columbus, Ohio, Publication—"Mineral Nutrition of Plants and Animals" (1948).

McCarrison, M.D., Robert, Director, Nutritional Research for India, 1927-1938, Publication—"Studies in Deficiency Diseases" (1921), Lectures—Mellon Institute, Pittsburgh, Pa. (1922); College of Surgeons (1931).

McCollum and Simmonds, Publication—"Newer Knowledge of Nutrition" (1929).

McGonigle, M.D., G. M., Officer of Health, Stockton-on-Tees, England, 1918-1932, Director—Mt. Pleasant Slum Clearance Project.

Morris, Captain C. Y., Explorer, His Report to Royal Geographical Society in 1928.

Schomberg, Colonel R. C. F., Traveler and Author, Publication—"Between the Oxus and the Indus" (1905).

Skrine, Traveler and Author, Publication—"Chinese Central Asia" (1926).

Stefansson, V., Famous Polar Explorer, Author, and Lecturer.

Stein, Sir Aurel, Traveler and Savant, Publication—"Sand Buried Ruins of Khotan" (1903).

Varrier-Jones, Sir Pendrill, Director, Tuberculosis Settlement Project, England.

Addition of Micronutrients to Fertilizer

(*From page* 8)

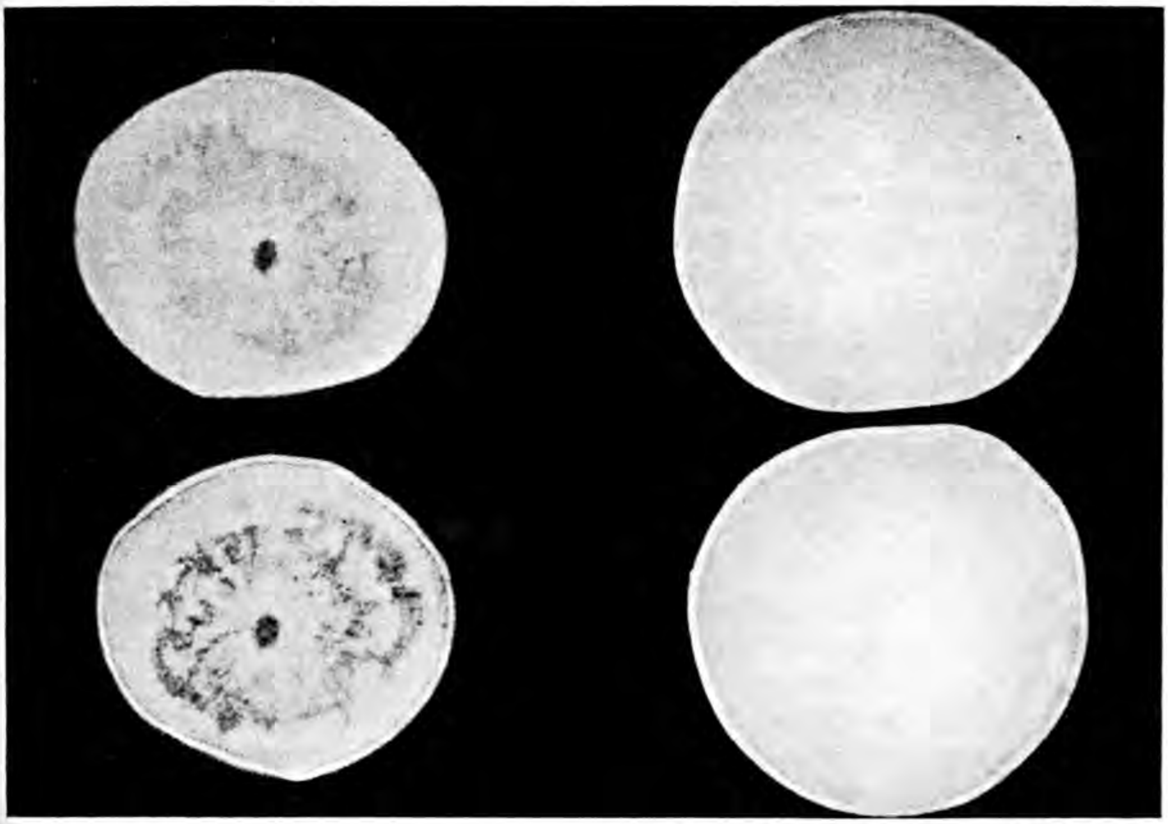
rate where borax is needed. It is no particular problem to make such a grade available, but warning tags must be attached to each bag to keep such fertilizer from being used for boron-sensitive crops. New York recommends 10 pounds of borax per acre for cauliflower for Long Island and the Albany and Buffalo areas, and 25 pounds in the Catskill area. Servicing these recommendations is no problem, but the amounts called for are greater than are likely to be added in a "shot-gun" mix.

For the production of onions on the muck soils in Orange County, New York, 300 pounds of copper sulphate per acre are recommended to be used as often as needed. Since this is only once in every 3, 4, or 5 years, farmers usually apply it separately. Again, it is a need that is not met by the addition of a pound or two of copper sulphate to each ton, although it is possible that under certain unusual conditions a pound or two per ton might be of some value.

On the alkaline muck soils of western New York, 200 pounds of manganese sulphate per acre are called for, and on the slightly acid mucks, 100 pounds.

This is not a place for a "shot-gun" mixture supplying small quantities.

A need for zinc under certain con-



Courtesy Campbell Soup Research Laboratories

Fig. 3. These rutabagas were grown on sassafras fine sandy loam with pH 6.2. They represent two plots, both of which received 1,500 lbs. of 5-10-10 per acre. The rutabagas with the dark centers received no borax, while those with the light centers received 40 lbs. of borax per acre.

ditions is showing in occasional instances. Certain new fungicides containing zinc have helped establish this. On crops that are regularly sprayed, the farmer may be wise to include zinc in his spray program rather than in the fertilizer, since zinc in the fertilizer does not give as consistent results as it does in the spray. For crops that are not sprayed and which need zinc, it will have to be incorporated in the fertilizer. It is not known how widespread zinc deficiency is. Five years ago it was not thought that there was any, and it is by no means certain now that any appreciable acreage in the Northeast is involved.

Dr. Hester and his associates in the Campbell Soup Research Division have some experiments in which they have demonstrated that if the nutrients contained in manure are applied in inorganic form, just as good results as with manure will be obtained. The manure they used contained 12 pounds of manganese, 15 pounds of iron, and 0.07 pounds of copper. Dr. Hester also feels that there should be at least 5 pounds of borax in a ton of fertilizer.

Magnesium has not been mentioned because in most areas in the Northeast it is supplied in dolomitic lime at small and often no additional cost over high-calcium lime. Fertilizer grades containing it are also available. To supply these quantities of micronutrients represents a substantial cost—too much, in fact, to add them to all grades without the backing of the State Agricultural Experiment Stations. At present it would be difficult to get any agreement from Experiment Station workers on the make-up of a micronutrient mix.

While the use of these micronutrients is fascinating and has the glamour of something new, it should not be forgotten that the most important mission for the betterment of agriculture still is the supplying of the major plant foods at a price that will enable the farmer to fertilize for near maximum yields at reasonable cost. Additional research on this micronutrient problem is needed. The problem is present, but it is not known how extensive it is. Most state recommendations now read, "See your County Agricultural Agent if you suspect you have a micronutrient deficiency." This is putting many county agents on the spot without helping the farmer, since the county agent all too often does not have sufficient information to permit him to give a positive prescription.

The Lactic Litany

(*From page* 5)

At the receiving door a delicate scale is used to weigh each batch of milk dumped there. Time was when milk was counted only by the canful measure. Bureau of Dairy Industry tests made at a city intake on 346 shipments indicated that by can estimate there should have been 6,185 gallons, but upon a careful weight analysis at 8.6 pounds to the gallon, only 6,068 gallons arrived. This meant a shortage of 117 gallons. This inaccuracy was attributed to the dented and battered cans, leaks or spills, and incomplete filling.

AT the time of weighing, testers sample the milk and run butterfat and acidity tests, or they make plate counts or methylene-blue bacteria tests, having special laboratories for this work. Thence into the plant in question goes the whole milk from that silly old ignorant cow, a product practically untouched by human fingers. First and foremost at all types of milk plants, the fluid stream gurgles and boils into a cylindrical storage tank, often lined with glass. For processing into fluid form for cheese or for dry milk and evaporated milk, the second step in the glittering parade of the droplets is through clarifier or filter.

Enclosed patent filtering machines are used at all the major plants where the dairy business booms. The clarifier takes foreign particles from the milk by centrifugal force, and for most operators is preferred to a simple filter —except on a cost basis.

Two other indispensable gadgets are seen on larger dairy floors—the homogenizer and the pasteurizer. The homogenizer is no new thing, but it is widely used for market milk. Its mechanical agitation breaks up the small fat globules so they cannot bunch up together and form the well-known cream line at the bottle top. It is claimed that the milk is less affected by oxidation than untreated milk, will hold its flavor longer, but is sensitive to bright sunlight.

Pasteur himself gave the familiar name to the milk machine called a "pasteurizer." Essentially then, it is a bacteria killer. That's why we hear so much argument over using raw milk for drinking or for making butter and cheese—always tipping our battered hat to the exacting producer of so-called "certified' natural milk. (If you ever operated one of those fancy places you'd know all about the headaches in the milk muddle.)

EVERY up-to-date, particular commercial plant runs a modern pasteurizer. It may be a flash process pasteurizer or a holding type. This means maintaining the milk at 143° F. for 30 minutes, or at not less than 160° F. for about 15 seconds. Besides ridding the milk of its nasty bugs (less apt to be there than of yore) the process helps to keep the fluid longer in palatable shape owing to the absence of lactic-acid-forming bacteria. To control the whole process definitely, intricate thermostatic automatic devices are found in tiptop plants.

You can wander at will and with astonishment through the larger plants and see tubular coolers, cooking vats, presses, hot wells, vacuum pans, drop tanks, driers, bottlers, packaging machines, and other stainless steel robots that handle the milk as it is pumped and forced along through stainless steel pipes.

These valuable adjuncts to your welfare afford a varied and a steady market for aluminum, antimony, bismuth, brass, bronze, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tungsten, vanadium, zinc, wood, glass, rubber, cork, and plastics. In the laboratories where the milk is tested, precision instruments add another touch to the complex scene and make still another market for the artisans of the world. Verily, that cow with her dreamy eyes and everlasting cud really started something despite her vapid disposition.

Although dairymen have invested fortunes in machinery to run these mammoth plants, they still require men to run them. The human element, the personal factor, is vital. Next to the arrangement scheme within the plant and its engineering features, the ability of the manager and the skill of the force determine the eventual success or fizzle of the enterprise and the ultimate satisfaction of the consumer.

LIKEWISE on the farm and in the country factory where small volume is handled, it takes brains and experience and a heap of faith and tradition to meet the above requirements of economy and quality. Nobody ever got a tip from the cow herself or very much sound advice from the guy who drinks the milk or nibbles at the cheese wafers. Like all American enterprise, it's the man behind the gun who must aim high and hit the target.

Some plants that take in only 1,200 gallons of milk per day will need 3 men —others of like volume require 6 workers. In the big buster outfits of over 20,000-gallon capacity daily the force may vary from 60 men to 130. Size doesn't make a good product either, taken by itself. I know tiny shack-like enterprises away out in the sticks that have earned a wide reputation for wholesome, tasty cheese which few of the gargantuan shops could even imitate.

ONE peculiar point so often forgotten about milk plants is that nobody can whistle for them to stop and start. Most of them just go on forever. Like the moo-cow herself, the white flood of milk can't be turned off at will and switched back again next Monday morning, or the day after the ball game. When the price for some other goods turns down and the boss scowls and gives the crew a vacation, your milk plant must keep on skimming and smiling, regardless of the price of cheddar or the cost of steel ingots.

Finally, after all the toil and trouble in the wake of the cow's tail on the road to the table—the greatest change of all perhaps is in the final selling thereof.

I can recall with dim repugnance how the milkman came daily to our door in the 1890's. His tottering hack rattled down our street and he rang a copper bell to notify the housewives to come hither with their pitchers. He claimed to be our friend, but sometimes I wonder!

Mother held out her jug or pitcher while Mr. Jones dipped frothy milk of a pale bluestone hue from a rusty can in the back end of his sagging wagon. He had no ice and neither did we. The milk had to be drunk that day or used to make pancakes, clabber pudding, or cottage cheese. Butterfat readings were unknown and bacteria and flies got their fill before we did.

Sometimes downtown a drugstore would shake us up a flat-tasting milk drink, and sometimes we enjoyed an ice cream "sociable" on the church lawn. Otherwise there was nothing doing in dairyland. Of course those who kept a backyard bovine before the city dads got so finicky about sanitation were able to wrestle themselves up a freezerful of lumpy ice cream on Sundays, or slop around with an old dash churn to coax the fat globules into forming a bit of streaky butter for us.

But now they chatter widely about contacts and luxury attractions at the "point of sale." Every street in every town boasts its soda fountains, bobtail milk bars, refrigerated cabinets, and automatic vending machines—and we buy milk in heavy cardboard or fiber containers, inhale it through straws, munch it in cones, and enjoy it in Eskimo pies.

AND lo, of a summer evening on my city street I hear again the sound of a dairyman's bell. But this time it is the motor vehicle bearing its dry-iced load of frozen pints and quarts. From every direction come the children and the women seeking a quick dessert for tomorrow's meal.

Yes, the cow has come home to roost once more. She is my neighbor and my friend, the foster mother of the so-called human race, the nurse of countless famished kids, the balancer of diets, the sign manual of health.

But believe me, it "ain't her fault." If we had no busy and ambitious men of daring and inventive mind and no capital willing to take a risk and bet on bossy, I am here to tell you that we'd be right back where we started—trying to keep well on salt pork, navy beans, and taters and gravy.

Here's to your health in a long, cool drink of you know what to wash down that sandwich, spread with the natural yellow product derived from a contented cow. That's just the same as wishing you a long life and freedom from ulcers.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

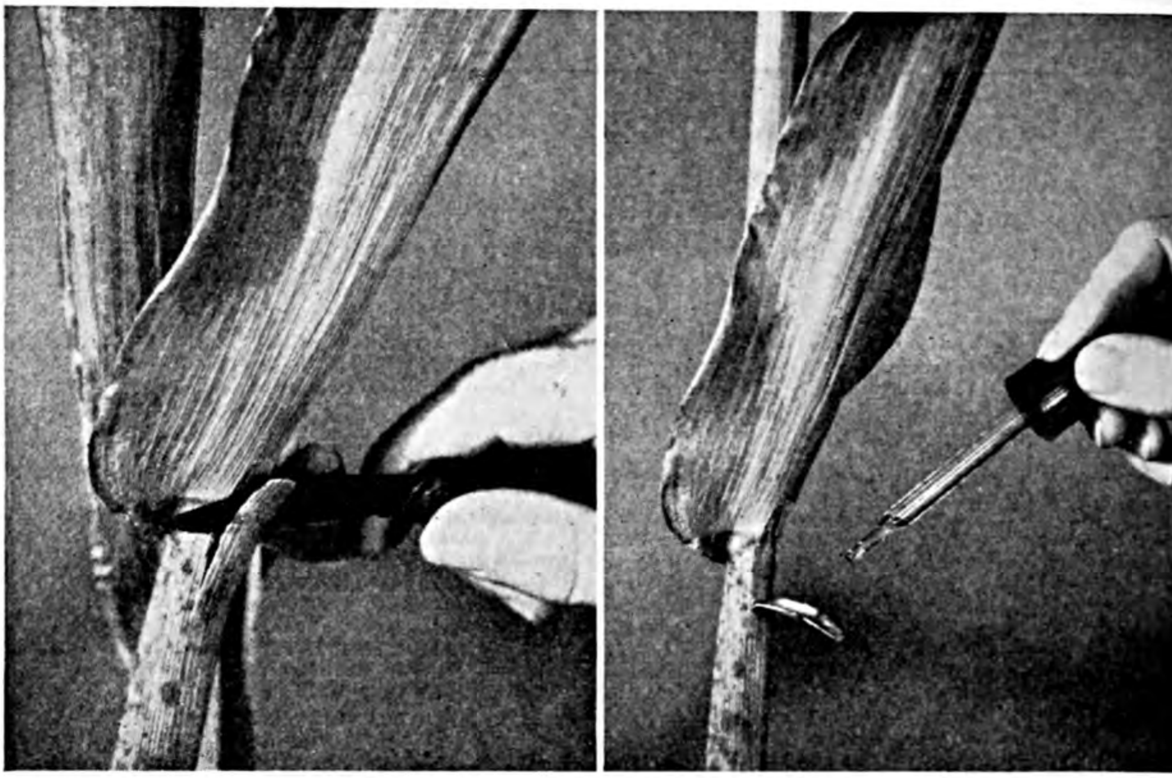
Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
II-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
NN-10-46 Soil Testing—A Practical Aid to the Grower & Industry
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
G-2-47 Research Points the Way for Higher Corn Yields in North Carolina
I-2-47 Fertilizers and Human Health
P-3-47 Year-round Grazing
S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
Y-5-47 Increasing Grain Production in Mississippi
AA-5-47 The Potassium Content of Farm Crops
DD-6-47 Profitable Soybean Yields in North Carolina
GG-6-47 Corrective Measures for the Salinity Problem in Southwestern Soils
SS-10-47 Soil Fertility and Management Govern Cotton Profits
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
BBB-12-47 The Management of Mint Soils
E-2-48 Root Rot of Sweet Clover Reduced by Soil Fertility
H-2-48 Soil Testing and Soil Conservation
J-2-48 The New Frontier for Midwestern Farmers
L-3-48 Radioisotopes: An Indispensable Aid to Agricultural Research
O-4-48 Legumes Improve Drainage and Reduce Erosion
R-4-48 Needs of the Corn Crop
V-5-48 More Abundant Living with Soil Conservation
W-5-48 Will These New Tools Help Solve Some of Our Soil Problems?
X-6-48 Applying Fertilizers in Solution
Y-6-48 Response and Tolerance of Various Legumes to Borax and Critical Levels of Boron in Soils and Plants
AA-6-48 The Chemical Composition of Agricultural Potash Salts
CC-8-48 Soil Analysis—Western Soils
EE-8-48 A Soil Management for Penn Tobacco Farmers
FF-8-48 Soil Conservation Raises Midwest Crop Potentials
GG-10-48 Starved Plants Show Their Hunger
II-10-48 The Need for Grassland Husbandry
MM-11-48 Better Hay with Potash
NN-11-48 Ladino Clover—Italian Gift to North Carolina Pastures
OO-11-48 The Use of Soil Sampling Tubes
PP-11-48 Applying Soil Conservation Through Local Contract
QQ-12-48 Legumes Supply Organic Matter
RR-12-48 Increasing Corn Yields in Union Parish, La.
SS-12-48 Hubam Sweetclover
TT-12-48 Season-long Pasture for New England
UU-12-48 The Relation of Credit to Soil Conservation
A-1-49 Organic Matter Puts New Life in Old Soils
B-1-49 Hardening Plants with Potash
C-1-49 Military Kudzu
D-1-49 Permanent Pastures in South Carolina
E-1-49 Establishing Bermuda-grass
F-2-49 Fertilizing Tomatoes for Earliness and Quality
G-2-49 The "Put and Take" in Grassland Farming
H-2-49 Wise Land Use Increases Farm Income in the South
I-2-49 Maintaining the Productivity of Irrigated Lands
J-2-49 Increasing Tung Profits with Potassium
K-2-49 Four West Virginia Veterans Top 100-bushel Corn Yield
L-3-49 The Development of the American Potash Industry
M-3-49 Better Louisiana Corn
N-3-49 Are you Shortchanging your Corn Crop?
O-3-49 Undeveloped Soil Resources of the Southeastern Atlantic Coastal Plain

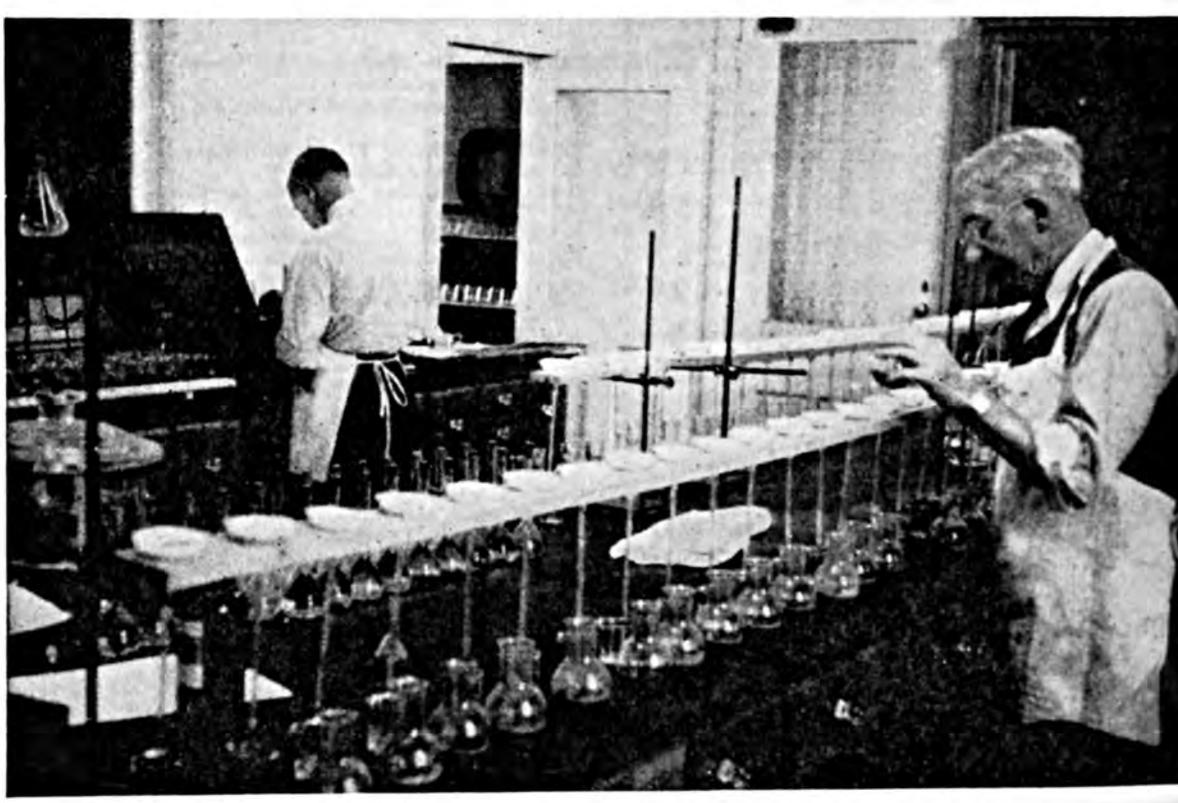
---

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

A Few Whinnies

Joe's wife caught up with her husband in a bar, sampled the highball he was drinking, and demanded, "How can you drink such horrible stuff?" "See!" said the husband, "and all the time you've thought I was out having fun!"

* * *

Mr. "Teaching that calf to drink took me two hours, roughly speaking."

Mrs. "That's what you may call it, John, but I'd call it plain cussing."

* * *

Visiting Nurse: "Did you drink three pitchers of water and stay in bed like I told you?"

Patient: "I drank the water."

* * *

The boss was working diligently in his office when his beautiful, blonde, 110-pound secretary walked in. The young lady was about to hand him the morning mail when she tripped, lost her balance, and sat squarely on his lap.

The boss roared like a lion, dumped the beautiful blonde unceremoniously on the floor, screamed that she was a clumsy good-for-nothing, ordered her out of the office, and told her she was fired.

Now you tell one.

* * *

A Farmer's Wife had lost her mind. As they carried her away in a strait jacket he said: "I jest can't figger what got into her—she ain't been outta the kitchen in 30 years!"

We wonder—if all horses say "Neigh," where in the world do little horses come from.

* * *

Gal: "Gosh, can't you be good for five minutes?"

Gob: "Say, sister, I'll be good for twenty years yet."

* * *

A colored lady was asked if she had ever been X-rayed.

"No, sah," she replied. "But I has been ultra-violated."

* * *

We're not surprised that the quintuplets have learned to swim, if they all slept in the same bed.

* * *

MOTHER IS JUST RIGHT

The day before last Mother's Day, a small boy, money in fist, entered a department store and timidly approached a woman clerk.

"I want to buy a present for my mom," he said. "A slip," he added, somewhat embarrassed.

"What size does she wear?"

The young man was really flustered. He admitted that he didn't know anything about sizes.

"Well," asked the sales girl, "is your mother tall or short, large or small?"

"She's just right,' said the lad firmly, and the girl wrapped up a size 36.

The day after last Mother's Day, the boy's mother came into the store with the slip and quietly exchanged it for a size 52.

Printed in U.S.A.

Better Crops WITH PLANT FOOD

June-July 1949 10 Cents

The Pocket Book of Agriculture


Make the Good Earth Better

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 6

TABLE OF CONTENTS, JUNE-JULY 1949

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America

Fun in the Harvest Field

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON, D. C., JUNE-JULY 1949 No. 6

Considering . . . .

Kernels and Combines

Jeff McDermid

BILLION-BUSHEL-PLUS crops of wheat for each of six straight years have meant a terrific, overflowing tide of golden kernels from our fertile soils, to beat in breaking waves even to the coasts of Europe and beyond. These seven and a quarter billion bushels of the chief bread grain which this country has raised in six years since 1944 may be compared with four and five billion bushels produced in any similar span of time. This amazing world record in wheat production, to clog our huge elevators and spread dusty coats on busy millers, is not just a happy accident that happened at a time of emergency and human hunger.

On the contrary, the most of it is traceable to the agronomist, the soils specialist, and the mechanical engineer. These forces of science and progress, coupled with the willing and well-paid farmer, and blessed with generally favorable weather, have given us superabundance instead of ordinary plenty.

More than that, our better know-how is catching hold abroad as the foreign wheatlands recoup their losses and make their own comebacks to prewar production levels. This, as it naturally happens, throws the magnificent largesse of our plant, soil, and engine doctors smack dab into the laps of the economic doctors and interns who operate on crops that have high blood pressure due to excess fatness and inertia. The old adage that "nobody loves a fat man" may be applied to the wheat crop—although we know in reality that it is false theorizing when a third of the world's populations is gaunt and emaciated, and would prefer the good humor of a rotund Falstaff to the sorrows of a skeleton.

When we older wiseacres were kids nobody fretted overmuch about the disposition of the land's abundance. Of course, the land was not so abundant then anyhow and there wasn't as much of it cultivated and seeded to food and feed. More home folks were muscle workers instead of white-collar "idlers." But that just scratches the surface of our so-called surplus dilemma, because world population as a whole is climbing fast, and even faster, they tell me, than the increase in our acre yields of wheat and corn.

WISER land-use projects have been advanced frequently as a panacea for this unbalance between bushels and bellies. But to quash that passing fancy, let's consider what Dr. Robert M. Salter, Chief of the Bureau of Plant Industry, U. S. Department of Agriculture, once stated:

"Those who look to improved land use for solution of the entire farm problem cannot escape disappointment. It cannot overcome the disparity of agriculture resulting from the comparatively elastic demand for the products of industry or from industry's advantage in tariff protection. It cannot reduce the exorbitant costs of distribution which today consume two-thirds of what the consumer pays for farm products. It cannot recover the wealth that has been drained from the country to the city by inheritance or by movement of farm youth off the land. It cannot solve the huge problem of farm tenancy. It cannot alter the fact that there are double the number of farmers and perhaps twice as much land as needed to supply the present demand for agricultural products. It can do little by itself to fulfill the crying need for greater outlets for the products of the land. The answers lie rather in the field of political economy."

But Dr. Salter did not quit there. He went on to say that increased efficiency and soil conservation are proper steps. He frowns on any scheme that tries to overcome surplus problems by penalizing efficiency. He rightly points out that the total cost to society of keeping a given sound standard of living on our farms—either in subsidies or otherwise—must vary inversely with the collective efficiency of agriculture. In other words, would any of us seek a solution to the wheat surplus by advocating ancient, costly methods of the pioneers, which are in wide use also in many countries abroad? If our wheat farmers were piddling producers, harvesting grain in hundred-bushel lots, using poor seed and poorer soil managements and rotations, would we feel justified in granting non-recourse loans or income payments or any form of financial encouragement to them? We still want food-makers, not famine-makers.

One might safely digress right here a moment to inject the idea that perhaps there should be some way of banishing from our favored and accepted list of wheat growers, under any loan or grant, all those who are mere absentee speculators and land-renting despoilers of the acreages now ripening with wheat. Such refinement of any forthcoming adjusted legislation might be only fair to those who conserve their farms and remain good stewards of the soil.

TO attempt any catalog of the soil scientist's great contributions to bumper and continually greater wheat yields would be like counting blades of grass. Each state and county had its own surveys and improvements to make, few of them exactly alike and all dependent upon acceptance and proper use of specific ways and means by the majority of the producers and landowners.

Hardly less easy to properly credit

for wheat betterment are the numerous State and Federal plant breeders and field crops specialists, both those in the research industry and the ones who took the message to Garcia through Extension demonstrations. All that we know is that in the decade from 1936 through 1946 more than 50 new varieties of wheat were distributed to growers in the commercial grain belt by Experiment Station workers.

These varieties were not just prettier ones, taller ones or shorter ones (to match the combine), or fancy ones to put into exhibit cases at shows. They were varieties obtained by selections and crosses to resist smut, rust, drought, insects, and winter-killing.

We had Thatcher spring wheat, a boon to growers when Marquis went down under stem rust outbreaks. But when Thatcher made good and swept the prairies only to droop when hit by leaf rust, then came the breeders with Renown variety, followed by Pilot and Rival, reasonably secure from the leaf rust that humbled Thatcher on some of our big wheat ranches. Then out in California stem rust continued to be severe, until science came across with Baart 38, and its companion, White Federation—both of which have eliminated this spore disease from the entire State.

Meanwhile things were not so good in the hard red winter wheat zones. Old standby varieties gave out from many causes, but high-yielding and resistant kinds soon replaced them, such as Tenmarq, Cheyenne, Pawnee, and Comanche. Scouts went to Russia and the Caucasus, the mid-European lands and Asia, and toted back promising kernels which were multiplied, tested, and finally distributed to take the wishing and the waiting out of the wheat game, in preparation for billion-bushel crops and mechanical marvels to handle them.

We used to think it was the last word in mechanics to see the big, wide binders drawn by several teams or tractors cutting the wheat crops on the prairie seas; but along came the engineers who connived together for even speedier harvesting. They figured and experimented and drew blueprints, aiming at a machine that would do away with the victual-consuming and time-wasting crews of threshermen.

By degrees they evolved what we know as the "combine." It was primarily dedicated to the limitless, fairly level lands of the Great Plains, making it possible to cut wheat at the right stage, scores of acres daily, thresh it right on the traveling outfit with power take-off arrangements, elevate it into attached bulk trucks, and haul it to market quickly. In a few years this invention was modified and adapted to the smaller, rolling farms of the humid regions—where most of the cereals raised are put into livestock rations.

It has been truly observed that each new advance we make presents new difficulties in some related direction. Just so with the coming of the combine and the rapid transportation of the quickly cut wheat to commercial storages.

TODAY when we say that the "wheat harvest has begun" we snap a signal to all the intricate chain of agencies which receive it on its road to processing or export. There is no longer any breathing spell reserved for the curing and threshing tasks. Immediate de-

(*Turn to page* 49)

Fig. 1. This excellent photograph of a fertilizer test plot demonstrates several things. The sign is attached to a portable stand. The cross bar is adjustable to indicate the height of the plants on either side. Note the neat, black lettering on a white background.

Some Photographic Hints For Agricultural Workers

By Ross E. Hutchins

Mississippi Agricultural Experiment Station, State College, Mississippi

PHOTOGRAPHS are playing an ever-increasing role in the modern world. The past 20 years have seen tremendous advances in the science of photography and more are around the corner. There are new films of greater speed and greater versatility, practical color processes that almost any one can use, new and better equipment that would make an old-time photographer green with envy. Pick up any magazine or technical journal and you will realize the part that good pictures play in presenting information. Visual means of education are being utilized more and more in nearly every school and college. The agricultural worker, whether he be in research or in extension work, can and should employ pictures to record the results of his experiments and to present his information to the public.

It goes without saying that every agricultural worker should have some knowledge of photography. This is desirable even though he has a professional photographer to actually take his pictures. Photography has, like everything else, its limitations and special requirements, and the worker should understand these things in order to plan his methods of presentation. Very often a photographer is called upon to make a picture that could have been portrayed much more effectively had the agricultural worker known something about the technical side of photography.

The science and art of photography are complex in the extreme, yet for the ordinary work of making pictures only a few fundamental principles need to be understood. Most agricultural photography is relatively simple, but in the first place a good camera is an absolute necessity. One cannot expect professional results from inferior equipment. Neither can one expect professional results from expensive equipment in the hands of an inexperienced worker. All too often an expensive camera is purchased in the hope that good equipment will compensate for lack of knowledge. Such a belief is very erroneous. If you know nothing about photography and are not willing to learn a few of the simple fundamentals of the subject, the best thing to do is to purchase a simple, inexpensive camera. Your percentage of good pictures will be higher. Remember that an expensive camera with all its gadgets is capable of making excellent pictures, but only if it is properly used.

Selecting the Camera

This is a difficult subject and one that usually causes considerable concern. The agricultural worker must have a camera that is capable of producing negatives that may be enlarged up to 5 x 7 inches and still show adequate detail. This is necessary for publication, for most magazines and papers require a picture that large or preferably 8 x 10 inches. A poor lens will not give such a picture. Photographic equipment is expensive and the camera lens is the most expensive single item. But a camera is only as good as its lens. If you know nothing about lenses, seek the advice of a photographer or a reliable dealer. More than likely the camera you buy already will be equipped with a lens and you will not have any choice in the matter. Most good cameras are fitted with good lenses.

Before we talk about cameras, it might be well to consider prices. The writer once was advising a prospective camera purchaser, and in reply to the question, "How much do you wish to pay?" the answer was, "I want to get a good camera and I wouldn't mind paying as high as $15." This man was an optimist. Cameras can be obtained for that price, but they will not produce pictures adequate for publication. To obtain pictures of the type the agricultural worker needs he must pay at least $50 and probably as much as $200 for a camera.

It is impossible in the space avail-

Fig. 2. The problem of photographing an object so that no shadows are visible is one that the agricultural worker often encounters. In this case it was solved by placing the grapes upon a plate of glass elevated several inches above a white background.

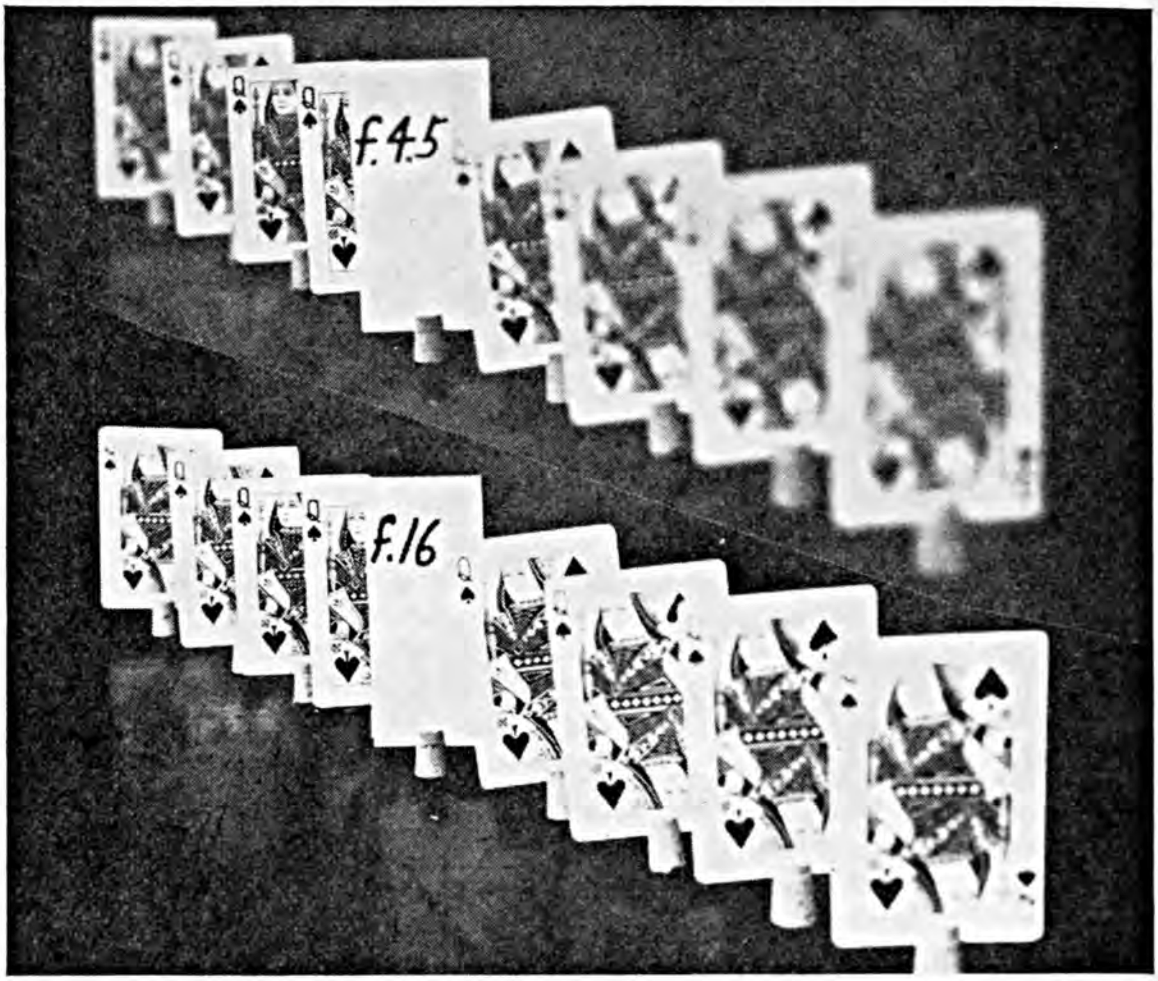


Fig. 3. Depth of field demonstration. In the upper row of cards the camera was focused on the white card and the diaphragm was set at f. 4.5. Note that only the white card and one or two playing cards beyond are in sharp focus. In other words, the "depth of field" is very shallow. In the lower row the diaphragm was closed to f. 16 with the result that the depth of field was greatly increased. This simple experiment demonstrates clearly the value of using a small diaphragm opening whether it be for a field scene or a close-up of an ear of corn.

able to discuss all the various kinds of cameras. Either the roll film type or the cut film and film pack type may be used. The latter are best but are usually more expensive. The size is important. The camera should be at least 3¼ x 4¼ inches. Press photographers use 4 x 5 inch cameras of the press type. The Speed Graphic is a good example of the latter. The small 35 millimeter cameras are of little value for this work except for making kodachrome slides. These, however, certainly have their place in agricultural work.

A ground glass is usually a necessity if any photographs are to be made of close-up subjects such as potted plants. If the only camera available has no ground glass, it is still possible to make close-ups by means of supplementary lenses. These are usually called portrait lenses and are nothing more nor less than spectacle lenses mounted in a ring that slips over the camera lens. When the camera is focused at infinity, each portrait lens will bring the focus up to a certain point depending upon the power of the lens. All one has to do then is to measure the distance from the lens to the subject. It is a necessity that the diaphragm or stop be closed down a great deal for close-up shots because the depth of field is very narrow. If much depth is needed, the diaphragm setting should be about f. 22. Depth of field will be discussed later on.

If no regular portrait lenses are available, they may easily be made of lenses from 10-cent store spectacles. When cheap spectacles are sold, there is a small disc of paper attached to the lenses bearing a number. This number indicates the power of the lens in dioptres. Now a lens of a given dioptre will always bring the focus up to a certain point when the camera is focused at infinity. For instance, if a spectacle lens of three dioptres is placed over your camera lens with the camera at 100 feet or infinity, the focus will be brought up to 13 inches. This is very useful to know. The following table shows various dioptre powers and the focal distances they give:

Spectacle Lens Dioptre	*Focal Distance*
.5	6½ feet
1	39 inches
1.25	31½ "
1.5	26 "
2	20 "
3	13 "

The spectacle lens should be mounted as close to the camera lens as possible. This may be done with a short section of cardboard tube. To get good pictures by this means some method of holding the camera rigid, such as a tripod, is necessary. Also to compensate for the close-up a good deal of increase in exposure time is necessary. This needs to be only approximate as modern film has a great deal of tolerance. For the one dioptre lens, increase exposure about four times and for the three dioptre lens increase it ten times.

Depth of Field

This is one of the most important things in photography and one that is not fully understood by many who take pictures. Suppose you are photographing a field of oats having a sign in the foreground indicating the variety or amount and kind of fertilizer used. How will you photograph the subject so that both the field and the sign will be in sharp focus? There is only one way to do this. Close the diaphragm down to about f. 16 or f. 22 and make appropriate time settings. Remember this: *You can have either great depth of field or great speed*—you cannot have both. You must decide which is the more important for the subject you are shooting. For the oat field we have seen that depth was paramount. Now suppose we are photographing a bunch of horses galloping across a pasture. In this case, speed to stop the action is important, and so we sacrifice depth and open the diaphragm to, say, f. 6.3 and

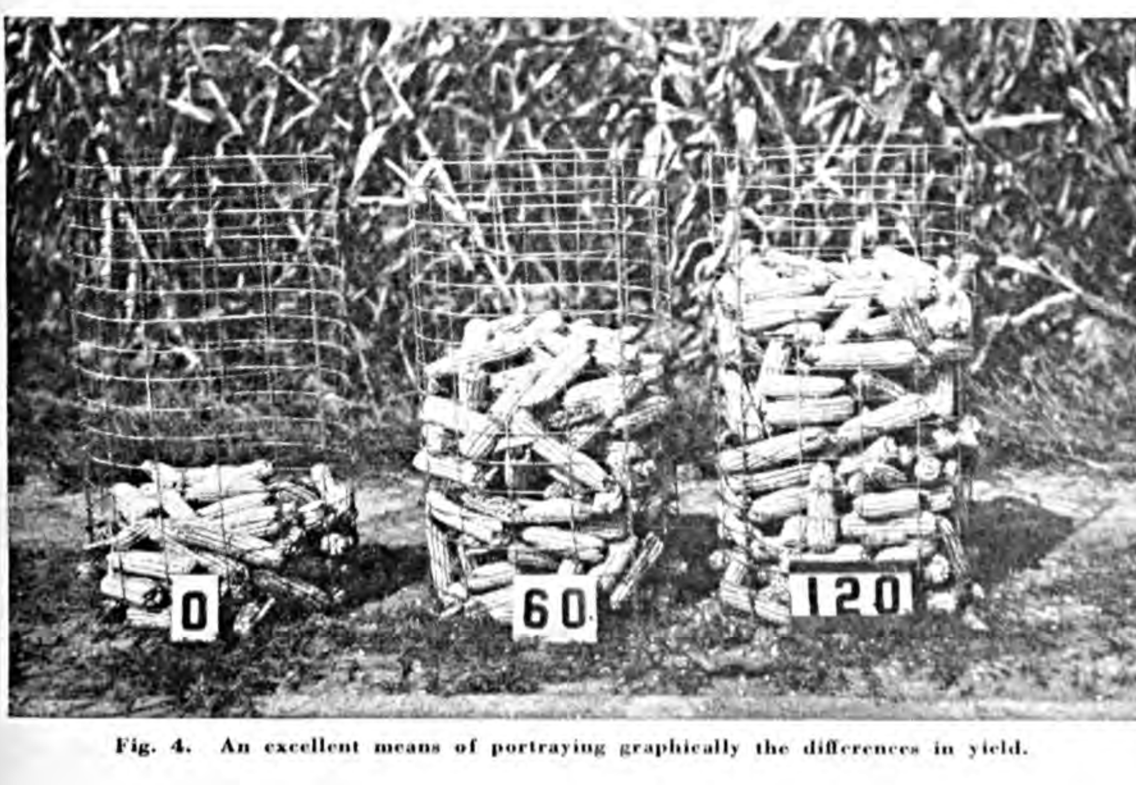


Fig. 4. An excellent means of portraying graphically the differences in yield.

cut down the time to about one two-hundredths of a second.

There is another way in which a knowledge of field depth may come in handy. Often certain subjects stand out better if the background is out of focus, thus emphasizing the subject. In this case open up the diaphragm and increase the shutter speed appropriately.

Exposure

Exposure is a subject that always causes a great deal of concern and doubt. If you can afford it, obtain one of the several electric exposure meters that are on the market. They will take a lot of guess work out of the question, but only if properly used. Point the meter at the subject being photographed—not at the sky. You are not trying to photograph the sky. Take several readings of various parts of the subject and average them. Film speed varies considerably, therefore always set the meter for whatever film you are using. Do not point your meter directly at the sun as this will harm it. Do not carry it in the hot glove compartment of your car. Study the directions that come with it and follow them closely.

If you cannot afford an electric exposure meter, then obtain a kodaguide from your dealer. These are small plastic calculators which cost only a few cents and with careful use will give excellent results.

Now one final word about exposure. Unless absolutely necessary take no pictures on dull, cloudy days unless you are photographing close-ups and using flash bulbs or other lights. Pictures taken on dull days usually look dull. If you want pictures with sharp detail and snap to them, use bright sunshine. There is one exception. Sometimes light clouds actually help color pictures. Remember, however, that in this case the color is giving you the detail and not the light and shadow as in black and white photography. If you have no meter, give one-fiftieth second at f. 16 in bright sun and you will usually get good pictures.

Some Rules and Suggestions for Agricultural Photography

1. Take care in the preparation of your subject. More than likely the photograph will be published. At least

(*Turn to page* 44)

Fig. 5. A field scene having great depth. A small diaphragm opening was employed so that everything is in sharp focus from the grass in the foreground to the trees in the distance.

Fig. 1. Productive soil and an adapted hybrid help, but do not assure, good corn yields.

Heredity Plus Environment Equal A Corn Crop

By L. L. Huber

Agronomy Department, Pennsylvania State College, State College, Pennsylvania

A CORN crop, good or poor, results from a combination of factors, partly hereditary and partly environmental. If a corn hybrid is truly adapted to a certain locality, it has good heredity as far as that vicinity is concerned. For the moment, let us consider all problems of corn heredity as solved by plant breeders—although of course they are not—and ponder what often happens to the environment, the fields, in which corn is grown.

Corn happens to be one of a succession of crop plants which will grow, let us say, in a certain field. If corn is grown after corn repeatedly (and no fertilizer is applied), eventually corn will not succeed in that area. Some other crop must be planted or weeds will take over.

This principle of succession of plants may be illustrated by reference to an old glacial lake near my former home. This lake is gradually filling up with organic matter. If one were to take a boat on this lake, he would observe in approaching the shore thousands of submerged water weeds with stems 10

Fig. 2. Heavy machinery compacts soil and lowers permeability. Careless cultivation prunes roots and destroys corn plants.

to 15 feet long. As these plants grow and decay, the water becomes shallower until in the end it is too shallow for them to endure. They can't grow in shallow water.

A little nearer to the shore water lilies begin to appear. They in turn grow and die down and fill their section of the lake. Nearer shore where the water has become too shallow for water lilies, cattails have appeared which in turn grow and die and thus help to fill up the lake. And beyond the cattails are the sedges; they are so close to the water's edge that they are submerged only in spring. Here at the water's edge, willows have begun to thrive. Back of the willows come cottonwoods with oaks and hardwood trees farther up on the higher land. In the end, hardwoods will cover the whole lake area.

One point of importance here is that in this succession, one species of plants gradually creates an environment more and more unfit for itself but more fit for something else. Almost within the memory of living man, a similar succession of plants has occurred in some of our farming areas. Settlers cleared the land and cropped it with corn and wheat, later perhaps to rye, and then to buckwheat. Who wants to grow buckwheat? Only he whose land will profitably support no other crop. Eventually the land has gone out of production, even of buckwheat, and coarse poverty grasses have taken over. In some instances, the poverty grass stage has been relatively short. Pines, such as Virginia pine, already have come in and natural reforestation has started again.

Crop rotation is man-made and man-regulated plant succession. Crop plants are subjected to the immediate action of their environment, the plants in turn having a marked effect on this environment. The whole problem of soil management and cultural practice largely roots in this relationship. It is our job to regulate crop succession to our advantage.

While plants are dependent upon environment, man is dependent upon plants for his food supply; hence, his most striking relationships are with plants. His problem is concerned with how to obtain the most from plants. A satisfactory crop rotation or plant succession is a triumph in man's attempt to gear his problem of food and shelter into the pattern set up by Nature.

Man and Nature may be mutually helpful or they may be antagonistic. Plants have shown us that if we are to be their master we must understand how to handle and regulate them. Unless we give thought to what we do, we may unwittingly create an environment which is more and more unfit for the crop that we want and more fit for one we do not want to grow.

How often have you seen corn following corn on the same field, year after year; or corn following soybeans; or soybeans following corn? What sort of environmental change is set in motion with this kind of practice? The ground is left bare each fall; perhaps the stalks are burned in the spring. Plant residues often are kept at a minimum.

The accumulation of humus is a universal process of nature. Any practice that interferes with the maintenance of organic matter in the soil is one which calls for attention. With decline in organic matter, aeration of the soil is decreased. Earthworms, soil insects, bacteria, and fungi are reduced in quantity, thus further decreasing aeration. Proper tilth disappears. The soil becomes hard. Erosion is increased because poor soil structure has been allowed to develop. Use of heavy farm equipment year after year through further compaction of already hard soil adds to the difficulties of growing crops.

This description shows how a single farm practice may set in motion a whole chain of events, many of which may not be predictable. It is evident that we can not safely ignore nature's laws.

Good corn crops don't just happen. An understanding of the relation of the corn plant to its environment is essential. How the corn plant performs is determined by its environment.

Environment, however, is more than soil. We may have a soil that is relatively high in organic matter, well aerated, rich in bacteria and fungi, adequately limed, well drained, and well supplied with nutrients, but we still may fail to produce a good corn crop. We must have the cooperation of the weather.

There is no substitute for adequate rainfall, favorable temperature, and plenty of sunshine. Whenever the soil moisture exceeds certain minimum and maximum proportions, the corn plant ceases to function to our advantage. The deleterious effect of drouth, however, is partly offset when soil is high in organic matter. Abnormally high rainfall on compacted soil or soil of poor structure is more damaging than on soil in good condition.

In addition to the soil and weather, the corn plant is subject to important indirect environmental factors; in fact, these indirect factors at times may be more serious than the major ones. For example, suppose a farmer has included

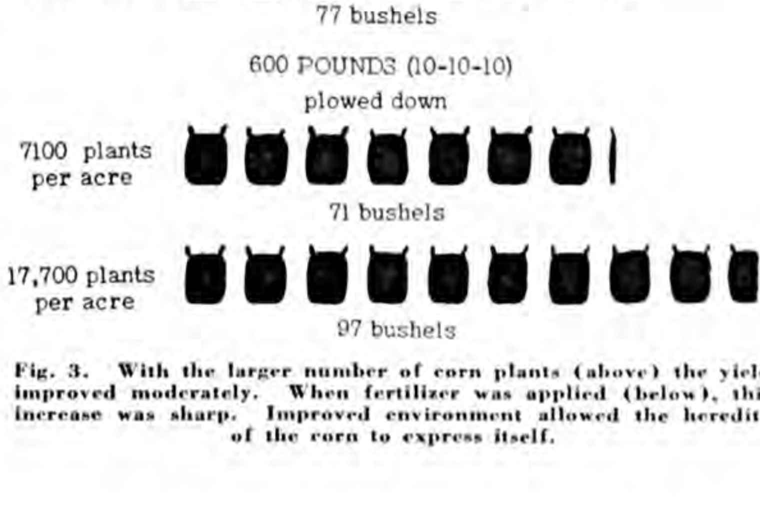


Fig. 3. With the larger number of corn plants (above) the yield improved moderately. When fertilizer was applied (below), this increase was sharp. Improved environment allowed the heredity of the corn to express itself.

sweet clover in his crop rotation; his soil is well drained; temperature and rainfall are adequate. His corn crop is growing vigorously; thus, it is more acceptable to the nutritive requirements of the corn borer—assuming of course that the corn borer is a major hazard in the environment. Such corn will receive a higher egg deposition by borer moths and will favor a higher survival of larvae. There is then a chance that the loss through borer damage would partly or completely offset the gains of added fertility.

Obviously nature is complex. One factor in crop production is associated with others. Furthermore, change is not always in the direction of increased yields.

We must remember, too, that the rotation that we employ and the crop we use are limited by environment. Not every farm or field will produce corn economically. Fundamentally the growth and functioning of the corn plant always depend upon the nature of the total environment and its adjustment to it and not on cultural practices. Cultural practices only modify the relation of the plant to the environmental complex. What man calls agriculture is, in a large measure, the creation of an environment more or less suitable to crop plants.

Now, after having considered some of the problems of corn environment, let us return to corn heredity. Plant breeding has resulted in greatly improved strains of corn. Hybrids which are more efficient in their use of nutrients have been created. They are more resistant to insects and disease, to drought and cold. They give a greater return of high quality corn per acre in relation to cost and ease of production. They are better adapted to the needs of the grower. The use of an adapted hybrid, one that fits the particular environment in a given field, can generally be counted upon to increase yields 25 per cent above those of open-pollinated varieties.

Unfortunately farmers do not always buy and use adapted hybrids; their choices often do not fit or only partly fit their farm conditions. A common mistake is to use a hybrid that is too late to insure maturity even in average years. Thousands of farmers sit on the anxious seat in September hoping for late frost. Year after year, like schoolboys watching a foot race, they hope for a photo finish. Soft corn often results.

"Adaptation" includes more than meeting the requirements of length of growing season. In areas where stalk rot is an important disease, a hybrid can not be considered adapted if it is susceptible to stalk rot. There are areas where the corn borer and the

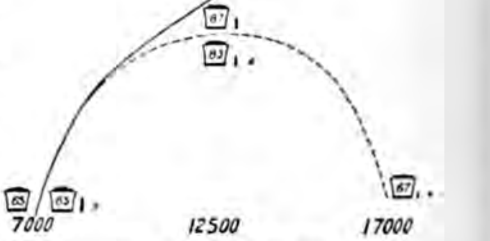
(*Turn to page* 43)

Number of plants per acre

Experiment A: This graph shows that on a fair soil, increasing the corn plant population with adequate plowed-down fertilizer increased yields. Without additional fertilizer, more than 11,000 plants per acre resulted in sharply lower yields. The tiny figures indicate average ear weights in pounds. *Penna. Sta. trials.*

CORN PLANTING CHART

INCHES BETWEEN ROWS	INCHES BETWEEN PLANTS IN ROW	PLANTS PER ACRE
42	8.4	17,000
40	8.8	
38	9.3	
36	9.8	
42	10.0	15,000
40	10.5	
38	11.0	
36	11.6	
42	11.5	13,000
40	12.1	
38	12.7	
36	13.4	
42	13.6	11,000
40	14.3	
38	15.0	
36	15.8	
42	16.6	9,000
40	17.4	
38	18.3	
36	19.4	
42	21.3	7,000
40	22.4	
38	23.6	
36	25.0	



Number of plants per acre

Experiment B: This graph shows that on a fertile soil, increasing the corn plant population increased yields which rose further with added plowed-down fertilizer. Without additional fertilizer, in this case, yields dropped off sharply when plant populations over 12,500 were grown. *Penna. Sta. trials.*

Fig. 4. A Corn Planting Chart.

The Search for Truth

By Firman E. Bear

Soils Department, Rutgers University, New Brunswick, New Jersey

ON the 24th day of May, 406 years ago, an old man, long confined to his bed by paralysis, awoke to find a messenger, with a book, standing by his bed. He reached out, grasped the book, eagerly scanned the title page, smiled happily, and fell back—dead. That man was Copernicus. The book was his "De Revolutionibus Orbium Coelestium." It contained the mathematical proof that the earth revolves around the sun, a discovery that was to start man on his first systematic search for truth.

To say that the sun was more important than the earth was heresy in Copernicus' day. For the system of learning of that time was based on the doctrines of Aristotle who taught that man was the center of the universe. To doubt that publicly meant to die an unnatural death.

Aristotle had assembled more knowledge than had ever before been compassed by one mind. He had surveyed the whole realm of thought and had written 400 books. But he had never stopped to test his conclusions by experiment. He reasoned so skillfully that one wonders how he could possibly have come to the conclusion, as he did, that human beings have only 16 ribs and that women have less teeth than men.

But Aristotle can easily be forgiven his mistakes when one remembers that he had no telescope to turn upon the heavens and no microscope to turn upon life. He had no watch, no thermometer, no barometer. And, except for the mathematics of Pythagoras and a few minor bits of experimental data, there were no proven facts.

There had been some wise speculations. But since they *were* speculations, Aristotle believed, quite humanly, that his were more dependable. He formulated a whole new philosophy of his own. Though the belief that the sun and the planets were not handmaidens of the earth had been suggested by Plato, his teacher, Aristotle would not permit his followers to stoop to so degrading a thought.

Yet Aristotle laid the foundation for science by organizing the existing knowledge of the world and teaching men to think. Out of their thinking came *doubt*. And doubt is a potent force that rudely pushes ignorance aside and cuts new channels for thought.

It was doubt that made Novara check Ptolemy's astronomical calculations. As a result he noted discrepancies, which he confided, behind tightly closed doors, to his pupil, Copernicus. It was doubt that led Copernicus to devote night after night and year after year in plotting the movements of the stars. And the data he collected, added to the calculations of Kepler and the experiments of Galileo, not only yielded the knowledge that the sun was the center of our solar system, but opened the door to still greater truths that lay ahead.

It was doubt that sent young Galileo to the top of the Tower of Pisa to drop his weights, a heavy and a light one. Aristotle had speculated that a heavy weight would hit the ground before a light one, and his verbal proofs were so convincing that no one had dared to doubt it. But when Galileo's weights banged on the pavement simultaneously, they started reverberations that were heard round the world, and they have been echoing down through the centuries ever since.

Galileo put all beliefs, including his own, to experimental tests. To test the Copernican theory he needed some device by which he would see the heavens better. So he read up on optics, designed a three-power telescope, enlarged it to a 30-power one, and saw, with his own eyes, what Copernicus had said man would see if his vision could be sufficiently enhanced.

The Senators of Venice were so intrigued by this instrument, which brought their ships into view two hours before they could be seen with the naked eye, that they raised Galileo's salary and made his job good for life. But Galileo's experiments were so devastating to the opinions of the professors of his day that they finally rose up in resentment against him and caused him to be called before the Inquisition in Rome. Galileo would have gone to the stake, had he not recanted his too-modern beliefs. As it was, he spent the last days of his life a prisoner. But that did not prevent his recording the results of his experiments and formulating laws of motion that have survived the test of time.

The year before Galileo died, an English farm boy was born who was to pick up the torch of truth and carry it on for his generation. That boy grew up to be the great Isaac Newton. By the time he was 24 years of age, Newton had laid the foundations for differential calculus, he had formulated the laws of gravitation, and he had unlocked the door to the secrets of the spectrum. But, after some unfortunate early experiences in trying to enlighten the Royal Society of England, he didn't tell anybody about his discoveries. In fact, the minds of most of the men about him were so cluttered up with impossible notions about the world in which they lived that no useful purpose would have been served by revealing his thoughts to them.

Newton's laws on gravitation had been gathering dust for nearly a generation when Picard, a Frenchman, found that a degree was nearly 10 miles longer than it had previously been believed. That was all Newton needed to make his calculations check. For the next two years he was lost in celestial mathematics. Sometimes he would sit on his bed, only half dressed, the whole day long. He never knew whether he had eaten or not. And, for weeks at a time, he never left the house. He was writing his Principia, the most famous scientific treatise of all time.

Strange as it may now seem, much more thought had been given to the universe than to the world in which men lived. The thoughts of the early philosophers and scientists were on the heavens rather than on the earth. They knew little of the air they breathed, the ground they walked on, the food they ate, and the life that throbbed within themselves. The eighteenth century was at hand, yet men knew literally nothing about the things that were closest to them.

For centuries, the alchemists had been so engrossed in their search for means by which the baser metals could be transformed into gold that most of them had lost sight of the real values of that day. But a few masterminds had turned their efforts toward the earth beneath their feet and the life that continued to grow out of it. One of them, Robert Boyle, was pulling substances to pieces, for no other reason than to find out how they were made. When he got them reduced to their component parts, he called these parts elements, and a new science, chemistry, was born.

Of all the mysteries of all time, the greatest was the phenomenon of fire. All that men knew about fire was that it never occurred except in the presence of air. Boyle discovered that air was a mixture of gases, but he could not separate them. Priestley had isolated oxygen, but he had no conception of its relation to combustion. Fire was something called Phlogiston that escaped into the air when a substance was burned. And that was less than 200 years ago.

The world had to wait for the great French chemist, Lavoisier, to solve this age-old riddle. Wealthy enough to lead a life of ease, this tireless man was one of the most active scientists the world has ever known. He never allowed himself the luxury of a leisurely meal. For long stretches, to save time, he lived on bread and milk alone.

With Lavoisier, accuracy came into the chemical picture. He designed the analytical balance, a veritable sword of truth. He weighed substances before they were burned and the residues that remained. He found that sulfur and phosphorus added weight, but that the air around them lost an identical amount in the process. Soon he had pieced together the fundamental law of the indestructibility of matter, that nothing is actually gained or lost when chemical processes take place.

For 20 centuries it had been believed that water, on boiling, turned to stone. That explained the deposit in the bottom of the teakettle. Lavoisier doubted this. For 100 days and 100 nights, he distilled and redistilled pure rain water, never letting the flame go out. Yet at the end of that time he had only a mere speck of solid matter remaining in the bottom of his flask, and this his balance accounted for in the loss in weight in the flask itself.

Once again the ugly head of ignorance and prejudice raised its head to crush an amazing truth to earth. Incited by jealousy and by their inability to comprehend the workings of this pioneering mind, his fellow scientists incited action against Lavoisier. Suddenly, one day, the door of his laboratory was burst open and soldiers came pouring in to the sound of crashing glass. Shortly afterward the head that had done so much to advance the truth in France fell under the guillotine.

But Theodore de Saussure, then 27 years of age, was standing by, ready to take up, immediately, where Lavoisier had left off. His scientific interest went back to his grandfather, who was forever writing papers for the local agricultural society. This inquisitive old man possessed a lot of practical knowledge of the means by which crop yields could be increased. He knew, for example, that manure, bones, and wood ashes stimulated plant growth, that lime cured sour soils, and that legumes improved the land, and he was annoyed that he didn't know why. But young de Saussure burned plants, analyzed their ashes, and made the important discovery that soil is a necessary constituent of living things.

But it was not until young Jean Boussingault, then a mere two-year-old, who was being brought up among ragpickers on a dark, narrow street in Paris, had grown to manhood that anyone was to see the real significance of de Saussure's work. Somehow, Boussingault rose above his surroundings, grew to be a chemist, became interested in agriculture, married a farmer's daughter, and began experimental work with plants on his father-in-law's farm. There he put laboratory experiments to field test. He kept a record of the intake and outgo of elements from the soil by way of the crop. He analyzed the soil, the crop that came off it, and the manure that went back onto it.

And yet another mastermind was in the making in Justus von Liebig, a brilliant young German, who had wedged his way into Gay Lussac's laboratory in the Sorbonne in Paris. There he was soon so impressed with the superiority of the laboratory over the lecture room as a means of learning that he resolved to have a laboratory of his own at the first opportunity. And that was not far ahead for, by 1840, Liebig's laboratory at Giessen had become the world center for students of plant and animal nutrition. Out of the work in his laboratory came the first clear-cut analysis of soil-plant-atmosphere relationships. It was Liebig who first enunciated the law that plants create organic matter out of purely inorganic substances, a thing that animals are incapable of doing.

A copy of Liebig's book fell into the hands of young John Lawes who had just come into possession of his ancestral estate at Rothamsted, England. As Lawes read the book he quickly became intrigued by the idea that crop yields could be increased at will, merely by adding a few minerals to the soil on which the crops were to be grown. Lawes was quick to see the possibility of an artificial manure industry that might well assume large proportions if Liebig was correct. A commercially-minded man, he set to work immediately to cash in on this idea.

But first he had to find out the exact effects of chemicals on soils and crops. He began by employing Henry Gilbert, the best chemist he could find. He set aside a whole field, and later a whole farm, for experimental work. There, over 100 years ago, Lawes carefully laid out what is now the oldest set of fertilizer plots in existence, and he seeded them to wheat. And wheat has been planted in them every year since.

Three men were now the center of a controversy that was to continue with increasing intensity for half a century. This controversy had to do with the source of the nitrogen of plants. Liebig, the theoretical chemist, said that plants got their nitrogen from the ammonia of the air, which comes down in the rainfall, but he didn't take time off to prove it. Lawes, the commercial chemist, caught some of the rainwater that fell on Rothamsted, analyzed it, and found that the quantity of nitrogen thus supplied to an acre of land was only a small fraction of what a good-sized crop required. But Boussingault, the farmer-chemist, analyzed his soils, the manures that were applied to them, and the crops that were removed from them and found more nitrogen than he could account for.

Over in America, W. O. Atwater, of the Connecticut Agricultural Experiment Station, began working on this problem. But the real answer escaped him, as it had all those before him. It was not until 1886, over a decade after Liebig had died and in the last year of Boussingault's life, that Hellriegel, a German chemist, startled a group of his associates with the announcement of his discovery of the nitrogen-fixing powers of the bacteria that live in the nodules on the roots of legumes. When the full significance of this discovery dawned on the chemists of that day, they realized that an entirely new science, bacteriology, had come to their aid.

Leeuwenhoek, a Dutchman, had glimpsed the microbial universe in the seventeenth century, by the use of his new invention, the microscope. De Saussure had discovered the manner in which microorganisms multiply. Spallanzani had collected convincing evidence that the vibrant life which he saw with the lens played a mysterious part in the processes of Nature. Then came Pasteur, the Magellan of the microbe world.

Previously a chemist, Pasteur had turned bacteriologist quite by accident when the distillers who operated plants near his laboratory brought their troubles to his door. Sometimes their mash produced alcohol, but often it yielded acid instead. Accustomed to examining crystals under a lens, Pasteur, not knowing what else to do, put some of the mash under the microscope. To his surprise, two different kinds of living things came into view. One of them proved to be a budding yeast, and the other a rod-shaped bacterium. A whole new world opened up before him—a teeming, previously unseen world of living plants and animals, all ceaselessly working for man, or perhaps against him.

From that day on, Pasteur was lost in a new field of exploration that was to lead him from one trouble to the next, in quick succession, until he was dealing with the most dangerous dis-

(*Turn to page* 44)

Recommended Practices For Growing Peanuts

By B. E. Grant

County Agent, Windsor, North Carolina

THE war years were a time of expansion of food and feed crops. Farmers were requested to produce the maximum amount of many of these crops so that there would be ample food for our fighting forces, our allies, and those engaged in the manufacture of war supplies.

Peanut farmers were requested to *greatly* expand production. We were told that food would win the war and write the peace. We realized at the time that many peanut farmers were already growing peanuts on their land more often than they should, but we also realized that our country could not afford to lose the war. As a result we planted peanuts on land where they should not have been planted.

We are now embarking on a period of readjustment; and in order to bring the supply more nearly in line with anticipated demand, we have acreage control again this year. However, the quota program on peanuts is on acreage, as it is with tobacco, and not on total production. We have seen how tobacco farmers have increased their yields per acre since quotas were established through the adoption of practices that give higher yields per acre. To some extent peanut farmers can accomplish similar results, although peanuts do not respond to direct applications of fertilizer in the same way that tobacco, corn, and cotton do. Yet they are heavy feeders on mineral plant foods such as phosphorus, potash, and lime. In this respect, farmers have often referred to them as a very peculiar crop.

Since peanuts cannot be depended on to respond uniformly to direct applications of fertilizer, even though they use considerable amounts of plant food in producing a good crop, it is of great importance to follow a system of farming in which the soil fertility is maintained. This can be accomplished through the use of soil-conserving crops and a rotation that keeps up the organic matter in the soil, with adequate lime, phosphate, and potash used for the crops in the rotation that precede peanuts so that there will be plenty of plant food left over. Peanuts have been referred to as a scavenger crop

Fig. 1. Treating seed peanuts with Arasan helps to insure a better stand.

with the ability to take up plant food left in the soil from other crops.

While a considerable acreage of peanuts has been grown on the same land two or more years in succession, this is not a good farm practice. Even though a large per cent of the crop is grown in a 2-year rotation, this is not considered the best rotation. Some of the better farmers have found that it pays them to follow a 3-year rotation. The problem on many farms is to adjust operations so this can be done, and the reduction in acreage and increased interest in livestock will enable more farmers to follow such a rotation.

In addition to maintaining the fertility of the soil through a better crop rotation and use of soil-conserving crops, it is important to maintain a satisfactory pH in the soil with calcium and magnesium. The pH refers to the relative acidity of the soil, which is determined by soil test. A pH of 6 or slightly above appears to be about right for peanuts.

According to the North Carolina Agricultural Experiment Station, it is necessary to have available calcium in the row when the peanuts are making in order for them to develop a normal crop. For this reason land plaster is applied on the plants in July. Land plaster contains calcium sulphate which has a neutral effect on the soil. In a test conducted in 1948 by the Experiment Station on W. L. Powell's farm in Bertie County a yield of 1,242 pounds of nuts was made where no lime or plaster was used. Plaster alone increased the yield to 1,784 pounds. Dolomitic lime alone gave slightly less results than plaster but a combination of the two gave a higher yield than either used alone. In this case a further increase was obtained from 40 pounds of actual potash on the row. The Experiment Station reports that it is not unusual to get an increase from potash on potash-deficient soils.

While peanuts need lime, we should bear in mind that too much lime can be used. Several fields were found last summer where the growth of the peanuts was stunted and the yield reduced. A soil test on many of these fields showed that too much lime had been used. The State Department of Agriculture maintains a Soil-testing Laboratory and makes no charge for testing soil samples from North Carolina farmers. An increasing number of farmers are taking advantage of this service.

It has been said that a well-prepared seedbed is half of the cultivation of a crop. Peanuts are no exception to this rule.

In planting-date experiments conducted by the North Carolina Station, early planting usually gave higher yields than medium or late planting. While it is important to treat all peanut seed with Arasan before planting, it appears to be even more important with early planting since the Arasan used in the seed treatments helps to prevent the peanuts from rotting in cold soil and helps to get a better stand.

Spacing tests have in instances given as much as 1,000 pounds difference in yield between thick spacing and the normal spacing practiced by farmers. In row spacing and thickness in the row experiments conducted by the Experiment Station in 1948 on peanut farms in the peanut belt of northeastern North Carolina, the average of 4-, 8-, and 12-inch spacing in the row on Norfolk sandy loam soil of the William Charles farm at Ahoskie was 2,683 pounds per acre with 36-inch rows. With 27-inch rows the average of the same spacings in the row was 3,205 pounds. With 18-inch rows and the same spacing in the row the average yield was 3,963 pounds per acre. Highest yield in this spacing experiment was with 12-inch spacing in the row and with 18-inch rows.

This soil appeared to be somewhat deficient in potash, for in duplicate spacing experiments on this farm where 100 pounds of potash were used as the peanuts were cracking through the soil,

Fig. 2. This grower is planting peanuts and applying fertilizer in bands in one operation.

the yield in the 12-inch spacing in the 18-inch rows was increased from 3,963 pounds to 4,644 pounds, an increase of 681 pounds. The yield of 12-inch spacing in the 27-inch rows was increased from 3,023 pounds to 4,269 by the application of 100 pounds of potash, an increase of 1,246 pounds per acre.

In a similar experiment with Bertie fine sandy loam on Edenhouse farm, the highest yield where no additional potash was used was with a spacing of 4 inches in the row on 36-inch rows. A spacing of 12 inches in the row on 36-inch rows gave a yield of 2,752 pounds, but 4-inch spacing on 36-inch

Fig. 3. Dusting to control disease has resulted in an increase of more than 300 lbs. of nuts per acre.

rows on this farm gave a yield of 3,596 pounds, or an increase of 844 pounds per acre. A topdressing of 100 pounds of potash per acre in this experiment did not consistently give an increase in yield.

In another spacing experiment located on Dunbar fine sandy loam on the Broswell estate at Battleboro with 18-, 27-, and 36-inch rows, where 4- and 8-inch spacing in the rows were compared, highest yield was obtained with 27-inch rows and 4 inches in the drill. This yield was 2,517 pounds. Eight-inch spacing in 36-inch rows gave a yield of 1,960 pounds per acre, or 557 pounds less than 4-inch spacing on 27-inch rows. In the duplicate plots of this experiment where 100 pounds of potash per acre were used, the average yield of all plots was depressed, although there was increase in some of them.

In summarizing the results of these experiments, it appears to be very important to have a good stand of peanuts on the land in order to make the most profitable yield. Most farmers may have some difficulty in cultivating rows as narrow as 18 or 27 inches and it must be remembered that more seed will be required to plant an acre with the thicker spacing. It appears, however, that regardless of the width of rows used farmers might profitably plant their crop 6 to 8 inches in the drill, bearing in mind that a high population of plants is necessary for maximum yield.

Chopping is an expensive item on many peanut farms. The use of a weeder before and after the peanuts come up is advisable. Also advisable are rotary hoes on the cultivator so as to keep down weed growth and reduce the expense for hoe labor. One farmer told us that he did not have to put a hoe in some of his peanut fields where he made liberal use of the weeder and rotary hoe.

Experiments have shown the importance of land plaster to furnish available calcium in the area where the peanuts develop, so it is recommended that 400 pounds per acre be used early in July applied so as to cover the entire width of the row where the peanuts develop.

When disease affects the leaves of a plant, it reduces the ability of the plant to add fruit according to the amount of the leaf area affected. Leaf spot usually starts in a small way on

(*Turn to page* 46)

Fig. 4. Two rows at a time are being dug with this equipment.

Fig. 1. The original Clover and Prosperity truck which carried the exhibits used at Clover and Prosperity Days, 1923-1926. Standing from left to right are C. E. Carter, Extension Specialist in Field Crops; Miss Fra Clark, Extension Specialist in Home Management; and P. F. Schowengerdt, Extension Specialist in Soils. At most of the Clover and Prosperity Days a separate meeting for the ladies attending was held by an Extension Specialist in Home Economics.

Clover—A Symbol of Prosperity

By N. M. Coleman

Columbia, Missouri

FARMERS of the State of Missouri are using nearly 80 times as much limestone as they did in 1923. The annual use of commercial fertilizers has increased 985 per cent and the acreage of legumes approximately 600 per cent. Much of the credit for these increases must be accorded the Clover and Prosperity Campaign started in 1923 by P. F. Schowengerdt and C. E. Carter, Extension Specialists in Soils and Crops.

To understand the significance of the Clover and Prosperity Campaign, one must have a picture of the time setting. Between 1919-1921, farm income dropped 61 per cent. Because of this low economic level it was imperative that farmers be aroused to the necessity of building up soil fertility by the use of legumes, lime, and fertilizers.

One day as Carter and Schowengerdt were returning from Ohio, they discussed the seriousness of the situation.

"Carter, we're too academic! You go out and advise farmers what crops to grow, and then I follow up and talk about soil. Why can't we go together and help with the over-all plan. We're like a painter and a paperhanger working on the same room a month apart." Carter nodded agreement, and observed that the most prosperous farms in Ohio grew clover.

"Clover is a symbol," said Schowengerdt, thinking aloud. "It will get them thinking; and if a farmer can do anything in the way of making progress, he is making ground. Yes, I think a Clover and Prosperity Campaign might be worked out."

An idea was born, and the two men were ideally suited to work together on it. Schowengerdt was a man of vision, and Carter had a keen sense of the practical and the impractical. They worked day and night getting the plan down on paper and decided to start the campaign off by designating one special day during the summer to be known as "Clover and Prosperity Day." It was to have something of the Chautauqua, side-show, and the county fair. The first "day" was to be held in St. Francis County.

Difficulty was encountered when the plan was still on paper. They were told that it was not befitting the dignity of the University to resort to circus-like tactics. It was necessary to sell the institution on the idea of propaganda for a purpose before approval was given. The springboard of the campaign would be information gathered over 40 years of experiments at the Experiment Station at Columbia, the oldest field of its kind west of the Mississippi.

Schowengerdt and Carter went to St. Francis County to gather necessary information from Roy Copeland, the County Agent. At first, he was skeptical; nothing like it had ever been done before. However, he soon caught the spirit of the project and agreed to go all-out for Clover and Prosperity Day. He made out a list of prominent farmers, bankers, and business men who were to be asked, even urged, to have a part in the campaign.

The Specialists then stopped at the newspaper office. In a recent interview with Mr. Schowengerdt, he has only praise for the editors over the State. "The campaign could not have been a success without their help. They wrote editorials, they used all the advance material sent out by the College, and they gave front page space for

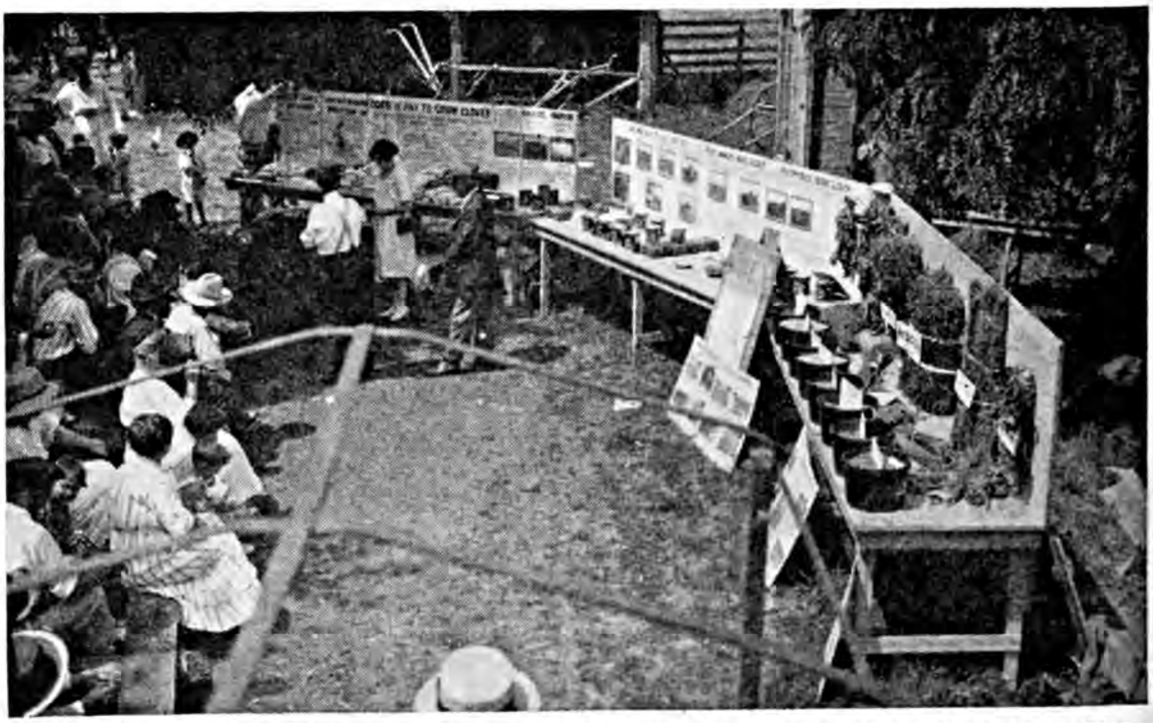


Fig. 2. At most of the Clover and Prosperity Days an essay contest was held on "Why Clover Means Prosperity." This picture shows a contestant reading her essay.

Fig. 3. Prizes were given for the best specimens of legumes exhibited on Clover and Prosperity Day.

'Clover Column,' 'Ask Me Another,' and 'I'll Be There' statements from leaders in the community. It was the editors who got the people out."

From Copeland's list various committees were appointed. There were an Ice Water Committee, Legume Exhibit Committee, Basket Dinner Committee, Grounds Committee, Music Committee, Sticker Committee, and Entertainment Committee. Weeks before the event, four-leaf clover stickers appeared on cars in St. Francis County, and a hundred red arrows pointed the way to the meeting place.

Five thousand people turned out to the St. Francis County Clover and Prosperity Day. The St. Louis Post Dispatch had this to say regarding the meeting. "The messages of C. E. Carter and P. F. Schowengerdt were enthusiastically received. Farmers put aside farm work and declared the coming of the Specialists a holiday. Clover and Prosperity on every farm was adopted as a slogan of the campaign."

The propaganda phase was a success, not only in St. Francis County, but in 12 other counties that first summer. However, the Specialists realized they must further the interest shown by the farmers. There should be more than one gala day in the summer. It was time to stress the educational, and mass adoption phase.

Schowengerdt returned to St. Francis County in November.

"That was a fine turnout for Clover and Prosperity Day, Copeland, but farmers want more than speechmaking. Will you help us plan a Clover and Prosperity Conference, to be held at the courthouse sometime in January? We'd like to have from three to five farmers from each school district appointed as delegates to this meeting, and we'll ask the business men to furnish free lunch for them. It is the aim of the Conference to develop community consciousness relative to the legume problem, locate and develop legume leaders, and create general interest and respect for a new type of demonstration with the view of avoiding mistakes of the past."

"Don't tell me we'll have to tack up another hundred red arrows!"

"I'm afraid so," replied Schowengerdt. "And there'll be more committees and delegates to appoint. You see, Copeland, the Conference is not to be a repetition of Clover and Prosperity Day, but a step in advance toward the development and carrying forward of a long-time program. I don't think it will be necessary to have another Clover and Prosperity Day; the idea is to make the Conference an outstanding annual affair, activated and developed by the farmers themselves because they see the need for it."

Again the papers and County Agents took it up. Each delegate received an impressive certificate informing him that he had been selected as an outstanding leader in his community. Then he got a letter from banker or business man inviting him to be guest at lunch on Conference Day. To further impress the delegates of the importance of the appointment, their names were prominently displayed in banks, business houses, and newspapers.

Of course, the delegates turned out. It was then that Carter and Schowengerdt used uncanny restraint. They opened that first Conference, a quarter of a century ago, with an informality which seemed almost casual, considering the hours that had been spent getting ready for it. They realized that many of these farmers were suspicious of the white-collared men they had come to hear, and perhaps argue with.

Today that attitude has changed. Farmers of Missouri are eager and ready for technical knowledge, because they no longer have a choice about building up soil fertility.

Schowengerdt usually started the meeting. "Well, what's on your mind? What are your problems?"

"What's all this talk about clover makin' you money?" asked a farmer. He stood up and turned his pocket insideout. "I got forty acres of clover, an' I still ain't got a dime!"

"Clover is good, but it's not the whole picture," Carter explained. "Sweet clover, soybeans, all legumes are needed, each in its proper place."

This started a lively discussion. "I'll grow some sweet clover for you boys, if that's what you want," drawled one of the delegates.

"Why not grow it for yourself?" asked Schowengerdt. "I don't own a farm in this county, and neither does Carter, but *you* do. That's the whole point. Try some of these legumes, and come back next year and tell us about it. Let us hold demonstrations on your land so all can find out what to do about the problems here in this county."

No one had anything to say to this. "Well, if that's the way you feel about it we'd just as well adjourn the meeting. It looks like you're all as prosperous as you want to be."

Talk picked up. "Who has nerve to tackle sweet clover?" Carter asked. Several offered. "Don't say you'll do it on rundown land without proper treatment. It won't grow."

A voice from the back of the room was heard to ask, "What you say we ought to do 'bout it?"

"Schowengerdt and I can advise you, and tell what results they had at the Experiment Station, but unless you work it out on your land, in your county, it won't be of practical use to you."

"I don't need to grow legumes," someone said. "Manure is just as good any day."

"But there's never enough manure."

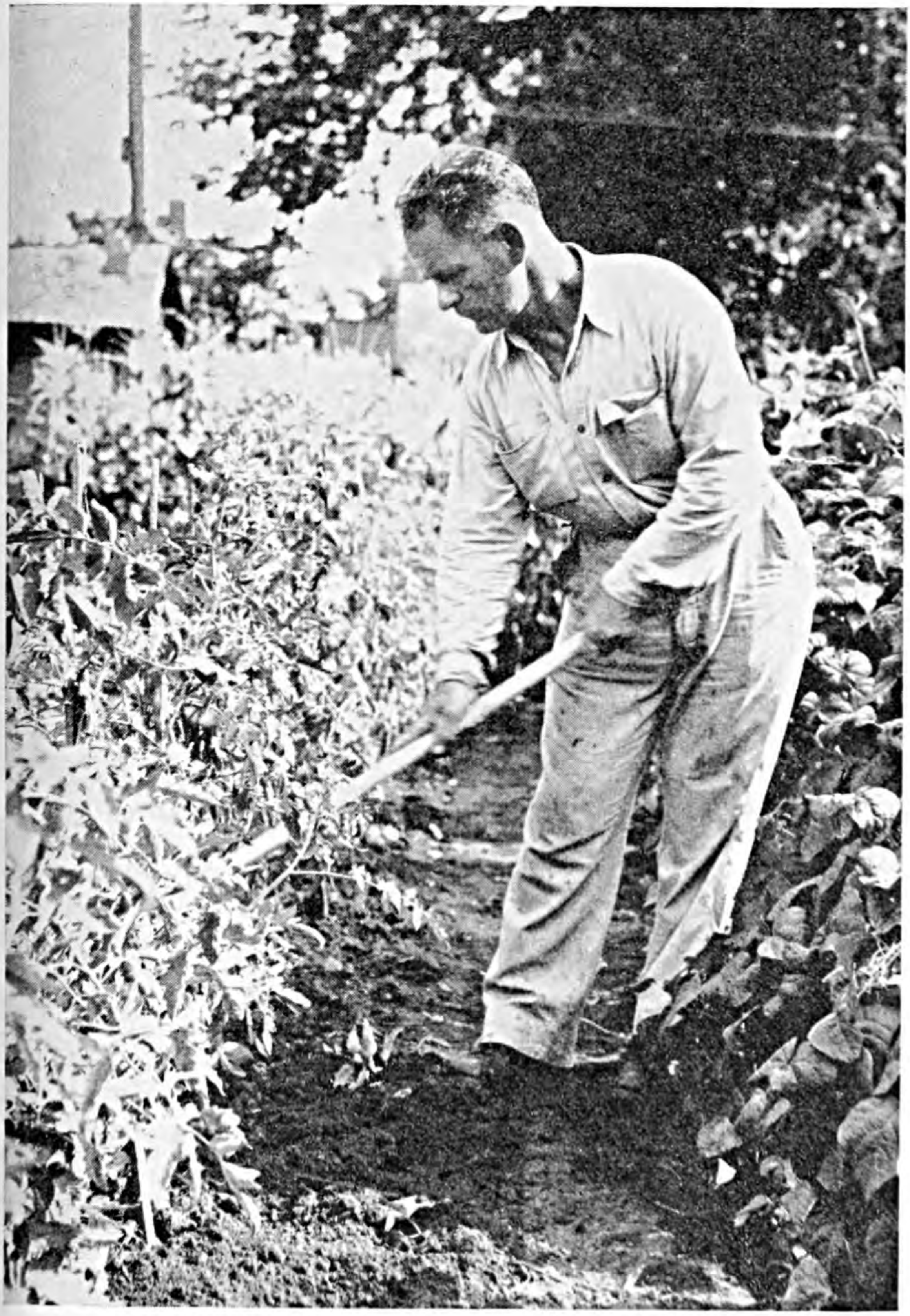
The meeting lasted until late afternoon, and there was a decided change in the attitude of the delegates. Gone was the I've-farmed-my-land-for-twenty-year-and-nobody's-gonna-tell-me-how-to-run-it look on their faces. Officers were elected, and delegates appointed for the next Conference.

By 1926, Clover and Prosperity Conferences covered half the State. Instead of a small, tarpaulin-covered truck, the College sent out a two-ton truck of exhibits and charts over 4,217 miles of Missouri roads and highways.

Schowengerdt and Carter had addressed a larger number of persons than had ever been reached by two speakers in a similar period in any other agricultural extension project in the United States. Other Specialists were added to the staff to assist in the work.

(*Turn to page* 48)

PICTORIAL



Garden Golf

Above: **Combines rolling in one of the big wheat fields in Kansas.**

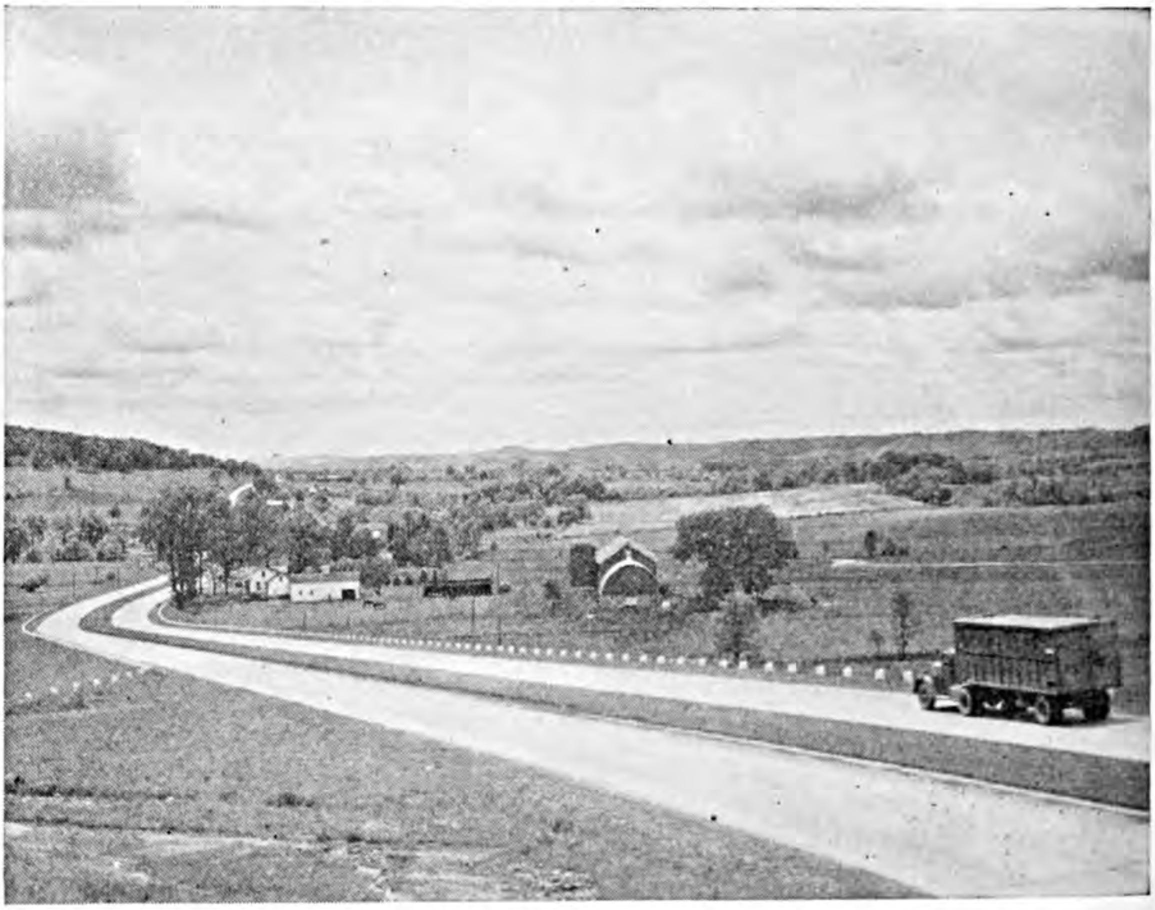
Left: **Trucks loaded with wheat at standstill in a Kansas town.**

Right: In Indiana, where more of the grain is kept on the farm.

***Below:* More physical comfort is possible in harvesting smaller acreages.**

Above: **Preparation for a long trek to market.**

Below: **On the way!**



The Editors Talk

Review and Outlook

Mid-year is check-up time for the fertilizer industry. In line with this policy, the National Fertilizer Association held its 24th annual convention at White Sulphur Springs, West Virginia, June 13-15, and the American Plant Food Council, its 4th annual at Bretton Woods, New Hampshire, June 19-22. The time at both conventions, exclusive of that spent on association reports, elections for the ensuing year, and recreational features, was devoted to a review of past problems and accomplishments and a look at those to be faced in the future.

Prominent agriculturists from the administrative, teaching, and research fields addressed both conventions. Coming from these talks are many opinions deserving of careful consideration in all agricultural planning. For instance, Dr. W. I. Myers, Dean of the College of Agriculture at Cornell University, is firm in his belief that "no farmer or group of farmers has yet devised a way of increasing farm income by decreasing production" and he emphasizes that "we cannot have a prosperous agriculture unless the rest of the economy—our consumers—are prosperous."

During the present deflationary period he recommends cautious, conservative operation as the soundest policy. The problem, he thinks, is to get an orderly downward readjustment of prices and costs by agriculture and other business to a basis on which the U. S. economy can move ahead with confidence. He lists efficient, low-cost production as the first important factor in the maintenance of farm income. To individual farmers, as to other businessmen, this means reduce cash costs, increase efficiency, and produce products desired by consumers. Involved are increased output per man, higher yields through improved varieties, better use of fertilizers which are still the lowest cost item in farm production, and more efficient methods of insect and disease control.

Dean Myers, in spite of the troubled outlook for the next few years, is optimistic about the long-run prospects for agriculture. To provide 150 million people in the United States with the present per capita diet will take about all that American farms are now producing with no allowance for substantial food exports except moderate amounts of wheat, lard and vegetable oils, and some fruit if Europe can afford it. As population increases during the next 10 years, still higher production will be needed, or more imports, or a less desirable diet. In addition, Western Europe will need large food imports even after full recovery. He explained that the principal way of obtaining increased food production in the next decade is by higher yields from land already in use. "This goal is attainable if vigorous programs of research are continued and if these improved practices are put promptly into use by farmers."

Dr. Robert M. Salter, Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, also had something to say about research, particularly concerning optimum rates of fertilizer application under conditions combining the most advanced methods of producing crops.

He predicted that studies will show that rates presently recommended under many conditions are considerably below the optimum. He stated that agricultural scientists are finding that while one improved crop production practice is beneficial, "the advantages often pyramid when several good practices are used in the right combination, and recognition of this principle is spreading rapidly in research programs throughout the country."

Dr. Salter believes that so far we have no more than scratched the surface with this combined approach to research. "Of this we are sure, we have by no means exhausted the possibilities of still further increasing crop yields as we learn to combine in optimum degree the various factors of crop production under the diverse environments of soil and climate. We now recognize that past ideas of what constituted adequate fertility must be revised drastically upward if we are to strive for top yields through this combined approach."

Attendance at both conventions was high and it is safe to say that every industry man left with a renewed sense of his responsibility to American agriculture.

A Week to Remember

If one had a roster of all the weeks in the year which have been set aside to observe a worthy cause, he probably would find his calendar not only filled but carrying duplications for some weeks. These reminders have grown in number to the point of ridicule from "sophisticated" sources. However, we wonder in the fast pace of our American life if they are not serving a very useful purpose.

Certainly, there can be no question as to the importance of the sixth annual National Farm Safety Week, proclaimed by the President for 1949 as July 24-30, to every agriculturist, particularly when some of the facts are known. In full recognition of the necessity for a safe agriculture, the President in his proclamation does "hereby call upon the Nation to observe . . . and request all organizations and persons interested in farm life and welfare to join in a continuing drive against practices which endanger farm people in their homes, in the fields, and on the highways."

According to the Bureau of Agricultural Economics of the U. S. Department of Agriculture, during 1948 at least one resident out of every six farms was the victim of an accident involving one day or more lost from regular activities. The surveys on which the Bureau based its estimates indicated that at least $36,000,000 were spent last year for medical, dental, and hospital care resulting from accidental injuries to farm people. This estimate does not include the costs where people were killed or suffered permanent total disabilities, nor the value of lost time, which totaled about 17,000,000 days. Reports of time lost averaged about 20 days per accident. Medical care costs, as reported, averaged $43 per accident, and about a fourth of such costs were covered by insurance.

Further facts garnered by the estimates prove revealing. Falls were the leading type of accident and accounted for a fourth of all accidents to farm people. Machinery and animals each accounted for about an eighth. Sixteen per cent of all accidents to farm people occurred in the home, 56 per cent elsewhere on the farm, 11 per cent on roads or streets, and 17 per cent off the farm.

What can be done? Just what we are attempting to do with a review of these startling figures—publicize the importance of the National Farm Safety Week as a means of acquainting all interested in farm life with the necessity of guarding against accidents on the farm. The busy season is on—minds are preoccupied, bodies tired—all the more reason for a reminder. July 24-30, A Week to Remember!

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924...........	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941...........	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947...........	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
June.........	35.22	41.7	187.0	246.0	216.0	211.0	17.90	92.20	....
July.........	32.99	43.6	166.0	262.0	202.0	203.0	18.20	96.00	....
August.......	30.41	47.4	158.0	265.0	191.0	196.0	17.80	76.60	....
September...	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October......	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November....	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December....	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January......	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February.....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March.......	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April........	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May.........	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1924...........	185	190	98	170	166	141	107	147	143
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	93	81	109	74	87	110
1938...........	69	196	80	83	76	64	57	97	88
1939...........	73	154	100	85	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	107	117	107	81	211	129
1942...........	153	369	168	136	143	124	91	202	163
1943...........	160	405	188	232	174	154	125	231	245
1944...........	167	420	214	219	170	160	138	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	175	249	212	209	141	319	204
1947...........	252	380	224	245	366	273	146	379	249
1948									
June.........	284	417	2'8	280	336	239	151	409	213
July.........	266	436	238	298	315	230	153	428	213
August.......	245	474	227	302	298	222	150	340	172
September...	250	467	220	264	277	223	152	302	150
October......	251	506	204	236	215	224	155	282	176
November....	246	428	207	226	188	231	155	306	186
December....	239	457	220	250	192	232	161	305	209
1949									
January......	236	429	238	269	195	229	169	291	282
February.....	235	295	249	279	174	219	173	237	285
March.......	232	319	250	290	184	224	168	228	263
April........	241	247	260	314	190	226	160	223	236
May.........	242	325	260	312	190	226	149	224	213

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
June	2.78	1.90	14.69	9.11	8.23	8.24
July	2.78	2.07	14.56	9.22	8.80	8.73
August	2.91	2.10	10.91	9.76	8.92	8.98
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
June	104	67	420	258	244	234
July	104	73	416	261	261	248
August	109	74	312	276	265	255
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259

Wholesale Prices of Phosphates and Potash * *

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367 [1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
June	.760	4.61	6.60	.330	.634 [1]	12.76 [1]	.176
July	.770	4.61	6.60	.353	.676	13.63	.188
August	.770	4.61	6.60	.353	.678	13.63	.188
September	.770	4.61	6.60	.353	.678	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
June	142	128	135	62	67	53	80
July	144	128	135	65	71	56	82
August	144	128	135	65	71	56	82
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
June	295	266	241	128	85	309	142	65
July	301	266	247	231	88	317	144	68
August	293	266	247	129	91	285	144	68
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72
May	256	257	228	134	99	293	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897 The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Eleventh Annual Report of the Arizona Fertilizer Control Office—Fertilizers and Agricultural Minerals—Year Ending December 31, 1948," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Spec. Bul., Feb. 1949.

"Potato Fertilizer Trials, San Joacquin County, 1948," Truck Crops Div. and Agr. Ext. Serv., Univ. of Calif., Davis, Calif., Unno. Mimeo. Spec. Rpt.

"Celery Fertilizer Trials, San Joacquin County, 1948," Truck Crops Div. and Agr. Ext. Serv., Univ. of Calif., Davis, Calif., Unno. Mimeo. Spec. Rpt.

"Tonnage of Different Grades of Fertilizer Sold in Michigan in 1948," from reports submitted by Fertilizer Companies, Mich. State College, East Lansing, Mich.

"Fertilizer Sales by Grades in Order of Tonnage, July 1, 1948-December 31, 1948," State Dept. of Agr., Raleigh, N. C.

"Fertilizer Sales 1948," compiled by Dept. of Agron., Ohio State Univ., Columbus, Ohio.

"Fertilizer Requirements for Rice of the Gulf Coast Prairie of Texas, 1947-48," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1144, Jan. 6, 1949.

"Boron Requirements and Fertilization of Wisconsin Crops," Dept. of Soils, Univ. of Wis., Madison, Wis., K. C. Berger and H. H. Hull.

"1948 Results of Plow Sole Fertilizer Demonstrations in Wisconsin," Soils Dept., College of Agr., Madison, Wis., Dec. 1948, C. J. Chapman.

"1948 Results of Fertilizer Demonstrations on Small Grain and Hay," Soils Dept., Univ. of Wis., Madison, Wis., C. J. Chapman.

"Commercial Fertilizers—1949," State Dept. of Agr., Madison, Wis., No. 293, Jan.-Feb. 1949, W. B. Griem.

Soils

"Lime and the Availability of Plant Food in Soil," Agr. Exp. Sta., Univ. of Del., Newark, Del., Cir. 23, Sept. 1948, G. M. Gilligan and C. E. Phillips.

"Soil Fumigation for Cigar-Wrapper Tobacco Fields," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 655, Oct. 1948, R. R. Kincaid and G. M. Volk.

"Soil & Water Conservation Research, Red Plains Station, Guthrie, Oklahoma," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., M-182, May 1949, H. A. Daniel, H. M. Elwell, and M. B. Cox.

"Soil & Water Conservation Research, Wheatland Exp. Station, Cherokee, Oklahoma," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., M-183, May 1949, H. A. Daniel, H. M. Elwell, and M. B. Cox.

"Land Use and Soil Conservation in the Broad River Soil Conservation District of South Carolina," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Bul. 373, June 1948, A. T. M. Lee and G. H. Aull.

"Let's Practice Conservation on Pacific Slopes," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 131, April 1949, M. D. Butler.

"Soil Survey, Grainger County, Tennessee," U.S.D.A., Washington, D. C., Series 1940, No. 4, Nov. 1948, E. H. Hubbard, B. L. Matzek, and Clifton Jenkins.

Crops

"A Look Ahead at Arkansas Agriculture," 58th A. R., Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 483, Dec. 1948.

"For Abundant Living," 1948 A. R., Ext. Serv., Univ. of Ark., Fayetteville, Ark., Cir. 462.

"The Blueberry," Dominion Dept. of Agr., Ottawa, Can., Publ. 754, Farmers' Bul. 120, Rev. March 1949, E. L. Eaton, C. W. Maxwell, A. D. Pickett, and J. F. Hockey.

"Pasture and Forage Crops for Irrigated Areas in Colorado," Ext. Serv., Colo. A & M, Fort Collins, Colo., Bul. 403-A, Aug. 1948, D. W. Robertson, R. M. Weihing, and R. H. Tucker.

"Crop Residues as Causative Agents of Root Rots of Vegetables," State Agr. Exp. Sta., New Haven, Conn., Bul. 526, Jan. 1949, V. W. Cochrane.

"Citrus Propagation," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Bul. 139, March 1949, A. F. Camp.

"Composition of Florida-Grown Vegetables, Part II," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 455, Jan. 1949, B. E. Janes.

"Daylilies in Florida," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 88, March 1949, J. V. Watkins.

"Growing Cabbage Plants in Seedbeds," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 656, Nov. 1948, E. N. McCubbin, A. G. Eddins, and E. G. Kelsheimer.

"Blackberry Culture in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 657, Dec. 1948, R. D. Dickey.

"An Author and Subject Index to the Publications of the Georgia Agricultural Experiment Station and the Georgia Coastal Plain Experiment Station, 1888-1946," Univ. Libraries, Univ. of Ga., Athens, Ga.

"Pecan Culture and Grove Management," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Cir. No. 15, Jan. 1949, Otis Woodard.

"Iowa Corn Yield Test, 1948," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. P97, Feb. 1949, C. D. Hutchcroft and J. L. Robinson.

"Prepackaging Tree-ripened Louisiana Peaches," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. 434, Jan. 1949, J. M. Baker.

"Rice Varieties for Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. 436, Feb. 1949, N. E. Jodon and D. A. de la Houssaye.

"Louisiana Cotton," Div. of Agr. Ext., La. State Univ., Baton Rouge, La., Ext. Bul. 14, Oct. 1948, R. A. Wasson and I. W. Carson.

"Louisiana Corn," Div. of Agr. Ext., La. State Univ., Baton Rouge, La., Ext. Cir. 161, Sept. 1948, R. A. Wasson and A. G. Kilgore.

"Hogging-off Corn and Soybeans," Div. of Agr. Ext., La. State Univ., Baton Rouge, La., Ext. Leaf. 21, 1949, R. A. Wasson and A. D. Fitzgerald.

"Maine Extension Service Reviews Busy Year for the Year Ending June 30, 1948," Ext. Serv., Univ. of Maine, Orono, Maine, Bul. 383, Aug. 1948.

"Evergreens," Agr. Ext. Serv., Univ. of Minn., St. Paul 1, Minn., Ext. Bul. 258, June 1948, L. C. Snyder, Raymond Wood, Clyde Christensen, and A. C. Hodson.

"Growing the Winter Wheat Crop," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Bul. 389, Aug. 1948, T. A. Kiesselbach and W. E. Lyness.

"Seed and Soil Treatments for Vegetable Crops Grown in Nebraska," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Cir. 86, Nov. 1948, N. W. Felton and J. E. Livingston.

"Nutritive Value of Wild Meadow Hay as Affected by Time of Cutting," Agr. Exp. Sta., Univ. of Nev., Reno, Nev., Bul. 181, Aug. 1948, M. A. Shipley and F. B. Headley.

"1517B, A New Strain of 1517 Cotton for the Rio Grande Valley," Agr. Exp. Sta., N. M. College of A & M, State College, N. M., P. B. 1027, Jan. 1949, G. N. Stroman.

"Measured Crop Performance, 1948," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 364, Jan. 1949, H. L. Cooke and R. P. Moore.

"Mechanical Harvesting of Cotton in North Carolina, 1947," Agr. Exp. Sta., Univ. of N. C., Raleigh, N. C., P. R. (Preliminary) Dept. of Agr. Econ. AE—Information Series No. 20, Dec. 1948, J. G. Sutherland and H. B. James.

"Curing Bright Leaf Tobacco," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 332, Jan. 1949, R. R. Bennett and S. N. Hawks.

"Ohio W-R Globe, A New Wilt-Resistant Glasshouse Tomato Variety," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 689, March 1949, L. J. Alexander.

"Pastures for Poultry, A Home-grown Vitamin Program for Ohio Poultrymen," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Bul. 269, Rev. Apr. 1948, C. M. Ferguson, Earl Jones, and D. R. Dobb.

"Palatability Trials of Winter Pasture Crops, and Effect of Phosphate Fertilizers on Palatability," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Tech. Bul. T-35, March 1949, Hi W. Staten.

"The Chemical Content and Nutritive Value of Oklahoma Pecans," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Mimeo. Cir. M-176, Dec. 1948, V. G. Heller and F. B. Cross.

"Soybean Variety Tests, 1948," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Mimeo. Cir. M-179, Feb. 1949, C. L. Canode.

"Brush Control Research, Red Plains Station, Guthrie, Oklahoma," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., M-181, May 1949, H. M. Alwell and M. B. Cox.

"Growing Subclover in Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 432, Oct. 1945 (Rev. Feb. 1948), H. H. Rampton.

"Walnut Tree Decline and Loss in the Pacific Northwest, Causes and Control," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 453, June 1948, P. W. Miller and C. E. Schuster.

"Profitable Red Raspberry Production in Pennsylvania, Culture—Insect and Disease Control," Agr. Ext. Serv., Pa. State College, State College, Pa., Cir. 319, June 1948, C. S. Bittner.

"Sweet Corn Variety and Strain Trials—1948," Agr. Exp. Sta., Pa. State College, State College, Pa., Pa. Journal Series Paper No. 1478, Oct. 1948, C. J. Noll and M. L. Odland.

"Lima Bean Variety and Strain Trials—1948," Agr. Exp. Sta., Pa. State College, State College, Pa., Pa. Journal Series Paper No. 1480, Oct. 1948, M. L. Odland and C. J. Noll.

"Snap Bean Variety and Strain Trials—1948," Agr. Exp. Sta., Pa. State College, State College, Pa., Pa. Journal Series Paper No. 1479, Oct. 1948, M. L. Odland and C. J. Noll.

"Carrot Variety and Strain Trials—1948," Agr. Exp. Sta., Pa. State College, State Col-

lege, Pa., Pa. Journal Series Paper No. 1484, Nov. 1948, M. L. Odland.

"Cabbage Variety and Strain Trials—1948," Agr. Exp. Sta., Pa. State College, State College, Pa., Pa. Journal Series Paper No. 1492, Nov. 1948, C. J. Noll and M. L. Odland.

"Bay Oil Production in Puerto Rico," Federal Exp. Sta., Mayaguez, P. R., Cir. 30, Dec. 1948, F. Childers, P. S. Robles, and A. J. Loustalot.

"Summer Grazing and Feedlot Gains of Yearling Steers at the Blackland Experiment Station," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1166, Cattle Series 76, May 7, 1949, J. R. Johnston, J. H. Jones, and O. J. Tippit.

"New Hay-Pasture Crops," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Cir. 116, March 1949, L. H. Smith.

"1948 Varietal Tests," Agr. Exp. Sta., Blacksburg, Va., Bul. 420, Jan. 1949, Edward Shulkcum, C. F. Genter, C. W. Roane, T. J. Smith, and T. M. Starling.

"Boxwood," Agr. Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., 1949, A. G. Smith, Jr.

"Inoculate Legumes—It Pays," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 484, March 1949, O. N. Allen.

"Fifty Eighth Annual Report of the Wyoming Agricultural Experiment Station, 1947-48," Univ. of Wyo., Laramie, Wyo.

"Forage Plants for Wyoming Range," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Cir. 35, Dec. 1948.

"Birdsfoot Trefoil and Big Trefoil," U.S.D.A. Washington, D. C., Cir. 625, Nov. 1941, (Rev. Feb. 1949), R. McKee and H. A. Schoth.

"Diseases of Cabbage and Related Plants," U.S.D.A., Washington, D. C., Farmers' Bul. 1439, Rev. Nov. 1948, J. C. Walker.

"Kudzu as a Farm Crop," U.S.D.A., Washington, D. C., Farmers' Bul. 1923, Rev. Dec. 1948, R. McKee and J. L. Stephens.

"List of Available Publications of the United States Department of Agriculture," Div. of Publ., Office of Information, U.S.D.A., Washington, D. C., Misc. Publ. 60, Rev. Nov. 1948.

"Fiber and Spinning Properties of Cotton: A Correlation Study of the Effect of Variety and Environment," U.S.D.A., Washington, D. C., Tech. Bul. 970, Dec. 1948, H. D. Barker and O. A. Pope.

Economics

"Changes in Farm Family Living in Three Areas of the Prairie Provinces, from 1942-43 to 1947," Econ. Div., Marketing Serv., Dominion Dept. of Agr., Ottawa, Can., Publ. 815, Tech. Bul. 69, Feb. 1949, M. A. MacNaughton, M. E. Andal, and J. M. Mann.

"The Agricultural Outlook for Canada, 1949," Dominion Dept. of Agr., Ottawa, Can.

"Prices of Forage Crop Seed in Indiana," Agr. Exp. Sta., Purdue, Univ., Lafayette, Ind., Sta. Bul. 535, Morris White and Don Paarlberg.

"Economics of Alfalfa Seed Production in Kansas," Agr. Exp. Sta., Manhattan, Kans., Agr. Econ. Rpt. 36, Oct. 1948, R. E. Marx.

"The Agricultural Outlook for Kentucky, 1949," Ext. Div., Univ. of Ky., Lexington, Ky., Dec. 1948.

"An Economic Study of the Farm Storage of Sweet Potatoes in Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. 433, Dec. 1948, M. E. Miller and M. D. Woodin.

"Dairy Farming in the North Louisiana Upland Cotton Area—Organization, Costs, and Returns," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. 435, Oct. 1948, F. D. Barlow, Jr., and M. L. McGough.

"Management Problems on Farms Growing Sweet Potatoes in the Macon Ridge Area of Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo. Cir. 87, Dec. 1948, C. B. Danielson and F. D. Barlow, Jr.

"Dairy Farming—North Louisiana Upland Cotton Area—Economic Study," Agr. Exp. Sta., La. State Univ., Mimeo. Cir. 88, Dec. 1948, M. L. McGough and F. D. Barlow, Jr.

"Standards for Successful Farming in Maine," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Ext. Cir. 254, March 1949.

"Seasonal Price Changes of Major Michigan Farm Products," Agr. Exp. Sta., Section of Econ., Michigan State College, East Lansing, Mich., Spec. Bul. 355, Jan. 1949, L. L. Boger.

"1949 Outlook, Agricultural Act of 1948," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 164, Dec. 1948, D. C. Dvoracek.

"1949 General Outlook for Agriculture," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 165, Dec. 1948, S. B. Cleland.

"Transferring the Farm to the Next Generation," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 515, July 1948, O. R. Johnson.

"Purchasing Power of Missouri Farm Products," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 420, July 1948, R. L. Kohls.

"What's the Story on Canhouse Tomatoes," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 526, March 1949, J. W. Carncross.

"1949 New York State Agricultural Outlook," Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 758, Dec. 1948.

"Oregon's Farm Forest Products, 1946," Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 691, July 1948, B. E. Black.

"Oregon's Grain and Hay Crops 1909-1947," Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 692, Aug. 1948.

"Oregon Farms—an $850,000,000 Plant," Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Cir. 524, Oct. 1948.

"Farmers' Support of Cooperatives," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 505, Nov. 1948, J. K. Stern and H. F. Doran.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 133, Apr. 30, 1949, Karl Hobson.

"Rural Zoning in Wisconsin," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 479, Nov. 1948, W. Rowlands, F. Trenk, and R. Penn.

"Forests and National Prosperity, A Reappraisal of the Forest Situation in the United States," Forest Serv., U.S.D.A., Washington, D. C., Misc. Publ. 669, Aug. 1948.

"Price Programs of the United States Department of Agriculture, 1949," Prod & Mktg. Admin., U.S.D.A., Washington, D. C., Misc. Publ. 683, March 1949, H. W. Henderson.

"Flue-cured Tobacco Market Review, 1948-49 Season (1948 crop)," Prod. & Mktg. Admin., Tobacco Branch, U.S.D.A., Washington 25, D. C., Apr. 1949.

"Missouri River Basin Agricultural Program," Sec. Office, Spec. Rpt., U.S.D.A., Washington, D. C., Apr. 1949.

Sod-bound Western Meadows

By Jack F. Schinagl

Agricultural Extension Editor, University of Wyoming, Laramie, Wyoming

ONE big agricultural headache of the entire western United States is old, unproductive, sod-bound meadowlands.

Thousands of acres of such meadows—some 30 to 40 years old—are gradually dropping off in yield. When first established, they yielded from one to two tons of feed per acre. In 1945 the average yield was three-fourths of a ton per acre with only an approximate 40-per cent quality of the original seeding.

Ordinary meadow renovation and

Fig. 1. The tiller also pulverizes soil on unplowed meadows. Depth of penetration can be adjusted from one to five inches. This meadow of native grasses was 30 years old.

Fig. 2. Side view of tiller shows the mounted gas engine and the pulverized soil being kicked from the revolving hammers.

topdressings of barnyard manure and commercial fertilizers will stimulate growth for a few years, points out F. A. Chisholm, Wyoming Agricultural Extension Service Agronomist, but the yield trend will continue downward. Desirable grasses will continue to be crowded out by less desirable grasses.

The most effective and economical solution is that of plowing, leveling, and reseeding. That, too, used to be a problem when the land had not been touched by a plow from the time it was first established as a meadow. Now, however, equipment that will work these sod-bound soils into almost ideal tillable condition has been developed and is being improved.

Most of such newly-seeded meadows are put into various mixtures of timothy, alsike clover, alfalfa, and natural or native grasses. The mixture will depend, however, on existing water tables for the area.

¶ A good over-all picture of citrus growing, handling, and marketing is contained in the publication, "Citrus Industry of Florida," issued by the Florida Department of Agriculture in cooperation with the University of Florida. The first two sections make up the bulk of the 200-page bulletin and were written by Dr. A. F. Camp of the Citrus Experiment Station. Part I covers the various aspects of citrus growing including background history of citrus fruits, production in Florida and California, soil considerations, stocks, varieties, propagation, planting, cultivation, fertilization, pruning, pest control, irrigation, cold protection, cost data, and of particular interest to the small landholder, the management of what is called dooryard plantings. Part II covers packing-house operations; Part III, citrus marketing by Robert C. Evans of the Florida Citrus Commission; and Part IV covers citrus processing by L. G. MacDowell, also of the Florida Citrus Commission. This is an excellent practical bulletin for anyone interested in the citrus industry.

More Nitrogen for Sugar Cane

FERTILIZER experiments with sugar cane involving fertilization at two levels of nitrogen, one at 40 pounds per acre and the other at 60, were begun in 1945. The first year's results from these experiments showed that the highest yields of sugar were obtained on stubble cane with applications of nitrogen, P_2O_5, and K_2O at the 60-pound level. On plant cane the best results were obtained with a combination of 40 pounds of nitrogen with 40 pounds of P_2O_5 and 60 pounds of K_2O per acre.

The 1946 season was very wet and both plant and stubble cane responded profitably to nitrogen at the 60-pound per acre level. Generally the best adapted treatment was 60 pounds of nitrogen, 25 pounds of P_2O_5, and 40 pounds of K_2O per acre, and the increase in the yield of sugar from the combination of these amounts of plant food was approximately 1,800 pounds of sugar per acre. The increases in yield of sugar varied from 1,600 to 3,500 pounds per acre. The percentage of purity and the sucrose content were not depressed by fertilizers. The 1946 results showed that more nitrogen could be used on the very fine sandy loam, silt loam, and silty clay loam soils of the sugar cane area.

Nine experiments were conducted in 1947. Four of these experiments were with stubble cane and five were with plant cane. The 1947 growing season was very dry and normal yields were obtained at only two locations. In general, the yields were about 30 per cent below normal and the experimental errors were high. In 1947 the results showed that stubble cane responded significantly in three out of four experiments. In one on Commerce silty clay loam where the highest yields for the year were obtained the 60-25-40 mixture increased the yield of cane 17.1 tons and sugar 3,820 pounds per acre. In another, 40 pounds per acre of nitrogen alone was best, but the yield was low, 16.8 tons per acre, due to drought. In the third the 60-0-40 mixture was best; here also the yield was low. The data from the five experiments with plant cane indicated that the cane responded to fertilizer in three out of the five experiments. In two of the three, 40 pounds per acre of nitrogen alone was best, while in the other one the 40-40-40 mixture produced the highest significant yield.

The 1948 growing season like that of 1947 was very dry. Out of 10 experiments located in different soil areas of the sugar belt, seven gave data showing definite responses to fertilizer treatments. Five of these seven successful experiments were on stubble cane. The treatment consisting of 80 pounds per acre of nitrogen with 40 pounds of P_2O_5 and 60 pounds of K_2O gave the highest significant yields in three experiments, while the 60-25-60 was best in one and the 60-40-40 in the other. The increases at the 80-pound level of nitrogen with the minerals averaged 10.9 tons of cane and 1,890 pounds of sugar per acre. Two experiments with plant cane gave normal yields in 1948. In each of these experiments the 60-25-40 mixture gave the highest yield. The average increase was 12.0 tons of cane and 1,980 pounds of sugar per acre. In both cases, however, the complete fertilizer was not significantly better than 40 pounds per acre of nitrogen alone.

The source of P_2O_5 used in these experiments was superphosphate. The K_2O was supplied as muriate of potash. The nitrogen was supplied as ammonium nitrate except where ammonia was used as indicated. In this experiment anhydrous ammonia was compared to ammonium nitrate as a source of nitrogen. The data show that the two forms are equally effective.

The amount of nitrogen being applied to sugar cane in Louisiana has increased from slightly over 30 pounds per acre in 1941 to almost 50 pounds per acre in 1948. This increase in the use of commercial nitrogen has compensated for the slackening off in the amount of legumes turned under and the increase in the amount of summer fallowing practiced in the control of Johnson grass.

Data from these experiments indicate that in most cases 40 pounds per acre of nitrogen can be profitably applied to plant cane.

The data also show that 60 to 80 pounds of nitrogen per acre, 25 to 40 pounds of P_2O_5, and 40 to 60 pounds of K_2O applied to stubble cane have definitely given good results under conditions of normal soil moisture and good weed control, and on soils of intermediate texture such as very fine sandy loams, silt loams, and silty clay loams. —V. E. Green, D. S. Byrnside, and M. B. Sturgis, *Agr. Exp. Station, Baton Rouge, La.*

Heredity Plus Environment Equal A Corn Crop

(*From page* 14)

corn leaf aphid are important environmental hazards. In such areas, a hybrid can not be considered adapted if it is susceptible to these insects. Hybrids should be purchased on the basis of proved performance. Too many are bought because of friendship or good salesmanship.

Furthermore, good soil and good weather plus a good hybrid do not necessarily equal a good yield. The tendency is to cultivate corn too deeply, and in an untimely and careless manner. This tendency is not entirely dissociated with the use of power tools. Growers forget that the roots are the nutrient-absorbing areas of the plants. There is no profit in encouraging corn breeders to produce hybrids with superior root systems only to have the roots pruned back by deep and careless cultivation. At the same time, corn should not have to compete with worthless weeds for water and soil nutrients.

Although pretty well known to scientists, too few farmers are using the yardstick of efficient corn production. This measure is explained and implemented by the accompanying "Corn Planting Chart." The basic unit of measurement is the half-pound ear, the average weight of ear which has shown to result in highest yields per acre. If the average weight of ear from a field is above .6 pound, the number of plants per acre should be increased 2,000. This rule of thumb applies for plant populations up to 15,000. Caution should be used in exceeding 15,000 plants. If the average ear weight is below .6 pound, the plant population should be decreased 1,000 plants per acre. Ears larger than .6 pound may be handsomer and more easily husked by hand, and thin stands make for big ears, but also for low yields. Large ears do not indicate efficient production.

Obviously, adjustment of the planting rate and of the fertility level of a field must be considered jointly if the aim is efficient production. It is equally obvious that no one can make a blanket recommendation that will fit all farms or fields. The amount of fertilizer to apply and the plant population must be determined to some extent on the basis of experience. We have no way of knowing in advance exactly what the average ear weight will be, although if ears of last year's crop are weighed, a very useful indication may be obtained.

That planting rate may be adjusted to fertility level to the profit of corn growers has been pretty conclusively demonstrated by Murray McJunkin, Vo-ag member of the Pennsylvania Station Corn Team. Startling increases in corn yields have been obtained by hundreds of students throughout Pennsylvania working in McJunkin's corn projects. Mr. McJunkin will report his findings in detail in a subsequent issue of Better Crops. He will show how experimental results were duplicated by farm boys under the guidance of teachers.

Some Photographic Hints

(*From page* 10)

you should assume that it will be. Never hurry. Time spent in arranging the subject material is never wasted. Field plots should have unnecessary weeds and grass in the foreground removed. The photographing of livestock offers many special problems. Many times a whistle given at the moment the shutter is clicked will cause the animals to look at the camera.

2. If signs are shown in the picture, have them simple black-on-white and avoid fancy decorations. Be sure they are in focus.

3. Avoid confusing backgrounds when possible.

4. Hold your camera steady. If possible, use a tripod for all pictures. Certainly use a tripod for all pictures taken slower than a fiftieth of a second. If you have no tripod and cannot rest your camera against a tree or on a stump, then take a deep breath and hold it as the shutter is snapped. A good means of holding the camera steady is to tie one end of a string to the camera and hold the other end under your foot, with the string tight.

5. Always have the sun at your back if possible. At least do not "shoot into the sun."

6. If you do not do your own processing, then choose the photographic studio which does it for you carefully.

The Search for Truth

(*From page* 18)

eases to which men and animals are heir. Previous to his day, when smallpox, hydrophobia, anthrax, cholera, and similar microbial diseases broke out in any given area, nothing could be done about them but to let them run their course. Men died by the thousands, and even by the millions, from these and similar scourges. But with Pasteur came modern serums, antiseptic surgery, and great expectations for disease control.

The age-old notion of spontaneous generation by which living things emerged from nowhere still had a firm hold on the superstitious minds of men. But Pasteur showed that the decay of plants and animals was brought about by organisms so small that thousands of them could cling to a pin point, or float about on a particle of dust. To the end of his distillation flask he fitted a long S-shaped tube that permitted the movement of air but prevented the flow of dust, and spontaneous generation was stopped cold.

Over in England another pioneer, Charles Darwin, was busily engaged in gathering evidence to support an enormous doubt that had arisen in his mind as to the fixity of species. Out of this doubt was finally born a concept which holds that man is the fulfillment of an evolutionary process. This process began with the merest microbe and ended with the most complex of the plant and animal forms that surround us. Darwin's concept was so revolutionary that only the most courageous of men dared to espouse it in Darwin's day. The concept of evolution is still dangerous to deal with in many portions of the globe, not excluding considerable areas in the United States of America.

The search for truth goes forward in cycles. Every so many years, or centuries, we find ourselves back at the same starting point, but in the course of an ever-enlarging circle that reaches out greater distances into the unknown. Copernicus had dared to say that man was not the center of the universe. Now, three centuries later, Darwin pointed out that man was merely the highest round in an evolutionary ladder, and that, somehow, he had become endowed with a brain and an imagination that largely enabled him to control his own career. Yet both Copernicus and Darwin were targets for the religious bigots of their day, Copernicus because he thought of man as a mere speck on the horizon of the universe, and Darwin because he conceived of man as having risen out of the slime of the ages.

But the field of thought had been so enlarged by the studies that culminated in Liebig's, Pasteur's, and Darwin's findings that men began to visualize enormous possibilities in harnessing science to their own use. Dictators found in science the perfect weapon for controlling their own subjects and for conquering their neighbors. Industrialists saw in science a means for amassing great wealth. Scientists, themselves, hoped that, by science, they could somehow build a better world out of the chaos in which we live.

Supported by governmental and private funds alike, science branched out into a great variety of fields of endeavor. Mathematicians and physicists quickly became engineers, architects, and builders of dynamos, motors, airplanes, and atomic bombs. Chemists were soon engaged in tremendous undertakings which were so involved that they had to break them up into pieces, and assign these pieces to bio-chemists, physical chemists, industrial chemists, and chemical engineers. Biologists no longer found it possible to keep in touch with the whole field of this evolutionary science, but began confining themselves to such parts of the problem as botany, zoology, ecology, microbiology, physiology, genetics, entomology, pathology, parasitology, and nutrition.

To follow all of these lines of exploratory research forward from the days of Liebig, Pasteur, and Darwin is more than any one man can hope to do in any adequate way. Suffice it to say that the search for truth has gone rapidly forward with an ever-increasing rate of accomplishment. Unfortunately, at the moment, the constructive and destructive forces of science are in conflict, and progress in some of the most important fields of research is being delayed.

At this point we must stop and consider which of the many possible avenues of approach to the truth offer the greatest promise. Do we believe that the best road to a better world is by way of the physical sciences that give us ever faster automobiles, clearer television, speedier airplanes, and more destructive bombs with which to hold our enemies in check? Should we follow the ever-widening highway of the biological sciences that provide us with such remarkable remedies as penicillin and streptomycin, by which we are able to by-pass disease and reach the ranks of the centenarians? Would it be better to choose the route that leads to vastly increased production of good food so that all the people, all over the earth, are well fed?

"The moving finger writes and, having writ, moves on: nor all your piety nor wit can lure it back to cancel half a line, nor all your tears wash out a word of it." And that holds for the accomplishments of the physical and the biological sciences. Certainly none of the remarkable developments in these fields of endeavor can be erased, and none of us would want them to be. They are, moreover, the mere beginnings of much greater accomplishments that are yet to come. Maybe we shall fly to Mars and, hopefully, return. But there are other tangled trails that lead to truth, and these must also be explored. The entrance to these is found in the yearnings of mankind, as revealed by his history, literature, art, religion, and music. But there is a much more difficult and dangerous path, that of the social sciences, which not only holds great hope but offers great promise of helping man understand himself. These, like all the other trails to truth, must not only be kept open but they must be greatly widened so that ever more men of science are tempted to explore them.

Certainly, if we are unable to keep open the way that leads to the Ultimate Truth, there is little hope for mankind. The problem is one that engages the attention of the most intelligent men on earth. Unfortunately, out of some two billion transient souls that inhabit the globe at any one time, only a relatively small number have been endowed with the capacity to formulate new concepts and to carry them through to dependable conclusions. On the shoulders of these mentally better-endowed men rests the special obligation of saving the world from its own follies. And on the shoulders of the rest of us lies the equally important obligation of encouraging them in their work.

David Starr Jordan, in his book on "Life's Enthusiasms," quotes an ancient author who said:

"My son, you must store up a lot of absurd enthusiasms in your youth, else you reach old age with an empty heart, for you lose many of them by the way."

If I may be permitted to offer a wish for the younger generation, it is that they may be inspired with absurd enthusiasms to search for truth, whatever the field of endeavor with which they may be concerned. In proportion as they can uncover the truth and apply it, they are fulfilling the highest purpose of mankind.

Recommended Practices for Growing Peanuts

(*From page* 22)

peanut leaves in July. Since farmers have been accustomed to this disease, many have considered it the natural development of peanuts and thought that nothing should be done about it. However, numerous experiments, demonstrations, and experiences of farmers have shown that better yields are usually obtained where the leaf spot disease is controlled by three applications of dusting sulphur or copper-sulphur, with the first application made between July 1 and 15 and repetitions at 14-day intervals. Any application that gets washed off by heavy rains should be repeated within 24 hours. An average of 37 demonstrations conducted by Bertie farmers over a 10-year period gave an increase of more than 300 pounds of nuts per acre from dusting.

Fig. 5. Many farmers have learned the hard way the importance of better stacking.

It should be borne in mind that, since controlling leaf spot results in more foliage being on the plants when they are dug, they will need additional time to dry out before being picked. Where weather is favorable it appears to be desirable to let them cure a day or two before stacking. During the past two seasons many farmers have learned the hard way the importance of better stacking. It seems to have been the practice with many farmers to do a rather poor job of stacking, making sorry stacks and leaving considerable dirt in them. I have heard it said by Bertie farmers many times that peanuts are stacked the poorest in Bertie County of any county in the belt. In talking with County Agents in other counties they report that farmers in their county do the poorest job of stacking the crop, so it appears that no county has a monopoly on this feature. The wet seasons in the falls of 1947 and 1948 caused many to see the importance of doing a better job of stacking the crop, and it appeared that the 1948 crop was stacked better than the 1947 crop.

We have seen how the average corn yield in North Carolina and other Southern states is being increased through the adoption of the five steps for increased yields. We have also seen how flue-cured tobacco yields have been increased during the past 15 years by following improved practices. Even though peanuts are referred to as a crazy crop and the statement is made that nobody knows anything about it, enough has been learned by our Experiment Stations in recent years to indicate that if peanut growers would adopt the recommended practices in peanut production, as much yield could be made on the reduced acreage for 1949 as in normal years. Briefly these improved practices include the following:

(1) Plant the allotted acreage on the best peanut land.
(2) Have a soil test to determine the need of lime and fertilizer.
(3) Prepare a good seedbed.
(4) Use the best seed available of the variety grown in the community. Treat seed with Arasan.
(5) Plant between April 25 and May 10.
(6) Compare thicker spacing with normal spacing for the farm. It is suggested that 2-foot rows and

6-inch spacing in the row be tried for Va. Bunch. For Jumboes 6 to 8 inches in the row with rows 33 inches.

(7) Follow the recommendations of soil test report on fertilization. If lime was needed, it should have been broadcast some time in advance of planting, especially if dolomitic lime is used. Where potash is applied directly to the crop, apply it just as the peanuts are cracking the soil.

(8) Run a weeder over the land just before and just after the peanuts come up, going diagonally with the rows in both directions. Cultivate shallow and do not cover up the peanut plants. If a rotary hoe is available use it on the cultivator while the peanuts are small to reduce the expense of hoe work.

(9) Apply 400 pounds of gypsum or land plaster early in July so as to cover the row space where peanuts are developed.

(10) Make three applications of dusting sulphur or copper-sulphur at 14-day intervals, starting between July 1 and 15. Allow dusted peanuts additional time to cure on account of having heavier foliage.

(11) Get the dirt out and stack the peanuts so they can stand rain. Use poles that will stand up.

The corn program was started with a few one-acre demonstrations in each county. These demonstrations proved the program to be sound. It is suggested that farmers follow these recommendations for peanuts on one acre, or even one stack row and compare the results with their normal practices in growing peanuts.

Clover—A Symbol of Prosperity

(*From page* 26)

Each year, up to 1927, the use of lime increased by a hundred per cent. There are now as many County Agents as there were lime users at the beginning of the campaign. Paul Schowengerdt knew the name of every farmer in the State who used lime in 1923, and he got this information from limestone companies. He went to the implement companies to learn who had bought small lime pulverizers.

The story of the campaign is not complete without mention of the Clover and Prosperity Special Train, put on in Northeast Missouri, by the Burlington and the Q. O., and K. C. Railroads. The coming of the five-car Special was indeed a great day. Business men put on Dollar Days, and telephone operators broadcast over country lines the news about the time of arrival. Usually, a band played as the train pulled in.

Four railroad officials, and four specialists from the College of Agriculture traveled with the train. There were two cars of exhibits emphasizing the fact that clover is a symbol of prosperity, and how to grow legumes. The charts were striking, impressive, and easily understood.

Many farmers brought soil samples to the soil-testing car, and for those who missed the Special, a scooter train followed. Samples were marked and left with the station agent in advance of the arrival of the scooter.

The Clover and Prosperity Conferences have grown enormously during the past 25 years. The real planning is done by the farmers themselves. The legume problem is being solved. Other specialists carry on the work, and the Conference now has a new name. It is called Soils and Crops Conference, but to many of the old-timers it is still "Clover and Prosperity."

The Soils and Crops conferences this past winter drew a record attendance, 29,875, even in the face of ice storms and bitter weather. The total this year exceeded by more than 2,000 the previous record.

Held in every county of the State, the meetings formed a high point in each county's winter agricultural program. The general pattern for the gatherings was to begin with local farmers telling their experiences with the better practices. Then, the Production Marketing Administration program for 1949 was explained by a local committeeman.

In many places, civic or business groups provided the noonday lunch. In the afternoon, the county agent and a specialist from the Missouri University Agricultural Extension Service discussed Balanced Farming practices which would receive attention in 1949.

Specialists from the state extension office who took part in these included J. Ross Fleetwood, Arnold Klemme, O. T. Coleman, John Falloon, William Murphy, and C. R. Meeker.

Kernels and Combines

(*From page* 5)

livery to storages that sometimes still contain large consignments of last year's bounty is now our dilemma. We have outwitted the old labor monopoly of the "wobblies" only to transfer our problem to maintaining wheat quality by safe, clean, and prompt storage facilities—minus mold and insect injury.

It is usually calculated now that by the end of August all of the winter wheat should be under suitable cover—but in many cases this has been impossible. Right behind the winter wheat flow will come the high piles of spring grain, demanding that the industry in some manner provide the needful protection—for why raise a bumper crop of anything valuable only to waste it afterwards?

Last summer in one Kansas town of a few hundred folks every available regular wheat elevator was brimful a week after the combine crews swept into the golden grain fields. So they desperately turned the elevator carrier spouts into a large four-story building, pouring in the oceans of grain steadily for two days, until the metal sides of the structure collapsed under tons of pressure, with the wheat breaking through in a Niagara of kernels to spill on the adjacent ground below. Before the job was done, they say, a tower of loose wheat rose to the top of the building, almost hiding it from the view of passers-by.

Thus the impact of the speedy wheat-gathering business hits mills and elevators in the short spell of three weeks. Some data on just how much faster it arrives come to notice. About 30 years ago, for example, the number of railroad cars received at Kansas City in the months of July and August carried about 15 per cent of the total carloads of wheat expected for the season. In the past five years, the receipts during the same midsummer period represent just about 50 per cent of the crop to come.

The presence of old wheat aggravates the storage situation. Including local and terminal elevators in seven of the large winter wheat states, there was in May of this year a reduction of public storage capacity reaching 45 million tons—mostly government loan wheat being snugly ensconced in that amount of space. To move out the old grain covered by government loans and purchase agreements, the railroads in April assembled about 20,000 boxcars at country stations in the West. It seems from latest guesses by railroad spokesmen that plenty of cars are handy to handle the wheat this summer—if and when the right amount of storage room is ready.

BECAUSE the loading of more railroad cars to haul new wheat to elevators is a useless job when the mills are running behind on grinding fresh receipts, when the terminal storages are full, and switch-yards blocked with waiting cars, embargoes on more shipments from the harvest zones must be imposed. Go out to Oklahoma, Kansas, or the Dakotas and Montana sometime this summer and you'll get a better idea, from the lines of waiting grain trucks, why these jams and embargoes happen so often.

This season the government has tried to take direct action in helping to get new storage, to furnish a little government space to shelter some wheat, and to offer so-called distress loans to growers in regions where a few weeks of outdoor, exposed wheat dumping will not seriously harm the grade and quality. Moreover, to be extra kind about it, Uncle Sam's wheat buyers have promised that if a wheat grower signs up for a distress loan with makeshift storage he will not be docked or penalized in case there is a drop in the wheat grade before he can get satisfactory storage facilities.

But the feeling is general that if the government continues to lend support to the wheat price through loans and purchase agreements, this offer will be whittled down to a reduced acreage next year. Any plan that thrusts the American wheat grower into world competition with producers elsewhere on low-priced land—as a surplus implies—cannot be entirely offset by government aid. Wheat leaders are busy these hot days working on allotments and possible market quotas, too.

Counting the 1944 reserve stocks on hand July 1 of that year, and adding the enormous bushelage of wheat produced in the six subsequent harvests, this country has handled about seven and a half billion bushels. Close to two and one-half billion bushels of that volume have been sent abroad under the various plans afoot in the past six years. Consumers here at home meanwhile have eaten their "wheaties and toast" to the tune of somewhat over three billion bushels. We have fed somewhere near one and a quarter billion bushels of wheat—not all the finest grade—to livestock which we were bent on raising for wartime and postwar demand. The rest is what we used to sow more wheat, to get more big crops, to fill more storages, and hunt more outlets. Seed amounts to only 85 million bushels —needed these days to reap over a billion bushels return.

Nobody enjoys retailing woe or forebodings of any kind to make fuel for depressed activity. Yet in some degree it is never sound policy to stick your brains in the sand, like an ostrich, hoping to dodge consequences or escape current trends. Neither can perennial postponement of decisions or tossing of responsibility to the public in general—or to the government—serve the purposes of courageous men. Countries that follow such a blind and secretive course play into the maws of the dictator and revolutionists. It's not the American way. We face our dilemmas finally and conquer them.

GROWERS did not reduce the wheat acreage by a slight percentage in 1949. They increased it. The June crop report says we have a prospective all-wheat output of 1,337,000,000 bushels, just now rated second of record in volume but likely to top everything hitherto before the final spring wheat toll is taken. I have even heard well-sustained estimates by the trade that reckon our 1949 production close to a billion and a half bushels. So we can look forward to providing ample home supplies for eating, feeding, and seeding, with about 650 million bushels looking to foreign outlets. If the present season's exports reach 450 million bushels we will be keeping a good pace.

The new international wheat agreement offers some stability. It took the delegates a long time to hatch it out, and Congress did a lot of debating before it was ratified. It would go into force as of September 1, 1949. It sets a range of prices within which 456 million bushels of wheat (168 million composed of U. S. stocks) will move into world commerce each year.

Thus we cannot by artificial means entirely escape the weight of responsibility for the situation now being faced. Growers hiked the wheat acreage 14 per cent above the goal which wheat farm leaders themselves helped to suggest. The 82 million acres of seeded wheat this year won't all be harvested probably, but such as it is, the outlook for combining for ourselves an acreage about 24 per cent better than the annual 1939-43 average is real and persistent.

STOCKS of wheat found in the four big exporting countries early this year were over 550 million bushels, which, although very large, is nothing like the one and three-fourths billion bushels which those same exporters had ready to unload back in July 1943. Our own wheat exports at around 475 million bushels or so could be realized with the international agreement in force that grants us 168 millions in the world pool. This is because we have extra foreign outlets through military takings and non-agreement countries, with some chances for sales to agreement countries beyond the levels set down as minimum. There will be great dickerings and doings from now on to ease our burdened storages via the ocean routes.

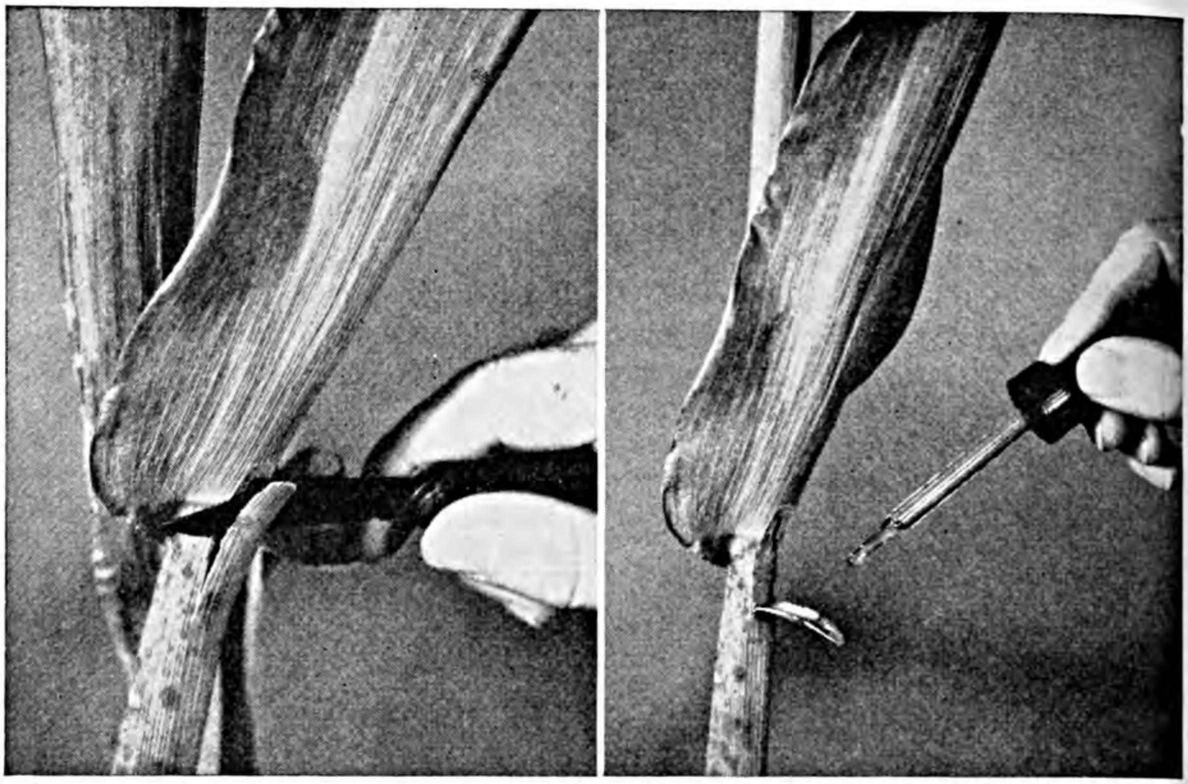
One of the interesting points about the wheat expansion deal that you notice when scanning the well-thumbed monthly crop reports is that some of the normal livestock-raising specialty states are growing more wheat than usual. New York, Pennsylvania, Illinois, Michigan, and Colorado are fair examples. If prices falter as the markets get clogged, considerable of the wheat in such areas may be fed. Yet we are watching the corn crop also, to see how it pans out on top of the finest pasture growth for cattle that recent years have known. One sure thing we can bank on—starvation is not our lot.

I RECKON it all boils down finally to some sort of acreage allotments—which wheat growers may have imposed on them without any choice—and maybe, if bins explode, to marketing quotas also. In any event, growers will have a vote before the quotas and penalties attached to excess marketings become effective.

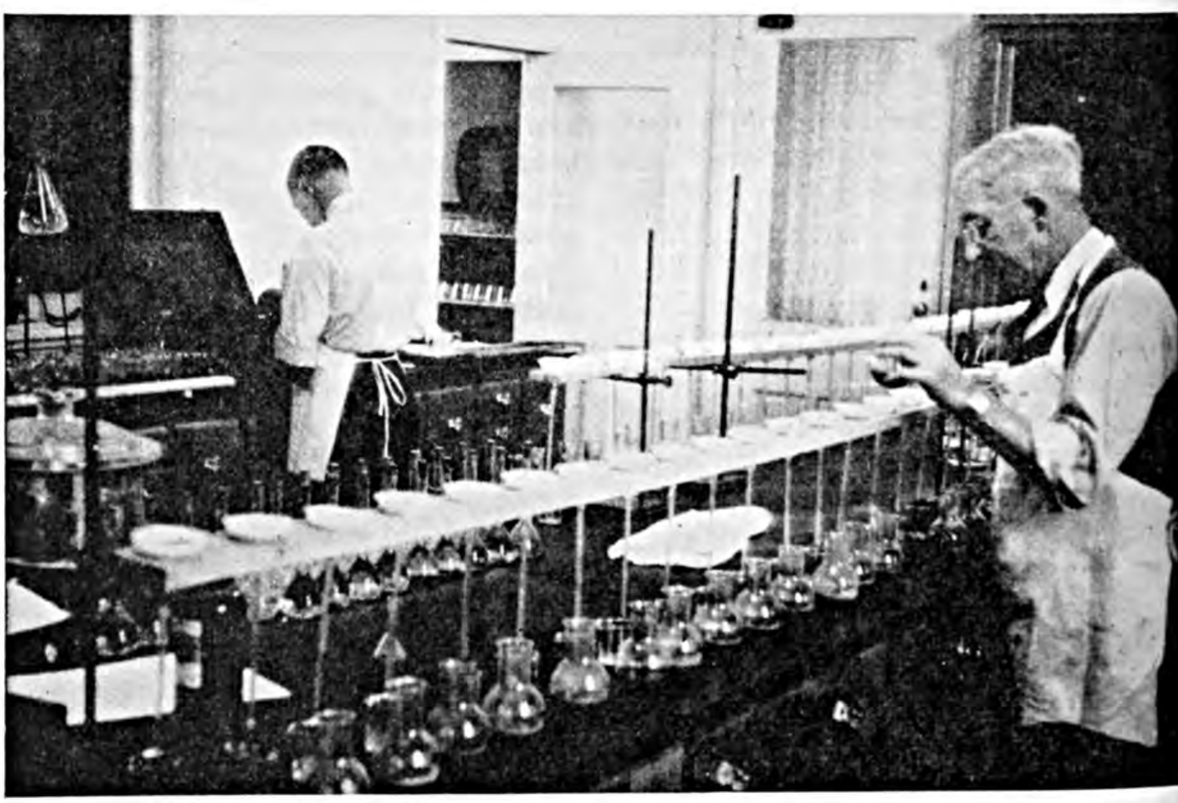
Uncle Sam isn't doing all this planning from his multitude of Washington and state offices either. The great bulk of the "grief" and the preliminary spinning of details is now being handled in the community outposts manned by expert wheat growers themselves. As stated before, America meets its own knotty problems head-on, sometimes a little late, but usually with blunt and forthright honesty.

In fact, I have noticed that the fellows in the field are ready to jump and perform tough assignments well ahead of the guys at headquarters who are often so timid about "federal interference." You see, my friends, only a small percentage of the chaps in Washington have been there very long. They remember what they said about the centralization of authority while they were in the states, and hence we see caution and prudence—almost to the point of hesitation.

Yes, we too can help in a pleasant way—by increasing our own allotments of waffles, wheat cakes, and breadstuff.



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
II-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
NN-10-46 Soil Testing—A Practical Aid to the Grower & Industry
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
G-2-47 Research Points the Way for Higher Corn Yields in North Carolina
I-2-47 Fertilizers and Human Health
P-3-47 Year-round Grazing
S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
Y-5-47 Increasing Grain Production in Mississippi
AA-5-47 The Potassium Content of Farm Crops
DD-6-47 Profitable Soybean Yields in North Carolina
GG-6-47 Corrective Measures for the Salinity Problem in Southwestern Soils
SS-10-47 Soil Fertility and Management Govern Cotton Profits
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
BBB-12-47 The Management of Mint Soils
E-2-48 Root Rot of Sweet Clover Reduced by Soil Fertility
H-2-48 Soil Testing and Soil Conservation
L-3-48 Radioisotopes: An Indispensable Aid to Agricultural Research
O-4-48 Legumes Improve Drainage and Reduce Erosion
R-4-48 Needs of the Corn Crop
V-5-48 More Abundant Living with Soil Conservation
W-5-48 Will These New Tools Help Solve Some of Our Soil Problems?
X-6-48 Applying Fertilizers in Solution
Y-6-48 Response and Tolerance of Various Legumes to Borax and Critical Levels of Boron in Soils and Plants
AA-6-48 The Chemical Composition of Agricultural Potash Salts
CC-8-48 Soil Analysis—Western Soils
EE-8-48 A Soil Management for Penn Tobacco Farmers
FF-8-48 Soil Conservation Raises Midwest Crop Potentials
GG-10-48 Starved Plants Show Their Hunger
II-10-48 The Need for Grassland Husbandry
MM-11-48 Better Hay with Potash
NN-11-48 Ladino Clover—Italian Gift to North Carolina Pastures
OO-11-48 The Use of Soil Sampling Tubes
QQ-12-48 Legumes Supply Organic Matter
SS-12-48 Hubam Sweetclover
TT-12-48 Season-long Pasture for New England
UU-12-48 The Relation of Credit to Soil Conservation
A-1-49 Organic Matter Puts New Life in Old Soils
B-1-49 Hardening Plants with Potash
C-1-49 Military Kudzu
D-1-49 Permanent Pastures in South Carolina
E-1-49 Establishing Bermuda-grass
F-2-49 Fertilizing Tomatoes for Earliness and Quality
G-2-49 The "Put and Take" in Grassland Farming
H-2-49 Wise Land Use Increases Farm Income in the South
I-2-49 Maintaining the Productivity of Irrigated Lands
J-2-49 Increasing Tung Profits with Potassium
K-2-49 Four West Virginia Veterans Top 100-bushel Corn Yield
L-3-49 The Development of the American Potash Industry
M-3-49 Better Louisiana Corn
N-3-49 Are you Shortchanging your Corn Crop?
O-3-49 Undeveloped Soil Resources of the Southeastern Atlantic Coastal Plain
P-4-49 Nothing Like Nodules for Nitrogen in Forage Production
Q-4-49 Potassium in the Oregon Soil Fertility Program
R-4-49 Vermont's Agricultural Conservation Program

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.

A Few Whinnies

The reason why my gal reminds me of a switchboard is because when she walks all her lines are busy.

★ ★ ★

HE KNEW

A motorist was rolling down the road at sixty miles, when he crashed into a load of hay and upset it. "Hadn't you better tell your father?" he said to the farm boy who stood looking at the upset hay.

"He knows," replied the boy.

"He knows? But how can he?"

"He's under that thar hay."

★ ★ ★

Mandy went in the the bank and, digging down into her ample bosom came up with 35 dollar bills to deposit. "Why, Mandy," said the Teller, "have you been hoarding."

"No, sah," replied Mandy. "Ah made this money takin' in washin'!"

★ ★ ★

Specialist: "This eccentricity you speak of in your daughter—isn't it, after all, a matter of heredity?"

Mother (severely): "No, sir! I'd have you know there never was any heredity in our family!"

★ ★ ★

A certain guy who came home very late and very unsteady had a brilliant idea. He stopped in the kitchen and tied together all the pots and pans he could find. Then he proceeded upstairs, dragging the kitchenware and muttering confidently, "She'll never hear me in all thish racket."

The old farmer was dozing in the shade of his front porch, when a high-pressure salesman bustled up the front walk and awakened him with a cheery "Good afternoon." He had a sample book of a 10-volume set on scientific agriculture he was selling.

The old farmer was at length persuaded to page through the specimen volume.

"Nope," he objected, "ain't got no use for it."

"But you ought to have it," the salesman insisted. "It will teach you to farm twice as good as you do now."

"Hell, son," barked the ancient agriculturist, "I don't farm half as good now as I know how."

★ ★ ★

Before the Judge in a county court a woman moaned, "I'm sure my husband is unfaithful to me because not one of the children looks in the least like him."

★ ★ ★

Funeral services were being conducted for a woman who had been thoroughly disliked in her rural community. With a violent explosive disposition she henpecked her husband, drove her children mercilessly and quarreled with her neighbors. Even the animals on her place wore a hunted look.

The day was sultry and as the service ended the storm broke furiously. There was a blinding flash followed by a terrific clap of thunder.

"Waal, she's GOT there?" a mourner said.

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)
Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

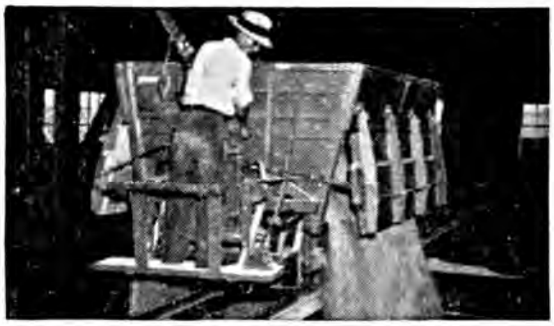
American Potash Institute
1155 Sixteenth Street
Washington 6, D. C.

Printed in U.S.A.

Better Crops WITH PLANT FOOD

August-September 1949 10 Cents

The Pocket Book of Agriculture



V-C Fertilizer is a properly-cured, superior blend of better plant foods.

V-C Fertilizer stays in good condition, when stored in a dry building.

V-C Fertilizer flows through your distributor, smoothly and evenly.

V-C Fertilizer encourages a good stand, uniform growth, bigger yields.

OUR FULL-TIME JOB

TO YOU, the selection and use of the best fertilizer is only one practice essential to your success in making your farm a better-paying business.

To V-C, however, the manufacture of the best fertilizer is a full-time job. The extra crop-producing power of V-C Fertilizers is the result of over 50 years of V-C scientific research, V-C practical farm experience and V-C manufacturing skill.

Since 1895, V-C factory experts, chemists and agronomists have constantly tested and developed new methods and new materials, to produce better and better V-C Fertilizers for every crop you grow.

If you want to give your soil the power to produce abundant yields, see your V-C Agent! Tell him you want V-C Fertilizers!

VC FERTILIZERS ®

VIRGINIA-CAROLINA CHEMICAL CORPORATION

401 East Main Street, Richmond 8, Virginia

Norfolk, Va. • Greensboro, N. C. • Wilmington, N. C. • Columbia, S. C.
Atlanta, Ga. • Savannah, Ga. • Montgomery, Ala. • Birmingham, Ala.
Jackson, Miss. • Memphis, Tenn. • Shreveport, La. • Orlando, Fla.
Baltimore, Md. • Carteret, N.J. • E. St. Louis, Ill. • Cincinnati, O. • Dubuque, Ia.

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 7

TABLE OF CONTENTS, AUGUST-SEPTEMBER 1949

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America

A Peaceful Valley

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON, D. C., AUGUST-SEPTEMBER 1949 No. 7

Lest We Forget . . .

Our Waning Woodlands

Jeff McDermid

RIGHT now, when many of us are communing with nature in the wild, let's ask a question and give an answer. Aside from bugs and diseases, what are the three main causes for the drain on our forests? To this, knowing one's reply: Men, women, and children!

If planks and scantlings were the only good we derive from these giant plants we call "trees," then we could sit back and be as calm about it as we are when we see the horse losing out in the race with the motor age. But cows and sheep and wild animals cannot eat a plank. When seeking a vacation spot for beauty, we don't visit a lumber yard. We can't hunt bears and moose and elk among heaps of two-by-fours and shingles. Neither will a barrier of planks and beams protect our vast watersheds or hold back floods. All of which means that a passable substitute for construction wood or even paper-making wood could be found, if worst comes to worst—but where will we seek grazing, recreational, wild life, and land-conserving benefits without these green and growing trees?

I was raised, and maybe you were too, in the era of reckless and wanton exploitation of the original virgin woodlands. My county's richest nabob made a fortune felling timber and rafting sawlogs to the mills. A few of the wiser ones used "selective cutting" and some even did some replanting. But for the most part, those old ravagers were crazy for immediate profit in an expanding country crying for timber products, and they behaved like a lot of ignorant boys robbing birds' nests. One of my relatives was engaged in the business amid the booms, but he was just an axman and did what he was paid to plunder. But the same thing happened to the wild buffalo and the Indian—they got in the way of somebody who didn't know their real worth.

HOWEVER, times and minds have changed. Lately I saw a smoke-jumper demonstration in a large eastern city, staged by the U. S. Forest Service to show how a thorough but dangerous task can be handled by trained parachutists leaping from low-flying planes over burning glades of woodland. But that stunt from the air was perhaps not the big point. Right after the event, a meeting was held to give recognition to a number of vital business executives who had done yeoman work to further the public welfare in preventing needless waste of natural forest resources.

All this change of heart doesn't come too late either. Nature is still operating, and organized study and action to aid her efforts are commendable even at some temporary sacrifice of rugged independence and temporary profits. That we still have some wood resources to rely upon, thanks to new attitudes of recent years, is shown by the fact that in the stress of World War II we were able to find timber products enough at hand without too much loss to carry on the detailed effort. How stupendous this wood usage was for all manner of construction and shipping is indicated by estimates that it was equal to the volume of lumber which would build a city the size of Chicago. Much of that was dissipated, lost at sea, bombed and burned, or lost abroad. Yet the significant idea is that we had it to squander in an emergency, ironically putting a still higher building cost on new houses for new families, too often "jerry-built" and shoddy.

For our security this country is said to have land enough to grow all the trees we need to make timber, plus that safe margin we have found so essential, and even for a little export business too. But we must bolster up our management a lot or this timberland won't be much to lean upon. Out of the 624 million acres of forests, somewhere near 460 million acres are classed as "commercial" property and type. Some of this land is idle, denuded, poorly stocked, some is just pole timber or saplings, and a third of it second-growth saw timber. Only 12 million acres are of tiptop virgin quality.

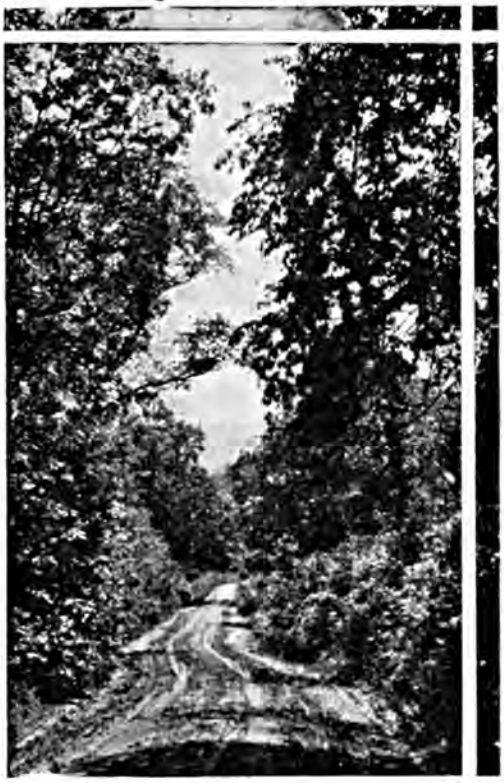
Complaint is common about the retail prices paid at local lumber yards and the green condition of so much wood going into new houses. This has its factual background. About a third of the Nation's saw timber is derived from less than 10 per cent of the commercial forest land, located in the Pacific Northwest. There is not enough growing stock left in the eastern forest tracts to keep up the present rate of demand. Low-value hardwoods and scrub stock occupy large areas suitable for growth of something better.

FOREST experts often remind us that our saw-timber drain is biting us hard. It is said to exceed the volume of growth by about 50 per cent. Cutting accounts for almost 90 per cent of this drain and the rest is caused by fire, insects, diseases, and neglect.

Present dependence for adequate timber supplies rests mainly on privately owned land. Here the management practices are not as good as many believe they could be. About three quarters of the commercial forests are in private hands and one quarter of the land is owned by state, federal, and local governments.

Forest figures say that about one fourth of the private woodland stands in medium and large holdings of 5,000 acres or over. Of this part of the commercial area, lumber and pulp concerns and individuals hold sway, possibly less than 4,000 owners in all. Then we have the other three fourths owned in tracts of varying sizes, all 5,000 acres or less, decidedly less. More than half of this portion lies in farms and the rest in non-farm tracts often owned by absentees. It foots up to somewhere near four million individuals with an average forest property of possibly 65 acres apiece.

Only about 8 or 10 per cent of the present harvests of timber on private lands is such as to measure up to fairly good standards of practice. More than 60 per cent of the cutting on private lands is said to be miserably destructive or poor, to say the least. The best



and highest percentage of excellent cuttings is that done on larger properties. Farm properties do not get a good rating on cutting methods, as seen by official foresters. They are rated 73 per cent poor or harmful, 23 per cent just fair, and only 4 per cent good.

So it simmers down after the pot is stirred to the fact that the level of forestry management for public interest can be bettered chiefly by finding ways to induce the ones who have small tracts to improve their systems for the future. Grazing of woodlands by livestock and serious overcutting by untrained persons are two major reasons why the farms show up so poorly. The best way to bring about a gradual improvement is worth discussion in any rural meeting, but to let it be after a talkfest gets us nowhere.

In essence, the job that we have cut out for us is to practically double the estimated annual saw-timber growth of 35 to 40 billion board feet each and every year. It's a plant expert's job, as well as one for the engineer, and the Extension Service worker, and the teacher. The idea is to maintain forest-growing stock in sufficient volume of healthy trees so that when one year's crop is harvested there will be plenty more coming along to provide next year's crop.

I'VE never seen a farmer yet who neglected to provide enough seed and fertilizer and machinery and rotation land to grow another crop when he had harvested and stored his current season's abundance. Just why we should adopt one system of careful advance planning in a vast field of vegetative husbandry and put no thought whatever to similar foresight with the world's tallest and most valuable plant life is hard to understand.

I presume the answer is that in the development of this country we have regarded both trees and grass as outright natural gifts—wild life which had no claim on man for culture or maintenance. It's only in recent years that we have really accepted pastures and woodlands as regular farm crops.

If Nature's herbaceous resources served only to please the eye and vary the scenery, or give comfort to wild animals and vacationists, we would be amply justified in adopting them and becoming stewards for their perpetual welfare.

But you can pick up any scientific guide to the treasures locked inside of trees and find startling evidence that a dwindling timber supply threatens huge industries, endangers personal health and conveniences, and strikes at the incomes of thousands of daily breadwinners.

Nobody wants to dig into all the chemistry and physics involved in a thorough outline of the valuable things

(*Turn to page* 48)

Fig. 1. Members of the Winter-grazing Tour leaving Lefler's farm, Stanley county, North Carolina, January 1949.

The Red Hills of the Piedmont Need More Green Blankets

By James A. Naftel [1]

Auburn, Alabama

THROUGH the establishment of winter-grazing crops it is possible and practical to cover our red hills of the Southeast with green blankets of lush sod crops. Winter grazing has been practiced only a few years on a large scale, but from this small and late beginning it has now grown into a full-scale movement in grassland farming. It should be understood as a part, perhaps the most valuable part, of the year-around pastures which are attracting the attention of agricultural leaders and writers, as well as the editorial writers of our daily newspapers.

Winter grazing is simply the establishment of combinations of small grains, grasses, and legumes during the late summer and early fall for grazing through the winter. Thus winter pastures in combination with the more common spring- and summer-grazing crops afford year-around pastures that are not only proving successful but also

[1] Chairman, Pasture Subcommittee of the Plant Food Research Committee of the National Fertilizer Association.

highly satisfactory to farmers. In fact the farmer with winter grazing is like the successful alfalfa grower, he will always take you to these fields to show you the appetizing forage and the good condition of his livestock. (If he has a prize herd of beef or dairy cattle on his lush winter grazing, you had better plan on spending the day with him!)

Now to get back to the "red hills" of the Piedmont, which extend from a point near Auburn, Alabama, northeastward through Georgia, South Carolina, North Carolina, and Virginia; we spent a week early this year on a 1,400-mile trip to see and study winter grazing, particularly in this area. It was a pleasant sight to view the green hillsides of north Georgia in late January, standing out in bold contrast to the bare fields being subjected to the ravages of winter rains. It is possible in this brief space to report only a few typical examples of the many farms and large acreages covered with green blankets of winter-grazing crops.

A father and son on Route 1, Laurens, South Carolina, T. P. and D. Eugene Brown, have demonstrated how a year-around grazing program may bring new prosperity to a farm family. For years they had been fighting a losing battle of holding their land, both as to title and soil fertility, through the accustomed practice of row cropping their red hill farm. Dairy farming and winter grazing are now winning the battle for them. As we approached the community under the guidance of C. B. Cannon, an outstanding county agent, the entire landscape was a pattern of green up the hillsides and down the valleys.

The motorcade, then numbering about 40 cars and approximately 100 people including neighboring farmers and business men of the towns around, drove off the paved highway into the middle of the Browns' farm, where the son began telling us his success story. He related how his father a number of years ago was forced to sell off part of his land to meet obligations, but after turning to dairying and winter grazing had not only regained all of his previous land but was buying land around him. During 1946 and 1947 the Browns had 30 acres of annual grazing and 40 acres of permanent pasture. In 1948 the annual grazing

Fig. 2. Members of the Winter-grazing Tour observing heavily grazed ladino clover-fescue pasture on the farm of Watson Morris, Mecklenburg county, North Carolina, January 1949.

was increased to 142 acres. At present they have 175 acres of annual grazing with 100 dairy cows, and are happy with their program.

Mr. Brown's recipe includes good land preparation, the use of lime, and 500 to 1,000 pounds per acre of commercial fertilizer such as 5-10-5 or 0-12-12 with ample seeding of combinations of barley, rye grass, and crimson clover, or fescue and ladino clover, or other combinations which include alfalfa. Last year a topdressing of nitrogen was applied in early November and grazing which was begun the middle of November has been continuous except for one or two days.

Here is an example of a farmer starting his grazing program with a small acreage and now successfully expanding it over most of his farm. Driving for several miles around this community convinced us that the Browns' neighbors also believe in winter grazing, for most of the farms had blankets of grass.

Many other farms with acreages of green grazing were seen throughout the Piedmont of South Carolina—in fact, H. A. Woodle, Extension Agronomist of Clemson, stated that the acreage in his State had increased from 40,000 acres in 1945 to approximately 400,000 in 1948-49.

There is no single combination of winter-grazing crops recommended, which was well illustrated by the program of C. T. Smith of Newberry County, South Carolina, who uses 8 different combinations of grazing crops for his 180 head of dairy cattle.

This farmer produces all of the feed used except cottonseed meal. The program on this farm was begun in 1932 and now all but 18 acres of his cropland is in feed or grazing crops. An unusual and interesting observation on Mr. Smith's farm was that he had at least 6 combinations of grazing crops and also alfalfa for hay or grazing as well as re-seeding crimson clover which is followed by grain sorghum. Some of these combinations have overlapping periods to provide insurance in case one combination fails. Surplus forage, especially in the late spring, is put up as silage for later use when needed.

Winter grazing is successful on small acreages as well as large. This was shown on 10 acres of row crop land in 1947 by J. M. Caldwell of Chester County, South Carolina. He applied 600 pounds of complete fertilizer per acre and seeded a mixture of 6 to 8 bushels of mixed oats, barley, and wheat, 20 pounds of crimson clover, and 20 pounds of rye grass the first of October. On November 10 he began grazing 12 head of dairy cattle continuously until the first of January, when they were taken off for topdressing with 200 pounds of nitrate of soda. The 12 head of cattle were put back on the 10 acres the middle of January and remained until the middle of March. The clover was allowed to seed and 1,000 pounds of seed were saved from 3 acres. Cattle were put back on and grazed for an additional 30 days.

This field was plowed last summer and winter-grazing crops were again established as described above. Ten head of cows were turned in on November 15 and have been on continuously except for a few days of heavy rainfall. As to the value of this winter grazing, Mr. Caldwell estimated his land fertility has increased 30 to 40 per cent. Milk yield has practically doubled, in addition to the cows picking up some weight and the daily savings on hay and grain.

Moving into North Carolina under the leadership of Sam Bobson, Pasture Specialist of the North Carolina Extension Service, we found a pattern similar to that seen in South Carolina except possibly more ladino clover and more alfalfa acreage. An outstanding example of a farm being converted over completely to grazing crops was the farm of Watson Morris of Mecklenberg County. Here were 100 acres of alfalfa in addition to the small grain-crimson clover, ladino clover-orchard grass, or

(*Turn to page* 47)

Fig. 1. A high-producing dairy herd on a high-producing ladino clover-grass irrigated pasture in Santa Clara county, California.

Why Use Potash on Pastures?

By M. E. McCollam

San Jose, California

THE question "Why use potash on pastures?" may well be asked in the West, where nitrogen fertilizer seldom fails to produce increased growth of grass, and phosphorus still further contributes to the volume of forage by greatly benefiting legumes such as the clovers and alfalfa.

The answer is, of course, that the increased production caused by nitrogen and phosphorus draws heavily on all of the nutrient elements of the soil. If any one of these nutrients is mined from the soil (for instance potash) because at first it apparently is not needed, sooner or later its scarcity will place a limit on the productive power of the soil. Replenishment will be necessary. Also, strangely enough, in the midst of a reputed abundance of potash in Western soils, we are finding as we actually become better informed, more and more cases of soil which probably was always deficient in the power to supply enough potash for the best production of certain crops.

There is a mistaken idea that in pasturing land, the land is thereby "rested" or improved. Very often the pasture crop is relegated to the poorer land on the farm, because pasturing is expected to improve it. The reason why pasture herbage is so highly regarded as a feed for livestock is that harvested in the immature state, it contains concentrated amounts of digestible nutrients and

Fig. 2. First cutting on pasture plots in Western Washington. N. P. K. combination of 60-60-60 gave the highest yield of pasture dry matter—4,924 pounds compared to 2,002 on unfertilized plot.

minerals. This concentrated material draws continuously and heavily on the plant foods in the soil including large amounts of potash.

In a pasture experiment in Western Washington the unfertilized area, cut three times in the pasture stage, yielded 3,370 pounds pasture dry matter per acre. This withdrew from each acre 12 pounds of phosphoric acid (P_2O_5), 65 pounds of potash (K_2O), and 47 pounds of lime (CaO) from the soil. An area fertilized with nitrogen and phosphorus under the same treatment yielded 4,520 pounds pasture dry matter per acre. This withdrew from each acre 24 pounds of phosphoric acid (P_2O_5), 73 pounds of potash (K_2O), and 77 pounds of lime (CaO) from the soil.

Without the use of fertilizer in a good pasture management system, it may be suspected from the above figures that the pasture crop in many cases may become unproductive through soil impoverishment. The return of fertilizer by animals on the pasture in the form of manure helps to replenish the soil, but each year there is a net loss of potash. This has been well explained by Midgley and Varney in a previous article in this magazine entitled "Pot-

TABLE I.—YIELDS OF PASTURE DRY MATTER, POUNDS PER ACRE

Location	600# Superphosphate	200# Muriate of Potash 600# Superphosphate	Increase due to 200# Muriate of Potash
Bow, Wash. (2-yr. av.)	5,578	6,155	577
Eatonville, Wash., Location 1	3,082	4,077	995
Eatonville, Wash. (2-yr. av.) Location 2	7,268	8,766	1,498
Lynden, Wash. (2-yr. av.)	6,191	8,035	1,844
Snohomish, Wash. (2-yr. av.)	6,578	7,011	433
Shelton, Wash.	4,471	6,776	2,305

TABLE II.—YIELD OF PASTURE DRY MATTER, POUNDS PER ACRE

Location	125# Sul. of Ammonia 125# Treble Superphosphate	100# Muriate of Potash 125# Sul. of Ammonia 125# Treble Superphosphate	Increase due to 100# Muriate of Potash
Buckley, Wash., 1937	5,129	7,565	2,436
Buckley, Wash., 1938	11,361	15,651	4,290

ash Losses on the Dairy Farm."[1] It is stated that on an average dairy farm of 15 cows, where the supplemental grain feed is purchased, the net loss of potash is 195 pounds (K_2O) each year.

The American Potash Institute has been associated with much of the pasture fertilizer experimental work carried on in Western Washington. Here potash has proved to be of value in raising yields of pasture dry matter and in encouraging a balanced sod of grasses and legumes. In five series of fertilizer plots on pastures in four counties, as early as 1930 the value of potash in addition to phosphorus for fertilizing grass land was established, as the results in Table I show.

Again, in 1937, potash proved to be of great effectiveness in raising the yield of pasture dry matter on a newly seeded pasture at Buckley, Wash. Here the results for two years are shown in Table II.

[1] April, 1946. Rp. T-4-46.

In 1941, pasture experiments were continued at four more locations, and the results were again in favor of including potash, along with nitrogen and phosphorus in the pasture fertilizer program. The results are condensed here in Table III.

Because the dry matter of grass in the pasture stage (immature) is highly digestible and generally contains considerably more protein than alfalfa hay or wheat bran, it is not difficult to assign a dollar and cents value to this type of feed. Certainly *pasture dry matter* is worth as much as the concentrate feeds ordinarily fed to livestock, and a value of $50 per ton would be conservative. With this reasoning, it is readily seen that all of the increases in pasture dry matter here tabulated, due to using potash in the fertilizer treatment, have returned a profit over the cost of the potash.

Fertilizer treatment can greatly influence the kinds of plants making up

TABLE III.—YIELD OF PASTURE DRY MATTER, POUNDS PER ACRE

Location	200# Nitrate of Soda 150# Treble Superphosphate	100# Muriate of Potash 200# Nitrate of Soda 150# Treble Superphosphate	Increase due to 100# Muriate of Potash
Battleground, Wash.	3,324	4,193	869
Custer, Wash.	2,370	2,700	330
Ferndale, Wash. (2-yr. av.)	2,087	2,616	529
Kent, Wash. (2-yr. av.)	3,821	4,689	857

the pasture. Heavy use of nitrogen will increase the amount of grass and reduce the amount of clovers and other legumes. The mineral elements phosphorus, potassium, and calcium encourage the growth of clovers and other legumes, and if generously used as fertilizer will reduce the proportion of grasses in the pasture. A desirable proportion of grasses and clovers can be maintained in a pasture by balancing the use of the plant foods. Another striking effect of fertilizer is the control of certain weeds in pasture land, as in the case of dandelion here illustrated (Figure 3).

It should not be assumed that it is only necessary to use fertilizer to get high-yielding pastures. Management of the animals on pasture is very important, and usually a system of pasturing several relatively small pasture fields in a rotation plan is quite desirable.

A shortage of soil moisture cuts down the yield of pasturage very quickly, and the irrigation of pasture land is becoming a common procedure. Even in humid sections it has been found profitable to have irrigation equipment to water the pastures during periods in the summer when soil moisture becomes short. The effectiveness of fertilizer and water combined can be seen from the tabulation of results obtained at Western Washington Experiment Station. Fertilizer cannot exert its greatest benefit unless sufficient soil moisture is present.

In California, the establishment of irrigated pastures in conjunction with dairying and livestock raising has become a widespread undertaking, and acreage devoted to this crop has been increasing to imposing figures. One forage plant which has been going right along with this development is ladino clover. Its earliest extensive use in California was in the Oakdale district in the San Joaquin Valley, where it steadied a faltering agriculture and created the base for a prosperous community. Fertilizer was used to good advantage on these ladino pastures, this practice for many years being confined to superphosphate applications. Subsequent fertilizer experiments have shown that potash in addition to the phosphate treatment gives still greater yields of pasturage. Lime was also found to be a desirable part of the fer-

Fig. 3. Fertilizer treatment often discourages weed growth in pastures and brings in a strong growth of clovers and grasses. Left—no fertilizer. Right—a nitrogen and potash plot (60-0-60).

Fig. 4. Under frequent irrigation and generous fertilizer practice ladino clover looks like this in California's interior valleys.

tilizer treatment.

The possibilities in a phosphate-potash fertilizer combination can be seen in these results of field experiments at Oakdale, Calif.

Treatment	*Tons Green Weight per Acre*
No fertilizer	7.82
Phosphate	12.68
Phosphate-potash combined	17.05

FERTILIZER AND IRRIGATION PLOTS ON PASTURES

Without water and fertilizer	**368**	**Fertilized but without water**	**589**
Watered but not fertilized	**594**	**Watered and fertilized**	**848**

The figures are for cuttings taken on June 12 and represent about 2 weeks' growth of grass during an exceptionally dry period of weather. They show the favorable effect of sufficient soil moisture upon the yield of fertilized pastures during periods of dry weather.

Other field experiments with fertilizer on ladino clover at Galt, Calif., showed these results:

Treatment	*Tons Green Weight per Acre*
No fertilizer	25.07
Phosphate	27.42
Potash-phosphate combined	31.14
Potash-phosphate-lime combined	39.27

The use of phosphate, potash, and lime is considered a necessary basic treatment of pasture land over a wide area. By this treatment, the clovers and other legumes are benefited, which means higher yield and better quality of pasturage. The use of nitrogen is necessary, as well, to stimulate the growth of grasses and maintain a good proportion of these plants in the pasturage. Nitrogen may be used several times during the season to good advantage to stimulate growth of the pasturage, provided soil moisture is in good amount and the mineral plant foods are present to balance this effect.

On irrigated ladino clover pastures in San Joaquin Valley, Calif., a combination of phosphate, potash, and lime has produced the best yields of clover. The phosphorus may be supplied in the form of 200 pounds of superphosphate per acre, and potash either in the muriate or sulphate form should be applied at the same rate. Mixed fertilizer containing these two plant foods can also be obtained.

If an application of lime is made, 1,000 pounds per acre should be enough for two or three years. A lime application is most effective where worked into the soil prior to seeding new stands of clover. A certain proportion of grass is desirable in ladino clover pastures, and grasses are commonly seeded with the clover. Some nitrogen may be used in the fertilizer program to maintain a proportion of grass along with the clover.

In applying phosphate-potash fertilizers to irrigated pastures using the

(*Turn to page* 45)

BUCKET TESTS—LADINO CLOVER on San Joaquin loam soil, showing growth prior to third cutting. These bucket tests show the additional value of lime with the phosphate-potash combination.

LEFT TO RIGHT: (13) Phosphorus, Potash, and Lime Treatment—Yield green weight per acre 14.28 tons. (12) Phosphorus-Potash Treatment—Yield green weight per acre 11.14 tons. (4) Phosphorus Treatment—Yield green weight per acre 8.09 tons. (1) Untreated—Yield green weight per acre 4.11 tons.

Fig. 1. A group of farmers view a cantaloupe experiment during the Field Day at the Delaware Agricultural Substation.

Efficient Vegetable Production Calls for Soil Improvement

By E. P. Brasher

Horticulture Department, University of Delaware, Newark, Delaware

THERE are many ways to accomplish soil improvement. It may be done by supplying the land with water or by draining the land. The same feat can be accomplished by maintaining the limited amount of moisture in the soil; thus preventing run-off which carries away the topsoil as well as plant nutrients. It may also be done by the addition of fertilizer and organic matter or by the improvement of the physical condition of the soil. In Delaware the most feasible methods appear to be: (1) Application of fertilizer, (2) addition of organic matter, and (3) improvement of the physical condition of the soil. Only these three methods will, therefore, be discussed.

Before initiating soil improvement practices, it is desirable to know the type of soil that is to be improved—its depth, pH, and organic and mineral content. Soil fertility levels in Delaware are generally such that marked responses are obtained from applications of the major fertilizer elements. However, the balance of these elements is usually so delicate as to make it a potential source of difficulty in the nutrition of crops. A recent study of Delaware soils conducted by the Agronomy and Agricultural Chemistry Departments revealed that they generally have a low exchange capacity and are low in nitrogen, available phosphorus, potassium, and possibly certain minor elements. The topsoil in the truck crop region is usually six to eight inches deep, the organic carbon content 0.5 to 1.0 per cent, and the pH from 4.8 to 6.0. The soils, for the most part, range from sand to sandy loam.

One of the most feasible means of measuring the improvement in soils is through crop yields. This method, therefore, will be employed to a large extent throughout this paper. Yields of tomatoes, lima beans, potatoes, and some of the cucurbits will be frequently cited since these crops are some of the most important vegetable crops grown in Delaware.

A Combination of Soil Improvement Practices

No one practice can be expected to restore the productivity of a poor soil in a short period of time. It usually requires a combination of good practices. This combination may consist of adequate fertilization, liming, the use of manures or cover crops, and good cultural practices.

It is well known that the roots of most vegetable crops will not penetrate to a great depth in a subsoil which contains only a small amount of available plant food and has a pH of 4.5 or lower. Vast areas of soils in Delaware are in this category. Since some of these soils do not have over six inches of topsoil, the crops grown thereon are easy prey to droughts. When the root growth of a crop is largely restricted to six inches and that crop is grown without irrigation, moisture is likely to be the limiting factor. On deeper soils or soils which have a more desirable subsoil for root penetration, moisture is not so apt to be deficient. Shallow soils with undesirable subsoil can be greatly improved within a few years by employing the combination of practices listed above. The fertilizer and lime should be plowed down as deep as soil conditions will permit. If manures are used, they also should be plowed down. One cover crop, preferably a legume, should be turned under each year. This crop can be grown in addition to a cash crop. By following these practices, a great improvement may not be noticeable the first year; but as the years pass, the root growth will gradually penetrate deeper and a definite improvement in productivity will become evident.

In 1942, the Delaware Agricultural Experiment Station purchased a neglected farm in Sussex County for an Agricultural Substation. At the time of purchase, only inferior yields of crops could be obtained. Now, however, after following the practices of plowing under fertilizer, lime, cover crops, and poultry manure, large yields of most crops are obtained. In 1947, such yields per acre as 17 tons of tomatoes, 5 tons of sweet corn, 12 tons of watermelons, and 10,000 cantaloups were obtained. Under identical conditions, except for the soil, it is believed that the yields of these crops in 1943 would have been only a fraction of those of 1947.

Fertilization

Few, if any, topics on the production of vegetable crops have received as much attention as fertilization. This has been necessary because of the complexity of the problem. Soil fertility tests have been of value in determining fertilization practices but they are not the sole solution.

In a study of soils from productive and less productive tomato fields in Kent County during 1941, some striking relationships between the soil content and yields were revealed. When yields from soils containing varying amounts of organic carbon were compared, there was revealed a substantial difference in favor of the higher organic carbon content. Likewise, a high nitrate-nitrogen content increased the yields greatly over a medium nitrate-nitrogen content. Soils containing a medium supply of potassium also produced greater yields than soils containing less potassium. In the case of phosphorus, however, those soils containing the least amount produced the greatest yields. With magnesium, the reverse was true. Soils with a pH of less than 5.8 produced more tomatoes than those with a pH above 5.8. This same study was duplicated in 1942, but the results with phosphorus, magnesium, and pH were exactly opposite from those of 1941. Approximately 240 acres of tomatoes in 50 fields were represented in this study.

If conclusions from this work had to be drawn, it would be necessary to conclude that the art of soil testing, alone, could not be relied upon to determine the most satisfactory soil fertility level for the production of tomatoes in Kent County, Delaware. Perhaps tissue testing or a combination of tissue and soil testing would be more desirable in solving fertilization problems. Certainly, tissue testing would be a valuable tool if criteria were established to indicate what is an adequate or optimum amount of nutrients in a given plant.

Fertilizer Rates

The present per-acre rate of fertilizer for vegetable crops grown in Delaware lags far behind that of the most economical. It is estimated that the average farmer in Delaware applies 700 pounds for tomatoes, 500 for potatoes, 400 for lima beans, 200 for sweet corn, and 500 for muskmelons. According to the Delaware Agricultural Experiment Station's recommendations, all of these crops could use economically much more fertilizer. How much more will depend upon a number of factors, such as soil, rainfall, temperature, cultural practices, etc.

In a test (Table I) in 1947 the yields of three out of nine vegetable crops (sweet corn, muskmelon, and squash) were significantly increased when the fertilizer application was increased from 1,500 to 3,000 pounds of a 4-8-12 fertilizer per acre. Of these increases, however, only one, that of muskmelon, was economical. This supports pre-

Fig. 2. This lima bean crop was preceded by a cover crop that was plowed under. Five tons of poultry manure were broadcast after plowing, and 500 pounds of 5-10-15 per acre were banded at planting time.

vious work at the Delaware Station in that it is rarely profitable to apply more than 1,500 pounds per acre of a 20 or more unit fertilizer to any vegetable crop. In most cases, even this amount is too much for economical returns.

Fertilizer Ratio

It is rather simple to calculate the amount of each fertilizer element necessary to produce a good yield of any vegetable crop. It is not so simple, however, to determine the proper ratio for that crop. In the past, fertilizer ratio recommendations have been based largely on experimental evidence obtained by testing various ratios in the field. Sound recommendations have been established by this procedure but there is always some doubt as to the value of any ratio when it is used under conditions where it has not been tested.

In Delaware it appears that some crops are more exacting in their ratio requirements than others. Tomatoes for example seem to thrive efficiently on a number of different ratios. During the period from 1942 to 1944, inclusive, ten different ratios were tested. At the conclusion of this study, there was no significant difference in yield between any of the ratios. On the other hand, in an experiment with Irish potatoes a 1-2-3 (5-10-15) ratio was outstanding for three consecutive years. This same ratio was particularly good in the production of asparagus, lima beans, and muskmelons.

A faster and more reliable method of determining nutrient requirements for plants under a given set of conditions is badly needed. A start has been made toward finding this method. At present, horticulturists and agronomists in widely separated areas of the United States are pooling their research data to expedite the work in determining the optimum content of nutrients in crops.

Poultry Manure

According to results obtained at the Delaware Agricultural Experiment Station, the vegetable growers who have access to poultry manure and fail to use it are missing the opportunity of producing maximum yields. An extensive study with the use of poultry manure in the production of tomatoes, lima beans, and asparagus has revealed that greater yields of these crops can be obtained with a combination of poultry manure and commercial fertilizer than with commercial fertilizer alone. By substituting five tons of poultry manure for one-half of a good application of commercial fertilizer, yield increases of 2.2 tons of tomatoes, 351 pounds of shelled lima beans, and 123 pounds of asparagus per acre resulted. Further studies also indicated that chicken manure could be successfully substituted for horse manure in the production of cantaloupes and watermelons. In this case, however, it was necessary to apply the chicken manure to the cover crop in the fall before planting the cantaloupes and watermelons the following spring.

TABLE I. THE EFFECTS OF FERTILIZER RATES ON THE YIELDS OF NINE VEGETABLE CROPS, GEORGETOWN, 1947

Treatment per acre	Tomato, tons per acre	Potato, bus. per acre	Sweet Corn, tons per acre	Broccoli, lbs. per acre	Cabbage, tons per acre	Sweet Potato, bus. per acre	Watermelon, tons per acre	Muskmelon, tons per acre	Squash, tons per acre
No fertilizer......	9.67	151	3.11	1,213	2.33	140	6.91	6.35	3.32
1,500 lbs. 4-8-12...	14.33	190	4.15	2,054	4.36	257	11.11	9.32	4.93
3,000 lbs. 4-8-12...	14.10	199	5.19	2,582	5.86	257	11.24	12.39	7.24
L.S.D............	1.90	31	0.84	1,213	1.60	31	2.43	2.01	0.81

Fig. 3. Checker board effect in rye cover crop produced by fall application of poultry manure. Photograph was made in early spring.

The National Committee on Fertilizer Applications is performing an excellent service to experimental workers in the fields of horticulture and agronomy. Through its efforts, large volumes of scientific information of inestimable worth have been collected and published. This information will, no doubt, have far-reaching effects in promoting better fertilizer placement practices in the production of vegetable crops.

Fertilizer Placement

In recent years, fertilizer placement studies with vegetable crops in Delaware have been confined to tomatoes, potatoes, lima beans, and asparagus. Results after three years of study with tomatoes, potatoes, and lima beans, and one year with asparagus showed that broadcasting the fertilizer on the soil surface and then plowing it down was the superior method of applying tomato fertilizer when a starter solution was used. The band method was best with potatoes and lima beans; while with young asparagus, it was best to apply the fertilizer in a band 18 inches wide over the top of the row. Seven different methods were tested with tomatoes and four each with potatoes, lima beans, and asparagus.

Minor Elements

The increased incidence of nutrient disturbances in vegetable crops on the Coastal Plain soils of Delaware has made it necessary to initiate studies with minor elements. An exploratory experiment was, therefore, designed in 1947 to reveal information which might be of value in further investigations. Some of the results were so striking that they are presented herein. The treatments together with the crops studied and their respective yields are presented in Table II.

Of the nine vegetable crops tested, several responded to one or more of the minor elements. Tomatoes, potatoes, cabbage, and squash produced significantly greater yields when 20 pounds of borax were applied per acre. Only cabbage and squash responded to magnesium. Potatoes, cabbage, and squash responded to copper. When Es-Min-El was used tomato, potato, cabbage, and squash yields were increased significantly. One of the most phenomenal yield increases due to a minor element was that of tomato. Boron increased the yield by 3.3 tons per acre. This yield increase was highly significant. Other yield increases which also were highly significant are: Tomato with Es-Min-El; cabbage with copper and with boron; and squash with Es-Min-El, with magnesium, and with copper. None of the minor elements, at the rates used, resulted in a significant yield reduction.

During the growing seasons all nine vegetable crops were checked for deficiency symptoms but in no case could a clear-cut boron, magnesium, or copper deficiency symptom be detected on the check plots. The plants were, therefore, obtaining enough of these elements to sustain normal growth but not enough in some cases, to produce optimum yields.

Since this study was conducted in a single season on only one soil type, the results although significant should not be considered conclusive. However, they may have value in determining the vegetable crops that are apt to respond to minor elements on coastal plain soils.

Organic Matter

There is general agreement among agricultural workers on the value of organic matter in the soil. Since this is true, there is no need in discussing obvious benefits of organic matter here. One question, however, on which there is not general agreement is: How economical is it to supply extra amounts of soil organic matter? An experiment at Wyoming, Delaware, in cooperation with the Libby, McNeill, and Libby Company was designed to answer this question in connection with tomato production. This experiment was only initiated in 1946; so the results to date are very meager and insignificant. Some of the consistent trends, however, indicate that:

1. Nutrients cannot be economically fed to tomato plants through the cover crop.
2. As the period of time before applying fertilizer decreased, tomato yields increased.
3. The aerial tonnage of cover crops produced from spring fertilization was greater than that produced from fall fertilization.
4. Legume cover crops were more effective in increasing tomato yields than non-legume cover crops.
5. When no fertilizer was involved, it was economically sound to precede the tomato crop with a vetch or a combination of a rye and vetch cover crop.
6. When 1,200 pounds of a 5-10-10 fertilizer were applied immediately before plowing in the spring, it was economically unsound to precede the tomato crop with any cover crop tested.

(*Turn to page* 43)

TABLE II. EFFECTS OF MINOR ELEMENTS ON THE MARKETABLE YIELD OF NINE VEGETABLE CROPS, GEORGETOWN, DELAWARE, 1947

Treatment per acre	Tomato, tons per acre	Potato, bus. per acre	Sweet Corn, tons per acre	Broccoli, lbs. per acre	Cabbage, tons per acre	Sweet Potato, bus. per acre	Watermelon, tons per acre	Muskmelon, tons per acre	Squash, tons per acre
1,500 lbs. 4-8-12...	14.33	190	4.15	2,054	4.36	257	11.11	9.32	4.93
1,500 lbs. 4-8-12 + 20 lbs. Borax....	17.63	249	4.77	2,178	6.64	238	11.60	11.17	5.99
1,500 lbs. 4-8-12 + 50 lbs. $MgSO_4$...	14.63	199	4.72	1,805	6.27	263	10.60	9.94	6.72
1,500 lbs. 4-8-12 + 50 lbs. $CuSO_4$....	15.97	226	4.98	2,240	6.85	230	11.92	10.10	7.62
1,500 lbs. 4-8-12 + 50 lbs. Es-Min-El	17.00	229	4.67	2,645	6.53	251	12.87	10.33	6.78
L.S.D.—5%.......	1.90	31	0.84	1,213	1.60	31	2.43	2.01	0.81
L.S.D.—1%.......	2.66	44	1.14	1,711	2.25	44	3.41	2.83	1.13

The Old Rotation at Auburn, Alabama

By Franklin L. Davis[1]

Alabama Polytechnic Institute, Auburn, Alabama

THE Old Rotation at Auburn, Alabama, is probably the oldest field experiment in the United States in which cotton has been grown. Started in 1896 by the late J. F. Duggar it has been conducted continuously since that time by the Agricultural Experiment Station. Because only minor changes have been made in the cropping system, the record of the fertilizer used and of the yields obtained provides considerable information on the fundamental problem of maintaining soil fertility in the South.

The cropping plan and the changes that have been made in the crops grown are shown in Table I. Vetch was substituted for crimson clover as the winter legume after only three years. Beginning in 1925, the cowpeas in the plots on which corn and cowpeas were interplanted were dropped and vetch was used to replace them. At the same time vetch was also introduced into the 2-year (plots 5 and 9) and the 3-year (plots 10, 11, and 12) rotations following cowpeas. The only change in the major crops grown has been the change from corn and legumes continuously and corn alone continuously on plots 1 and 2 to cotton alone continuously. This was done because the corn yields represented relatively low returns in comparison to those obtained from cotton. The subsequent yields of the cotton have given an excellent measure of the effect of the accumulated legume residue on plot 1.

The total amount of phosphate and potash applied to each plot has been the same for the entire period that the experiment has run. Although the amounts applied each year have been changed a few times, the amount applied any one year has always been the same. The changes in the amounts of phosphate and potash used were made to meet obvious fertility needs. Consequently, they are given in full.

From 1896 to 1920, inclusively, all plots received annually 160 lbs. per acre of 14% P_2O_5 acid phosphate and 160 lbs. per acre of kainit (12% K_2O). These were applied in the spring before planting summer crops. No nitrogen fertilizers were used.

Fertilizer Changes Made

The first change in fertilizer applications was made in the fall of 1921. To quote from the record for that year, "To increase the available phosphorus for the legumes and main crops, 400 lbs. per acre of 16% superphosphate were applied to the west half of each plot before seeding to vetch." This was repeated in the fall of 1922. In the spring of 1923, 800 lbs. per acre of 16% superphosphate were applied broadcast to the east half of all plots. Beginning in the fall of 1923, 400 lbs. per acre of 16% superphosphate were applied to the entire areas of *all* plots. Thus, from 1924 to 1931, inclusively, 400 lbs. per acre of 16% superphosphate were applied in the fall to all plots

[1] Manuscript prepared by Franklin L. Davis, Soil Chemist. Members of the staff of the Department of Agronomy, Alabama Experiment Station, have at different times planned the experiment and the changes made. Much of the work in conducting it has been done by the following: J. F. Duggar, E. F. Cauthen, H. B. Tisdale, E. L. Mayton, and D. G. Sturkie.

planted to oats or winter legumes. One hundred sixty pounds per acre of 16% superphosphate and 160 lbs. per acre of kainit were applied to all plots in the spring. In addition, 400 lbs. per acre of 16% superphosphate were applied to those plots that did not receive it in the fall.

In 1932 a change was made from kainit to muriate of potash and nitrogen was added as a topdressing for oats. Thus, from 1932 to 1943, inclusively, the fertilizer applications were the same as before except that 38.4 lbs. per acre of 50% muriate of potash were used instead of 160 lbs. of 12% kainit and the oats on plots 10, 11, and 12 were topdressed with 200 lbs. per acre of nitrate of soda each spring beginning in 1933.

Since 1944 all plots except No. 13, which gets 50 lbs. of 60% KCl in a 2-year period, have received annually 400 lbs. per acre of 18% superphosphate and 100 lbs. per acre of 60% muriate of potash. All plots on which winter cover crops are grown, except plot 8, receive half of the fertilizer before oats or winter legumes. On plot 8 all fertilizers are applied before cotton in the spring.

Maintaining Fertility

The yields of corn, cotton, and oats and the record of the fertilizers used throw considerable light on the problem of maintaining soil fertility. Of primary interest is the small but gradual decline in yields of both corn and cotton during the early years of the experiment. This decline was due to the small amount of growth made by the winter legumes. One hundred sixty pounds per acre of 14% acid phosphate applied annually to the summer crops did not provide sufficient phosphorus for the winter legumes. When 400 lbs. per acre of 16% superphosphate were applied in the fall, the vetch immediately began to make good growth and

TABLE I.—CROPPING SYSTEM USED ON THE OLD ROTATION, AUBURN, ALABAMA.

Plot	1896–1924	1925–1931	1932–1948
1	Corn and cowpeas continuously	Corn-vetch continuously	Cotton continuously Legume residue
2	Corn alone continuously	Corn alone continuously	Cotton continuously No Legumes
3	Cotton continuously Vetch [1]	Cotton-vetch continuously	Cotton-vetch continuously
4 & 7	2-yr. rotation Cotton-vetch [1] Corn and cowpeas	Cotton-vetch Corn-vetch	Cotton-vetch Corn-vetch
5 & 9	2-yr. rotation Cotton-vetch [1] Cowpeas	Cotton-vetch Cowpea hay-vetch	Cotton-vetch Cowpea hay-vetch
6	Cotton alone continuously	Cotton alone continuously	Cotton alone continuously
8	Cotton continuously Vetch [1]	Cotton-vetch Same as No. 3	Cotton-vetch continuously
10 11 12	3-yr. rotation Cotton-vetch [1] Corn and cowpeas Oats followed by cowpeas	Cotton-vetch Corn followed by oats Cowpea hay-vetch	Cotton-vetch Corn followed by oats Cowpea hay-vetch
13	2-yr. rotation on single plot Cowpeas Cotton-vetch [1]	Cotton-vetch Cowpea hay-vetch	Cotton-vetch Cowpea hay-vetch

[1] Crimson clover was planted until the fall of 1899.

TABLE II.—SUMMARY OF CORN, COTTON, AND OAT YIELDS ON THE OLD ROTATION.

Plot No.	Cropping System	10-yr. Av.[1] 1896–1905	10-yr. Av.[1] 1906–1915	4-yr. Av. 1920–1923	3-yr. Av.[2] 1924–1927	4-yr. Av. 1928–1931	4-yr. Av. 1932–1935	4-yr. Av. 1936–1939	4-yr. Av. 1940–1943	4-yr. Av. 1944–1947
	Corn Yields—Bushels per Acre									
1	Corn and Legumes continuously [4]	19.2	16.2	17.5	19.8	26.1	......	......	......	......
2	Corn alone continuously [4]	17.1	10.2	8.4	10.2	9.8	......	......	......	......
4 7	Corn and Legumes Cotton and Vetch	17.9	13.1	14.1	17.6	31.8	28.7	28.5	40.3	34.8
10 11 12	Cotton and Vetch Corn and Peas Oats and Peas	14.0	12.6	14.5	22.0	28.2	33.0	30.0	41.4	41.9
	Cotton Yields—Lbs. Seed Cotton per Acre									
1	Cotton continuously Legume residue	......	......	......	......	......	1,395	1,143	723	470
2	Cotton continuously No Legumes ever	......	......	......	......	......	563	574	334	288
3 8	Cotton and Vetch continuously	813	678	575	1,188	976	1,296 1,289[3]	1,329 1,336[3]	1,152 1,111[3]	1,070 1,064[3]
4 7	Corn and Vetch Cotton and Vetch	820	751	628	1,402	1,017	1,442	1,487	1,367	1,398
5 9	Cotton and Vetch Peas and Vetch	890	958	1,061	1,466	953	1,305	1,281	1,054	1,162
6	Cotton continuously No Legumes	803	573	308	492	502	528	495	430	242
	Oat Yields—Bushels per Acre									
10 11	Cotton and Vetch Corn and Peas	737	804	591	1,139	905	1,403	1,286	972	1,125
12	Oats and Peas	16.8	22.4	12.3	28.7	20.2	64.3	68.6	55.0	54.1

[1] Yield records for 1896 to 1919 lost in fire; records for 1896 to 1915 recovered.
[2] No corn or cotton harvested in 1925 due to drought; these data are 3-year averages.
[3] All phosphate applied to cotton, plot 8, from 1932-1943.
[4] Changed to continuous cotton, no legumes in 1932.

adequate tonnage of green matter. The subsequent yields of both corn and cotton, i. e. after 1923, show the effects of the increased growth of the winter legumes.

It is especially interesting to note that approximately a bale per acre of cotton has been produced on the corn-cotton rotation (plots 4 and 7) when vetch was grown each winter. This rotation also has produced fair corn yields, an average of 30.3 bushels per acre for the last 24-year period was obtained. The continuous cotton followed by vetch each year (plots 3 and 8) shows an average yield for the 24-year period of 1,181 lbs. per acre of seed cotton as compared to an average of 1,352 lbs. per acre from the cotton in rotation with corn. Obviously the yield of cotton is improved by rotation with corn. These yields have been made without any commercial nitrogen fertilizer. One can only speculate as to how much they might have been increased by side-

(*Turn to page* 46)

A Hoosier Dynasty of Good Farmers

By C. W. Gee

Soil Conservation Service, Milwaukee, Wisconsin

THE rich, black soil of western Indiana has been good to the Foster family, and they in turn have been good to the soil. No one but a Foster has ever tilled their farm near Attica. And, since the first of their forefathers broke out the virgin sod 123 years ago, seven generations of the same family have called it theirs.

A heritage of good husbandry has been passed down with the farm from father to son. For generations, not a stalk of stubble nor any other crop residue has been burned. When the first red clover was introduced in the Midwest, the Fosters began growing it and by 1875, clover was one of their principal crops. When lime and commercial fertilizers came into use, the Fosters were the first to adopt them.

This is why J. Lee Foster and his stalwart son, Paul, are producing 145-bushel corn today on land which has been tilled since the days of John Quincy Adams. They are raising better crops than any Foster before them, not alone because of better seed, equipment, and improved methods, but because the land is just as rich today as it was a century ago, perhaps richer. The Fosters have found a sure road to a permanent American agriculture.

First of all the Indiana Fosters was Benjamin, who was the great, great, great, great grandfather of young Colin, least of the Fosters. Colin, now five years old, represents the seventh generation.

As might be expected, little is known today of Benjamin Foster except that he bought the farm from the government in 1825. Benjamin was a minister's son and lived in Madison county, Ohio. His choice of the Indiana farm was a wise one. With the exception of 60 acres of rolling land on the north side, the 220-acre farm lies as level as a table top.

The bulk of it is Wea silt loam, a prairie soil, black and rich in organic matter. Underlaid with gravel, the land is well drained, and fertile topsoil on most of it is three feet deep.

Shortly after Benjamin bought the farm, his son, James, loaded his young wife and baby into a covered wagon and began the long overland journey to the Shawnee Indian country of Indiana. Reaching the new farm, James moved his family into an abandoned cabin until a log house could be constructed.

But before he had had time to start opening the tough prairie bluestem sod with a breaking plow, his team strayed away. Young Mrs. James Foster and her baby remained by themselves in the cabin, deep in the heart of the Indian country, while her husband trailed his horses to Ohio and brought them back.

This is only a vignette in Foster family history but it indicates the tough, self-reliant stock from which the present generation sprang.

Four years after he had bought the farm from the government, Benjamin Foster deeded it to his son. By this time, James must have had a portion of the land under cultivation, and still more of the prairie sod went under the breaking plow before he died in 1845.

For a time the land was operated under a guardian's management since not all of the heirs had reached their majority. Then, in 1853, the eldest son, John, bought out the other heirs and the farm welcomed the third generation of Fosters.

Until this point is reached in the family history, little is known about how the land was treated. But evidence that the earliest Fosters were also good farmers was there in the still fertile soil that rolled back from John Foster's plowshare prior to the Civil War. J. Lee Foster, present owner, can remember as a boy how he watched his grandfather work down the fields into a smooth seedbed by dragging the top of a crabapple tree over the plowed ground.

Not only was John Foster a good farmer who plowed under the stubble and diversified with grain and livestock, but he was also a resourceful one. A market for farm produce was still a question in that day because the country was only thinly settled and roads to the towns were little more than trails.

Working out his own solution to this problem, John Foster became his own processing and transportation system. He ground his own grain, butchered his fat hogs, packing them into casks of brine and then cut his own hardwood timber for a raft.

Loading his raft with flour, cornmeal, and pork, he floated it down the Wabash river until he reached New Orleans where he sold his produce including timber from the raft and returned home, his pockets jingling with silver dollars.

In 1875, John's son, George Foster, took over the management of the farm and became owner when his father died about 30 years later.

George Foster was ahead of his time. In this era, he would be called a good conservation farmer. In his day, he was regarded as a "clover crank" who believed that burning off stubble from a field was a mortal sin.

While others were following corn with corn, George Foster practiced his own ideas of crop rotation. He used a four-year rotation of corn, oats, wheat, and clover. In drouth years his land often produced yields double that of other farmers who laughed at the idea of plowing under straw and growing legumes.

Clover was his principal crop and his income came from the sale of seed and the sale of beef cattle. During all the years George Foster worked the farm, every scrap of stubble was plowed under. Every bit of manure went back on the land.

While his neighbors looked on wonderingly, George Foster with his walking plow turned under the red clover and a big English variety which was available in those years. J. Lee Foster and his brothers followed down their father's furrow with sticks, poking under clover which the plow failed to cover.

"I remember one dry year when most corn was a failure," J. Lee Foster

The farm welcomed the third generation of Fosters when John and his wife took over its management in 1853.

recalls. "Father's corn made 50 bushels to the acre on land that had been in clover the year before. He used to say if there was enough rain to get the crop up in good shape, his ground would raise a crop without another drop of rain."

This kind of husbandry is responsible for the fact that J. Lee Foster today doubles the corn yields of his father. For J. Lee Foster has heavy-yielding hybrids, good commercial fertilizers, and efficient farming equipment to use on land which is still highly productive.

As old age crept up on George Foster, his son took over management of the farm in 1903. A few years before his death in 1922, George passed the farm and his tradition of good husbandry down to the fifth generation.

J. Lee Foster followed in the footsteps of his father. He used a four-year rotation of corn, oats, wheat, and clover. And, he produced all the feed he needed for hogs and beef cattle which were then his principal income.

Ahead of Times

As early as 1912 he was spreading lime on his land. No spreaders were yet available and so he hauled lime in a wagon and spread it with a scoop shovel. As a result he grew one of the first good crops of alfalfa to be found in Fountain county.

Since then the entire farm has been limed regularly with never less than two tons to the acre being applied every four or five years. Heavy applications of fertilizer are also a standard practice. As a sample, in 1948 the land received 400 pounds to the acre of 8-8-8 fertilizer which J. Lee Foster and his son, Paul, plowed under with the sweet clover. In addition, 150 pounds per acre of 0-20-20 were drilled in the row on corn that same season and a like amount of 3-18-9 for oats.

Because the land is level, with deep, productive topsoil, J. Lee Foster and Paul, who has been in partnership with his father since 1937, are able to use shorter and more intensive crop rotations than are generally recommended. Their basic rotation is corn, oats, and sweet clover.

In 1948 the certified Clinton 59 oats yielded 60 bushels to the acre. Corn varieties were two yellow hybrids, U. S. 13 and Indiana 605. Besides the corn and oat land, the farm includes three 14-acre fields which are in a corn-oat-clover rotation. This is rotation pasture for poultry.

The north 60 acres which include all the rolling land on the farm have been developed as permanent pasture. Twelve acres of this have a four-year-old stand of birdsfoot trefoil. The remainder of the pasture is a mixture of alfalfa and bluegrass and a mixture of birdsfoot trefoil with bluegrass.

The principal income of the Foster farm today comes from a herd of registered Aberdeen Angus cattle and from poultry. The only grain crops of any kind which are sold are surplus and above their livestock requirements.

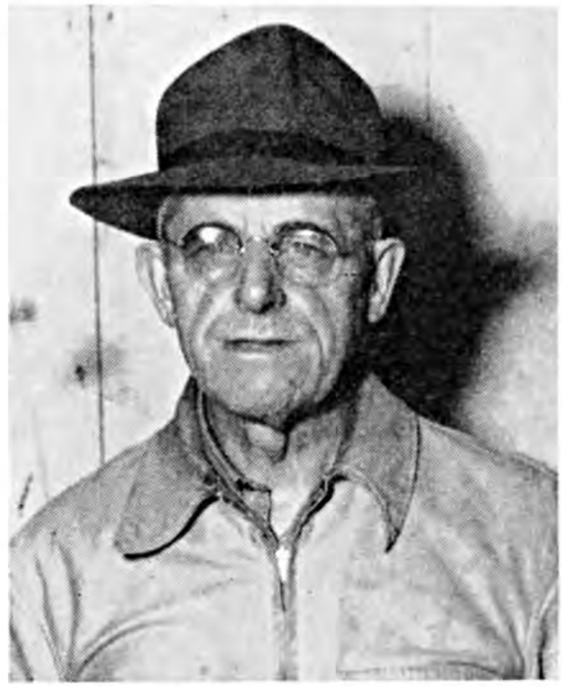
Surplus Buys Fertilizer

"Right now," J. Lee Foster says, "it looks like we will never feed up all our corn. However, we make a practice of selling surplus crops and using the proceeds to buy fertilizer which goes back into the land, poultry feed, and supplement."

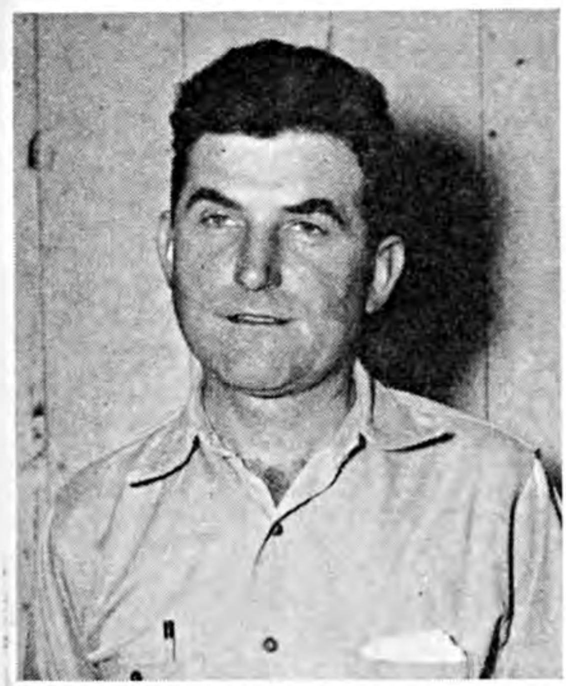
The Foster poultry venture is no mere farm sideline. Starting in 1913, J. Lee Foster developed his flock as an important source of farm income. Then, in 1920 he attended a poultry short course at Purdue University and came home full of new and better ideas. This short course started him to keeping farm accounts which he has since maintained continuously. It also convinced him his poultry business should be expanded.

Today the Fosters carry 2,000 white leghorn laying hens through the winter. They buy sexed chicks from trap-nested stock, and raise them on clean ground, utilizing the ladino rotation

George Foster who succeeded to the farm in 1875 was a soil conservation farmer two generations ahead of his day.



J. Lee Foster, fifth generation, has used modern technical advances to double corn yields of his forefathers.



Paul Foster, sixth of the line, follows the fine traditions of those who tilled the land before him.

Young Colin Foster of the seventh generation will one day carry on the tradition of good husbandry.

pastures. The hens are kept for one laying season.

Nothing is overlooked in modern poultry management. In the laying houses, all hens are de-beaked and all equipment represents the best yet devised. Some of it, such as the nests, was developed by J. Lee Foster himself who is no mean hand as an inventor and all around mechanic.

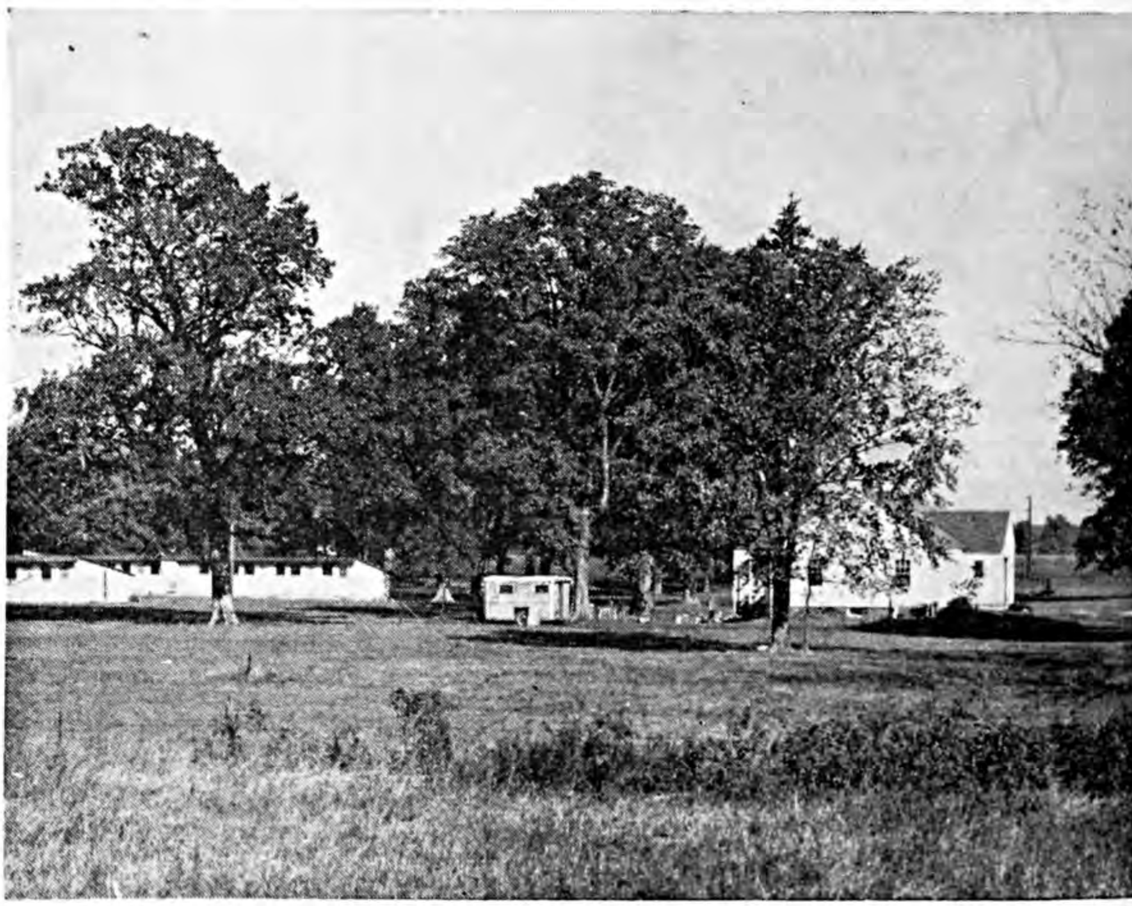
In addition, Mr. Foster built an automatic egg grader largely on his own design and later added a cooler and humidifier which he built by Purdue specifications. These added one cent a dozen to the price he receives for eggs. At peak production the flock turns out from 25 to 28 cases a week which the Fosters truck to Versailles, Ohio, and sell on a quality market.

They began their registered Aber-

(*Turn to page* 44)

Above: **The J. Lee Foster home near Attica, Indiana, reflects good living from well-kept soil.**

Below: **Back of his father's house, Paul Foster has built a snug, white bungalow.**



Above: **Only a few years ago this grass waterway where J. Lee Foster stands was a raw gully.**

Below: **Some of the best Angus families are represented in the Foster foundation herd.**

Left: **J. Lee Foster inspects hybrid corn which yielded 145 bushels to the acre.**

Below: **Modern poultry methods provide eggs to be sold on a quality market.**

The Editors Talk

Pasture Progress

Backed by all the major agricultural agencies, the fertilized pasture still forges ahead. While this applies to all agricultural areas, it has special significance in the South where diversification away from cotton increasingly has been recognized as of fundamental importance to the economy of that great agricultural area. This means diversion to livestock, which only a few years ago was regarded as an impracticable proposition. Now with the fertilized grass-legume pasture as a substitute for the broomsedge ranges, it has been widely and convincingly demonstrated that a livestock industry meeting every economic requirement is entirely feasible.

Starting with scientific research and experimentation, followed by widespread demonstration, it now has become a major activity of the educational forces to bring the pasture story to the individual attention of the millions of farmers, large and small, who stand to benefit from the information now available. To this educational enterprise many noteworthy contributions are constantly being made, among the more recent of which are two meriting special mention.

First, lately from the press is "The Pasture Book," a veritable handbook for the farmer who would like to have a fertilized pasture of his own and for the consultant guiding him in obtaining it. The author is that indefatigable pasture enthusiast, W. R. Thompson, Mississippi Extension Service's well-known agronomist. Here is a book written in plain language that any farmer can understand—concise, well-illustrated, and containing all the essential information that the farmer needs in launching and maintaining his pasture program. It is based on the author's own personal observations during eight years of field work in the State, two years' study of pasture research in twelve other Southern States, and discussions with the men in the South who know most about plants, soils, fertilizers, machinery, weed control, management, and other pasture problems. The statements therefore are authoritative, certainly as they pertain to Mississippi conditions, with fundamental principles pertinent far beyond this State's boundaries.

Second, a companion piece, so to speak, is the motion picture, "Twelve Months Green," prepared and distributed by the Southern Educational Film Production Service of Athens, Georgia. As its title indicates, this film portrays that outstanding feature of the Southern livestock program, namely, winter grazing. Again based on research and demonstration, the agronomists have devised combinations and rotations of legumes, grasses, and small grains which adequately fertilized provide twelve months of grazing. As the result, one traveling through the rural South is shown with pride herds of fine cattle with the remark that sounds like a boast—"those animals haven't been in a barn for twelve months!"

It is the "Twelve Months Green" aspect of the Southern pasture program that affords economic advantages immediately recognized by any farmer and farmer educator who is interested in cutting down costs of production, establishing a balanced farm program, and improving and maintaining the fertility of the soil.

Fertilizers and Erosion

A concise statement of the role of fertilizers in keeping our topsoils from "going to sea" is to be found in the foreword in Bulletin 518 of the Missouri Agricultural Experiment Station—"Cropping Systems for Soil Conservation" by Dwight D. Smith, Darnell M. Whitt, and Merritt F. Miller. This foreword was written by Wm. A. Albrecht, Chairman, Department of Soils, of the Missouri College of Agriculture and internationally known soil scientist, who says in part:

"The recent emphasis on conservation in general, and on soil conservation in particular, is the delayed recognition of the great cardinal principle that, in nature, the many component parts are dependent one on the other and reinforce each other. According as the soils are deeper, more granular, and more fertile, they are less erosive. Their openness encourages infiltration of the water, and their stability of granulation resists dispersion by the falling rain and removal by the running water. These better soils grow more vegetation for more cover which in turn puts more organic matter into the soils to reduce erosion when they are delivering greater agricultural output.

"However, such reinforcement of the crops by the soil and of the soil by the crops is not possible under cultivation unless provision of the necessary fertility and return to the soil of its own organic matter creations are parts of the soil management. The choice then of a particular cropping system for soil conservation is first, an opportunity to arrange for protective vegetative cover during the maximum time, and second, an opportunity to introduce the lime and other fertilizers for building up the organic matter in the soil. By such reinforcement of nature, the body of the soil will be strengthened to make it more able to save itself from erosion. At the same time the economics of production will be improved. Whatever the cropping system, its service in soil conservation will depend much on what we help it do through the effects on the soil itself."

The authors of the bulletin, basing their conclusions on various studies by the Experiment Station from 1917 to the date of their writing, have this to say in their summary:

"High fertility and erosion control go hand in hand. When not existent, fertility must be supplied by the use of fertilizers, manure, etc. Erosion from small grain has been reduced one-half by the use of fertilizers. Vigorous grass and legume sods before corn, as a result of increased fertility, reduced erosion under the corn to less than one-half that following a grass-legume mixture that deteriorated through a decline in fertility. Crop sequences for effective soil conservation provide (a) maximum of cover protection, and (b) soil conditioning to resist erosion when a new crop is seeded or when row crops are grown."

This importance given to the role of fertilizers in lessening the losses of our valuable topsoils is of value to the whole conservation program. Too often farmers and others have considered that ditching, terracing, and other devices to control water run-off were all that were necessary. With soil fertility taken into consideration in order to insure both greater soil porosity and bigger yields of "soil-holding" crops, the problem of keeping our soils from "going to sea" should be made easier.

"None of us in the Nation can afford wasteful agricultural production or soil destruction. We are *all* affected by such waste, whether we live in a shack or a millionaire's penthouse apartment. In the last analysis, every man, woman, and child depends for life on the fertility of the land. And the continuing fertility of the land, in turn, depends upon a great many economic and social factors."—*Secretary of Agriculture Charles F. Brannan.*

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay[1] Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
September	30.94	46.7	153.0	232.0	178.0	197.0	18.00	68.10	....
October	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....

Index Numbers (Aug. 1909—July 1914 = 100)

1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	175	249	212	209	141	319	204
1947	252	380	224	245	366	273	146	379	249
1948									
September	250	467	220	264	277	223	152	302	150
October	251	506	204	236	215	224	155	282	176
November	246	428	207	226	188	231	155	306	186
December	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282
February	235	295	249	279	174	219	173	237	285
March	232	319	250	290	184	224	168	228	263
April	241	247	260	314	190	226	160	223	236
May	242	325	260	312	190	226	149	224	213
June	243	315	251	301	188	210	138	207	175
July	243	565	222	323	195	206	132	166	185
August	236	446	221	305	184	202	135	197	174

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
September	3.00	2.20	10.70	9.87	9.18	9.03
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	22.75	12.14

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
September	112	77	306	280	272	257
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345

Wholesale Prices of Phosphates and Potash* *

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
September	.770	4.61	6.60	.353	.679	13.63	.188
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
September	144	128	135	65	71	56	82
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	141	100	112	65	71	56	82

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
September	290	265	247	131	94	287	144	68
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72
May	256	257	227	134	99	293	144	72
June	252	257	223	134	99	304	144	65
July	249	256	225	140	100	349	144	68
August	245	254	222	143	100	372	144	68

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Boron as a Factor in Arizona's Agriculture," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Tech. Bul. No. 118, March 1949, H. V. Smith.

"Fertilizing Materials—1948," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., Spec. Publ. No. 231, March 1949.

"Annual Report for the Calendar Year 1948," State Dept. of Agr., Sacramento, Calif., Reprint from The Bulletin, Vol. XXXVII, No. 4, Oct., Nov., Dec. 1948, A. B. Lemmon.

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended March 31, 1949," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., Announcement No. FM-180, May 31, 1949.

"Principles of Composting," Agr. Exp. Sta., Dept. of Soils, New Haven, Conn., Spec. Bul. Soils V/200, June 1, 1949.

"The Fertilization of Shade Trees," Dept. of Soils, Agr. Exp. Sta., New Haven, Conn., Spec. Bul. Soils VI/250, June 3, 1949, H. A. Lunt.

"Reports on Experimental Plots for Fertilizer Treatment, Variety Tests for the Year 1948," Dept. of Agron., College of Agr., Univ. of Ga., Athens, Ga., Unno. mimeo., Jan. 21, 1949.

"The Kansas Commercial Fertilizer Law," Amended by the Legislature of 1949.

"Tonnage of Commercial Fertilizer Reported by Manufacturers as Shipped to Kansas in the Fall of 1948, by Counties," State Board of Agr., Control Div., Topeka, Kansas, Dec. 1, 1948.

"Letter to the Feed and Fertilizer Trade," Dept. of Feed and Fertilizer, Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Feb. 15, 1949.

"Louisiana Fertilizer Report—Fertilizer Consumption, Fertilizer Recommendations, Fertilizer Analysis, 1947-1948," State Dept. of Agr. and Immigration, Baton Rouge, La., E. A. Epps, Jr.

"Commercial Fertilizers, 1948," Agr. Exp. Sta., Orono, Maine, Official Inspections 209, Oct. 1948, E. R. Tobey.

"Efficient Fertilization of Potatoes in Maine," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Ext. Bul. 373, March 1948, Arthur Hawkins, G. L. Terman, and O. L. Wyman.

"Fertilization of Sugar Beets in the Red River Valley," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Sta. Bul. 399, June 1948, C. O. Rost, H. W. Kramer, and T. M. McCall.

"Fertilizer Trials in Mower County, 1948," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Soil Series No. 25, Hormel Institute Publ. No. 39, April 1949, A. C. Caldwell.

"A Progress Report of Fertilizing Oats on Several Soil Types in East Central Minnesota in 1948," Agr. Exp. Sta., Univ. of Minn., Soil Series No. 27, May 1949, J. M. MacGregor and E. R. Duncan.

"Commercial Fertilizer Report for 1948," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 460, Feb. 1949, A. H. Kruse.

"Fertilizer and Lime Recommendations for New Jersey," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 521, Dec. 1948.

"Analyses of Commercial Fertilizers for Fiscal Year 1947-1948," Bulletin of the N. C. State Dept. of Agr., Raleigh, N. C., Number 116, June 1949.

"Fertilizer Studies on Small Grains with Special Emphasis on Time and Rate of Nitrogen Application," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. No. 209, Feb. 1949, O. H. Long and J. A. Ewing.

"Effects of Fertilizers Upon the Yield and Grade of Cabbage," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1145, Jan. 14, 1949, W. R. Cowley, N. P. Maxwell, and C. C. Edwards.

"Fertilizers for Western Washington," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. No. 386, March 1949.

"Fertilizer Tonnage Sales Survey Report for Washington, July 1, 1947 to June 30, 1948," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. No. 76, May 1949, S. C. Vandecaveye.

Soils

"East Alabama Soil Conservation District—Supervisors Annual Report, January 1-December 31, 1948."

"Land Drainage," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 391, April 1949, W. W. Weir.

"Eliminating Tillage in Citrus Soil Management," Agr. Ext. Serv., Univ. of Calif., Berke-

ley, Calif., Cir. 150, March 1949, J. C. Johnston and Wallace Sullivan.

"Effects of Certain Soil Conditions and Treatments upon Potato Yields and the Development and Control of Potato Scab," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 463, Dec. 1948, G. L. Terman, F. H. Steinmetz, and Arthur Hawkins.

"Our Teeth and Our Soils," Agr. Exp. Sta., Univ. of Mo., Cir. 333, Dec. 1948, Wm. A. Albrecht.

"Soil Conservation Districts in North Dakota," Ext. Serv., N. D. Agr. College, Fargo, N. D., Spec. Cir., March 1949.

"Conservation Farming in Marion County, South Carolina," Clemson Agr. College, Clemson, S. C., Cir. 317, June 1948, S. C. Agronomy Committee.

"Mineral Elements in Our Soils and Foods," Ext. Serv., Univ. of Vt., Burlington, Vt., M 4085/3-4/49-1000, A. R. Midgley.

"The Range Lands of Wyoming," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. No. 289, Feb. 1949.

"Agricultural Conservation Program—State Summaries of Practices, 1947," Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., March 1949.

Crops

"Fifty-ninth Annual Report for the Year Ending June 30, 1948," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Jan. 1, 1949.

"A Study of Lime-induced Chlorosis in Arizona Orchards," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Tech. Bul. 117, Feb. 1949, W. T. McGeorge.

"4-H Gardening," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Cir. No. 359, rev. Apr. 1948, E. J. Allen and L. H. Burton.

"4-H Club Manual in Growing Early Irish Potatoes," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Cir. No. 380, Rev. March 1948, E. J. Allen.

"Twenty-ninth Annual Report—Period Ending December 31, 1948," State Dept. of Agr., Sacramento, Calif., Vol. XXXVII, No. 4, Oct., Nov., Dec., 1948.

"Progress Report, 1937-1946," Dominion Exp. Sta., Can. Dept. of Agr., Saanichton, B. C., Can.

"Progress Report, 1937-1946," Dominion Exp. Sta., Can. Dept. of Agr., Lethbridge, Atla., Can.

"Factors Influencing Tomato Production in Delaware," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. No. 277, Jan. 1949, E. P. Brasher.

"Cliett Bunch Porto Rico Sweet Potato Proves Superior to Standard Vining Porto Rico," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 60, April 1949.

"Improved Cultural Practices for Sweet Potatoes," Ga. Coastal Plain Exp. Sta., Mimeo. Paper No. 62, May 1949.

"The Production of Watermelons in the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 63, May 1949.

"Lupines for Green Manure," Ga. Exp. Sta., Univ. of Ga., Experiment, Ga., Press Bul. 610, May 12, 1949, J. M. Elrod.

"Koa Haole (Leucaena glauca) Its Establishment, Culture and Utilization as a Forage Crop," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, Bul. 100, June 1949, M. Takahashi and J. C. Ripperton.

"The Anthurium and Its Culture," Agr. Ext. Serv., Univ. of Hawaii, Honolulu, Hawaii, Ext. Cir. #264, April 1949, A. M. Hieronymus.

"Green Manure Crops for Idaho Farms," Ext. Div., Univ. of Idaho, Moscow, Idaho, Ext. Cir. No. 105, Nov. 1948, V. T. Smith.

"Agricultural Extension Points the Way," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., 35th A. R. 1947.

"The Lawn—Its Making and Maintenance," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 254 (3rd rev.).

"Asparagus Production," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 339, 1948, W. B. Ward and N. K. Ellis.

"The Next Step with Your Trees and Shrubs," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 340, 1948.

"Wheat Improvement in Southwestern Indiana and Southeastern Illinois," 3rd A. R., Purdue Univ., Lafayette, Ind., 1948, H. R. Lathrope.

"Ten Pointers on Tree Windbreaks," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Leaflet No. 294, 1949.

"Contributions from Iowa Corn Research Institute," Agr. Exp. Sta., Ames, Iowa, Vol. 3, No. 2, June 1948, J. C. Cunningham.

"Fourteenth Biennial Report of the Director for the Biennium July 1, 1946, to June 30, 1948," Agr. Exp. Sta., Kans. State College, Manhattan, Kans.

"A Preliminary Report on Experiments Conducted by the Crops and Soils Department of the Louisiana Agricultural Experiment Station, 1948," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., W. G. Taggart.

"Lawn Management," Ext. Serv., Univ. of Mass., Amherst, Mass., Leaflet No. 85, Rev. Oct. 1948, L. S. Dickinson.

"The Green Pastures Program for 1949 Will Help You," Ext. Serv., Univ. of Mass., Amherst, Mass.

"Eighty-seventh Annual Report of the Secretary of the State Board of Agriculture of the State of Michigan, and Sixty-first Annual Report of the Agricultural Experiment Station from July 1, 1947 to June 30, 1948," Mich. State College, Lansing, Mich., Vol. 43, No. 23, May 1949.

"Thirteenth Biennial Report for the Fiscal Years Ending June 30, 1947, and June 30, 1948," State Dept. of Agr., Lansing, Mich.

"Strawberry Growing in Michigan," Coop.

Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Bul. 297, R. E. Loree, Ray Hutson, and Donald Cation.

"Cotton Variety Tests in the Yazoo-Mississippi Delta, 1945-47," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 458, Oct. 1948, J. B. Dick and S. G. Brain.

"Corn Hybrids and Varieties in Mississippi—1948 Tests," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 460, March 1949.

"Sudan or Millet for Summer Grazing," Ext. Serv., State College, Miss., Leaflet 86 (Rev. 50M), April 1949, W. R. Thompson.

"Double Mississippi's Corn Yield—A Contest for 4-H Club Members," Ext. Serv. and Amer. Potash Inst., W. R. Thompson, State College, Miss.

"1948 Yield Trials with Corn Hybrids in Missouri," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Manual 48, Jan. 1949, M. S. Zuber and W. E. Aslin.

"Sow Winter Barley for Fall Pasture and Early Grain," Agr. Ext. Serv., Mo. Univ., Columbia, Mo., Mo. 23E—4/48—25M.

"Science and the Land," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., 69th A. R., 1947-48.

"Strawberry Growing in New Jersey," Ext. Serv., Rutgers Univ., New Brunswick, N. J., Ext. Bul. 253, Feb. 1949, E. G. Christ.

"Science Working for New Mexico Farms and Ranches," Agr. Exp. Sta., N. M. College of A & M Arts, State College, N. M., 59th A. R., 1947-48.

"Sixty-seventh Annual Report of the New York State Agricultural Experiment Station, Geneva, New York, 1948," Cornell Univ., Ithaca, N. Y.

"Better Rural Living," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., A. R. 1948.

"Raising Beef Cattle," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C. Ext. Cir. No. 268 (rev.), March 1949.

"Carolina Lawns," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. No. 292, Nov. 1948, J. H. Harris and R. L. Lovvorn.

"What Makes Your Yard Beautiful?" Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. No. 335, Jan. 1949, John Harris.

"More Corn Per Acre," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., E. R. Collins and B. A. Krantz.

"Farm Science and Practice," Agr. Exp. Sta., Wooster, Ohio, 67th A. R., Bul. 660, Nov. 1948.

"Winter Pasture for More Feed and Better Feed at Lower Cost," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Bul. No. B-333, May 1949, H. W. Staten and V. G. Heller.

"Cotton Production, Variety and Fertilizer Recommendations," Ext. Serv., Okla. A & M, Stillwater, Okla., Cir. 504, W. Chaffin and J. D. Flemming.

"Feeding and Breeding Tests with Sheep, Swine, and Beef Cattle—Progress Report: 1948-49," Agr. Exp. Sta., Okla. A & M, Stillwater, Okla., Misc. Publ. 15, May 1949, D. F. Stephens, O. B. Ross, W. D. Campbell, R. W. MacVicar and A. E. Darlow.

"Oregon's Agricultural Progress through Research," Agr. Exp. Sta., Corvallis, Oreg., Sta. Bul. 461, Dec. 1948.

"Will Rhode Island Have the Greenest Pastures?" Ext. Serv., R. I. State College, Kingston, R. I., J .W. Atwood and H. G. Allbritten.

"Sweet Potato Production in South Carolina," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 326, Jan. 1949, H. A. Bowers.

"Progress Report of Research in Crops and Soils at the South Dakota Experiment Station," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Cir. 72, June 1948, W. W. Worzella, A. N. Hume, L. F. Puhr, J. E. Grafius, C. J. Franzke, D. B. Shank, V. A. Dirks, J. G. Ross, M. W. Adams, and R. A. Cline.

"Plains Barley," Agron. Dept., Agr. Exp. Sta., S. D. State College, Brookings, S. D., Cir. 74, April 1949, J. E. Grafius.

"Variety Performance Trials of Corn, Oats, Barley, Wheat, Soybeans, and Cotton—Data for 1948 with Summaries of Results from Previous Years," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. No. 208, Jan. 1949, S. F. McMurray.

"The Miles Watermelon—A New Wilt-resistant Variety," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. No. 103, Dec. 1948, J. M. Epps and C. D. Sherbakoff.

"Rhodesgrass for Hay and Pasture in South Texas," Ext. Serv., Texas A & M, College Station, Texas, C-245, 1949, R. R. Lancaster.

"Weslaco Cotton Variety Test, 1944-48," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1146, Jan. 24, 1949, W. R. Cowley.

"Crop Variety Tests at the Blackland Experiment Station," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1147, Jan. 27, 1949, J. W. Collier, W. O. Trogdon, and J. R. Johnston.

"Sweet and Common Sudan Grass for Pasturage," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1149, Cattle Series 74, Feb. 9, 1949, E. M. Neal, R. A. Hall, and J. H. Jones.

"Grain and Forage Sorghum Test, Big Spring Field Station, 1944-48," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1168, May 13, 1949, F. E. Keating.

"Wheat Varieties for the Texas Panhandle," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1170, May 23, 1949, K. B. Porter and C. J. Whitfield.

"Grass Silage," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Brieflet 821, May 1949, L. H. Smith.

"Watercress Growing," Agr. Exp. Sta., Blacksburg, Va., Bul. 424, Feb. 1949, G. M. Shear.

"Eighteenth Biennial Report," State Dept. of Agr., Olympia, Wash.

"Lawns," Ext. Serv., Univ. of Wis., Madison, Wis., Stencil Cir. 244 (Rev. Dec. 1948), J. G. Moore.

"Growing Onions in Wisconsin," Ext. Serv., Univ. of Wis., Madison, Wis., Stencil Cir. 283, Dec. 1948, J. G. Moore and O. B. Combs.

"The Inheritance of Tuber-set in Solanum tuberosum L.," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. 287, Dec. 1948, W. A. Riedl.

"Progress Report on Some Range and Grass Research, Archer Field Station," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Wyo. Range Management Issue No. 1, June 1948.

"Native Vegetation in Relation to Soil in Parts of Wyoming," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Wyo. Range Management Issue No. 3, Sept. 1948, H. Bindschadler.

"An Annotated Index to Grass Names," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Wyo. Range Management Issue No. 4, Oct. 1948, A. A. Beetle.

"Trees—The Yearbook of Agriculture, 1949," U.S.D.A., Washington, D. C.

"Report of the Administrator of Agricultural Research, 1948," Agr. Research Admin., U.S. D.A., Washington, D. C.

"Yield and Composition of Cottonseed as Influenced by Fertilization and Other Environmental Factors," U.S.D.A., Washington, D. C., Tech. Bul. No. 974, Feb. 1949, W. H. Tharp, J. J. Skinner, J. H. Turner, Jr., R. P. Bledsoe, and H. B. Brown.

Economics

"Marketing Desert Grapefruit," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 221, May 1949, R. E. Seltzer.

"Connecticut Vegetable Industry and Its Outlook for 1949," State Dept. of Farms and Markets, Hartford, Conn., Bul. No. 103, April 1949.

"Indiana Crops and Livestock," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., No. 280, Jan. 1949.

"Management Problems on Sweet Potato Farms, St. Landry and Lafayette Parishes," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Mimeo. Cir. No. 90, Jan. 1949, F. D. Barlow, Jr. and E. R. McCrory.

"Rural Organization in Three Maine Towns," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Bul. No. 391, June 1949, D. G. Hay, D. Ensminger, S. R. Miller, and E. J. Lebrun.

"Index Numbers and Seasonal Variations of Prices of Farm Commodities, Mississippi, 1909-1948," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. No. 456, July 1948, D. W. Parvin.

"Forecasting the Price of Corn on the Basis of Current Crop Reports," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Research Bul. 431, Feb. 1949, E. T. Hadorn.

"If Not Potatoes—WHAT?" Agr. Exp. Sta., Rutgers Univ., New Brunswick, New Jersey, Cir. 523, February 1949.

"North Carolina Agricultural Statistics," N. C. Crop Reporting Serv., State Dept. of Agr., Raleigh, N. C., 1948 Annual Issue, No. 90.

"Cost of Producing Red Raspberries (for Processing) in the Willamette Valley, Oregon —A Progress Report," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 440, Nov. 1948, G. W. Kuhlman and D. C. Mumford.

"Cost of Producing Black Raspberries (for Processing) in the Willamette Valley, Oregon —A Progress Report," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 441, Nov. 1948, G. W. Kuhlman and D. C. Mumford.

"Cost of Producing Loganberries (for Processing) in the Willamette Valley, Oregon —A Progress Report," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 443, Dec. 1948, G. W. Kuhlman and D. C. Mumford.

"An Economic Study of Family-sized Farms in Puerto Rico, San José Farm Security Administration Project, 1943-44, 1944-45," Agr. Exp. Sta., Univ. of Puerto Rico, Río Piedras, P. R., Bul. No. 77, June 1948, Guillermo Serra and Manuel Pinero.

"The Agricultural Outlook, South Carolina, 1949," Ext. Serv., Clemson Agr. College, Clemson, S. C., Ext. Cir. 322, Dec. 1948, M. C. Rochester.

"Economic Land Classification of Richmond County," Agr. Exp. Sta., Blacksburg, Va., Bul. 418, Jan. 1949, G. W. Patteson, A. J. Harris, and Z. M. K. Fulton, Jr.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 134, May 31, 1949, Karl Hobson.

"Keeping up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 135, June 27, 1949, Karl Hobson.

"Workers in Subjects Pertaining to Agriculture in Land-grant Colleges and Experiment Stations, 1948-49," Agr. Research Admin., Office of Exp. Stations, U.S.D.A., Washington, D. C., Misc. Publ. No. 677, April 1949.

"Farm Production, Farm Disposition, and Value of Principal Crops, 1947-1948, by States," Crop Reporting Board, Bu. of Agr. Econ., U.S.D.A., Washington, D. C., May 1949.

"Dark Air-cured Tobacco Market Review, 1948-49 Season, (1948 crop)," Tobacco Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., May 1949.

"Fire-cured Tobacco Market Review, 1948-49 Season, (1948 crop)," Tobacco Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., May 1949.

"Light Air-cured Tobacco Market Review, 1948-49 Season, (Type 31—1948 crop) (Type 32—1947 crop)," Tobacco Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., June 1949.

Why I Save Soil

By Alton G. Wilson

Route 5, Reidsville, North Carolina

SOME authorities say that we have per capita about 14½ acres of all land in waste woods, rivers, roads, cities, home sites, etc. We have 3½ acres of cropland to provide food and fiber for each of us. The minimum requirement per person is around 2½ acres, which means we have an acre from which the produce may be sold.

If our present rate of erosion continues and population keeps increasing, the time is coming when we will lack the necessary cropland per capita. We now have 282 million acres of land completely lost by erosion and 775 million more in a seriously eroded condition. We have lost by erosion the area of a state larger than the average size of a New England state, and there is another area almost three times as great that is suffering tremendous losses.

I am a farmer with about 37½ acres of cropland on my 81-acre farm, enough to produce sufficient food for 15 persons or an average of three families. We are one family on this farm; then this farm is responsible for two other families' food and fiber. If you were one of those other families and knew it and you also knew you could get no food or fiber from any other source, would you not be interested in how good a steward of the soil I would be? If I were to allow the soil to rush toward the ocean with each rain, would you not try to encourage me to do something about this?

I have seen such commonplace foods as lard and fatback become critical during our war period. Food we must have; and soil we must have if we are to have this food, along with conservation if we are to have the soil. This means we must have education, better crops, and better farm management.

Today the fertility and texture of my soil are far ahead of what they were when I bought my farm six years ago, and this improved condition is due to the proper soil conservation practices which I have carried out. Last year I made five bushels of corn where only a bushel grew the year I bought it. This is five times the yield of 1941. Good crops go hand in hand with good conservation and proper fertilization.

Many crops require different rates as well as different analyses of fertilizers. For instance, I have a waterway which we call a meadow strip. It was seeded to ladino clover and orchard grass in 1942. In 1946 the ladino showed signs of receding. From seeing a motion picture presented by the County Agent, showing nitrate, boron, phosphate, and potash deficiencies in plants, I was able at once to recognize potash deficiency in my clover, even though I had used 2-12-12 fertilizer, lime, 50 per cent phosphate, and topdressed with 0-14-7. Looking up the potash requirements of ladino clover I found it to be a heavier user of potash, so I added 200 pounds of 50 per cent potash per acre. The result was almost miraculous. I had ladino equal to my first and second year.

You may ask, what does texture have to do with erosion control? The only way the texture of the soil can be improved is by adding humus, and you may add humus in no better way than growing legumes. When we get a high percentage of humus in our soil it absorbs water. This lessens runoff and stores water for crops during drought periods. It also reduces floods in our streams. Do you have a stake in this? Yes, if you consume food, use electric power, and in many other ways.

My first obligation was to my parents. My responsibilities are to my family and country, and I shall always be grateful and indebted to my country for the wonderful help and counsel provided by the many government agencies, including the Farmers Home Administration, Soil Conservation Service, Triple A, and the County Agent. So the least I can do is take particular care of my soil, make it produce high and efficiently, so as to pass food on to our people as cheaply as possible and at a fair profit to myself. This I think you have reason to expect of me.

Sweet Potatoes Need Potash

COMMERCIAL fertilizer high in potash is necessary for maximum production of sweet potatoes, especially in northeast and northwest Louisiana. Plenty of the right kind of fertilizer has given yields up to 600 bushels per acre.

Results obtained by the North Louisiana Experiment Station at Calhoun indicated this in 1946. Some 20 or more demonstrations were set up throughout the northeast and northwest section of the State this year. Fertilizer analyzing 4-8-8 or 4-12-8 was used on these demonstrations at the rate of 400 to 600 pounds per acre, applied at least 10 days prior to setting plants to field. These demonstrations were set up chiefly by 4-H Club members who entered a sweet potato production contest. Yields of over 600 bushels per acre were made when fertilizer was increased to 1,000 pounds per acre.

If these fertilizers are not available, get the nearest to them. A 5-10-7 is good and in many instances will be available, as it is used extensively for other crops. Any fertilizer is better than none, but if you can choose, get one analyzing high in potash and phosphorus.

Land for sweet potato production should be selected in the fall. Well-drained, sandy loam soil is ideal. Preparation should begin in the fall as soon as the current year's crop is harvested. Where possible, follow cotton with sweet potatoes. If potatoes are to follow a cotton crop, the cotton stalks should be cut in the fall, while still green, and plowed under as follows: First, plow out the middles and then bed the old row back in the middle with a turn plow or middle buster.

If severe rains occur during the winter, packing the soil and washing the beds down, you can bed back in the middle, making new rows. This should be done not later than the last week in March or the middle of April. In other words, the bed should be made up in time to be water-firmed prior to setting plants in the field. If the beds are flat, fertilizer can be applied when these final beds are being made up. It should be applied four to six inches deep in the bed underneath the area where potato vines are to grow.

The sweet potato plant root grows downward until it reaches soil containing sufficient amounts of moisture for growth. It then begins growing and potatoes are formed as lateral roots branching off from the main root system. If the soil is packed too tightly, potatoes will have a tendency to be rough. Growth will not be uniform, because expansion will be limited by the hard packed soil. It is necessary to build up high, wide beds in order to allow plenty room for expansion by the sweet potato. Do not plant sweet potatoes after a heavy winter cover crop, as unrotted green matter sometimes causes scurf disease.—*John A. Cox, Extension Horticulturist, Louisiana State University.*

Efficient Vegetable Production

(*From page* 20)

In view of the limited time that this experiment has been in existence, it is pointed out that these results are only preliminary. They may change as the experiment progresses.

Plowing Versus Discing Soils

In recent years the topic of plowing versus discing of soils in preparation for the planting of crops has been popularized by the press, agriculturists, novel writers, and others. In all of this publicity, there seemed to be very little experimental evidence to justify the recommendation of plowing over discing or that of discing over plowing. An experiment was, therefore, designed to test the yielding ability of certain vegetable crops when planted on plowed and on disced soils.

Large plots (36 by 300 feet) were established at the Substation, near Georgetown, Delaware, in 1944. Each treatment was replicated four times. Rutgers tomatoes were grown in 1945, Hale's Best muskmelons in 1946, and Irish Cobbler potatoes in 1947.

Yield differences per acre favoring the plowed areas were as follows: 0.22 tons of tomatoes, 931 muskmelons, and 50 bushels of potatoes. The muskmelon and potato yield differences were highly significant while that of tomato was not significant. Since no significant change could be detected in soil nutrients, pH, and organic carbon content between the plowed and the disced areas, it is believed that as time progressed, the physical condition of the disced plots became less favorable for plant growth. This may possibly explain why there existed such a small difference in tomato yields and such a large difference in the muskmelon and potato yields.

Summary

In the foregoing discussion an attempt has been made to present some of the outstanding soil improvement practices for vegetable crops. Those presented are for the sand and sandy loam soils so typical of peninsula Delaware. The combined characteristics, a thin six- to eight-inch topsoil, the low exchange capacity, deficient nutrients, and a low pH make the following six practices desirable.

1. Encouraging deeper root growth through deepening, enriching, and sweetening the soils by the plowing down of fertilizer, lime, and organic matter.
2. Efficient employment of soil and tissue testing or a combination of soil and tissue testing to determine the optimum nutrient level in soils or crops.
3. Providing adequate amounts of each major element for all vegetable crops through the use of commercial fertilizer or a combination of commercial fertilizer and poultry manure.
4. Determining through field trials, if tissue testing is impractical, the necessity of applying certain minor elements.
5. Growing cover crops whenever the practice is economically sound.
6. Improving the physical condition of the soil not only by adding organic matter but by proper tillage practices.

Experimental evidence and observation indicate that these practices for improving the soil have the potential power to increase the efficiency of vegetable-crop production in Delaware.

A Hoosier Dynasty

(*From page 27*)

deen Angus herd with the purchase of three heifers in 1941. Today they have a foundation herd of 22 cows and heifers representing some of the best Angus families in the country.

Grand dam of the herd is "Enchantrene 6th," now 14 years old, from the Eileenmere family, bred on the Tolan farm near Pleasant Plains, Ill. She won her class at the International Show in Chicago and is full sister to a grand champion at the same show. Her two-year-old son is now herd sire.

During 1948 the Fosters sold 12 head of registered Aberdeen Angus from their herd. Calves are creep-fed and only the steers go to market, since the Fosters are still expanding their herd. Many are sold as 4-H club project calves.

Manure from this herd and from the chicken houses all goes back on the land, for such is the Foster tradition of good husbandry. They even use it to "fence off" weak spots in the birdsfoot trefoil because cattle will not graze areas so treated.

When farmers of Fountain county organized a soil conservation district early in 1944 the Foster farm was among the early ones on which technical assistance was requested. Surprisingly enough, in spite of generations of good farming, it had one erosion problem no Foster had ever been able to solve. This was a major gully which continued eating back into the rolling land on the north 60 acres and carrying water down to flood a lower meadow.

J. Lee Foster and his son had already gone far to improve the woods pasture on the north sixty. They had rigged a circle saw to the power take-off on their tractor and had cleared off all of the woods area except a better stand of timber on a small hill which was fenced off as a farm woodlot. But this did not cure either the gully or the overflow it caused. All of the excess water from 20 acres of Foster land and 80 acres of two adjoining farms, drained down into it.

J. Lee Foster's father fought that gully all of his life, plowing it in only to see a heavy rain erase his efforts. As late as 1939, J. Lee and Paul were still trying to whip the gully by the same system. That year they straddled it with two tractors carrying a pole between them and plowed it in. Then they put in wheat and seeded it to a legume-bromegrass mixture. This helped, but the gully was still far from tamed.

When the soil conservation district, of which J. Lee Foster is a supervisor, was organized, he called in outside help on his gully problem. A representative of the U. S. Soil Conservation Service was assigned to the new district and was soon on the ground looking over the Foster farm. With his technical assistance, the father and son developed a complete farm conservation plan which carried with it a sure-fire cure for the gully.

A thorough engineering job was done in developing a new water disposal system. The flat land at the lower end of the gully had grown up to brush. This was protected from further flooding by a 1,000-foot diversion. It was cleared of brush and developed into a fine meadow. The entire drainageway above the diversion was re-shaped and developed into a grassed waterway. The last sore spot on the 123-year-old Foster farm has been healed.

Eventually, the Fosters plan to seed the entire 60 acres to birdsfoot trefoil, divide it into three equally sized rotation pastures, and graze these on a schedule of 10 days to a plot. They believe their farm has a potential capacity of 5,000 chickens and 100 head of cattle.

From his work with the soil conservation district and his own success in curing the gully problem, J. Lee Foster believes an adequate amount of technical assistance on the land is the greatest need of the American farmer today. He has also been active in Farm Bureau affairs for some years.

Proof that the permanent type of agriculture the Fosters practice pays off in dollars and cents can be found in a study of their actual records. Purdue University analyzed the accounts of 81 average Indiana farmers who kept books in the disastrous year of 1932. The 81 farmers showed a return of minus eight-tenths of one per cent on their investment that year. The 27 most profitable farms of the group showed a return of plus three per cent. The Foster farm's return on the investment for 1932 was plus 11.8 per cent.

In 1946, 64 Indiana farms, on which accounts were kept, yielded an average of 66.8 bushels of corn to the acre. The Foster farm averaged 90 bushels. The 64 farms averaged 45.1 bushels of oats; the Foster farm, 55 bushels.

That year the 64 Hoosier farms had an average crop yield index of 97. The 21 most profitable farms had an average index of 100. The Foster farm's crop yield index was 136.

As might be expected, a detailed analysis covering the operations of Indiana farmers for the past year has not yet been completed. However, Purdue experts made a careful check of corn yields and in December, 1948, the results were announced. One cornfield on the Foster farm produced 127.6 bushels of corn to the acre while the other made 144.9 bushels. When James Foster broke these same fields back in 1825 he probably would have regarded reports of such yields as another tall tale.

After 123 years of production, the Foster farm is hale and hearty, better than it ever was because that outlying 60 acres of rolling land are safe now from soil losses. At 68, J. Lee Foster faces the future unafraid, either for his own security or for the future security of his farm.

Around the corner from the big comfortable white house which has been the Foster home for these many years, son Paul has built a snug white bungalow. Here he is raising the seventh generation of Fosters, raising them to love the land as all Fosters have before them.

And young Colin who may someday step into his father's shoes has ample evidence before his eyes of how good soil farmed by a good husbandman leads the way to a permanent American agriculture.

Why Use Potash on Pastures?

(*From page* 14)

border check method of irrigation, it is desirable to broadcast the fertilizer only on the upper two-thirds of each irrigation check.

In Extension Bulletin No. 386, "Fertilizers for Western Washington," issued by the State College of Washington, recommendations are given for pastures. It is stated that on soils which show a need for potash 300-400 pounds of a 5-15-10 fertilizer should be used, both to establish new seedings and to fertilize old stands. On muck and peat soils, 200-300 pounds of 0-20-20 or 5-20-20 fertilizer are suggested.

The Old Rotation

(*From page* 23)

dressings or application of nitrogen fertilizer.

The yields of cotton grown continuously with vetch (plots 3 and 8) were somewhat lower than that of the cotton grown in rotation with corn. These plots have produced an average for the last 16 years of slightly more than 1,200 lbs. of seed cotton per acre. The yields produced on these plots in 1944, the forty-ninth year of continuous cotton, were 1,656 and 1,512 lbs. of seed cotton per acre, respectively. This would indicate that the cotton as a crop does not deplete the soil or run it down excessively. The cultural practices of leaving the land bare through the winter and of not preventing erosion are responsible for the generally low fertility level of many soils on which cotton is grown.

Need for Potash

Of further interest is the increased need for potash that developed after the phosphate applications were increased. This was evidenced by the appearance of rust on the cotton grown in the 2-year rotation with peas (plots 5 and 9). In the early years of the experiment the peas were picked for seed and the vines turned under. In 1923 and after, the peas were cut for hay and followed by vetch. As long as the peas were picked for seed, i. e. from 1896 to 1922, cotton yielded more than it did in the rotation with corn (plots 4 and 7). However, soon after the beginning of the removal of the peas for hay the cotton started to decline and the data show that after the 1924-27 period the yields of the cotton in rotation with peas have been gradually declining in comparison to those of cotton in the corn-cotton rotation. In the years just previous to 1944 "cotton rust" was so severe on plots 5 and 9 as to cause the cotton to almost completely lose its leaves. The severe rust of the cotton on these plots is, of course, a potash deficiency and must be ascribed to the removal of the potash in the cowpea hay.

Leguminous Manure

Green leguminous manures are not as effective a source of nitrogen for fall-planted or cool-weather crops as they are for regular summer crops. The

Fig. 3. Cotton on Plot No. 4 in 1948. Rotation of cotton-vetch and corn-vetch. Yield 2597 pounds of seed cotton per acre.

Fig. 4. Corn on Plot No. 7 in 1948. Rotation of corn-vetch and cotton-vetch. Yield 75.8 bushels of corn per acre.

Fig. 1. Cotton on Plot No. 6 in 1948. Cotton alone continuously since 1898. Yield 482 pounds of seed cotton per acre.

Fig. 2. Cotton on Plot No. 8 in 1948. Continuous cotton-vetch since 1896. Yield 1968 pounds of seed cotton per acre.

yield of oats in the 3-year rotation (plots 10, 11, and 12) is a good example of the extent to which cool-weather crops may be limited when leguminous nitrogen alone is used. The average yield of oats obtained from 1896 to 1931 (the yields for only 30 years were available) was 19.9 bushels per acre and from 1932 to 1947, inclusive, when 32 lbs. per acre of supplementary mineral nitrogen were applied annually was 60.5 bushels per acre. Although part of this increase may be due to the larger amounts of phosphate that have been applied since 1920, it is still a phenomenal increase. This increase in oats presents the question of how much the yields of corn and cotton could have been increased by application of supplementary nitrogen fertilization. One would not expect them to be increased as much since oats are a winter crop and make much of their vegetative growth during the season of the year when nitrification is slow.

The Red Hills of the Piedmont

(*From page* 8)

ladino clover-fescue combinations and permanent pasture. Cows were feeding on the dense sods of green turf even though there had been heavy rains the day before. The soil on this entire farm appeared to be tied down with the sod crops, which will prevent erosion and at the same time provide feed crops.

The sun was shining but it was moderately cold and wet on January 20 when we visited the farm of W. J. McAteer, Route 6, Monroe, North Carolina, to see his small cotton farm which has been converted almost entirely to grazing crops within a period of 4 years. It was in 1944 that he reduced the cotton acreage and added a few dairy cows. There are now 7 fields with green grazing crops totaling 48 acres and carrying 17 milking cows and 8 springing heifers. The average daily milk production last winter was 48 gallons. All of the feed consumed is produced on this farm except for some corn that is bought and ground.

This is an example of a small farm that is typical of much of the Piedmont area and one that can be duplicated in a practical way. It was fortunate that our largest crowd, approximately 250 to 300 local farmers, G. I. farm trainees, local business men, agricultural workers, and our group were present on this farm. There were seedings of small grain—rye grass and crimson clover, orchard grass and ladino clover, barley and Dixie crimson clover, and a pure seeding of ladino clover for a seed patch with 4 hives of bees for pollination. This program is working well toward the balanced farming and uniform distribution of labor throughout the year for which Mr. McAteer is striving.

It might be expected that in the more highly industrialized sections of Durham and Wake Counties, North Carolina, with their higher priced land, less acreage would be devoted to winter grazing. This was not true, however, as it was being successfully practiced in these areas.

It was evident in North Carolina that ladino clover was living up to all of the great things that had been said about it. From our observations, it appears that Alta or Kentucky 31 fescue are gaining ground on orchard grass as partners with ladino clover, due mainly to their wider adaptability in poorly drained as well as upland soils.

In summarizing the value and advantages of winter grazing, foremost seems to be the utilizing of rainfall and soil moisture during the winter when more is available. After all, water is perhaps the greatest limiting factor in plant growth and winter-grazing crops are produced when the Southeast has its highest rainfall. Through them soil conservation is promoted, feed costs and labor costs lowered, and farm income stabilized.

In looking ahead not too far in the future, we can visualize a complete change in the landscape of the Southeast when the bare red hills of the Piedmont are covered in warm green blankets. Here is the opportunity for the Southeast by vigorous and progressive leadership and determination to utilize its full resources of mild temperatures, abundant moisture, and extensive lands for the improvement of farmers and, in turn, all of us.

Our Waning Woodlands

(*From page* 5)

we get from trees. Yet a short side-glance at the subject belongs in any argument respecting better forest cropping. You can get hold of fact sheets that will supply all details, so let's merely scan it in passing.

At the treetop Nature has provided seeds. Countless nuts and fruits come from the reproductive process of trees while oils, extracts, and decorative material are derived from the foliage. From the trunks of special trees we get commercial goods galore, as well as logs, poles, piles, posts, and cordwood. Tree gum from the trunk yields resins, from which we make paints, varnishes, disinfectants, insulators, fireworks, printing ink, crayon, insecticides, adhesives, drugs, chewing gum, and flavoring extract.

Cordwood isn't just to toast our toes either. From it we manufacture tannin, charcoal, dye, pulp, excelsior, tar, creosote, lime, wood alcohol, and obtain by chemistry a multitude of marvels, not to mention all the direct derivatives from wood fiber. The heavy logs are no longer so sizable as of yore, but they still work up into materials varying in function, from stout handles for agricultural implements to delicate musical instruments.

I daresay that no other branch of plant life furnishes as many useful and indispensable materials as do our trees. No wonder folks have begun to regard the oak, elm, pine, and hemlock with as much zest as they have hitherto shown toward apple, peach, and citrus trees.

How are we going about it to get that goal of more growing timber? We'll also get something else, too, in the same process—more wild life and better outdoor fun and refreshment.

EXPERTS reply that more public help to private timber owners is a logical first step. Small owners with small chance for any investment in education or travel must have technical advice, and even some actual show-the-way service. To attain this objective the U. S. Forest Service and forestry departments in many states are engaged in direct contact with large and small owners in nearly 700 counties. That's a good start, but the goal is to provide similar aid in about 2,000 counties.

We have "basic crop" loans galore for the benefit of farmers and presumably for consumers indirectly. It is said that we also need a forest credit system to make long-term loans at reasonable interest rates to the hard-pressed owners of small tracts.

Encouragement of cooperative forest management and cutting associations is a second move which is being investigated. Then, in the direct field of stepping up forest plantings much headway has been made. Fully 3 million acres have already been successfully planted by farmers and other private timber crop owners, but the demand for nursery trees which are growing in numerous areas is far ahead of the available supply. The use of new and rapid tree-planting machines by extension foresters and landowners has recently been a feature of this part of the plan. The original cost of the small trees and a lower cost of putting them in well are both points under constant study. You can't expand any new idea widely if the outlay prohibits ordinary folks from joining in. You likewise need to get a pretty good rate of survival from these tiny young tree sprouts to make results look well in the present and the future.

On the defensive side much remains to be done in fire guarding. Forest Service cooperates with many states under the Clarke-McNary federal law to supervise, direct, and aid in the better protection of private lands from their greatest mass menace. In spite of progress in providing such fire protection, over 99 million acres, or a fourth of the lands owned by states and private individuals, still lack any real organized machinery for halting the ravages of fire.

Car cards and posters, advertisements and radio programs, during the season when outings are customary, all warn people to be extremely cautious about campfires, matches, and smoking when enjoying the beauty of the wild. Forest Service has at least two imaginary characters to emphasize this angle of public conservation. One is Smoky Bear, the wise and watchful denizen of the woodlands, ready with quip and sage reminder; and the other, less well known gent—Willy Everlearn—typifies the neglectful and blundering woods worker who is a constant danger to himself and his associates.

MOTION pictures also have done a great piece of propaganda in behalf of stopping the causes of woodland blazes. These films should get wider showing, especially at midwinter farmers' meetings and at the theaters in summer resort centers.

On top of all natural threats to forest integrity we also have cumbrous and injurious tax laws, some of them adding heavily to the constant pressure put upon small landowners that finally forces more liquidation of timber resources. We need more counsel and suggestions for improved legislation in states where forest tax laws are needlessly harsh and damaging.

And moreover, in a reasonable view of the matter, isn't it just as important to protect forests against destructive cutting methods as it is to guard them against fire? It may seem like closing the w. k. barn door after the nag is swiped to ask for wider and stronger public control of all forest land management—but that idea is taking root and may grow into reality.

If it spreads to a number of states there will be a "regimentation" protest filed by sundry earnest citizens. But regulation of some kind is coming sooner or later, probably by the states using practical standards with which to measure good cutting practices which may be enforced with no harm to the ultimate welfare of any citizen who owns timber tracts.

Probably the national forests serve as an example of what could be done generally in conservation. Much remains to be improved even there. Yet today our national forests, covering 160 million acres on the continent and numbering 150 in 40 states, are said to be in many ways the outstanding forest system of the world.

The principal reasons for their existence as wards of yours and mine lie in various directions. Their resources comprise timber, range, recreation, sustenance of wild life, and conservation of water supplies.

TO begin with the timber thereon, the national forest preserves rate as high as 30 per cent of our Nation's sawtimber volume. Scores of towns and hundreds of busy sawmills rely solely upon the growth in national forests to keep them buzzing. The yearly cut of timber is about 4 billion board feet. With more access roads and funds from timber sales, this volume can be increased by 50 per cent on a sustained yield basis. The Alaska forests are as yet not exploited. In time their pulpwood value will be heavy. Steps to set up a permanent paper-making industry in Alaska are being taken. Large tracts in the public forests are poorly stocked and need thorough replanting as badly as many of the private areas do, but a whole century will probably pass away before the proper end is reached in this regard.

As for the range resources of the national forests, this includes about 85 million acres of the Far West, where seasonal grazing under permit is provided for almost 10 million cattle and sheep. It might be useful to remember that the national forest pastures provide nearly 8 per cent of the entire feed requirements of the sheep and cattle in 11 of these Western Range states, exclusive of intensively fed milk cows.

RESEEDING and sane pasturage are the two factors for protection. About 200,000 acres in the forests owned by the government have been resown with suitable grass and pasture mixtures. But nearly 4 million range acres ought to be seeded if the quality of the forage and the herd management are to benefit properly.

Judging from hearsay, nearly 25 million visitors will invade the bosky aisles and upland meadows of the national forests this year, to spend a little spare time next to Nature. This does not include all of the wandering motorists who just whiz through the forests preserves for a short stay en route somewhere else. Aside from the 4,500 gaming sites and sport areas which the government Forest Service has established, there are national parkways maintained by the Interior Department and hundreds of private resorts and summer homes to make recreation easier and better.

Speaking in behalf of the true natives of the woodlands, there is said to be a third of the country's big game creatures making their homes within the national forests. Plenty of small game, fur-bearing animals, and upland birds share these pristine areas with man. In 1948 over five million hunters and fishermen complied with state game laws and sought to catch the unwary amid the woods and waterfalls.

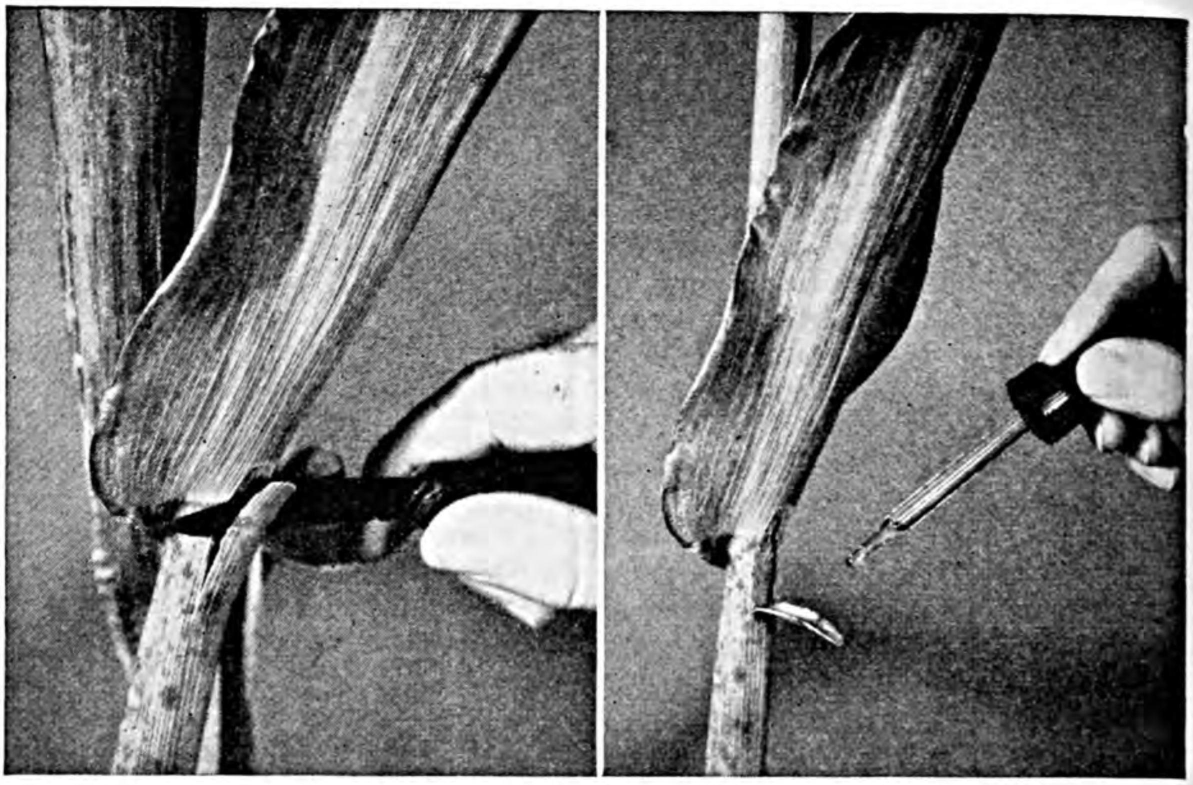
Within the limits of these vast forests there are at least 90,000 miles of fishing streams and nearly 2 million acres of fishing lakes. In some spots the deer and the elk are doing almost too well by themselves in numbers—to a danger point where the capacity of the range is inadequate to handle them.

And lastly, these government forests are at the headwaters of notable rivers which give aqua pura aplenty to countless towns and cities, and furnish power facilities and water flowage for irrigation projects. The major share of the economy and well-being of a considerable western zone depends upon the conservation of the national forest water resources. To maintain adequate timber and grass cover is the vital point, which means proper cutting, sound grazing, and ample fire-control systems.

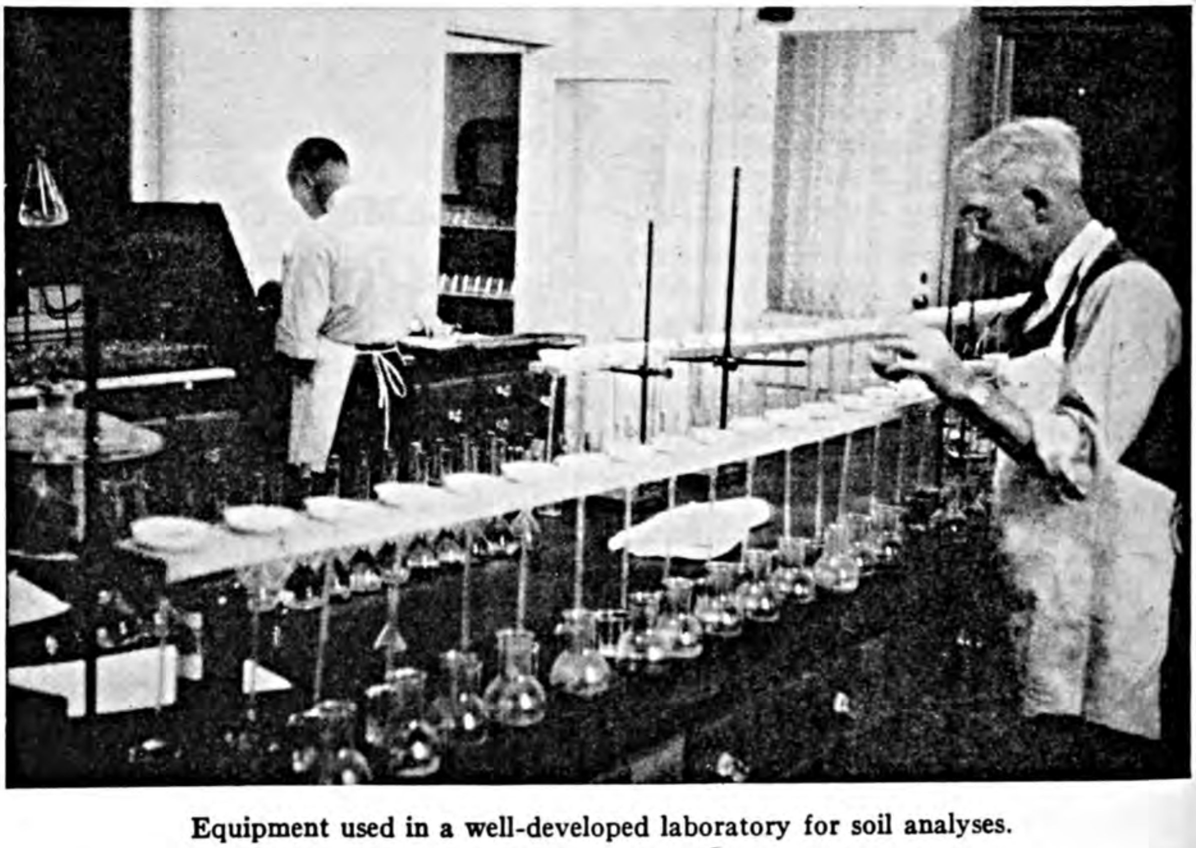
This year has seen blizzards and drought and storms, each having some part to play with the underlying forces involved in forest management. If we are to realize our natural inheritance to the fullest, every man jack of us should do his little bit to safeguard the present movement in all good phases of public and private woodland thrift.

FOREST Service capped the year's endeavor with publication of the annual year book issued by U. S. Department of Agriculture. This attractive tome is much in demand. It is properly speaking a Congressional document, one that gets its major distribution through senators and representatives. Our earnest plea and cogent reminder to all and sundry is not to order it from the Department but to solicit your own dearest friend in the halls of legislature, or else buy it from the superintendent of documents.

But whatever you do and whatever strong pledge you make to help the forests, resolve to stick to it through thick and thin and in the face of ax grinders' criticisms. If not, we'll all be up the last tree before long in a land denuded of beauty and devoid of riches.



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

A Few Whinnies

The long-winded lecturer had been holding forth for over an hour, except for brief pauses from time to time to gulp a hasty drink of water. Finally, during one such intermission, an old man in the audience leaned toward his neighbor and announced in a loud whisper: "First time I ever saw a windmill run by water!"

★ ★ ★

Lawyer (to gorgeous witness)—"Answer me, yes or no!"

Witness—"My, you're a fast worker, aren't you?"

★ ★ ★

"What's the matter, Mary?"

"I've got rheumatism in my muscles."

"You ought to visit a masseur."

"What's that?"

"A man who pinches you all over."

"Oh, you mean a Marine!"

★ ★ ★

A young physician and his wife had considerable difficulty teaching a new maid to answer the telephone properly. In spite of repeated instructions she persisted in answering: "Hello," instead of "Dr. Jones' residence." After many practice sessions, everything seemed to be all right. Then one morning the extension in the bedroom rang, and the maid, busy making the bed, grabbed the phone and blurted: "Dr. Jones' bedroom."

★ ★ ★

Some women attain their ends by not taking enough exercise.

On the witness stand, the old mountaineer was as cool as a cucumber and as close as a clam. The prosecuting attorney was beside himself with anger and impatience.

"Sir," hissed the lawyer, "do you swear upon your solemn oath that this is not your signature?"

"Yep," replied the witness.

"Is it not your handwriting?"

"Nope," said the witness.

"Does it resemble your handwriting?"

"Nope."

"Do you swear that it doesn't resemble your handwriting?"

"Yep."

"You take your solemn oath that this writing does not resemble yours in a single particular?"

"Yep."

"How can you be certain?" demanded the lawyer.

"Cain't write," replied the witness.

★ ★ ★

Patient: "Doctor, I blush so easily that it worries me. When I sit down and think, I blush. How can I stop it?"

Psychologist: "The best way, young lady, is to think about something different."

★ ★ ★

Mother: "Daughter, dear, your escort brought you home very late last night."

Daughter: "Yes, it was late, mother. Did the noise disturb you?"

Mother: "No, the silence."

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

- Potash in Southern Agriculture (South)
- In the Clover (Northeast)
- Bringing Citrus Quality to Market (West)
- Machine Placement of Fertilizer (West)
- Ladino Clover Pastures (West)
- Potash from Soil to Plant (West)
- Potash Deficiency in Grapes and Prunes (West)
- New Soils from Old (Midwest)
- Potash Production in America (All)
- Save That Soil (All)
- Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

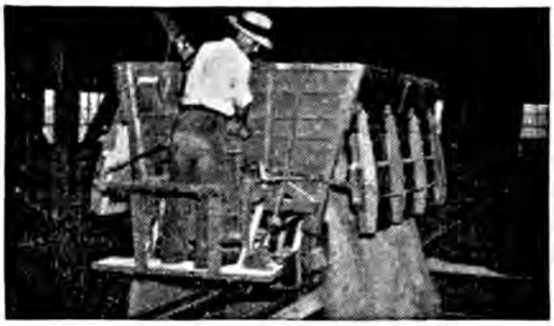
American Potash Institute
1155 Sixteenth Street
Washington 6, D. C.

Printed in U.S.A.

Better Crops with PLANT FOOD

October 1949 10 Cents

The Pocket Book of Agriculture



V-C Fertilizer is a properly-cured, superior blend of better plant foods.

V-C Fertilizer stays in good condition, when stored in a dry building.

V-C Fertilizer flows through your distributor, smoothly and evenly.

V-C Fertilizer encourages a good stand, uniform growth, bigger yields.

OUR FULL-TIME JOB

TO YOU, the selection and use of the best fertilizer is only one practice essential to your success in making your farm a better-paying business.

To V-C, however, the manufacture of the best fertilizer is a full-time job. The extra crop-producing power of V-C Fertilizers is the result of over 50 years of V-C scientific research, V-C practical farm experience and V-C manufacturing skill.

Since 1895, V-C factory experts, chemists and agronomists have constantly tested and developed new methods and new materials, to produce better and better V-C Fertilizers for every crop you grow.

If you want to give your soil the power to produce abundant yields, see your V-C Agent! Tell him you want V-C Fertilizers!

VC FERTILIZERS ®

VIRGINIA-CAROLINA CHEMICAL CORPORATION

401 East Main Street, Richmond 8, Virginia

Norfolk, Va. • Greensboro, N. C. • Wilmington, N. C. • Columbia, S. C.
Atlanta, Ga. • Savannah, Ga. • Montgomery, Ala. • Birmingham, Ala.
Jackson, Miss. • Memphis, Tenn. • Shreveport, La. • Orlando, Fla.
Baltimore, Md. • Carteret, N.J. • E. St. Louis, Ill. • Cincinnati, O. • Dubuque, Ia.

Better Crops with PLANT FOOD

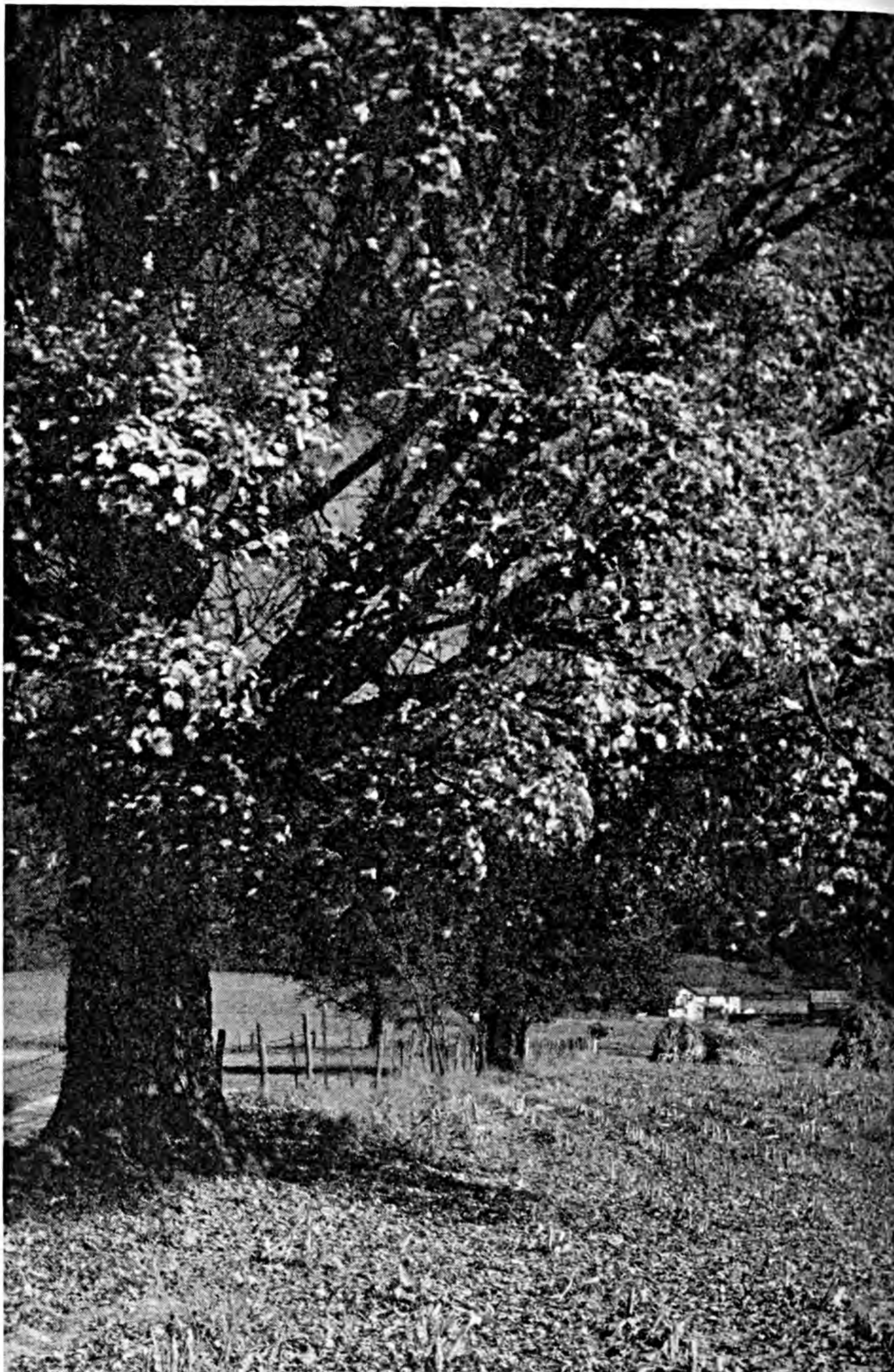
The Whole Truth—Not Selected Truth
R. H. STINCHFIELD, *Editor*
Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIII NO. 8

TABLE OF CONTENTS, OCTOBER 1949

The American Potash Institute, Inc.
1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America



Behold congenial Autumn comes, the Sabbath of the year. . . . *Logan*

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON D. C., OCTOBER 1949 No. 8

Our Memories . . .

Like Autumn Leaves

Jeff McDermid

NOBODY up in our valley ever figured out for certain what made the leaves turn into all the bright sunset colors along sometime in the fall. This strange thing always came in time for us to look up across the hazy hills as we trudged off to school along the dusty, winding road, bordered with wild grape vines. It set us to imagining what the "Injuns" believed the Great Spirit did to make the woods look so nice after the corn was harvested and the birds began to migrate southward.

I don't suppose anybody who still resides in our valley, after all these scientific years we have had since, has really guessed exactly what makes the oak trees look so mixed in color tones, or why the maples and the sumacs turn bright red and the elms and the cottonwoods show off in pale golden yellows, after all the weeks of summer during which they have stood there so green and quiet.

I'm fairly sure that none of our old neighbors know more about it now than they ever did, or spend much time in wondering why this gorgeous pattern comes to the valley every season. I'm hurt to say it, but I suppose some of them never really see those woods at all, being so busy bending over at tasks which earn them bread and butter and a little nestegg against the future and the winter that's on the way.

But the drawback has always been that these fancy bands of bright colors sweeping over the hills surrounding our valley never stay with us long enough. They're at their best for only about two weeks and soon vanish, nobody knows where. You can't find any ordinary way of keeping the autumn colors in a leaf from getting fainter and fainter, and finally petering out to a brown, flat, dull monotone—like some old piece of tanned leather. It's like trying to keep the fresh beauty of youth or the dreams of childhood safe from change and decay. It's no use, and the mystery of how come these colors and where they go to remains as big a question mark as our own lives and what comes afterward. I've heard high-toned professors try to brush it all off as a mechanical and chemical transformation, with about as much poetry in it as growing whiskers and shaving them off—but somehow it never satisfies me nohow to lay it aside so lightly.

MY Mother always kept up hope of preserving the autumn leaves in all their brilliance and tonal shading, like she succeeded in doing quite well with her canned tomatoes and peaches. I don't blame her because she failed to fix those colors in her scrapbooks. I seldom pick up one of her old favorite books or open the old family Bible with the nickel clasps on it without finding a few dry, faded leaves she laid away to press on some autumn day back there when the grandpas in our valley were young and husky and the times more tender.

Every time that Earl and Bill and their sisters and our own folks all together went off on a Saturday nutting expedition or had a picnic on the ridge somewhere, Mother always brought home a handful of autumn leaves, tucked into the completely empty lunch basket. It's the mementos of such trips to the museum of nature that I find scattered through the pages of our old books and catalogs—except for a few extra special samples she laid away after her wonderful journey to Tennessee—"once upon a time"—brittle tulip and persimmon leaves devoid of any hint of the long spent Dixie sunshine which grew them long ago.

You can't explain the coloration of the various species of flaming leaves by blaming the job onto Jack Frost, sneaking up our valley time after time to pinch the tendrils of the vine and nip the stomata of the leaves just before the sun rises out of the fog on a clear, snappy October morning. The hitch to that idea is that the best colors in the panorama seen on our ridges often come before there is any sign of frost coating on the roofs or in the flowerborders. And sometimes when the cold weather ends our autumn quickly, we get but little color in the trees.

I guess it's some internal business going on in the leaves after they have fulfilled a brief season's intense and fluttering responsibility amid the dancing sunbeams and cloud shadows. This last bright change in their dress gives them one more chance to be gay and attractive before they get the signal from somewhere to dry up and drop off.

ALL of which makes philosophers of us mature folks of the valley, where we can liken our own stages of life to the first curled tree buds of spring or the last flutter of the autumn leaves after most of their work is done. A few of us intend, if we can, to hang on through another chilly winter to witness one more spring—reminding us of the white oak leaves in our yard that never quite felt like falling to the ground until the buds of April pushed them off. (And there was no romance whatever in the double raking jobs resulting from their tenacious dangling.)

Not being able to agree on the reasons why the leaves turned prettier in October wasn't because we didn't do any pondering and thinking up there in our valley. Most of us had lots of time to think, and we put in some good licks at it, while doing chores and working in the fields and on the way to school—yes, and even in school itself. We used to sit there in school and look off through the open door and windows in mild fall weather and imagine a lot of things and try to figure out whys and wherefores.

Printed books, even the tattered geographies that told us about far-away places we never expected to see, couldn't stop us from thinking about what made the seasons different and why dumb animals were not always as dumb as they looked. There were plenty of strange, new things right around us to keep us interested and eager.

I remember how we'd sit there hunched up and peering around the edge of our study books at the sunshine and the gaudy tints in the forest and the fall blossoms in the weedy pasture that was right close up to the school-

house yard. Everything that we saw out there and looked at along the road made us wonder and think. We pestered the home folks and the teacher for correct answers, and once in a blue moon we were satisfied—but mostly we were not, and our wondering got to be a habit. In fact, I sometimes yet feel just the same about some of the puzzles and riddles which are almost as mysterious today as they were in school.

We gazed out there and asked ourselves some queer questions. Why did most of the cows in the pasture keep their heads in the same direction while grazing? What caused those tough, woody white growths on the base of trees, like little shelves? What was the reason for the fairy rings we found marked off in the wild grass? Why did our dog turn around three or four times before he laid down to sleep? Why did all the worst thunder and lightning storms come up over the Caledonia bluffs to the southwest? And why did the sleet storms and the big snow flurries come from the other direction?

Why were there always so many little toads hopping around right after a cloudburst? Why were there so many sandburrs growing in a country where shoes were so scarce? What made the sun dogs, the spots on each side of the sun? Why did the maples run sappy in March and the spruces get gummy in August? What caused all the lacy, filmy webs floating in the air in summer without any spiders around? Yes, and while we're talking of spiders, who tells them how to make such regular weaving, and where do their threads come from anyhow? And why do hummingbirds build nests like a big thimble while swallows plaster creek mud underneath the eaves?

I COULD go right along posing all these perplexing questions and getting no answers worth quoting from anybody, at least not any complete answer that would give you the password to nature and all her sideshows. When I was a kid the closest time I ever came to finding literature that gave the kind of answers in the kind of language I wanted to hear, and the sort of explanation which fit the spirit of it, was in a few bulletins from Cornell University. I can't praise the author of those nature leaflets because I never found out who it was with all that common sense and understanding. At any rate, he didn't make fun of a fellow for wondering hard, and if he didn't have any real answers he said so.

Lots of fellows in our valley and outside of it, too, get the name of being an idiot or a zaney because they keep on wondering about ordinary things they see every day; and the more they wonder and grope around and ask people and get squelched, the worse gets their fever to know a lot more about countless happenings that smart folks take for granted. I always hold that

(Turn to page 49)

Fig. 1. Corn must be planted thick to get maximum yields as demonstrated by vocational agriculture instructor Jack Upchurch and student Preston McAbee. This corn was spaced 12 inches apart in 36-inch rows and produced 97 bushels.

We're Learning How to Grow Corn in Alabama

By Bill Nichols

Agronomist, Sylacauga Fertilizer Co., Sylacauga, Alabama

FOUR years ago our company became interested in corn production in Alabama. We knew that cotton within itself was not a balanced farming program. Our county agricultural agents had been preaching diversification for years—more chickens, more turkeys, more beef and dairy cattle, and more hogs on every Alabama farm would raise our farm income. Our 4-H Club boys had been encouraged to grow prize beef cattle for our State fair and fat cattle shows, but our Alabama farmers were still buying their feed. We were shipping into Alabama every year thousands of bushels of corn and other feed materials. Here was our trouble—the average yield of corn in Alabama was only 13 bushels per acre.

In 1945 our company made application through the War Production Board for additional potash for our farmers. This request was flatly refused with the statement by officials in Washington that "Alabama doesn't produce enough corn to feed its own livestock; any additional potash which we might have must, for the sake of the war effort, be allocated to the Midwest." We decided that it was high time to begin doing something about corn production in Alabama.

Our "Parker's Acre Hybrid Corn Contest," in which we encouraged 4-H Club and vocational agriculture boys in our fertilizer territory to plant one acre of corn of an adapted hybrid variety, was originated in the spring of 1947. Each boy was to use a minimum application of 500 pounds of a 4-10-7, 6-8-4, or 6-8-8 commercial fertilizer at planting time and was to sidedress with a minimum of 48 pounds of nitrogen when the corn was 35 days old. It was to be thinned to 12 to 16 inches in 3½-foot rows.

Corn planted this thick was unheard of previously. The old-timers said "Corn planted this close will not make." Other equally good farmers were sure that 500 pounds of fertilizer would "burn up" the boys' acres. Many of our farmers expressed doubt about these new hybrids and preferred to stick to their old open-pollinated varieties.

In spite of these factors, 125 boys completed their demonstrations. The average yield of their acres was 57.8 bushels, more than four times the State average. Five of these acres produced more than 100 bushels and these boys were awarded a trip to the International Livestock Exposition in Chicago with all expenses paid by our company.

Fig. 2. No plant food-deficiency here—Bobby Keller used 500 pounds of 6-8-8 and sidedressed with 200 pounds of uramon. Yield, 91 bushels.

Fig. 3. Doris Bryant, Coosa County 4-H Club girl, smiles beside five ears of Funks G-714 hybrid. Yield, 96.4 bushels.

Increased interest in our acre contest was apparent in 1948. Vocational agriculture teachers and assistant county agents were encouraging their boys to grow out an acre of hybrid corn for the "100-bushel club" and the boys were not the only ones who were planting hybrid corn. Their fathers and neighbors who had seen the boys' acres planted a few acres themselves alongside their open-pollinated corn. They fertilized it heavily and left their corn spaced thick in the row. Often these farmers planted with a 5- or 6-hole plate and did not bother to thin. Liberal amounts of nitrogen in the form of nitrate of soda, ammonium nitrate, ammonium sulphate, or uramon were used as sidedressing. The rains came just right last year to grow corn—I do not recall a single acre which suffered for lack of moisture, and the demonstration acres showed up well through-

Fig. 4. Charles Lynch, vocational agriculture student, Clay County, Alabama, won a trip to Washington with this acre of Tenn. #10 hybrid. Yield, 109 bushels.

out the summer.

During the months of July and August our county agents held farm tours which were well attended by our farmers in all communities throughout the counties. The following important factors for corn production were brought out in these demonstrations:

1. Grow corn on land where a good winter legume crop has been turned. Additional moisture is present in legume land which is most helpful in late summer months.

2. Use plenty of high analysis fertilizer under the corn and sidedress with ample nitrogen. (Corn firing is often due to nitrogen starvation.)

3. Plant an adapted hybrid variety and leave corn spaced thick. (100-bushel yields require 10,000 or more stalks per acre.)

4. Cultivate shallow and "lay-by" early for high yields—late plowing injures feed roots.

More than 600 4-H Club and vocational agriculture boys and adults carried out highly fertilized, thickly spaced, hybrid corn demonstrations in our section and the results this past year were outstanding. The average yield of all acres actually checked was 58 bushels per acre. In Talladega County alone out of 189 acres actually checked for yields, the average yield

(*Turn to page 43*)

RESULTS TALLADEGA COUNTY CORN DEMONSTRATIONS 1948

Yield groups	Number of acres in each group	Per cent of total acres measured in each group	Average amounts fertilizer used under corn expressed in pounds of plant food			Side-dressing used (pounds of nitrogen)	Population per acre
			(N)	(P)	(K)	(N)	
100 bushels or over...	38	20	31	43	25	71	13,200
90–100 bushels......	15	8	26	36	23	60	13,000
80–90 bushels........	22	11	32	42	21	59	12,000
70-80 bushels........	39	21	26	38	20	55	10,200
60–70 bushels.......	34	18	25	41	27	36	9,700
50–60 bushels.......	26	14	30	40	25	50	9,600
50 bushels or less....	15	8	30	40	20	30	9,000

What Makes Big Yields?

By R. E. Stephenson

Soils Department, Oregon State College, Corvallis, Oregon

THE profits in crop production depend upon good yields, low production costs, and reasonably good prices. When yields can be increased without too much increase in cost of production, profits are increased. Sometimes it is more profitable to employ practices that increase the yield per acre than to increase the acreage in crop.

So far as soil properties are concerned, yields are governed by the capacity of the soil to supply air, water, and nutrients simultaneously and in adequate amounts to the roots of the growing plants. To make a big harvest, considerable amounts of both water and nutrients must be continuously available to a well-aerated root system.

Food and Water

To produce 225 bushels of corn per acre, the record yield to date, would require approximately 350 pounds of nitrogen, 125 pounds of phosphoric acid, and 250 pounds of potash. In addition the corn would require nearly 50 pounds of sulfur, 60 of magnesium, 50 of calcium, one-fifth of a pound of copper, about three pounds of iron, less than two pounds of manganese, about one-half pound of zinc, and a small amount of boron. A few other things are present but, so far as is known, are mostly unnecessary for plant growth. Some of these, such as silica, may be abundant in the plant, sometimes to the extent of more than one per cent, without serving any essential function. Some elements, such as aluminum, if too abundantly present may become toxic to the plant.

Plants contain not only the elements necessary for their own growth but others not needed by the plant, yet essential for animal nutrition and health. The record corn yield mentioned would contain about 40 pounds of chlorine, some sodium, and a small amount of cobalt and iodine, all necessary for animal nutrition. The elements which give the livestock man most concern because of their possible deficiency in forage are iodine, calcium, phosphorus, and sometimes iron and cobalt in certain areas. Thus both yield and quality of produce are of economic importance because of their significance to the health of man and animals. Both yield and quality of produce are much influenced by the quality of the soil.

Adequate moisture is as important for producing big yields as is an ample supply of available nutrients. Although corn has a lower water requirement than many plants, the 225-bushel crop would require the equivalent of about 50 inches of water for the season over each acre to furnish water enough for good growth, using 392 pounds of water to produce a pound of dry matter, the requirement reported by Kiesselbach in studying corn production on a fertile soil. This is more than the total annual precipitation, and much more than the precipitation during the period of the growth of the corn in most areas.

Corn would probably have about a six-foot root zone in the soil. The good soil may hold 12 inches of crop water at one time in six feet of depth, less than one-fourth enough to produce the corn crop if the crop used it all. Corn is produced in about four months time, during which the total precipitation and the stored moisture in the soil would usually be entirely inadequate to provide more than a fraction of the water needed for such large yields. Even with the soil at full moisture capacity when the corn was planted, and a very favorable season otherwise, and assuming little loss of moisture by direct evaporation from the soil, there is still a wide margin between the crop needs for the record yield and the usual available supply of moisture. The conclusion is that such a yield of corn would scarcely be possible, regardless of how good the soil, or how well fertilized, unless some supplemental irrigation is provided.

Soil Properties

Moisture and nutrients in the soil are useless to the plant except when the physical soil properties are such that roots can develop profusely and function efficiently. This requires a porous sponge structure associated with a granular crumb arrangement of the soil particles. Soil structure is, therefore, the determining property so far as availability of both nutrients and moisture in the soil are concerned, and except as the roots are able to absorb oxygen from the soil, both moisture and nutrients are nearly useless to the plant even when roots are present. Good soil aeration is necessary, therefore, first for roots to develop adequately, and second for the roots to function after they are developed.

Things other than the soil and what it is able to furnish to the plant affect crop yields. The supply of carbon dioxide has been cited as a factor. Plants are 90 to 95 per cent carbon, hydrogen, and oxygen which air and water supply either through the soil or through the outside atmosphere. Carbon alone constitutes 40 per cent or more of the organic material of plants. To produce the 225-bushel corn yield would require nearly 40,000 pounds of carbon dioxide to furnish the carbon needed for the growth.

The atmosphere contains an average of only 4½ pounds of carbon dioxide in 10,000 pounds of air. Over an acre of soil at any one time there would be only a little more than enough carbon dioxide (about 44,000 pounds) to meet this need. Fortunately, however, carbon dioxide is continuously evolved from the soil, sometimes at rates equivalent to the use by plants. The carbon dioxide is given off by the roots of plants and is produced by various soil organisms that bring about rotting of organic matter.

Experimental work has demonstrated that plant growth can be considerably stimulated by increasing the carbon dioxide of the air about the foliage. Only one way of affecting this increase is practical, and that is by providing more organic matter in the soil to rot and give up its carbon dioxide to the soil air where it is carried to the surface and to the foliage of plants by the process of diffusion.

Organic Matter

Forty tons of manure an acre containing 10 tons of organic matter are sometimes applied to the soil in striving for big yields. If one-fourth the organic matter is converted to carbon dioxide during the growing season of the crop, the carbon dioxide evolved would provide carbon for 2½ tons, dry weight, of new plant growth. In addition there would be the carbon dioxide from the rotting of other organic matter already in the soil and that evolved from the roots of the crop growing at the time. This evolution of carbon dioxide from rich soil manured and fertilized has been credited with contributing materially to increased crop yields.

There are, of course, several factors outside the soil that affect crop yields, such as temperature, sunshine, length of daylight during the growth period, the plant itself, and others. Some of these the grower has little direct control over, except by such procedures as choosing the planting date, spacing his plants, and selecting and breeding for high yields. The production of hybrid corn, for example, has been credited with adding 20 to 25 per cent to corn yields.

Other Factors

Failure to recognize the controllable yield factors, or lack of specific knowledge for their control, is responsible for some of the low average yields and for the sometimes too prevalent tendency toward lower yields. On the other hand, the success of the best farmers in increasing their already good yields is evidence that right methods and improved practices do pay off when consistently followed.

A grower asked why his land, which once yielded 10 to 12 tons of alfalfa hay per acre, now yields only half that amount. There is perhaps no complete answer to this question that can be backed by definite proof. Probably more than one factor is contributing to the reduced yield. Insects and diseases that tend to increase at times may be part of the answer.

Considering fertility alone, the heavy yields reported if removed for 20 years (a total of 200 tons of hay) would take off 2,400 pounds of phosphoric acid or the equivalent of six tons of 20 per cent superphosphate per acre. Potassium removed would be equivalent to nearly five tons of 50 per cent muriate of potash per acre. In addition to the above, sulfur removed would be equivalent to four tons of land plaster per acre. A relatively large quantity of minor elements would be removed also. This was in an area where hay was either sold or fed without much return of manure. Even if the alfalfa, being a legume, could obtain all the nitrogen needed from the air, the other fertility losses must account for part of the reduction in hay yield.

A western Oregon wheat grower became concerned about his low wheat yields on a type of soil usually highly productive. A little inquiry revealed that the same land had produced wheat nearly continuously for 75 years. Not only the present farmer, but his father and the grandfather had been producers of wheat. An estimated 1,500 bushels of wheat per acre had been sold off the land with little fertility returned. Considering only three elements, nitrogen equivalent to more than six tons per acre of ammonium sulfate, phosphorus equivalent to nearly 2½ tons of 20 per cent superphosphate, and potassium equivalent to nearly 1½ tons of 50 per cent muriate of potash had been removed from the soil by the wheat. The fertility removal by the grain and straw was the equivalent of nearly 10 tons of fertilizer per acre, and this is only three of the 11 or 12 elements the soil must supply. Such fertility removal with little returned must become an important contributing factor to low yields.

Another farmer, who wished to know how to fertilize to produce 100 bushels of corn per acre in western Oregon, was probably bucking an impossible climatic factor. Corn is a hot weather plant and western Oregon has little first-class corn weather. There are too many days with temperatures in the 60's and 70's, when temperatures in the 80's and 90's are better for corn. Breeding for a cool weather variety of corn may make 100-bushel yields possible, but with the present varieties 100-bushel production will rarely, if ever, occur even with irrigation and other factors made as favorable as possible.

Temperature

The temperature factor is one of the important controls of both crop distribution and yields, sometimes more important than the quality of the soil. Northern Iowa is reported to have a 20-degree average temperature disadvantage—too cool for corn to do its best. The warmer southern Iowa fields out-yield those of the north, although the northern Iowa soils are likely to be more fertile.

Because of moisture limitation, as well as fertility and other things at times, western Oregon spring barley growers consider one ton of barley per acre about the top limit for production. Eastern Oregon growers with irrigation on good soils can produce two tons. Spring barley in western Oregon cannot be seeded before the first of March and often it is April before the soil is dry enough for seeding. The harvest is complete long before fall rains make any contribution to the scant summer moisture supply. The total precipitation for six months, March through August, averages only about 10 inches. If all this moisture and 12 inches of crop water that it is possible to have previously stored in six feet of root zone of the best soils went to make a crop, the two-ton yield could hardly be reached. Probably not more than 75 per cent of this total of moisture ever contributes to the yield of the crop. To produce two tons of barley grain would require the production of about 9,000 pounds of dry matter including the straw, and seldom is there enough available moisture to produce this yield.

Using a water requirement of 515 pounds obtained in Colorado studies for barley, the 9,000-pound total growth needed for two tons of grain would require a little more than 20 inches of crop water which must be absorbed from the soil and passed through the plant during the growing season. Total precipitation in the growing season after March averages only about six inches and after April only 3½ inches. The earliest possible spring planting is necessary to get big yields, and only when the soil is unusually good and the season favorable is the yield likely to go much above one ton per acre. With average soil and conditions as they are, yields are more often below than above one ton.

In striving for big yields, plants come to compete for standing room and light exposure in the field. Sunflowers grown in gallon cans about six inches in diameter and six inches deep, when heavily fertilized (five plants per can), yielded at a rate of more than 36 tons an acre of dry plant material. The cans had to be spaced a considerable distance apart, however, to allow the tops of the sunflowers to spread and reach a light exposure. It is not possible to grow plants in the field spaced as they were in the individual cans. Therefore, a 36-ton yield is not likely to be obtained in the field.

Since how big the yield may be depends upon a number of factors not all residing in the soil, the grower must so far as is possible identify and evaluate all the various yield factors and determine which are controllable and which are not susceptible to improvement. The grower not uncommonly puts too much faith in commercial fertilizer and pays too little attention to crop rotation, humus renewal, and the moisture supply. Because of neglect of other yield factors he gets less out of his fertilizers than would be obtained if he recognized other things which needed attention. The physical properties of the soil sometimes appear to be completely overlooked and frequently they, as much as fertility, are the limiting soil factors in the growth of plants. Soil structure for some plants, such as potatoes, is critically important and no kind or amount of fertilizer can take the place of mellow crumb structure.

How Much Fertilizer?

How much fertilizer can be economically used is always an important question and deserves much study to get the most from a given amount of land. The general tendency is toward more liberal fertilizer rates, perhaps due in part to soil fertility depletion and in part to a better knowledge of how to get results from fertilizing. When prices of farm products are high, fertilizer is used more liberally. Big yields are associated with profitable production, and profits contribute the means for fertilizer purchases.

Good experimental work has taken much of the guess out of what fertilizer, how much, and when and where to

(Turn to page 44)

Fig. 1. J. A. Martin (left), Associate Horticulturist, South Carolina Experiment Station, and Dr. D. G. Langham, Head of Department of Genetics, Venezuelan Ministry of Agriculture, during Martin's recent inspection trip to Central and South America.

Sesame—New Oilseed Crop for the South

By H. M. Simons, Jr.

South Carolina Experiment Station, Clemson, South Carolina

A PLANT which has been grown in the "skips" in cotton and corn fields for generations to provide seed for birds and game is now offering Southern farmers new possibilities for a cash crop. This plant is sesame, familiarly known as "benne," and has been grown in the South since antebellum days on a limited scale. The crop has never been commercially important in the United States due to its uneven ripening nature, seed shattering character, and high labor requirements at harvesting time. Another disadvantage was the extremely long growing period required to mature the older varieties of sesame. However, this has been overcome by utilizing in the breeding program an early Russian variety which matures in only 70 days.

Just what is sesame? It is one of the world's oldest oilseed crops, having been grown in the tropics from time immemorial. The plant is thought to have originated in the Indian Archipelago, and many ancient peoples pressed its seeds to use the oil they contained for cooking purposes. Approximately 1,500,000 tons of sesame seed are produced annually around the globe, with China furnishing over half of the total and India, Latin America, and Africa supplying the rest. Although the portion of total sesame production confined to Latin America is small, production is increasing and the crop has lately become of commercial importance in Mexico, Nicaragua, Venezuela, Colombia, and other South American countries. Small acreages of sesame have been grown in the United States, chiefly in the Carolinas, Georgia, Nebraska, Kansas, Arizona, California, and Texas.

Sesame seed, which has extensive commercial uses in the United States, yields from 45 to 55 per cent of its total weight in an excellent edible oil—over twice as much as cottonseed. Sesame oil is now being utilized in the manufacture of oleomargarine, shortenings, cooking oils, and in insecticides, soaps, paints, and drugs. One of its important new uses is as a carrier of penicillin. The whole seeds are used on certain types of bread and rolls and in confectionery products to add flavor. It has been reported that in New York City approximately 1,000 tons of sesame seed are used annually

Fig. 2. Actual size sesame pods. The left one is an old variety that shatters; the right, one of the improved types which opens only at the tip and retains the seed until inverted. Mechanical harvesting is now possible with better varieties that do not open at all.

by one confectionery firm alone. The residual cake or meal which is left after the oil has been pressed from the seed provides a nutritious livestock feed which is high in protein.

But back to its production in the South. Why hasn't it been grown extensively before now? The answer to that question is the key to the whole series of investigations which were begun by the South Carolina Experiment Station back in 1943. Although the crop grew well in the South and was easy to cultivate, its seed shattering nature, uneven ripening, and high labor requirement at harvest time made it too costly to grow. Machine harvesting was out of the question because the capsules matured progressively from the base of the plant to the top and as the lowermost capsules opened and shattered their seed, the uppermost capsules remained green.

Today, after almost six years of research, J. A. Martin, Associate Horticulturist of the S. C. Experiment Station, seems to be within sight of the solution to the problem—a non-shattering type of sesame which may be harvested mechanically with a grain combine. Although much research and breeding work remain to be done before sesame can be successfully grown on a commercial scale, Mr. Martin has already developed many shatter-resistant types which have resulted from crosses between shattering and non-shattering strains. These strains will be tested to ascertain the various desirable plant characteristics from the standpoint of adaptability to mechanical harvesting and climate as well as for high yield, high oil content, and disease resistance.

Progress in developing a type of sesame that could be adapted to mechanical harvesting was slow during the first few years of experimentation. However, in 1948, a variety was obtained from Venezuela which did not shatter its seeds when mature. This type of sesame was developed by Dr. D. G. Langham, an American geneticist who is head of the Department of Gene-

Fig. 3. A closeup view of sesame plants experimentally grown at Clemson. Sesame usually matures by September 1. Seed are borne in capsules along the main stem of the plant. Yields have averaged 1,000 pounds of seed per acre when harvested by hand.

tics of the Ministry of Agriculture at Maracay, Venezuela. As a result of crossing two varieties, Dr. Langham in 1943 discovered in the fifth filial generation a single plant with non-shattering pods. Many defects were present in the original progeny of this plant, such as low yield, susceptibility to disease, and partial sterility. However, after a few years of breeding work, Dr. Langham was able to eliminate most of these undesirable characteristics.

The non-shattering type of sesame which Dr. Langham discovered is now being used extensively in the breeding program at the South Carolina Experiment Station and at several other locations in an effort to combine the non-shattering character with desirable features present in other varieties, such as high yield, high oil content, and disease resistance. Most of these factors already exist together in several varieties. The chief aim at present is to combine them with the non-shattering characteristic.

The planting and cultivation of sesame are very similar to that of cotton. However, the small seeds cannot be covered more than half inch deep, and since the plants are not able to compete well with weeds during the first four weeks after emergence, they must be carefully cultivated during this period.

A commercial fertilizer (4-10-6) should be applied in the drill shortly before planting time at the rate of 800 pounds per acre. Plantings are usually made during the latter part of April and harvesting takes place the latter part of August, depending upon weather conditions. Although sesame is not a legume, if the plant residue is turned under it is definitely beneficial in a rotation with other crops. As contrasted with other oilseed crops such as soybeans, it is much more widely adapted to Southern climatic conditions and soil types. This is attested by the fact that some older varieties have escaped cultivation and now grow wild in the coastal areas of Georgia and South Carolina. Sesame is a drought-resistant annual which fits in well with rotations of other crops and can be used to follow small grains. Newer varieties mature early enough to allow fall plantings of cover crops.

(Turn to page 47)

Trends in Fertilizer Materials and Their Use in Compounding Fertilizer Mixtures

By Vincent Sauchelli

Director, Agricultural Research, Davison Chemical Corp., Baltimore, Maryland

WHAT is fertilizer? The question is asked in all seriousness. There was a time not so long ago when a simple answer could readily be given. But today it is not so easy. It may be helpful to take a good look at what we now have and then look back a little in quick review. Usually we can better judge the future by carefully studying the past and the present.

A review of what is being offered in the fertilizer bags today all over this wide country of ours shows a bewildering assortment. Some have simply the old-fashioned N-P-K formulation, which still is in the majority. Here's a bag with N-P-K and a whole gamut of chemical elements—16 of them. This bag claims N-P-K plus "soil correctives," whatever that means. That one includes hormones or auxins—claiming to improve root development, control the rate of growth, and selectively destroy weeds. There's a bag with special micronutrients selected so as not only to mineralize the food crop, but also correct unbalanced glandular functions and eliminate abortion in cows. So it goes—N-P-K, plus insecticides, soil fumigants, fungicides, specific bacteria, rare elements, and vitamins. And, of course, this being the atomic age, it would be strange indeed if we did not find here and there bags with a little radioactivity thrown in for which all sorts of claims are made. And wonderful to behold, here is one that goes beyond radioactivity, bringing us into the post-atomic age prematurely—the fertilizer with mystic, paratomic influences. What that is, the Lord only knows! The problem becomes progressively more complicated. I wonder how much can be left out of the fertilizer bag and still leave it a fertilizer; or the other way round, how much can be put into the bag and still call it a fertilizer.

Did I say bag? By the look of things in some areas the old fertilizer bag may soon be only a memory. For, look around you and you will see farmers getting fertilizer in fluid form out of drums, tank cars or trucks, and steel cylinders. New words have been coined for this change: "nitrogation," "nitrojection."

Compounding Fertilizers Is an Art

In the manufacture and use of mixed fertilizers many problems of both chemical and physical nature have to be resolved. The compatability of any new fertilizer materials must be worked out. For example, recent research has introduced the so-called alfa-tricalcium phosphate, a product of the electric furnace, calcined to drive off fluorine and accordingly make the phosphate more readily available. For direct use it may find a place on certain soil types. But being highly alkaline in reaction it is unsuited for compounding fertilizers having ammonium salts because it would avidly react with such and cause a loss of ammonia. Or, take the use of solid urea or even solid ammonium nitrate in large amounts in mixed goods.

Their excessive moisture-sorptive property reduces their suitability. On the other hand, a material like sulfate of ammonia with relatively low hygroscopicity is a boon to the dry-mixer. The selection of materials and formulation of mixtures for specific purposes is a fine art, if not a science, requiring experience and judgment for profitable results.

To my mind, no single problem facing the industry is more important than that of producing and maintaining good physical condition. This involves problems in formulation, storage, transportation, and application to the soil. The over-all problem involves such factors as caking, segregation, moisture absorption, and drillability. Every new material introduced into the formulation and every change in grades add to and complicate the problem.

Progress of Fertilizer Industry

At the beginning of this century when the mixed fertilizer industry began to get into its modern stride, the manufacturing problems were relatively simple. The fertilizer materials employed were generally of low analysis. Chemically processed materials were practically unknown, except, of course, sulfate of ammonia and superphosphates. The cost per unit of plant food was, however, relatively high. During the intervening period both processes and products of the industry have been substantially improved. Materials of very much higher plant-food content have been introduced. The cost per unit of plant food to the farmer has been sharply reduced. In fact, we can say that during the past two decades the fertilizer industry has made such technological advances that it has advanced from a scavenger business to become one of the largest and most valuable units of the modern chemical industry. To the winning of the two world wars of this generation the modernized chemical fertilizer industry made a significant contribution by helping agriculture produce the indispensable food, feed, and fiber weapon.

All living, active systems have this in common: They are ever-changing, impelled by the necessity to fit into changing conditions. New economic factors are merciless drivers. That is the result of free enterprise. The fertilizer industry is no exception. And since it is now definitely a part of the great chemical family, it is henceforth subject to those evolutionary changes spawned by the research laboratories. The most powerful force is the economic one of arriving at the lowest unit production cost. The same necessity rules commercial agriculture. To survive, the farmer must learn how to keep his unit production costs down.

The fertilizer industry is conscious of its function to provide the raw materials essential in the production of economic crops and the building of a permanent system of farming. Our main job is to supply the raw chemical elements which can increase the yield and the nutritional quality of the crop without depleting the productivity of the soil. In all parts of our country, and particularly on the soils of the South, the use of fertilizer is indispensable to any profitable system of agriculture. Throughout the Southland the trend in fertilizer practice is definitely to apply fertilizers containing from 4 to at least 7 nutrient elements exclusive of calcium and sulfur. Climate and the nature of soils here make it imperative to employ commercial fertilizers if agriculture is to be prosperous.

Natural Organics and Inorganic Nitrogen

The best, because quickest, way to bring out certain trend relationships is by the use of tabulated data. Let us therefore look at Table I. It was prepared by Dr. F. E. Bear of the New Jersey Experiment Station and is the story of the decline in use of natural organics in the manufacture of mixed goods. It is particularly of interest to Southerners because of the strong farmer belief in this region that organics should be used in mixed goods.

In 1900, 473,000 tons of these materials were consumed, with about half of the total, 209,000 tons, derived from animal products—tankage, dried blood, fish scrap, hoof and horn meal. By 1944, the total dropped to 9,000 tons. Now note the plant materials—cocoa by-products, peanut hull meal, and tobacco stems. These provided 10,000 tons in 1900; in 1944, 145,000 tons. However, note also the decline in quality. Nitrogen in animal products has an availability of between 45 and 68 per cent; in plant materials, only between 5 and 15 per cent. They are relatively worthless, or at least of very low quality.

In 1900 the total consumption of mixed fertilizers in the country was 1,770,600 tons; in 1945, 9,457,600 tons. Despite the remarkable increase in total fertilizer consumption, the total amount of organic materials used by the industry remained almost unchanged, while the actual amount of equivalent nitrogen supplied by these materials dropped from 32,000 tons to 28,000 tons.

Now let us consider Table II, "Consumption of nitrogen in commercial fertilizer and the portion derived from natural organic sources." This table was prepared by the U. S. Department of Agriculture, Bureau of Plant Industry, Fertilizer Division. It supplements the data in Table I. In 1900 about 90 per cent of the total nitrogen used in mixed goods was derived from organics; and of the nitrogenous materials used for direct application, about 85 per cent came from organics too. Then followed a gradual decline. By 1944, of the total nitrogen used in mixed goods, only 8.3 per cent came from organics. This was a drop from 90 to 8.3 per cent In the meantime the total amount of nitrogen consumed in-

TABLE I.—NATURAL ORGANICS USED IN THE MANUFACTURE OF MIXED FERTILIZERS [1]

Materials	Nitrogen availability [2]	Tonnage of materials in thousands of short tons							Equivalent Nitrogen	
		1900	1909	1919	1929	1939	1944	1945	1944	1945
	Per cent									
Seed meals [3]	54–67	151	367	269	197	136	130	130	7.9	7.0
Animal products [4]	45–68	209	227	300	158	95	9	25	.8	1.25
Process tankage	18–37	.....	.....	10	126	93	105	87	8.7	6.96
Garbage tankage	-3	103	150	116	110	31	15	14	.45	.42
Sewage products	16–53	.....	.....	.....	24	57	115	101	6.0	5.0
Manures	7–77	.....	.....	33	29	35	25	58	.75	1.16
Plant materials [5]	5–15	10	15	61	103	145	145	155	2.8	2.97
Peat	4	.....	10	25	40	40	40	40	.6	.6
Total	....	473	769	814	787	632	584	610	28.0	25.36
Equivalent N		32.3	42.0	49.2	36.3	31.1	28.0	.....	28.0	25.36
Average nitrogen content, %		6.8	5.5	6.0	4.6	4.9	4.8	.....	.....	.....
Average availability, % [2]		52.3	53.1	52.9	44.4	42.6	39.2	.....	39.2	.....

[1] Sources: 1900-1929. Yearbook of Commercial Fertilizer.
1939. Better Crops with Plant Food 26 (1): 20-22, 40-42, 1942.
1944. Agricultural Statistics 1946. 1945 Agr. Stat. 1947.
[2] Based on data of Rubins and Bear, Soil Sci. 54 (6): 411-423, 1942.
[3] Apricot seed meal, castor pomace, cottonseed meal, hempseed meal, linseed meal, rape seed meal, soybean meal, tung meal, etc.
[4] Animal tankage, dried blood, fish scrap, hoof and horn meal, and miscellaneous organics.
[5] Cocoa byproducts, peanut hull meal, and tobacco stems.
Source: Firman E. Bear.

TABLE II.—CONSUMPTION OF NITROGEN IN COMMERCIAL FERTILIZER AND PORTION DERIVED FROM NATURAL ORGANIC SOURCES [1]

Year	Total nitrogen in commercial fertilizer	Natural organic sources					
		Total		Used in mixtures		Used as separate materials	
		Nitrogen	Portion of total N	Nitrogen	Portion of total N in mixtures	Nitrogen	Portion of total N in separate materials
	Tons	Tons	%	Tons	%	Tons	%
1900	72,000	63,100	87.6	32,300	91.1	30,800	84.2
1909	125,000	67,300	53.8	42,000	67.7	25,300	40.2
1919	219,000	76,200	34.8	49,200	53.6	27,000	21.2
1929	352,000	58,500	16.6	36,300	22.0	22,200	11.9
1939	398,200	48,000	12.1	31,100	15.2	16,900	8.7
1944	634,500	33,000	5.2	28,000	8.3	5,000	1.7

[1] Compiled largely from "Consumption and trends in the use of fertilizers in the year ended June 30, 1944." Mehring, A. L., Wallace, H. M., and Drain, M., U. S. Dept. Agr. Cir. 756.

creased from 72,000 tons to 635,000 tons.

Synthetics

What has replaced these organic sources of nitrogen? Processed nitrogenous materials—synthetics. And the reason? Undoubtedly cost. This is brought out by Table III which shows the wholesale prices of nitrogen in various fertilizer materials on a unit cost basis. In 1900, nitrogen in sulfate of ammonia and in nitrate of soda cost per unit about the same as in natural organics. In the late 1930's, ammonia solutions came into the picture. By 1946 the unit cost of nitrogen in processed materials dropped significantly, whereas in organics the price remained relatively high.

With these significantly important changes in sources of raw materials, new and difficult problems were ushered in for the plant superintendent. The organics were bulky materials and provided considerable buffering to produce a mixed fertilizer having good storability. It handled well at the plant

TABLE III.—WHOLESALE PRICES OF NITROGEN IN VARIOUS FERTILIZER MATERIALS [1]

Year	Ammonium sulfate	Sodium nitrate	Ammonia solutions	Natural organics [2]
1900	$2.64	$2.37	....	$2.57
1910	2.79	2.76	....	3.63
1920	4.08	4.44	....	8.71
1930	1.79	2.49	....	4.50
1940	1.37	1.68	$1.22	3.55 [3]
1946	1.42	1.75	1.03	3.81 [4]

Sources: Fertilizers and Lime in the United States. Resources, Production, Marketing, and Use U. S. Dept. Agr. Misc. Pub. 586, 1946. Office of Price Admin. 2nd Rev. MPR 135, 1946.

[1] Average prices per unit of 20 pounds of nitrogen at producing points or ports in bulk carlots.

[2] Average in animal tankage, dried blood, cottonseed meal, and fish scrap.

[3] Average in animal tankage, castor pomace, cottonseed meal, fish scrap, and process tankage.

[4] Average in castor pomace, process tankage, and sewage sludge. OPA ceiling prices.

and on the farm. But the water-soluble inorganics lacked this attractive property and there developed plenty of problems as to how to achieve good mechanical condition, reduce caking and lumping, and create easy drillability through the new, fast-moving, tractor-drawn fertilizer distributors.

One of the changes we must consider because the factors behind it are still operative is the production of raw materials of higher plant-nutrient content. This ties in with delivered cost to the farmer. Let us take a quick look at Table IV. In 1900 the average nitrogen content of the organics used in mixed goods was about 5 to 7 per cent. Ordinary superphosphate then contained about 14 per cent P_2O_5. Most

(Turn to page 41)

TABLE IV.—WEIGHTED AVERAGE PLANT-FOOD CONTENT OF PRINCIPAL MATERIALS CONSUMED AS FERTILIZER IN THE UNITED STATES AND TERRITORIES

Material	Plant food, %[1]					
	1900	1910	1920	1930	1940	1945
Nitrogenous Materials						
Ammonia and solutions[2]	....	....	....	46.3	38.5	39.6
Ammonium nitrate	....	....	....	....	....	32.9
Ammonium phosphates[3]	....	....	11.0	14.0	13.0	13.8
Ammonium sulfate	20.5	20.5	20.6	20.7	20.7	20.7
Calcium cyanamide	....	14.0	20.4	22.7	21.3	21.0
Sodium nitrate	15.3	15.3	15.3	15.5	16.0	16.0
Other chemical nitrogen[4]	14.0	14.0	14.5	19.0	24.5	24.4
Average chemical nitrogen	15.9	17.2	18.0	19.6	20.2	22.2
Natural organics[5]	5.1	5.5	5.7	6.7	5.3	4.5
Phosphatic Materials						
Ammonium phosphates[3]	....	....	48.0	34.0	35.0	32.1
Bone meal	23.3	23.7	24.0	25.2	23.7	24.0
Superphosphate, ordinary[6]	14.5	16.3	17.3	18.3	19.3	19.3
Superphosphate, double[6]	43.8	43.8	43.8	44.5	46.9	46.0
Average	15.1	16.8	18.0	19.1	22.0	20.2
Potassic Materials						
Kainit	12.5	13.0	13.7	14.7	....	....
Manure Salts	20.2	21.3	20.6	20.9	22.7	25.2
Potassium chloride	50.2	50.2	50.2	51.7	58.3	59.5
Potassium sulfate	48.0	48.0	48.0	48.0	50.5	49.5
Sulfate of potash-magnesia	26.0	26.0	26.0	26.0	24.0	22.0
Average	23.7	23.1	22.4	33.3	54.8	53.5

[1] Either N, P_2O_5, or K_2O, according to the material classification.
[2] Anhydrous ammonia, ammonia liquor, ammonium nitrate-ammonia solutions, and urea-ammonia solutions.
[3] Includes ammonium phosphate-sulfate.
[4] Includes ammonium nitrate-limestone mixtures and solid urea.
[5] Includes bone meal, tobacco stems, and wet-mixed base goods from rough ammoniates.
[6] Run-of-pile basis.
Source: K. D. Jacob, U.S.D.A.

Potash in Wisconsin's Test-Demonstration Program

By F. H. Turner

Field Crops Specialist, University of Wisconsin, Madison, Wisconsin

THE Agricultural Service of the Wisconsin College of Agriculture joined forces with the Tennessee Valley Authority in 1940 in a soil-fertility program testing the phosphate fertilizers produced by the T.V.A. While it would be far from the truth to say that we did not recognize the need for potash at that time, we frankly admit that we did not appreciate its true importance in our program of soil building through the production of larger and better legume crops.

To illustrate the change in attitude toward potash taking place during the past nine years, I am going to cite an example. The potash contributed by the American Potash Institute in 1941 (100 tons of 60 per cent muriate of potash to supplement the 60 per cent calcium metaphosphate provided by the T.V.A.) was divided among the 11 counties participating in the program that year by Professor C. J. Chapman and myself on the basis of what we thought were the soil requirements in the counties involved. We allocated larger amounts to the light soil counties and smaller amounts to the counties with heavier soils. We planned on providing about half the potash requirement of the demonstration farms in each county.

One heavy soil county was given an allotment of 6.9 tons, which together with a similar amount to be purchased by the demonstrator was to supplement 20 tons of 60 per cent calcium metaphosphate. A short time after the allocations were sent out to the counties, we received word from the County Agent telling us that he needed only half of his allotment and to give the balance to some other county. Results from potash on alfalfa in this county were so outstanding that two years later the demonstrators were buying more tons of potash than their allocations of phosphate.

The average yield of hay in 1942 where no fertilizer was applied in 1941 was 2,661 pounds per acre in the first cutting. Where phosphate only was applied the average yield was 3,754. Where both phosphate and potash were applied in the ratio of about two to one, the yield was stepped up to a 4,659 pound per acre average in the first cutting alone.

Early Recommendations

In the first years of the test-demonstration program in Wisconsin, we recommended that phosphate and potash be applied on a small area at a two to one ratio where the soil test showed from 160 to 200 pounds of exchangeable potash, none where it was over 200, and at a one to one ratio for readings of 80 to 150 pounds. Some of the demonstrators applied potash on small areas where soil tests showed over 200 pounds of exchangeable K per acre and obtained profitable increases in hay yields in many cases, particularly so on the Spencer silt loam soils of north central Wisconsin.

For the cropping season of 1949 our demonstrators purchased 575 tons of 50 and 60 per cent muriate of potash to supplement 300 tons of calcium

(Turn to page 46)

An Approved Soybean Program for North Carolina

By E. R. Collins[1] *and L. A. Powell*[2]

TESTS conducted cooperatively by the North Carolina Experiment Station and Extension Service, with W. L. Nelson supervising the fertility studies and E. E. Hartwig supervising the variety tests and the breeding program, resulted in a summary of nine points necessary for profitable soybean yields. These steps were listed as follows:

1. Have your soil tested and limed when needed.
2. Provide adequate fertility.
3. Prevent fertilizer injury.
4. Plant an adapted variety.
5. Provide enough plants.
6. Treat seed to prevent seedling diseases.
7. Prepare a good seedbed.
8. Control weeds early.
9. Control insects.

The results of several variety fertility tests in 1946 showed that lime, alone, gave an increase of 2.8 bushels for an extra return of $6.50 above the cost of treatment. Four hundred pounds of 0-10-20 fertilizer, alone, gave an extra yield of 5.2 bushels for an extra return of $7.30. When the soils were limed in accordance with requirements as shown by a soil test and 400 pounds of 0-10-20 fertilizer were used per acre, the extra yield was 12.4 bushels for an added return of $25.90 above the cost of the lime and fertilizer treatment. The 12.4 bushels were a 55 per cent increase over the 22 bushels obtained with no treatment.

These results demonstrated that when the nine steps were properly applied on representative soils, two times the State average yield of soybeans could be produced at considerable profit above the cost of treatment. These results were obtained by using Ogden and Roanoke soybeans, both of which had been released relatively recently by the Experiment Station.

The first step in an educational program is to familiarize the agricultural leaders with the latest information. With this in mind, in 1946, the white and Negro county agents were brought together in small groups in a county where one of the fertility and variety experiments was located. The program consisted of a short talk, illustrated by colored slides, giving the background and a summary of the results obtained. The group was then taken to the field experiment, where the response from lime and proper fertilization could be readily observed in the field.

Soybean result demonstrations were cooperatively drawn up for adult and 4-H groups. These demonstrations carefully outlined each step with specific instructions. Demonstrations were started in most of the soybean-growing countries in 1947, with exceptionally good results. Due to the shortage of potash and the unavailability of the recommended 0-10-20 fertilizer, muriate of potash was made available to supplement the fertilizer used. All demonstrations were to be fertilized at a rate equivalent to 400 pounds of an 0-10-20 fertilizer.

---

[1] Dr. Collins is in charge of Agronomy Extension at North Carolina State College, Raleigh, North Carolina.

[2] County Agent, Currituck County, North Carolina.

For example, on the four demonstrations in Tyrrell County, muriate of potash side-dressed, in addition to 0-12-12 fertilizer, gave increases of 2.1 bushels, 6.3, 5.9, and 2.0 bushels per acre for an average increase of 4 bushels per acre.

In 1948, Currituck County was selected for a county-wide demonstration on the use of all approved practices including the use of a new fertilizer grade, namely 0-10-20, made available by the fertilizer industry for this demonstration. This was the first time the grade had been sold in the State and the amount totaled 386 tons, supplied by five fertilizer companies operating in the area.

The education on the county level consisted of meeting with GI classes, community groups, and a county-wide meeting where the background of the soybean demonstrations, together with the probable return that would be realized by using all of these improved practices were discussed.

One-acre Trials

From the action standpoint, each farmer was asked to try these recommended practices on at least one acre. During the first part of the program, cooperating farmers were restricted to one ton of the 0-10-20 fertilizer. As the fertilizer industry found it possible to supply more of this grade of fertilizer, the restriction on the amount per grower was lifted. With 121 farmers using 386 tons of 0-10-20, the average was 3.2 tons per farmer. At the rate of 400 pounds per acre, this would mean that the average cooperating farmer fertilized 16 acres with this new fertilizer the first year.

A report on 116 completed demonstrations showed that the yields ranged from 7 bushels to 41.8 bushels per acre. One hundred fourteen of these were above the State average with only two being below 15 bushels per acre. Three demonstrations were above 40 bushels, with the highest yield being 41.8 bushels per acre. Twelve demonstrations were above 35 bushels, 25 above 30 bushels, 29 above 25 bushels, 25 above 20 bushels, 20 above 15 bushels, with only two demonstrations below 15 bushels per acre. The best comparison relative to fertilizer response can be shown from those demonstrations conducted in the same fields or on the same type of soil with the same previous fertilization history.

	No. Dem.	No. Bushels	Av. Bushels	Fert. Cost Per Bu.
0-10-20. .	14	441	31.5	25.3
0-12-12. . .	8	224	28.0	25.7
0-14-7. . . .	2	41	20.5	31.2
6-8-6.	2	39	19.5	43.0

It should be recognized that the results in the table above are only a confirmation of previous experimental results and should not be overemphasized. There is also a hidden factor which cannot be evaluated at the present time. These soils are generally low in potash and the residual potash in an 0-10-20 should theoretically be higher than that in an 0-12-12 applied at the same rate. Therefore, the corn which follows these soybeans should show an advantage for the higher rate of potash fertilization. The effect on the following corn crop will be checked in 1949.

This county-wide program has attracted attention of agricultural workers and farmers in adjoining counties. All indications point toward a rapid spread of these practices to surrounding territories and a rapid increase in the tonnage of this fertilizer as the supplies of material permit the manufacturers to offer 0-10-20 as a regular grade on the market.

Research developed a sound soybean program. The agricultural leaders were acquainted with the practices involved through visiting experiments and conducting demonstrations. The county-wide demonstrations in Currituck County have given agricultural leaders, farmers, and the fertilizer in-

(Turn to page 45)

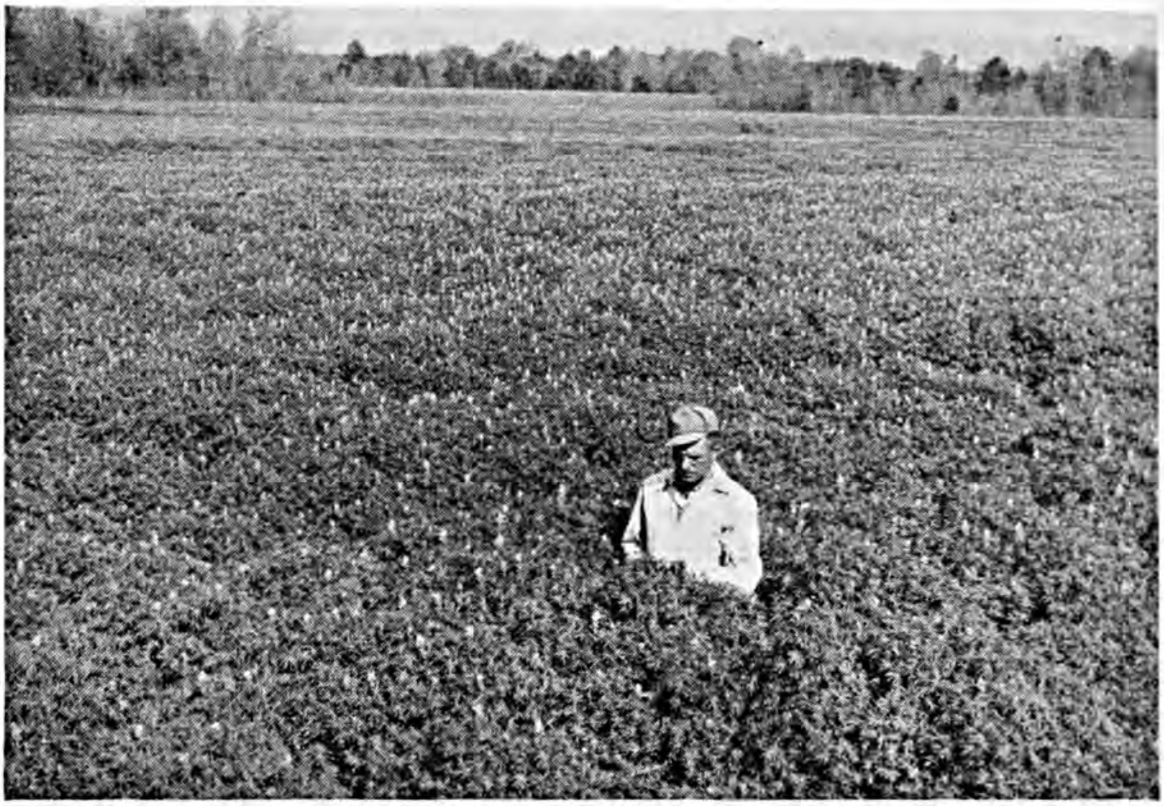


Fig. 1. The spread of blue lupine for soil improvement has been phenomenal. Here is how this legume grows on J. M. Tollison's farm near Perry, Georgia.

We Turn to Grass

By T. S. Buie

Southeastern Region Conservator, Soil Conservation Service, Spartanburg, South Carolina

"WHOEVER heard tell of puttin' guano on grass? Anybody knows it'll grow without anything 'cept water."

That was the way a long, double-jointed field hand in East Georgia expressed his indignation at the "new-fangled" way of farming which Owner Carl Wilkinson started. To him, the idea of encouraging grass to grow was absurd. Had he not spent most of his spring and summer days fighting grass in the sandy fields of cotton and corn? Had he not taught his children that grass was their enemy and that it was something to be destroyed on every hand?

At Evans, Georgia, J. H. Marshall now watches his son, J. H., Jr., fertilize and seed clover and lespedeza over the same Bermuda grass that his father fought for a lifetime, trying to keep it out of his cotton and corn. And the elder Marshall not only sees that the soil stays in place where the grass grows but that cows grazing there bring more profits than row crops did before.

Another Georgian, L. H. Boswell of Taliaferro county, a supervisor of the Piedmont District, expressed his sentiments this way: "I spent 50 years of my life trying to kill grass before I realized that growing it is the easiest way to make a living. I wish I could spend another 50 years fertilizing it and trying to make it grow better on each acre I have. If my farm had been in row crops this year instead of grass and permanent legumes, the recent rains would have stripped the land of its remaining topsoil."

Throughout the South, many thousands of farmers at last have come to realize that grass, once considered an enemy, can be made a friend. They learn that it will serve them, keep their soil from washing, put new life in worn-out land, make their farms more attractive, produce high-quality low-cost feed for livestock, make them more money. This is indeed a change for people who all their lives have thought in terms of "keeping ahead of the grass," of "getting out of the grass," or "of fighting General Green."

Agricultural leaders of the South for many years encouraged more livestock and less dependence on cotton, more pastures and fewer acres planted to row crops. But this advice was, in a large measure, unheeded until recent years. It took a new generation of farmers—many of whom were trained in agricultural colleges, in vocational agriculture in high school, and in 4-H Club activities—to recognize the value of grass and to treat it as a friend.

And it took the "on-the-farm, shirt-sleeve" work of Soil Conservation Service technicians to help farmers fit grass into complete farm soil and water conservation plans. In the Southeastern region alone, by June 30 this year, SCS technicians had helped 274,776 farmers in 373 soil conservation districts make farm conservation plans. Each month they help about 3,300 other farmers join the ranks of those who seek to use the land according to its capabilities and treat it according to its needs. These "tailor-made" plans, almost without exception, call for the use of grasses and legumes on lands best suited to or needed most for the production of close-growing crops.

Farmers are not expecting miraculous benefits from such practices. They are doing their part in supplying seed, lime, and fertilizers as needed. For

Fig. 2. Good pasture and good cattle helped Joe McArthur balance his cotton farming near Gaffney, South Carolina. These Herefords graze a fescue-ladino mixture.

Fig. 3. In Alabama's Black Belt where only cotton grew for years, M. S. Braisfield's Jerseys harvest rank-growing grass near Demopolis, Alabama.

instance, in 1948, farmers of Wilcox county, Alabama, who are cooperating with their soil conservation district, used 4,108 tons of fertilizer on pastures. This is four times the amount used on pastures in any previous year.

But how is this grass-in-conservation-farming working out?

Joe F. Park of the Buck Level Community in Greenwood county, South Carolina, sums up his experience this way: "Soil conservation is most valuable to me. Before I started to put a soil conservation plan into effect, my land was washing down the hills and into the streams. My farm wouldn't support more than 20 cows. Now I have most of the land tied down with such crops as lespedeza, rye grass, crimson clover, sericea, kudzu, and trees. The same farm is now supporting 200 cows, and my soil is improving instead of washing away."

In Mississippi where farmers have long been noted for their tall cotton and big crops, W. M. Windham of Pontotoc county said, "We have established about 65 acres in recommended grasses and clovers, using ample fertilizer, and in addition, from 65 to 100 acres of oats and lespedeza for supplemental grazing and hay. Before we started this work, there were 10 cows on the place. Now, the average is 110." But the program was well under way before Windham got so many cattle. Following his schedule of conservation operations, the Mississippi farmer reduced the acreage devoted to row crops and began to plant them only on land not subject to erosion.

Supervisors of the Flint River Soil Conservation District in South Georgia cite in their 1948 report the record of the Holton Brothers at Camilla in explaining how close-growing crops fitted into land-use plans benefit local farmers.

James and Harry Holton bought a badly eroded 625-acre farm in the fall of 1946. At their request, the local SCS technician helped them plan and put into operation a complete conservation program. As a result, these brothers have developed good pastures. They keep them well-fed with fertilizer.

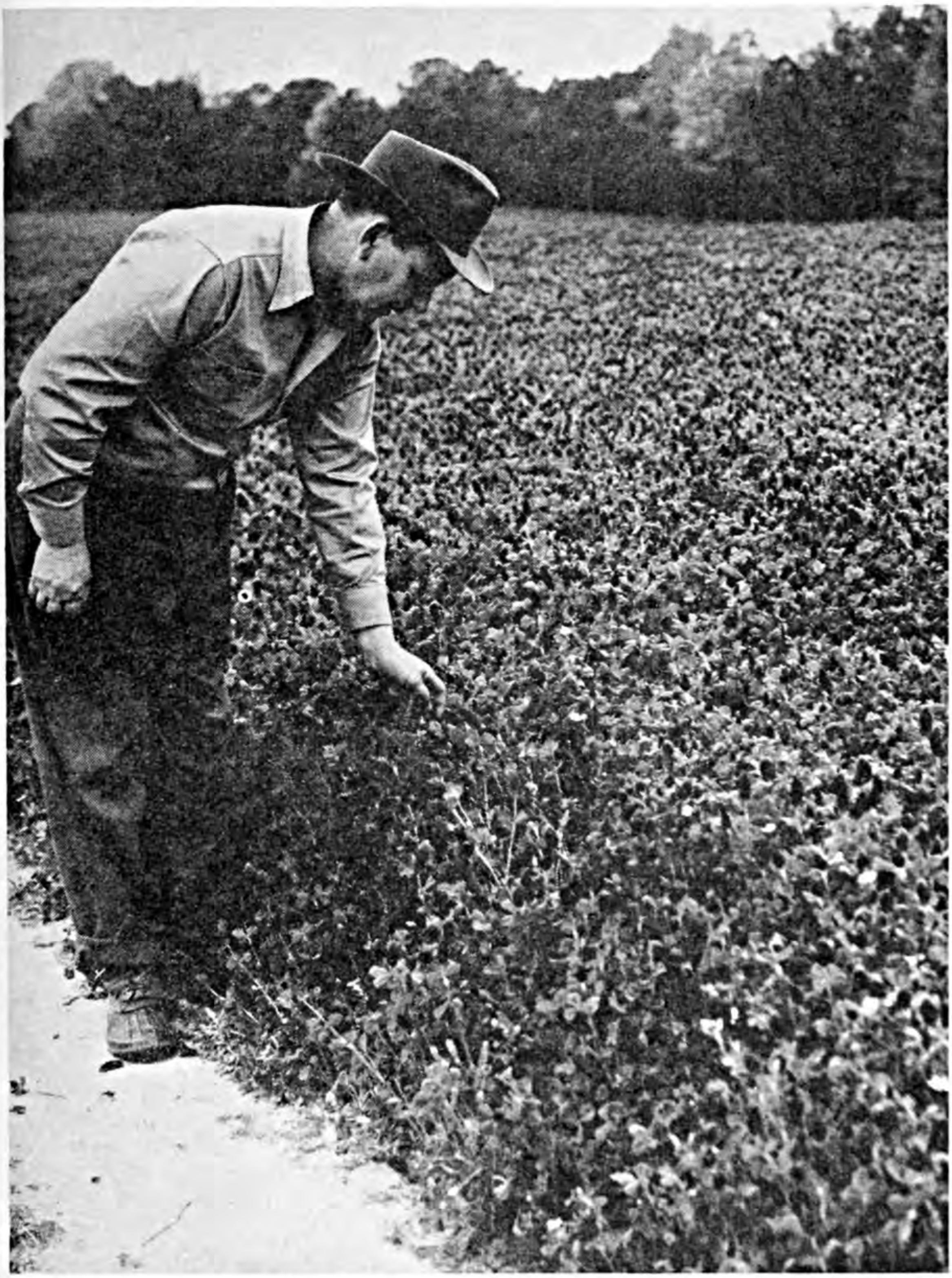


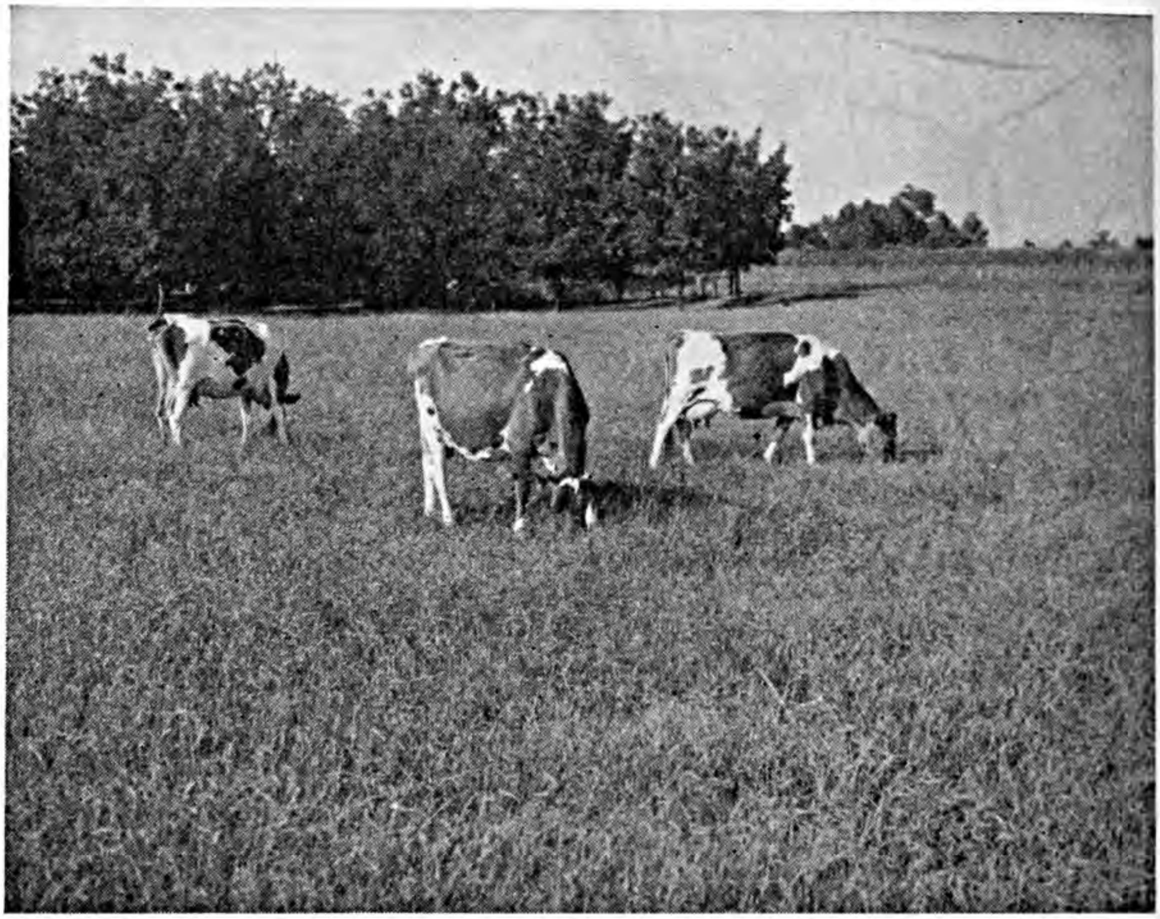
Fig. 4. Farm-owner J. B. Mask in a field of reseeding crimson clover near Griffin, Georgia. Mask has grown this type of crimson clover for 10 years.

Holton said, "A good pasture makes good money. For example last April 15, we bought a steer on the open market for $78. This steer grazed on Kobe lespedeza until September 1 when he was sold at the local auction for $253."

The seas of green that dot the landscape keep spreading—and to land that needs a protective blanket to halt erosion and to put or return it to a productive and safe use.

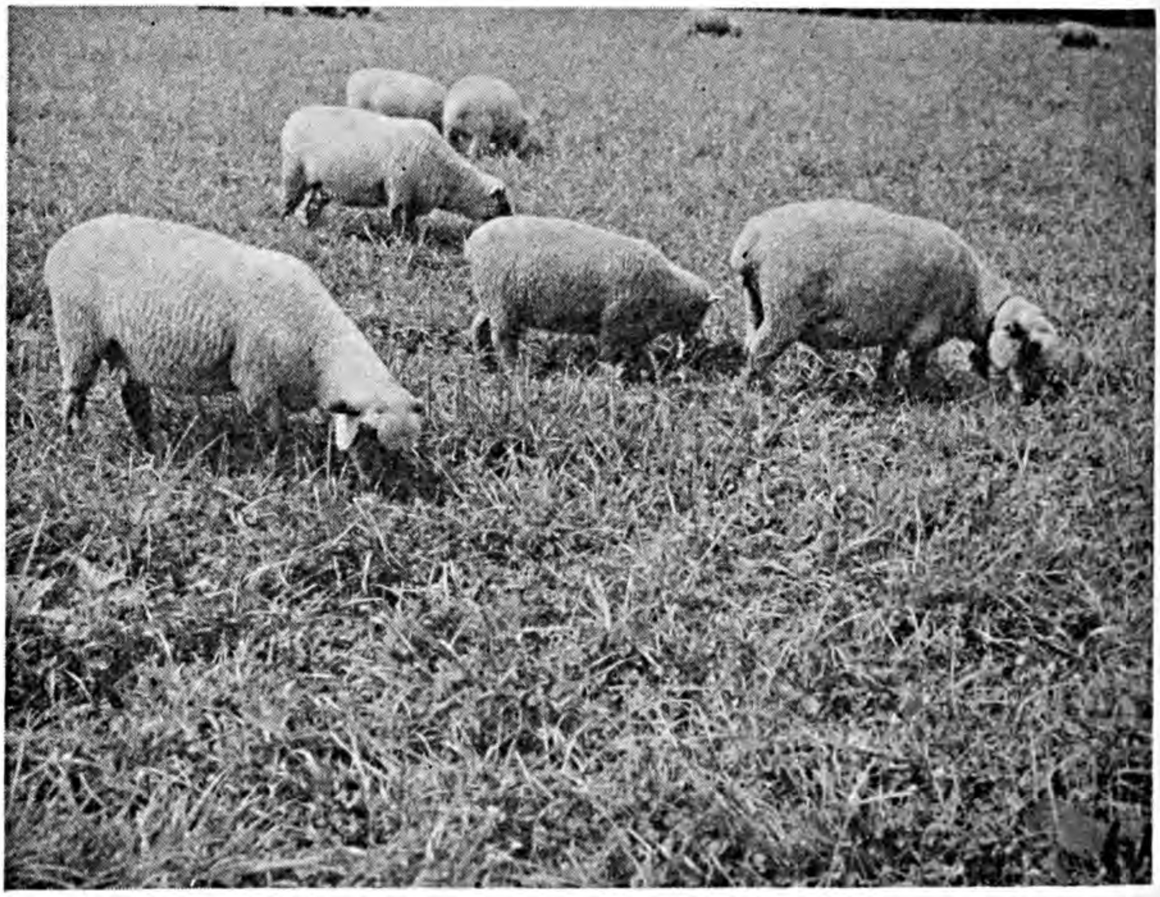
The change on J. Harold Graham's

(Turn to page 48)



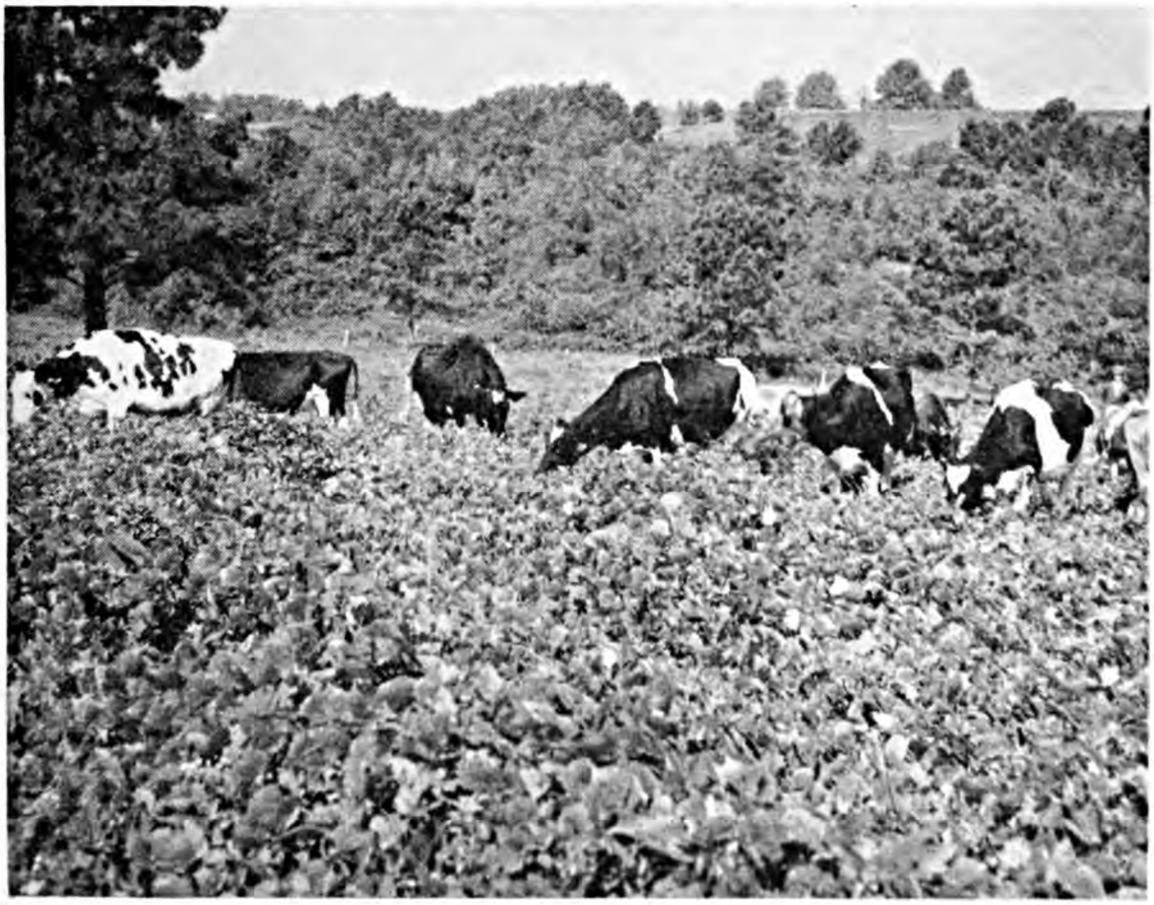
Above: **Wet lands go to Dallis grass and lespedeza for H. C. Morgan, Dadeville, Alabama.**

Below: **Sheep on ladino clover, Kentucky 31 fescue, and lespedeza, Warren County, Kentucky.**



Above: **Georgia State Prison Farm's Jerseys on white clover and fescue, Reidsville, Georgia.**

Below: **Kudzu holds the soil of a steep slope for T. J. Lawlor, Carrollton, Georgia.**



Above: **Jerseys on Dallis grass and white clover on A. T. Harrison's farm, Munford, Alabama.**
Below: **H. D. Moore's cattle graze ladino, fescue, and orchard grass, Farmville, North Carolina.**

The Editors Talk

Why the Leaves Change Color

We believe that our readers are going to be particularly interested in Jeff's "Like Autumn Leaves" in this issue. Fall is the season of reflection, not only on Nature and her wonders, but on our own lives and the achievements obtained in line with our ambitions. Few of us there are, who are not given to some degree of introspection as we witness the dying of the brilliant foliage and bloom which have pleasured our summer.

We noted especially Jeff's posing of the question—What makes the leaves change color? For several years we have carried in our reference file a very readable little pamphlet prepared by the Forest Service of the U. S. Department of Agriculture giving the scientific explanation of this phenomenon. Parts of it can well be quoted here for the benefit of those of us who, as in other autumns, will be asked this question by numerous "small fry" and neighbors.

"Many people suppose that Jack Frost is responsible for the color change, but he is not. Some of the leaves begin to turn before we have any frosts. The Indians had a fantastic idea that it was because the celestial hunters had slain the Great Bear—his blood dripping on the forests changed many trees to red. Other trees were turned yellow by the fat that splattered out of the kettle as the hunters cooked the meat. In reality, however, change in coloring is the result of chemical processes which take place in the tree during its preparation for winter.

"All during the spring and summer the leaves have served as factories, where the foods necessary for the trees' growth have been manufactured. This food-making takes place in numberless tiny cells of the leaf and is carried on by small green bodies which give the leaf its color. These chlorophyll bodies, as they are called, make the food for the tree by combining carbon taken from the air with hydrogen, oxygen, and various minerals supplied in the water which the roots gather. In the fall when the cool weather causes a slowing down of the vital processes, the work of the leaves comes to an end. The machinery of the leaf factory is dismantled, so to speak; the chlorophyll is broken up into the various substances of which it is composed, and whatever food there is on hand is sent to the body of the tree to be stored for use in the spring. All that remains in the cell cavities of the leaf is a watery substance in which a few oil globules and crystals and a small number of yellow, strongly refractive bodies can be seen. These give the leaves the yellow coloring so familiar in the autumnal foliage.

"It often happens that there is more sugar in the leaf than can readily be transferred back to the tree. When this is the case the chemical combination with other substances produces many color shades, varying from the brilliant red of the dogwood to the more austere red-browns of the oaks. In cone-bearing trees which do not lose their foliage in the fall, the green coloring matter takes on a slightly brownish tinge which gives way to the lighter color in the spring.

"While the leaf is changing, other preparations are being made. At the point where the stem of the leaf is attached to the tree, a special layer of cells develops and gradually severs the tissues that support the leaf. At the same time Nature heals the cut, so that when the leaf is finally blown off by the wind or falls from its own weight, the place where it grew on the twig is marked by a scar.

"The shedding of leaves is another of Nature's wise provisions for winter. Broadleaf trees of the North shed their leaves so that their branches will more easily bear the winter's burden of snow and ice. In the Southern States where there is seldom snow or ice, some broadleaf trees are practically evergreen. The conifers—pines, spruces, cedars, firs, and hemlocks—have no definite time for leaf shedding. Their leaves are either needle or scalelike—a form adapting them to the shedding of snow.

"Through fallen leaves, Nature has also provided for a fertile forest floor. Although the food prepared in the cell cavities of the leaves is returned to the tree in the fall, mineral substances with which the walls of the cells have become impregnated during the summer months are retained. Therefore fallen leaves contain relatively large amounts of valuable elements which were originally a part of the soil. Decomposition of the leaves enriches the top layers of the soil by returning the elements borrowed by the tree, and at the same time provides for an accumulation of humus. However, if fires are allowed to run through the forest and the leaves are burned, the most valuable of the fertilizing elements are changed by the heat into gases and escape into the air. Forests which are burned over regularly soon lose their soil fertility even though no apparent damage is done to the standing timber."

Fall Fertilization of Pastures

Agronomists are advocating the fall fertilization of pastures and meadows. Their reasons make good sense and include: (1) Saving labor next spring because a farmer usually has more time in the fall to haul and spread fertilizer; (2) easier spreading when the turf is solid rather than when wet and soft as it may be in the spring; (3) supplies of fertilizer which may be more readily available in the fall than in the spring. They point out that fall fertilization often starts growth earlier in the spring and increases the amount of grazing or hay over that obtained from spring fertilization. Applications in the fall should be made at least two weeks before the ground freezes so that the grass roots will take up the plant food quickly and prevent its being washed away.

With good pastures now conceded to be the cheapest and easiest way to feed livestock, the importance of any measures to improve swards and maintain them at a high-producing capacity should be urged upon growers. With labor high-priced and with the increased demands upon the time of farmers desiring to cut their production costs, any steps which can be taken this fall to improve next year's pastures spell foresightedness and good planning.

OUR COVER: Among the photographs received to illustrate Dr. Buie's article, "We Turn to Grass," appearing in this issue was one of Miss Lou Ellen McHugh of Madison, Georgia, in a field of crimson clover on the farm of W. L. Carmichael near Madison. We thought it would make a fine cover picture and Miss McHugh graciously gave her consent to its use for this purpose.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay[1] Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
October	31.07	50.6	142.0	207.0	138.0	198.0	18.40	63.70	....
November	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	175	249	212	209	141	319	204
1947	252	380	224	245	366	273	146	379	249
1948									
October	251	506	204	236	215	224	155	282	176
November	246	428	207	226	188	231	155	306	186
December	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282
February	235	295	249	279	174	219	173	237	285
March	232	319	250	290	184	224	168	228	263
April	241	247	260	314	190	226	160	223	236
May	242	325	260	312	190	226	149	224	213
June	243	315	251	301	188	210	138	207	175
July	243	565	222	323	195	206	132	166	185
August	236	446	221	305	184	202	135	197	174
September	240	487	198	263	181	212	137	193	205

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
October	3.00	2.20	9.31	9.98	9.41	9.48
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
October	112	77	266	283	279	269
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
October	.763	4.61	6.60	.375	.720	14.50	.200
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash in bags	Sulphate of potash magnesia	Manure salts
1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
October	142	128	135	68	76	60	83
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
October	277	263	243	130	94	277	142	72
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72
May	256	257	227	134	99	293	144	72
June	252	257	223	134	99	304	144	65
July	249	256	225	140	100	349	144	68
August	245	254	222	143	100	372	144	68
September	249	253	225	138	100	334	144	68

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizer Sales, by Grades, 1948-1949 Season," State Dept. of Agr. & Ind., Old Post Office Bldg., Montgomery, Ala., 72-49, Aug. 15, 1949, J. C. Garrett.

"Fertilizers, Soil Analysis, and Plant Nutrition," State Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 367, Rev. Apr. 1949, D. R. Hoagland.

"Sales of Commercial Fertilizers and Agricultural Minerals Reported to Date for Quarter Ended June 30, 1949," Bu. of Chem., State Dept. of Agr., Sacramento 14, Calif., No. FM-183, Aug. 29, 1949.

"Commercial Fertilizers Registrants to Date for the Fiscal Year Ending June 30, 1950," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., No. FM-184, Aug. 30, 1949.

"Agricultural Minerals Registrants to Date for the Fiscal Year Ending June 30, 1950," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., No. FM-185, Aug. 31, 1949.

"Fertilizer Experiments with Citrus on Davie Mucky Fine Sand," Agr. Exp. Station, Univ. of Fla., Gainesville, Fla., Bul. 461, June 1949, T. W. Young and W. T. Forsee, Jr.

"Summary Report of Fertilizer Materials Consumed in Florida for Fiscal Year July 1, 1948, thru June 30, 1949," Fert. Stat. Div., Bu. of Insp., State Dept. of Agr., Tallahassee, Fla.

"The Relative Efficiency of Different Forms of Nitrogen in Flue-cured Tobacco Production," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Cir. 14, May 1949, J. M. Carr and Ivan Neas.

"Fertilizer Analyses—Spring 1949," State Board of Agr., Control Div., Topeka, Kans.

"Commercial Fertilizers in Kentucky, 1948," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 73, July 1949.

"Orchard Fertilization," Ext. Serv., Univ. of Mass., Amherst, Mass., Spec. Cir. No. 161, Feb. 1949, W. D. Weeks.

"Experimental Use of Fertilizer in the Production of Fish-food Organisms and Fish," Zoo. Section, Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Tech. Bul. 210, March 1949, R. C. Ball.

"Influence of Fertilizers on Composition and Quality of Sugar Beets," Agr. Exp. Sta., Univ. of Minn., Tech. Bul. 183, April 1949, L. E. Dunn and C. O. Rost.

"Fertilizers for Corn in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 435, April 1949, H. V. Jordan, S. P. Crockett, T. E. Ashley, and J. F. O'Kelly.

"The List of Grades of Fertilizers and Fertilizer Materials Approved for Next Year," Ext. Serv., Miss. State College, State College, Miss., Aug. 5, 1949, I. E. Miles.

"County Fertilizer Data: Mixed Goods and Materials—July 1, 1948, through June 30, 1949," State Dept. of Agr., Jackson, Miss.

"Fertilizer Inspection and Analysis; Spring 1948," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 526, July 1949, J. H. Longwell, H. J. L'Hote, and R. C. Prewitt.

"Lime Your Soils for Better Crops," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 566, Nov. 1948, O. T. Coleman.

"Commercial Fertilizers, Manures and Agricultural Lime, 1948," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Insp. Series 33, April 1949, S. B. Randle.

"Fertilize Corn for Higher Yields," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 366, June 1949, B. A. Krantz.

"Data on Fertilizer Tonnage, Number of Official Samples Secured and Percentage Found Deficient for Certain Periods from 1905 through 1948," Dept. of Fert. Insp. and Analysis, Clemson Agr. College, Clemson, S. C., Aug. 1949, B. D. Cloaninger.

"Nitrogen Distribution in the Corn Plant," Dept. of Exp. Sta. Chem., Agr. Exp. Sta., S. D. State College of A. & M., Brookings, S. D., Tech. Bul. No. 7, June 1948, E. I. Whitehead, F. G. Viets, Jr., and A. L. Moxon.

"Fertilizers . . . And Their Use," Agr. Ext. Serv., Texas A & M College, College Station, Texas, B-167, 1949, M. K. Thornton.

"The Vitamin Content of Peas as Influenced by Maturity, Fertilizers, and Variety," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 337, 1949, E. B. Wilcox and K. E. Morrell.

"Boron for Alfalfa," Ext. Serv., Univ. of Wis., Madison, Wis., Stencil Cir. 296, July 1949, K. C. Berger and E. Truog.

"Influence of Fertilizers on Growth Rates, Fruiting Habits, and Fiber Characters of Cot-

ton," U.S.D.A., Washington, D. C., Tech. Bul. 979, May 1949, D. R. Hooton, H. V. Jordan, D. D. Porter, P. M. Jenkins, and J. E. Adams.

"1948 Field Results with Certain Radioactive Materials as Plant Stimulants," Bu. of Plant Ind., Soils, and Agr. Engineering, Agr. Research Admin., U.S.D.A., Washington, D. C., Progress Report 1948, May 1949.

Soils

"When to Use Sprinkler Irrigation in Colorado," Ext. Serv., Colo. A & M College, Fort Collins, Colo., Bul. 405-A, July 1949, W. E. Code and A. J. Hamman.

"The Story of a Lake," Ext. Serv., College of Agr., Univ. of Ill., Urbana, Ill., Cir. 644, June 1949, E. D. Walker.

"Principal Soil Association Areas of Illinois," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., AG1397, May 1949.

"Productive Soils," Agr. Ext. Div., College of Agr. and Home Ec., Univ. of Ky., Lexington, Ky., Cir. 468, April 1949, P. E. Karraker.

"Evaluating Annual Changes in Soil Productivity," Agr. Exp. Sta., College of Agr., Univ. of Mo., Bul. 522 (Rev. of Bul. 405), Jan. 1949, A. W. Klemme and O. T. Coleman.

"Effect of Grass on Intake of Water," Agr. Exp. Sta., College of Agr., Univ. of Nebr., Lincoln, Nebr., Research Bul. 159, April 1949, F. L. Duley and C. E. Domingo.

"Conservation Practices for the Wheat Lands of New Mexico," Ext. Serv., N. M. A & M College, State College, N. M., Cir. 221, March 1949.

"Maintain the Diversion Terrace," Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 762, April 1949, H. A. Kerr and H. M. Wilson.

"Soil Conservation—Biennial Report, 1947-48," State Soil Conservation Board, State Capitol, Oklahoma City, Oklahoma.

"Soil Conservation in Texas Since 1903," Ext. Serv., Texas A & M College, College Station, Texas.

"The Colorado River and Utah's Agriculture," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Spec. Rpt. 1, April 1949, W. P. Thomas, G. T. Blanch, O. W. Israelsen, D. F. Petersen, and D. S. Jennings.

"Crop Growth and Soil Reaction," Agr. Exp. Sta., College of Agr., For., and Home Ec., W. Va. Univ., Morgantown, W. Va., Bul. 337, May 1949, T. C. McIlvaine and G. G. Pohlman.

"Soil Survey, Candler County, Georgia," Bu. of Plant Ind., Soils, and Agr. Eng., Agr. Research Admin., U.S.D.A., Washington, D. C, Series 1939, No. 6, Issued Oct. 1948, T. E. Beesley.

"Flow of Water in Channels Protected by Vegetative Linings," S. C. S., U.S.D.A., Washington, D. C., Tech. Bul. No 967, Feb 1949, W. O. Ree and V. J. Palmer.

Crops

"Effects of Time of Planting and Digging on Yield and Grade of Sweetpotatoes in Southern Alabama," Sta. Leaflet 25, Nov. 1948; "Production of Vine Cutting for Late Plantings of Sweetpotatoes in Southern Alabama," Agr. Exp. Sta., Ala. Polytechnic Institute, Auburn, Ala., Sta. Leaflet 26, Feb. 1949, T. P. Whitten.

"Pasture Improvement for Arkansas Uplands," Agr. Exp. Sta., College of Agr., Univ. of Ark., Fayetteville, Ark., Bul. 485, May 1949, M. A. Sprague, R. P. Bartholomew, and Warren Gifford.

"Irrigation and Cultivation of Lettuce, Monterey Bay Region Experiments," Agr. Exp. Sta., College of Agr., Univ. of Calif., Berkeley, Calif., Bul. 711, March 1949, F. J. Veihmeyer and A. H. Holland.

"Irrigated Pastures in California," Agr. Ext. Serv., College of Agr., Univ. of Calif., Berkeley, Calif., Cir. 125, Rev. June 1949, B. J. Jones and J. B. Brown, Rev. by M. D. Miller and L. J. Booher.

"Hybrid Field Corn," Agr. Exp. Sta., New Haven, Conn., Bul. 532, May 1949, D. F. Jones and H. L. Everett.

"Insect and Disease Control in the Home Orchard," Section of Hort., Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 404, Jan. 1949.

"Home-grown Christmas Trees for Connecticut," Ext. Serv., College of Agr., Univ. of Conn., Storrs, Conn., Bul. 409, Oct. 1948, R. H. Fenton and F. M. Callward.

"How Good Lawns Grow," Agr. Exp. Sta., New Haven, Conn., Cir. 169, June 1949, H. G. M. Jacobson, E. M. Stoddard, and J. C. Schread.

"Sweet Corn Trials, Mt. Carmel and Windsor, Connecticut, 1948," Agr. Exp. Sta., New Haven, Conn., P. R. 48G2, Jan. 15, 1949, W. C. Galinat.

"Agricultural Experiment Stations," Univ. of Fla., Gainesville, Fla., Annual Report for Fiscal Year Ending June 30, 1948.

"1948 Report, Florida Agricultural Extension Service," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Report of General Activities for 1948 with Financial Statement for Fiscal Year Ended June 30, 1948.

"Corn in Georgia," Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 547, March 1949, E. D. Alexander, J. B. Preston, and J. R. Johnson.

"Manchar Smooth Brome," Agr. Exp. Sta., Dept. of Agron., Univ. of Idaho, Moscow, Idaho, Bul. No. 275, April 1949, R. H. Stark and K. H. Klages.

"Progress in Solving Farm Problems of Illinois—A Nine-year Report, 1938-1947," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., 1948, H. P. Rusk.

"Yields of Corn Hybrids Harvested for Silage, Second Report," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 533, April 1949, W. B. Nevens and G. H. Dungan.

"Spring Oats . . . Varieties for Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 638, March 1949, J. W. Pendleton, G. H. Dungan, O. T. Bonnett, and G. E. McKibben.

"Spring Barley, Varieties and Culture," Agr.

Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 641, April 1949, J. W. Pendleton, A. L. Lang, and G. H. Dungan.

"Winter Wheat . . . Varieties for Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 643, June 1949, J. W. Pendleton, O. T. Bonnett, W. M. Bever, and G. E. McKibben.

"Sixty-first Annual Report of the Director," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., for Year Ending June 30, 1948.

"Plan the Dairy Program Around Quality Roughages," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Cir. 347, 1949, W. A. King, F. E. DeLaCroix, G. O. Mott, M. H. Cohee, and H. E. Moore.

"Grape Growing in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 248, Feb. 1949, (Cir. 177 rev.), R. J. Barnett and R. W. Campbell.

"Sixty-first Annual Report of the Director," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., for the year 1948.

"Tobacco Diseases," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 437, Dec. 1942, (Rev. July 1948), W. D. Valleau, E. M. Johnson, and Stephen Diachun.

"Soybean Production in Kentucky," Agr. Ext. Div., College of Agr. and Home Ec., Univ. of Ky., Lexington, Ky., Cir. 466, Feb. 1949, E. J. Kinney.

"Research in Agriculture," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., A. R. 1947-48.

"Louisiana Sugarcane," Div. of Agr. Ext., La. State Univ., Baton Rouge, La., Bul. No. 15, Jan. 1949, R. A. Wasson and E. R. McCrory.

"Growing Flax in South Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Cir. No. 37, Oct. 1948, H. B. Brown.

"Increasing Plant Stand in Blueberry Fields," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 467, Feb. 1949, C. W. Hitz.

"Maine Potato Diseases, Insects, and Injuries," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 469, May 1949, Donald Folsom, G. W. Simpson, and Reiner Bonde.

"Blueberry Research and Service, Blueberry Hill Experimental Farm, University of Maine, 1945," Blueberry Ind. Advisory Comm., Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Misc. Publ. No. 614, Jan. 1949.

"The Inheritance of Certain Fruit and Foliage Characters in the Peach," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. No. 452, May 1949, J. S. Bailey and A. P. French.

"Cover Crops for Massachusetts Soils," Ext. Serv., Univ. of Mass., Amherst, Mass., Leaflet No. 219, April 1949, A. B. Beaumont and K. J. Kucinski.

"The Nature of an Efficient Agriculture in the Shortleaf Pine Area of Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 457, Nov. 1948, D. W. Parvin.

"1948 Cotton Variety Tests in Hill Sections of Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 462, Feb. 1949.

"Soybean Varieties for Seed and Production Practices for the Mississippi Delta," Agr. Exp. Sta., Miss. State College, State College, Miss., Service Sheet 417, March 1949, E. E. Hartwig and R. B. Carr.

"Aristogold Bantam Evergreen Leads in Trials at Crystal Springs," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 425, Feb. 1949, S. L. Windham.

"Snap Bean Trials 1947 and 1948," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 427, Feb. 1949, J. A. Campbell.

"Supplemental Irrigation Pays Off on Tomatoes," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 431, March 1949, J. A. Campbell.

"Radioactive Materials do not Benefit Crops," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 432, March 1949, U. S. Jones and C. D. Hoover.

"Bush Lima Bean Variety Trials," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 433, March 1949, J. A. Campbell.

"Agricultural Research in Missouri, Annual Report of the Missouri Experiment Station, 1945-1946," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 520, Dec. 1948, E. A. Trowbridge and J. E. Crosby, Jr.

"Research for The Farmer, Annual Report of the Missouri Experiment Station, 1946-1947," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 524, April 1949, E. A. Trowbridge and J. E. Crosby, Jr.

"The Effects of Plant Growth Regulating Substances on Flower Bud Development and Fruit Set," Agr. Exp. Sta., College of Agr., Univ. of Mo., Columbia, Mo., Research Bul. 434, Feb. 1949, D. D. Hemphill.

"The S-100 Soybean," Agr. Exp. Sta., College of Agr., Univ. of Mo., Columbia, Mo., Bul. 521, Jan. 1949, C. V. Feaster.

"An All-year Pasture System for Missouri," Agr. Exp. Sta., College of Agr., Univ. of Mo., Columbia, Mo., Cir. 335, Feb. 1949, W. C. Etheridge, C. A. Helm, and E. M. Brown.

"Planting and Care of Forest Trees," Agr. Ext. Serv., College of Agr., Univ. of Mo., Columbia, Mo., Cir. 563, Aug. 1948, L. E. McCormick.

"Recommended Varieties of Farm Crops for Montana," Central Mont. Branch Sta., Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Cir. 191, March 1949.

"Safflower Production in the Western Part of the Northern Great Plains," Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Cir. 87, Feb. 1949, C. E. Claassen.

"Crop Varieties in Nebraska," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., Ext. Cir. 100 Rev., March 1949, H. H. Wolfe and C. O. Gardner.

"Producing High Corn Yields," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 114, Rev. Feb. 1949, H. H. Wolfe.

"Alfalfa in Nebraska," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 183, Jan. 1949, D. L. Gross.

"Spring Care of Established Lawns," Cir. 524, March 1949; "Summer Care of the Lawn," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 525, March 1949, G. H. Ahlgren and R. E. Engel.

"Choosing the Right Pasture Crops," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaflet 25, Feb. 1949, C. S. Garrison and M. A. Sprague.

"Seeding Smooth Bromegrass," Leaflet 26, April 1949, "Growing Alfalfa in New Jersey," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaflet 27, April 1949, C. S. Garrison.

"The Chemical Composition of Ripe Concord-type Grapes Grown in New York in 1947," State Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., Tech. Bul. 285, Feb. 1949, W. B. Robinson, A. W. Avens, and Z. I. Kertesz.

"Woodlot Improvement, Managing the Woodlot," College of Agr., Cornell Univ., Ithaca, N. Y., 4-H Club Bul. E 43, Rev. Dec. 1948, J. A. Cope and F. E. Winch, Jr.

"The Home Lawn," Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 469, Rev. April 1949, J. F. Cornman.

"Small Fruit Culture for Home Gardeners," Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 333, Jan. 1949, H. R. Niswonger.

"Kentucky Bluegrass," Agr. Exp. Sta., Wooster, Ohio, Research Bul. 681, July 1949, M. W. Evans.

"Alfalfa Varieties for Ohio," Ext. Serv., Dept. of Agron., Ohio State Univ., Columbus, Ohio, Bul. No. 291, Feb. 1948, C. J. Willard, D. F. Beard, and L. E. Thatcher.

"Alfalfa, Queen of Forage Crops," Ext. Serv., Okla. A. & M. College, Stillwater, Okla., Cir. 497, Wesley Chaffin.

"Lespedeza, A Good Pasture Plant," Ext. Serv., Okla. A. & M. College, Stillwater, Okla., Cir. 507, Sam Durham.

"Hybrid Field Corn Trials in Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 452, April 1949, R. E. Fore, E. N. Hoffman, C. A. Larson, J. T. McDermid, and H. H. White.

"Field Corn Production in Malheur County," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 454, April 1949, E. N. Hoffman and R. E. Fore.

"Science for the Farmer," Agr. Exp. Sta., Pa. State College, State College, Pa., Sup. No. 3 to Bul. 502, A. R. 61, June 1949.

"Research for the Farmer," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Contribution 734, A. R. 61, May 1949.

"A Half Century of Crop Rotation Experiments," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Bul. 303, Jan. 1949, R. S. Bell, T E. Odland, and A. L. Owens.

"Corn Varieties in Rhode Island," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Bul. 306, May 1949, R. S. Bell and T. E. Odland.

"Sixtieth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College," Clemson, S. C., Sept. 1948, for the year ended June 30, 1947.

"Agricultural Progress in South Carolina, 1948, More Income—Better Farm Living," Ext. Serv., Clemson Agr. College, Clemson, S. C., Ann. Rpt.

"Questions and Answers on Permanent Pastures in South Carolina," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 339, June 1949, W. H. Craven.

"Sweet Potato Seed Treatments," Ext. Serv., Clemson Agr. College, Clemson, S. C., Info. Card No. 74, Feb. 1949, W. C. Nettles and A. E. Schilletter.

"Agricultural Research in South Dakota," Agr. Exp. Sta., S. D. State College of A. & M. Arts, Brookings, S. D., 61st A. R., Annual Station Report July 1, 1947 to June 30, 1948.

"1948 Corn Performance Tests—South Dakota," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Cir. 76, Feb. 1949, D. B. Shank.

"South Dakota Crop Varieties, Recommendations and Descriptions," Agr. Ext. Serv., S. D. State College, Brookings, S. D., Ext. Cir. 449, Feb. 1949.

"Better Home Grounds Growing and Transplanting Trees and Shrubs," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 196, (Rev.), March 1948, W. C. Pelton.

"Sweetpotato Production and Storage," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 287, (Rev.), Feb. 1948, Arthur Meyer.

"New Agriculture," Ext. Serv., Texas A & M College, College Station, Texas, R-12, A. R. June 1949.

"Fruit Varieties for Texas," Ext. Serv., Texas A & M College, College Station, Texas, C-150, 1949, J. F. Rosborough.

"Annual Lespedezas—for Pasture, Hay, and Better Soil," Ext. Serv., Texas A & M College, College Station, Texas, C-178, 1949, R. R. Lancaster.

"Denton Corn Performance Tests, 1944-48," P. R. 1152, March 7, 1949, M. J. Norris and D. I. Dudley; "El Paso Valley Cotton Variety Test, 1948," P. R. 1155, April 8, 1949, G. F. Henry, P. J. Lyerly, and L. S. Stith; "Denton Cotton Variety Tests, 1944-48," P. R. 1156, April 12, 1949, M. J. Norris and D. I. Dudley; "Cotton Variety and Spacing Test, Big Spring Field Station, 1944-48," P. R. 1157, April 13, 1949, F. E. Keating; "Denton Sorghum Variety Tests, 1943-48," P. R. 1160, April 21, 1949, M. J. Norris and D. I. Dudley; "Barley Varieties for the North-Central and Rolling Plains Areas of Texas," P. R. 1162, April 25, 1949, I. M. Atkins; "Wheat Varieties for the North-Central and Rolling Plains Areas of Texas," P. R. 1163, April 25, 1949, I. M. Atkins; "Oat Varieties for the North-Central and Rolling Plains Areas of Texas," P. R. 1164, April 25, 1949, I. M. Atkins; Agr. Exp. Sta., Texas A & M College, College Station, Texas.

"Pollen and Nectar Plants of Utah," Agr.

Exp. Sta., Utah State Agr. College, Logan, Utah, Cir. 124, June 1949, G. H. Vansell.

"Emergency Pasture Program and Roughage Conservation Program," Ext. Serv., College of Agr., Univ. of Vt., Burlington, Vt., July 1949.

"Your Cheapest Feed—Good Pasture," Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 480, July 1949.

Economics

"A Statistical Handbook for the Desert Grapefruit Industry," Agr. Exp. Sta., Dept. of Agr. Econ., Univ. of Ariz., Tucson, Ariz., Mimeo. Rpt. No. 87, March 1949, R. E. Seltzer.

"Mechanization of the Rice Harvest," Agr. Exp. Sta., College of Agr., Univ. of Ark., Fayetteville, Ark., Rpt. Series 11, Aug. 1948, M. W. Slusher and Troy Mullins.

"1948 Alfalfa Seed Production Study, Imperial County," Ext. Serv., Univ. of Calif., Berkeley, Calif.

"Agricultural Policy," Ext. Serv., Colo. A & M College, Fort Collins, Colo., Cir. 161-A, Feb. 1949.

"Rural Land Ownership in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 460, June 1949, D. E. Alleger and M. M. Tharp.

"Some Economic Facts for Farmers," Ext. Serv., College of Agr., Univ. of Ill., Urbana, Ill., Cir. 640, April 1949, R. W. Bartlett.

"Indiana Crops and Livestock," Dept. of Agr. Stat., Agr. Exp. Sta., Purdue Univ., W. Lafayette, Ind., No. 279, Dec. 1948.

Trends in Fertilizer Materials

(From page 20)

of the potassic materials were of the manure salts type, averaging about 23 per cent K_2O. Note the upward trend. If we take the weighted average of the materials in each class for the period 1900 to 1945 we have for chemical nitrogen an increase of from 15.9 to 22.2 per cent; phosphates, from 15.1 to 20.2 per cent; potash, from 23.7 to 53.5 per cent. But, do you see what has happened in each class? The plant-nutrient content has enormously increased. Nitrogen solutions now available average over 40 per cent nitrogen, solid urea has 42 to 45 per cent, solid ammonium nitrate 32 to 33 per cent N; concentrated superphosphates average 40 to 47 per cent P_2O_5; and muriate of potash now has 60 to 62 per cent K_2O.

Chemical and engineering research is actively engaged in producing new materials of high analysis and of more suitable physical and chemical properties. Urea-formaldehyde, shortened to "Uraform", is one of the new water-insoluble nitrogen carriers with a more or less controlled rate of availability. Unlike organics it has a high nitrogen content—35 to 38 per cent. But it behaves much like an organic carrier in its slow release of nitrogen and in its good conditioning qualities.

More developments in the future in this factor of concentration can be expected because of its favorable bearing on consumption. These developments will also modify manufacturing practices. With more highly concentrated raw materials will come naturally the formulation of higher-analysis goods, which enable the manufacturer to produce at lower cost and to pass savings on to the farmer. The latter will thus be induced to consume more plant food, especially on the high per-acre cash crops. Table V, prepared by A. L. Mehring and W. H. Ross, gives a breakdown of these operations. The authors may be a little optimistic, but no one will dispute the fact that all-round savings are possible in the production and sale of high analyses.

The average composition and plant-nutrient ratio of mixed fertilizers should reflect the change caused by a higher plant-nutrient content of the raw materials. This change is shown in Table VI.

In 1900 the average composition of mixed fertilizers was 2.0-9.4-2.5, or a total of 13.9 per cent plant nutrients. The N-P_2O_5-K_2O ratio was 0.21-1.00-0.27.

In 1945 the average composition was

TABLE V.—RELATION OF CONCENTRATION TO THE COST OF PLANT FOOD IN MIXED FERTILIZER

Concentration of plant food, %	Equivalent quantity of fertilizer pounds	Processing and distribution cost, dollars	Saving	
			Dollars	Portion of total, %
20	2,000	24.00	....	....
25	1,600	19.20	4.80	40.0
30	1,333	16.00	8.00	66.7
35	1,143	13.72	10.28	85.7
40	1,000	12.00	12.00	100.0

Source: Ross, W. H., and Mehring, A. L., "Plant-food concentration as a factor in the retail prices of fertilizers," Ind. Eng. Chem., News Ed. 12, 430-432 (1934).

3.91-10.29-7.45, or a total of 21.65 per cent plant nutrients. The N-P_2O_5-K_2O ratio was 0.38-1.00-0.72.

We have just seen that the highest concentration in materials has been accomplished by the nitrogen and the potash producers. Triple superphosphate, although available, is not yet generally used by the industry for formulating mixed goods; but a big change in this respect is to be expected within the next five years.

A great deal of research work remains to be done. The job is never completed. This should gladden the heart of the younger research chemists. Uraform is a type of which many more examples will be welcomed. A type of phosphorus carrier is needed, one that releases its phosphate ion at a controlled rate of availability and has the ability to elude the fixing elements in the soil. That is perhaps only a pious hope. The problem is exceedingly difficult. However, considerable research is being devoted to phosphates.

Reports so far released deal with efforts to produce raw materials of a higher P_2O_5 content. There is calcium metaphosphate containing about 60 per cent P_2O_5; fused tricalcium phosphate, 26 to 30 per cent P_2O_5; dicalcium phosphate, with 50 to 52 per cent P_2O_5; and a new phosphate-nitrogen type of material known as dicalcium phosphate - ammonium nitrate, containing 40 to 50 per cent P_2O_5 and 32 to 33 per cent ammonium nitrate. These are all products of the furnace process. With the possible exception of the last, the nature of these phosphatic materials fits them for direct

TABLE VI.—AVERAGE COMPOSITION AND PLANT-FOOD RATIO OF MIXED FERTILIZERS CONSUMED IN THE UNITED STATES AND TERRITORIES

Calendar year	Composition, %				Ratio $N:P_2O_5:K_2O$	Total mixed Fertilizer, tons
	N	P_2O_5	K_2O	Total		
1900	2.0	9.4	2.5	13.9	0.21:1.00:0.27	1,770,600
1910	2.1	9.3	3.4	14.8	0.23:1.00:0.37	3,437,200
1920	2.3	9.2	2.4	13.9	0.25:1.00:0.26	4,062,200
1930	3.1	9.8	5.0	17.9	0.32:1.00:0.51	5,615,907
1940	3.76	9.64	6.5	19.9	0.39:1.00:0.67	5,513,425
1945	3.91	10.29	7.45	21.65	0.38:1.00:0.72	9,457,600

Source: A. L. Mehring (U.S.D.A., Bu.P.I.).

application rather than for use in formulating mixed goods.

Of the new potassic materials only potassium metaphosphate has been developed through the pilot plant stage. It is a highly desirable material containing a total of about 90 per cent plant food represented by P_2O_5 and K_2O. The industry would welcome a good potassic carrier of a relatively low solubility.

Methods of application influence the quality and type of fertilizer. The wise fertilizer manufacturer closely follows developments in this field. We have noted how fast-moving, gasoline-powered farm equipment demanded a free flowing, easy drillable type, and the granulated form met the demand ideally. Distribution by airplane calls for a homogeneous, high-analysis kind. The carrying space of the helicopter is limited, and the speed and the height from which fertilizer is applied require a homogeneous, non-segregating type, best served by the granulated type.

The spraying of plant nutrients, an important method of applying minor elements on citrus trees, recently has been extended to include nitrogen spraying of the apple orchard. The nitrogen sprays are being recommended for the apple orchard only. But I have seen experimental work involving the nitrogen spraying of tomatoes with highly satisfactory results. If this practice grows, the industry will be called upon to produce completely soluble, highly concentrated forms of fertilizers, both single materials and mixed. These new methods of application—airplane and spray—are in the future picture of fertilizer practices and will have to be reckoned with by the trade.

With each new material introduced into the formulation comes new work for the control chemist. He has his problems now, which, no sooner solved, have to be revised. The future will compound those problems and will involve new methods and equipment for sampling and analyzing fertilizers and better methods for the analysis of the minor elements. The future mixed fertilizer will certainly be formulated to provide not only the traditional big three—the N-P-K elements—but at least four of the no less essential elements from among the group comprising copper, zinc, cobalt, manganese, boron, molybdenum, and magnesium.

We are living in a period of great change. He is rash indeed who would try to predict the things to come. For our part, we are conscious that significant changes are in the making. The ferments of evolution are at work in the fertilizer pile. The changes will be met by corresponding changes in the techniques of the chemical control laboratories. Let us welcome change. Where there is change, there is vitality.

Corn in Alabama

(From page 8)

was 77.5 bushels and 29 of these demonstrations made more than 100 bushels per acre. Such high yields, though commonplace in the corn belt, are considered outstanding in Alabama inasmuch as the average of these demonstrations is more than five times our county average for the past 20 years.

What does all this increase mean to the future of Alabama's agriculture? In spite of increased corn production, cotton is still king. Cotton is our number one money crop and indications are that it will remain our money crop for at least several years to come. In Alabama today we are growing over 2½ million acres of corn. This figure exceeds the combined acreage of both cotton and peanuts, Alabama's two biggest cash crops, and when we raise the production of corn from 13 bushels to 21½ bushels, which the Bureau of Agricultural Economics says is our 1948 State average, then we have an additional 24 million bushels of corn produced in the State.

Twenty-four million bushels of corn will produce a lot of pork and beef. It will grow out a lot of chickens and turkeys and will save the dairy farmer from buying corn on his winter feed bill.

Fig. 5. Jack Neighbors, FFA boy, and father with registered Jersey calf presented by Sears Roebuck Foundation in Parker's Acre Contest. Yield, 105 bushels.

Fig. 6. Morgan Sims planted after winter peas and fertilized with 600 pounds of 6-8-8, side-dressed with 200 pounds of ammonium nitrate. Yield, 114 bushels.

Yes, Alabama farmers are learning how to grow corn and to grow it on fewer acres than their fathers did. They will have extra acres to release to pasture and other field crops and the day of our balanced agricultural program and diversification of farm income is not far away.

What Makes Big Yields?

(From page 12)

place it for any particular crop and soil. It is known that from 1½ to 2 pounds of nitrogen are needed to get one bushel of corn increase in yield if nitrogen is the limiting growth factor. Suppose land produces 75 bushels of corn without fertilizer and the grower decides that it is possible to try for a 150-bushel yield. He is likely to need to use 150 pounds or more of nitrogen plus the correction of whatever other controllable deficiencies exist in the soil.

In the use of fertilizers it is important to recognize that not all the fertilizer applied to the soil can be used by the immediate crop. The average for nitrogen is about 50 per cent. Much less of the phosphorus is immediately available, the actual amount being quite variable according to the form of phosphate used, the method of use, the quantity used, and the kind of crop and soil. The available portion varies from nearly nothing up to about 33 per cent. The portion of potassium fertilizer used that is immediately available seldom is as much as 50 per cent and is likely to be much less. These facts must be given consideration in planning fertilizer rates for any particular crop.

Even under the most favorable conditions a considerable portion of unused fertilizer remains in the soil held in some insoluble combination. Some may be entirely lost by leaching. Phosphates, while not much lost by leaching, may be strongly fixed in unavailable forms in the soil. Potash, likewise, may be subject to considerable fixation in the soil. Some of the fixed fertilizer may become available to other crops at some future time. The portion of fertilizer which remains in the soil raises the general fertility level by that much.

Perhaps the soil needs rest from cultivation by growing a sod crop, either grass or a legume or a mixture of both. The sod treatment will do more to improve physical properties, especially the structure, than any chemical treatment can do. Fertilizers used on sod crops show a fruitful response not only in producing more cheap feed but in bringing about fertility improvement.

When is a corn yield likely to be bigger than after a clover or alfalfa sod? Alfalfa has a large root system to open and aerate the soil to great depth. In one report there were eight tons, dry weight, of roots under alfalfa to a depth of six feet, equivalent in organic matter and in fertility value to 32 tons of average wet stable manure per acre. Alfalfa that has been heavily fertilized followed with corn also heavily fertilized, to provide for both major and minor element deficiencies, provides physical and chemical properties of the soil that are as nearly ideal as it is practicable to make them. Assuming that there is moisture and that the spacing, planting date, and variety are well chosen, the yield should be as big as the general environment will permit.

Big yields, therefore, are dependent upon soil properties, physical, chemical, and biological; upon the available moisture supply; upon the climatic conditions; upon the hereditary properties of the plant; upon the control of insects and diseases; and upon any other factors, such as tillage, which may either limit or stimulate growth. To make big yields, the resources of the soil, the air, moisture, sunshine, and light must all be used effectively. Anything less than the most efficient control and utilization of all controllable yield factors will fail to produce the maximum harvest.

Soybean Program for North Carolina

(From page 23)

dustry an opportunity to observe these practices on a farm scale. Over 95 per cent of the 116 demonstrations completed were above the State average. It was difficult to get enough lime for all the farmers to properly lime all of the area which went into demonstrations. About 93 per cent of the demonstrations used the Ogden variety of soybeans recently released by the Experiment Station. All indications point to a spreading of the practice, not only in the county, but in adjoining counties. The fertilizer cost per bushel was less with 0-10-20 fertilizer than with any other fertilizer used in the demonstration, and in addition the 0-10-20 leaves a larger reserve of potash in the soil which should reflect in higher yields on succeeding crops.

Potash in Wisconsin

(From page 21)

metaphosphate and 200 tons of 46 per cent phosphate. If more potash had been available, the ratio would have been still higher in favor of potash. Many of our demonstrators have found that applications of 165 to 200 pounds per acre of potash at the time of seeding has been insufficient to maintain high yields of alfalfa in the second and third years without topdressings of manure.

The recommended application of fertilizer for new seedings of alfalfa-brome grass on our test-demonstration farms is 160 pounds of calcium metaphosphate and from 165 to 200 pounds of 50 or 60 per cent muriate of potash per acre in a five-year rotation, or the equivalent of 500 pounds per acre of 0-20-20. Our experiment station findings would indicate that this rate could be increased profitably to the equivalent of 750 pounds of 0-20-20 per acre on many of these farms, but our rates of application have not been stepped up to that point because of shortage of both T.V.A. phosphate and muriate of potash.

Summary

A summary of yield increases for the period from 1941 through 1948 shows an average increase of 16.1 bushels of oats per acre and 1,530 pounds of hay. The increase in hay is from one cutting only. If we would include two cuttings, the increase would easily be over a ton per acre. The above yield increases are from applications of both phosphate and potash compared with unfertilized check strips.

Both small grain nurse crop and hay increases have been very consistent. The largest average increase on grain was 18.5 bushels per acre in 1945, a very favorable year, and a low of 14.2 bushels in the extremely dry year of 1948. On hay, the high year was also 1945, with an average increase of 1,990 pounds. The lowest increase in hay was 1,087 pounds per acre in 1941. Incidentally, this lowest increase on hay came in the second year of the program following rather light applications of potash in 1941. No field received more than 80 pounds of muriate of potash per acre in 1941 and many of the fields received no potash at all.

Chemical analyses of a small part of the hay samples were run and indicated that both phosphorus and protein have been increased about 12 per cent by the phosphate and potash treatments.

Our demonstrators are not only getting larger yields but are getting more nutritious feed as well. Many of the demonstrators claim that they have doubled the livestock carrying capacity of their farms over a period of five years, and the farm records for these farms verify their claims.

Soil tests in Wisconsin during the past 10 years show a steady decline in exchangeable potash. This is due in part to the large acreages of legume roughages grown in Wisconsin, but the larger part is due to losses of potash in the handling of manure. Since most of the potash is in the liquid portion of the manure, we are recommending the chopping of bedding to make it more absorbent and suggesting the use of superphosphate in the gutters of our dairy barns as ways in which the losses of potash can be reduced.

While the use of high analysis phosphate has been proven profitable in Wisconsin, our results have demonstrated that the use of phosphate alone will not insure catches of legumes and that for most profitable results both phosphate and potash are needed in any soil-building program.

Sesame—New Oilseed Crop

(From page 15)

In recognition of the importance of sesame research, the National Cottonseed Products Association has approved research grants-in-aid or fellowships for sesame breeding at the South Carolina Experiment Station, the North Carolina Experiment Station, and the Texas State Research Foundation. Last summer the Association financed a six-weeks' trip to Central and South America by Mr. Martin for the purpose of studying the commercial production of sesame. He visited Venezuela, Colombia, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, and Mexico, searching for new facts to apply in the sesame research program and to obtain seed of promising varieties. In the current breeding program, three generations are being grown each year by using greenhouses in the winter for two generations and field plantings during the summer for the third.

Preliminary experiments with mechanical harvesting of non-shattering strains have shown that an ordinary tractor-drawn corn binder can be used successfully to harvest the crop. Last summer at one location in South Carolina, an entire acre of sesame was harvested in this manner in one hour and fifteen minutes with only two and one-half man-hours of labor. This operation formerly required the labor of six men for half a day or a total of 30 man-hours. Future experiments are planned to utilize a conventional-type combine in the harvesting work in addition to other mechanical equipment.

Although several years of additional research lie ahead in the development of strains of sesame which will be profitable for commercial production, it appears that this goal is not too far from realization. With it will come the opportunity for a new cash crop for Southern farmers and perhaps those of other sections of the country as well.

Fig. 4. A tractor and corn binder were used at Florence, South Carolina, to harvest an acre of sesame in 1¼ hours, requiring only 2½ man-hours. Hand-harvesting operations take approximately 30 man-hours per acre.

We Turn to Grass

(From page 27)

farm at Mt. Ella, N. C., is fairly typical. Fourteen years ago, Graham's 100 acres were seriously eroded as a result of cotton and corn farming. He had 31 acres of these crops with no soil conservation practices. Now, 20 cows graze a 30-acre pasture on the steepest part of the farm. He has 12 acres in strips of alfalfa and five acres of cotton.

On up in the farm-famed Shenandoah Valley of Virginia, district supervisors said this about progress in 1948: "The tendency here in the Valley seems to be toward grassland farming, leading to better land use. Nearly 50,000 acres were treated with fertilizers and grass-seed mixtures for a dual purpose —to produce better livestock and to prevent costly erosion."

In Kentucky where many farmers for a long time have taken great pride in good pastures, Charles M. Meacham Jr. has spread grass over 170 acres of his 639-acre farm in Union county. Every acre of land on the farm where erosion is difficult to control under cropping is in permanent pasture.

Fifty acres of Meacham's pasture has been in bluegrass sod continuously for 47 years. But he now fertilizes this sod every other year, limes it every five or six years, and has added clovers. This treatment has increased greatly the length of grazing season and the amount of grazing. The 47 acres provide ample forage for 50 cows and calves from April to November.

"That bluegrass pasture is my show window," Meacham said. "It lies along the highway, and I sell all the young stock I raise as a result of people passing along and making inquiry."

In this sweeping shift from row crops to sod crops, many plants, which until recent years were little-used or unheard of by most farmers, are being used.

Kudzu, grown for many years as a shade vine and on gullies, was pulled down from the porches and put to work on eroded acres throughout the Southeast, under the guidance of R. Y. (Dick) Bailey, SCS's Regional Agronomist. Kudzu now produces pasture and hay for our growing livestock numbers on thousands of acres that produced little or nothing useful before.

Sericea lespedeza, another deep-rooted perennial legume, is filling a deep-seated need for erosion control and forage production. Farmers of Harris county, Georgia, have learned that Henry Dyer, an SCS worker assigned to the district, was right when he claimed "An acre of sericea will supply more 'bites' per season than any other pasture crop we can grow."

Probably no grass has ever gained popularity so fast as Kentucky 31 fescue (Suiter's grass). This grass, used in combination with ladino clover or other legumes, is playing a prominent role in the land-use programs on thousands of farms over most of the Southeast.

A good example of how this combination is used to advantage along with other soil-conserving plants is this: Jennings Jones of Murfreesboro, Tennessee, started in 1946 to put each acre on his 458-acre dairy farm to a productive and safe use. Like many farms in the Rutherford District, it had some wet land growing ironweeds, cedar bushes, and sedge grass. Much of the land was depleted and sheet-eroded during the long period when cotton and corn were used almost continuously.

Jones planted 53 acres of imperfectly drained land to fescue and ladino after making open ditches and beds to drain the part where water stood much of the time. He doubled the acreage of alfalfa on well-drained land. He seeded

18 acres of thin upland having plastic subsoil to sericea. Here are some of the results: Jones' 85 dairy cows have more hay and pasture per cow than did the 50 kept prior to 1946. Average milk production per cow has increased by at least 25 per cent. The amounts of grain produced and concentrates bought are unchanged.

Over the nine states of the Southeast, many other plants are playing an increasingly prominent role—each fitted to the land where it is adapted and needed. Some of these are Pangola grass, Pensacola Bahia grass, hairy indigo, blue lupine, button clover, reseeding crimson clover, and Caley peas.

Farmers throughout the South are getting ready for livestock production by putting to grass the lands that are best suited to that use. Undoubtedly cotton will continue to be grown by many cotton farmers. But cotton and other soil-depleting crops will be confined to land for which they are best suited. And the land will be treated so as to keep it in condition for profitable and safe row-crop production.

As complete farm soil and water conservation plans are applied to the farmlands of the South with the resulting switch to grass and livestock, the multiple benefits of wise land use will be more and more in evidence.

Like Autumn Leaves

(From page 5)

ignorance which seeks light is far ahead of a lot of learning that overlooks common things. You have to be real childish and not be ashamed about it, or you won't learn much about the little things that make the world big.

Too many fellows quit wondering about strange plants or birds they see, because they think grown up folks are past all juvenile habits. Too many of the country boys try to look as though they knew almost everything without asking questions—which includes getting themselves good and ready for a lot of duties, responsibilities, and privileges that a chap comes face to face with soon after he gets into long pants.

But there have always been a few smart ones in our valley who kept a sort of fresh outlook on life and yearned to find answers to countless everyday happenings that had nothing to do with barter and trade or making more money. They felt, I suppose, that folks were put on earth to live and help each other understand mysterious workings of nature and then find out how to use that kind of information to help make the world a little better and happier—even if it was only a pretty small and insignificant portion of the earth they influenced.

Some of them just moseyed along and put a lot of spare time into searching among the hills and along the creek bottoms and talking some with the few Injuns who were left among us. These individuals didn't ever make much of a splash as business standards go, and they never got elected to offices or went to work for the state or the government, but they satisfied their own cravings and managed to eke out a living somehow and died happy.

Yet there were several others of an inquiring mind who really stuck to it and had good luck besides. They even got famous in a way and played a part in adding to the store of facts and discovering the way out of difficulties and troubles that beset humanity.

There was a little country girl with a freckled face who liked to listen to the birds a lot and wandered off frequently to wild places in the deep woods, studying bird songs and nesting habits. She made good after awhile, after she was married. She wrote a bird book that didn't read as dry as books of that kind often do, so the publishers had a good painter draw some colored plates for it.

Another person in our valley with a yen for wild things and how they live and multiply decided to work his way through college and get familiar with the fancy Latin names for classes and groups. He got to be an expert with the bow and arrow, too, and never quit trying to write and lecture for country people so they would join in to stop wasting all the benefits the good Lord gave them. He died a year or two ago and left a green memory which doesn't end at our state line either, because his energy and earnestness put him among the nature leaders.

LONG before my time there was a queer and awkward farm boy whose parents were strict and penurious and too religious sometimes, if you know what I mean. He got awful sick of life with father and finally lit out for good and traveled and studied and climbed mountains and roamed among the bears and buffaloes and slept outdoors and took a heap of notes. In the end this persistent man whose whole life was a series of question marks got to be one of the world's authorities on forests and plants and glaciers.

Along back when I was a boy there was a fellow living in a tiny hamlet in our valley who beat everything at flowers and gardens. I guess there wasn't a plant or an herb or a wild flower or a fern growing in the northern states that he didn't know like an old friend. Even poison sumac and poison ivy were among his oldest acquaintances—but not bosom friends, as it were. He could tell you what any blossom was if you got puzzled and sent one to his place with a return postcard. It might be toad flax or vervaine or iron weed or Joe Pyeweed or that strange white ghostly growth they call Indian pipe; or it might be rattlesnake plantain or viper's bugloss—anything. And the womenfolks wrote to him too, because he got to be an expert so that a national ladies' slick paper magazine hired him to run a department. One day after he got pretty old, I went to see him, but he wasn't like I expected, being shy and quiet and glum. When he died the folks in his village put up a stone monument near his old house, although today I suppose only a few visitors ever remember who he was.

South of our valley near a big lake there was an old gent of foreign birth who got excited about Injuns and how they made their arrow heads and tips, having plowed up a lot of them. He kept working away and poking around and imagining he was back in the wilderness by himself and needed something sharp to hunt with. At last he discovered how to chip and carve the flint stones with a piece of bone, doing it deftly like nobody's business. He got famous in the scientific field that deals with ancient crafts, and so delegations came to see him and watch him make arrowheads. Of course, he didn't add a thing to motor mechanics or banking or farm stability, but he opened the eyes of his neighbors and got their respect.

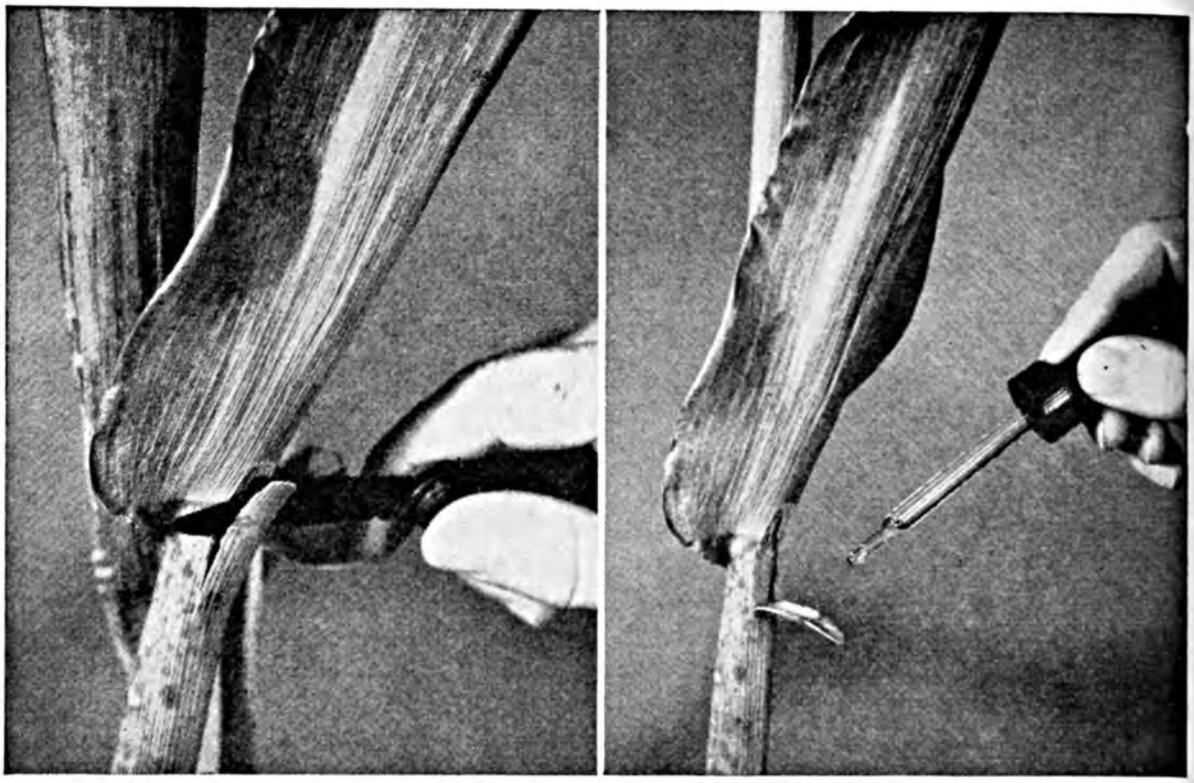
Still another country lad from our parts began trying to cure sick animals and fix broken birds' legs and study animal anatomy. He didn't get far by himself, of course, but he stuck to his dream and went where others could teach him things. He became a noted surgeon and headed up a clinic that treated cases from all over the country—with many of them getting relieved or cured without mortgaging their farms.

WE had a smart farm boy in our valley who figured that folks who called the earth "dirt" were missing its real meaning. His dad had a small farm on poor land and his uncle had a big farm on rich soil. The boy worked on both places real hard, and he wanted to find out why there was so much difference between the crops that grew on those two sections. He couldn't lay hands on any sound advice in his vicinity, so he went through high school and got to agricultural college finally. To make it brief, this man has become a noted soil expert and has invented a few tests they use to improve the sweetness and richness of worn-out farms. If he hadn't looked into things and found out reasons, but had just squatted on his fanny and took what zip there was out of the land without restoring it, lots of farmers would be growing 20-bushel corn.

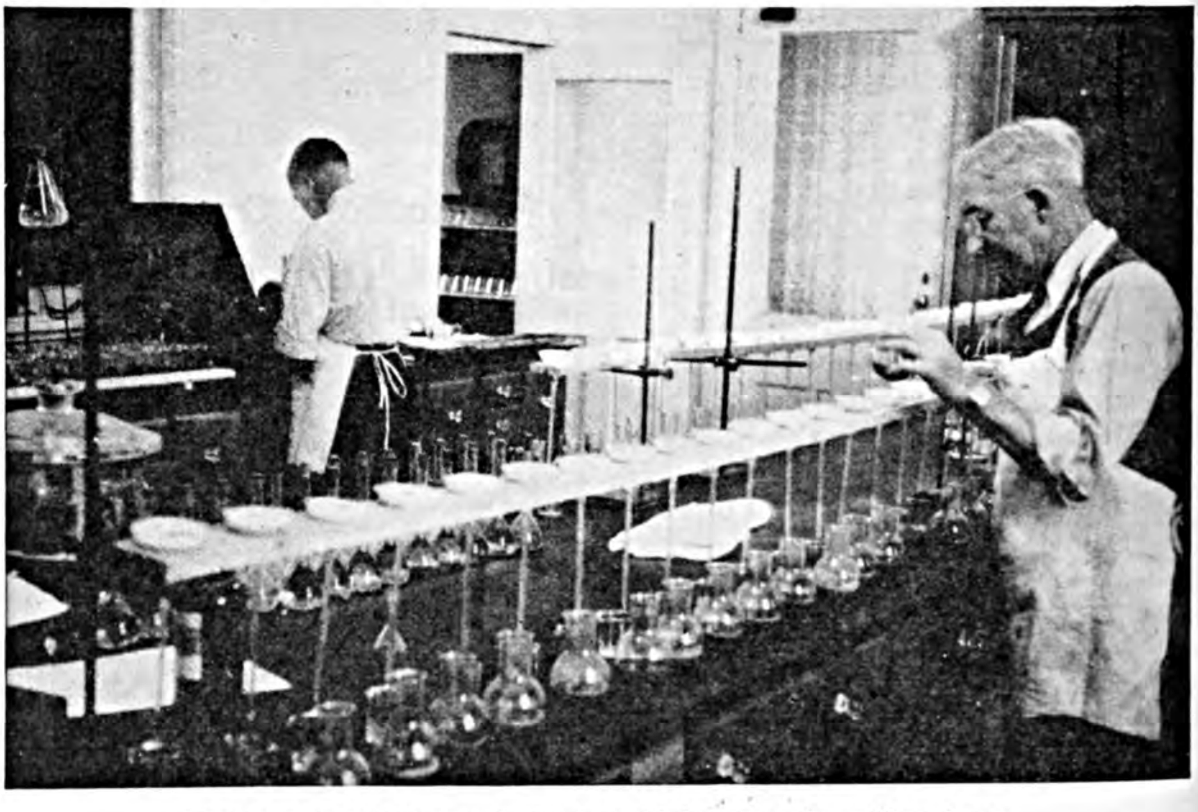
NOT all the ones from our valley with ambitions to get wiser were dealing with material life for its own sake. I could name you a few who got to be teachers of social reform or ministers of grace and rare devotion—which is something that also starts with a question mark, thrives on discouragement, and ends with a prayer. I guess we give too little thought or credit to the teachers and the preachers, and I mean the kind that help folks over rough spots and make them brave enough to face any terrors in this life and the world to come.

So it all stems right back again to the original starting point back in the valley where you and I were raised. It always has something in it to remind you of long-gone autumns and bonfires of musky leaves and heaps of yellow corn between the rows of stalk bundles. It makes you a little sad for awhile, and remorseful maybe, that you didn't do this or avoid doing something else, so that your own contribution might have been bigger and possibly worth more to others.

But it's cheerful to think that autumn comes after a bountiful summer and that when the winter's ice and cold are gone again we shall all have a kind of resurrection into another spell of budding and growing and blossoming. Such ideas will stir up the minds of the young folks who must take our places, and they'll look at the trees and the clouds and the sunshine and begin a new series of questions—from which will come a much finer and safer era, not only for our valley but a long ways farther out.



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

"John, let's don't let the people on the train know we've been married less than an hour."

"Okay. You read a book and I'll go talk to the blonde in Section 13."

* * *

Local Lady: "Doctor, is there anything wrong with me?"

Doctor: "Yes, but it's trifling."

Local Lady: "Oh, I don't think that's so very wrong, is it?"

* * *

When a noted film star got married not long ago and the time arrived for him to kiss the bride, he put all his histrionic ability into it, making it last on and on until a kid's voice rang out in the church:

"Mommy, is he spreading the pollen on her now?"

* * *

We were at a mountain cabin of a friend for the opening of the hunting season:

We (to old timer)—"What's the weather going to be like tomorrow—Fit for hunting?"

Old Timer—"Don't know, boy. Used to be, man could always judge about the weather. Now the government has took it over and you can't tell what the hell it will do."

* * *

"My grandfather lived to be over 90 and never used glasses."

"Well, lots of other people prefer it out of the bottle, too."

The very small son of a contractor asked his father, "Daddy can I have a baby brother?"

The father absorbed in his contracting business replied, "I don't have time, son."

To which sonny replied, "Can't you hire some more men daddy?"

* * *

"Jack dear, why are some women called Amazons?"

"Well, my dear, I remember learning that the Amazon River has the largest mouth—"

And then the door slammed.

* * *

Necking Party: "An affair that lasts until someone gives in, gives up, or gives out."

* * *

Judge: "Lizz, you're charged with running around in the nude."

Lizz: "It's des way, Jedge, when my Henry comes home drunk and wants to beat me, I pulls off my nightgown and runs out in the dark so he can't see me."

* * *

The little girl showed unusual interest in the church wedding and then suddenly turned to her mother with a puzzled expression.

"Did the lady change her mind?" she whispered to her mother.

"Why, no, what makes you think that?"

"Cause she went up the aisle with one man and came back with another," the child replied.

Printed in U.S.A.

Better Crops with PLANT FOOD

November 1949 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

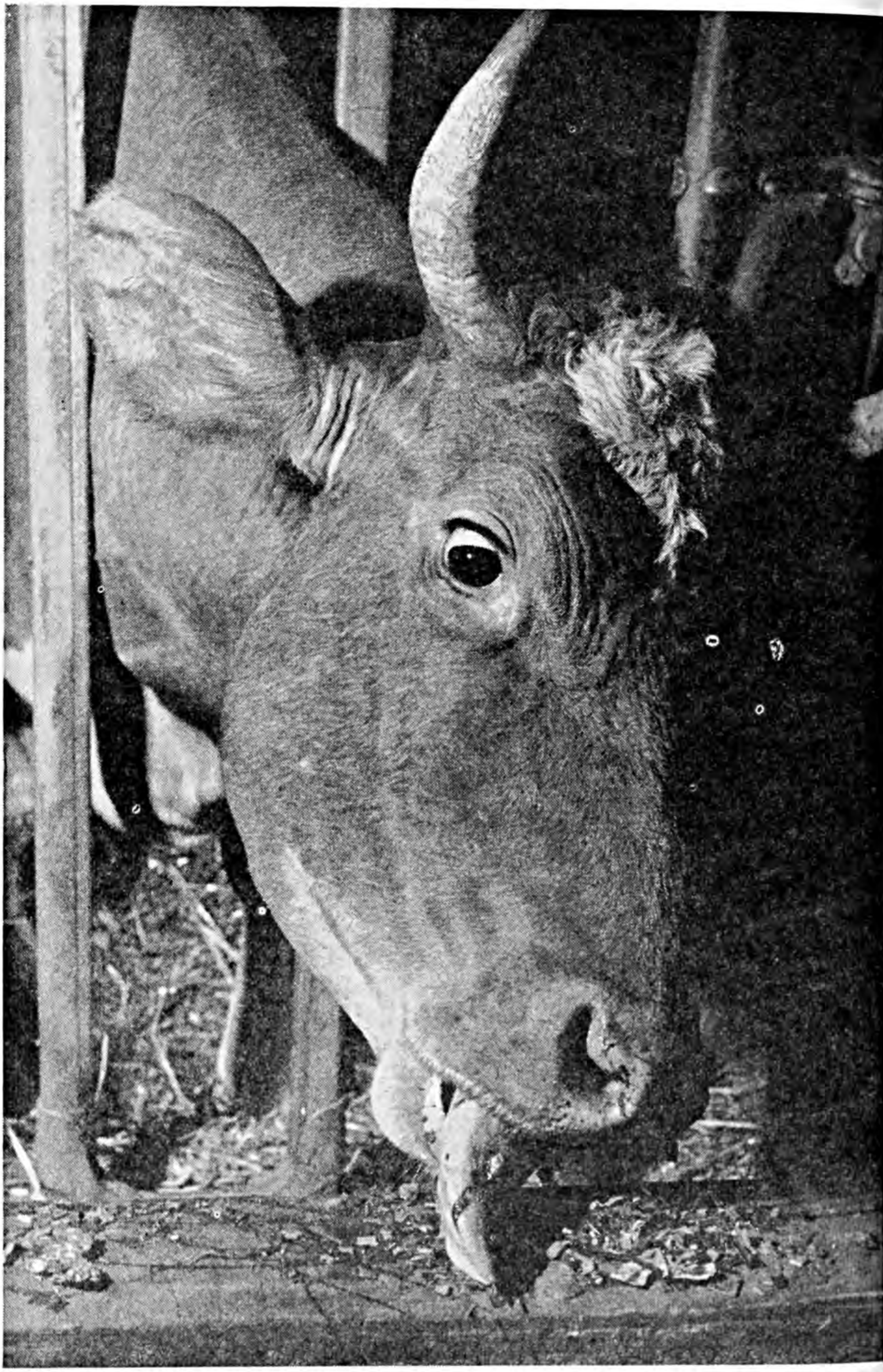
VOLUME XXXIII NO. 9

TABLE OF CONTENTS, NOVEMBER 1949

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America



"Good to the Last"

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON, D. C., NOVEMBER 1949 No. 9

Retired but . . .

No Quitter!

Jeff McDermid

OF all the habits of a long lifetime, top rank among those most difficult to shake off goes to the "American Way of Life," which usually includes a love of work for the work's sake, a fetish for regularity and consistency, and a compelling desire to "stay on the job" as one comes closer to the customary or required "time of retirement." But the field of opportunity is wide for men of good will, and so much depends upon the reason for retirement, the circumstances surrounding it, and the physical condition of the man himself that a dealer in mushy platitudes and copybook mottoes must beware and discriminate lest he offend in dishing out advice.

When we were young, as you perhaps still recall, we also hated the words "quit" and "retire," that is, except for the end of a long schoolday or the close of an irksome chore. Young Americans always shrink from quitting their playtime diversions and protest the admonitions of elders to retire for the night.

I think that persistent opposition of the young toward any quitting or retiring from activity and enjoyment grows on one through the years and animates much of our thinking even after there are no longer any presiding authorities to govern our coming and going and our periods of zest and rest. I have heard tell that Europeans and tropical dwellers alike have a different ruling passion in respect to labor and leisure. In the one case by custom and in the other by climate, many of them take naturally to repose and retirement, to siestas and idle whimsies. Indeed, they go so far as to chide and scoff at us Americans for being so enthralled with our desks that we miss the world's delights and wind up too weary to take up an avocation when our vocation itself has run its course.

During my writing career I have had occasion at times to take notes on the achievements of some worthy man's life so that a suitable "work obituary" might be prepared to give him proper recognition and satisfaction in the field from which he was about to "retire." Invariably I have edited my efforts thoroughly to rid the wording of any thought which might convey rank idleness, declining powers, good-riddance, or mournful resignation. I borrowed the theme of rugged Liberty Hyde Bailey of Cornell instead, to carry the idea that this person was not laying aside his profession or his talents or his strength, but merely transferring them from routine grooves to a wider and broader line that previous experience and wisdom had fitted him to enter.

FOR background to that, you recall that Dr. Bailey's suggestion is that you are lucky to reach the time when you can leave a prescribed post with its limitations to really begin to be your own boss and seek the goals so long postponed—or something of that nature. It means that during a whole lifetime of specialized effort and study one crosses intriguing paths that lead off into attractive places. Yet, if you are a woodsman guiding a party direct to the nearest objective, it is treason to stop and chase off willy-nilly after strange calls, wafting scents, and distant vistas. No, you leave that fond pleasure for a time when you are alone and undisturbed by responsibility, when you can make a campfire on some wild promontory and gaze off at the clouds, the mountain mists, and the eagles in the sky. And you don't have to be crazy or erratic or neurotic to follow such a dream.

Now, as I noted before, all this romantic side of retirement is just so much bilgewater to anyone whose health is spent and who must quit his accustomed toil and breadwinning perforce unwillingly. Let us omit such persons from our present discourse, for their happiness rests on a degree of fortitude for which few have any recipe. (Save that of Christian courage.) And so, returning to my "work obituary," it is safer and better to include some hint therein that the subject of the sketch is still an active consultant, a pursuer of facts and studies, who is making good use of spare time to extend the scope of knowledge or good will, with no thought of idling or drifting to an inglorious exit.

THERE are also those who really quit the fields in which their life has been spent, to relax and refresh themselves with games, sports, social diversions within their strength, or trips to a far country. I have seen numbers of these elderly fellows seated in clubrooms around smoky card tables, or chalking cues, or lugging golf bags—tackling anything but tennis. Some of us who do not have a happy faculty for convivial hours or whose skill and liking for games and contests have never been strong find little relief or comfort in store if retirement means just "resting."

Strange enough, we who are not fortunate in this respect begin to wonder and worry lest our boon companions will avoid us because we do not care for hunting, sporting, or traveling. Yet this is just an idle fancy, because what things a man considers relaxing and enjoyable to himself are really the things he needs and must indulge in—regardless of what form the other guy's recreation takes. No matter how vast the volume of work a fellow has performed in his favorite field, the world always has dark corners left and unsolved points to wrestle with right within that science or that craft. If your own work is your main hobby, keep right at it.

Your own reputation and standing will usually justify it and see you through with satisfaction. For heaven's sake do not lay it down to learn poker or pool. Leave that to the chaps who need outside stimulus to keep mentally vivacious.

There's another class of men who come to retirement without enough substance saved to see them through. As in cases of those who are ill and failing, few of us are able to offer much but sympathy and perhaps some tem-

porary task to tide them through awhile. Here again we face a situation wholly beyond advice or ordinary remedy. It is here that the progress in remedial social legislation finds its most glorious fruit. The old, outmoded way—depending upon the children or the poorhouse on the hill—is a shameful reminder of an age of materialism.

So, then, for the most of us who are neither invalids nor paupers, there should be nothing upsetting in the act of quitting a certain group of rooms or set of people or time of beginning or ending a day's routine. To admit that we are stumped by customary scenery being taken away is to admit that we are not much more than machines and marionettes. We do not quit because we are sick. We do not quit because we are mentally failing. We do not fear to quit for lack of money. But we do quit because we are too old and too smart to stay on and miss the opportunity to be ourselves instead of being in somebody's way.

Yet I have a quarrel with some of the rules of the retirement system, wherein certain corporations and some government offices take an arbitrary digit and set that down as the end of any and all employment. I know several fellows who went on the retirement list in far better vigor and health than many of the men half their age who were retained under the rules in force. This can be dismissed with the thought that the employing agency may have been the loser.

Solace and happy reflection for mature workers who approach the time when they must quit what they are presently doing to enter a more purposeful and self-directed era have been the theme of philosophers for countless ages. Maybe a few quotes from ancient sentiments of this kind may not be wholly lost.

IN an old English Reader issued at Utica, N. Y., in 1832, there is a piece about "virtuous sensibility" and what it does to him who possesses it, when other things fail.

"The good effects of true sensibility on virtue and happiness admit of no dispute. . . . Even the face of nature yields a satisfaction to him which the insensible can never know. When he beholds the spring coming forth in its beauty and reviving the decayed face of nature, or in autumn sees the fields loaded with plenty and the year crowned with all its fruits, he lifts his affections with gratitude to the Great Father of all and rejoices in the world about him.

"His powers are much more frequently called forth into occupations of pleasing activity. Numberless occasions open to him of indulging his favorite taste, by conveying satisfaction to others. Often it is in his power to soothe the afflicted heart, to carry some consolation into the house of woe.

"In a circle of friends enjoying one another, he is as happy as the happiest. He lives in a different sort of world

(*Turn to page* 51)

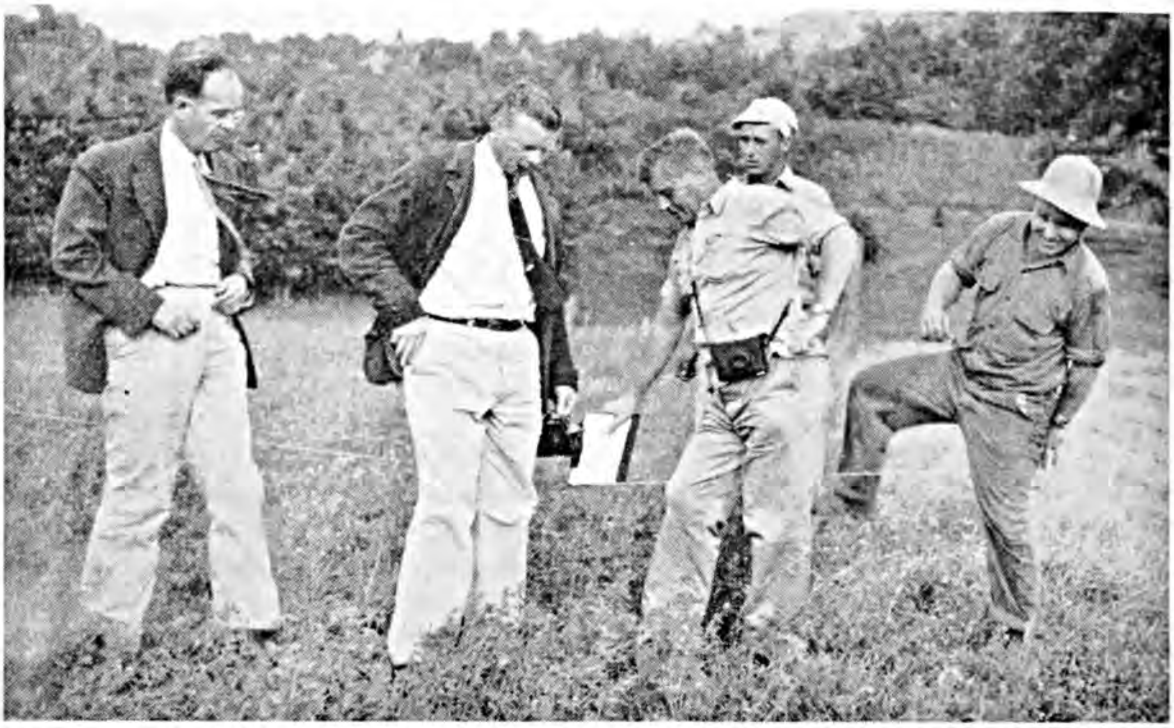


Fig. 1. The Reed Brothers, of Claremont, stood high in the Green Pastures program in New Hampshire. In the picture, from left to right, are Louis Zehner, New England Chairman; Stanley Colby, County Agent of Claremont; Ralph Littlefield, New Hampshire Extension Agronomist and Chairman of the New England judges; and the Reed brothers themselves. Note the heavy pasture growth in August, also the electric division fence which everyone regards with caution.

Things Learned from the 1949 N. E. Green Pastures Program

By Ford Prince

Agronomy Department, University of New Hampshire, Durham, New Hampshire

THE second New England Green Pastures program has now been completed. For a time during the summer of 1949 it appeared that the extreme drought would interfere with judging, if not suspend it altogether. In spite of this midsummer drought, which was the worst in the 75-year history of weather bureaus in the area, and summer temperatures that averaged four degrees above normal, judging went forward on schedule. Many excellent pasture programs were found and some observations were made which should be valuable in future years, whether wet or dry.

The regional judges who picked the three top pasture programs in each of the six New England States secured fairly complete data. These data present an accurate picture of the methods on each of these farms and not only furnish a clue as to why these farmers were up at the top of the heap in their respective states, but outline the forage pattern which is now so well defined amongst the progressive dairymen in the area.

Again, as in 1948, the soil-fertility programs of these men stand out as being more or less revolutionary when compared with the ideas of the fertility needs of forage crops in the immediate past. If these records mean anything, it is that to produce high yields of forage, lime and fertilizers must be skillfully used, and used in abundance.

State and regional judges have emphasized this point by saying that in the drought, those men who had kept their soils in a high state of fertility had made better pastures and hay crops than those whose use of fertilizers was more limited. From this point of view, then, we have learned something from the drought.

An analysis of the figures on these 18 farms shows that they had 2,471 acres of field land and 248 acres of improved permanent pasture, or a total of 2,719 acres which were being regularly limed, fertilized, and manured. They kept 1,102 cows and 407 young stock for a total of 1,306 animal units, or almost exactly an animal unit on each two acres of land. To do this, high fertility is certainly required.

During the year, these farmers used 1,430 tons of lime, which is just over a half ton for each acre of improved land and amounts to more than a ton of lime for each animal unit on the farms. Here, then, is the basis for a good fertility program, a liming procedure that has been going on on these particular farms not just this year alone, no doubt, but for many years.

In respect to the amount of fertilizer used, the data show that these 18 farmers purchased 815 tons of fertilizer during the year. This averages 600 pounds for each acre of land in feed crops and gives a total of 1,250 pounds for each animal unit on the farms. These amounts per acre and per animal unit are slightly higher than the figures indicated for the 1948 winners, but not significantly so. What they do emphasize, it seems to me, is that the new pattern for fertilizing forage crops is now at around 600 pounds per acre. Where it will go in the future can only be conjectured and will undoubtedly depend upon economic factors, the trend into irrigation in the area, as well as a continued trend into more intensive roughage programs.

Since these top men are relying very

Fig. 2. The aim of the Green Pastures program is to stimulate the development of pastures like this one on Sumner Brown's farm, West Swanzey, New Hampshire. Five acres of ladino, with irrigation, fertilized lightly after each grazing, fed 27 head through most of the season of 1949.

heavily upon ladino clover and alfalfa in mixtures with grasses, we have been very much interested in the fertilizer grades and ratios which they have used. Fortunately, this year we have a complete record of all fertilizers purchased on these farms. Breaking these purchases down into the various grades and materials shows the following:

Materials	Superphosphate	287	Tons
"	Muriate of potash	46	"
"	Ammonium nitrate	2.5	"
Grades	0–14–14	185	Tons
"	5–10–10	96	"
"	3–12–12	72	"
"	8–16–16	38	"
	Miscellaneous [1]	88.5	"

It will be observed that this list of fertilizers does not include the manure produced on these dairy farms, although it does include 285 tons of poultry manure which was purchased or otherwise secured from nearby poultry growers. In evaluating this poultry manure, we have assumed that it carries in one ton an amount of plant food which is equal to one bag of 10-10-10 fertilizer. This, in view of recent poultry manure analyses, is a conservative figure.

If, then, these total purchases are reduced to their plant-food elements and if we calculate an average value for each ton of plant food applied, the figures show that this fertilizer would approximate a 2-14-10.5 grade for the whole lot. The phosphorus content of the average grade is higher than that for potash, it is true, but this is not surprising. Most of the superphosphate is distributed under the government programs and, at the moment, it is somewhat easier to get phosphates than potash. At the same time, the tendency is to balance the phosphates with potash pound for pound, even though actually it wasn't quite achieved. For balancing these two nutrients in the production of clovers and alfalfa there is ample proof.

Furthermore, if we carry the plant food applied one step further and add to it the cow manure which was used on these farms, it is apparent that these farmers are applying actually as much potash as phosphates, since cow manure is higher in potash than it is in phosphoric acid. To make this computation, I have assumed that each animal unit produces eight tons of manure annually, which is saved and returned to the land. Using the average value usually ascribed to farm manure of this kind as containing 10 pounds of nitrogen, 5 of phosphoric acid, and 10 of potash, (although I realize that these values may be slightly shopworn) and adding these figures to the plant food purchased, we arrive at a fertilizer which is almost exactly in a 1:2:2 ratio, or one which approximates a 5-10-10 or an 8-16-16 fertilizer.*

The fundamental reason for the dependence of these farmers upon fertilizers high in potash and phosphoric acid is revealed by their cropping systems. Ladino clover, of course, stands out as their major pasture clover, with alfalfa a prominent crop on 10 of the 18 farms. All of these men were growing ladino clover. In point of acreage, ladino mixtures occupied 55 per cent of the tillage land on these farms, with alfalfa or alfalfa and ladino mixed occupying another 20 per cent of the acreage. This means simply that three acres out of four on these top farms were in legumes or legume mixtures, and, of course, legumes are heavy users of potash and phosphorus, as well as lime.

This drought year has been a good one to test farmers in producing feed and to test the efficiency of crops under extremely dry conditions. Frankly, it has not been a good ladino clover year. Alfalfa has shown up to much better

(*Turn to page* 50)

[1] Miscellaneous grades include: 7-7-7, 10-10-10, 5-12-20, 5-12-8, 4-12-4, 6-9-12, 3-12-6, and poultry manure brought onto the farms from nearby poultrymen.

* Note: According to these calculations the actual amount of plant-food elements applied on these farms was nitrogen 134,000 lbs., phosphoric acid 282,000 lbs., potash 275,000 lbs.

Irrigation Opportunities in the Southeast*

By W. B. Camp

W. B. Camp & Sons, Inc., Bakersfield, California

IRRIGATION is used so little in the Southeastern States, with their supposedly ample rainfall, that in advocating it one runs the risk of being labeled "fantastic" even though irrigation could lead to better farming in many areas. I am perfectly willing to run that risk, or to advocate any other agricultural change or development that will enable Southeastern farmers to produce "a quantity of quality product on the same acre."

Good farmers everywhere are continuously trying to reduce production costs by growing bigger and better crops. Farming is the most competitive business in the world. Successful farmers are those who can do the production job both better and cheaper. They know—just as surely as water runs downhill—that the consumer's dollar is eventually going to the farmer who can grow both quality and quantity and do it economically.

Irrigation Has Limitations

Irrigation, of course, has its limitations. I certainly am not advocating for the Southeast any blanket use of irrigation. As a matter of fact, the greater percentage of Southeastern land probably should not now, or ever, be considered for irrigation. Certainly not every acre on every farm in the Southeast could possibly be considered for irrigation.

On the other hand, irrigation also has its possibilities and its opportunities, and I submit that these are worthy of greater exploration and greater study. This is particularly true where farms or fields are adjacent to or near a free water supply such as a river, creek, lake, or inexpensively constructed pond.

Agricultural progress is built on the overcoming of obstacles. Our forefathers cleared the forests. Since then, succeeding generations have labored to keep the soil fertile, to develop better production methods, and to lower unit costs.

In this battle to obtain "a quantity of quality product from the same acre," agriculture has had the invaluable help of science and the technical skills. As a result, most good farmers know—whether they actually practice them or not—such basic things as how to take care of their soil and the other essentials to crop growth and maximum yields. I believe that these same good farmers who have been quick to adopt new developments once they had been proven are the very ones who will eventually look on irrigation as a tool of production that will give them increased yields and higher-grade crops.

I was born and raised on a South Carolina farm. My education was obtained in South Carolina schools. Since I finished Clemson, some years ago, most of my farming has been and still is in California. However, at the present time, my two sons and I are developing some cattle properties in the Piedmont section of South Carolina.

* From an address by W. B. Camp, W. B. Camp & Sons, Inc., Bakersfield, Calif., before the Association of Southern Agricultural Workers, Baton Rouge, La., February 1, 1949.

Out there in California, where I am, we live by irrigation. Without it we wouldn't farm, we could not farm, except possibly a little ranching on those dry lands. In this respect, the Southeast has a wonderful advantage over the West. Out there we have to raise all, or nearly all, of our crops with irrigation water. The Southeast would need only to supplement its rainfall, which is not often very deficient.

Crop Insurance

To the Southeastern farmer who can obtain irrigation economically, this man-made rain could undoubtedly be the finest "insurance" he could secure for his crops. Just as the average good farmer, as a matter of good business, carries fire insurance on his barn, many Southeastern farmers could insure "a quantity of quality product from the same acre." But, just as the farmer has to obtain and carry that fire insurance so it will be there ready to help him in case his barn burns, he ought to have his irrigation equipment in and ready so it can prove its value in times of drought.

Sometimes the application of a small quantity of water makes the difference between an abundant crop and a partial or total failure. I am sure that those of you with farm background can recall the terrible experience of watching a growing crop literally burn up in the field while waiting for rain. How wonderful it would have been to have been able to control the moisture on those crops, to have been able to apply life-giving water at the proper time, to have saved the tremendous economic loss and resulting heartaches in the farm home.

I can recall at home in Cherokee county, South Carolina, that we seldom if ever made a crop that did not suffer at some time during its growth from lack of moisture. In an area with about a 47-inch rainfall, its hard for the dry-land farmer to see the need for irrigation here. But it does exist, for these Southeastern lands do not seem to hold water like the lands in the West do. There, a watering will often last for weeks. Here, a shower is largely gone in a week or two at most.

Weather records for the past 42 years at the Columbia, South Carolina, Station show the following number of drought periods during that time: 117 periods have run from 14 to 21 days; 79 periods have run 21 to 27 days; and 69 periods have run over 27 days without rain.

Thus we see that during the past 42 years we have had a total of 265 drought periods that were sufficiently protracted to seriously damage a crop or entirely blast the harvest, if it hit at the critical time. The record at Columbia is doubtless representative of the entire Southeast. That's a little over six drought periods a year. Weigh that against crop yields.

In most of the irrigated areas of the country, getting suitable water for irrigation is the problem. In the Bakersfield, California, area where I live, the water comes from deep wells and has to be pumped. One well will take care of about 160 acres, roughly, and it costs $10,000 to $25,000 to drill and completely equip with pumping plant. The land has to be leveled and periodically planed. So you can see that all of this adds enormously to the capitalization of farming there. The same holds true where water comes by gravity from the large irrigation basins that have to be paid for.

Nature Favors Southeast

It's obvious that the Southeast is favored in this respect. It is one of the best watered areas in the country. The mountain areas, where most of the streams originate, have heavy waterfalls. In fact, a considerable strip of the Southern Blue Ridge mountains shows a rainfall in excess of 72 inches. Only one spot in the Nation equals that, and it is a small area in the Northwest.

The Southeast has a dependable water supply, whereas irrigation wells vary and sometimes become pumped out. Streams vary and threaten the great irrigation areas at times, and there is a fight for water rights in the old, dry irrigation areas. But here in the Southeast the ancient streams go to waste down their channels to the sea, as they have done for ages, while crops often wither and perish on their very banks.

With costs mounting on every item that goes into a crop, we will be foolish if we do not look into every means of lowering costs and increasing yields. The know-how is at hand for making big yields of all crops. Improved varieties, cultural methods, and the like make this so. We can usually control insects and most other hazards and make good yields, if we get the water. With modern irrigation systems that do not require leveling of the land, and with good fresh water going to waste by many a field in the Southeast, I am wondering if this area will be long in finding out more about the possibilities of the man-made shower to insure the harvest here.

Irrigation in South Carolina

Something is being done toward exploring the possibilities of practical irrigation in South Carolina. Some of the other Southeastern States are making similar moves. South Carolina has an Extension Engineer available to help farmers plan and develop irrigation. And I am told that farm calls are now keeping him busy. The Experiment Station has started experiments in irrigating crops on rolling lands. Encouraging reports come from those farmers who are getting irrigation started on their farms.

In York county, Mr. Cloinger got seven good cuttings on his irrigated alfalfa during 1948's dry summer while other plantings in that area yielded but three to four meager cuttings because of lack of moisture. He irrigated from his farm pond and is building another in order to have more storage for water.

In Greenville county, the high yield of corn for 1948 was made on irrigated land. There were other fields that had just as good a chance, except this one had the needed shower applied through irrigation at the right time. It made 162.24 bushels of dry corn per acre, as determined by Clemson College, while the other similar fields made from 80 to 100 bushels. There were enough stalks and fertilizer for them to have made more, but there was not enough water.

Normal Rainfall

Experience indicates that normal rainfall can't usually be counted upon to make more than 80 to 110 bushels of corn per acre, and it takes a pretty favorable season to do that. But, according to this Greenville experience, the added water can push that up by something like 50 per cent in a fairly good corn year. If it had been a bad dry year, as often comes in that section, the benefit from this irrigation would likely have been even larger. That water came from the creek that was flowing to waste along its ancient channel by the field, as it had done for ages, until the farmer put some of it to work for the first time.

In 1946 the cantaloupe crop in the Blackville area was ruined by drought in May. One man reached part of his field with irrigation. From that, he sold $253 worth of cantaloupes per acre. From the rest of the field, none.

At Clemson last fall, Dr. Garrison produced a bumper crop of late tomatoes with irrigation when it was so dry that others were of little value. He saved them twice from frost by turning the water on before day and washing the frost off before the sun struck them. This extended the season several weeks and added greatly to the yield.

In Chester county, Porter Gaston kept his pastures lush and green during the summer while others around him became parched. "Skeet" Allison of Richland county did the same thing with sprinkler irrigation from a stream that flows by his pasture.

In Greenville county, Earl Taylor saved his early peach crop from the

May drought by irrigation. His irrigation worked well on his fall tomatoes, too. He is putting in more ponds for more water storage. Dave White, at McBee, has pioneered with irrigation on his sandhill peaches, having to pump the water over a mile and raise it over 100 feet. But it has given him some of the finest peach crops in the State, despite dry years. He has practically no small peaches or culls, while other orchards there are making mostly marbles due to drought.

Several large truckers along the coast have been irrigating for some years. They say now, after these years of experience with it, that they would not try to farm a piece of land that couldn't be reached with the showers that they control.

These examples are from my native State of South Carolina. Other Southeastern States have similar case histories.

In Other States

The North Carolina Extension Service is promoting the widespread use of farm fish ponds. In many instances irrigation is going hand-in-hand with the ponds. Truck farmers in eastern North Carolina for some years have found irrigation profitable. On some of the mountain farms surface irrigation is widely used, with water being drawn around the hills in open ditches. Experimental irrigation on tobacco fields is going on in Wake and Halifax counties. Guilford county farmers are using irrigation on their pastures, and general farmers in Rowan county have been irrigating for years.

In Georgia, the number of irrigation systems has increased five times since 1945. Nearly 5,000 acres of all types of crops are now under irrigation, and the Georgia Extension Service estimates that this acreage will be increased considerably in the near future. Georgia dairy farmers who have found they can double their winter pasture grazing are among the most enthusiastic boosters of irrigation.

The Florida Extension Service reports that irrigation is rather widely used in Florida now for both citrus fruits and truck crops. Sub-irrigation, surface, and overhead irrigation are used on truck crops. As irrigation proves its value on truck and citrus, it no doubt will become widespread in Florida.

In Mississippi, the State Extension Service reports that its engineers are observing several irrigation installations. The State has between 50 and 100 acres of truck crops being grown experimentally under irrigation. Results so far have been so satisfactory that commercial truck crop growers are being advised to put in irrigation facilities, especially for growing fall crops for market.

In Louisiana and Arkansas, large-scale irrigation for rice is a "must" and has been routine in that area for a long time. In the Louisiana strawberry belt, many small farms are irrigated with individually operated systems using shallow wells. Most berry farmers have similarly simple systems and in many years would be unable to grow plants without irrigation.

The Louisiana Extension Service reports that during the past year 14 vegetable growers between Baton Rouge and New Orleans have installed pumps to draw water from the Mississippi river. There are other systems used by vegetable growers below New Orleans. Louisiana gets ample moisture, but often at the wrong time of the year. The vegetable growers get most of their dry weather during the fall, and not infrequently find their irrigation systems useful in the spring as well. On experimental sweet potato plots, Louisiana has found, in some years, that irrigation has increased production by 50 to 100 bushels to the acre.

It's not geographically in the Southeast, but we all like to claim Texas as a "Southern" State, so I don't believe the folks in the biggest State of all would mind my using some of their irrigation figures.

(*Turn to page* 47)

BARLEY RESPONDS TO POTASH

Fig. 1. Barley yield was increased by 10 bushels per acre where 0-20-20 was applied as compared to 0-20-0 on the farm of Douglas Goodrich, St. Croix county, Wisconsin. Both fertilizers were applied with a combination fertilizer-grain drill at the rate of 200 pounds per acre.

Why the Push on Potash

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

POTASSIUM (commonly referred to as potash) is an essential element of plant food. In fact, it is one of the so-called "critical" elements. More and more, soils in Wisconsin are becoming deficient in their supplies of available potassium.

The lack of potash reflects itself in the stunted growth of many crops and their inability to produce vigorous, healthy leaf growth. Potassium is in some way related to the synthesis or formation of starches, sugars, and cellulose or fiber. Sugar beets, potatoes, cabbage, hemp, tobacco, and onions—in fact all of the bulb and root crops as well as fiber crops—are heavy feeders on potash. Corn and all members of the legume family, such as alfalfa and clover, are likewise very heavy feeders on potash.

The percentage of potash in mixed fertilizers is always that amount expressed in the third figure of the formula. Thus, a 4-12-8 fertilizer grade contains 4% of nitrogen, 12% of phosphate (P_2O_5), and 8% of potash (K_2O). When we speak of potash we are actually referring to the element potassium. The chemists in early days got into the habit of calling the oxide of potassium *potash*. The word *potash*, then, is usually used when speaking of the salts or oxides of potassium, whereas the word *potassium* is used when we refer to the element itself.

Theoretically, there is enough total potassium in our soils to meet the requirements of our crops for a good 200 years. But it is not becoming available fast enough to satisfy the requirements of even average-yielding crops. In other words, much of the potash in our soils is a "frozen asset." Actually, we have been using up this diminishing supply of potash as fast as it becomes available from the native stores of potassium-bearing minerals in the soil. Hence the need for supplemental applications of potash fertilizer in order to make possible the production of good yields of farm crops.

Soil Tests and Field Demonstrations Reveal the Lack of Potash

Twenty-five years ago soil tests indicated that phosphate was the chief limiting element of plant food. Next in line was potassium. In those days a good 75% of our soils showed a deficiency of available phosphorus, but only 50 to 60% of these soil samples were deficient in available potassium. Now, however, tests show that supplies of available potassium are relatively lower than those of available phosphorus. Tests made on 166,464 soil samples during the past five years showed 71% deficient in available phosphorus, whereas 79% were deficient in available potassium.

Field demonstrations with fertilizer support the findings of our soil tests. The average of 735 grain demonstrations carried out over a period of the past 16 years gave increases of 10½ bushels where straight superphosphate (0-20-0) was applied. Where potash (0-20-20) was added, yields were increased by 17 bushels. But that is only part of the story, for the residual benefit of fertilizer applied at the time of seeding resulted in substantial increases in the yield of clover and alfalfa the following year, and here potash has played an even more important role. The 0-20-0 plots made an average increase of 1,340 pounds in yield of legume hay; on the 0-20-20 plots there was an average increase of 2,101 pounds of hay.

One reason for the diminishing supply of available potassium in the soils in Wisconsin is the fact that we have wasted tremendous amounts of it in the careless handling of stable manure. We have been shortchanging our cropland in the plant food returned in manure applications. When we realize that from 70 to 80% of the potash contained in crops fed to animals is voided in the liquid manure, we can readily appreciate the reason for the diminishing supplies of this valuable plant food. More and more, farmers are becoming aware of this fact and are doing everything possible to prevent losses of this liquid portion.

Wisconsin livestock farms are losing potash at a more rapid rate than are the farms in the corn, soybean, and grain-growing states, where most of the residues of these crops go back on the land. Most of the potash taken up by a crop of grain is in the straw, and where combined, the straw is usually left on the field to be plowed under. The same is true for soybeans. Where corn is husked in the field, the cornstalks are left on the land, and when plowed under, return potash and organic matter to the soil. However, where crops such as alfalfa and clover and corn are harvested and fed to our livestock, there may be, as pointed out, a considerable loss of potash in the handling of animal manures. Authorities tell us that on the average farm not more than 45% of the potash contained in crops fed to livestock actually finds its way back to our fields in the manure.

The great increase in the acreage of alfalfa on farms in Wisconsin in recent years has resulted in pumping potash out of our land at an accelerated rate, and this is in part responsible for the rapid decline in the supply of available potassium in our soils. In fact, it is my belief that in recent years the lack of potash in Wisconsin soils has been more responsible for short crops of alfalfa and clover than has the lack of phosphorus.

In the early days, wood ashes were an important source of potash. We read in early American history where trees were cut and burned for their ashes, these ashes leached, the potash extracted, and this potash shipped to Europe.

Prior to World War I, the potash used in America came from the German mines. Since then potash has been extracted from the brines of certain salt lakes of California and Utah; in fact, one of our largest potash refining companies is located at Trona, California, where the brine of an old lake bed is the source of thousands and thousands of tons of potash fertilizer every year. Beginning in 1931, the large deposits near Carlsbad, New Mexico, have furnished even larger amounts of potash for agriculture and industry.

Speaking of wood ashes, most farmers have observed that where brush piles were burned in the field, clover and alfalfa grow luxuriantly. Wood ashes carry from 3% to as high as 8% of potash. Of course wood ashes contain from 60 to 70% of lime and some phosphate as well. Nevertheless, it is the high potash content of these wood ashes that makes them so valuable as a fertilizer for legume crops.

Also observed has been the fact that an abundance of potash in our soils results in stiffer straw in our grain crops. The stubble of grain in those spots in fields where brush piles were burned literally bristles, and new seedings of clover are frequently found to be knee-high in the fall of the same year in these spots, whereas the seedings in the rest of the field may be just a bare "catch."

(*Turn to page* 41)

LEGUMES RESPOND TO TREATMENT WITH POTASH

Fig. 2. The response to treatment with potash may not always show up on the grain (nurse crop) the year seedings of clover or alfalfa are made, but the residual effect of potash in the mixture will frequently make a big showing the year following. This was true on Christ Mayer's farm, Junction City, Wisconsin. The soil was Spencer silt loam.

Yields of Oats

0-20-0 @ 400 pounds per acre	51.0 bushels per acre
0-20-20 @ 400 " " "	48.2 " " "
No fertilizer	29.2 " " "

Yield of Clover-Timothy Hay the Following Year

0-20-0 (applied previous year)	2,623 pounds per acre
0-20-20 (" " ")	5,997 " " "
No fertilizer	469 " " "

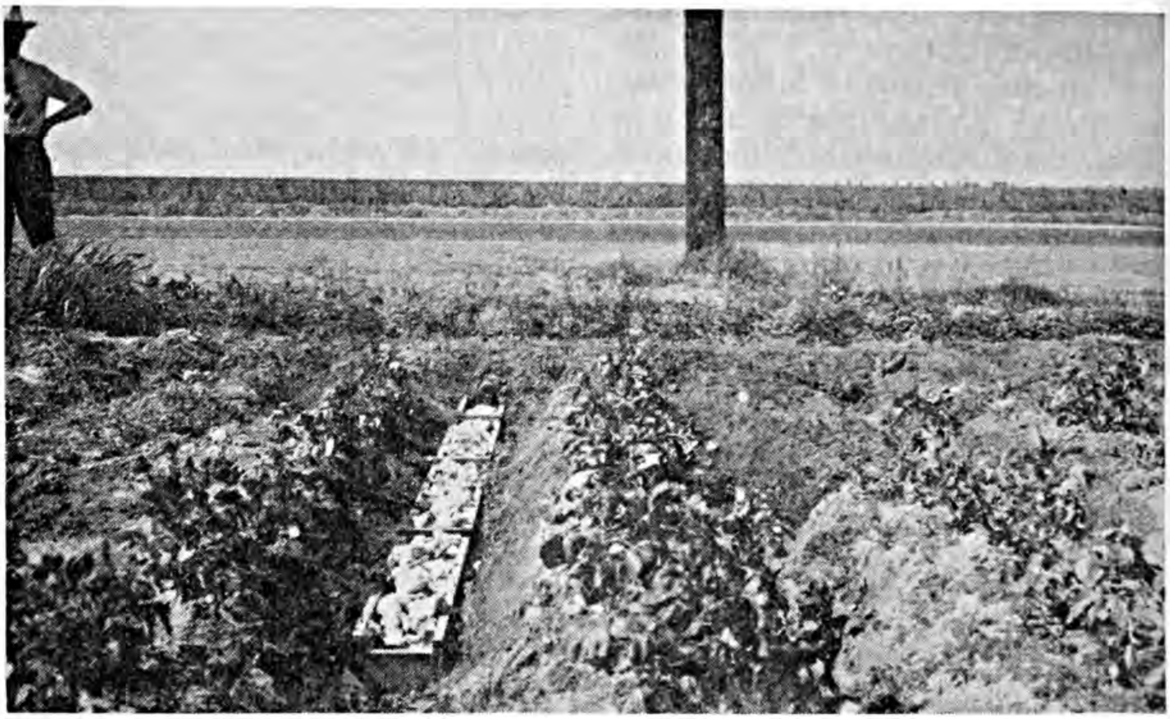


Fig. 1. Experimental method of dissolving gypsum in irrigation water for individual tests in Kern county, California.

The Use of Gypsum In Irrigation Water

By J. D. Axtell[1] *& L. D. Doneen*[2]

WATER penetration of soil has, in recent years, become a problem in certain areas of the upper San Joaquin Valley of California. It is also known that certain types of irrigation water may be harmful eventually to plant growth.

One of these types constitutes an unfavorable sodium-calcium ratio which may cause a sealing of the surface soil, preventing the water from penetrating into the lower root zone. This dry condition results in wilting of the plants between irrigations. Even if wilting is prevented by frequent irrigations, the growth of the plant is somewhat retarded due to the limited volume of wet soil from which plant nutrients may be absorbed.

Well water, or underground water, contains minerals in varying proportions, depending upon the type of material through which the water percolates. If the minerals dissolved are in the form of calcium and magnesium salts, the water is known as hard water, and common soaps do not form suds

[1] Assistant Farm Adviser, Kern county, University of California, College of Agriculture.
[2] Associate Irrigation Agronomist, University of California, College of Agriculture, Davis, California.

in it readily. This type of water usually is considered good for irrigation purposes, as only occasionally do the calcium and magnesium salts reach a concentration toxic to plant growth.

On the other hand, the so-called soft water may come from either of two sources: (1) rain water that contains very few minerals, which usually will include runoff waters from melting snow or excessive rains which have not had sufficient contact with soil or rock to dissolve appreciable quantities of minerals; and (2) water containing a high percentage of sodium salts. These salts may reach a concentration toxic to plants, but even at low concentrations they cause deterioration of the soil structure. With their continued use, the surfaces of the soil will seal and prevent the wetting of deeper layers. To counteract this condition, gypsum is applied to the land, and in some localities it is a general practice to apply 1 to 15 tons per acre.

Irrigation Waters Studied

A study was made with irrigation waters of low salt content, but with most of the salts in the form of sodium (90-92 per cent sodium), in an area of extremely low infiltration rates. In other words, the rate of water intake by the soil was very slow. Even with furrows one-half mile long, and small flows, a large percentage of the irrigation water was run off at the lower end of the field.

A large number of infiltration tests were made under these conditions. Varying quantities of gypsum were continuously dissolved in the irrigation water. Upon adding the gypsum, the irrigation showed only a small increase, but continued to increase with succeeding irrigations, and gave an over-all increase of 40 to 168 per cent when compared with the untreated irrigation water.

The results of some of these tests are given in Table I.

In fields "A" and 123, the irrigation furrows were one-fourth mile long; in the others, one-half mile. The infiltration rate is given in gallons per minute for the entire length of the furrow for the untreated water, and for the furrows irrigated with water containing dissolved gypsum. The last column of Table I gives the per cent increased infiltration from the use of gypsum. Of the total salts, 90 to 92 per cent is in the form of sodium salts. After adding gypsum (calcium sulphate $CaSO_4 \cdot 2H_2O$), the per cent sodium was reduced in proportion to the quantity dissolved. The amount of reduction is indicated in the fifth column of Table I. Analyses of the waters numbered "A" and 122 have approximately the same percentage sodium in relation to the other minerals, but water "A" has nearly twice the quantity of sodium as has water No. 122. Therefore, it will require about twice the quantity of gypsum to reduce the per cent sodium to a given level in water "A" as compared to water No. 122. The pounds of gypsum added per acre-foot of water are given in the fourth column of Table I. These tests were made over periods of three weeks to more than two months. During this time, gypsum

Fig. 2. Gypsum applicator designed by University of California, Agricultural Extension Service, Kern county, California.

was continuously added to the water which was used in irrigating the gypsum furrows. A number of tests were made on these furrows and are listed as No. of Tests in the second column of Table I.

After adding the gypsum, the first irrigation showed only a small increase, but continued to increase with succeeding irrigations until it was greater than that reported in Table I. The percentages reported in the table are the average of all the tests, including the low percentages at the beginning of the experiment and the higher ones later in the trial. The soil is classified as Delano sandy loam for the first three fields listed in Table I, that is, fields No. "A", 124, and 126. The reduction of sodium to 60-70 per cent in these fields gave a 65 to 70 per cent increase in water penetration, with a smaller reduction in sodium (75 to 77 per cent) an increase in water penetration of 33 to 40 per cent was secured for fields 126 and 124. Field No. 122, with a soil classified as Hesperia sandy loam, gave the greatest increase in infiltration with the use of gypsum. The third soil type reported in Table I is Field No. 123, classified as a Madera sandy loam and a hard-pan soil. Thus, soil type plays a role in water penetration, particularly in the rapidity with which a high sodium water will seal a soil and prevent rapid infiltration.

Direct application to the soil should be beneficial for the first few irrigations early in the season. While being effective in increasing penetration of water, the gypsum will be dissolved and leached from the bottom and sides of the furrows. After dissolving and

(*Turn to page* 42)

TABLE I. INFILTRATION RATES OF WELL WATER BEFORE AND AFTER THE ADDITION OF GYPSUM

Field* No.	No. Tests Made	Treatment	Amt. of Gypsum added Lbs. per acre-ft.	Per Cent Sodium	Infiltration	
					Gals. per Minute	Per Cent Increase
A	10	Check	0	92	2.59	65
		Treated	660	57	4.26	
124	17	Check	0	91	4.58	70
		Treated	365	67	7.79	
124	11	Check	0	91	7.59	40
		Treated	191	77	10.63	
126	5	Check	0	92	5.55	33
		Treated	187	75	7.36	
122	19	Check	0	90	3.76	
		Treated	297	60	10.08	168
123	4	Check	0	92	2.66	83
		Treated	572	50	4.87	
Per cent increase due to gypsum (weighted average)						90.4

* For the purpose of this discussion, the waters used on these fields will be considered as having the same number as the field.

Some Fundamental Principles of Soil Building

By S. D. Gray

Washington, D. C.

AGRICULTURE in the Northeastern States, the oldest farming area in the Nation, started with vast soil fertility resources. These resources are still vast, but they have suffered tremendous reductions since the soils were cleared of forests. Continuous removal of plant food in the crops grown and the losses from leaching and erosion have seriously impaired their productive capacity. Cheap land, however, enabled many pioneer farmers to move to new areas when crop yields became unsatisfactory. Land abandonment, the inevitable result of this chop, crop, and get-out system of farming, was indelibly written in the agricultural record of practically every state in this region.

Northeastern agriculture, not unlike that of other great agricultural regions, has experienced prosperity based on soil fertility exploitation as well as the ills which inevitably result. Today everyone interested in the business of farming recognizes as the most important problem the application of a rational land-use policy—one that contemplates soil conservation as well as soil building. In any permanently successful land-use policy, the role of commercial fertilizer occupies a position of importance.

Early Colonial Practices

The earliest record of the need for plant food in this country dates back to the first white settlers. The Indians taught the settlers agricultural practices which, in the light of later scientific research, were sound and practical. Of greatest interest, perhaps, was their practice of using fish and wood ashes in the growing of corn. Fish alone, on the newly cleared land greatly increased the yield of corn, the Indians advised. On the older clearings, however, best yields were obtained only if a generous supply of wood ashes was used to supplement fish. Thus, it is evident that the essential plant-food elements, nitrogen and phosphorus supplied in fish, and potash and lime supplied in wood ashes, have played an important role since the beginning of agriculture in this region.

Research of Experiment Stations

Probably the greatest single factor in developing an appreciation of the need for conservation of our national soil fertility resources and the importance of commercial plant foods has been the system of State Agricultural Experiment Stations. Since their establishment under the Hatch Act of 1887 they have carried on a vast amount of research with soils, fertilizers and cropping systems, diseases and insects. The results of their experiments have been carried to the farmers by the Extension Services and have been the basis for soil management programs that have gone a long way toward the establishment of a permanent and prosperous agriculture. Supplementing these agencies is the Soil Conservation Service. Together these three hold the key to the prosperity of American agriculture.

Food consumption in the United States has increased enormously in the past decade. On the average each person eats 1,650 pounds of food in a year or approximately 17 per cent more than before World War II. With a population of 145,000,000, the acreage of harvested crops in this country last year was 350,000,000 or about 2½ acres per capita. Census figures reveal that the population has increased 13,000,000 since 1940. At this rate it will likely approach 160,000,000 by 1970. The world population, now about 2¼ billion, has available for food production slightly less than one acre of farm land per capita. This disparity, between world population which continues to increase and land for food production the acreage of which continues to decline, poses a serious problem. The world problem of feeding an increasing population is not so much a matter of productive soils as it is of developing social institutions to put and keep our soils in full production. Unless we stop the losses and start rebuilding our soil, we cannot hope to maintain our present standard of living.

The big problem before farmers, wherever they may be located, is—How can we utilize to best advantage the remaining plant-food resources by such methods as will prevent further needless waste and, at the same time, increase the production of food without proportionate increase in cost? The problem is the same whether we look at it in terms of our own farms or the whole agricultural area of the Nation.

How Soils Are Formed

What is this thing we call Soil? It differs from most of Nature's creations in that it was developed from the outside in or from the top down. The fine material which went into soil came from rotting or mechanical disintegration of rock material near the surface of the earth. This process liberated soluble nutrients which were used by plants and was always accompanied by an increase in vegetative growth which was deposited on or near the surface to decompose. The rotting vegetative material supplied organic matter and considerable of the soluble plant nutrients. Over the ages inert rock material under the influence of plant and microbiological action became the soil, the source of all food—the foundation of civilization.

Virgin Soil Usually Fertile

Most virgin soils are inherently fertile soils. Their mineral, organic, and biological conditions have been kept in balance by natural processes. When man plows or cultivates a soil, however, he immediately brings about more favorable conditions for soil microorganisms (bacteria and fungi), which increase their activity. This stimulated activity increases decomposition and finally reduces the organic-matter content of the soil. Incorporation of organic materials into the soil by plowing is not conducive to its unlimited accumulation. This does not mean that the turning under of organic material is an undesirable practice. It merely indicates a weakness in our soil management programs and emphasizes the constant need for consideration of cropping systems and cultural practices designed to maintain optimum organic content. An important value of cover crops or green manure crops, it should be pointed out, is to convert the soluble plant nutrients of the soil into green material at a time when otherwise they would be subject to leaching and therefore lost.

Almost every farmer has observed that when land lies idle for several years, crops following the plowing of such land are better. This is attributed to the rapid decomposition and release of plant nutrients contained in the surface accumulations. Here, as in virgin soils, are natural soil-building processes in full action, working from the surface downward. Early observations on the benefits from incorporation of organic matter, as well as results of experimental work, no doubt influenced the development and use of the plow in soil management. The plow is necessary, of course, to get rid of plants and crop residues on the surface and to make possible the preparation of a seedbed. Necessary and desirable as is the plowing operation, it is without question the chief reason why the organic content of our soils cannot be maintained satisfactorily and easily.

This discussion is not intended to infer that we must abandon the plow, for this cannot be done. It does, however, point to the desirability of redesigning the plow and other machinery for soil cultivation with the idea of effecting satisfactory seedbed preparation and soil cultivation without complete incorporation of plant residues. In other words, the ideal tool would be one that insures a proper balance between rapidly decomposing plant residues in the lower soil area and the more slowly decomposing plant residues in the upper soil area or on the surface. Recent research by agricultural engineers has partially accomplished these objectives in the designing of the T.N.T. plow. Its development marks the beginning of a new era in soil building through application of the fundamental principles in which Nature excels and from whom we still have much to learn.

Important Soil Factors

Figure 1 portrays the fundamental factors involved in soil building. While all five factors are important in crop production, the fact remains that organic matter always plays a central role. It is directly related to each of the remaining factors—moisture, aeration, soil temperature, and mineral nutrients. Unless maintained at an optimum level, the other factors are thrown out of balance and the soil's productive capacity quickly deteriorates.

Much ado is being made today about the great importance of organic matter in relation to soil fertility, soil conservation, and crops of satisfactory nutritive value. This is as it should be. Soil organic matter is of tremendous importance. No one questions that. It serves as a food for various types of desirable soil microorganisms. It supplies essential plant nutrients for re-use by succeeding crop plants. It aids in improving the physical qualities of soils. Its presence as living or dead material on or in the soil aids enormously in the control of erosion by wind and water.

The fertility and organic-matter content of gardens and other small areas may be satisfactorily maintained through the use of animal manures and composts. However, when larger areas are involved, as is the case in general farming, this practice becomes impracticable because of the enormous volumes which would be needed and the labor cost involved. Fortunately, in general farming, it is both convenient and profitable to follow a crop rotation system to supply organic matter and to use animal manures produced on the farm in the feeding of crops. About all that is required is proper use of lime, phosphorus, potash, and some-

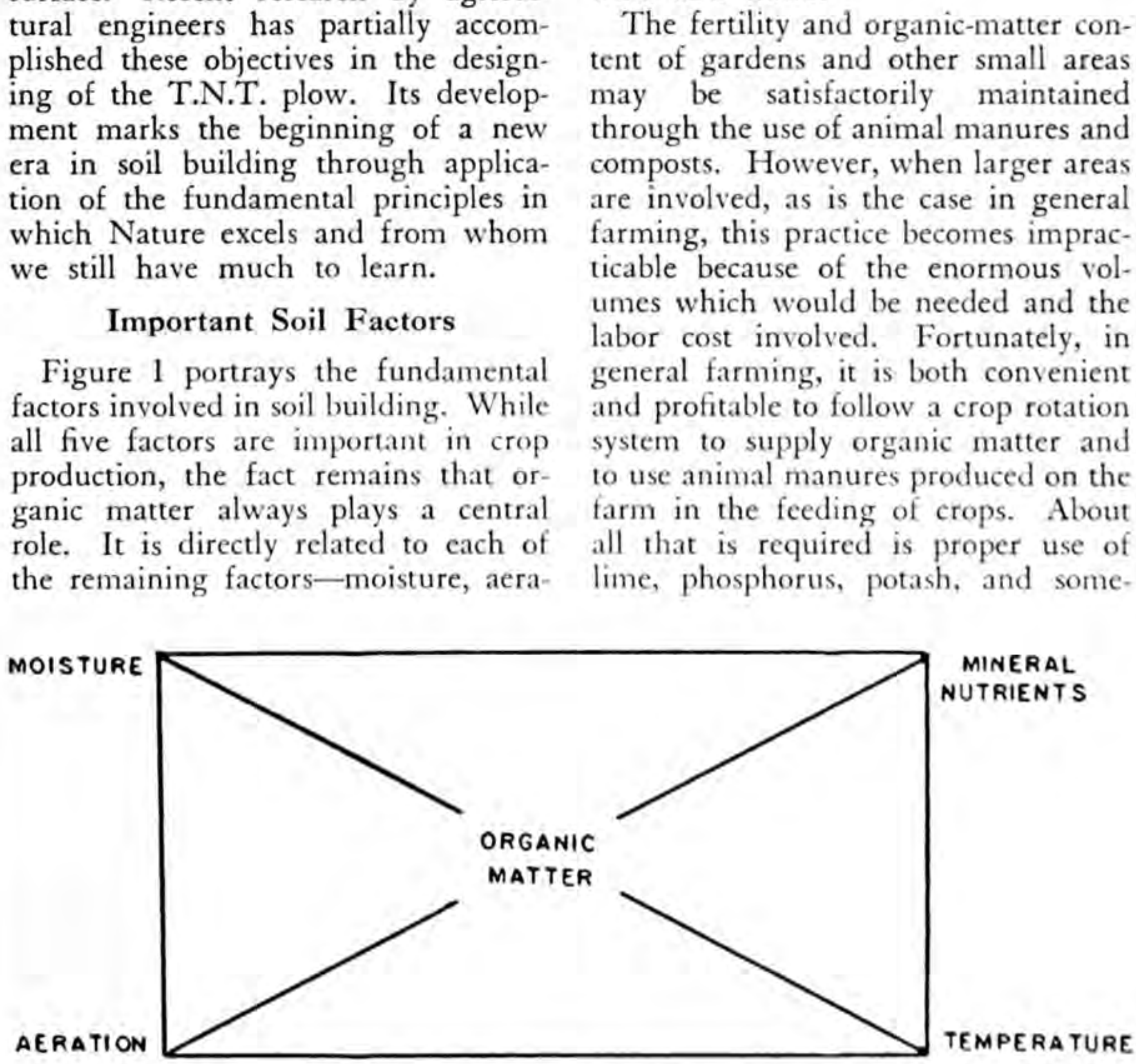


Fig. 1. Important soil factors

times nitrogen. Thus, the key to the nitrogen and organic matter problem is a high mineral fertility which will assure a luxuriant growth of the superior legumes, such as alfalfa and the clovers, particularly, sweet clover.

Give The Soil Air

Agronomists tell us that soils need more air than they are getting under American methods of farming. This applies not only to the topsoil where the roots of plants grow heaviest and where they get the bulk of their food but also to the subsoil where they send their deeper roots. It has been shown by experimental work that if both the topsoil and subsoil were better drained and given more air, crops would grow better and there would be bigger cash return from the same acreage. In other words, if organic matter or humus can be injected into the soil, thus improving its physical condition, making it more porous and open, it rapidly becomes more productive.

If the topsoil and subsoil are dense and hard, neither soil air nor water with absorbed oxygen have that freedom of movement so necessary to plant growth. The principal reason for breaking up hard formations in our soil is to permit water to enter easily and quickly so that the plant roots will be able to get ample water during dry weather. When rain falls upon land, it passes downward through the air spaces until it finds an obstruction which causes it to accumulate or until it assumes the form of capillary water. If the soil structure is loose and open all the way down, there will be adequate water for plant growth and best performance of the soil microorganisms.

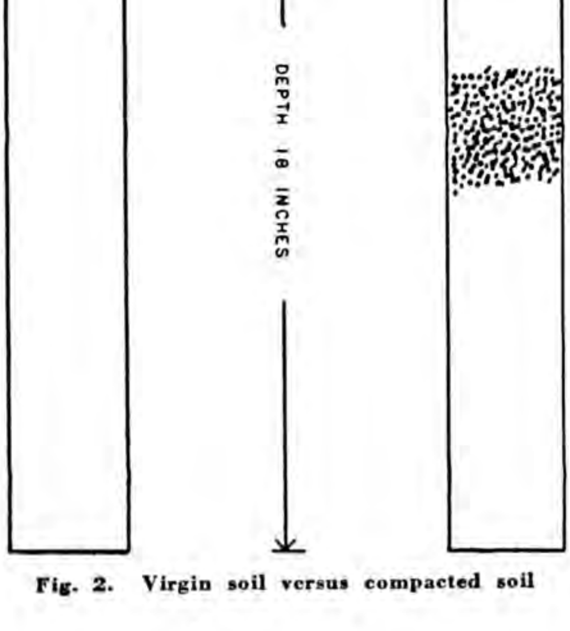


Fig. 2. Virgin soil versus compacted soil

Compacted Soils Versus Virgin Soils

If the topsoil is dense and compacted, the farmer generally knows how to take care of the situation. Ordinarily, he will make a generous application of manure, green or barnyard, and plow under all crop residues. Such operations as these tend to make the soil more porous and pliable. While the topsoil is an open book to the farmer, the subsoil often is a region of darkness and mystery. It is this part of the land being farmed that requires more and more attention on the part of the farm operator. Everything that he does in the way of machine operation, especially where heavy farm machinery is used, tends to compact the soil and to exclude air which is so necessary for the germination of seed and for the beneficial soil organisms which convert organic residues into plant food. It is important, therefore, in thinking of soil building to develop and put into operation cropping and cultural practices aimed at correcting those unfavorable soil conditions which prevailing farming practices have produced.

While the principal step in keeping land in good condition is the maintenance of organic matter, keeping the subsoil reasonably open for the movement of water and air is also essential. Growing deep-rooted legumes is com-

(*Turn to page* 48)

Fig. 1. Pictured here is a field of alfalfa at the University of Georgia, College of Agriculture, Athens, Georgia, prior to the second cutting in 1949 and the 27th cutting of the field since it was established in 1942.

Alfalfa as a Money Crop in the South

By W. O. Collins

Agronomy Department, University of Georgia, Athens, Georgia

ALFALFA can be grown successfully and economically in the South. Field experiments established in 1942 on the agronomy farm of the University of Georgia at Athens, have shown conclusively that alfalfa can compete with cotton and other cash crops grown in the South.

The soil on which this experiment is located is classified as Cecil sandy loam and for approximately 75 years was cultivated by cotton-growing tenant farmers. The fertility level of the soil was probably below that of the average farm soil in the Piedmont Plateau Province.

In the spring of 1942 the land was plowed, harrowed, and sowed to cowpeas. In August the cowpeas were plowed into the soil and thoroughly cut with the disk-harrow. The land was harrowed with a drag-harrow about September 15, and on October 15 Kansas common alfalfa seed were sown with a cyclone seeder at the rate of 50 lbs. per acre. The land was then cross-harrowed with a drag-harrow, and cultipacked in two directions to insure a firm seedbed.

Table I shows the initial and annual fertilization. For the first two years muriate of potash was applied at the rate of 200 lbs. per acre. Potash was increased to 300 lbs. per acre in 1946 and in 1947, then raised to 400 lbs. per acre in 1948. Nitrate of soda was applied in the initial fertilization to insure rapid growth during early fall so that the alfalfa would withstand the winter by establishing a good root system and would be better able to compete with weeds and grasses in early spring. All fertilizers were applied in late winter, before spring growth of alfalfa began. The superphosphate, potash, lime, and borax were mixed and broadcast on the surface.

TABLE I.—KIND AND AMOUNT OF FERTILIZER AND LIME USED PER ACRE.

	Initial fertilization*	Annual fertilization
Dolomitic limestone	6,000	1,000
18% superphosphate	800	600
60% mutiate of potash	200	400
Borax	30	20
Nitrate of soda	100	...

* One-half of the initial fertilizer, except nitrate of soda and boron, was applied when cowpeas were planted; the remainder, on September 15 before the land was harrowed.

An average yield of 4.08 tons of hay per acre has been obtained for the six-year period. The 1943, 1944, and 1945 years were all dry summers. Particularly during the months of July and August, the rainfall was less than one-half of the normal rainfall for those months.

Experiments in the rate of seeding have been conducted by the Department of Agronomy. It was found that 10 to 15 lbs. of seed are ample for seeding when moisture conditions are favorable for germination either in the spring or fall. However, since weeds and grasses are the biggest enemies of alfalfa, the thicker the stand of the alfalfa the less chance there is of weeds and grasses crowding it out. We have found that 25 to 50 lbs. per acre are ample and give a good stand. Fall seeding is more likely to give a good stand and have less difficulty with weeds and grasses than spring seeding since there is an opportunity for the root system of alfalfa to become well established during the first winter.

Taking the average price received by the Georgia farmer for loose alfalfa hay for the period 1943-1948, which was $24.50 per ton, and a yield of 4.08 tons per acre gives a gross return of $99.96 per acre per year. The cost of fertilizer and labor to produce an acre of alfalfa in this experiment was $37, leaving a net income of $62.96 per acre. The labor and fertilizer costs to produce an acre of cotton on the experimental farm was $65 and gave a return of $114.50, based on 1943-48 price of cotton and cotton seed, or a net return of $49.50 per acre. This gives a return of $13.46 per acre in favor of alfalfa. Since the labor requirement of an acre of cotton is approximately four times that of alfalfa, the farmer can grow four acres of alfalfa instead of one acre of cotton and raise his labor profit to $52 per

(*Turn to page* 48)

TABLE II.—YIELD OF AIR-DRY HAY BY CUTTINGS FOR SIX-YEAR PERIOD 1943-1948.

Cuttings	1943	1944	1945	1946	1947	1948
1st	2,190	2,245	1,811	2,230	2,679	2,303
2nd	2,760	1,315	1,825	2,091	2,727	2,614
3rd	950	1,550	1,540	1,089	2,728	1,814
4th	....	....	1,851	741	937	3,740
5th	....	....	....	719	1,416	2,025
Total	5,900	5,110	7,027	6,870	10,487	12,496

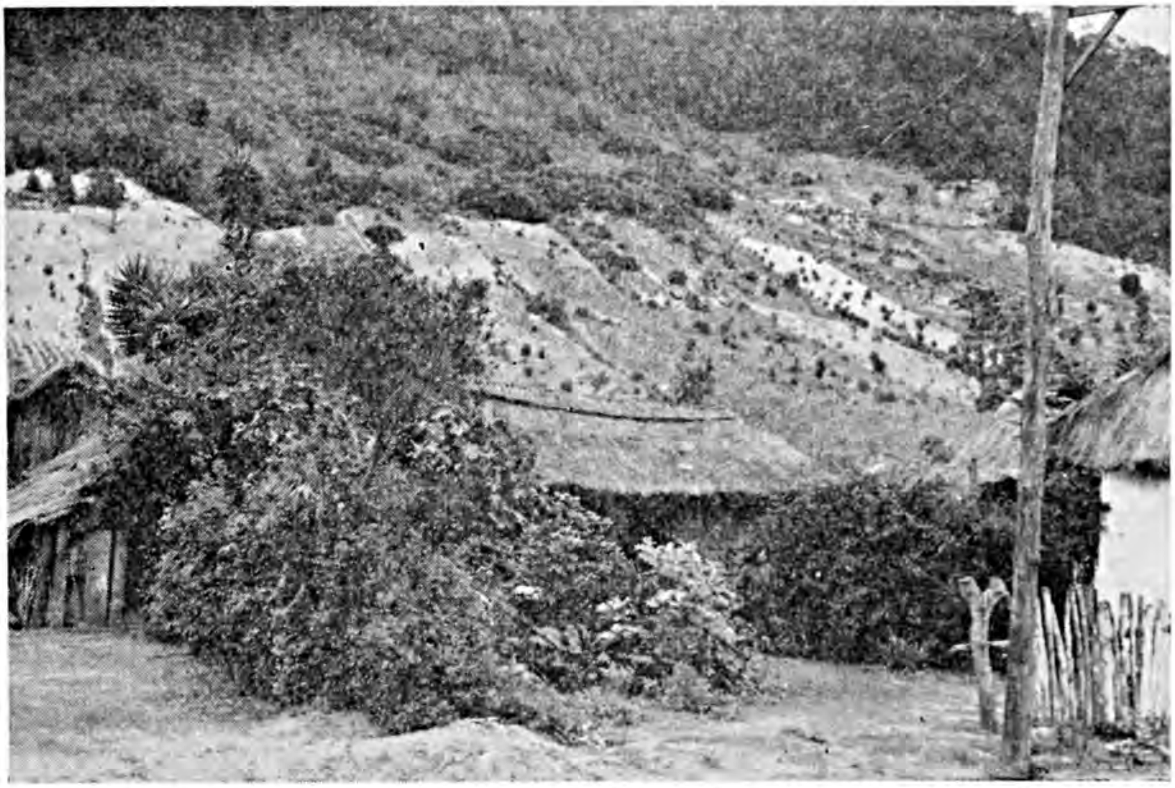


Fig. 1. Every Indian has his milpa (corn patch). These milpa are often found on mountain slopes as high as 10,000 feet above sea level. Areas grown up in brush will be burned off and put back in corn after two or three years.

In the Land of the Corn God

By Edgar A. Hodson

Soil Conservation Service, Little Rock, Arkansas

THE Highland Plateau of Southern Mexico and Guatemala was the first Corn Belt in North America, and the natives there rely on corn almost exclusively for their food now as they did in pre-Columbus days.

On a recent trip to Guatemala to study corn production, I flew from Mexico City to get a glimpse of this old Corn Belt from the air. Revealed was a procession of haciendas and villages surrounded by geometrical patterns of corn fields, forests, and barren lands worn out by corn growing long ago. All of these formed an intricate mosaic in mute evidence of the endless labor of countless generations.

Guatemala is a land of corn, earthquakes, and volcanoes—a land steeped in antiquity. This land was the home of the Maya Indians for many centuries before the beginning of the Christian Era. To understand the native Indians of today, it is necessary to know something of their ancient ancestors.

The history of the native Guatemala Indians is old and proud. In 1524 the Spanish Conquistadors under Alvarado conquered all of what is now Guatemala. These Indians represented various tribes of the Maya who had for their heritage the most advanced civilization on the North American continent. The basis of this brilliant civilization was agriculture—an agriculture limited to the production of corn. The fall of this people seems to have resulted from their total dependence upon this one crop.

Population Mostly Indians

About 65 per cent of the population of Guatemala now is pure Indian. Because of their stubborn resistance to change, they still retain most of the habits and customs of their ancestors. They live in the same kind of thatch-covered houses, speak the same tribal language, and depend upon corn for their existence, just as their forebears did 400 years ago. Every family grows its own milpa or corn patch, and in the thickly settled parts of the Highlands, almost every available foot of ground that can be used is planted to corn. The sides of the mountains are covered with milpa up to altitudes of eight to ten thousand feet. On land so steep, there is real danger of falling out of the field! The Indians generally live in villages, which makes it necessary for many of them to locate their milpa long distances from home, in many cases up to 20 miles or more. And since very few of them have any livestock, this long trip must be made on foot.

A reverence for corn is an integral part of the Mayan history, which really began several thousand years ago when corn first came into existence. Corn similar to that now being grown by these same Indians has been found among the ruins of their ancient temples, so we know it has existed in its present form for a very long time. The manner in which these Indians came into possession of corn is not known, for nowhere on earth has corn ever been found growing in the wild, and corn, as we know it, could not survive without the help of man. It is one of the few cultivated crops that would disappear completely in one or two years if left alone to reproduce itself.

Among the clues to the origin of corn are two botanical relatives still to be found in Guatemala. These are *Teosinte* and *Tripsacum*. The former has some characteristics similar to corn and is related closely enough that hybrids of these two plants can be produced. The corn-teosinte offspring do not provide sufficient evidence to solve the puzzle. Our modern corn plant may have come about as a sport (mutation) which appeared in the related species, or the Indians may have had some Burbank in the ranks of their priesthood who developed it after long years of tedious work in breeding and selection. No one knows.

When the Mayas came to depend upon corn as their principal source of food, they began to burn off patches of ground for their milpa and settled down to live in permanent villages. This farming economy was apparently responsible for a very rapid cultural development which extended from about 300 A. D. to 800 A. D. During this period they built many cities and erected beautiful temples and tall pyramids of massive limestone in honor of their gods. Their social structure consisted of three main classes: The common people (corn growers), the priests (intellectual group), and the nobility (the rulers).

Priests Developed Culture

The permanent settlements gave the priests an opportunity to turn their attention to science. Considering the fact that they had no equipment whatever, they made a remarkable showing. They developed a system of hieroglyphics for recording dates. And, because a knowledge of the seasons was of so much importance in the growing of corn, they calculated the exact length of the lunar month and the solar year. From these data they devised a calendar more accurate than the one we use today. They were the first people on earth to use a place system of numerals comparable to our decimal system.

However, it was based on 20 digits instead of 10 and was cumbersome to use.

It is obvious from the numerous dated monuments that have been found that their system of numbers and the hieroglyphics for recording them was an early development. These monuments apparently were erected periodically to commemorate certain years set aside for celebrations.

This amazing civilization began to decline about 800 A. D. and the once magnificent cities are now crumbling ruins, overgrown with lush tropical vegetation. The exodus from this region took place between 800 A. D. and 1,000 A. D. when the people moved eastward into Yucatan to relocate and build new cities. Not even the exact names of these deserted cities are known, nor the exact reason for their fall. The most logical reason for the decline of this empire is the failure to maintain agricultural production as a result of lowered soil fertility and the lack of equipment with which to cultivate the land.

Lacked Mechanical Development

In spite of the brilliant achievements of their leaders, the Mayas never developed any sort of mechanical contrivances, depending entirely upon the use of their hands for all work. To grow corn, they burned the brush from the land and by the aid of a sharpened stick (their only farming equipment) punched holes in the ground to plant the seed. After a year or two, the invasion of weeds and grasses made it necessary to abandon old corn fields and burn off new land. Several hundred years of such poor land use made it impossible to produce enough corn to sustain the increased population, so the whole people was forced to move to new country.

The religion of the Mayas, like their economy, was rooted in agriculture, and of their various gods, many were agricultural. As would be expected, one of the most conspicuous of these found in the sculpture of the old temples is the Corn God. In further evidence of the antiquity of corn, the Quiche—one of the tribes that inhabits the Highlands of Guatemala, believe that man was made from corn. Rodolpho H. Rivera Ariza, Sub-Director del Instituto Agropecuario Nacional, told me the interesting legend.

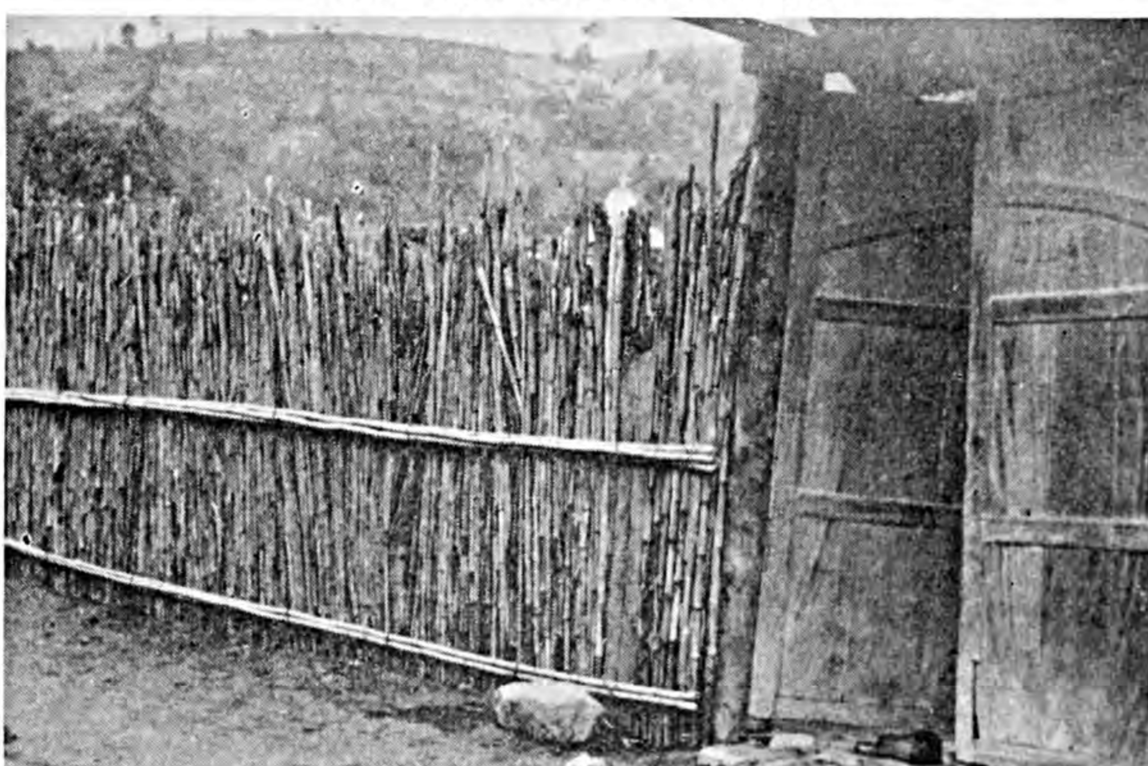
According to the Quiche story of creation, in the beginning of time nothing existed but the tranquil sea and a sunless sky. The gods lived as a shin-

(*Turn to page* 45)

Fig. 2. Young corn god from ruins of ancient Mayan city found at Piedras Negras. This monument was erected in 746 A. D.

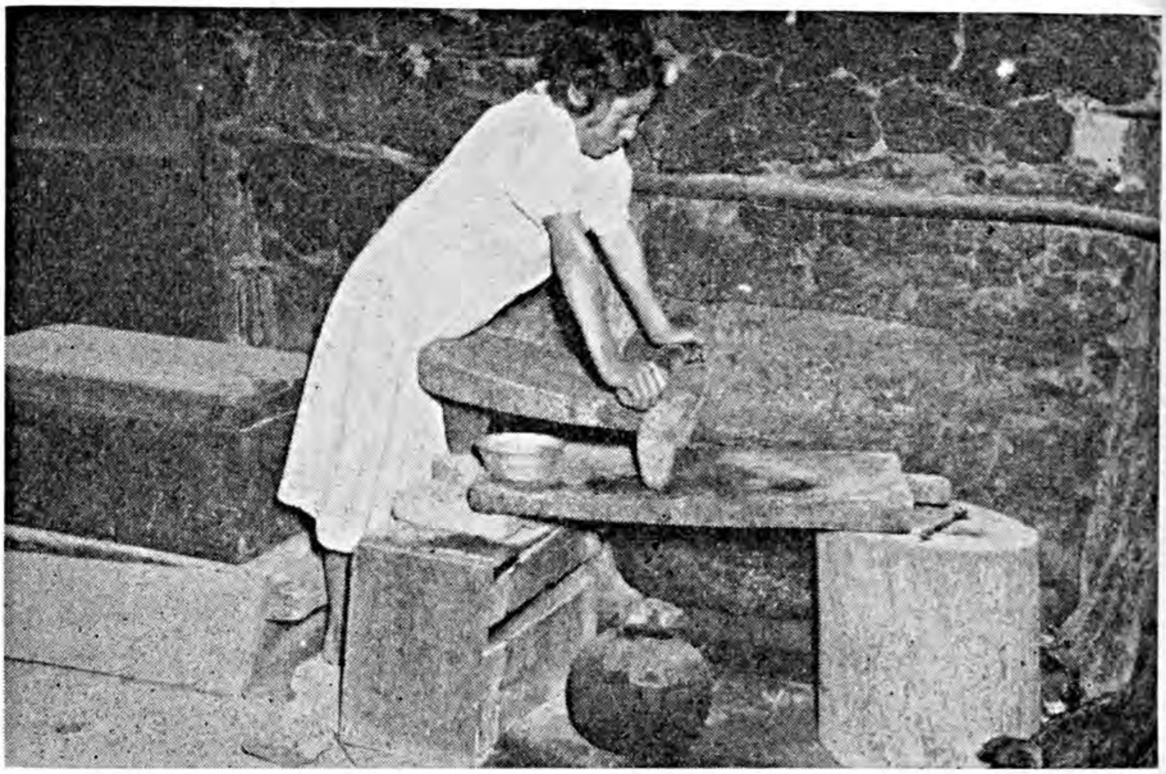
Above. **Large hoes such as these are the only tools that the Indians in the Guatemala Highlands use to cultivate their corn plots.**

Below. **Some use is made of every part of the corn plant. This fence is made of stalks; cobs are used for fuel; shucks as a substitute for paper.**



Above. Seed corn selected at the harvest ritual is stored until the next season by hanging it under the roof of the house.

Below. Corn vendor plying his trade on the village square at Momostenango. Shelled corn is weighed out on hand balances.



Above. **Grinding corn for tortillas. The corn is soaked overnight in lime water and then crushed immediately before using.**

Below. **On market days at Chichicastenango, tortillas are available from the open-air kitchens. Corn in some form comprises about 85% of the total diet.**

The Editors Talk

Business and Agriculture

The businessman in particular and the city dweller in general increasingly are being urged to learn more about the problems of American agriculture if they are to exercise their rights and privileges of citizenship to the best advantage of themselves and of society as a whole. Evidence is abundant that this sound advice is being heeded.

As a striking illustration and of special interest to our Southern readers is the report recently issued by Emory University of Atlanta, Georgia, under the title, "Problems in Land Rehabilitation and Soil Conservation." This is a report of the Business Executives' Research Committee organized by business executives to inform themselves as to what they can do as collaborators in helping to solve these problems of such vital importance to the South. Immediately this can be recognized as a most worthy and commendable enterprise reflecting the wisdom and public-spiritedness of the sponsors and their realization of the fundamental interdependence of business and agriculture if either is to attain and maintain its optimum level of prosperity.

The report deals with the South in general and more specifically with the State of Georgia. It outlines the magnitude of the problem of land rehabilitation following a century of neglect and misuse. While it acclaims the great achievements of the Soil Conservation Service and the various other agencies both state and federal laboring jointly and severally for the benefit of agriculture, it makes clear at the same time that the battle is far from won and cites some of the major obstacles that not only retard progress but may mean ultimate defeat.

Among these several opposing factors, the report's discussions of farm tenancy and the share-cropping system impress us as deserving special mention. While they deal with the subject factually and realistically, the recommendations are tempered to orderly procedures instead of the revolutionary methods of those writers and speakers who become emotional at the expense of the practical.

The share-cropping system is based traditionally on such crops as cotton and tobacco, crops easily divisible between landowner and tenant. Yet the rehabilitation of Southern agriculture calls for diversification, the development of improved pastures and crop rotations, combined with adequate fertilization, practices in which the tenant with his one-year contract takes little or no interest. He gets what he can out of his one crop and then (50% of his number) moves on to some other location. As the report states—"We still have no established pattern for dividing the shares of such commodities as livestock, grazing crops, vegetables, poultry, fruits, and dairy products, despite the fact that the increased production of these commodities is the very heart of successful farm diversification in the region."

Recognizing the "great need for developing a method of distributing income from all types of farm operations on a basis that will be fair and acceptable to both parties," the report makes the following recommendation which we feel warrants full quotation:

"Under the conditions which now characterize the majority of owner-tenant relationships both sides are penalized—the owner by a constantly diminishing crop-producing power of his land and the tenant by a feeling of insecurity on the land he operates. It is not likely that this unprofitable situation can ever be changed satisfactorily under traditional relationships. It does seem possible, however, that some of the undesirable aspects of tenancy can be corrected by written agreements between landowners and land operators based on a program of sound farming practices and extending over a sufficient number of years to assure both parties of fair and profitable returns. Such a change will assure the tenant that he will be on the land long enough to derive assured benefits from conservation farming and will thereby instill in him the much needed sense of security and stability. On the other hand the landowner will stand to gain more in the long run than the tenant, because it is *his* property which is being rehabilitated and conserved. For this reason, initiative to put into operation the new type of agreements should come from the landowners, and they should be encouraged to take the leadership in this instance. Admittedly much persuasion and educational work will be required to induce owners to make the needed shifts in their relations with tenants, but with enough effort it can be done eventually. Generations have come and gone while the present situation was developing, and the whole picture cannot be changed overnight. It will take time and experience by the most foresighted owners to demonstrate that the new relationships can be made to work successfully."

Science and Agriculture

Bringing together many of the continent's outstanding agricultural scientists for exchange of opinion and enlightenment on progress in research, the American Society of Agronomy and the Soil Science Society of America held their 41st annual meeting and the American Society for Horticultural Science, its 46th annual meeting in Milwaukee, Wisconsin, October 24-28. The attendance was one of the largest ever recorded and was well proportioned between the more youthful workers and elders whose lives have been devoted to research and whose judgments are sought and respected for their soundness.

A grower sitting in on sectional meetings and forums probably would have had difficulty in following the discussions, for it was scientific talk with terms well above the ken of those not working in similar fields. He would not, however, have missed the sincerity and earnestness with which these men presented the technical problems to be faced and what is being done to meet them. He would have gained a confidence that his future is in good hands and that sooner or later the knowledge being exchanged would be crystallized and translated into terms and facts for him to put into practice.

We need this confidence and faith in his profession on the part of the grower. Too often the vagaries of weather or economic cycles bring doubts and discouragment. We need also the confidence of the public in the farmer and his ability to meet and overcome his problems. The war and impoverished nations have taught us anew what agricultural production means to civilization.

"There need be no fear whatever of any lack of capacity to feed ourselves permanently in accordance with our desires," Dr. Firman E. Bear, retiring president of the American Society of Agronomy and Research Specialist in Soils at Rutgers University, told a large assemblage. "All we need to do is to make intelligent use of the abundant resources at our command."

It goes without saying that meetings such as these chronicled herewith disseminate the "intelligence" for "use."

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay[1] Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924...........	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941...........	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947...........	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
November...	30.52	42.8	144.0	198.0	121.0	204.0	18.40	69.00	....
December....	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January.....	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March.......	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April........	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May.........	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June........	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July.........	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August......	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September...	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	..
October......	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....

Index Numbers (Aug. 1909—July 1914 = 100)

1924...........	185	190	98	170	166	141	107	147	143
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	93	81	109	74	87	110
1938...........	69	196	80	83	76	64	57	97	88
1939...........	73	154	100	85	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	107	117	107	81	211	129
1942...........	153	369	168	136	143	124	91	202	163
1943...........	160	405	188	232	174	154	125	231	245
1944...........	167	420	214	219	170	160	138	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	175	249	212	209	141	319	204
1947...........	252	380	224	245	366	273	146	379	249
1948									
November...	246	428	207	226	188	231	155	306	186
December....	239	457	220	250	192	232	161	305	209
1949									
January.....	236	429	238	269	195	229	169	291	282
February....	235	295	249	279	174	219	173	237	285
March.......	232	319	250	290	184	224	168	228	263
April........	241	247	260	314	190	226	160	223	236
May.........	242	325	260	312	190	226	149	224	213
June........	243	315	251	301	188	210	138	207	175
July.........	243	565	222	323	195	206	132	166	185
August......	236	446	221	305	184	202	135	197	174
September...	240	**487**	198	263	181	212	137	193	205
October......	231	474	187	224	170	214	141	185	170

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
November	3.00	2.20	11.00	10.31	10.44	10.68
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
Index Numbers (1910-14 = 100)						
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
November	112	77	314	292	310	303
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331

Wholesale Prices of Phosphates and Potash* *

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
November	.770	4.61	6.60	.375	.720	14.50	.200
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
November	144	128	135	68	76	60	83
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
November	271	262	239	134	94	311	144	72
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72
May	256	257	227	134	99	293	144	72
June	252	257	223	134	99	304	144	65
July	249	256	225	140	100	349	144	68
August	245	254	222	143	100	372	144	68
September	249	253	225	138	100	334	144	68
October	243	251	222	138	98	331	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Nutrient Deficiency Signs in Plants," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 612, July 7, 1949, L. C. Olson.

"Fertilizer Tonnage Sold in Indiana as Reported by Fertilizer Manufacturers from July 1, 1948, to June 30, 1949," Ind. State Chemist, Lafayette, Ind., mimeo. rpt., F. W. Quackenbush.

"Effect of Late Applications of Nitrogen and Potassium on Potato Yields," Ky. Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 529, March 1949, E. M. Emmert.

"Official Report Maryland Inspection and Regulatory Service — Feed, Fertilizer, and Lime Issue," College Park, Md., Issue No. 211, Aug. 1949.

"A Progress Report of Fertilizer Trials on the Fayette and Tama Soils in Southeastern Minnesota—1948," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Soil Series No. 26, April 1949, J. M. MacGregor and E. R. Duncan.

"Fertilizer Inspection and Analysis; Fall 1948," Agr. Exp. Sta., College of Agr., Univ. of Mo., Columbia, Mo., Bul. 529, Sept. 1949, J. H. Longwell, H. J. L'Hote, and R. C. Prewitt.

"North Carolina Fertilizer Recommendations for Field Crops—1949," Agr. Ext. Serv., N. C. State College of Agr., Univ. of N. C., Raleigh, N. C., E. R. Collins.

"1949 Spring Sales of Fertilizers in Ohio," Dept. of Agron., Ohio State Univ., Columbus, Ohio.

"Fertilizer Report for the Year 1948," Pa. Dept. of Agr., Harrisburg, Pa., Gen. Bul. 624, Vol. 32, No. 3, May-June 1949.

Soils

"From Public Burden to Public Benefit — The Story of Marinette County's Land Program," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 483, Jan. 1949.

"Physical Land Conditions in Kit Carson County, Colorado," SCS, U.S.D.A., Washington, D. C., Physical Land Survey No. 43, 1949.

"Keep Crop Residues on the Surface of the Ground," SCS, U.S.D.A., Washington, D. C., SCS-TP-80, May 1949, J. H. Stallings.

"Soil Management for Tree-fruits and Truck-crops in the Southern Interior of British Columbia," Dept. of Agr., Province of British Columbia, Victoria, B. C., Canada, Hort. Cir. No. 76, 1949.

"Our Remaining Land—We Can Use It and Save It," SCS, U.S.D.A., Washington, D. C., AIS No. 79, June 1949.

Crops

"Growing Strawberries in the Home Garden," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 151, May 1949, R. E. Baker.

"Alfalfa Seed Production, Hemet Valley, Riverside County, 1948," Agr. Ext. Serv., Univ. of Calif., Farm Advisor Off., Riverside, Calif., Wallace Sullivan and O. A. Harvey.

"Bunch Grape Production in Georgia," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Cir. 160, Aug. 1949, F. F. Cowart and J. E. Bailey.

"Making A Lawn in Georgia," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 613, Aug. 31, 1949, L. V. Crowder.

"Temporary Winter Grazing in Georgia," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 614, Sept. 12, 1949, L. V. Crowder and O. E. Sell.

"Thirty-first Annual Report of Illinois State Department of Agriculture — 1949," Springfield, Ill.

"Report on Agricultural Research for the Year Ending June 30, 1948," Agr. Exp. Sta., Iowa State College, Ames, Iowa.

"Balanced Farming and Family Living in Kansas," Agr. Ext. Serv., Kans. State College, Manhattan, Kans., Cir. 212, April 1949.

"Carrying Science to Farm People," Ext. Serv., Univ. of Md., College Park, Md., 34th A. R., 1948.

"Annual Report for the Fiscal Year Ending June 30, 1948," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. 449, Sept. 1948.

"Improved Varieties of Farm Crops," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Folder 22, Rev. March 1949.

"Varietal Trials of Farm Crops," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 6, Feb. 1949, H. K. Hayes, E. R. Ausemus, J. O. Culbertson, J. W. Lambert, and R. G. Robinson.

"Highlights of the Work of the Mississippi Experiment Station," Miss. State College, State College, Miss., 61st A. R., 1948.

"Sweet Sudan Grass Increases Milk Production in North Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 430, March 1949, R. T. Landrum and S. P. Crockett.

"Alfalfa and Sweetclover Silage," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 173 Rev., May 1949.

"Better Tobacco Plants," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., N. C. Ext. Folder 70, Rev. March 1949, R. R. Bennett and S. N. Hawks Jr.

"Oregon's Seed Crops, 1936-1947," Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 694, Nov. 1948, B. E. Black.

"Comparative Costs of Uprooting Old Apple Trees," Agr. Exp. Sta., Pa. State College, State College, Pa., P. R. No. 8, April 1949, L. W. Linvill.

"Early Defoliation Often Increases Winter Injury of Sour Cherries," Agr. Exp. Sta., Pa. State College, State College, Pa., P. R. No. 13, July 1949, W. C. Kennard.

"Year Book of the Department of Agriculture of the State of South Carolina, 1947-1948," Columbia, S. C.

"Our Corn Program in South Carolina," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 338, June 1949, H. A. Woodle and P. S. Williamon.

"Rushmore Spring Wheat," Agron. Dept., Agr. Exp. Sta., S. D. State College, Brookings, S. D., Bul. 394, April 1949, J. E. Grafius and V. A. Dirks.

"Sixtieth Annual Report, 1947," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn.

"Strawberries—A Way to Grow Them in Utah," Ext. Serv., Utah State Agr. College, Logan, Utah., Ext. Bul. 175, April 1949, C. D. Ashton.

"Garden to Save Wheat, Save Meat, Save the Peace," Ext. Serv., W. Va. Univ., Morgantown, W. Va., 1949.

"Growing Strawberries in Wisconsin," Ext. Serv., Univ. of Wis., Madison, Wis., Stencil Cir. 237, Rev. Feb. 1949, J. G. Moore.

"Grass Silage Saves Feed and Cuts Costs . . . ," Ext. Serv., Univ. of Wis., Madison, Wis., Stencil Cir. 277, Rev. Feb. 1949, G. Bohstedt, W. H. Peterson, F. W. Duffee, and N. N. Allen.

"Collecting & Planting Seeds of Wisconsin Cone-bearing Trees," Ext. Serv., College of Agr., Univ. of Wis., Madison, Wis., Stencil Cir. 286, Feb. 1949, R. W. Abbott.

"How to Repair Girdled Fruit Trees," Ext. Serv., Univ. of Wis., Madison, Wis., Stencil Cir. 290, April 1949, C. L. Kuehner.

"Ladino Clover for Better Pastures," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 367, Rev. May 1949, H. L. Ahlgren and F. V. Burcalow.

"Extension—Alert Helper in Ranching, Farming, Homemaking," Agr. Ext. Serv., Univ. of Wyo., Laramie, Wyo., Bul. 14.

"Range Reseeding," Wyo. Range Management, Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Issue No. 8, Feb. 1949, A. C. Hull, Jr.

"Handling and Shipping Southern-grown Tomato Plants," U.S.D.A., Washington, D. C., Cir. No. 805, April 1949, E. V. Miller, W. D. Moore, H. A. Schomer, and E. K. Vaughan.

"Grazing Spring-Fall Sheep Ranges of Southern Idaho," U.S.D.A., Washington, D.C., Cir. No. 808, May 1949, J. F. Pechanec and G. Stewart.

"Report on the Agricultural Experiment Stations, 1948," Office of Exp. Stations, Agr. Research Admin., U.S.D.A., Washington, D. C., Jan. 1949.

"Home Vegetable Gardening in the Central and High Plains and Mountain Valleys," U.S.D.A., Washington, D. C., Farmers' Bul. No. 2000, March 1949, M. F. Babb and J. E. Kraus.

"Questions and Answers about Grazing on National Forests," Forest Serv., U.S.D.A., Washington, D. C., AIS No. 80, May 1949.

"Multiflora Rose for Living Fences and Wildlife Cover," U.S.D.A., Washington, D. C., Leaf. No. 256, 1949, W. L. Anderson and F. C. Edminster.

"Progress Report, 1937-1947, Dominion Exp. Sta., Beaverlodge, Alberta; Progress Report, 1936-1947, Dominion Exp. Farm, Agassiz, B. C.; Progress Report, 1937-1947, Dominion Exp. Farm, Brandon, Manitoba; Progress Report, 1936-1947, Dominion Reclamation Sta., Melita, Manitoba; Progress Report, 1937-1946, Dominion Exp. Sta., Harrow, Ont.; Progress Report, 1936-1946, Dominion Exp. Sta., Normandin, Que.; Progress Report, 1936-1946, Dominion Exp. Sta., Melfort, Sask.; Progress Report, 1937-1946, Dominion Exp. Substation, Regina, Sask.; Progress Report, 1937-1946, Dominion Exp. Farm., Indian Head, Sask.," Can. Dept. of Agr., Ottawa, Can., 1949.

Economics

"1949 Outlook—Wheat, Flax, and Soybean," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 167, Dec. 1948, M. K. Hinds and R. V. Backstrom.

"Procedure for Land Reclassification in Montana," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 459, Feb. 1949, H. G. Halcrow and H. R. Stucky.

"Adjustments in Maine Agriculture and Farm Prices—A Graphical and Statistical Presentation," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Misc. Publ. No. 615, Dec. 1948, C. H. Merchant and J. E. McKenney.

"Maryland Farm Crop Statistics 1939-1948," Agr. Exp. Sta. and Ext. Serv., Univ. of Md., College Station, Md., Supplement 1 to Bul. No. X 3.

"The Labor Supply and Mechanized Cotton Production," Agr. Exp. Sta., Miss. State Col-

lege, State College, Miss., Bul. 463, June 1949, Dorothy Dickens.

"Cost of Operating Tractors, Trucks, Trailers and Combines in the Yazoo-Mississippi Delta, 1947," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 147, April 1949, J. P. Gaines and G. B. Crowe.

"Systems of Farming for the Tri-County Irrigation Area in Nebraska," Exp. Sta., College of Agr., Univ. of Nebr., Lincoln, Nebr., Bul. 393, Jan. 1949, T. S. Thorfinnson and A. W. Epp.

"Suggestions for Organizing a County Crop Improvement Association," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 185, June 1949, C. R. Porter.

"Postwar Farm Incomes in the Pecos Valley, New Mexico," Agr. Exp. Sta., N. M. College of A & M Arts, State College, N. M., Press Bul. 1028, April 1949, H. B. Pingrey.

"Postwar Farm Incomes in Mesilla Valley, New Mexico," Agr. Exp. Sta., N. M. College of A & M Arts, State College, N. M., Press Bul. 1029, June 1949, H. B. Pingrey.

"Let's Discuss—Fixed and Flexible Price Supports—Programs and Problems Pertaining to Agriculture," Dept. of Rural Econ. and Rural Soc., Ohio State Univ., Columbus, Ohio, No. 1, April 1949, M. G. Smith.

"Cost of Producing Apples and Pears, Hood River Valley, Oregon—Progress Report No. II," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 456, June 1949, G. W. Kuhlman, A. E. Irish, and D. C. Mumford.

"Farm Earnings on Selected Farms in Clatsop County, Oregon, 1948," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Cir. of Info. No. 457, June 1949, M. H. Becker, L. E. Warner, and D. C. Mumford.

"Agricultural Development in the Pittsburgh District," P. R. No. 6, April 1949, D. C. Kimmel; "Agricultural Development in the Pittsburgh District (16 Western Pennsylvania Counties)," Agr. Exp. Sta., Dept. of Agr. Econ. and Rural Soc., Pa. State College, State College, Pa., P. R. No. 6A, April 1949, D. C. Kimmel.

"Part-time Farming in the Knoxville Farm-industrial Area of East Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. No. 210, May 1949, H. J. Bonser.

"Tennessee Co-op Handbook," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 311, Nov. 1948, A. L. Jerdan and F. J. Walrath.

"Production Practices, Costs and Returns from Lespedeza Hay in West Tennessee, 1947," Agr. Econ. and Rural Soc. Dept., Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Rural Research Series, Mono. No. 243, April 15, 1949, T. J. Whatley.

"Cost of Handling Texas Citrus, Fresh and Processed, with Comparisons for Florida, 1946-47," Agr. Exp. Sta., Texas A & M College System, College Station, Texas, Bul. 709, June 1949, K. A. Fugett and J. K. Samuels.

"Keeping Up on the Farm Outlook," Ext. Serv., Institute of Agr. Sciences, State College of Wash., Pullman, Wash., Ext. Cir. No. 136, July 27, 1949, Karl Hobson.

"Keeping Up on The Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 138, Aug. 31, 1949, K. Hobson.

"Consumption of Food in the United States, 1909-48," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Misc. Publ. No. 691, Aug. 1949.

"Origin, Structure, and Functions of the U. S. Department of Agriculture," Office of Information, U.S.D.A., Washington, D. C., Document No. 1, Rev. Sept. 1, 1949.

"Important Recent Achievements of Department of Agriculture Scientists," Office of Information, U.S.D.A., Washington, D. C., Document No. 6, Rev. Oct. 1, 1949.

"Agricultural Economic and Statistical Publications," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., BAE-AESP—7/49 4500, July 1949.

"Soybeans Harvested for Beans — Acreage, Yield and Production, 1947 and 1948, by Counties for 18 Principal States," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., July 1949.

"Marketing Northwestern Onions — Summary of the 1948-49 Season, Oregon, Washington, Idaho," Fruit and Veg. Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., June 1949, C. J. Hansen.

"Marketing California Grapes and Raisins, 1948 Season," Fruit and Veg. Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., July 1949.

"Marketing Arizona Salt River Valley Lettuce — Summary of 1948 Fall and 1949 Spring Seasons," Fruit and Veg. Branch, Prod. and Mktg. Admin., U.S.D.A., Washington, D. C., May 1949, C. B. Miller and W. F. Hines.

"Agricultural Statistics, 1948," U.S.D.A., Washington, D. C., 1949.

"Fruits (noncitrus)—Production, Farm Disposition, Value, and Utilization of Sales, 1947, and 1948," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., July 1949.

"An Economic Study of Family-sized Farms in Puerto Rico—II. Monserrate Farm Security Administration Farms, 1943-44, 1944-45," Agr. Exp. Sta., Univ. of Puerto Rico, Río Piedras, P. R., Bul. No. 78, March 1949, Guillermo Serra and Manuel Piñero.

A man with a wonderful vocabulary is one who can describe a shapely girl without using his hands.

Prof.: And now we find that X is equal to zero.

Student: Gee whiz, all that work for nothing.

How Hoosiers Grow Record Tomato Yields

By Thomas W. Higgins

Purdue University, Lafayette, Indiana

"THIS is my advice to you, anyone can grow tomatoes if he uses some common sense and plenty of fertilizer," Roscoe Fraser was saying as I entered his office where he was just ending a phone call from a farmer who wanted some advice on growing tomatoes for a local cannery. My interview with Mr. Fraser, Tomato Specialist at Purdue University, was to get some information on the large yields that Indiana growers are turning out.

First he spread out some records of the U. S. Won Club Champion. This club is composed of the farmers who wish to produce a larger quantity and a better quality of tomatoes for Indiana canners. It was organized by the Purdue Horticultural Department cooperating with the County Agricultural Agents, the Indiana Canners' Association, local canning companies, and the farmers who contract acreage with canning companies.

Mr. Fraser placed in front of me the record of a 17-year-old boy, Carlton Anderson, who was graduated from Clay Township High School in Miami County in 1947. Anderson had taken vocational agriculture in high school, and this was his first year on his own in tomato growing. He grew the crop on a 50-50 basis on the Schryler Lesh farm, which is located near Bunker Hill.

Anderson had 5½ acres of tomatoes and produced an average yield of 16.2 tons per acre—85.2 per cent U. S. No. 1's and two-tenths per cent culls. This is how he produced this record-breaking crop. First, 400 pounds of 3-18-9 fertilizer per acre were applied to the land about the first of May. Then the field was plowed to a depth of eight inches. When the plowing was done, the field was double-disced four times, harrowed twice, and 300 pounds of 3-12-12 fertilizer per acre were broadcast on the surface of the plowed ground by using a wheat drill. Then at planting time 250 pounds of 6-12-6 per acre were applied in the rows.

The field was direct seeded with Indiana Baltimore seed at the rate of 1½ pounds per acre. The rows were 40 inches apart, and the plants were thinned out to 18 inches apart in the rows. The crop was cultivated twice: first with a two-row cultivator and next with a one-row cultivator. There were two airplane dustings of seven per cent insoluble copper to help keep the crop free from diseases and insect attack.

After I had looked over this record, Mr. Fraser said, "You see this lad knew the value of plenty of fertilizer, and he applied good management, which was largely responsible for this crop."

The record of Kash Kissick, Route 5, New Castle, disclosed one of the other high yields. He was the 1947 winner of the Double Tonnage Tomato Club, a companion to the U. S. Won Tomato Club.

Mr. Kissick had upland soil of Miami type. He applied one ton of manure per acre before plowing, and at planting time he had 400 pounds of 3-12-12 applied with the plants in the row. The average yield per acre for his 7½ acres was 16.42 tons.

Another high yield was obtained by Don Caley, who was a junior in Union Center high school and a veteran 4-H club member of four years. He held the honor of being the 1947 Reserve

Double Tonnage Club Champion with a yield of 13.21 tons per acre in spite of the fact that he had some late blight in his field.

Don also used plenty of fertilizer, applying 600 pounds of 3-12-12 per acre with a grain drill before the Indiana Baltimore plants were set. He wasn't afraid of too much work, and his record shows that he cultivated the crop five times and hoed the field by hand three times.

In answer to what he thought about the size of future yields of tomatoes, Mr. Fraser replied, "I expect big things. The farmers are just finding out how well the practice of good growing will pay off when harvest time comes. With the added use of potash on tomato crops, we can expect almost anything. One thing for certain, we are going to see some record-breaking high yields in these two clubs this year."

Leaf Analysis Shows Plant Needs

Without even a whisper, a leaf can convey a fairly reliable report on the food material needs of the tree. The message shows up in chemical analysis.

Dr. O. A. Alben, soil technologist of the U. S. Department of Agriculture stationed at the pecan field laboratory, Shreveport, La., says that leaf analysis probably tells more than any other method about the mineral nutritional requirements of the pecan tree.

Analyses made over a period of years furnish scientists at the laboratory with data showing when the amount of a mineral element such as nitrogen, phosphorus, or potassium, in the pecan leaves is low, average, or high. Further information on deficiency symptoms has been obtained in analyses of leaves from pecan trees growing in sand cultures and fed solutions supplying known amounts of the various nutrients. On the basis of these studies, the scientists can now use leaf analysis to diagnose quickly nutrient deficiencies in the pecan tree.

Why the Push on Potash

(*From page* 15)

Another reason why potash has become an increasingly critical element is the fact that in the early days and even now we have been using fertilizers relatively rich in phosphate, and this has resulted in pumping potash out of our land at an accelerated rate. I tell farmers who are using rock phosphate that they should purchase some pure potash or mixtures such as 0-10-20 or 0-9-27 to go along with their rock phosphate.

Too, the liming of our soils has tended to accentuate the need for potash. It is a strange thing that the use of agricultural lime and the neutralizing of soil acidity should bring about changes in the soil that tend to slow down the rate at which potash is becoming available. Deficiencies of boron, manganese, iron, and possibly certain other trace elements also may follow in the wake of the liming of our soils. It appears that applying lime to our soils and raising the pH or soil reaction to the neutral point bring about a condition where potassium and certain other elements become less available to growing crops. I urge farmers to lime their acid soils but not to overlime. We believe it best to keep our soils a little on the acid side.

The 17 million tons of lime that have been poured onto Wisconsin farms in the last 15 years have no doubt been a factor responsible in part for the diminishing supplies of available potassium. This liming did, for a few years, result in substantial increases in the production of alfalfa, clover, and other crops, and in turn, these bigger crops of legumes pulled just that much harder on the supplies of potash. Liming an acid soil tends to increase the availability of soil phosphorus, and thus the pull on potash is still further increased.

Wisconsin farmers are now applying a substantial tonnage of commercial fertilizer (404,121 tons in 1948), and this large tonnage of fertilizer is helping to offset the unbalancing effect of the heavy applications of lime. But still we are not getting as much potash as we want or should be using. The ever-increasing production of potash from domestic sources, along with the small quantities coming from France and Germany, will before long really give our crops all the potash they need or can make use of economically.

The Use of Gypsum . . .

(*From page* 18)

removing the gypsum from the surface of the furrow, the high per cent sodium water again will cause this soil to seal and prevent deep percolation.

Even though the mass of soil between the furrows contains large quantities of gypsum, it will be of little use in preventing sealing adjacent to the furrows. To increase infiltration, it will be necessary to re-work the soil and re-furrow the land to bring soil containing gypsum in contact with the water. The other means of overcoming this sealing effect is the addition of gypsum to the irrigation water as was done in this experiment. The methods used in the experiment are not practical for field use, Fig. I. Other methods, however, are practical and have been widely used. The first field treatments were applied by shoveling the gypsum into the standpipe, or putting it around the outlet valves of the pipeline. These methods gave fair results, but were not satisfactory.

Farmers began improvising machines for this purpose by using potato fertilizer hoppers and other home-made devices. Some of these were built in such a manner that paddle wheels provided the power. For several years, this type of implement was used. However, no organized effort or standard machine was developed for this purpose.

In 1946, the Kern County Agricultural Extension Service designed a gypsum applicator for metering gypsum into irrigation water, Fig. 2. This first machine worked on the principle of a potato fertilizer hopper or manure spreader, in that a moving belt carried the load. The gypsum was metered by the speed of the belt and by the opening in the front of the hopper. The belt on the first machine was 28 inches wide and the hopper 26 inches square. Since gypsum has the property of bridging, the hopper was built with straight sides. The machine was geared to move the belt at the rate of about 8 inches per minute. The reduction on this original machine was obtained by the use of a Boston gear reduction and various belts, pulleys, and chains. The unit was powered by a 110-volt electric motor. The belt was supported at each end by 6-inch rollers mounted on roller bearings. The bearings at one end were movable, allowing for adjustment of the belt. Two-inch roller bearings were evenly spaced beneath the hopper to support the load of gypsum. The machine was designed to sit over an open ditch or standpipe and meter gypsum into the irrigation water.

Since this original machine was developed, several other machines have been designed, using similar or, in some cases, completely different ideas. Most machines now being built have a mixing vat which may be attached or come as a separate unit. This mixing vat takes a small portion of water from the pump discharge pipe, mixes it with the gypsum metered out, and pumps the suspension back into the discharge. This type of applicator is used where the irrigation system is operated under pressure.

Many applicators have been designed and built by the farmers themselves. Others are designed and built by various machine shops for the farmers. These machines may also be used to apply soluble dry fertilizer to the water.

The quantity of gypsum used in the irrigation water will depend somewhat upon the purpose for which the material is being applied. Some use has been made in applying excess gypsum to overcome an alkali condition. In this discussion, we will consider only the amount of gypsum necessary to correct the high percentage sodium irrigation water.

Where poor penetration is a result of a high sodium percentage irrigation water, as experienced in Kern county, gypsum can be applied to reduce the percentage of sodium. Water below 50 per cent sodium has not generally caused a great deal of trouble with infiltration. On the other hand, where trouble is experienced a great portion of the water is over 50 per cent sodium. Therefore, as an arbitrary figure, we choose to use 50 per cent as the dividing line.

Tables have been prepared giving the amount of gypsum required to correct the water when the percentage and quantity of sodium are known. Table II gives the pounds of gypsum required per hour to reduce various percentages of high sodium waters to 50 per cent for a 1,000 gallon per minute flow. The table is prepared using milligram equivalents of sodium per liter and gives the amount of gypsum necessary to reduce 60, 70, 80, 90, and 100 per cent sodium waters to 50 per cent. Assuming that we have a 90 per cent sodium water and one milligram equivalent of sodium per liter, which is one more or less commonly found in Kern county, it would require 38 pounds of gypsum an hour for each 1,000 gallons per minute discharge to correct the water to 50 per cent sodium. The quality of gypsum required for each milligram equivalent increase in sodium is 38 pounds an hour per 1,000 gallons a minute discharge.

Table III is prepared in the same manner as Table II, except the figures indicate the pounds of gypsum required per acre-foot of water to reduce the sodium content to 50 per cent. As-

TABLE II. POUNDS OF GYPSUM (APPROXIMATE) REQUIRED PER HOUR TO REDUCE VARIOUS PERCENTAGES OF HIGH SODIUM WATER TO 50 PER CENT SODIUM WATER WITH A FLOW OF 1,000 GALLONS PER MINUTE

Per Cent Na	* Milligram Equivalents Sodium per Liter									
	1	2	3	4	5	6	7	8	9	10
100	43	86	129	172	215	256	301	344	387	430
90	38	76	114	152	190	228	266	304	342	380
80	32	64	96	128	160	192	224	256	288	320
70	25	50	75	100	125	150	175	200	225	250
60	14	28	42	56	70	84	98	112	126	140

* Milligram equivalents per liter is a common term used by chemists in reporting water analyses. Sometimes the reported analysis is in parts per million, and to convert the sodium to milligram equivalents, divide by the factor 23. For example: 46 P.P.M.÷23=2 milligram equivalents per liter.

TABLE III. POUNDS OF GYPSUM (APPROXIMATE) REQUIRED PER ACRE-FOOT OF WATER TO REDUCE HIGH SODIUM WATERS TO A CONTENT OF 50 PER CENT

Per Cent Na	Milligram Equivalents Sodium per Liter									
	1	2	3	4	5	6	7	8	9	10
100	233	466	699	932	1,165	1,398	1,631	1,864	2,097	2,330
90	206	412	618	824	1,030	1,236	1,442	1,648	1,854	2,060
80	173	346	519	692	865	1,038	1,211	1,384	1,557	1,730
70	136	272	408	544	680	816	952	1,088	1,224	1,360
60	76	152	228	304	380	456	532	608	684	760

suming that three acre-feet of water are used to grow a crop, then three times the amount shown in Table III should be applied.

The data presented in Tables II and III are for the correction of water being used on land considered good agriculturally, but having its infiltration rate impaired by the use of high sodium percentage water.

The correction of high sodium water is limited to relatively low salt concentration. A high total salt and high sodium percentage water requires a large amount of gypsum to make the correction. Difficulty will be experienced in dissolving the gypsum at these high concentrations, and the cost will be high. It is questionable whether waters having a sodium content in the higher concentrations (Tables II and III) should be corrected. According to Table III, to reduce a 90 per cent sodium water to 50 per cent, with a concentration of 10 milligrams equivalent sodium would require approximately a ton of gypsum per acre-foot of water. It may not be necessary to reduce the sodium to a 50 per cent level to get improved infiltration. As indicated in Table I, a reduction in percentage sodium by 20-30 per cent may be sufficient to give adequate water penetration.

This material does not apply necessarily to alkali land, even though it may be useful in that connection. The work was done on the sandy loam soils of Kern county. The results obtained indicate that the amount of gypsum necessary to improve the infiltration rate is much less when applied in the water rather than directly to the soil. When the gypsum is applied to the soil, quite frequently it is thrown into the beds where it can be of little value in aiding infiltration. That quantity which is left in the furrow is soon leached, does its work, and is gone. Frequently, the gypsum applied to the soil is of very coarse texture or contains a large number of lumps, which render it less valuable as a soil conditioner.

Gypsum used in the irrigation water should be of high grade (90 per cent purity), if pipe lines are involved. The impure gypsum can be applied through the meter to open ditches, but should be used with caution in pipe lines, due to the settling out of impurities. The figures shown in Tables II and III are based upon 100 per cent gypsum. If the gypsum is lower than 90 per cent, some allowance should be made, and proportionately larger quantities of material used.

The rate at which the soil improves varies considerably from ranch to ranch. Some farmers have obtained very good results with the first irrigation. These instances, however, have been few. Normally, it takes about three irrigations before a great deal of improvement can be seen in the infiltration rate. Frequently, in an effort to obtain a more rapid response, a larger quantity of gypsum than these indicated by the table are applied at first. In that case, the limiting factor would be the amount of gypsum that the water would dissolve. After the initial application, only the amount of gypsum necessary to correct the water need be applied.

It is thought that the proper method is to correct all water pumped from the well. This will not allow the soil to become hard and seal over again during the growing season of any specific crop.

Summary

Field tests were run in Kern county, California, using gypsum in the irrigation water. The tests were carried out on ranches having water penetration problems. These ranches use water pumped from irrigation wells. This particular water is of low mineral content. Sodium salts, however, constitute a large portion of the minerals present. The infiltration rate of the water on these fields was increased by the use of gypsum in the irrigation water. The lowest average increase was 33 per cent obtained on Field No. 126. The highest average percentage increase was 168 on Field No. 122. The amount of gypsum added on these two fields was 187 pounds and 297 pounds per acre-foot of water, respectively, Table I.

Tables have been worked out for use in calculating the amount of gypsum necessary to correct irrigation water when the sodium percentages and quantities are known. One table is based on gallons per minute discharge and another on the basis of one acre-foot of water.

Field applications of gypsum to irrigation water are now being made by many farmers in Kern county. Metering machines are being used in most cases. The machines are being built by farmers and various machine shops. Their use has become a general practice in the soft water areas of Kern county.

In the Land of the Corn God

(*From page* 27)

ing circle of light. These creator gods possessed great thoughts and, in time, they began to speak to each other. At their command, the "Earth" appeared above the waters of the sea. They next created mountains, valleys, trees, grass, rivers, and lakes. Later they created animals, birds, and reptiles. The gods were dissatisfied because, up to this time, they had created nothing capable of thought and worship. So they decided to create superior beings and made the first men from damp clay. These clay creatures turned out to be clumsy, ugly, and stupid and they melted away when they got wet. So the gods destroyed all these beings by water and then set about to make a more suitable man. This second man was made of wood. He was less clumsy and more durable than the clay man. He could talk and reproduce, but he had a fatal spiritual defect—he had no feelings and he did not worship his creators. The gods attempted to destroy all of the wooden men by a rain of fiery liquid and monsters. But the legend says that a few of these men escaped and became monkeys.

Finally the fox, the coyote, and two birds (the parakeet and the falcon) brought word to the gods that they had found corn; that it was a marvelous plant with white and yellow ears, and it would be suitable material for them to use. The gods decided to try again, and they made four men of corn. But this time they had done their work too well. These men were beautiful creatures, clear-seeing and capable of understanding everything. They were so much like their creators that it was feared they would not be sufficiently humble. To correct this, a mist was passed over their eyes to prevent them from seeing too clearly. At last a satisfactory creature had been made to populate the earth. He could speak, think, and feel, but he was not too wise. And now the world is populated with white men, yellow men, and red men—because corn produces white, yellow, and red ears.

Pre-planting Ritual

Corn is so much a part of the lives of these people that they observe some sort of ritual from the time the seed is blessed in the church, when it is planted, cultivated, and harvested, through the final operation of selecting the seed for the next year's crop. The ceremony varies considerably from tribe to tribe, but each follows more or less the traditional rites that have been handed down to them for thousands of years.

Planting begins in March and extends into May, depending upon the rains. Before planting, the people purify themselves by burning incense and by making peace with their neighbors. On a Sunday before planting, a special mass is celebrated in church where the seed is carried to be blessed. At the church in Chichicastenango, each family selects a spot on the floor where their seed are placed, and then they surround their seed with lighted candles, incense, and flower petals. Finally, they kneel in a circle around the seed and pray.

The night before planting, the men burn incense and sprinkle the field with aguardiente (an alcoholic beverage of about the same potency commonly known in this country as "white mule") while they watch and pray at home with lighted candles. In the morning, the women take candles and festive foods to the fields for the planters. The candles are placed at points representing the four directions, and then, after the planting is done, the feast is served.

When the corn is harvested, another ritual season begins. The relatives and friends of each family help to gather the corn. The selection of the seed is of prime importance, though the process could hardly be called scientific. In some instances, only the corn from the center of the field is chosen (Corazon del Maiz—Heart of the Corn). The finding of twin ears is a cause for great rejoicing, for in them is the spirit of corn and the assurance of a good crop next season. One of the twin ears is saved for seed and the other is placed as a thank-offering before the figure of the family's household saint. On occasion, the twin ears may be buried in the pile of harvested corn as an example to the others to reproduce in like manner.

Long ago, the corn was piled on the ground as harvested, and the Indians gathered around to wait patiently for the Corn God to make certain ears jump out of the pile. These were invariably chosen for seed. In some localities, the largest ear found at harvest time is fastened to a rocket and discharged. If the ear reaches a great height, it is taken as a token that the corn will be sold for a high price.

Cultural methods have changed but little since the Spanish Conquest. In areas where land is plentiful, the brush is cut and burned to prepare the milpa for planting. A sharpened stick is still used for planting the seed which is carried to the field in a fiber bag. The sole change that has been made to date is that a large hoe is now used for cultivation of the plants.

In thickly settled areas, corn is grown on the same land year after year. In other areas, after two crops, a new milpa is cleared and the old one is allowed to grow up in brush, to be cleared again after a few years of rest.

In some cases, short sections of elderberry branches are planted under each hill of corn. These decay readily and supply a small amount of plant food.

A large bean, similar to the sort we know as horse bean, is commonly grown in each hill of corn. Although these beans are grown for food, they are no doubt of some help in maintaining soil fertility.

Cultivation consists mainly in pulling dirt up to the plant, forming a hill 12 to 18 inches high. There is a striking lack of uniformity in the plants which are mainly slender. The leaf sheaths are almost always found with a dense hairy covering, varying from green to nearly black. The color of the kernels may be white, yellow, red, or blue.

It can readily be seen that the large amount of hand labor required for growing the crop leaves little time for any other work during the corn-growing season. The men spend the greater part of their time producing the crop, and a very large proportion of the housewife's time is consumed in grinding the corn by hand and in cooking it. In spite of the limited variety of food consumed, these Indians are remarkably strong and energetic. They are very industrious, good natured, and friendly—these modern subjects of the Corn God.

Irrigation . . . in Southeast

(*From page* 12)

Texas has made tremendous strides in irrigation during the last 10 years and much of it has been on cotton. This has been due to the comparatively low rainfall, the growth of citrus and truck crop production in the Rio Grande Valley, and developments in other areas where irrigation is feasible.

In 1939, Texas had 843,839 acres under irrigation. In 1948, the irrigated area had grown to 3,038,006 acres. The Texas Extension Service reports that the State's irrigated acreage should continue on the increase, certainly for the years immediately ahead.

Texas, of course, is an exception. It has large, expensive citrus and truck crop areas that are absolutely dependent on irrigation. Without it, the land which is now high-priced, would be good for little except grazing. To produce its truck and citrus, Texas depends largely on irrigation.

The Southeast does not have to have irrigation. It is not an absolute necessity if we just wish to maintain the status quo. Statistics will show that the Southeast has what the Chamber of Commerce would call "ample rainfall." The vast network of rivers, creeks, lakes, and ponds has been there from time immemorial. However, generations of farmers have let the good water flow right by fields that were literally parched for want of moisture. Now, at long last, we see encouraging signs of an awakening to the possibilities that irrigation offers throughout the entire area. We see it in the Carolinas, in Georgia, in Florida, and other sections.

These signs mark the way we are headed. However, irrigation generally in this area is new, so new that we should go slowly. We need much research on the subject, for the ramifications of irrigation do not end with putting some water on the land. There is much to learn of timing, methods, how much, which crops, and so on.

We never learn by waiting. We must start; go slow; and not attempt too much at first. Then we can build on the findings of experience and experiment.

Interest in irrigation is growing, not because the Southeast has to have it, but because farsighted farmers want to achieve the natural goal of every good farmer—"a quantity of quality product on the same acre."

Alfalfa . . . in the South

(*From page* 24)

cotton acre, provided he has land for increasing the alfalfa acreage to four times that of his cotton acreage. On this basis alfalfa is a much better cash crop than cotton on the average Georgia farm.

Of course, all soils on which cotton is grown are not suitable for alfalfa production. According to soil survey maps of the State, there are approximately 1,800,000 acres of land in Georgia that are well adapted to it. There is less hazard from erosion, leaching, and soil deterioration with alfalfa than there is with cotton production, but it takes heavy applications of lime, superphosphate, and potash to maintain high yields of alfalfa.

Alfalfa can be grown successfully and economically in the Piedmont, Appalachian, and Limestone Valley soil regions of the Southeast and on the heavier, well-drained sandy loam soils of the Coastal Plains, particularly those soils with heavy sandy clay or clay subsoils. Five million acres of alfalfa properly fertilized in the Southeast will put its livestock business on a profitable basis.

Alfalfa can be harvested for hay or grazed if precautions are taken so as not to over-graze in dry weather, late fall, or mid-winter. Alfalfa has given a higher yield on our experimental farm than lespedeza or kudzu. It is a perfect hay crop and is ideal for handling with mechanical equipment. It is a labor saver. The average seeding of alfalfa should last from four to 10 years, making it cost less for seed and labor than any of our annual hay crops, and it affords year-round soil protection. The South has a "Green Gold"—so why not use it?

Some Fundamental Principles

(*From page* 22)

monly the best and most inexpensive method to open up the subsoil. For best soil condition the usual requirements might be summarized as follows: (1) A proper balance between intertilled and hay or pasture crops, (2) Winter cover crops where practical and economically sound, (3) Return to the soil of all crop residues as far as practical, (4) Good care and use of farm manures, and (5) Growing a deep-rooted legume where needed and then at least once in an average rotation.

Referring to Figure 2 and studying the virgin and compact soil illustrations, it is easy to see that under virgin soil conditions, the soil has been made open and porous by years of root penetration and organic accumulations. Speaking from the strictly physical viewpoint, it is this type of condition in soils which our farm operations should seek to emulate. In contrast to the virgin soil, a glance at the cylinder on the right shows that continuous cultivation has burned out the organic matter, and use of heavy farm machinery has pressed the soil particles close together resulting in a compact soil layer. This type of soil compaction shuts off the downward movement of water, limits the amount of air circulating, and restricts root development of plants to that thin margin between the compacted area and the soil surface. In looking at this situation from the standpoint of soil improvement or soil building, the problem is to employ every possible means, not only to prevent these undesirable compactions from forming, but when formed, to quickly and effectively break them up, thus permitting air, water, and root development in soils to function in a natural and more effective manner.

In the opinion of the experts, there are two ways of breaking up compacted soil areas: It can be done either by specially designed machinery, by nature, or both. It is generally believed that the best way to break up the plowsole is to provide soil conditions by liming and fertilization to grow deep-rooted legumes, and let nature take her course.

Mechanical Methods

Mechanical means for breaking up soil compaction have been employed in many parts of the country. The only trouble about mechanical equipment is, first, its cost, which in many cases, especially for the small farmer, is prohibitive; and second, on many types of soils the effect of deep tillage for breaking up the soil compactions is temporary. Where conditions are extremely bad to start with, it may be necessary to purchase or hire deep-tillage machinery in order to make soil conditions reasonably favorable for the establishment of a deep-rooted legume. For best all-around improvement of the physical condition of compacted soils, both the mechanical and natural means for correction may need to be employed. Machinery, no doubt, does the job more quickly than the use of deep-rooted legumes, but over a long period of time, and that is how we must view the problem of soil building, the best bet lies in the benefits from a well-planned rotation.

While farmers and soil scientists still have a great deal to learn about soil aeration and its effects on plants, the basic facts all point to the advisability of getting air both to roots of plants and to soil organisms which are so beneficial to growth. Whether we use a factory-made tool or a plant furnished by nature in accomplishing this matters little so long as we effect the desired movement of both moisture and air in soils and always toward the deeper parts of the soil.

Conservation Logic

In a recent report from the U. S. Department of Agriculture we were told that six billion dollars' worth of lime, phosphorus, potash, and nitrogen is lost from the country's soils each year. That is a third as much as our crops are worth. Less than one-sixth is replaced in the form of fertilizers. It would appear that we are still making a living by mining our soils. Our lime deposits are practically inexhaustible—nitrogen can be manufactured and for all practical purposes is inexhaustible. Phosphorus and potash deposits, on the other hand, are known to be limited. It behooves us, therefore, to do everything possible to use these supplies carefully. Unnecessary losses naturally mean higher fertilizer needs to grow crops and this means faster exhaustion of the scarce plant-food materials. To cut mineral losses it will be necessary to employ the following: (1) Prevent erosion, (2) keep the ground covered with growing crops, (3) develop well-balanced rotations, (4) store manure well or spread at once, (5) use all the lime that is needed, and (6) use phosphorus and potash as needed for legumes and soil-protecting crops.

Terraces, sod waterways, and dams are required on many farms to prevent erosion. When required, they are necessary first steps. Other lands can be used safely only for the growing of grass or trees. But on all lands used for crops or pasture, many other steps are required for successful maintenance of soil fertility. Many of these steps have to be repeated perhaps every year. And they have to be combined with others in a system for permanent soil fertility if needs for national production and individual farm success are to be met.

Details of systems necessarily vary greatly between areas, but certain essentials common to all are: (1) Land that is intensively cropped must be kept in good physical condition. If not, rain water runs off instead of soaking in, carrying the topsoil with it. Such land gets water-logged or puddled, is hard to work, suffers from drought, and fertilizers fail to give full results. (2) The supply of essential available minerals—lime, phosphoric acid, potash, and nitrogen must be kept at an adequate level. Shortage of any one may sharply limit yields and economic returns. High acre yields like mass production in industry are the secret of success in either undertaking. High acre yields are also the secret of success in erosion control and conservation farming. The doubling and trebling of the yields on the less erodible lands through adequate liming and fertilizing will make possible the return of the more erodible lands to forest and permanent pasture. This need not mean less food, but much more and better food for all.

. . . N. E. Green Pasture Program

(*From page* 8)

advantage, as has brome grass over timothy, under the dry conditions which prevailed throughout June, July, and August in many sections of New England. I have been accused, personally, of being partial to ladino clover, and perhaps the accusation is just. I still believe, however, that ladino clover can safely be depended upon in our grassland dairy farming rotations in the average season, for 1949 was far from that. Apparently, these 18 men feel the same way, since their acreage now growing ladino was just over one acre per animal unit on the farms.

Sometimes, one has to over-emphasize a point to get it across. That may be what we have done with ladino. Its wide soil and climatic adaptations are sufficient to recommend it universally in this area. But just because it is adapted so widely is no reason farmers shouldn't produce alfalfa on land that is adapted to it. And we suspect there will be more of a swing into alfalfa as a result of our experiences in 1949.

The drought has created a great deal of interest in irrigating pastures and hay fields, and several systems utilizing sprinklers have been installed throughout New England. Their use is limited to those farms where a water supply is available or can easily be made available. While it is too early to say what the future of irrigation will be, the preliminary installations have given good results, as would be expected in a season when in the three hottest months there were less than five inches of effective rainfall. With irrigation come new problems of fertilization and management, how often to fertilize, how much water to apply, and similar unanswered questions. Those farmers who watered their fields through the season fertilized after each harvest, if hay or grass silage was the objective, and some fertilized lightly after each pasturing where the harvesting was left to the animals. Irrigating should and will increase the acre amounts of fertilizer needed.

It is very difficult to criticize the methods of these 18 top men, as it was in 1948. If there is any one place where they can be criticized, it is in the lack of providing emergency crops for the hotter, drier portion of the year. It was interesting to note that of the 18, only seven had seeded any Sudan grass or Japanese millet for August feed, and these seven planted but 31 acres. Ten of these 31 acres were on a farm in the extreme northern part of New Hampshire, in a region where the rainfall was distributed well enough and in an amount so that the owner did not need emergency feed. At the moment, there is much more interest in growing rye or wheat for late fall or early spring pasture than in these midsummer insurance crops. Seven of the men had 82 acres of rye or wheat for spring feed and several of them were planning for late fall feed from one of the small grain crops. Grazing of oats when used as a nurse crop is, of course, fairly common practice.

The other observation comes as a result of comparing 1949 with previous years in respect to pasture management. These men are pointing the way to more skillful procedures, not only in soil fertility practices but in other phases of management which enable them to get more feed from their acreage. Clipping the pastures to keep them vegetative was more commonly practiced this year than in 1948. More fencing is being done, resulting in smaller acreages pastured at a time and less waste of feed. More emphasis is being placed upon water and shade, and several of these top men have developed loafing pastures adjacent to their small rotated pastures, with water and shade in the loafing area so the cows will come out of the lush ladino areas and drink and rest.

More men, too, are spacing their fertilizer applications to better advantage, thereby producing their feed when it is most needed. All but three of these 18 farmers topdressed some of their land after the first crop was cut or pastured, and the amount of land so treated amounted to 30 per cent of the total acreage on all the farms. This indicates progress.

Green Pastures, although it started in a small way with only 87 farmers enrolled in New Hampshire in 1947, has spread throughout New England, with 1,800 men entering in 1948 and 2,700 in 1949. Besides New England, many other states are trying out the idea. They will find, no doubt, as we have here, that a Green Pastures program, properly organized and executed, is one of the best educational tools yet devised to teach the principles of better pasture and forage production and management.

No Quitter!

(*From page* 5)

from that which the selfish man inhabits. He possesses a new sense which enables him to behold objects which the selfish cannot see. His enjoyments penetrate his heart and do not merely remain on the surface of the mind."

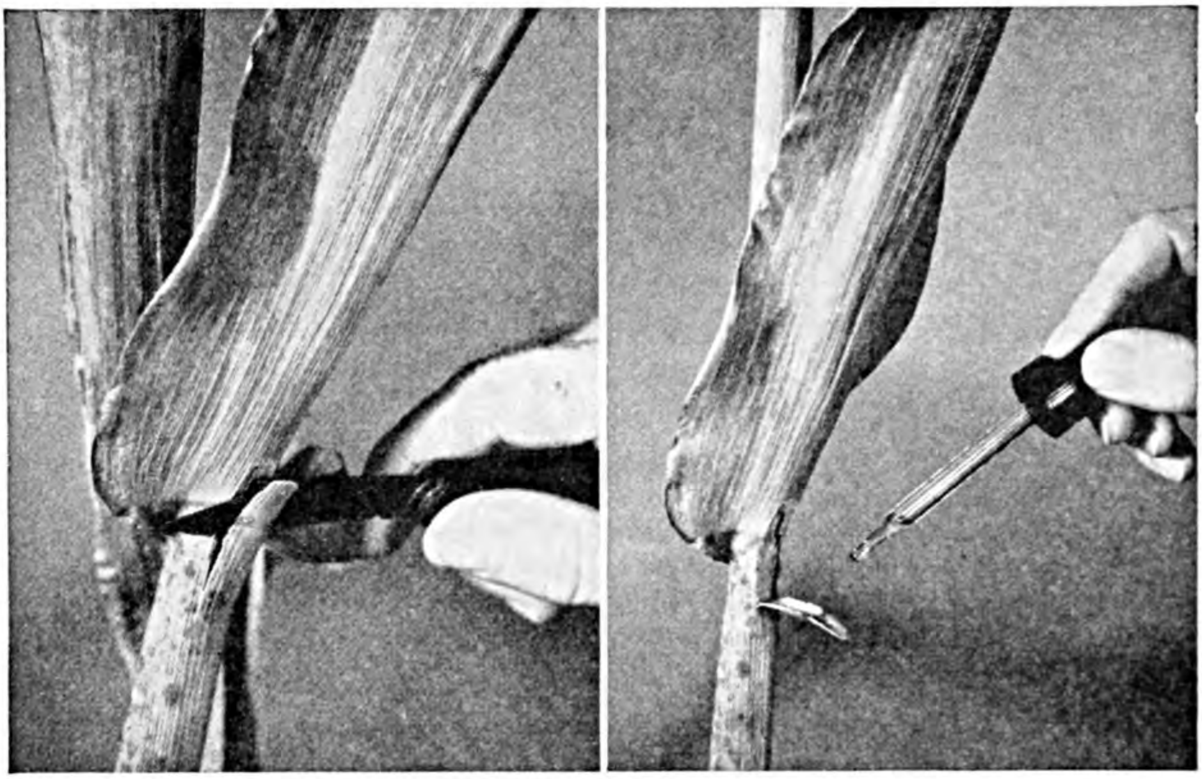
And finally, we all have little respect for a fellow who hangs tenaciously to his little nook of business or profession beyond the time when he can gracefully ease out and make room for others whom he has trained and counseled. I know a minister who did that and a high-school principal who stuck to his job too long. Both cases were sorry examples of stubborn pride. In neither case would a resignation and retirement been amiss and in both cases the quitters would have been honored and praised by their successors and their associates. Yet they both hung on too long, got into a row or two, showed petty attitudes, and barely escaped dismissal. All because they had the wrong outlook and by their defiance made painful what might otherwise have been a pleasant shift to purposeful achievement on retirement.

A man who retires with all his mental and spiritual powers intact and with enough life in his legs to take him places without anxiety is in for a happy time of it. He can drop into the old "roundhouse" occasionally just to kid the characters who work there like slaves when he is free, or maybe to give them a bit of sound advice when they ask it.

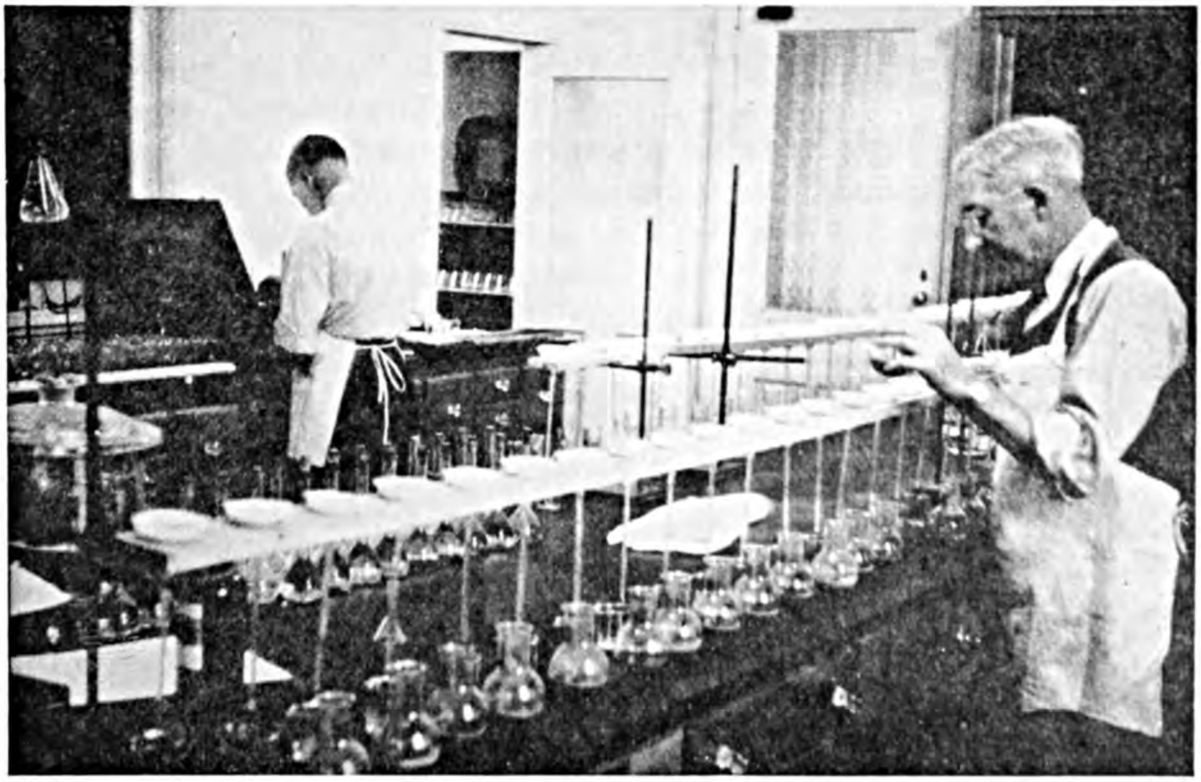
HE can take his grandchildren by the hands and toddle off with them to learn anew those things he has long since forgotten, what with red tape and dreary routine. He can help some neighbor plan and erect anything from a garage to a new house, or join some community effort that has in it some real abiding goal—with most of the members too busy to see it through, leaving there a space for him to fill. It's always valuable for any community to have men of maturity and experience and sense who can take firm hold of half-finished, immature visions and push them toward completion. Such a chance is a boon to a fellow who is supposed to have "retired."

As one looks around the country and dips into history, it becomes more and more apparent that age in years has never stopped the folks with soul and talent and character. So when we say of them that they have "quit" or "retired" we mean it's time to keep watch of them because they are loose at last and ready to render those things that the old grindstone kept their nose out of for countless working years.

So don't let me catch you saying you want to "die in harness." Just pray aloud to have them take off the harness, and the blinders and the check rein with it. Then kick up your heels and prance off to refresh yourself in green pastures.



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

Everyone in the Dean's office in the local law school was very busy. It was the beginning of the school year. The Dean was the busiest of anybody. The phone rang, and when the Dean answered, a sweet young voice said.

"Is this the gas co.?"

The Dean roared, "No, this is the law school!"

To which the sweet young voice replied: "Well, I didn't miss it so damn much, did I?"

* * *

Tommy came home proudly from his first day at school.

"What did you learn in school?" asked his mother.

"Nothing," said Tommy, then, seeing the look of disappointment on her face, he added, "But I learned a lot during recess!"

* * *

A hillbilly, back from the war, was sitting in the village store one day when a traveling salesman asked what he thought of military life.

"I liked the drinkin', card-playin', and wimmin right well," he replied, "but the fightin' was plum dangerous."

* * *

Once upon a time there was a boy penguin and a girl penguin who met at the Equator. After a brief but charming interlude, the boy penguin went north to the North Pole; the girl penguin went south to the South Pole.

Later on, a telegram arrived at the North Pole, stating simply: "Come quick—I am with Byrd."

Parson: "Goodbye and God bless you. Be careful that the rowdies in town don't play tricks on you."

Newlyweds: "Don't worry, Parson, they won't catch us napping."

* * *

EPITAPH

"Ma loved Pa, Pa loved wimmen;
Ma caught Pa with two in swimmin'.
Here lies Pa."

* * *

Oldest political story:

A negro, listening to the speech of a perspiring candidate at a country picnic, remarked:

"He sho' do recommend hisself powerful high."

* * *

Time tells on a man—especially a good time.

* * *

Father: "Why shouldn't I be friendly with my secretary? We work together every day. It's only logical."

Mother: "Wouldn't 'biological' be a better word, dear?"

* * *

IN LONDON

"You ladies ought to sit a little closer," said a male strap-hanger in the bus. "According to the Act of Parliament—every passenger is entitled to 18 inches of seating space."

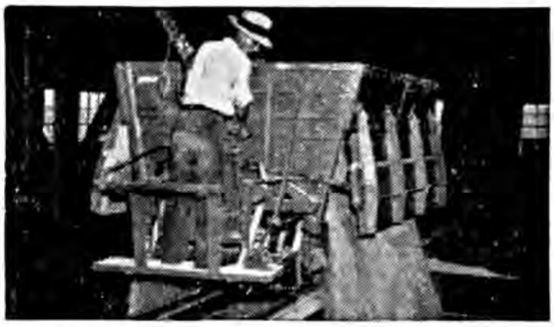
"You can't blame us," replied a matron tartly, "if we are not constructed according to the Act of Parliament."

Printed in U.S.A.

Better Crops WITH PLANT FOOD

December 1949 10 Cents

The Pocket Book of Agriculture



V-C Fertilizer is a properly-cured, superior blend of better plant foods.

V-C Fertilizer stays in good condition, when stored in a dry building.

V-C Fertilizer flows through your distributor, smoothly and evenly.

V-C Fertilizer encourages a good stand, uniform growth, bigger yields.

OUR FULL-TIME JOB

TO YOU, the selection and use of the best fertilizer is only one practice essential to your success in making your farm a better-paying business.

To V-C, however, the manufacture of the best fertilizer is a full-time job. The extra crop-producing power of V-C Fertilizers is the result of over 50 years of V-C scientific research, V-C practical farm experience and V-C manufacturing skill.

Since 1895, V-C factory experts, chemists and agronomists have constantly tested and developed new methods and new materials, to produce better and better V-C Fertilizers for every crop you grow.

If you want to give your soil the power to produce abundant yields, see your V-C Agent! Tell him you want V-C Fertilizers!

VC FERTILIZERS ®

VIRGINIA-CAROLINA CHEMICAL CORPORATION

401 East Main Street, Richmond 8, Virginia

Norfolk, Va. • Greensboro, N. C. • Wilmington, N. C. • Columbia, S. C.
Atlanta, Ga. • Savannah, Ga. • Montgomery, Ala. • Birmingham, Ala.
Jackson, Miss. • Memphis, Tenn. • Shreveport, La. • Orlando, Fla.
Baltimore, Md. • Carteret, N.J. • E. St. Louis, Ill. • Cincinnati, O. • Dubuque, Ia.

Better Crops *with* PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

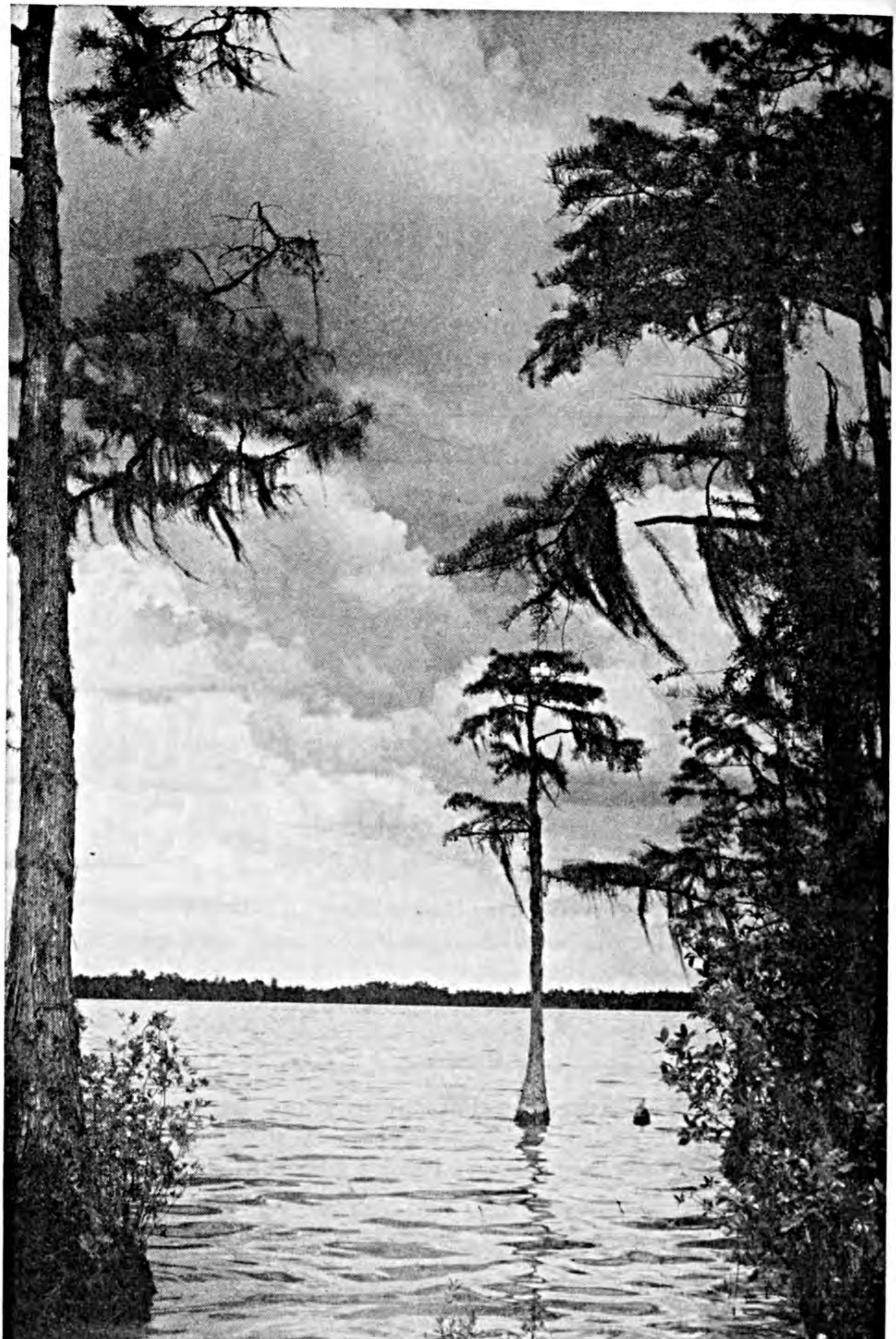
VOLUME XXXIII NO. 10

TABLE OF CONTENTS, DECEMBER 1949

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America



Christmas in Southern Waters

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIII WASHINGTON, D. C., DECEMBER 1949 NO. 10

Let's Spread . . .

Good Will

Jeff McDermid

AROUND the happy Christmas circle our thoughts turn in customary ways to matters of good will. This seems to be a good time for us to give credit to folks with good will who have helped us to get along better during life's ups and downs, and whose example has perhaps served at times to increase and invigorate our own stock of that precious commodity.

It isn't necessary to confine our text to the Christmas story in the scriptures when we refer to good will. I recall no less a philosopher than Paul in the course of one of his numerous letters to outlying brethren said, in effect, that everyone of us owes a debt—not only to the Greeks, but to the Barbarians; and likewise both to the wise and the unwise.

Now this is right up my alley, and I thank Paul for giving us a theme which has so much truth in it. I'm no preacher, nor am I the son of a preacher; and none of my relatives ever occupied a pulpit—if I exclude a second cousin of old times, who rode horseback on rural circuits in Michigan. Therefore, I am not exactly qualified or ordained to sermonize, and it's not my purpose to thump any text or stamp and rant around or convert anybody to my way of thinking exclusively.

So when Paul points out that all of us owe a debt to somebody else, and often to a throng of people that we never saw or ever thought about, he comes close to what I try to express in connection with men of good will.

After a spell of hard thinking—which taxes me no end—I believe that our welfare depends on developing and sustaining men of good will. That doesn't mean going in strong for "do-gooding" as a pretense or a profession, because some of the uplift gentry I've met up with don't act natural in such a borrowed role. Neither is it necessary for men of good will to submit the seats of their breeches to swift and frequent kicks without any protest; or for them to sit off in a corner and be backward and shy about telling the things they stand for.

To begin with, I believe that a guy who sticks to his job, wherever he is and whatever he does, and plugs along with the public interest at heart and pride in a task well done, is a benefactor and a good-will apostle. Countless folks away off yonder beyond the blue hills who never heard a word about this workman are in for a little bit of benefit and happiness from this chap's steadfast ways.

YOUR farmer, for example, who grows quality produce or makes his herd produce clean milk regularly —he's a purveyor of lots of useful good will, and what he turns off in that way gives plenty of satisfaction to hundreds of consumers who will never know him from green apples. It is even believed in soils laboratories that when a good farmer takes extra care of his land and gives it a dressing of plant food often enough in balanced fashion, that the food he eventually produces from such soil will be a heap better medicine for what ails folks than though it was harvested from weak, sickly, unbalanced acres.

There are many critics who would jump up here and holler that these successful farmers are often after easier money and bigger and better sales, and they don't give a hoot about the benefits to bellies beyond. Knowing better myself after long years of working beside rural folks, I can testify that isn't so. If consumers had as many men of good will to deal with in other lines as they have in agriculture, they'd be calling this country—Utopia.

But the same thing holds true for some industrial workers who never see the ultimate users of their goods. Many patient men at lathes, shoe benches, and in suit-making shops and steel plants put their best experience and good sense and skill into each nail, each stitch, and each rivet—so that happiness, satisfaction, and safety will be a reality to someone somewhere who has put trust in what they deliver.

WHEN you are sailing out in the restless, angry ocean and you peer out the portholes at huge waves reaching toward you with wild gestures of power, then you rely upon the faith you have in the training of the crew and beyond and behind that, in the ability and the integrity of the ship builder who raised her hull and the dock inspectors who grant her a licensed passage because she is seaworthy and sound.

In countless occupations and professions there are men and women who take pride in doing the best they know how, over and above the "call of duty," as the war medals specify. And we might add, over and above and beyond any monetary remuneration which they are so fortunate or unfortunate as to receive from their boss or from the corporation, or even from the State or the Federal treasury.

So often we hear folks say that it's no wonder a certain specialist of some kind has made a success, because, they add, he has always been well paid and has never had to worry about financial reverses. Or else they try to disparage a donation or a good-will idea made by some tycoon of commerce, on the grounds that it all comes out of his net income tax statement, and it represents free advertising besides.

I always take such comment with a whole bucketful of salt. That disinfects the situation. For it stands to reason that good will is something that ought to get fair play in the public eye and not be forever subjected to irony and criticism. There is hardly anything in the record as far as I have seen which prevents a man who earns a fortune from being gentle and discerning and generous and just as full of honest good will as somebody else

who only has a tiny mite of the "dollar exchange" we hear so much about these days.

In the final analysis, the only way to express good will in an effective and tangible form is to take just what ability and talent you have and use it for that purpose. It may be physical strength, endurance, and muscular power; or lots of spare cash; or wisdom in some useful line; or experience which serves as a guide to somebody; or such plain arts as cooking, sewing, knitting, or tinkering with tools; yes, and even writing or public speaking. The idea is to give all you've got when a crisis hits somebody.

You can't rely upon stores or warehouses or banks to supply you with evidences of good will that you can hand around by proxy or send by mail —that is, you can't do it that way and so escape putting some personal feeling and action into good will. I've known fellows with overflowing energy and good will who accomplished more by direct activity and individual push and friendly help in community improvement than some club or church or civic body could do by distributing circulars or holding benefit parties.

ANOTHER funny thing about good will is that before you try to pop off with a sample of it you must be sure that the time is ripe and the need for it really exists. Trying to manufacture sentiment or reform or benevolence is like setting up a straw dummy and putting a match to it. It makes a whopping big blaze, but the warmth soon dies out and nobody but the dummy has been changed. Misdirected and ill-timed good will is almost as bad in its way as having none at all. In some ways it's worse, because other folks may hold back afterwards when they feel a good-will spell coming on.

This bring to mind the modern community chest or federated welfare project, which is now a common method of combining the essential good-will agencies into one unit for the purpose of financial contributions. We can all see the reason why the present united and single solicitation is better and more effective than the old, scattered method.

I regret that we often miss the quotas which the organizations set up, but before this time we missed our quotas a heap wider and left plenty of worthy agencies out in the cold. Sometimes there creeps into these campaigns a rather deadly sameness and dullness, such as we all have when we are obliged to do our duty without much inside enthusiasm. Often we have had some bad adjustments and unfair allotments to contend with, which cut the returns; and we always have the hardest time to cash in when we hold these drives

(*Turn to page* 50)

Fig. 1. Row of tomatoes, left, did not receive starter solution. Right, this row got starter solution. Note difference in growth.

Fertilizing Vegetable Crops

By J. H. Boyd[1] *and J. O. Dutt*[2]

VEGETABLE growers today are again facing the old prewar problems of yields per acre, cost per unit of production, and crop management efficiency. Although we forgot these problems to some extent during wartime, their return now is as inevitable as the tide. As vegetable growing is one of the first phases of agriculture to feel the effect of lower consumer prices, efficient growers are developing the inquiring mind toward their fertilizer practices.

Commercial fertilizers, of course, play a vital part in any soil-management program regardless of the crop. Let it be said at the outset, however, that large quantities of fertilizer do not of themselves guarantee high yields. Furthermore, there is no one best fertilizer for any one vegetable on all soils or for all vegetables on any one soil.

Commercial fertilizers effectively increase vegetable yields when: (1) Enough lime has been applied to grow good red clover or to give a soil reaction of pH 6.0 to 6.6; (2) the soil's organic matter content is comparatively high; (3) there is no serious lack of a minor element or elements; (4) there is good soil drainage; (5) there is a balanced supply of soil mois-

[1] J. H. Boyd, University of Hawaii, Honolulu, was formerly Professor of Vegetable Gardening, Pennsylvania State College.

[2] J. O. Dutt is Professor of Vegetable Gardening Extension, Pennsylvania State College.

ture; (6) erosion or leaching is not serious; and, (7) the fertilizers are applied properly. Perhaps other conditions should be considered, but those named here require the grower's most frequent attention.

Lime—Organic Matter—Minor Elements

Liming for vegetable crops—It is generally true that vegetable crops grow best on soils which contain only small amounts of acid or sourness. Most vegetables require at least moderate amounts of lime in the soil to neutralize acid conditions and to supply adequate amounts of available calcium for direct nutritional purposes. Usually a soil which will grow good red clover will be suitable for vegetable production. In terms of the pH value, a standard measurement of soil acidity, this means a pH level of about 6.5.

However, vegetables vary considerably in the amounts of acid which they will tolerate. Table I gives an approximate pH range within which the various crops will grow satisfactorily when other factors are favorable.

This table must be regarded as being very general. Many other factors, such as soil texture, organic matter, colloidal content, moisture content, and drainage affect the response of plants to soil acidity or lime applications. It is not possible to give the best soil reaction for any particular vegetable crop under all conditions.

Remember also that the lime content of the soil greatly influences the availability of the fertilizing materials which are applied. Lime should be applied to soils, where needed, several months ahead of planting time or to some previous crop in the rotation, preferably a small grain or sod crop. This is especially true where lime will be badly needed to correct soil acidity before spring plantings. A good practice is an application to a cover crop the preceding fall.

Regardless of how lime is applied, it must be worked thoroughly into the soil. Nutritional deficiencies sometimes will occur in vegetable seedlings when lime is applied on the surface and not worked into the soil. The kind of lime applied has no particular influence on the final effect. Both ground limestone and hydrated lime are equally effective in reducing soil acidity when applied in equivalent amounts. About 1,500 pounds of hydrated lime are equivalent to 2,000 pounds of ground limestone. Hydrated lime acts more quickly, but ground limestone has a more lasting effect and is cheaper.

TABLE I—pH RANGE OF VARIOUS VEGETABLE CROPS

Crops which will stand a slight amount of acid pH 6.0–6.7	Crops which will stand a moderate amount of acid pH 5.5–6.7	Crops which will stand a strong amount of acid pH 5.2–6.7	Crops which will stand a very strong amount of acid pH 4.8–6.7
Asparagus	Broccoli	Brussel Sprouts	Watermelon
Beets	Cabbage	Carrots	
Celery	Cauliflower	Endive	
Lettuce	Cucumber	Kale	
Onion	Eggplant	Parsley	
Spinach	Lima Beans	Pumpkin	
	Muskmelon	Rutabaga	
	Parsnip	Snap Beans	
	Peas	Sweet Corn	
	Peppers	Sweet Potatoes	
	Radish	Tomatoes	
	Squash	Turnips	

It takes relatively less lime to raise the pH of a sandy soil one full point on the pH scale and more on a heavy soil well supplied with organic matter. However, a ton of finely pulverized limestone will raise the pH about 0.5 of a point. Once a soil is sweetened, a ton of ground limestone every four years usually keeps it sweet. Larger amounts would only store up excess calcium in the soil. On soils which are likely to be deficient in magnesium, the use of dolomitic ground limestone is desirable.

Soil organic matter—Every effort should be made to grow legume and non-legume crops in the rotation. They will aid in supplying nitrogen and organic matter to the soil.

Organic matter gives the soil a good structure and improves its tilth. It keeps the mineral elements more available to the plants and serves as a storehouse for nitrogen, available phosphorus, potash, and other elements. Organic matter also provides food for beneficial soil bacteria.

Rotations including grass-clover sods add organic matter to the soil. Domestic ryegrass, seeded 20 to 30 pounds per acre just after the last cultivation in late July or September, develops an extensive root system, which is very important in conditioning the soil and building up the organic content.

Fall cover crops, such as rye or ryegrass, following vegetable crops will utilize the excess nutrients, especially the nitrogen, that would otherwise leach away in many cases before the next growing season. A good growth of rye or ryegrass also will help much to reduce water and wind erosion.

Soils containing very little organic matter (less than 1 per cent) should be planted to soil-building green manure crops or to sod for one or more seasons before planting vegetables. For quicker results, it may be well to apply 300 to 500 pounds of complete fertilizer, such as 5-10-5, 5-10-10, or 4-12-8, to each acre before seeding the green manure or sod crop.

All kinds of farm manures make excellent fertilizer materials. Whenever a grower uses any one of them he will need less commercial fertilizer. However, all manures are proportionally low in phosphorus and this element needs to be added as 20 per cent superphosphate.

TABLE II—COMPOSITION OF MANURES AND ADDITIONS REQUIRED FOR BALANCED FERTILIZER

10 tons of manure	Contains approximately Pounds			When supplemented with		Is approximately equal to	
Kind	Nit.	Phos.	Pot.	Lbs.	Materials	Lbs.	Kind of fert.
Horse and straw.....	110	55	132	750	20% superphosphate	2,000	5–10– 5
Steer and straw......	110	70	96	600	20% superphosphate	2,000	5–10– 5
Dairy cow and straw.	90	60	84	1,000	20% superphosphate	2,000	4–12– 4
Hog..............	130	127	96	550 50	20% superphosphate 50% muriate of potash	2,000	6–12– 6
*Sheep and straw....	200	90	168	1,000 65	20% superphosphate 50% muriate of potash	2,000	10–10–10
*Poultry...........	180	175	96	160	50% muriate of potash	1,800	10–10–10

* Under most conditions it is not a good practice to apply more than four tons of poultry or sheep manure per acre if it is broadcast or plowed under. When used as a topdressing these two kinds of manure should be used sparingly at the rate of about one to two tons per acre.

Fig. 2. Proper fertilization had much to do with this 20-ton-per-acre yield of cabbage.

In order to make a balanced fertilizer out of sheep, poultry, and hog manures it will also be necessary to add muriate of potash. Suggested approximate additions are listed in Table II.

In addition to the three major elements, nitrogen, phosphorus, and potash, manure also contains many of the important minor elements which are essential to plant growth. It is also an excellent source of high-grade organic matter which improves soil conditions and greatly influences the availability of all plant-food materials. These are some of the reasons why manure is such an essential factor in soil management for vegetable crop production.

Minor elements—Deficiencies of boron, magnesium, and manganese have been found in certain areas of the State. These deficiencies may occur on: (1) Highly acid soils; (2) overlimed soils; (3) badly leached soils, and (4) soils receiving large amounts of chemical fertilizer without the addition of sufficient organic matter. Any grower who suspects a minor-element deficiency should consult the County Agricultural Agent for details as to treatment. Certain minor elements, especially boron, may do great harm to crops if too much is applied. The various vegetable crops are quite different in their minor-element needs.

Methods of Applying Fertilizer

Methods of using fertilizer are numerous and varied. The successful vegetable grower must be able to select the method best suited to his soil, rotation, the immediate crop to be grown, and his available equipment.

Broadcast drilling is perhaps the most common method of application. An ordinary grain drill with fertilizer attachments is used to place the fertilizer as deeply as possible after most of the seedbed preparation has been done. The object is to get the fertilizer down at least three to four inches deep without actually mixing it with the soil. This method is best adapted to early, shallow-rooted crops grown either in narrow or drilled rows, such as peas, radishes, leaf lettuce, beets, turnips, etc. Rates of application range from 500 to 1,000 pounds, depending on the crop and the specific situation.

Plowing down of fertilizer is becoming more popular on the heavier clay loam soils. Greater availability during midseason and particularly during dry seasons has led to its general adoption. There are two principal ways of using this method. In the first, the fertilizer is distributed evenly on the surface before plowing and then turned under. In the second case, the fertilizer is placed in a narrow band at the bottom of the furrow behind the plow and is covered by the next furrow without mixing it with the soil in any way. This method has given good results with many of the deeper-rooted crops, such as tomatoes, sweet corn, beans, cabbage, and even carrots and peas. Amounts per acre range up to 1,500 pounds when this is the only method used.

Band application of fertilizer on each side of the row about two inches away from the seed or plant and three to four inches deep is a desirable method where a relatively small quantity of fertilizer is used. This method is used more often for supplementary applications in combination with drilling, broadcasting, or plowing down. In some cases, broken bands are used to place short strips of fertilizer near the plant where the spacing in the row is wide. Amounts are usually 300 to 800 pounds per acre.

Sidedressing is practiced by placing the fertilizer in bands on each side of a row of plants after growth is well started. The bands often are four to eight inches away from the plant. Complete fertilizers are commonly used and are applied by the use of attachments on cultivators. The amounts commonly applied are 200 to 300 pounds per acre. Applications of this type may be particularly effective on light sandy soils.

Topdressings of readily available nitrogen (mineral), such as nitrate of soda or sulfate of ammonia, promote leafy growth, especially on sandy soils and such crops as leaf lettuce, spinach, early cabbage, and broccoli. They are placed on the soil surface and cultivated in at the rate of 100 to 200 pounds per acre. Applications of this nature are sometimes needed after heavy rains.

Starter solutions—Early growth is hastened and plants become estab-

(*Turn to page* 40)

Fig. 3. Plowing under fertilizer with a cover crop is a good practice.

Fig. 1. Sericea on farm of Freddie Brown, a cooperator with the Gaines Creek SCS District, McAlester, Oklahoma. Sericea cut at this stage makes good hay.

Grow Lespedeza Sericea For Forage and Soil Improvement

By W. M. Nixon and E. H. Greene

Soil Conservation Service, Fort Worth, Texas

LESPEDEZA sericea, a good soil-conserving, soil-improving hay and pasture plant, is fast taking its place in the coordinated soil conservation program of farmers in eastern Oklahoma, Arkansas, eastern Texas, and Louisiana.

Not too many years ago most agricultural workers as well as farmers were doubtful concerning its value. Soil Conservation Service technicians, looking for a perennial leguminous hay and grazing plant which would fit well into a soil-conserving and soil-improvement program, observed that there were a few farmers who were growing this crop and using it primarily for hay. Being a perennial, deep-rooted legume, there was no question but that it should be tried in the program. Technicians began to encourage soil conservation district cooperators to make plantings of sericea. It was found that sericea would grow well on soils where alfalfa or other desirable perennial legumes would not grow.

Sericea is well adapted to both heavy and sandy soils. It will not thrive on marshy land or where the water table is near the surface. Sericea does best on well-drained soils; however, it will grow on wetter, heavier soils than kudzu.

Soil Conservation Service technicians, through their assistance to district cooperators in establishing sericea, have found that the following cultural methods are essential to successful establishment:

1. Prepare firm, clean, smooth seedbed.
   a. Flatbreak or disc the site at least one month ahead of seeding.
   b. Allow seedbed to be firmed by rain if possible.
   c. If bermuda grass is present where sericea is to be planted, the area should be flatbroken to a very shallow depth during the dry summer months. This can usually be done in the latter part of July or August. It is very important that as much of the bermuda grass as possible be eliminated, since a heavy sod will crowd out sericea.
2. Apply broadcast 300-600 pounds of 0-12-12 or 3-12-12 when land is being prepared or disc in immediately prior to seeding. Firm seedbed by rolling with a cultipacker or corrugated roller. If these are not available, firm the soil with any available roller or drag.
3. Inoculate seed.
   a. Use inoculant for cowpea group.
   b. Put seed in a container, moisten slightly, and thoroughly mix inoculant with seed.
   c. Keep sunlight from seed to prevent killing of bacteria.
4. Plant at right time.
   a. Southern Arkansas and southeastern Oklahoma, Louisiana, and east Texas—latter part of February and March.
   Northern Arkansas and northeastern Oklahoma—April and May.
   (The above months are optimum planting time. Successful stands have been obtained when seeded in June, but moisture conditions were ideal.)
   b. Broadcast seed evenly, using 30-35 pounds of scarified seed per

Fig. 2. District cooperators working together in conservation group baling sericea hay. Hopkins-Rains-Wood SCS District, Northeast Texas.

acre. Where unscarified seed are planted, the seeding rate should be doubled and the seeding done approximately one month earlier. Successful stands have been established by fall planting of unscarified seed.

c. Run cultipacker or roller over area immediately after seeding.

5. Control weeds. Care should be taken to control weeds during first year. Raise the mower blade so as to clip the weeds off just above the top of sericea plants.
6. Do not graze sericea during first growing season.
7. If sericea shows a nitrate deficiency the first year, topdress with 100 pounds of ammonium nitrate or its equivalent per acre. Nitrate deficiency will usually show up when plants are 3-5 inches high.

The following results on runoff and soil losses from sericea lespedeza as compared with continuous cotton were obtained at the Southern Piedmont Conservation Experiment Station, Watkinsville, Georgia:

December 1943–November 1946

	Average % Runoff	Total 3-year Erosion loss
Lespedeza sericea..	7.8	.56
Continuous cotton.	24.0	84.84

In order to get a top quality hay, sericea must be cut when plants are 12-15 inches high. If allowed to become any taller, the hay will be coarse and stemmy and will retain only a small percentage of its leaves.

Fig. 3. Stock of ground sericea hay on G. E. Staner's farm near Wagoner, Oklahoma.

The number of cuttings depends on the season. An average of two cuttings a year may normally be expected. The last cutting should not be made later than August to allow the plants to have six inches or more growth before frost. Good stands have been killed out by cutting too late.

Hay yields from well-established sericea will average 1-2 tons per acre each cutting, Table I.

Sericea hay cures rapidly and should not be left too long before raking and baling. Sericea cut in the morning should be raked in the afternoon and baled the next morning. If it is not to be baled, it can be hauled in and stored as it is raked.

TABLE I.—YIELD OF SERICEA HAY AND ITS RELATIVE VALUE AS COMPARED WITH A FEW OTHER HAY CROPS.

Type of Hay	Yield Tons	Protein %	Calcium %	Phosphorus %
Lespedeza, annual	1–2	9.2	0.99	.19
Lespedeza, sericea	1–3	10.7	1.01	.24
Alfalfa	2–4	10.6	1.43	.21
Bermuda grass	1–2	3.7	0.48	.20
Kudzu	1–3	12.0	1.50	.27

(Taken from Morrison, F. B., 1937—Feeds and Feeding)

Sericea is proving to be a good grazing crop. It is especially valuable for early spring grazing. Cattle graze sericea best while the plants are succulent. If grazing is desired, the first growth in the spring can be used for this purpose instead of cutting for hay.

Where croplands are bordered by woods, the shading and the sapping of soil moisture by the trees often create a bare area. This is especially noticeable when the land is planted to cotton or corn. On sloping land and where farm implements are turned at field edges, gullies commonly form. Lespedeza sericea is one of the most useful plants for the protection of field borders. It not only protects the soil, but also provides a safe turnrow area. Many farmers harvest hay from sericea border plantings or use the borders for seed production blocks.

Sericea borders are often used by quail. These game birds nest and find shelter in the dense growing sericea. Although the seeds are little used by quail for food except when other foods are scarce, there are numerous records of quail feeding upon sericea. Bicolor lespedeza, a tall shrub which provides first-class quail food, is frequently planted with sericea. A few rows of bicolor next to the woods and a planting of sericea on the crop side form an ideal border planting. Such borders by providing soil protection, food and cover for wildlife, and hay or seed plots make good use of land that otherwise is often unproductive.

Sericea is an excellent soil-improving crop. Corn following a five-year-old stand of this legume yielded 53 bushels per acre, which was more than three times as much as the yield on similar land nearby where no sericea had grown. Its value as a soil-improving crop is shown by the following data obtained by the Tennessee Experiment Station on the yields of corn crops following sericea:

First crop	72.1	bu. per A
Second "	66.5	" " "
Third "	60.2	" " "
Fourth "	51.7	" " "
Fifth "	46.9	" " "
Sixth "	41.9	" " "
Seventh "	36.6	" " "
Eighth "	35.4	" " "
Ninth "	29.5	" " "
Tenth "	33.6	" " "

(*Turn to page* 39)

Fig. 4. A well-established border strip of sericea such as this serves many purposes in a soil conservation program.

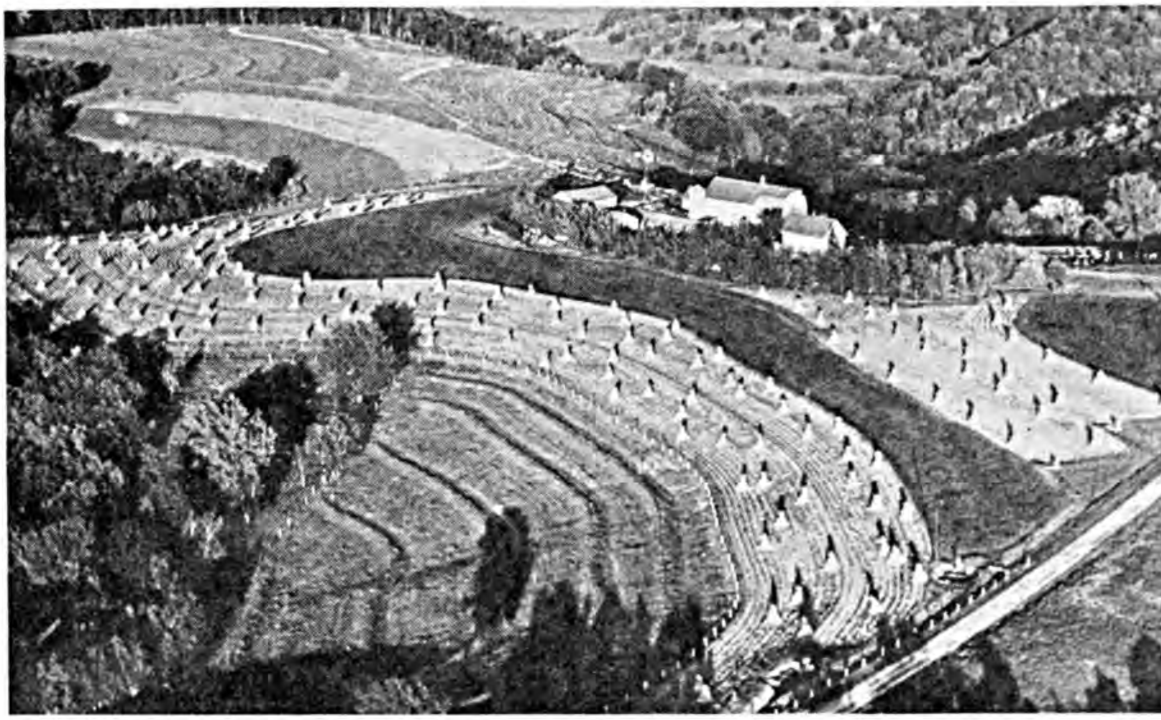


Fig. 1. Contour cultivation, strip-cropping, and terracing retard the velocity of flowing water as it moves over the surface of the ground, but do not protect against raindrop impact, except in the sod strip itself.

Water Erosion Control on Cultivated Land

By J. H. Stallings

Principal Soil Conservationist, Soil Conservation Service, USDA, Washington, D. C.

SOIL erosion caused by rainfall is the result of the application of energy from two distinct sources. These sources are first, the falling raindrop and second, surface flow (7)[1]. The energy exerted by the falling raindrop is applied slantingly or vertically from above, while that of surface flow is applied more or less horizontally from the side. Both the falling raindrop and surface flow detach and transport soil material in the erosion process. The chief role of the falling raindrop, however, is to detach soil particles whereas, the primary role of surface flow, outside of rills and gullies, is to transport soil. This discussion deals primarily with erosion resulting from rain falling on the area affected directly and does not treat erosion caused by water which may enter the area from an outside source.

Although the primary role of the falling raindrop in the erosion process is detaching soil particles, it plays a secondary role which is often as equally important. The falling raindrop makes a major contribution to the movement of soil on unprotected sloping lands, during periods of heavy impact storms, by splashing large quantities down

[1] Refers to literature cited.

slope, and by imparting transporting capacity to surface water by keeping it turbid.

The falling raindrop blasts the soil particles apart at the point of impact, and surface flow tears the soil particles from their moorings by the scouring process. The maximum amount of damage is done during periods of heavy impact storms when the falling raindrop and surface flow team up on bare land.

Since the falling raindrop applies its energy from above, it requires remedial measures entirely different from surface flow which applies its energy horizontally across the surface of the ground. Measures aimed at controlling the effects of the falling raindrop, to be effective, must be designed to intercept and de-energize the raindrop before it strikes the ground. These measures aimed at controlling surface flow must be designed to regulate concentration and to retard the movement of free water as it flows over the ground.

When falling raindrops strike the ground surface, or the thin film of water covering it, they splash bits of soil and organic matter into the air. Some of those splashed particles may rise to a height of two feet or more and move horizontally more than five feet on the level surface (4). On sloping ground most of the splashed material moves down slope. Two inches of rain on an area exerts enough total energy to raise a 7-inch layer of soil a height of three feet over the area if the energy could be applied at one time (11). More than 100 tons of soil per acre may be splashed by the most beating types of rain falling on a bare highly detachable soil (6).

Photo by Naval Research Lab.

Fig. 2. Each falling raindrop acts as a miniature bomb. Upon striking the bare ground falling raindrops blast soil particles and organic matter into the air.

Control of erosion caused by the falling raindrop can be accomplished by the proper use of vegetal covers, either living or dead. Vegetal covers when properly used on the surface of the ground serve as a cushion to absorb the energy of the falling raindrop and destroy its power to splash soil (1). Soil not splashed or torn loose by the falling raindrop is not likely to undergo any serious erosion. Vegetal and mulch covers may reduce the soil losses by erosion to less than one per cent of those on similar but unprotected soils.

Control of Raindrop Splash

The first step in developing a program to control erosion by raindrop splash is (a) to determine the potential capacity of the rainfall to erode during each season of the year, (b) determine the vulnerability of the soil to this type of erosion, and (c) plan a cropping system that will provide adequate vegetal cover to furnish protection in sufficient amounts at the proper time. The potential capacity of the raindrop to erode can be determined in a general way by reviewing the local rainfall records which show intensities. These data when arranged in chart form showing rainfall intensities by months may be used for this purpose. The rainfall intensity data may also be expressed in terms of the number of excessive storms by months. Rains falling at the rate of .25 inch during a 5-minute period or at the rate of .35 inch during a 15-minute period for all practical purposes may be considered excessive or severe erosion-producing rains. However, it is likely that more detailed information about the impact characteristics of raindrops will be needed as we move further into this method of studying erosion control.

In most localities the major portion of erosion is the result of a small number of rains. In some areas as much as 80 per cent of the annual erosion may be attributed to a half dozen or so intense storms. In practically all locations, more than half of the annual erosion may be attributed to a small portion of the total number of rains occurring during the year. By examining records of individual rainstorms for the locality it is possible to identify the season or seasons of the year when these erosion-producing storms occur.

Records from the Arnot Soil Conservation Service Experiment Station at Ithaca, New York, illustrate this point (9). Twenty-one rains or less than 12 per cent, out of a total of 177 which caused .5 ton or over of soil loss per acre each, accounted for 65 per cent of the total soil loss during a period of eight years and seven months ending December 31, 1943. Two of these rains caused 17.7 per cent of the soil loss.

A breakdown of the 177 rains at the Arnot station into intensity groups illustrates the importance of the rainfall intensity in the erosion process, Table I. These rains have been broken down into eight different groups, based on the maximum intensity for a 15-minute period, and the amount of soil lost by erosion from each group is presented.

The character of the rainfall is more important than the total amount of rain falling in causing erosion, when other conditions remain constant (3). A slow gentle rain is not nearly so destructive as an equal or even smaller amount of rain falling in only a small fraction of the time.

Fifty-five of the rains had an average total rainfall of .54 inch and an average maximum intensity of .5 inch for a 15-minute period. The average soil loss by erosion for the rains in this

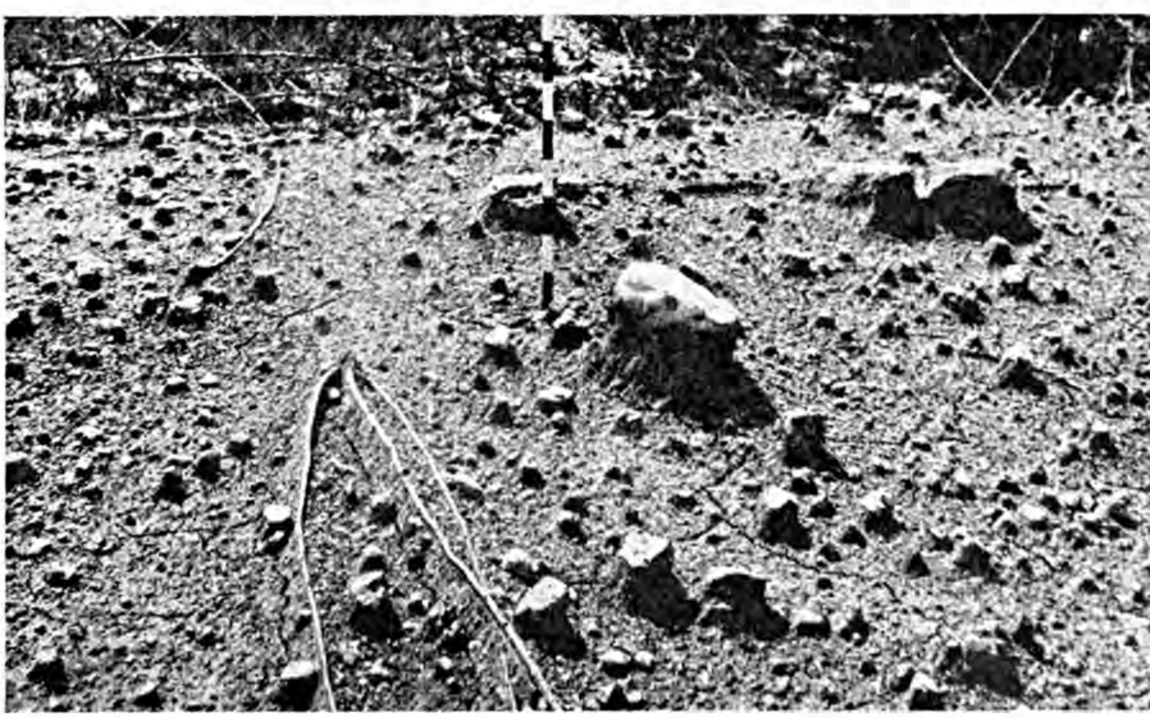


Fig. 3. About two inches of soil were removed from this plowed field by water erosion. The stone-capped pedestals show that the force causing the erosion was applied from above and not from the side as surface flow. The dead plant roots in the foreground protected the soil immediately beneath them while that between and to the side of them was splashed away.

group was eight pounds per acre. The next group, consisting of 29 rains, had an average total rainfall of .59 inch and a maximum intensity of .63 inch for a 15-minute period and eroded 57 pounds of soil per acre. The total rainfall in this group increased only .05 inch over the first group and the maximum intensity increased .12 inch over the 15-minute period, while the soil loss increased from eight to 57 pounds per acre. An increase in the intensity from 1.5 to 2.16 inches per hour for a 15-minute period increased the soil loss by more than 121 per cent with only .18 inch increase in the total amount of rain that fell. A total rainfall of 1.35 inches falling at the maximum rate of four inches per hour for a 15-minute period removed 14,427 pounds of soil per acre whereas, a total rainfall of 1.73 inches falling at a maximum intensity of 2.73 inches per hour for a 15-minute period removed only 5,704 pounds of soil per acre.

Other rainfall data from the Arnot station show that the main erosion hazard from rainfall occurs during the

TABLE I.—NUMBER OF RAINS CAUSING .5 TON OR OVER OF SOIL LOSS PER ACRE, AVERAGE RAINFALL, MAXIMUM RAINFALL INTENSITY FOR 15-MINUTE PERIODS, AND SOIL LOSS PER ACRE AT ITHACA.

Number of rains	Average rainfall	Average maximum rainfall intensity 15-minute period	Soil lost
	Inches	Inches per hour	Lbs. per acre
55	.54	.50	8
29	.59	.62	57
33	.68	.77	232
12	.77	1.14	721
27	.94	1.50	1,594
9	1.12	2.16	3,527
10	1.73	2.73	5,704
2	1.35	4.00	14,427

TABLE II.—AVERAGE ANNUAL RAINFALL, MAXIMUM 15-MINUTE INTENSITIES, AND EXCESSIVE STORMS BY MONTHS AT GUTHRIE, OKLAHOMA, 1930-1940.

Month	Rainfall	Maximum 15-minute intensities	Excessive storms [1]
	Inches	Inches	Number
January	1.45	.31	0
February	1.44	.87	.1
March	1.87	.93	.3
April	2.60	1.67	.9
May	4.37	2.45	1.6
June	3.73	2.08	1.6
July	1.63	1.72	.5
August	3.42	2.08	.9
September	3.67	2.13	1.1
October	1.97	1.15	.5
November	2.56	.60	.2
December	1.50	.33	0

[1] Average annual for 17-year period.

period of June-September, inclusive. During this same eight years and seven months period, the average annual excessive rains were: eight during June; 11 during July; 14 during August; four during September and one during October. No excessive rains occurred during any of the other seven months.

Total rainfall by months is not as reliable as rainfall intensity data or the number of excessive storms by months but may serve in the absence of the more reliable data in developing a rainfall hazard chart. This is illustrated by data obtained at Guthrie, Oklahoma, Table II, where the period of greatest total rainfall runs from April to November, inclusive (2). This coincides only roughly with the period of highest 15-minute maximum intensities, which extends from April-October, inclusive. The months of April, May, June, August, and September are the months having a large number of excessive storms (13).

The advantages of using the number of excessive rains per month over the use of the total rainfall, in establishing the rainfall hazard chart, is illustrated by the data obtained at Tyler, Texas, during the period 1931-1940 (12). Soil loss from continuous cotton plots during this period was more closely related with the number of excessive storms than with the total rainfall. This is illustrated by the data in Table III, which shows the average annual total rainfall, the number of excessive storms, and the tons of soil lost during the 10-year period.

By examining the data in Table III, it may be seen that the three months November-January, inclusive, record the highest total rainfall, while the period April-August, inclusive, includes the largest number of excessive storms. The period April-July, inclusive, includes the months showing the greatest soil loss by erosion. During June and July the total rainfall was relatively small compared with that of November, December, and January, when the loss was considerably lower than during the April-July period. It should be noted, however, that there was both a substantial rainfall hazard and soil loss during each month of the year at Tyler.

The occurence of excessive storms is not necesarily the same from month to month in different areas. This is shown by the data in Table IV, which shows the number of excessive storms by months for varying periods of time at five different locations (13). For the most part the period May-September, inclusive, represents the months of the greatest rainfall hazard for these particular localities.

TABLE III.—AVERAGE ANNUAL RAINFALL, NUMBER OF EXCESSIVE STORMS, AND SOIL LOSS BY EROSION ON CONTINUOUS COTTON LAND AT TYLER, TEXAS, 1931-1940.

Month	Rainfall	Excessive storms	Soil loss
	Inches	Number	Tons per acre
January	4.17	.5	.52
February	3.92	.4	.22
March	3.55	.8	.60
April	3.95	1.5	1.85
May	3.40	1.2	4.61
June	2.67	1.6	1.99
July	2.87	1.5	1.45
August	2.34	1.5	.54
September	2.04	1.0	.35
October	2.82	.4	.49
November	4.11	.8	.76
December	5.45	1.0	.97

TABLE IV.—AVERAGE ANNUAL NUMBER OF EXCESSIVE STORMS BY MONTHS FOR VARYING PERIODS AT FIVE DIFFERENT LOCATIONS.

	Bethany,[1] Mo.	Clarinda,[2] Iowa	Hays,[3] Kans.	La Crosse,[4] Wis.	Statesville,[5] N. C.
January	0	0	0	0	.3
February	0	0	0	0	0
March	.1	0	.1	.1	.8
April	.1	.8	.1	.5	.3
May	1.4	1.1	.8	.7	.7
June	1.8	2.1	1.4	1.3	1.7
July	1.0	2.0	.6	1.5	2.0
August	1.3	1.0	1.1	1.2	3.0
September	.9	.8	1.0	1.1	.3
October	.4	.5	0	.3	.8
November	.1	0	.1	.1	.5
December	0	.1	0	0	0

[1] Average annual for 10 years.
[2] Average annual for 8 years.
[3] Average annual for 9 years.
[4] Average annual for 15 years.
[5] Average annual for 6 years.

We have seen that rain storms vary widely in their capacity to erode soil. We find, likewise, that soils differ greatly in their stability or their capacity to withstand the erosive forces set into motion by falling raindrops. Soils deficient in those properties which impart stability are more vulnerable to the raindrop impact than those which are high in such properties. Soils having low resistance to the raindrop impact usually require more intensive protective measures than those possessing high resistance.

The difference between the forces supplied by the falling raindrops and the resistance offered to those forces by the soil represents the energy remaining to be absorbed by vegetal covers if erosion is to be controlled successfully. As is to be expected, vegetal covers vary widely in their protective values against falling raindrops. The kind, amount, and uniformity of distribution of vegetal cover influence its effectiveness. Dense, low-lying covers are more effective than coarser covers resting either on or some distance above the surface of the ground. Other things being equal, the protective value of vegetal cover, in controlling raindrop splash, varies more or less directly with the amount of cover. Even small amounts of vegetal cover exert a worthwhile influence.

Tests conducted on shallow, mixed range soils (5), to determine the effect of vegetal cover on reducing soil-splash by the falling raindrop, show that 657 pounds of range-forage cover per acre reduced the amount by 73 per cent of what it was on bare soil. The same tests show that 1,292 pounds of range-forage cover reduced the amount by 93 per cent, 1,865 pounds of cover reduced it by 96 per cent, and 5,592 pounds of cover reduced it by over 99 per cent. Corresponding figures obtained from similar tests conducted on hardlands (Pullman soil) show a reduction of 52 per cent of soil splashed by falling raindrops for 704 pounds of range-cover per acre, 90 per cent for 2,016 pounds of cover, 96 per cent for 3,307 pounds, and over 99.5 per cent for 4,785 pounds of cover per acre.

Vegetal covers are also effective in re-

(*Turn to page* 45)

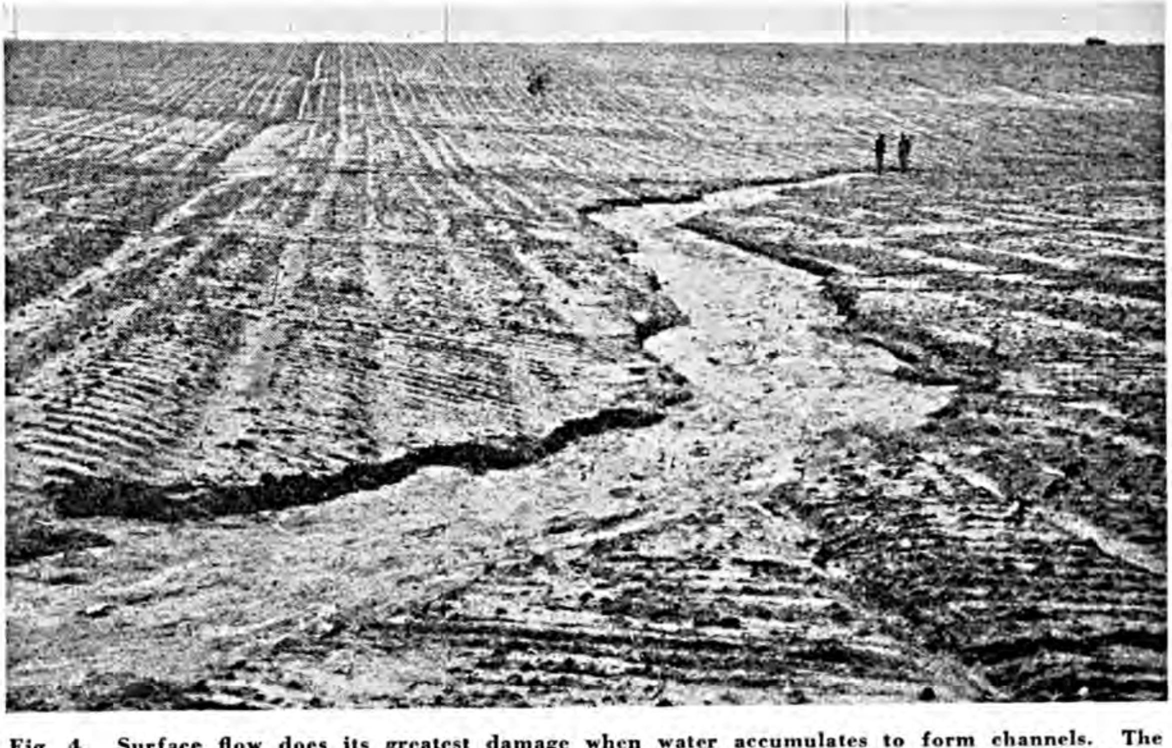


Fig. 4. Surface flow does its greatest damage when water accumulates to form channels. The major part of erosion occurring outside of rills and gullies is caused by raindrop splash. If the surface of the ground is kept protected with suitable vegetal cover, little erosion will occur on the areas between the rills and gullies.

Fig. 1. Land must be cleared in preparation for a strawberry field.

The Pacific Northwest Knows How to Grow Strawberries

By Louis King

Horticultural Inspector, Washington State Department of Agriculture

THE strawberry business in the Pacific Northwest has many growers who started with no capital and are now well established on their own fine farms. For instance, a grower and his wife who came to Western Washington from Missouri about 10 years ago, with only their hands to work with, have acquired one of the finest farm homes one could wish for, built at an estimated cost of $40,000. The land, home, and all equipment were paid for by the Marshall strawberry.

The coastal area is famous for the strawberries grown there and frozen for shipment throughout the United States. The land lies between the snow-clad Cascade Range on the east and the Pacific Ocean on the west. The climate, tempered by the Japanese current, is one of cool summers and mild winters.

History of Strawberry Industry

About 1904, Chap Bayes, a farmer in the Lynden, Washington, district, decided to test on his farm all of the available varieties of strawberries. He planted more than 100 and brought them into fruit. The Marshall variety was by far the best producer of fine-flavored fruit and was selected by him to be grown commercially. Planting stock was increased and soon became the most popular in the West. His son, Marshall Bayes, is growing the Marshall strawberry now.

In 1913, much of the land still covered with timber, as well as the cut-over land, was being settled. O. L. Sheets, who came from Missouri to work in a shingle mill, bought 40 acres of stump land near the mill where he was working. He and his wife built a small house, cleared one acre of ground, and planted Marshall strawberries. These grew so well that he cleared more land and planted more strawberries. The berries in those days were all sold as fresh fruit, and production was limited to the acreage a man and his family could pick and deliver to the towns.

Acreage Expansion

Most of the growers used horses and had to go from 10 to 15 miles to make their sales. About 1915 some of the growers were able to buy Model T's, and could get to town a little earlier or even make two deliveries a day. During the first world war canneries using strawberries for canning and jam were starting. This had the effect of expanding acreage.

The advent of freezing strawberries in barrels was the signal for a further increase in acreage. Growers could now be assured a market for the fruit from larger acreages. In 1929, the first signs of depression caused the packing plants to close or be refinanced. Some processing plants were able to come back; others were sold and opened by the new owners. The price of strawberries went to the bottom.

Many growers were not able to carry on, since strawberries sold for as low as four cents a pound. However, through the depression the acreage kept expanding despite low prices, since strawberries would at least sell readily at some price and the growers could make a little by carefully watching their costs. As prices came up slowly, more growers started in the business. Companies were in competition for Northwest strawberries, with the highest prices coming after World War II, when they rose to 30 cents a pound. In 1948 the price was from 15 to 20 cents a pound, and acreage in Washington had expanded to 7,000 acres, nearly all being found in Western Washington.

State Department of Agriculture

In 1928, E. D. Hunter, District Horticultural Inspector at Everett, conceived the idea of certifying strawberry plants. There had never been any certified plants, so it was necessary to start with the best stock available. Nothing was known about diseases of strawberries, therefore when a new field was set out, it was carefully inspected for any off-variety or weak plants, which were removed and destroyed. There was nothing very scientific about this procedure, but it worked. It had the effect of producing a more uniform plant and fruit.

O. L. Sheets of Lynden, Washington, was one of the original growers of certified plants. He selected young plants from good vigorous parent stock. These were set out, kept free from runners for one year, and allowed to fruit the next year. Only vigorous plants with a good crop of well-shaped berries were allowed to produce runners that fall. Most of the Marshall strawberries growing in Washington have come from this foundation plot.

The State Department of Agriculture inspects strawberry plants for certification during the growing season and requires that weak and diseased plants be rogued as soon as they can be detected. It has become increasingly more difficult to keep the diseases and insects in check. Formerly it was necessary to take out only a few plants, whereas now it requires more roguing, dusting, and spraying to achieve the same results.

Plant pathologists, entomologists,

plant breeders, and agronomists, in the Experiment Stations of Washington and Oregon are devoting much of their time to the strawberry industry. The Washington State Department of Agriculture is cooperating in this work, having allotted $12,500 of their funds from the Insect Pest and Disease Control Fund to the Experiment Stations. Out of this work have come recommendations for the control of insects and diseases, as well as recommendations for soil management and fertilizer use. Several new varieties have been developed for trial. These are placed in the hands of growers in various sections throughout the State. Not until a new variety has proven itself, will it be released for commercial planting. Each grower receiving a few of these plants must sign a contract that he will not sell or give away any plants until the Experiment Station and packers have found the variety desirable.

Fig. 2. Not all fields are planted by machine. About an acre (3,500 plants) can be set by hand in a day.

The ideal variety would be one that is resistant to insect pests and diseases, would grow a large crop of fine-flavored, highly colored fruit, would not be subject to break-down under wet weather conditions, and would be firm enough to withstand stemming and slicing. In addition, the berries should be easy to detach from the plant and should stem easily. This is quite an order for the plant breeders, but Western Washington Experiment Station horticulturists are trying to produce such a plant for the Northwest strawberry growers.

Fig. 3. First-year strawberry plants are being fertilized by hand in the above photograph.

Commercial fertilizers have played a great part in the production of strawberries in this area. It is a general practice to use 700 to 1,500 pounds of 3-10-10 or similar mixture per acre. This is usually applied in two applications, one-half in the spring, the other in the summer after harvest. The use of fertilizers has increased the production on the average of 50 per cent. In 1930 when little fertilizer was used the average production was from 1½ to two tons per acre, while in 1940, with fertilizer a general practice, the average was three tons. In recent years some fields have gone as high as seven tons. At a price of 20 cents per pound for the berries, the additional increase in receipts makes fertilizer a good investment.

Extensive fertilizer trials on strawberries are now being conducted by the soils department of the Western Washington Experiment Station. Studies on fertilizer rates, ratios, placement, phosphate carriers, minor elements, and time of fertilizer application are underway. Applications of phosphate fertilizer at time of planting, followed later by broadcast or sidedress applications of nitrogen and potash, appear to be of particular interest and will be discussed in a station bulletin in the near future. As previously mentioned, these investigations are financed in part by special funds allocated to the Experiment Station by the Washington State Department of Agriculture.

Harvesting Methods

The harvesting of the berry crop in Washington requires a large importation of labor, from 7 to 10 pickers per acre being needed to pick the crop. In addition to the pickers, there are field bosses, field checkers, and truckers working to move the fruit to the processing plants. More than 50,000 people are required in the fields to harvest the strawberries in Western Washington.

All available labor is recruited in local communities. An advertising campaign is put on to bring pickers from all of the larger cities and even other states. Many of the larger growers establish their own labor camps. Some camps have centrally located hot shower baths and laundry facilities. One large grower has over $20,000 invested in one camp alone. The grow-

(*Turn to page* 43)

Fig. 4. Hand picking results in high labor costs in the strawberry fields.

Fig. 1. Raleigh Experiment Field, 1920. J. E. Whitchurch standing in cornfield with treated land, LPK, on left and untreated land on right. Corn yields for 1920 and 1948 along with protein content for 1948 are:

	LPK	*None*
1920	60 bu.	24 bu.
1948	74 bu.	26 bu.
Protein	10.4%	8.6%

Observations of a Fieldman on Value of Experiment Fields

By C. J. Badger

Agronomy Department, University of Illinois, Urbana, Illinois

ILLINOIS Soil Experiment Fields were designed and put into operation largely through the efforts of the late Dr. Cyril G. Hopkins. These fields have been a strong influence in educating Illinois farmers in the rudiments of soil improvement. Such improvement has consequently resulted in an enlargement of our food supply. The wide distribution of these fields has given farmers almost a doorstep view of soil-building practices under local soil and climatic conditions.

When I went to work in the southern part of the State as a fieldman in 1920, I at once realized that I was somewhat of a glorified farm hand. My duties developed calluses on my hands, and I was usually glad when a rainy day came along—even though rain added to the hazard of driving the Model T over the many miles of dirt roads. I have always appreciated the rather broad experience and many other privileges the job afforded. From the start I was aware that folks showed me special deference because of the institution with which I was connected.

Evidently the hard-working men who pioneered before me had built substantially into the good will of the farmers and business men in southern Illinois.

As my first season progressed, I became amazed at the difference in crop growth on the treated and untreated plots of the fields upon which I worked. When traveling through the country I would see crops on the many farms which appeared similar to those on the experiment field plots. These crops were withered by drouth, discolored by starvation, and riddled by insects. I mentioned this discrepancy to my immediate superior, the late J. E. Whitchurch. He merely shook his head and said that even though progress was slow, many farmers were taking hold of the idea of soil improvement. He admonished me not to become too discouraged since in his experience, which had already covered 10 years, he had witnessed considerable progress.

J. E. Whitchurch previous to 1920 had built to his memory a monument of agricultural limestone. The Ewing experiment field is located about five miles from Whittington, the nearest shipping point. Each winter and spring all the vacant lots in and around the town were filled with mounds of finely ground limestone. This was brought about through the tireless efforts of Mr. Whitchurch, or "Uncle Whit" as we called him. When he was not engaged in overseeing field work, he was on the farmer's doorstep encouraging him to use limestone on his land. When the farmer became sufficiently interested, the order would usually be given to "Uncle Whit." He would see that the lime was delivered to the farmer's shipping point in due time. Many of these orders were filled in the winter and early spring when roads in those days would not permit heavy hauling. Each farmer would unload his car and pile the limestone on whatever space was available in Whittington. At times it became difficult to drive through the village because of the encroachment of these limestone mounds.

Farmers near these experiment fields who first followed "Uncle Whit's" friendly suggestions are now among the most prosperous in their respective communities. One of these farmers, in particular, has one of the finest sets of farm buildings in southern Illinois. In fact, he won a prize for having the most conveniently arranged and best kept farmstead in this area. This prize was awarded, also, on the basis that the results were accomplished entirely by returns from the farm.

Our local fieldman in 1920 at Ewing, the late J. R. Midyett, became an ardent follower of the limestone, legume, phosphate, potash program. Mr. Midyett was a dairy farmer and kept accurate accounts on his operations. When he presented his improvements in dollars and cents he left little room for further arguments along this line.

Mr. Midyett kept his farm in good condition both physically and financially. When he passed away, his daughter Lillian took over and ran the farm very successfully. This was such a good story that *Prairie Farmer* ran it along with Lillian's picture. The article created considerable interest and as a result Lillian was married to a young farmer in a distant county and gave up running the home farm.

The home farm is now operated by Knox Midyett, son of J. R. Midyett. Knox has kept up the soil treatment and rotation practices started by his father previous to 1920. His soybean, wheat, and clover yields are the talk of the neighborhood. In 1948 he baled a 40-acre field of red clover hay, and it was said that a man could walk over the entire field without stepping off a bale of clover.

Xavier Kiefer, who lived in an adjoining county, had heard about the Ewing experiment field and drove in one day to look it over. Both "Uncle Whit" and Mr. Midyett were there to explain things to him. He put up the very sincere argument that he was short of funds and didn't have the ready cash

(*Turn to page* 44)

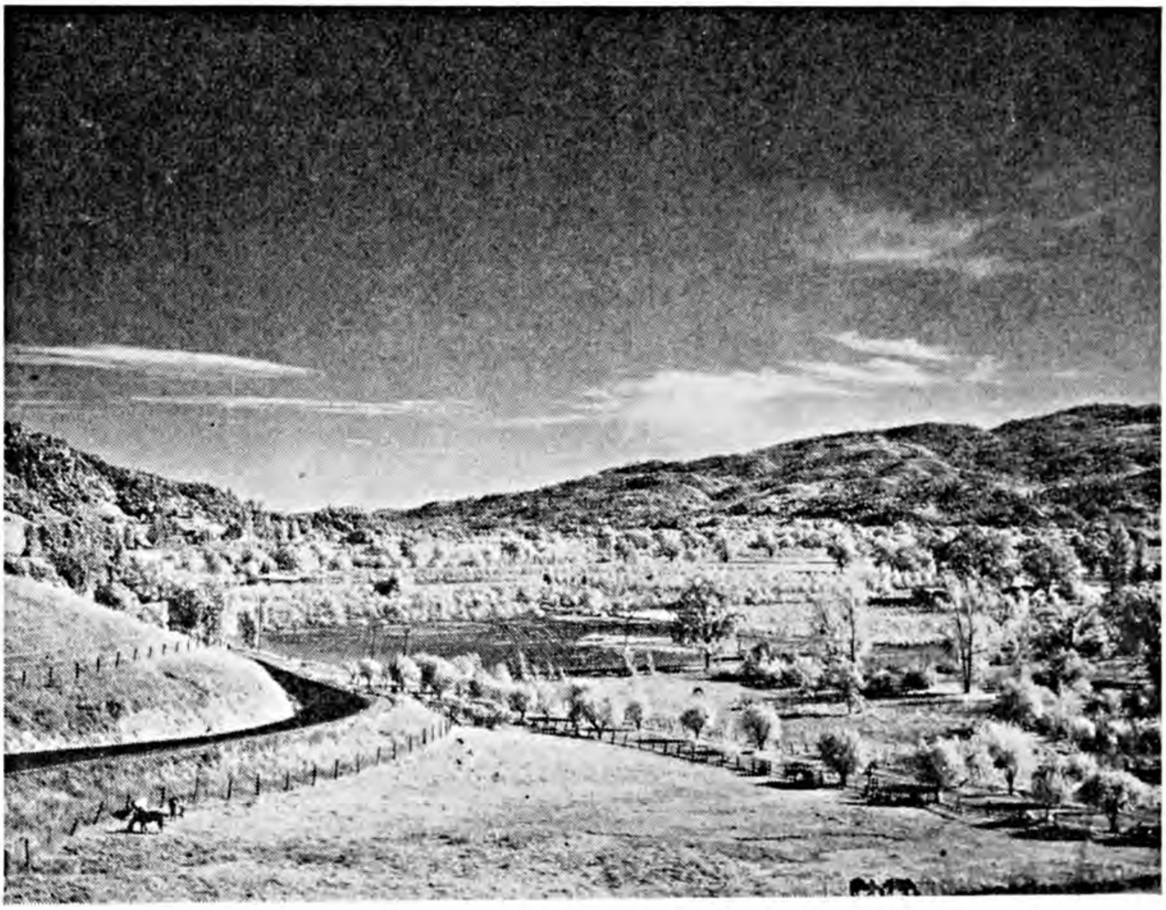
PICTORIAL

Miss Jeanne Burke of Providence, although a city girl, is a senior in agriculture at Rhode Island State College. She was crowned queen of the recently held Aggie Bawl at Kingston.

Courtesy WJZ Farm News Program

***Above:* A Winter lane.**

***Below:* Sunny California**



Above: Doing nicely, thank you.

Below: Corn in snow-fence crib.

Above: **An adult class in grain grading.**

Below: **Brain work takes fuel.**

The Editors Talk

Agriculture 1949

With 1949 drawing to a close, another near-record crop output and marketings of livestock are being written into American agricultural history. Despite the problems of surpluses which are looming over the horizon in some instances, what such abundance really means to the Nation is noted in some well-worded statements in the November issue of RURAL MARKETING, published by COUNTRY GENTLEMAN, Philadelphia, Pa. "Most of us would agree . . . man's first and most fundamental need is to satisfy his appetite for food. And we would probably admit further that there is a fairly close relationship between food and peace . . . between food and justice . . . between food and human happiness.

"We all immediately appreciate the importance of agricultural production of food. There are a few other facts about agriculture, however, that need to be repeated from time to time. How many persons, for example, know that industries which produce one-third of all our manufactured products would be completely crippled if they were deprived of agricultural raw materials? How many . . . realize that almost half of all the money American consumers spend for goods and services goes for products that originate on farms?"

On the other hand, what has 1949 meant to the farm operators? It is estimated that both prices received by farmers and cash receipts from farming will be about 10 per cent less than the record levels of 1948. This still will leave prices more than twice as high as before the war and incomes more than three times as high.

But there is more to figuring the progress in American agriculture than a summation in dollars and cents. There is to be recorded the advances in the science of farming, both in new research and in a fuller use of production technology already proved. To name a few, the amazing spread of farm mechanization to cut high labor costs has continued, and there has been research in the handling of farm products after they leave the farm. Strides have been made in the conditioning of crops for storage and for preserving their quality while in storage. Crop-drying units and means of insect and vermin prevention are coming into use. New and superior varieties of crops are being developed by plant breeders. Practical shifts in income-producing crops to effect wiser land use are being worked out. New food, feed, and industrial uses for field crops and their many by-products are being sought.

Dr. Robert M. Salter, Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Department of Agriculture, reports tremendous gains resulting from soil management and fertilizer research. "Much has been learned about the significance of soil reaction and how to control it, about ways to conserve water in the soil for growing crops and to reduce erosion, about the use of crop rotations, legumes and green manures for replenishing soil humus and nitrogen, about procedures for determining the nutrient needs of crops, and about materials, methods, and machines for meeting these needs efficiently. More and more is being learned about how to maintain soil structure—that is, the physical condition of the soil, its granulation and porosity.

"More extensive use is being made of fertilizers and manures in agriculture, and more efficient fertilizers are being developed," Dr. Salter says, pointing out the application of plant food in granular, liquid, and gaseous forms. It is his belief that if farmers in the United States had made full use of the new production technology already proved, they could have produced a corn crop the size of that of 1948, the largest ever grown, on one-third fewer acres, and at the same time had more income and improved their soil.

To shorten the time-lag between research and practical application, the United States and Canada have the finest agricultural extension forces in the world. To them must go a major share of the credit for the soundness of our fundamental industry. In their annual reports will be found the truest picture of Agriculture—1949.

Hunger Signs in Crops Up to Date

It is probable that the book, HUNGER SIGNS IN CROPS, published by the American Society of Agronomy and the National Fertilizer Association in 1941, needs little introduction to a large percentage of our readers. What may be news to them is the fact that a second edition, bringing the subject up to date with profuse illustration and easy-to-read text is just off the press.

The new book's foreword, written by Firman E. Bear, President of the American Society of Agronomy, and Russell Coleman, President of the National Fertilizer Association, best tells the interest in and demand for information with which to keep up with a plant's visual means of making known its nutrient requirements.

"When HUNGER SIGNS IN CROPS was first projected, those who cooperated in preparing the book believed they would be offering the agricultural public a much-needed treatise on the subject. Although rapid advances had been made by agricultural scientists in the study of nutrient-deficiency symptoms in crops, their work had not been assembled in convenient form.

"As in all such ventures, there was much uncertainty about the reception such a book would be accorded. Concern on this point was soon dispelled. Immediately after its announcement, orders began pouring in. Three printings were required, and high praise for the volume came from numerous organizations and individuals. The book was widely used by college professors, research and extension specialists, industrial chemists and agronomists, county agents, and teachers of vocational agriculture. Many farmers found it of much use in deciding on their fertilizer program.

"Rapid advances have been made in the knowledge of this subject, so that it has become necessary to prepare an entirely new edition. This second edition includes much material that has not previously been published. Many hours of unselfish labor have been devoted by the chapter authors to the revision. Credit is due also to their associates and colleagues who have offered suggestions and furnished photographs.

"Accordingly, the American Society of Agronomy and the National Fertilizer Association are now pleased to present to the public this second edition of HUNGER SIGNS IN CROPS. We hope it will continue to serve the cause of an ever better American agriculture."

Orders for the book should be addressed to the National Fertilizer Association, 616 Investment Building, Washington 5, D. C. The price is $4.50 per copy.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay[1] Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.6	64.2	88.4	11.87	22.55	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.4	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	122.0	218.0	156.0	191.0	16.70	71.90	....
1947	31.3	38.0	156.0	215.0	235.0	241.0	17.30	85.40	....
1948									
December	29.63	45.7	154.0	219.0	123.0	205.0	19.10	68.80	....
1949									
January	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....

Index Numbers (Aug. 1909—July 1914 = 100)

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	175	249	212	209	141	319	204
1947	252	380	224	245	366	273	146	379	249
1948									
December	239	457	220	250	192	232	161	305	209
1949									
January	236	429	238	269	195	229	169	291	282
February	235	295	249	279	174	219	173	237	285
March	232	319	250	290	184	224	168	228	263
April	241	247	260	314	190	226	160	223	236
May	242	325	260	312	190	226	149	224	213
June	243	315	251	301	188	210	138	207	175
July	243	565	222	323	195	206	132	166	185
August	236	446	221	305	184	202	135	197	174
September	240	487	198	263	181	212	137	193	205
October	231	474	187	224	170	214	141	185	170
November	224	434	192	216	159	215	141	188	226

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948						
December	3.00	2.20	11.52	11.65	11.39	11.46
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	10.21	10.39	10.78

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948						
December	112	77	329	330	338	326
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306

Wholesale Prices of Phosphates and Potash* *

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948							
December	.770	4.61	6.60	.375	.720	14.50	.200
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948							
December	144	128	135	68	76	60	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948								
December	268	262	237	137	94	336	144	72
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72
May	256	257	227	134	99	293	144	72
June	252	257	223	134	99	304	144	65
July	249	256	225	140	100	349	144	68
August	245	254	222	143	100	372	144	68
September	249	253	225	138	100	334	144	68
October	243	251	222	138	98	331	144	72
November	239	251	221	136	96	321	144	72

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Phosphorus Studies with Vegetable Crops on Different Soils," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Bul. No. 268, June 1949, L. M. Ware and W. A. Johnson.

"Fertilizer Studies with Vegetable Crops on Representative Soils in Alabama," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Bul. No. 269, June 1949, L. M. Ware and W. A. Johnson.

"Effect of Potash on Oranges—Studies on Deficiency and Excess in Relation to Tree Growth, Composition and Fruit Quality," College of Agr., Univ. of Calif., Berkeley, Calif., reprinted from Calif. Agr. 2(6):3, June 1948, H. D. Chapman, S. M. Brown, and D. S. Rayner.

"State Laboratory Fertilizer, Feed, Limes, and Seed Report, January—June 1949," State Board of Agr., The Green, Dover, Del., Quarterly Bul., Vol. 39, No. 2, June 30, 1949.

"Fertilizers, Feeds, Foods, Drugs, and Cosmetics, Insecticides and Fungicide—Year Ending December 31, 1948," Annual Report, State Chemist of Fla., J. J. Taylor.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 352, May 1949, F. W. Quakenbush.

"Analyses of Official Fertilizer Samples—Semi-annual Report, January–June 1949," Feed and Fert. Dept., Ky. Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 76, Oct. 1949.

"Fertilizer Recommendations for Maine—1949," Ext. Serv., College of Agr., Univ. of Maine, Orono, Maine.

"Analysis of the Bottom Fauna Production in Fertilized and Unfertilized Ponds and Its Utilization by Young-of-the-Year-Fish," Agr. Exp. Sta., Sect. of Zoology, Mich. State College, East Lansing, Mich., Tech. Bul. 207, May 1949, M. H. Patriarche and R. C. Ball.

"Farm Manure," Sect. of Soil Science, Ext. Serv., Mich. State College, East Lansing, Mich., Ext. Bul. 300, June 1949, L. M. Turk and A. G. Weidemann.

"Using Phosphate Fertilizers for Better Crops," Agr. Exp. Sta., Univ. of Mo., College of Agr., Columbia, Mo., Cir. 339, July 1949, A. W. Klemme.

"Fertilizer Grade Tonnage Report for the Period January 1, 1949–June 30, 1949," State Dept. of Agr., Raleigh, N. C., Sept. 14, 1949, A. H. Harris.

"Comparison of Various Organic Materials for Use in Construction and Maintenance of Golf Greens," Agr. Exp. Sta., School of Agr., Pa. State College, State College, Pa., P. R. No. 16, Sept. 1949, A. C. Richer, J. W. White, H. B. Musser, and F. J. Holben.

"Effect of Fertilizers Upon the Yields, Size and Grade of Tomatoes," Agr. Exp. Sta., Texas A & M College System, College Station, Texas, P. R. 1173, June 15, 1949, W. R. Cowley, J. S. Morris, N. P. Maxwell, G. R. Williams, and C. C. Edwards.

"Effects of Fertilizers Upon the Yield, Grade, Head Size, and Marketability of Early Round Dutch Cabbage," Agr. Exp. Sta., Texas A & M College System, College Station, Texas, P. R. 1175, July 22, 1949, J. S. Morris, G. R. Williams, N. P. Maxwell, and W. R. Cowley.

"Mixing Fertilizers on the Farm," U.S.D.A., Washington, D. C., Farmers' Bul. No. 2007, Aug. 1949, C. W. Whittaker.

Soils

"Construction of Farm Fish Ponds," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Cir. No. 95, June 1949, J. M. Lawrence.

"Studies in Gully Control," Agr. Exp. Sta., College of Agr., Univ. of Ark., Fayetteville, Ark., Bul. 486, May 1948, G. W. Hood.

"Reaction of California Soils," Agr. Exp. Sta., College of Agr., Univ. of Calif., Berkeley, Calif., Bul. 712, March 1949, R. C. Cole.

"Soil Profile Sampling Made Easy," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Spec. Cir. 2, July 1949, T. M. Bushnell.

"Youth and Conservation," Ext. Serv., Kans. State College, Manhattan, Kans., L-1, 1949, H. B. Harper.

"Sampling and Testing Soils for Lime and Fertilizer Needs," Ext. Div., College of Agr. and Home Econ., Univ. of Ky., Lexington, Ky., Cir. 475, July 1949, P. E. Karraker.

"Keeping Up Soil Organic Matter," Agr. Exp. Sta., College of Agr., Univ. of Mo., Columbia, Mo., Cir. 336, March 1949, M. F. Miller.

"Stubble Mulch Management for Water Conservation and Erosion Control on Hardlands of the Southern Great Plains," Agr.

Exp. Sta., Texas A & M College System, College Station, Texas, Bul. 711, June 1949, C. J. Whitfield, C. E. Van Doren, and W. Johnson.

"4-H Soil and Water Conservation in Washington Wheatlands," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. No. 398, Sept. 1949, M. D. Butler.

"4-H Soil and Water Conservation West of the Cascades," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. No. 399, Sept. 1949, M. D. Butler.

"4-H Soil and Water Conservation in Central Washington," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. No. 400, Sept. 1949, M. D. Butler.

"Available Nonexchangeable Soil Potassium at Three Northern Great Plains Locations by a Neubauer Procedure," Bu. of Plant Ind., Soils and Agr. Engineering, Agr. Research Admin., U.S.D.A., Beltsville, Md., Research Rpt., No. 167, Sept. 29, 1949, R. F. Reitemeier, R. S. Holmes, and I. C. Brown.

"Normalcy Tests of Precipitation and Frequency Studies of Runoff on Small Watersheds," S.C.S., U.S.D.A., Washington, D. C., Tech. Bul. No. 985, June 1949, W. D. Potter.

Economics

"California Spinach, Economic Status 1948–1949," Agr. Exp. Sta., College of Agr., Univ. of Calif., Berkeley, Calif., Cir. 393, Sept. 1949, Sidney Hoos and P. C. Habib.

"Costs and Returns on Family-type Sugar Cane Farms in Louisiana, 1946 and 1947," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. No. 438, March 1949, J. P. Gaines and J. N. Efferson.

"Louisiana Cotton Statistics with Comparisons," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. No. 439, April 1949, J. P. Montgomery.

"Success in Farming Rough Land in Southern Michigan," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Spec. Bul. 356, April 1949, F. M. Atchley.

"The Nature of an Efficient Agriculture in the Northeast Prairie Area of Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 459, Jan. 1949, D. W. Parvin.

"Facts and Figures—Annual Potato Summary—Crop of 1948," State Dept. of Agr., Trenton, N. J., Cir. No. 375, May 1949, A. W. Severson.

"Grade Defects in Pennsylvania Potatoes from Near-by Shipping Points through Wholesale and Retail Outlets in Pennsylvania, October–November, 1948," Agr. Exp. Sta., School of Agr., Pa. State College, State College, Pa., P. R. No. 9, May 1949, W. A. Lee and M. J. Caraccia.

"1950 Agricultural Conservation Program, State of Vermont," U.S.D.A. Prod. & Mktg. Admin., 102 Adams St., Burlington, Vt.

"Vermont Agricultural Conservation Program, 1947, Statistical Report," U.S.D.A. Prod. & Mktg. Admin., 102 Adams St., Burlington, Vt., July 1949.

"Virginia Farm Statistics," State Dept. of Agr., Cooperative Crop Reporting Serv., Richmond, Va., Bul. No. 15, 1949.

"Keeping Up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 139, Sept. 30, 1949, Karl Hobson.

"Your Farm Lease," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Misc. Publ. No. 627, Rev. June 1949, M. M. Tharp.

Crops

"Contour Planting of Unirrigated Perennials," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 152, May 1949, L. N. Brown.

"Growing Potatoes in California," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 152, June 1949, G. N. Davis.

"Grass Seed Production," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 155, Sept. 1949, D. C. Sumner and M. D. Miller.

"More and Better Alfalfa," Ext. Serv., Colo. A & M College, Fort Collins, Colo., Cir. 164-A, July 1949, R. H. Tucker and L. E. Washburn.

"1948 Annual Report," Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 555, June 1949.

"Winter Grazing in Georgia Coastal Plain," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Bul. 47, June 1949, G. W. Burton, S. A. Parham, B. L. Southwell, and J. L. Stephens.

"Crimson Clover for the Coastal Plain," Ga. Coastal Plain Ext. Sta., Tifton, Ga., Mimeo. Paper No. 64, Sept. 1949.

"Blue Lupine—Winter Cover Crop," Ga. Coastal Plain Exp. Sta., Tifton, Ga. Mimeo. Paper No. 65, Sept. 1949.

"Open-pedigree Corn Hybrids for Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Cir. 353, 1949, S. R. Miles and Marjorie Freihofer.

"Bromegrass Strains in Indiana," Purdue Univ., Lafayette, Ind., Sta. Cir. 348, Dec. 1948, J. J. Pierre and G. O. Mott.

"Let's Grow Corn," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 323, 1948.

"Iowa Year Book of Agriculture," 48th Annual, State Dept. of Agr., Des Moines, Iowa, 1947.

"Fruit Setting in the Delicious Apple as Influenced by Certain Post-blossoming Environmental Factors," Agr. Exp. Sta., Sect. of Hort., Mich. State College, East Lansing, Mich., Spec. Bul. 358, June 1949, V. R. Gardner, T. A. Merrill, and W. Toenjes.

"Trials of Grape Varieties in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 144, Dec. 1948, N. H. Loomis.

"Results of Date-of-Planting Sugarcane Tests in Mississippi, 1939–1946," Agr. Exp. Sta., Miss. State College, Miss., Cir. 148, April 1949, I. E. Stokes.

"Budding and Grafting Standard Apple Varieties on Hardy Stocks," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 525, July 1949, T. J. Talbert.

"Agriculture at the University of Nevada, Research — Resident Teaching — Extension," Univ. of Nev., Reno., 1949.

"Efficient Corn Production," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaf. 29, April 1949, J. S. Baylor and C. S. Garrison.

"Growing Christmas Trees in New Jersey," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaf. 30, April 1949, A. N. Lentz.

"Growing Better Crops of Winter Wheat in New Jersey," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaf. 31, May 1949, C. S. Garrison and J. E. Baylor.

"Growing Black Locust in New Jersey," Ext. Serv., College of Agr., Rutgers Univ., New Brunswick, N. J., Leaf. 32, May 1949, A. N. Lentz.

"Plan of Work—Extension Service in Agriculture and Home Economics, November 1, 1948—October 31, 1949," College of Agri., Rutgers Univ., New Brunswick, N. J., 1949.

"Thirty-third Annual Report, July 1, 1947—June 30, 1948," State Dept. of Agr., Trenton, N. J., June 30, 1948.

"Growing Grapes in New Mexico," Agr. Exp. Sta., N. M. College of A & M, State College, N. Mex., Bul. 347, June 1949, Arnold Krochmal.

"Research and Farming," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Spec. Tobacco Issue, July 1949, W. E. Colwell.

"Care of House Plants," Agr. Ext. Serv., State College Stat., Raleigh, N. C., Ext. Cir. No. 340, June 1949, J. H. Harris.

"Yields and Chemical Analyses of Small-grain and Annual Ryegrass Forages Clipped at Grazing Height," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Manuscript Rpt. Abstract No. 1, July 1949, V. G. Heller and H. W. Staten.

"Science for the Farmer," Agr. Exp. Sta., Pa. State College, State College, Pa., 62nd A. R., Bul. 515, July 1949.

"Grain Sorghum Variety and Date Tests, Dalhart Field Station, 1942-48," Agr. Exp. Sta., Texas A & M College System, College Station, Texas, P. R. 1178, July 30, 1949, Grady L. Randel.

"Cotton Defoliation Tests in the Lower Rio Grande Valley," Agr. Exp. Sta., Texas A & M College System, College Station, Texas, P. R. 1179, Aug. 16, 1949, J. S. Morris and W. R. Cowley.

"Weed Control in Small Ponds," Agr. Exp. Sta., Blacksburg, Va., Bul. 425, June 1949, H. W. Jackson.

"Four Keys to Good Gardening," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Feb. 1949.

"What's New in Farm Science," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 487, A. R. Part 1, June 1949.

"Soybeans, Culture and Varieties," U.S.D.A., Washington, D. C., Farmers' Bul. No. 1520, Rev. Aug. 1949, W. J. Morse, J. L. Cartter, and L. F. Williams.

"Pear Growing in the Pacific Coast States," U.S.D.A., Washington, D. C., Farmers' Bul. No. 1739, Rev. June 1949, C. F. Kinman and J. R. Magness.

"Grow Disease-resistant Oats," U.S.D.A., Washington, D. C., Farmers' Bul. No. 1941, Rev. 1949, T. R. Stanton and F. A. Coffman.

"Using Tall Fescue in Soil Conservation," U.S.D.A., Washington, D. C., Leaf. No. 254, Aug. 1949, R. Y. Bailey and L. B. Scott.

"1950 Agricultural Conservation Program National Bulletin," Prod. & Mktg. Admin., U.S.D.A., Washington, D. C., ACP-1950, July 1949.

"Comparison of Methods of Supplying Phosphorus to Range Cattle," U.S.D.A., Washington, D. C., Tech. Bul. No. 981, July 1949, W. H. Black, L. H. Tash, J. M. Jones, and R. J. Kleberg, Jr.

"Report of the Minister of Agriculture for the Dominion of Canada for the Year Ended March 31, 1948," Ottawa, Ont., 1948.

Grow Lespedeza Sericea

(*From page* 14)

Before planting sericea the plots were producing 30 bushels of corn per acre. The land was left in sericea three years and cut annually for hay.

Where seed are to be harvested, the last cutting for hay should be omitted. Seed can be harvested readily with a combine and are usually ready for harvest in November. About the best time for harvest is right after the first heavy killing frost. Seed yields range from 200-600 pounds per acre.

Sericea should be refertilized as often as necessary to maintain quality and quantity of forage. Thin stands can be replenished by allowing plants to seed. Mow after heavy frost, apply 400-600 pounds of 0-12-12 or 3-12-12 fertilizer, and disc lightly.

Fertilizing Vegetable Crops

(*From page* 10)

lished more quickly if a starter solution is applied in transplanting. This is especially true if fertilizer has not been placed in the row. Standard starter solution formulas are high in nitrogen, phosphorus, and potassium. Commercial mixtures should be used according to directions of the manufacturer.

An effective starter stock solution can be made by dissolving 3-12-6 or 4-12-4 fertilizer at the rate of one pound per gallon of water. The fertilizer is suspended in a bag near the top of the water and allowed to dissolve for several hours. This stock solution is placed in the water for transplanting at the rate of 8 to 10 gallons of the solution to 40 gallons of water, so that each 50-gallon tank contains 8 to 10 pounds of actual fertilizer.

Combined methods — Where long-time programs of soil management are involved, and in the growing of long-season crops, such as tomatoes, peppers, eggplants, and sweet corn, two or more methods of applying fertilizer often are combined. In such cases half to two-thirds of the fertilizer may be plowed down by the broadcast or plow-sole method and the remainder applied in bands or as sidedressing during the growing season. For many of the shorter-season market garden crops, half of the fertilizer often is broadcast and plowed down and the remainder applied with a grain drill, placing it about three inches deep after most of the soil preparation has been completed. Further supplementary applications may be made by the band method at planting time.

Concentrated fertilizers—In recent years large quantities of concentrated fertilizer, such as 10-20-10, 6-18-6, and 8-16-16, have become available. These higher analyses, in the same ratio, may be substituted in equivalent amounts for any of the suggested analyses shown in Tables III and IV. High-analysis fertilizers usually can be purchased at less cost per unit of plant nutrients than low-analysis fertilizers. As

Fig. 4. This cabbage transplanter places the fertilizer in bands and applies starter solution.

TABLE III—SUGGESTED ANALYSES AND RATES OF APPLICATION OF FERTILIZER

Crop	Medium loam soils			
	Manure or clover sod		No manure or clover sod	
	Analyses	Pounds per acre	Analyses	Pounds per acre
Asparagus	5–10– 5	1,000	5–10– 5	1,500
Beets, carrots, and other root crops	4–12– 8 5–10–10	1,000 1,000	5–10–10	1,500
Beans: snap and edible soy	3–12– 6 4–12– 4	500 500	5–10– 5 4–12– 4	750 750
Lima beans	4–12– 4 5–10– 5	750 750	4–12– 8 5–10– 5	1,000 1,000
Cucumbers, muskmelons, pumpkins, and squash	4–12– 4	750	4–12– 8 6–12– 6	1,000 1,000
Cabbage, broccoli, and cauliflower	4–12– 4 5–10– 5	1,000 1,000	4–12– 8 6–12– 6	1,000 1,000
Sweet corn	4–12– 4 5–10– 5	400 400	5–10– 5 4–12– 8	400–600 400–600
Celery	4–12– 8	1,000	5–10–10	1,500
Leaf lettuce	4–12– 4 5–10– 5	800 800	5–10– 5	1,000
Head lettuce	4–12– 4	1,000	5–10– 5	1,000
Spinach	4–12– 4 5–10– 5	1,000 1,000	5–10– 5	1,500
Onions	3–12– 6	1,200	4–12– 8	1,500
Peas	3–12– 6	500–700	3–12– 6	750–1,000
Peppers, eggplants	3–12– 6	750	5–10– 5	1,000
Sweet potatoes	4–12–12	800	4–12–12	1,000
Tomatoes	4–12– 4 3–12– 6 5–10– 5	800 800 800	3–12– 6 4–12– 8 5–10–10	1,000 1,000 1,000

an example, 500 pounds of 6-18-6 fertilizer supplies the same amount of plant nutrients as 750 pounds of 4-12-4 fertilizer. Other similar ratios may be substituted where they may be more conveniently obtained or where there is reason to believe they are more desirable.

How to Get the Most Out of Your Fertilizer

1. Choose land well adapted to the

vegetable crop to be grown. Fertilizer is much more likely to give better returns on good land than on poor land.

2. Be sure that the soil is well drained. Do not waste fertilizer by applying it to poorly drained soils.

3. Use enough lime; do not guess. If you are in doubt have soil tested. Soil testing leads to more intelligent liming.

4. Fertilize adequately. Apply fertilizer in a way that will not cause injury but will give highest yields.

5. Cultivate enough to control weeds.

TABLE IV—SUGGESTED ANALYSES AND RATES OF APPLICATION OF FERTILIZER

Crop	Sandy loam soils			
	Manure or clover sod		No manure or clover sod	
	Analyses	Pounds per acre	Analyses	Pounds per acre
Asparagus	5–10–10	1,800	5–10–10	2,000
Beets, carrots, and other root crops	5–10–10	1,800	5–10–10	2,000
Beans: snap and edible soy	5–10–5 4–12–8	850 850	5–10–5 4–12–8	1,000 1,000
Lima beans	5–10–10 6–12–6	1,000 1,000	5–10–10 6–12–6	1,250 1,250
Cucumbers, muskmelons, pumpkins, and squash	5–10–10	1,000	5–10–10	1,250
Cabbage, broccoli, and cauliflower	4–12–8 5–10–10	1,000 1,000	4–12–8 5–10–10	1,250 1,250
Sweet corn	5–10–5 4–12–8	400–600 400–600	4–12–8 5–10–10	600–800 600–800
Celery	5–10–10	1,500	5–10–10	2,000
Leaf lettuce	5–10–5	1,000	5–10–5	1,500
Head lettuce	5–10–5	1,000	5–10–5 6–12–6	1,500–1,800 1,500–1,800
Spinach	5–10–5 6–12–6	1,500 1,500	5–10–5 6–12–6	2,000 2,000
Onions	5–10–10	1,500	5–10–10	2,000
Peas	4–12–8	750–1,000	4–12–8	1,000–1,500
Peppers, eggplants	4–12–8	1,000	5–10–5	1,250
Sweet potatoes	4–12–12	1,000	4–12–12	1,200
Tomatoes	3–12–6 5–10–10 4–12–8	1,000 1,000 1,000	5–10–5 4–12–8 5–10–10	1,500 1,500 1,500

You cannot grow both weeds and vegetables.

6. Give as much attention to the need for sidedressing vegetables with readily available nitrogen during the growing season as to the need for the initial fertilizer application.

7. Adopt a sound rotation. Follow vegetables with some soil-improving crop, such as ryegrass.

Pacific Northwest . . . Strawberries

(*From page* 24)

ers like to have families move in, with mother, father, and children all picking berries. Many families use this as their annual vacation where all can work, make money, and enjoy a pleasant healthful outing together.

The harvesting in the fields is accomplished by the picker stemming the fruit as it is removed from the plant and then placing it in one-pound hallocks. There are six empty hallocks in a carrier, a small wooden box with a handle extended over the top for carrying in the field. When a carrier is delivered to the field table, the checker takes it and gives the picker an empty one, at the same time punching the picker's record card, giving credit for boxes picked. When the card is full, the picker can turn his card in at the office and receive his pay.

Processing

The berries are trucked to the processing plants, unloaded, and weighed. A sample is taken from each load for inspection. The State Department of Agriculture has inspectors in many of the plants who grade and establish the percentage of No. 1 berries in the lot. The growers are paid on this grade.

Packers process the berries as soon as they are received in order to keep all of the fresh fruit flavor in the product. The strawberries are dumped in water and washed, and come out on a belt where water under pressure is sprayed over them. They then move down grading belts where all off-colored, misshapen, or off-grade berries are removed. Then they are sliced, and sugar is added. They are packed in one pound packages, and placed in a sharp freeze tunnel, where the temperature is 30 to 40° below 0° F. When frozen they are removed, packed in cartons, and held in cold storage ready to be shipped in carload lots to the distributor.

Problems

The concentration of crops in any area always seems to bring trouble. In the early days of strawberry culture, the strawberry root weevil, a destructive pest, almost caused the downfall of the Northwest strawberry industry. The larvae eat the roots during the winter and devitalize the plants. If the insect population is allowed to build up, a field may be completely ruined. Growers were almost out of business when M. J. Forsell, Horticultural Inspector at Everett, Washington, developed "Go West," a poison apple-pomace bait. This timely development put strawberry growing back on a paying basis.

At the present time virus diseases are reducing both the growth of plants and yields; not only in the Northwest but in the East as well. In time these also may be controlled by some easier method than spraying, dusting, and roguing mother-plant beds that are grown in isolation, as is the practice now.

It appears from many years of experience with strawberry growers that it is of prime importance to plant clean stock, use recommended disease and insect control measures, and to get high production and quality fruit by proper soil preparation and generous use of fertilizers.

Observations of a Fieldman

(*From page* 26)

to pay for a carload of limestone. To this "Uncle Whit" countered, "You say you have some dairy cows. I'd advise you to order the limestone now and then sell some of your cows to pay for the lime when the car arrives." This argument evidently sank in because Mr. Kiefer paid for his first car of limestone by selling one of his best dairy cows. Later he was able to lime his entire farm, and through the years has also put on many tons of phosphate and potash.

Another outstanding example is the Apple Brothers, Leo, Ed, and Paul, who farm near the Enfield experiment field. They started a number of years ago to use lime and legumes on a small farm which they had taken over. Now they have over 400 acres operated as a unit and fully equipped with machinery, substantial buildings, and hog-tight fences. Their main crops are corn, barley, wheat, and clovers. The corn and barley are fed to hogs, with the barley serving as a fall and spring pasture as well as a grain feed. They plow under many acres of sweet clover each year and use in addition large amounts of mixed fertilizers.

The Ewing experiment field, started in 1910, is located on level, gray soils with a rather impervious subsoil. Without soil treatment this land appears hopeless as a farming proposition. When properly treated and under good management, it becomes highly profitable. The soil is very acid and requires four to six tons of limestone an acre. It is deficient in organic matter, necessitating the return of all pos-

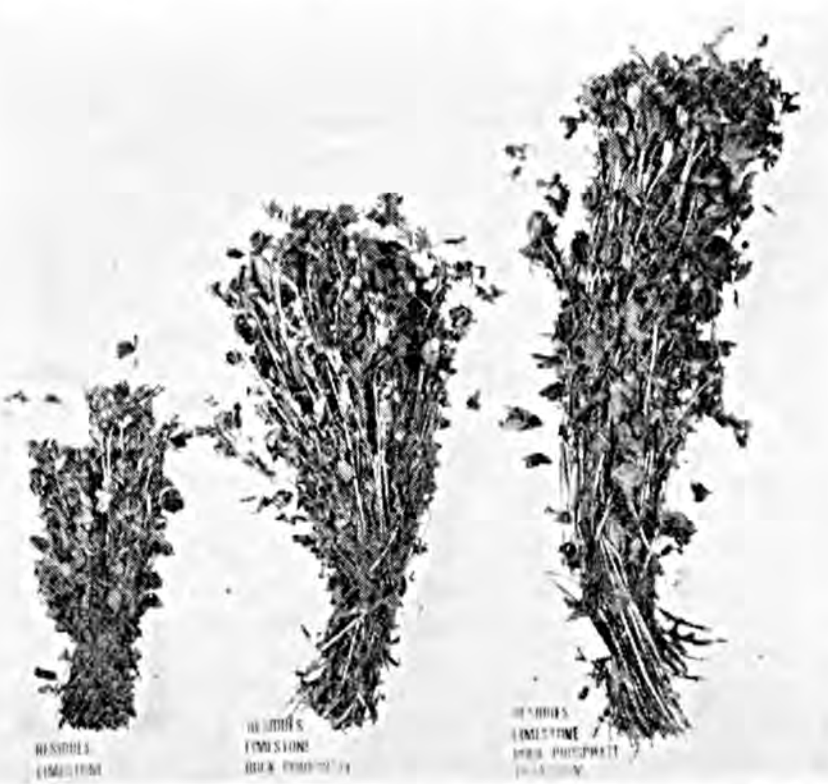


Fig. 2. Alfalfa-red clover grown on the Enfield Experiment Field, 1948. Each bundle represents the growth from a 4-ft. square area under the soil treatments indicated.

Residues **Limestone**	**Residues** **Limestone** **Rock phosphate**	**Residues** **Limestone** **Rock phosphate** **Potassium**

sible crop residues, especially legumes. Phosphate and potash also are highly essential on this land. Results such as shown in Table I may be obtained under good management when the soil is properly treated.

The Elizabethtown field, started in 1918, is located on the yellow hill land of extreme southern Illinois. This field affords an excellent demonstration of what may be accomplished on this type of farm land by crop rotation, lime, legumes, phosphate, potash, and general soil conservation practices. The results in Table II indicate that it would scarcely be profitable to farm this land without soil treatment. However, with the proper amounts of limestone, phosphate, and potash, and with legumes plowed under, the crop yields are substantial and farm operation is profitable.

TABLE I. EFFECT OF SOIL TREATMENT FOR 38 YEARS ON THE LEVEL GRAY SOILS OF THE EWING EXPERIMENT FIELD.[1]

	Acre Yields	
	No Fertilization	LPK[2]
Corn	12 bu.	50 bu.
Wheat	3 bu.	31 bu.
Oats	11 bu.	37 bu.
Soybeans	6 bu.	25 bu.
Alfalfa—Red clover	340 lbs.	2,700 lbs.

[1] All crop yields are not averaged for the full 38 years. There were some failures and a change from oats to soybeans in 1945.
[2] L—Limestone; P—Rock phosphate; K—Muriate of potash.

TABLE II. EFFECT OF SOIL TREATMENT FOR 30 YEARS ON THE ROLLING YELLOW HILL LAND ON THE ELIZABETHTOWN EXPERIMENT FIELD.

	Acre Yields	
	No Fertilization	LPK
Corn	12 bu.	48 bu.
Wheat	4 bu.	22 bu.
Oats	6 bu.	42 bu.
Alfalfa—Red clover	80 lbs.	3,500 lbs.

Corn and wheat 30-year average.

Water Erosion Control

(*From page* 20)

ducing soil loss when used on cultivated land. The use of 750 pounds of buckwheat straw per acre as a mulch at Ithaca, New York, reduced the soil loss to less than one-fourth (9). Present indications are that from one to two tons of vegetal cover (dry-weight basis) per acre, uniformly distributed over the ground surface at the time of the storm, are needed for effective protection against raindrop impact.

The adequacy of vegetal cover, produced by the cropping system in use, in absorbing the raindrop impact may be illustrated graphically by comparing a chart which shows the extent of the rainfall hazard by months with another which presents a combination of resistance offered by the soil to the hazard and the amount of protection supplied by the cropping system in use. The difference between the energies exerted by the falling raindrop and the resistance offered by the soil and the amount of these energies absorbed by the vegetal cover present represents the raindrop hazard remaining to be dealt with.

The adequacy of the vegetal cover produced by the crop or crops in use, in controlling raindrop impact, is illustrated in Figure 5 (10). The chart in the upper part of the figure shows the raindrop hazard by months, as

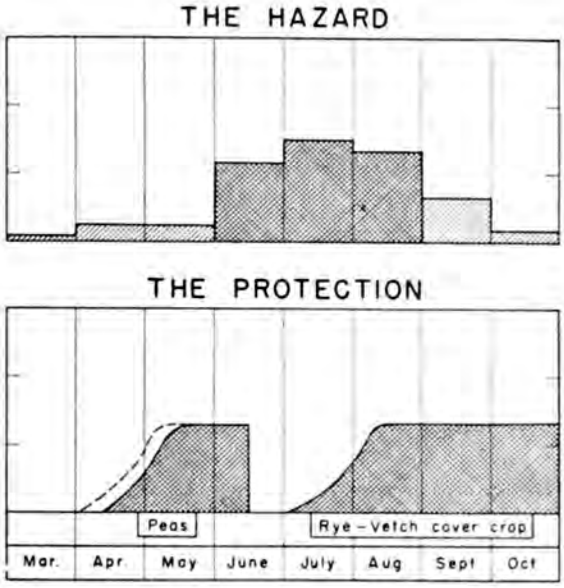


Fig. 5. Schematic outline illustrative of a gap in the protection provided by a crop in a rotation and the following winter cover crop.

measured by the number of excessive rains, for the period March-October, inclusive. The months omitted from the chart had no excessive rains recorded. The chart in the lower half of the figure indicates the estimated protection against the raindrop impact supplied by the foliage of the crops used in the rotation, and which occupy the ground during the same period of the year.

It may be seen that the major rainfall hazard occurs during the months of June-August, inclusive, with a fairly high degree also coming in September. The peas which occupy the ground the first part of the year supply adequate protection during May and the first half of June. However, the peas are harvested for canning and the top growth removed from the field at the beginning of the high rainfall hazard period, June-August. The removal of the peas exposes the bare ground to the impact of the falling raindrop until the cover crop of rye-vetch can be established and produce sufficient cover to absorb the energy of the falling raindrop. Since the cover crop is not seeded until July and some weeks elapse after the planting date before adequate vegetal cover is produced, the land is without satisfactory protection during the major part of the period mid-June-August. It can be safely assumed that at no time after the peas are harvested is there sufficient vegetal cover to provide effective protection to the ground against the ravages of falling raindrops during this period. From this, it is evident that the crop-

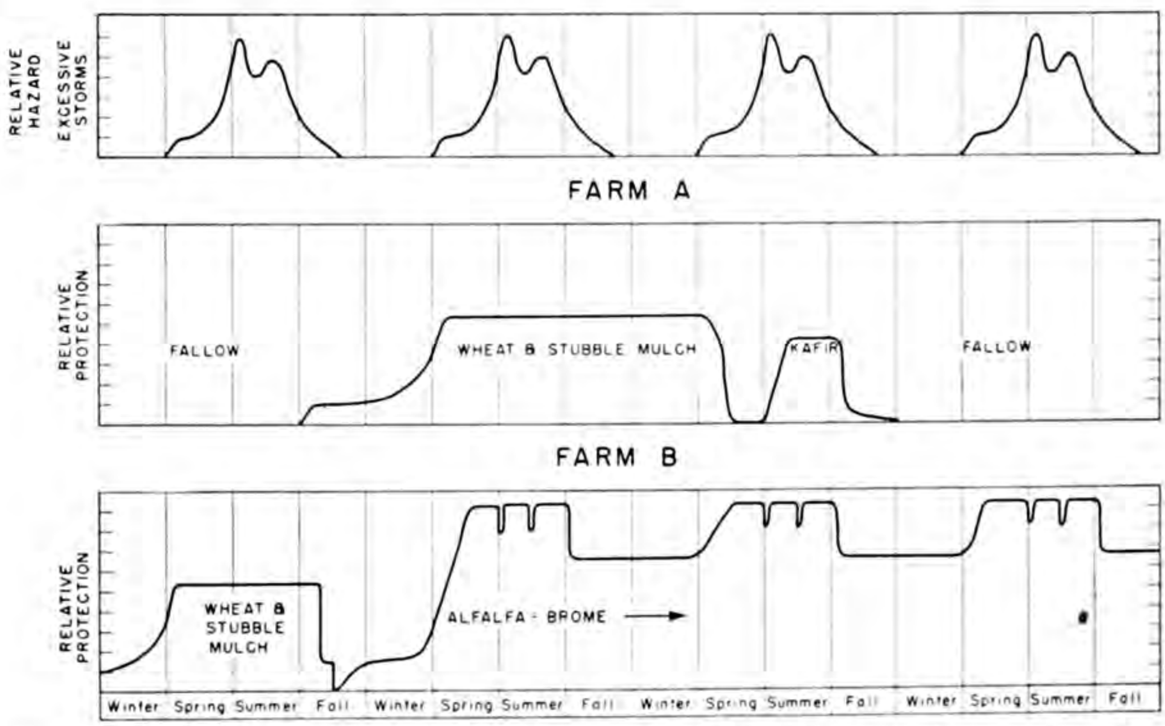


Fig. 6. Schematic outline illustrative of the occurrence of the hazard (excessive storms) and the protection (obtained from agronomic practices) on two different farms in the same area during a 4-yr. period.

ping system in use does not meet the requirements of a conservation cropping system.

The same method may be used in determining whether or not a given crop rotation possesses the requirements of a conservation rotation. In order to accomplish this, however, it is necessary to prepare the two charts so they will cover the full period of time occupied by the rotation. The rainfall hazard chart will be the same for each year of the rotation but the protection chart should reflect the protection provided by the crops used in the rotation during each season of each year of the rotation. This is illustrated graphically in Figure 6, by the use of two distinct types of crop rotations which have the same rainfall hazard (10).

The rainfall hazard begins in early spring and increases steadily until it reaches a peak in June. It declines somewhat after reaching a peak in June but remains high throughout the summer. It declines gradually during the early fall and disappears the latter part of the season. Farm A is cropped to a 4-year rotation consisting of fallow-wheat-kafir-fallow. The two fallow years provide no protection against the raindrop impact except what little is provided by kafir stubble during the second year. The wheat year, when stubble mulch tillage is practiced, provides fair protection throughout the year whereas, the kafir does not develop any degree of protection until after the peak of the rainfall hazard has been reached and passed. The maximum protection supplied by the kafir during the latter part of the summer is inadequate.

The 4-year rotation practiced on farm B supplies protection much superior to that on farm A. Again a 4-year rotation is used but this time it consists of one year of wheat and 3-years of alfalfa-bromegrass hay. Stubble mulch tillage is practiced during the wheat year and, as a result, fairly adequate cover protection is supplied during the entire rainfall hazard period. The alfalfa-bromegrass hay supplies ample protection during the last three years of the rotation.

It is evident that the cropping system shown in Figure 5 and the 4-year crop rotation used on farm A in Figure 6, fail to supply the vegetal cover needed to protect the soil against the ravages of the falling raindrop. Under field conditions it may be found impossible or impractical in many instances, especially where row crops are used in the rotation, to develop crop rotations which will, in themselves, provide the necessary cover in adequate amounts at the proper time. In such cases the crop rotation must be supplemented by he use on the ground surface of crop residues and mulches, if raindrop splash is to be controlled.

Control of Surface Flow

That portion of the rainfall which does not find its way into the soil by percolation, or is not impounded in depressions on the surface of the ground, or is not intercepted by the plant canopy, escapes from the field as surface runoff. As has been stated previously, the chief role of surface flow in the erosion process, before concentrating into rills and gullies, is transporting soil material. It has been stated also that soils which are protected from splash erosion by falling raindrops are not apt to undergo serious erosion as a result of surface flow of excess water from the area.

The force of surface flow is applied more or less horizontally across the surface of the ground. The amount of force generated by surface flow is definitely related to the concentration and velocity with which it moves down slope. The secret of reducing the damage caused by surface flow, then, is to control its concentration, and to retard, or regulate, its velocity.

When runoff water from one small area is allowed to run straight down the slope, it joins with the runoff water from other areas and soon attains great volume as well as high velocity. Since an acre-inch of water weighs more than 113 tons and the ability of flowing water to move objects varies approximately with the sixth power of its velocity, it is easy to realize the tremendous power exerted by runoff water and visualize what is required to stop a load of this magnitude once it gets under way. Doubling the degree of slope increases the total soil loss 2.8 times (16). It is small wonder that tons upon tons of topsoil may be rolled, or suspended and carried from a cultivated field, leaving eventually but a small amount of either soil or moisture on the field for plant growth.

The regulation of both the concentration and velocity with which free water moves over the surface of the ground may be accomplished by controlling the length of slopes over which the water moves. Where slopes are sufficiently steep, or long, to favor damaging concentrations and velocities, they need to be shortened by establishing appropriate mechanical barriers at strategic distances. The most popular mechanical barriers now in use for shortening slopes include the terrace,

Fig. 7. Plant covers protect the soil against the blast of the falling raindrop and serve as a cushion to absorb the raindrop's energy. The water then reaches the surface without any damaging effects to the soil.

contour cultivation, and contour strip-cropping.

By terracing, the field slope is divided into several small watersheds. The short slopes thus formed, plus the use of a cropping plan, soil treatment, and cultural practices fitted to that field, will allow only a minimum of runoff water to attain scouring velocity. By controlling the velocity practically all of the soil is kept on the field and more runoff water may be absorbed as it moves slowly from the field.

Types of Terraces

On the basis of the primary functions of terraces, they may logically be divided into two types or classes, level and graded. Both types are alike in that they are used to control water and save soil but differ in that the level terrace is used to conserve moisture, whereas the graded terrace is used for the orderly disposal of surplus water during times of excess rainfall. Since one of the major functions of the level terrace is the conservation of moisture, its use naturally would be restricted to those areas where the rainfall is inadequate for maximum crop growth and where conservation of moisture is of primary importance. The graded terrace, on the other hand, is recommended for humid conditions where conservation of moisture is not a major factor as a rule.

Contour strip-cropping is the growing of a soil-exposing crop such as corn, cotton, or potatoes in relatively narrow strips across slopes on the level, or contour, alternated with strips of soil-protecting meadow, or small grain crops seeded in meadow mixtures. One of the functions of the strip of sod-producing crops in a strip-cropping system is to retard runoff and catch any soil eroded from the cultivated strip. The vegetal cover also impedes surface flow. This results in much of the soil material carried in suspension being deposited on the sod strip. Various width strips of the soil-conserving crops are effective in reducing erosion and decreasing the distance of soil movement

Fig. 8. Wheat stubble and other crop residues, when left on the surface of the ground, protect the soil against the blasts of the falling raindrops. Soil particles not torn loose by raindrop impact are not apt to suffer any serious erosion.

on between-terrace slopes (3). Under some conditions little or no soil moves from cultivated strips while under other conditions large colluvial fans accumulate in meadow strips (8). Some of these colluvial fans are of sufficient size and extent to indicate that there is continuous severe erosion from the cultivated strip, and in consequence the quantity of vegetation in the meadow strip decreases and its quality deteriorates. The volume and distribution of the colluvial fans appear to be affected by variations in physiographic, pedalogic, and agronomic factors.

Contour cultivation, when properly used under appropriate and applicable conditions, is one of the most effective mechanical ways of saving both soil and water on cultivated land (14). It is effective from the standpoint of increasing crop yields, reducing runoff, and in preventing erosion losses. Like other conservation measures, it has its limitations and maximum results may be expected only when used in conjunction with other erosion control practices. In some areas contour cultivation should be supplemented with terracing. In the humid areas diversion ditches and strip-cropping on certain types of slopes may be necessary. Grassed waterways are useful to protect the field against needless gullying.

Factors, such as soil type and soil condition, amount and intensity of rainfall, the length, irregularity, and steepness of slope, all modify the effectiveness of contour cultivation. In semi-arid areas where the conservation of moisture is of primary importance contour cultivation by listing may be sufficient during periods of heavy rainfall for the orderly disposal of surplus water, or in the semi-arid areas for the conservation of moisture. It is in those areas where contour cultivation serves this double function that appropriate supplemental measures are essential for maximum results.

Information now available indicates that maximum results can be had only by fitting the control measures to the land. This usually calls for various combinations of appropriate cropping systems, contour strip-cropping, terracing and contour cultivation. The three probably should be considered as companion practices in those areas where they are adapted (15).

1. Borst, H. L. and Woodburn, Russell. The Effects of Mulching and Methods of Cultivation on Runoff and Erosion from Muskingum Silt Loam. Agr. Eng., Vol. 23, No. 1, pp. 19-23, January 1942.
2. Daniel, Harley A., Elwell, Harry M., and Cox, Maurice B. Investigations in Erosion Control and Reclamation of Eroded Land at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma, 1930-40. USDA Tech. Bul. No. 837, January 1949.
3. Dieseker, E. G. and Yoder, R. E. Sheet Erosion Studies on Cecil Clay. Ala. Agr. Exp. Sta. Bul. 245, November 1936.
4. Ellison, W. D. Soil Erosion Studies—Part II, Soil Detachment Hazard by Raindrop Splash. Agr. Eng., Vol. 28, No. 4, pp. 197-201, May 1947.
5. Ellison, W. D. Experiments in Soil Erosion and Infiltration on Range Lands in the High Plains. USDA SCS Mimeo., Fort Worth, Texas, 1948.
6. Ellison, W. D. Soil Detachment by Water in Erosion Process. Trans. Amer. Geo. Union, Vol. 29, No. 4, Part I, pp. 499-502, August 1948.
7. Ellison, W. D. and Ellison, O. T. Soil Erosion Studies—Part VI, Soil Detachment by Surface Flow. Agr. Eng., Vol. 28, No. 9, pp. 402-405 and 408, September 1947.
8. Gerdel, R. W. Soil Losses from Cultivated Strips in Strip-cropping Fields in the Ohio Valley Region. USDA Cir. No. 588, December 1940.
9. Lamb, John, Jr., Andrews, J. S., and Gustafson, A. F. Experiments in the Control of Erosion in Southern New York. Cornell University Agr. Exp. Sta. Bul. 811, March 1944.
10. Musgrave, G. W. Designing Agronomic Practices To Meet Specific Erosion Hazards. USDA SCS-TP-84, July 1949.
11. Nichols, M. L. and Gray, R. B. Some Important Farm Machinery and Soil Conservation Relationships. Agr. Eng., Vol. 22, No. 10, pp. 341-343, October 1941.
12. Pope, J. B., Archer, James C., Johnson, P. R., McCall, A. G., and Bell, F. G. Investigations in Erosion Control and Reclamation of Eroded Sandy Clay Lands of Texas, Arkansas, and Louisiana at the Conservation Experiment Station, Tyler, Texas, 1931-40 USDA Tech. Bul. 916, June 1946.
13. Potter, W. D. Normalcy Tests of Precipitation and Frequency Studies of Runoff on Small Watershed. USDA Tech. Bul. No. 985, June 1949.
14. Stallings, J. H. Effect of Contour Cultivation on Crop Yield, Runoff, and Erosion Losses. USDA SCS Multi., June 1945.
15. Stallings, J. H. Review of Terracing Data on Crop Yield, Runoff and Soil Loss. USDA SCS Multi., December 1945.
16. Zingg, Austin W. Degree and Length of Land Slope as It Affects Soil Loss and Runoff. Agr. Eng., Vol. 21, Nos. 2 and 3, pp. 3-8, March 1940.

Good Will

(*From page* 5)

in winter—just as the taxes and fuel bills jolt our resources.

Yet all these are minor things to put alongside the bigger theme, which is to remind us all that we really have a share in social welfare—even if we miss half the fun of it by having all the services done for us by professionals.

The community chest idea is a good and useful thing to have happen to your town, yet there's one angle to it that hurts good will of a spontaneous kind. I know some geezers who believe that when they have dug up a few dollars a year and received a ticket stub to prove they are donors, it means the end of the business for them. They prefer to assume no further responsibility. You couldn't get them to lug a Christmas basket to a poor family or lift a poor, crippled charity child into a car for a pleasure ride, or wave a finger to gesture good will in any direction—except to clink the cocktail glasses or the tom-and-jerry mugs.

Yet despite that side which deprives a man of the experience of turning good willed on his own hook, the net result to the kids and the other neglected ones by virtue of the modern welfare movement is something to be proud of after all. For in the long run the best kind of professional improvers and supervisors know how to avoid some very awkward errors in passing out good will.

This is partly because some folks who are supposed to get the benefit of all this largess of the heartstrings are poor receivers and go right out and do the naughty things which your streak of good will was aimed to prevent or discourage or make unnecessary.

IF we were as patient as the Creator and as wise as Solomon and as prudent as Paul, we might get through such a disappointing reaction without tarnishing our meager stock of good will. But most of us just "ain't" built to withstand a shock to our vanity and charity. We just lack the same tolerance with a human failure that we accept when some mechanical gadgets bust in our faces.

However, when all's said and done, it's the folks with good will who lived with us in past years who give us the biggest reinforcement to our faith in the basic kindness of man.

I remember about a rather forlorn foreign family who settled in our community on a small rented place. Few visited them or paid much attention to their presence among us, until one winter we had a severe epidemic of fever which swept the countryside and taxed the utmost skill of the doctors. The humble wife and mother in this immigrant family was a practical nurse, maybe a trifle better than the ordinary in that she had served in emergencies with good physicians in her homeland. Although two of her sons were ill, this woman volunteered to go out into the neighborhood through most of that winter, nursing the sick and keeping the families fed whenever the housewives themselves were stricken. Thus she ran a local "Red Cross" relief service of her own and even pressed into service some of the more apt young women she was able to recruit.

My father had a near neighbor, big, handsome, powerful, and genial, who made up many times in kindness for what he surely lacked in education or knowledge of current affairs and big social movements and issues. He couldn't argue about tariffs or the workmen's compensation law or immigration quotas or dissect the platforms of the political parties—all of which were favorite evening topics around our local firesides. Yet whenever we had livestock troubles—like an animal becoming cast or a cow in difficult calving—or when there was a huge stump or knotty tree to fell, or a stone to load on the drag sled, he seemed to appear from nowhere to lend a mighty arm with a booming word of encouragement and a wide, disarming smile. That man was a real shining knight in blue denim armor to father and me, and when he moved away in search of a better landlord and a better farm we at least knew that his new neighbors would profit by our loss.

TO this day and age I often muse about A. J., as we called him. I haven't seen him for thirty years. He's either old and wrinkled or living beyond irksome farm chores and rural dilemmas, where in the latter case he is probably oiling the big hinges of Peter's golden gate or helping the angels build "them shining stairs."

Connecting our hamlet and a larger city sixty miles northward there ran a rusty single track accommodation line railway when I was a kid. Its entire length passed through farming lands, most of them poor and profitless places, so that the routine passenger traffic thereon was made up of people of small means and rather grubby outlook. The saving grace of that lonesome line was the good will of the conductor, who bossed that slow-motion outfit during all of a quarter of a century. His company paid him meagerly and his uniform was always shiny and baggy. But in courtesy to old ladies and to women with infants, to strangers on their first dreary ride, to kids going away from home, to folks in mourning, and to a few who were weak and ailing—in these thoughtful attentions he was unique. To their credit let it be said that every community on the line gave him a royal send-off on his last day's run.

Your community and mine also enjoyed the cheerful dependability of a rural doctor, whose annals invariably included weariness and self-sacrifice, long cold rides and midnight vigils spent in tense battles with disease and infected wounds long before these modern wonder-working drugs were his to command. Here again there have often been public testimonials of appreciation given by two or three generations of folks at whose birthday advent he presided. When they pass out gold medals for good will, I am afraid that the country doctors will be entitled to all of the first edition which is cast.

SAD as some things remain in this "vale of sorrow" and worldly care, one finds countless traces of simple good will on every hand, not only in our own quiet haven but in taking ambitious journeys to other states and other lands beyond the seas.

In a strange street where everyone talks in foreign tongues, it is a bright and happy feeling to have a chance passer-by respond to your inquiry about directions or particular sights, and even to have that kindly stranger run off and find another a block or two away—that other citizen being able to understand you and reply in broken but clear English words.

It is very good indeed to return and find a hearty Irish youth presiding at the touchy customs desk, who tells you to take it easy and not be flustered by red tape and fine type documents, and who just lifts your suitcase lid and says, "It's pretty full all right and it gets worse as you go down, so never mind the routine and get going home." (I surmise, however, that his good will doesn't always mar his judgment or blind him to making strict search where search is advisable.)

Over and beyond our personal remembrances of such treasured incidents of good will as we have partaken ourselves there is a whole literature and tradition which clings to good will and underscores the greatest human lives our world has ever known. These folks of wide renown have earned it, and although most of the better ones are not famous for conquest or victory in battle, it is also true that many an act of good will has brightened and humanized the horrid scenes of strife and siege on land and sea.

IN fact, it is that element of good will and fraternal spirit which creates and sustains comradeship among those of our kindred who spent part of their lives in war-time services.

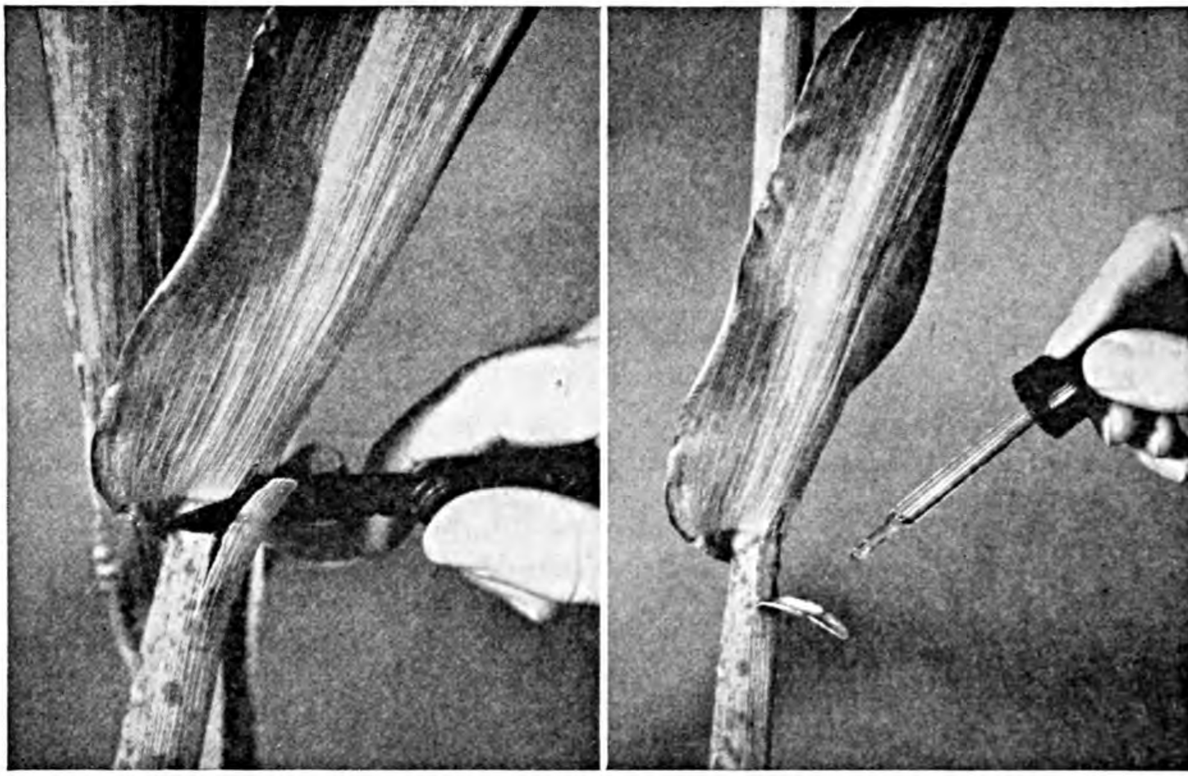
Just as you, too, have your list of local exponents of good will worthy of fond remembrance, I also have a few names to give among scores who might be mentioned as public benefactors against stiff odds and even danger.

We would name Madame Curie of radium fame, Louis Pasteur of bacteria renown, Jane Addams of Chicago's Hull House, General Booth of the Salvation Army, Mahatma Gandhi, soulful thinker, and Walter Reed, who gave his life in conquest of yellow fever.

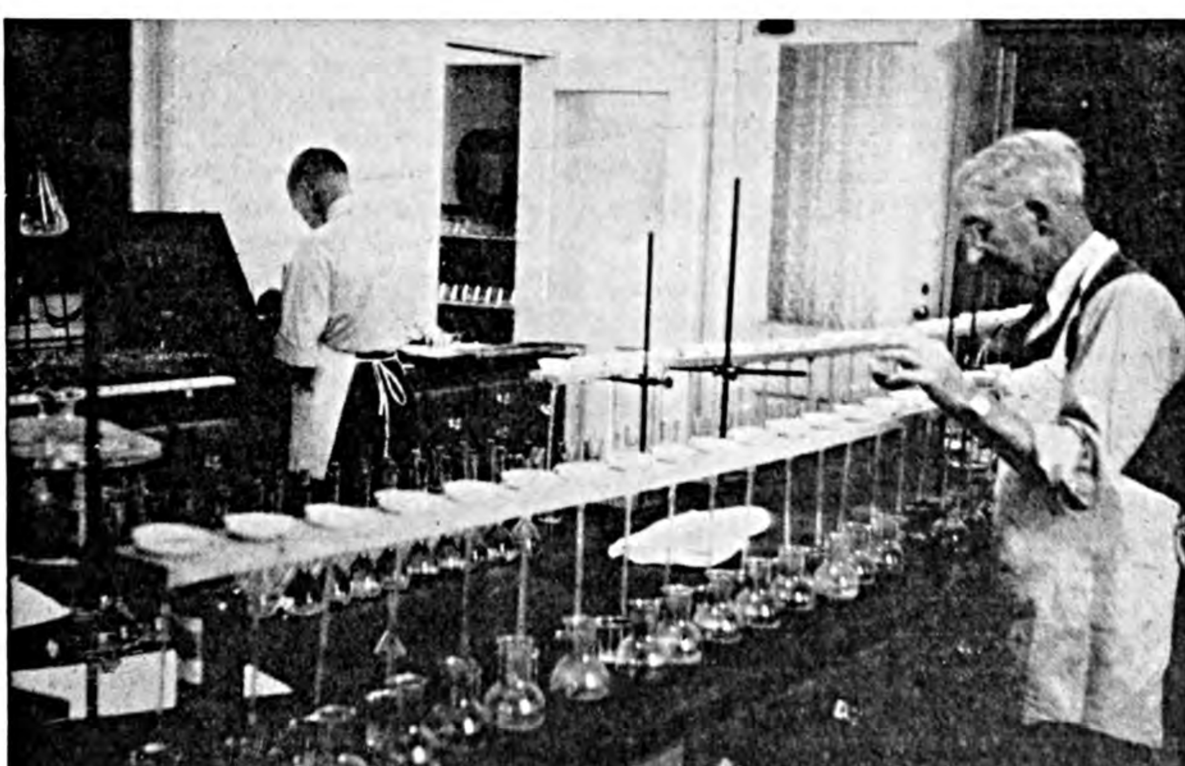
I leave you to fill in your own list to add to these scanty examples. Every day brings evidence of fresh outpourings of good will. You can't miss seeing or hearing them if you stay alert and responsive. But on the other hand, if we stumble along bent over our own intimate troubles and perplexities and never look around or exchange a grin—then the chance of catching someone performing a deed of good will is not so good.

Queer isn't it about good will? To be able to know it when it happens and be thankful it did occur, you have to keep a little assorted stock of it in your own make-up.

Merry Christmas to you and yours along with a very Happy New Year, for the times and the chimes sing Good Will.



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

A Few Whinnies

After-Dinner Speaking—An occupation monopolized by men. Women can't wait that long.

* * *

Three salesmen were sitting in a tavern, having a few rounds of beer.

"I hate to see a woman drink alone," said the liquor salesman.

"I hate to see a woman eat alone," added the grocery salesman.

The mattress salesman remained quiet, like a gentleman.

* * *

"Can I be of any assistance?" asked the sympathetic motorist of a man who was looking unutterable thoughts at a disabled car.

"How is your vocabulary?"

"I'm a minister, sir."

"Drive on."

* * *

"We were happy for more than a year," the tearful wife told the judge, "and then the baby came."

"Boy or girl?" asked his honor.

"Girl—a blonde; she moved in next door."

* * *

Little Bobbie tripped and fell on his face on the sidewalk. An elderly lady rushed over to help him to his feet.

"Now, little boy, you must be brave about this," she purred. "You mustn't cry!"

"Cry, my foot," replied Bobbie. "I'm going to sue the hell out of somebody!"

An old Scotch bachelor received a request from an organization in London to take care of a dozen evacuated children during the blitz. The Scotchman refused on the basis that he hated kids. He was then asked to house six expectant mothers instead. "All right," the Scot replied, "but the gals mustn't expect too much. I am past 70 years."

* * *

The maid was asked if she had hung up any mistletoe this Christmas.

"Not me," she replied. "I got too much pride to advertise for the ordinary courtesies a lady has a right to expect."

* * *

A newly married couple boarded the Golden State Limited for their honeymoon. They were in their berths and the bride about every two minutes would exclaim: "Johnny, I just can't convince myself that we are married." This went on and on for half an hour. Finally a voice from the other end of the car shouted, "Johnny, will you convince her so that we all may go to sleep?"

* * *

When people ignored his "No Swimming" signs, a man posted this sign: "Although Labidesthes Sicculus Abounds in This Water, It Gives No Warning of Its Presence." The swimming stopped.

Labidesthes Sicculus is the scientific name of a small fish usually called silversides.

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)
Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

American Potash Institute
1155 Sixteenth Street
Washington 6, D. C.

Printed in U.S.A.