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Better Crops with PLANT FOOD

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The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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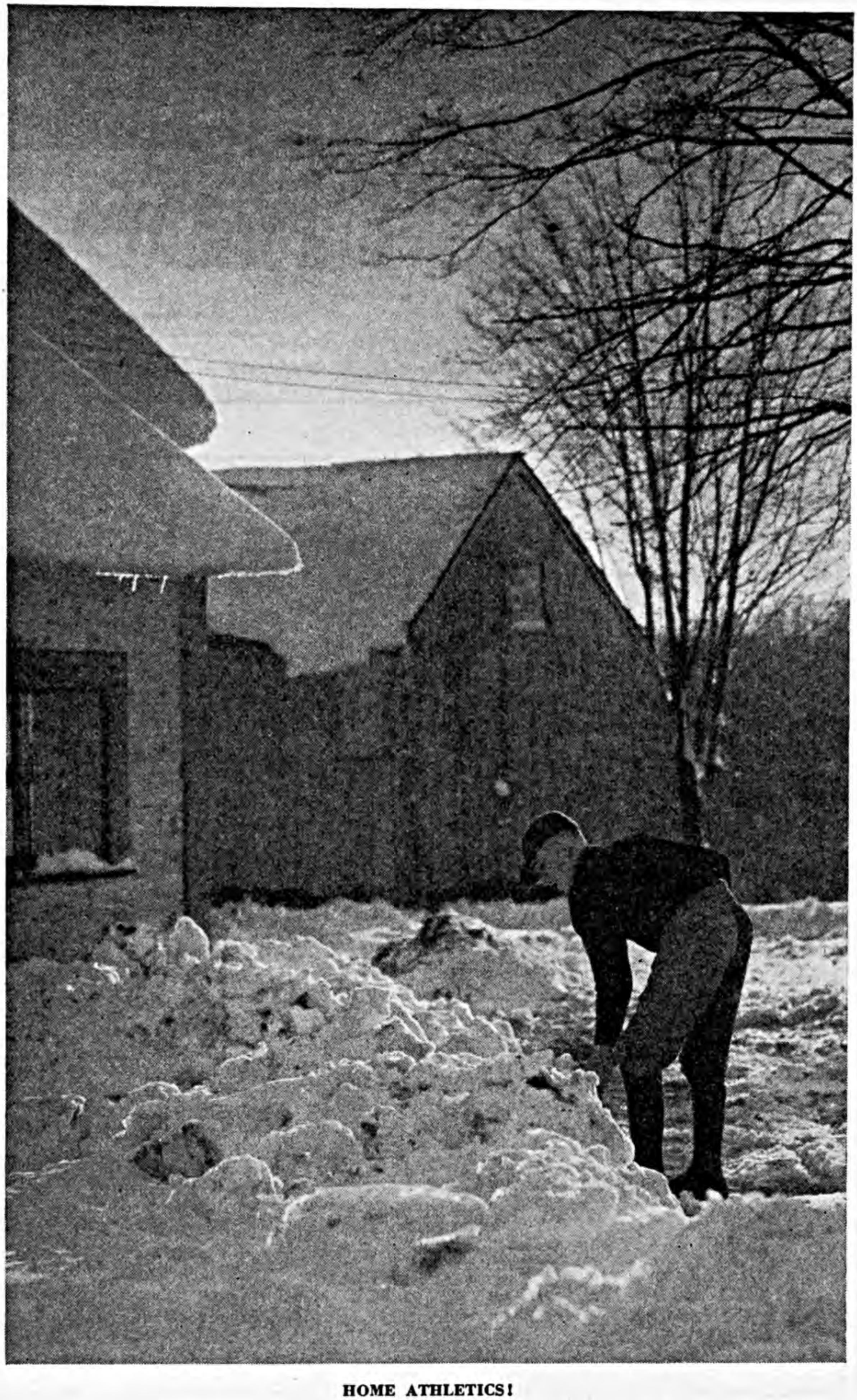

HOME ATHLETICS!

Better Crops with PLANT FOOD

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The Challenge of . . .

TOMORROW

Jeff McDermid

SOME folks have cut out making New Year's Resolutions for Tomorrow, such obvious ones as not to kick the cat or be mean to mother-in-law. Upon diligent research I have found their underlying reason for resolving not to resolve anymore. They believe that the age of individualism is "kaput" and the era of the ego is the worst casualty of the war. Of what avail, they ask, is one guy's wishful thinking?

In plain street corner conversation, their hunch is that the influence of personal idealism and the example of lofty single aspirations no longer count on the score-board. Their attitude is like that of a forlorn prairie pioneer who sees a cyclone cloud forming to the windward and who has neither the power to shift its course nor a convenient storm-cellar in which to seek imperfect shelter. So he says, "I might as well finish this furrow and then be gone with the wind!"

Too much perplexing complexity, too many special privilege pressure groups, and a surplus of smart scientists—that's the answer often given for the cringing state of mind which governs them; although the ones having extreme cases of this mental turbulence mention untrustworthy foreign relations and the alleged callous indifference of our age to crimes of cruelty and viciousness.

To be sure, our holiday season went along on schedule nonetheless, minus a few customary festive things and without numerous friendly faces we were wont to associate always with the spirit of those pleasant reunions. Amid the turmoil of shopping, ministers of grace sensed the need for greater confidence and searched the scriptures for the vitamins required to fill the strange void which victory left in our queasy spiritual stomachs.

Taking up the first and foremost complaint that causes folks to mistrust the future, we have to admit on the face of it that you and I have emerged gradually and almost imperceptibly from a simple community life to a bewildering age of fantastic technical complexity. This same thing was said to me in the early 1900's by a garrulous old uncle (and endorsed by my father). He could span the years from the tallow dip and the ox team to the carbon filament lamp and the automobile, and he could remember when a hoot and a holler was the only mode of distant rural communication. He loved to brag about his former deprivations amid his current comforts, and to allege that we of the modern era would be helpless if thrust back again to the backwoods.

Nevertheless and notwithstanding those pronouncements by my worthy relations, I am not shaken from the belief that the period of my life has developed the most marvels of any 50-odd years in the progress of the cosmos. This is so because of ideas and discoveries made in realms previously assigned to higher nature or to the supernatural; because of imagination, confidence, skill, patience, devotion, and faith—all truly noble attributes which for the most part helped and healed mankind as our race had not been helped and healed in countless centuries before.

What we are so sorely bothered about in these days of dilemma are the motives and the directing forces with which our brilliant science (often trained at public expense) will proceed. Will our wonder-workers go on beyond the horizon to do more new things almost as miraculous, and we trust as gracious, as those done so long ago in Galilee?

WILL economic planning, the handmaiden of practical science, broaden out and blossom forth with a better concept of the good goal than solely one of profit and compound interest? It's all in the adaptation of science, whether its discoveries be of benefit or the reverse. Maybe if we had more real scientists in charge of the counting house, the final fruit would be riper and sounder.

Take our younger generation seeking what seems remote and unattainable—a cozy home for themselves. Surrounded by the greatest array of comfort-catering gadgets and modish designs for healthful living ever blueprinted, they are up against out-of-date financing, unreasonable labor demands and squeezes, and the crazy circumlocutions of the construction industry. Their grand-dads of a simpler time got a roof over their heads by their own efforts or by letting the whole job to one self-reliant contractor, free of pressure rackets and profit-taking subcontractors. Finally when the shelter was done it was a sturdy and strong dwelling, and not a jerry-built contraption worthy only of a place in the prop-room of a theater.

WILL the inexcusable conditions of which the housing situation serves as an example spur our powerful young veterans' alliances to seek common-sense correctives for all post-war privilege and abuse of social obligations? Or will they accept them as necessary evils, not willing to fight on the home front as manfully as they did abroad? Personally I put my bets on reform, although it may seem slow in coming, like some of our other pledges of democracy.

Is the individual put at a discount when such reforms are sought? Must the fact that forces and movements are on such a terrifying scale discourage anybody from "crusading at the cross-roads?" Must we sit back and let the steam roller of the times run over us without a peep? Is the chap who writes the "vox pop" in the newspapers just a voice crying in the desert?

Well, when a fellow has a dream he experiences it alone. Sometimes others have similar dreams, but they come individually anyhow, never in the mass. Almost any new scientific wonder or any germ idea for social or medical betterment happens first to a single mind, like a spark to light the mental darkness. One or two persons grasp such a hunch and give it a test in secret, whisper its possible significance, and try to prove it gradually. You stand by yourself as a renaissance, if you please.

Somehow it seems to me that we can't escape having our hopes pinned on what some individual will imagine or dream, or overlook the individual courage and daring it takes to foster such new ideas until they become accepted in the face of indifference or hostility.

You can test that theory against all the technical marvels which have been developed since 1941, some of them born in the urge to destroy enemies or defend us from them. Not one of them could have materialized without the genius, skill, and imagination of individual workers. You can't hatch such programs by an automatic machine or expect the masses to create them by wishful thinking in concert. However, this concerted desire and mass requirement always give some individual an itch to see what may be done about it.

So the only kind of individual who is out of luck these days is the chap who has no imagination, no training, no skill, and no zest for creating. For those who continue their education, who have faith in the future without fear, and who believe they are put here for something besides consuming and being "guaranteed" everything by a munificent government—for such there is a bigger field for personal achievement than the world has ever known.

And yet this is not all. We must question individual achievement which has cheap, unworthy, and selfish motives. We have a right to expect the best of those who have the privilege of pursuing individual inclinations in a land of liberty. We have every reason to hope that the veterans now enrolled in collegiate courses suited to their desires will make as much use of education as they did of military training to stamp out abuses and set up needful reforms.

I THINK this has been more than splendidly upheld by Col. Charles Lindbergh who in a recent return to the platform insisted upon Christian motives in governing a new world order.

In concluding his talk, Col. Lindbergh said: "We in America already have the most powerful air force, the greatest Navy, and the best equipped Army. We have demonstrated that we can outbuild any other nation. We have the atomic bomb. We are a Christian people. The ideals we profess are high. We have all the necessary elements to lead the world through this period of crisis. But can we combine these elements in our daily policies and lives? Whether our western civilization is facing new heights of human accomplishment or whether it is doomed to extinction depends not so much on technical progress as on the answer we make to this question."

One may sum up the case by saying that decent behavior among the power-wielding nations will come either because they really want to be good or because they are afraid not to be. To follow the first is to act positively,

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A group of agriculturists inspects a field of wild winter peas in Holmes County, Mississippi.

A New Legume for the South
Wild Winter Peas

By A. D. Suttle

Mississippi State College, State College, Mississippi

THE wild winter pea (Lathyrus hirsuta) also known in Louisiana as Singletary pea and in Georgia and Alabama as Caley pea, is one of the annual legumes which matures seed at oat harvesting time. This pea matures seed a little earlier than vetch and is much more prolific, frequently producing 1,000 pounds of seed to the acre. Records show a production of 10,367 pounds of green manure to the acre in Louisiana.

This pea was collected and placed in the plant collection of the Botany Department at Mississippi State College in 1891 by Dr. S. M. Tracy, at that time Director of the Mississippi Experiment Station. It was first noticed as a promising crop by J. N. Lipscomb, then Dean of the School of Agriculture, and the writer in 1926, on that portion of the college farm known as the Maxwell Bottom. The peas produced such an abundance of green foliage with a thin stand that year that we estimated it at above three tons of green material to the acre. Ten years later, 1936, the pea was unusually outstanding in a Johnson grass meadow on a place adjoining the college property. So thick was the pea on this meadow that it created trouble in harvesting the hay. Out of this hay H. W. Bennett, Associate Agronomist of the Mississippi Experiment Station, obtained the seeds he has been using in his research with this crop.

About 1936, the Moss Tie Company,

Columbus, Mississippi, recognized the value of the wild winter pea both as a grazing and as a green manure crop. It is the writer's impression that the Moss Tie Company was the first firm to market this seed.

The purpose of this article is not to maintain that the wild winter pea is a better green manure crop than vetch or Austrian winter peas. Both will out-yield the wild winter pea in tons of green manure from a given acre. Probably the wild winter pea would not have a place in our farming if farmers had a source of cheap seed of vetch and Austrian winter peas. However, with the scarcity of vetch and the high price of Austrian winter pea seed, the wild winter pea occupies an important place as a green manure crop in the Southern states.

The abundance of cheap seed in connection with fair yields of green manure makes the wild pea important as a green manure crop. It rarely, under favorable conditions, yields less than 500 pounds and has been known to produce the stupendous yield of 1,600 pounds of seed to the acre. Vetch, as a rule, will not produce in excess of 300 pounds of seed to the acre. At times Austrian winter peas make a good yield of seed in the South, yet records show that their failures exceed their successes. The wild winter pea, it is apparent, will produce from three to five times as much seed as vetch or Austrian winter peas.

The seed of wild winter peas may be distinguished from the hairy vetch by the black color of the vetch seed which have a smooth surface and are sometimes marbled with brown. The seed of the wild winter pea has a rough seed surface and is brownish gray. The seed of the two plants are about the same size. Austrian winter pea seed are gray mottled with purple and are about four times the size of vetch and wild winter pea seed.

Wild winter peas may be planted for three purposes: (1) green manure crop, (2) seed crop, and (3) grazing crop. Since the plants of the wild winter pea do not attain quite as much growth as vetch, a few more seed should be planted to the acre. Probably 40 pounds of wild winter peas are the most desirable amount of seed

Stacking and threshing from the stack is probably the cheapest and safest way to save wild winter pea seed.

to plant, whereas 30 pounds of vetch and 40 pounds of Austrian winter peas give most nearly a desired stand. When planted for a green manure crop, the simplest and probably the most desirable method is to sow broadcast three rows at a time. This should be followed by a middle breaker in the middle of the row, covering the seeds well and at the same time leaving the land in rows to afford thorough drainage. Sown in this manner, a larger early crop of green manure will be obtained. Thorough drainage enables the plants to grow faster.

When sown for a seed crop, breaking the land and drilling or broadcasting the seed as in the case of oats are desirable. The ground should be well smoothed to enable the combine to do a clean job of harvesting. During exceptionally dry spring seasons, the peas may not make enough growth and it will be necessary to run the blade of the combine close to the ground in order to save all of them.

When sown for grazing, wild winter peas should usually be planted on meadows or pasture sod with only light disking or with no preparation of the seed bed. The peas seem to be relatively palatable and are able to withstand, without injury, a large amount of heavy grazing. The wild winter pea is much better adapted to grazing and furnishes nutrients in a more palatable form than either vetch or Austrian winter peas.

Date of Seeding

The most desirable time for sowing wild winter peas is with the first rains in September. They may be sown with fair results until the first of November. Sowing early for green manuring is more desirable since the wild pea is later than vetch in making its full growth in the spring. Early sowing in the fall increases spring growth to unusual proportions. Early fall sowing more nearly approaches conditions of the pea in its wild state than late fall sowing.

Scarification

Generally speaking, about one-half or two-thirds of the wild winter pea seeds, when harvested, may be termed hard seed. They will not germinate for a rather long period. As a result, the seeds are usually scarified before planting. Having 35 or 40 per cent of hard seed after scarification is not unusual. The seeds come up rather quickly, however, when planted under favorable conditions. Thirty pounds of scarified seed to the acre gave a perfect stand in 1942. If conditions are exceptionally favorable, the greater portion of the hard seed will germinate almost as soon as those which are not hard. Scarifying the seed is generally considered good farm practice. Good stands may be obtained by planting 40 pounds of unscarified seed to the acre, if the facilities for scarification are not available.

Inoculation

Inoculation is just as essential for the wild pea as for vetch, Austrian winter peas, or any other legume, the same inoculating material being used. Inoculation is unnecessary, however, if the land that produces the seed is to be sown again in wild winter peas. Inoculating either vetch, Austrian winter peas, or wild winter peas is unnecessary on most black land farms where the three grow wild on practically the entire area. Certainly, inoculation is cheap insurance against crop failure.

Fertilizing

Few data are available on fertilizing wild winter peas. Obviously phosphorus and potash are the only elements necessary, since the crop receives the greater portion of its nitrogen from the air. A good practice is to apply 200-400 pounds of superphosphate and 50-100 pounds of muriate of potash to the acre before the peas are planted. Yield data from eight field tests obtained in an organized demonstration program con-

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Nitrogen (60 lbs. of ammonium nitrate per acre) applied as a top-dressing in addition to 0-20-20 at 250 lbs. per acre made possible an increase of 41 bushels of oats per acre on the farm of Ivar Karri, Hurley, Wisconsin.

Crop Production Horizons

By C. J. Chapman

Soils Department, College of Agriculture, Madison, Wisconsin

POWERFUL and tremendous forces are at work today and may result in widespread changes in the political as well the social outlook of millions of people in the world of tomorrow. The resources of the whole world were thrown into a gigantic war which on the active battle fronts of Europe, Asia, and the south and east Pacific has destroyed physical and cultural achievements gained throughout generations of human progress.

The aggressor nations have exhausted themselves and drained heavily upon the resources of the rest of the world. Cities and countrysides have been reduced to rubble and waste. But the world is now turning its energies toward peacetime pursuits in the reconstruction of its cities, the rehabilitation of its agriculture, and the re-establishment of law and order. Now the chief concern of hundreds of millions of people is food, clothing, shelter, and a desire for some of the comforts and even luxuries which this modern age of science and invention should and can provide.

It is fortunate that long before we became involved in World War II, this nation had been engaged in a program concerned with the conservation of its great natural resources. Men had been considering very seriously this matter of our national well-being, not so much in terms of the immediate welfare of its citizens, but in terms of their future.

Our Greatest Resource—The Soil

For nearly 30 years I have been traveling the State of Wisconsin and in my extension activities have tried to arouse farmers to an appreciation

The residual effect of 0-20-10 (225 lbs. per acre) applied at the time of seeding, 1944, resulted in a difference of 3,849 lbs. green weight per acre in the growth of clover hay in 1945 on the farm of Duane Thomas, Darlington, Wisconsin, although the soils on this farm had been maintained in a state of average fertility through manure applied every four or five years.

of the seriousness of soil fertility waste. In the early days I was looked upon with pity and disdain by many of my fellow colleagues. But now with the combined results of the findings of our agricultural experiment stations together with the help of county agents, extension workers, and teachers of vocational agriculture in carrying out thousands of demonstrations and experiments we have built up a vast fund of information and evidence that has put aside any doubt as to the seriousness and the need for a program of soil conservation. We have proven without question the value and economy of using commercial fertilizers in Wisconsin. And it is fitting right here that we give recognition to the early and continued efforts and influence of the late Professor A. R. Whitson, former Chairman of the Soils Department of the University of Wisconsin. Professor Whitson for more than 40 years was one of the country's outstanding leaders and educators in the field of soil conservation.

During the past 30 years I have seen many changes in the attitude of the general public toward the use of commercial fertilizers. Programs in Wisconsin along the lines of soil conservation carried out through federal and state agencies are blazing the story of soil fertility in the headlines as well as in farm practice. Tonnage reports for Wisconsin during 1945 indicate the largest use of commercial fertilizers in all history. It is estimated that in 1945 better than 250,000 tons of commercial plant foods were purchased and applied on Wisconsin farms. Thirty years ago (1915), records show that Wisconsin farmers used only 3,000 tons. During the past 10 years the tonnage has increased by leaps and bounds. (A total of 28,414 tons were sold in 1935.)

We have made great strides in our program for liming the soils of the State. In the past 11 years a total of nearly 12 million tons of liming materials have been applied on Wisconsin's acid farm lands. Crop reports this past year show that Wisconsin produced the second largest crop of tame hay in all history. Clover again flourishes on Wisconsin farms. The average yields of grain and corn have increased a good 30 per cent in the past few years. It is true that our increased yields of corn are due in part to the more extensive plantings of hybrids and in the case of oats to the almost complete shift to our new high-yielding, rust- and smut-resistant Vicland variety. Yet the increased tonnage of lime and fertilizers has played an important role in attaining these higher average yields.

And so I do feel that our educational efforts have been fruitful. I am confident that even though our job in Wisconsin is far from finished, with the support that has been given through the help of thousands of agricultural leaders working with us through associated educational agencies, our program will go forward with increased momentum.

This past year in Wisconsin we again conducted a total of more than 400 fertilizer demonstrations. These demonstrations were supervised by some 50 county agricultural agents and in many counties the Smith-Hughes teachers of vocational agriculture assisted with the work. The fertilizer industry through the Middle West Soil Improvement Association and the American Potash Institute furnished most of the commercial fertilizer for these demonstrations on pasture, hay, corn, small grain, and legume seedings. Substantial contributions were made by the Tennessee Valley Authority in supplying phosphate for whole farm demonstrations in 28 Wisconsin counties. The sum total of all combined agencies and effort has given us a record year for demonstrations which show more convincingly than ever that Wisconsin soils will respond profitably to fertilizer treatment.

Evidence revealed in our district and state soil-testing laboratories and backed up by actual field demonstrations points to the need of more potash in addition to phosphate on our Wisconsin soils. For many years we have recognized the need for potash on our sandy and low black bottom soils. But we have been amazed to find that a vast area (some 5,000 square miles) of heavy silt loam soil in north-central Wisconsin (known as Colby or Spencer silt loam) is showing a marked response to potash. Even

Nitrogen fertilizer (ammonium nitrate at 175 lbs. per acre) applied to permanent June grass pasture on the Wells Himsel farm at Paoli, Wisconsin, produced earlier and more abundant grazing and an increase of 3,200 lbs. of green weight per acre.

This photo shows the typical response of timothy to treatment with nitrogen fertilizer. Here on the Wm. Zielke farm at Gliddon, Wisconsin, the yield was increased from 1,500 to 3,750 pounds per acre—not only 2,250 pounds more hay per acre, but a leafier and more palatable feed. Ammonium nitrate was applied as a top-dressing at rate of 200 lbs. per acre on April 12, 1945.

the silt and clay loam soils of southern, western, and eastern Wisconsin have shown a profitable response to potash in better than 60 per cent of the demonstrations conducted this past year.

By far the greatest and most important effect of the use of fertilizers applied to grain at the time of seeding is the influence which this plant food has had, not only on "catches," but on the increases in yields of hay the following year. The average of 138 field demonstrations (see Table 1) carried out during the past 13 years where residual benefits to the hay crop have been measured shows that 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.

And now another new opportunity for increasing the productiveness of our permanent pastures and grassland hay meadows looms up on the horizon.

TABLE 1.—RESIDUAL CARRY-OVER BENEFIT OF HAY CROP (13 YEARS, INCLUDING 1945). SHOWING TOTAL VALUE OF HAY, GRAIN, AND STRAW, AND PROFIT OVER COST OF FERTILIZER (138 PLOTS).

Treatment	Rate per acre	Average yield grain	Value of increase grain & straw[1]	Average yield of hay	Pounds increase hay[2]	Value of inc. grain, straw and hay	Cost of fertilizer	Net profit per acre
0-20-0	200	52.3	$8.95	4749	1400	$19.45	$2.65	$16.80
0-20-10	200	56.0	10.79	5434	2085	26.43	3.75	22.68
Check		41.5		3349				

[1] Oats and barley figured at average value of 65¢ per bushel; straw at $4.00 per ton.
[2] Hay figured at $15.00 per ton.

TABLE 2.—AVERAGE OF 550 GRAIN DEMONSTRATIONS (13 YEARS, INCLUDING 1945) WHERE THE YIELDS OF 0-20-0 AND 0-20-10 OR 0-20-20 ARE COMPARED

Treatment	Average rate per acre	Average yield	Increase yield	Average yield straw	Increase straw	Value of increase grain & straw [1]	Cost of fertilizer	Net profit per acre
0–20–0	200	53.04	10.38	2537	443	$7.63	$2.65	$4.98
0–20–10	200	57.16	14.50	2705	611	10.64	3.75	6.89
Check	....	42.66	....	2094	....	....	....	....

[1] Oats and barley figured at average value of 65¢ per bushel; straw at $4.00 per ton.

The number one limiting element in the growth of pasture grasses is nitrogen. Practically all of our permanent grassland pastures are suffering from a lack of this element. The best proof of this shortage of nitrogen in our permanent pastures can be seen in the spring where those dark green patches of rank growing grass are so much in evidence. These urine spots are good demonstrations of what nitrogen will do to increase the early growth of grasses. There are some five million acres of non-wooded permanent pasture in Wisconsin—a good three million of which would undoubtedly respond profitably to nitrogen fertilization.

Nitrogen Fertilizer for Permanent Pasture Proves Profitable

In the four demonstrations recorded below, the value of nitrogen fertilizer has been measured in terms of milk production. In these demonstrations, uniform pasture fields were divided into equal halves. One half of each was treated with a nitrogen fertilizer. Records were kept of the number of days the cows grazed on each half and also the pounds of milk produced on each area.

Demonstration Number 1

In this demonstration, carried out on the Nick Schmidt farm at Monroe

On the Potter Porter farm at Evansville, Wisconsin, 700 pounds of 8-8-8 applied on the plow-sole plus 125 pounds of 2-12-6 in the hill resulted in an increase of 33.7 bushels of corn per acre. No manure was available for this field. The yield on the plot receiving 2-12-6 only was 36.0 bushels per acre.

in 1933, a 16-acre creek bottom pasture field was selected. Calcium cyanamid (21 per cent nitrogen) was applied at the rate of 300 lbs. per acre on one half of the field (eight acres). The entire herd of 13 Brown Swiss milch cows together with 12 heifers and dry cows were turned into the fertilized portion on May 13. They were subsequently switched back and forth. Each area was grazed to approximately the same level each time. The experiment was terminated on September 1.

The results were as follows:

	Fertilized	*Unfertilized*
Number of pasture days for entire herd	71	38
Pounds of milk produced	35,500	19,000
Value of milk at $1 per cwt.	$355.00	$190.00
Value of pasture for 12 heifers and dry cows	$ 77.50	$ 41.50
Total value of pasture	$432.50	$231.50
Cost of fertilizer	$ 40.80	....
Net returns from pasture	$391.70	$231.50
Difference in favor of fertilized pasture	$160.20	

Demonstration Number 2

A similar demonstration was carried out on the Karl Schumann farm at Mazomanie in 1938. In this case a four-acre tract of uniform creek bottom pasture was divided into two-acre paddocks. One half (two acres) was treated with ammonium sulphate (20 per cent nitrogen) at the rate of 200 lbs. per acre. Five of Mr. Schumann's Holstein cows were turned in on the fertilized area on May 11 and the same five cows were rotated back and forth until June 25 when the experiment was terminated.

The results were as follows:

Number of pasture days for five cows on unfertilized area	14
Number of pasture days for five cows on fertilized area	32
Pounds of milk from the fertilized area	5,611
Pounds of milk from the unfertilized area	2,658
Pounds of milk increase	2,953
Value of milk at $1 per cwt.	$29.53
Cost of 400 lbs. of ammonium sulphate	$ 8.00

Demonstration Number 3

In the spring of 1944, a demonstration was set up on the Wells Himsel farm at Paoli. A 23-acre creek bottom pasture was selected. It was divided in half with an electric fence. Ammonium nitrate (33 per cent nitrogen) was applied at the rate of 175 lbs. per acre. (Actually only eight acres were treated; the balance was wet and boggy.) The entire herd consisting of 14 milch cows, 5 heifers and dry cows, and the bull was turned into the fertilized half on May 20. They were subsequently rotated back and forth from fertilized to unfertilized until August 13 when the experiment was ended. (Results, top page 15.)

Demonstration Number 4

The demonstration described under No. 3, conducted on the Wells Himsel farm at Paoli, was repeated in 1945. Ammonium nitrate was applied on March 31 at 200 pounds per acre on the same half of pasture as in 1944. The entire herd (averaging 17 milch cows, one heifer, one to two dry cows, and the bull) was turned into the fertilized half on May 19. They were rotated back and forth from fertilized to unfertilized as in previous experiments for a period of four months and 26 days. (The experiment was terminated October 10.)

The fertilized half was ready for grazing a good week earlier than the

The results of demonstration No. 3:

Number of pasture days for entire herd on fertilized area	56
Number of pasture days for entire herd on unfertilized area	30
Pounds of milk from the fertilized half	18,934
Pounds of milk from the unfertilized half	10,269
Pounds of milk increase	8,665
Value of increase at $3.15 per cwt.	$272.94
Value of pasture for heifers, dry cows and bull (26 days)	$ 12.00
Total value of increased production due to fertilizer	$284.94
Cost of fertilizer	$ 36.00

unfertilized, and for the period May 19 to mid-July there was a tremendous difference in the amount of grass on the fertilized portion. One noticeable observation made during the July and August period was the great difference in weed infestation. The unfertilized portion became badly infested with White Top daisy. There were very few weeds in the fertilized half, due apparently to the early vigorous and rank growth of grass. There was a noticeable difference during the entire summer in the thickness of the turf—the fertilized half produced a matted sod whereas the unfertilized half was always thin and sparse.

Except for a period of 14 days (September 4 to 18) this 23-acre pasture furnished practically all of the feed for the whole herd (21 head) for the entire summer. (During the period September 4 to 18 the herd had access to a stubble field of new seeding clover as a supplement to the feed furnished from the fertilized half. During this 14-day period one-half of the milk production was credited to the extra feed furnished from the field of new seeding clover.) (Results, bottom of page.)

The results of the above four demonstrations indicate quite conclusively that nitrogen fertilizer can be used with profit on June grass permanent pasture which supports a good turf and where the water-holding capacity is good.

It must be pointed out, however, that the continuous use, year after year, of straight nitrogen fertilizer will eventually result in the depletion of the available reserves of lime, phosphate, and potash in the soil. It is therefore recommended that the mineral reserves of the soil be maintained through the application of lime, phosphate, and potash fertilizers. Larger increases from the use of nitrogen fertilizers can be expected on land that has been so treated.

There is still another place on many Wisconsin farms where nitrogen fertilizer may be used with profit. And

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Results of the 1945 demonstration:

Number of pasture days for entire herd on fertilized area	96
Number of pasture days for entire herd on unfertilized area	50
Pounds of milk produced while on fertilized half	31,479
Pounds of milk credited to new seeding clover (14 days) (½ of total production for period September 4–18)	1,580
Total net pounds of milk credited to fertilized pasture	29,899
Total pounds of milk produced while on unfertilized pasture	16,678
Pounds of milk increase resulting from fertilizer	13,221
Value of milk at $3.25 per cwt. credited to fertilizer treatment	$429.68
Value of pasture for heifers, dry cows, and bull (46 days)	$ 15.00
Total value of increased production due to fertilizer	$444.68
Cost of ammonium nitrate used on fertilized half	$ 48.00

The Fertilizer Rate Problem

By R. E. Stephenson

Soils Department, Agricultural Experiment Station, Corvallis, Oregon

A FARMER reported 100 pounds of sulfate of ammonia used on onions; another reported 100 pounds of sodium nitrate used on mint. In neither case was there any appreciable response, and crop growth was entirely unsatisfactory—so much so that assistance was sought to diagnose the trouble and explain the unsatisfactory growth and harvest.

In both cases, whatever if anything else may have been wrong, the fertilizer program was inadequate. In both cases a complete fertilizer should have been used, and a sulfur carrier should have been included for the particular area. Considering nitrogen alone, the 20 pounds supplied the onions could not contribute a very great increase in growth. A 300-bushel yield would have 40 pounds of nitrogen in the bulbs and at least that much in the tops. Crops seldom recover more than 75 per cent of the nitrogen supplied in the fertilizer, and a 50 per cent recovery is reasonable. A 10- to 15-pound nitrogen recovery where 80 or more is needed could not be expected to cause much increase in yield. The mint crop was still more inadequately fertilized.

These are isolated cases but are typical of much fertilizer practice. The reason probably is lack of knowledge of plant requirements and perhaps partly lack of well-established faith in commercial fertilizers. In some cases, no doubt, disappointing experiences may have been to blame—at least there was not a full understanding of the needs of a growing crop or the means of meeting those needs.

In fertilizer studies with cover crops it was found that 100 pounds of nitrogen in the fertilizer (not 100 pounds of fertilizer) when broadcast on the surface in early spring (February) gave excellent results. Use of 50 pounds of nitrogen usually gave appreciable increases, but 25 pounds of nitrogen could seldom be detected either in the appearance of the cover crop or in the weighed amount of growth. A farmer using the light rate probably would have considered the fertilizer of no value, as was true because of its inadequacy. The farmer who used 100 pounds of nitrogen would have been well pleased with the results.

For Crop Increases

Crop increases cannot come from nothing. As one observer stated, to produce a big increase from so little fertilizer is an impossibility that would be quickly recognized with a little study of what takes place in plant growth where fertilizers are used. In the first place, the crop, the bacteria and fungi of the soil, and the soil itself compete for nutrients that are present or added as fertilizer. In the case of phosphates, soil fixation may commonly prevent two-thirds or three-fourths of the applied phosphorus from contributing to plant growth. In the use of fertilizer, this fact must be taken into consideration. A 10-ton tomato crop needs about 35 pounds of phosphoric acid for growth. But if the soil gets 105 pounds and the grower expects to add 10 tons to his yield with fertilizer, there would need to be at least 140 pounds of phosphoric acid applied per acre. This is equivalent to 700 pounds of 20 per cent superphosphate.

Nitrogen is the most evanescent element applied to the soil. It leaches readily and is likely to be lost in the drainage. Gaseous forms of nitrogen develop not only in the manure heap but in the soil, and losses may occur in this manner. A carbonaceous residue such as straw in the soil results in a large utilization of nitrogen by bacteria and fungi that rot the straw. There is a good measure of uncertainty, therefore, as to what may happen when nitrogen fertilizer is used. A 10-ton tomato crop uses about 100 pounds of nitrogen, the amount supplied by 500 pounds of sulfate of ammonia. But if crop recovery is excellent and such a yield impossible, it may be necessary to supply more than 700 pounds of sulfate of ammonia to the soil to meet the crop needs for adding 10 tons to the yield. Results will probably be better if the application is broken up and a side-dressing or two is made at appropriate times. There would then be less chance for loss, and more of the nitrogen would go to the tomatoes at critical times in the growth period of the crop.

In the case of potash, the story is somewhat the same. Leaching losses are not usually high, but there is considerable fixation by the soil. At least a part of that fixed by the soil may ultimately become available to crops, but the immediate crop cannot get it. There is the necessity, therefore, to provide more than the amount that is equivalent to the demands of the crop increase that is expected. The same principle applies to all elements which crops need and which must be supplied in the fertilizer that is used.

For Greatest Benefit

An important part of the problem in the use of fertilizers is to use them in such a way that the crop can receive the greatest benefit. A study of methods and time of application has been very helpful in increasing the returns from fertilizers. Such things as keeping the fertilizer off the plants or seed are now pretty well understood. Recent studies have brought out certain advantages of deep application, often designated as "plow-sole" application. By this method, the fertilizer is concentrated in rills in the bottom of 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.

The most approved methods of fertilizer application make it possible to use heavy rates safely, whereas the same rates carelessly used might cause more damage than good. One grower is reported to have unwittingly mixed the soil and a large amount of fertilizer. He then set his tomatoes in the fertilized soil. Fortunately the mistake was discovered, but the tomatoes in the much-fertilized soil had to be reset. The same fertilizer a few inches away from the plant or on the plow sole probably would have worked well. I have seen excellent beans grown in basement subsoil where liberal fertilizers were applied on the plow sole. Liberal fertilizing also demands an adequate moisture supply if the fertilizer is to be most effective. However, drouth damages are minimized by adequate fertilizing.

Much of the drouth damage is due indirectly to lack of available nitrogen. Most of the organic matter is in the topsoil. Nitrates are produced by breaking down organic matter. Therefore, soils in dry weather are devoid of nitrates because nitrification cannot take place in dry soil. Moisture is necessary for the bacteria which form nitrates. That is why nitrogen fertilizer placed deep enough to be in moist soil is effective in partially overcoming drouth. Or the lawn fertilized in early spring before the drouth comes goes through dry weather better because some reserve of nitrogen has been stored in the root system of the grass and possibly in the deep soil to carry the grass through the dry period.

There are two critically important

times in the growth period of the plant. These are when growth starts and again at fruiting time. Booster solutions used on plants that are reset have been helpful in overcoming the shock of resetting. A light application of fertilizer in the row near the plants for seeded crops has proved helpful in giving the crop a good start. Side-dressings used later in the growth period, particularly just before fruiting, contribute to an improved harvest. At no time in the growth period, however, should plants be allowed to suffer because of lack of available nutrients, or both the quality and quantity of crop produced may be disappointing.

It is important to provide by complete fertilization that there be no nutrient deficiency, especially when high value crops are produced. Nitrogen alone may produce an increase, but the increase may be limited because there is not enough available phosphorus, potassium, sulfur, or some other element to support the maximum possible increase. An additional $5 an acre to include potash in the fertilizer program when a $500-per-acre crop is produced is the cheapest insurance against the reduced yields which might result from potash deficiency.

For Most Economy

The economic factor can never be overlooked in deciding upon fertilizer rates. A crop of corn would seldom be worth more than $100 an acre, even with high yields and high prices. A crop of filberts or walnuts, however, may bring more than $500, and a crop of cherries may bring more than $800. Other crops may bring even higher returns. On these crops any amount or kind of fertilizer necessary to get results can be used. Some orchardists in citrus areas have spent $100 an acre for fertilizer. The same expenditure on corn or wheat might be twice the total value of the crop. A fertilizer trial on filberts showed enough increase that the returns from one year would pay the cost of adequate fertilization for several years to come. An increase sufficient to return a profit for one year is acceptable to the farmer.

How much fertilizer to use then must be decided after considering many factors. Present yields are usually known within certain limitations. A 50-per-cent increase from adequate fertilization is a reasonable expectation. Doubling the yield is not impossible. We have more than quadrupled cover crop yields with fertilizers used in orchards. We have under favorable conditions increased the yields of nuts and fruits by 50 per cent.

The element of time must be given due consideration in planning the fertilizer program. Some crops are harvested six weeks after planting, and some may require more than six months. Orchards may not begin to bear for six years and may still be in production at 60 years. On early vegetables, fertilizer response is immediate if at all. On an orchard that is run down, a minimum of three to five years may be required to build enough vitality into the tree to show a response at harvest time. It is a very different problem then to fertilize a plant that grows from a tiny seedling to harvest in six weeks and fertilizing a stunted and starved tree which already has made a relatively enormous but inadequately nourished growth. These factors are particularly important influences that govern expected fertilizer responses.

In deciding on fertilizer rates, two major factors must be kept in mind. How many bushels, pounds, or tons are a reasonable expectation to add to the present average yield of crops? Then, after making due allowance for soil fixation and various other factors that affect crop yields so far as they can be anticipated, enough of the various known deficient elements with some margin of safety to produce the hypothetical crop increase that appears reasonable should be provided. Seldom perhaps will full expectations be realized, but the method is less haphazard

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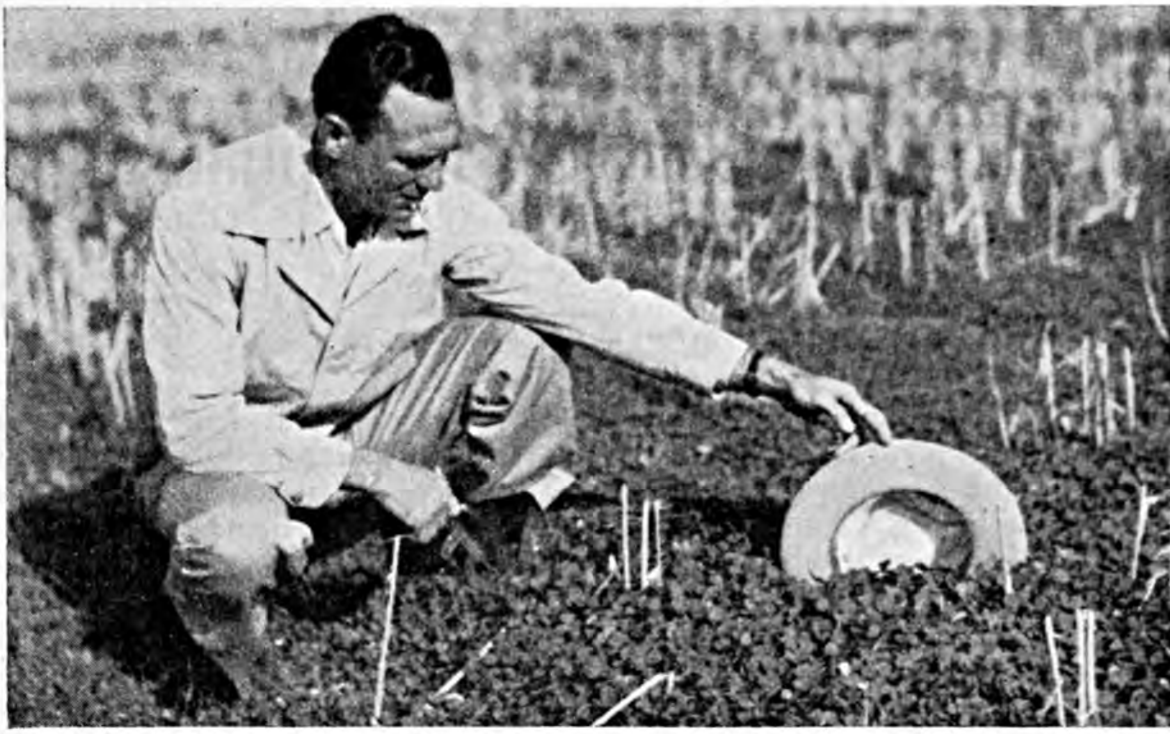

This white clover field on the J. E. Bertinot and Sons farm near Opelousas, La., over-seeded on rice stubble without any land preparation, received 250 lbs. of 20 per cent superphosphate and 10 lbs. of seed per acre in November 1944. The picture was taken March 9, 1945.

The Use of Clover in Rotation On Rice Land in Louisiana

By T. C. Beasley

Soil Conservation Service, Ruston, Louisiana

USED in the crop rotation to improve the soil and increase rice yields, white clover has also more than paid its own way in the production of seed, pasture, and hay on the J. E. Bertinot & Sons farm, six miles northwest of Opelousas, Louisiana, which is cooperating with the Grand Coteau Soil Conservation District.

That is the report of C. P. Dugal, manager of the farm. He points to the production in 1945 of over $11,000 in seed and hay from white clover. In addition, he said, the calf crop last spring was the best in the history of the farm. This was following the grazing of 50 acres of white clover, which had been seeded in 1944, together with the regular rice pasture and light winter feeding.

Use of the crop rotation is part of the conservation plan which Mr. Dugal worked out with the aid of Soil Conservation Service technicians assigned to the soil conservation district. Extension representatives helped establish the white clover. The whole Bertinot farm is irrigated but the drainage system is not adequate. This can not be corrected, however, until the main drainage canal—a community program—is completed.

The farm is in the extreme northeastern part of the Coast Prairie area. The land is almost level. Its soil—

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The Sources of Potash for Flue-Cured Tobacco

By J. A. Stinson

Dominion Experimental Substation, Delhi, Ontario

THAT muriate of potash may be used to supply a larger part of the potash in flue-cured tobacco fertilizers for Ontario than was hitherto believed advisable has been strongly indicated in tests carried out over the past 12 years at the Dominion Experimental Substation at Delhi, Ontario.

The earlier experimental work relating to this subject was designed to compare the commercial grading and yield of leaf where muriate, sulphate, and different portions thereof were used as sources of potash in the fertilizer for this crop. More recent work dealt with time of application of muriate of potash in relation to its effect on the crop. In these tests the behavior of chlorine and potassium in the soil and the influence of potash source on the burning quality of leaf received attention.

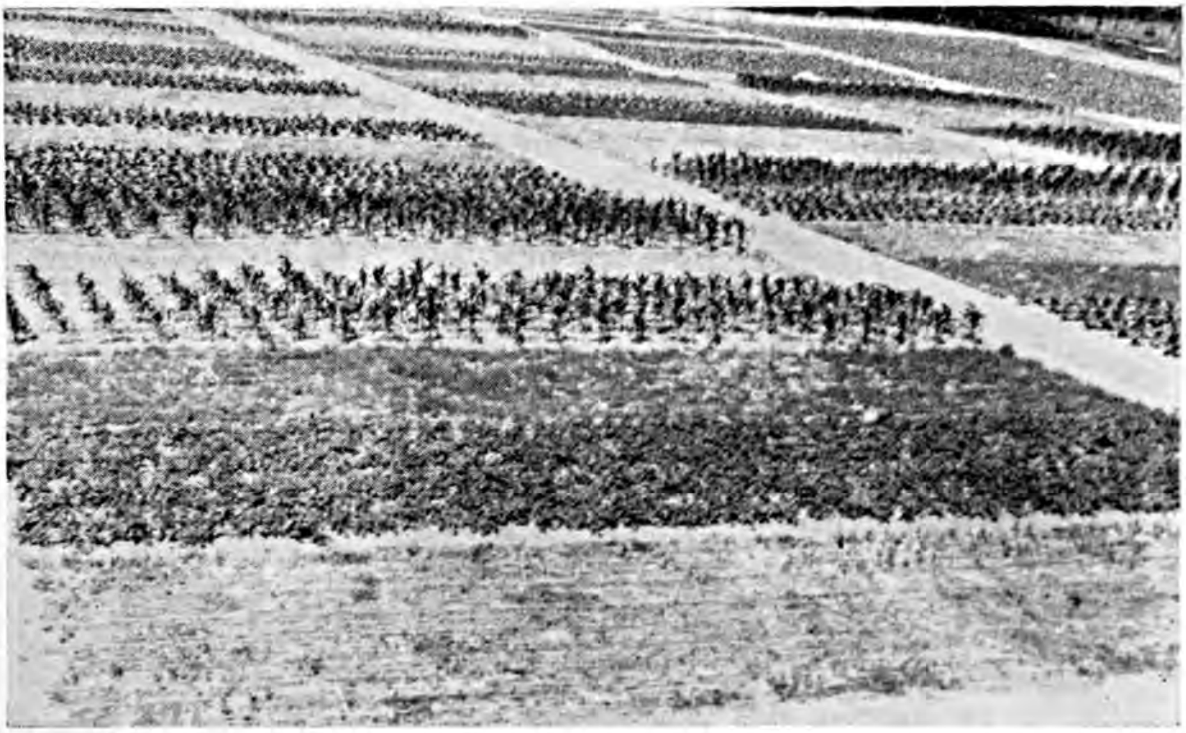
The fertilizer plots were laid out on uniform areas of Fox Sand which were cropped in two-year rye-tobacco rotations. The pH of this soil was 6.0. Quadruplicate plots, 1/32 acre in size were used. The standard fertilizer treatment consisted of 2-10-8 used at a rate equivalent to 1,000 pounds of commercial mixture per acre. This fertilizer was mixed and applied in the rows about a week before setting the seedlings. All other cultural operations were similar to those employed in handling a commercial crop with the exception that as the leaf matured in these plots it was primed and tagged with the plot numbers so that it could be identified throughout curing, grading, and weighing. Leaf from each plot was graded in accordance with the usual practice by employees of a commercial leaf processor. Grade indexes were calculated on the basis of yield of the different grades and the relative prices of these grades when sold to manufacturers.

The average results summarized in Table 1 for the six-year period 1933 to 1938 indicate an interesting relationship between source of potash and the leaf produced.

The results shown in this table would indicate that the yield of leaf was increased by replacing the sulphate

TABLE 1.—SIX-YEAR AVERAGE FOR FLUE-CURED TOBACCO WITH DIFFERENT SOURCES OF POTASH (1933-1938)

Treatment	Sources of potash	Grade index ¢	Yield per acre lbs.	Crop index $
A	Muriate of potash	27.1	1322	359
B	⅔ potash-muriate ⅓ potash-sulphate	27.4	1325	363
C	⅓ potash-muriate ⅔ potash-sulphate	27.9	1279	357
D	Sulphate of potash	27.0	1263	341



Crop rotation studies for flue-cured tobacco are an important part of the work at the Dominion Experimental Substation at Delhi, Ontario.

source with muriate up to two-thirds of the total. A slightly larger portion of the leaf fell into the higher priced grades where two sources of potash were used. In this test the presence of the higher rates of muriate of potash was accompanied by a small but significant increase in the percentage of the sponged-leaf grades. This factor was responsible for lowering the grade indexes for these treatments. As the presence of high chlorine in the leaf is known to cause an increase in the amount of starch and water in the leaf cells, this tendency toward sponging when cured in a kiln along with leaf receiving less chlorine is not surprising. It may be presumed that sponging while curing could have been effectively reduced in a kiln of leaf with uniform fertilization. Under ideal conditions for maturing, delayed ripening was sometimes noticeable where all of the potash was furnished in muriate form. Usually, however, differences in maturity were not in evidence and over the period of this test such differences failed to reach significant proportions.

With the impending shortage of sulphate of potash occasioned by the outbreak of war in 1939, the question of source of potash for flue-cured tobacco in Ontario took on a new significance and prompted further investigation of the subject. In this connection it was believed that practical use could be made of whatever difference might exist in the rate at which chlorine and potassium would disappear from the soil. Accordingly, a series of treatments was planned in which muriate of potash broadcast in the fall and one month before transplanting, respectively, could be compared with other treatments using different sources of potash in fertilizer applied in the usual way. During the spring of 1940 precipitation was unusually heavy and the results that year suggested that the potash was less efficient when applied in the fall and early spring. Accordingly, beginning in the spring of 1941 the early spring application was raised from 80 lbs. of K_2O per acre to 120 lbs. per acre and subsequent fall applications of muriate were made at the rate of 160 lbs. of K_2O per acre.

For the purpose of studying any possible relationship between lime con-

TABLE 2.—AVERAGE RESULTS WITH DIFFERENT SOURCES AND TIMES OF APPLYING POTASH FOR FLUE-CURED TOBACCO IN 1940

Treatment	Source of potash & time of application (80 lbs. K_2O per acre)	High-limed soil			Unlimed soil		
		Grade index ¢	Yield per acre lbs.	Crop index $	Grade index ¢	Yield per acre lbs.	Crop index $
A	Muriate of potash	22.7	1235	281	22.1	1077	222
B	¼ potash–muriate ¾ potash–sulphate	20.9	1255	263	21.7	1001	217
C	Sulphate of potash	19.7	1237	244	21.9	975	213
D	Muriate of potash one month before transplanting	21.4	1187	253	21.7	967	210
E	Muriate of potash previous fall	19.5	1158	225	20.5	917	188

tent of the soil and effect of potash source on the leaf, the plots in this test were laid out on limed and unlimed soil, respectively, in the fall of 1939. The limed area was in the course of preparation for black root-rot studies and had received four tons of ground limestone and 10 tons of barnyard manure per acre in 1939. This area had produced a crop of tobacco in 1939. Although it was planned to repeat this test again the following year on the same soil, black root-rot had become by that time a dominant factor in limiting growth and this phase of the test had to be discontinued at harvest time. Tobacco followed rye on the unlimed area and each succeeding year this test was carried out in a two-year rye-tobacco rotation. The technique employed was similar to that described in connection with the previous tests.

The results shown in Table 2 might indicate that on the limed area there was a slight improvement in grade index following the application of muriate of potash. The lower grade after the fall application compared with that following the application broadcast in early spring would also suggest a favorable response to chlorine under these conditions. While no such response is evident in the results on the unlimed soil that year, the presence of appreciable leaching or fixation following applications of muriate of pot-

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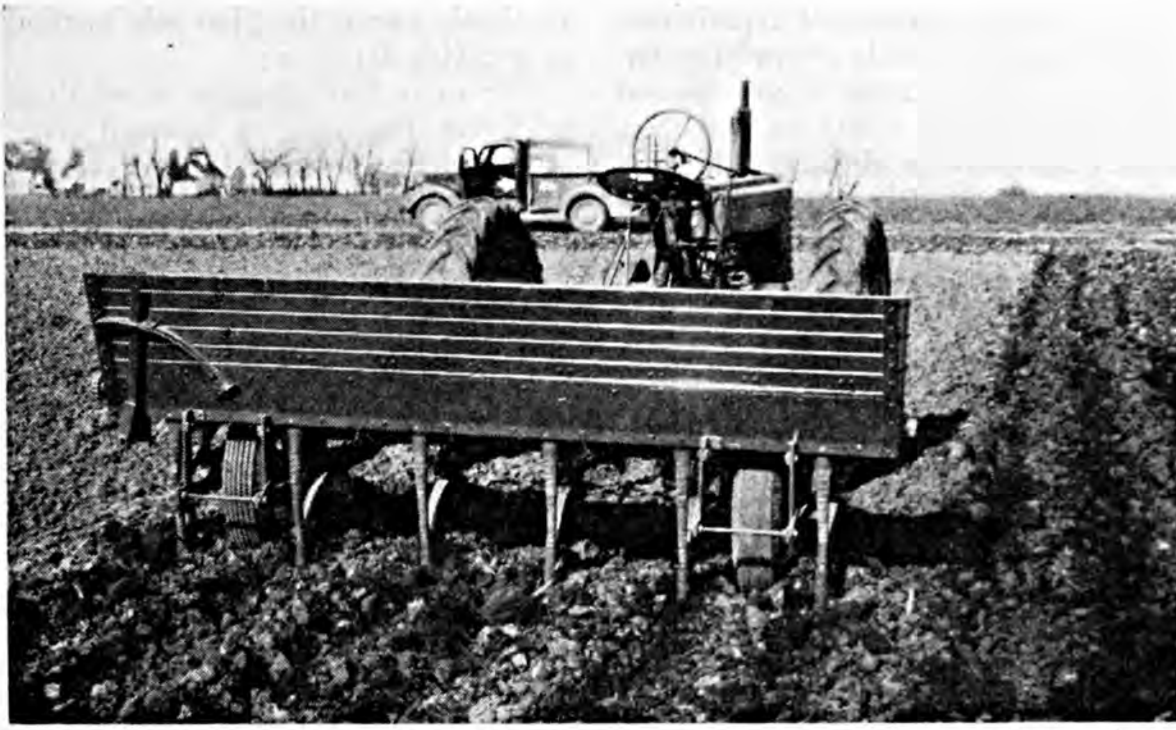
TABLE 3.—AVERAGE RESULTS WITH DIFFERENT SOURCES AND TIMES OF APPLYING POTASH FOR FLUE-CURED TOBACCO IN 1941

Treatment	Source of potash & time of application (80 lbs. K_2O per acre)	Grade index ¢	Yield per acre lbs.	Crop index $
A	Muriate of potash	23.9	1442	345
B	¼ potash–muriate ¾ potash–sulphate	23.5	1445	357
C	Sulphate of potash	23.1	1494	345
D	Muriate of potash (120 lbs. K_2O per acre) one month before transplanting	23.4	1474	345
E	Muriate of potash previous fall	24.2	1465	355



The Thorp deep fertilizing machine in operation. Tubes carry the fertilizer from the large box, capable of holding 500 lbs. of fertilizer, to the base of the field cultivator shovels. The shovels can be regulated to a depth of six inches.

A New Machine for Deep Fertilization

*By E. W. Nordlinger**

Chicago, Illinois

A MACHINE capable of placing fertilizers at plow-sole depth and covering as high as 30 acres a day has been developed by a Central Illinois grower. Fertilizer placed at root depth in the soil or in the bottom of the plow furrow has been gaining advocates at a rapid pace. But growers have been hesitant to use this placement fully because of the present slow method of application.

Claude W. Thorp of Clinton, Illinois, was not completely sold on deep fertilization until this past season. He and his son, Carl, had heard many agricultural research men advocate placing fertilizer at root depth in the soil. The Thorps' main crop is suitable strains of hybrid seed corn for the Central Illinois region. Fertilizer is important to them and they faced this problem squarely—are we getting the most for the money and time spent?

In 1944, they tried out the much publicized plow-sole method. Fertilizers placed in the upper few inches of the soil are fine to start the plants off; but when the roots start going down as the plant becomes bigger, there must be plant food available down there to continue maximum growth.

* The author was formerly associated with the Purdue Agricultural Experiment Station, working with Drs. George Scarseth and J. D. Hartman on fertilizing problems. At present he is Crops Editor for the Food Packer magazine.

The Thorps ran several experiments using various methods of applying fertilizers. Their accurate records showed a decided gain in yields for the deep-placed fertilizer, producing as high as 30 per cent more sound corn with fuller ears. One plot yielded a net return of $11.27 per acre over row fertilization. Plow-sole fertilizing meant more profits for the time and energy spent.

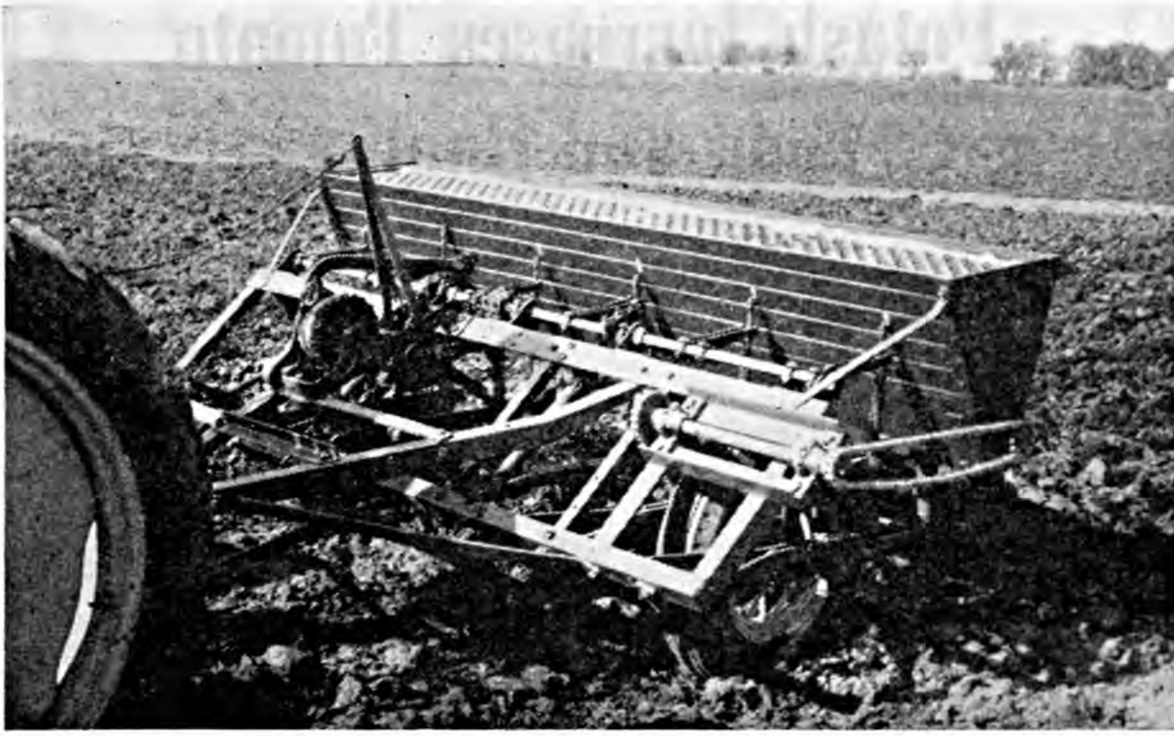
Then arose their biggest problem—how to get the fertilizer deep into the ground. Carl Thorp was most interested for he was just as irritated as the rest of the farmers with the present inconvenient methods which consist of a fertilizer box attached above the breaking plow. Since most of the weight of the box and its contents is on the plow, it must be made small. It holds 50 pounds although Carl enlarged his box to hold 100 pounds. But it still was inconvenient. Carl found 50 pounds went only one plow row. Then he would have to dismount and fill up the box again. That added up to plenty of waste motions. Often he found the weight of the fertilizer in the box influencing the plow depth. These and other reasons have prevented the wholesale use of the plow-sole method of applying fertilizers.

The more Carl thought about these problems, the more he realized some of the difficulties could be overcome. Last winter he attended the National Fertilizer meeting at Purdue University. Many prominent soils men were in attendance. When discussion lead to plow-sole fertilizing, Carl spoke up to inquire if some satisfactory machine had been developed to make this method easier to use. Even such advocates of the method as Drs. Scarseth of Purdue and Black of Iowa could not help Carl. However, R. H. Wileman of the Purdue Agricultural Engineering staff had been working on such a machine.

Later Carl had a personal conversation with Mr. Wileman and some surprising results came of it. Wileman had helped develop the initial fertilizer box attached to the plow. He, too, realized its limitations. Carl told him about a commercial fertilizer spreader he had built the previous year.

Back to Clinton went Carl with several good ideas for devoting his spare time to making a suitable deep-fertili-

The present method of applying fertilizers deep in the soil is by this attachment over the plow. Growers have found many disadvantages to this method. Carl Thorp solved many of these disadvantages by developing a new machine.



This side view of the Thorp machine shows the supports to hold the fertilizer container. The chain belts take the power from the ground wheels to run the reel within the container.

zing machine. A field cultivator was in his barn. He began to vision its curved shovels going down around six inches and placing the fertilizer there. The cultivator was nine feet wide, and with fertilizer being placed at each of the rear six shovels, it would cover plenty of ground, apply plenty of fertilizer, and save a lot of time. And that is exactly what it has done.

After a season's use this machine has proven very satisfactory. It can be easily assembled by any competent machinist, for it is just a container, similar to a grain box on a wheat drill, built on a field cultivator.

However, Carl has added many interesting devices that make this box different from any on the market. The box holds 500-800 pounds of plant food. So that big lumps will not hinder operation, a heavy iron screen (1¼-inch mesh) is on top of the box. A reel runs on the lower length of the box and is placed ⅛ inch from the bottom. Thus all small lumps of fertilizer are crushed before running in the tubes. This reel is run off the ground wheels of the cultivator with chain belts. Another unique feature is a special steel baffle plate directly above the reel. This takes the weight off the reel and provides smoother running as well as better crushing operations. Every farmer knows the benefits of such a baffle plate. It is hinged and runs the entire length of the box.

Carl found that his original fertilizer spreader, which was welded, was hard to dissemble for repairs, and so he used bolts on his latest machine. The bottom of the box is made of 4-inch channel iron with openings every 18 inches. The adjuster that regulates the slide is located on the back of the box at the left. It is suitable for applying as low as 300 pounds to the acre and as high as a ton per acre.

The fertilizer leaves the box through conventional tubes which run to a special heel on the cultivator shovel. At this spot Carl is not entirely satisfied with his "brain child." Fertilizer draws moisture out of the soil. Thus the fertilizer cakes around the lower opening of the heel, preventing free flowing. This is characteristic of all fertilizers. However, he believes that by using a broader shovel and a larger heel, the opening will not clog so often. He is incorporating this idea in a ma-

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Potash Increases Tomato Yield and Quality

By George R. Cobb

Salisbury, Maryland

FACED with the fact that increased yields and improved quality were necessary lest the tomato industry move to other states, County Agent Russell Wilson of Kent County, Delaware, and Dr. W. J. Dufendach and F. A. Schaedel, managers of Libby, McNeil and Libby branches at Houston and Wyoming, Delaware, decided that heroic measures were in order to save the tomato industry for the farmers of the State.

At a conference with officials of the Experiment Station it was recalled that in 1909 experiments with fertilizers on tomatoes were started and carried on for four years. Based on this work it was suggested that potash might be one of the limiting factors in tomato production in the State. The following table taken from Bulletin No. 101, written by C. A. McCue and W. C. Pelton in 1913, summarizes the four years' work:

	Yield in pounds	Per cent of ripe fruit
Average of four checks	10,979	78.4
600 pounds of a 4–8–10	17,339	88.[illegible]
600 pounds of a 4–8–10 plus 20 tons of manure	23,279	81.8
250 pounds of superphosphate plus 120 pounds of muriate of potash	17,887	84.8
250 pounds of superphosphate	13,342	80.2
1,200 pounds of a 4–8–10	26,886	88.7
120 pounds of muriate of potash	15,248	85.0

It will be noted from the above table that 120 pounds of muriate of potash per acre increased yields nearly 5,000 pounds over the checks whereas 250 pounds of superphosphate showed but slightly more than a 2,000-pound increase, thus indicating that potash might be more of a limiting factor than phosphorus. The potash increased the percentage of fruits that ripened in addition to increasing the yield.

It was decided that a group of growers would be selected by the managers of the plants together with their fieldmen and County Agent Wilson and that these farmers would be given 200 pounds of muriate of potash to be applied as a side-dressing after the last cultivation. This 200-pound application was to be in addition to their regular fertilizer treatment.

That this decision and its results were satisfactory is confirmed in the Annual Report of the Delaware Agricultural Extension Service for 1940 in which on page 7 is stated: "1940 saw the continuance of costs of production records and fertilization tests on tomatoes in Kent County. Twenty-five tomato growers maintained cost account records. Seventeen of these same tomato growers demonstrated that the use of 200 pounds of muriate of potash, in addition to regular fertilizers, increased the quality of the crop and boosted tomato production two tons per acre over the average of plots to which potash was not applied."

The growers to whom the potash was given were selected solely on the basis that they were reliable and might be counted on to report yields from the plots under demonstration. No account was taken of their ability as growers, size of farm, rotation of crops, fertility of soil, fertilizer practices, or location of farm. By selecting growers in this manner it was thought that a typical cross-section of the area would be obtained. Each grower fertilized his acreage as he wished, but in addi-

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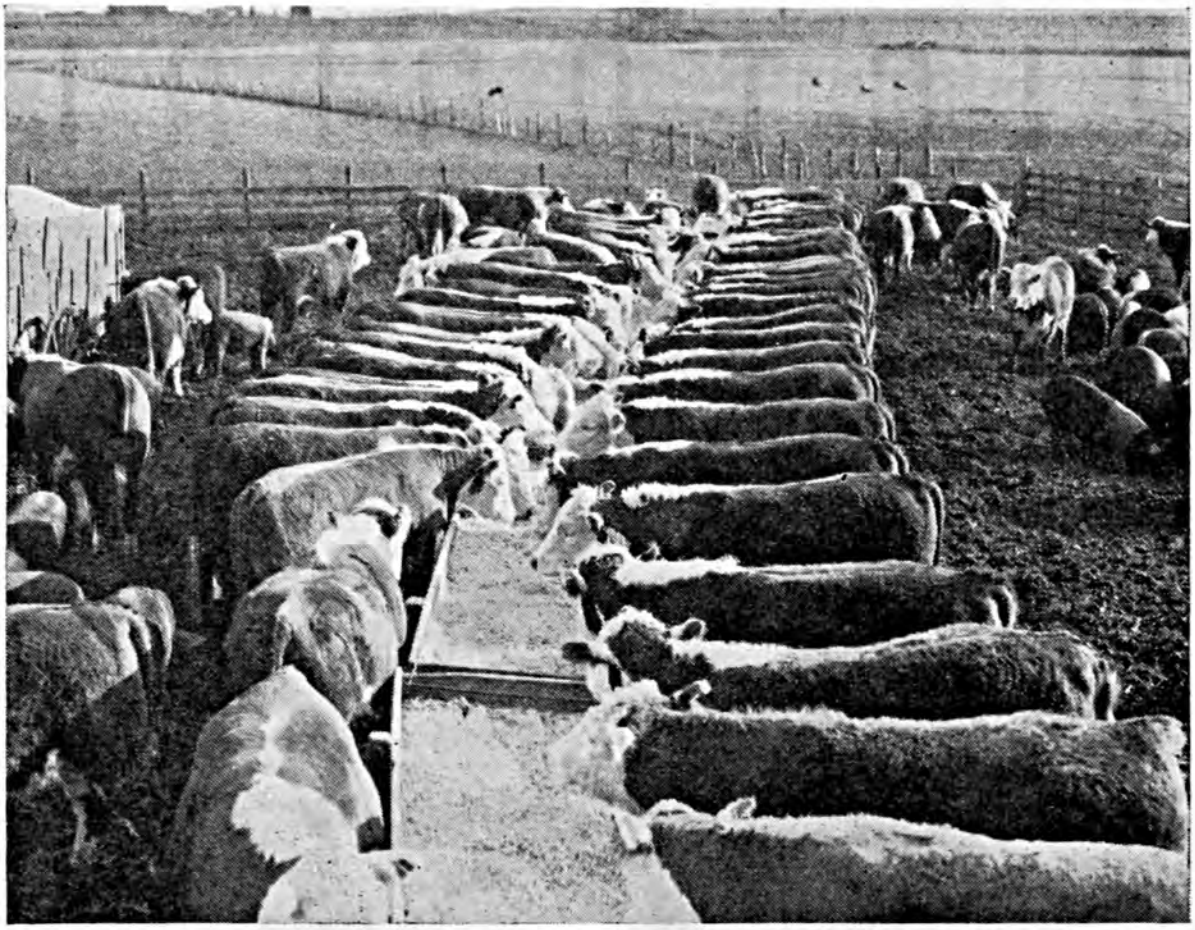
PICTORIAL

WHO IS DOING THE BAA-ING?



Above: A well-stocked feed line.

Left: Fuel for the meat factory.

Right: Winter satisfaction of summer labor.

Below: Quality produce in good display.

A COUPLE OF BLACK BEAUTIES WAITING FOR JUDGMENT

The Editors Talk

Agriculture 1946

American agriculture is now launched upon its first full postwar year. Answers to the speculation and problems of how the industry would fare in the reconversion period are in the process of being made. It would be unusual if some of the solutions are still not clear or that there be divergences of opinion on the best course to steer. However, the over-all picture is one that lends confidence in the capabilities of our farmers to produce in relation to a long-time view of their best interests.

To begin with, the announcement of 1946 goals dispelled doubts that the industry would suffer from the necessity of drastic reductions in production as a result of the return of peace. The 296 million acres of cultivated crops called for are 9 million acres more than were actually planted for 1945 crops. Including hay and hay seed crops, the final total of more than 357 million acres is 10 million more than the 1945 actual total. "The end of the war has not brought an end to the almost unlimited need for American food," Secretary of Agriculture Clinton P. Anderson said in recommending the goals to the states. "The 1946 goals indicate a pattern of production which provides continued high output of those commodities for which wartime demand is continuing and shifts toward peacetime levels for others."

The ability of American farmers to continue to meet goals is seen in an excellent discussion of this capacity by J. B. Hutson, Under Secretary of Agriculture and Administrator of the Production and Marketing Administration, before the Indiana Farm Bureau Federation at Indianapolis on November 15. "Looking at it from the over-all standpoint," he said, "the end of the war finds U. S. agriculture geared to a production level approximately 25% above the output of the prewar years. . . . It goes without saying that we will be able to produce plenty of food and fiber in the post-war period. The problem is not one of producing enough. Rather it is one of price relationships, of markets, and of distribution. . . . In short, the problem ahead is to stabilize farm prices and the farmer's income, while at the same time maintaining a high level of consumption and exports."

Mr. Hutson went on to say: "It seems to me that any discussion of these questions must necessarily center on: (1) the present productive capacity of the farm plant, and (2) the size and kind of market for which the farm plant will produce." He felt that most would agreed that given time to make the necessary changes, the plant could produce greatly in excess of the record production of the war period. Large areas of new land could be brought into cultivation, additional shifts to soil-conserving and higher-yield systems and crops could be made. The use of commercial fertilizer increased substantially during the war—the tonnage used was 85% greater in 1944 than in the pre-war years. Application of lime nearly tripled during the war period. Use of these materials could be greatly increased, he said.

Then turning to the period immediately ahead, he asked this question: With our farm plant presently geared to a level well above pre-war production, can production be maintained at this level in the reconversion period, and afterwards? For purposes of considering this question he divided farm production into three parts, (1) cash crops, such as wheat, cotton, tobacco, fruits and vegetables, and oilseed crops, (2) feed crops, such as corn, oats, barley, grain sorghums and hay, (3) livestock. Appraising the factors which might affect the production of each classification, it was his conclusion that it would be safe to count on a production capacity for cash crops of some 20% above that of prewar years; for feed crops, 25% above; and for livestock, 25 to 30% above prewar level.

With this capacity to produce one-fourth greater than at the beginning of the war, Mr. Hutson believes the basic answer to farm prosperity is to be found in high domestic consumption and a healthy export market. During World War II, per capita consumption of food was maintained at a level about 8% above prewar and the demand was not fully met. With a high level of employment and an adequate volume of trade with other countries, there probably will be a market ahead that will approximate the present capacity to produce at a level one-fourth above prewar.

Secretary Anderson has stated his conviction that a large part of the solution to the farm problem ahead must be sought in the direction of expanding the total market for agricultural products. One of the greatest contributions which we can make is to maintain full employment and at the same time develop international relations in such a way as to encourage foreign trade. "Under a full employment situation," he said, "the problems of agriculture will not all be solved. They will, however, be manageable. Even with full employment and an active foreign trade, many steps will be necessary in the fields of agricultural, labor, and business policies, if we are to have a sound and prosperous agriculture."

Among such steps are consumer education on improved diets and greater use of foods high in nutritive value and school lunch programs. These are close to home to most of us and will have our interest. However, if this war has taught nothing else, it has taught that our interests must be broadened. Anyone concerned with the prosperity of American agriculture must now realize its interdependence with the welfare of other industries and of this country with other countries of the world.

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Since January 1943 *Better Crops With Plant Food* has carried price data for certain farm commodities which were previously published in the *Potash Journal*. The yearly prices heretofore included for specific farm products have been on a calendar year basis. However, the price data currently published by the U. S. Department of Agriculture in their publication, "Agricultural Statistics," quote prices on a crop-year rather than a calendar-year basis.

During periods of rather stable prices, there is usually not such a great variation between annual prices calculated on a calendar-year or a crop-year basis. However, when the price of a given commodity fluctuates widely during the year, there may be considerable difference. Thus in certain cases there appeared a wide discrepancy between the figures previously carried in this publication and those published by the Bureau of Agricultural Economics of the U. S. Department of Agriculture. For that reason, it was believed desirable to revise the series in *Better Crops With Plant Food* so that the two would coincide. For each commodity with the exception of tobacco and truck crops, the crop year is indicated by the months at the top of the column.

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	87.8	64.2	88.4	11.87	22.55	....
1920	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
December	20.85	43.5	150.0	175.0	106.0	145.0	16.50	53.10	....
1945									
January	20.20	41.9	158.0	190.0	107.0	146.0	17.10	52.80	....
February	19.99	31.8	165.0	201.0	106.0	147.0	17.70	52.70	....
March	20.24	21.4	171.0	207.0	107.0	148.0	18.10	52.00	....
April	20.20	21.4	174.0	211.0	107.0	149.0	16.90	51.90	....
May	20.51	42.2	177.0	214.0	108.0	149.0	16.50	52.10	....
June	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	128	173	180	161	96	207	139	114	....
1921	137	195	163	129	81	117	98	129	....
1922	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
December	168	435	215	199	165	164	139	235	228
1945									
January	163	419	227	216	167	165	144	234	262
February	161	318	237	229	165	166	149	234	223
March	163	214	245	236	167	167	152	231	203
April	163	214	250	240	167	169	142	230	259
May	165	422	254	244	168	169	139	231	193
June	169	512	258	251	173	170	134	233	269
July	171	563	263	262	174	165	130	244	244
August	172	449	240	292	176	164	123	233	240
September	175	432	198	236	174	164	120	228	159
October	180	459	181	205	176	171	120	226	181
November	182	467	188	212	173	173	126	227	235
December	184	438	197	221	170	174	130	228	223

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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	Fish scrap, wet acidulated 6% ammonia, 3% 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	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944	1.75	1.42	7.68	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1945							
January	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	146	129	139
1927	112	79	145	166	143	128	162
1938	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	131
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944	65	50	219	163	110	144	191
December	65	50	223	163	110	144	191
1945							
January	65	50	223	163	110	144	191
February	65	50	223	163	110	144	191
March	65	50	223	163	110	144	191
April	65	50	223	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	110	144	191

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
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	.524
1927	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
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	....
December	.650	2.20	6.10	.535	.797	26.00	.200	....
1945 January	.650	2.20	6.10	.535	.797	26.00	.200	....
February	.650	2.20	6.13	.535	.797	26.00	.200	....
March	.650	2.20	6.20	.535	.797	26.00	.200	....
April	.650	2.20	6.20	.535	.797	26.00	.200	....
May	.650	2.20	6.20	.535	.797	26.00	.200	....
June	.650	2.20	6.20	.471	.701	22.88	.176	....
July	.650	2.20	6.20	.503	.749	24.44	.188	....
August	.650	2.20	6.20	.503	.749	24.44	.188	....
September	.650	2.20	6.20	.503	.749	24.44	.188	....
October	.650	2.20	6.28	.535	.797	26.00	.200	....
November	.650	2.20	6.40	.535	.797	26.00	.200	....
December	.650	2.20	6.40	.535	.797	26.00	.200	....
Index Numbers (1910-14 = 100)								
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
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	....
December	121	61	125	75	84	108	83	....
1945 January	121	61	125	75	84	108	83	....
February	121	61	126	75	84	108	83	....
March	121	61	127	75	84	108	83	....
April	121	61	127	75	84	108	83	....
May	121	61	127	75	84	108	83	....
June	121	61	127	66	74	95	80	....
July	121	61	127	70	79	101	82	....
August	121	61	127	70	79	101	82	....
September	121	61	127	70	79	101	82	....
October	121	61	129	75	84	108	83	....
November	121	61	131	75	84	108	83	....
December	121	61	131	75	84	108	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 materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
December	200	178	152	97	57	175	121	78
1945								
January	201	179	153	97	57	175	121	78
February	199	179	153	97	57	175	121	78
March	198	180	153	97	57	175	121	78
April	203	180	154	97	57	175	121	78
May	200	180	154	97	57	175	121	78
June	206	180	155	95	57	175	121	69
July	206	180	154	96	57	175	121	74
August	204	180	154	96	57	175	121	74
September	197	181	153	96	57	175	121	74
October	199	182	154	97	57	175	121	78
November	205	182	155	97	57	175	121	78
December	207	183	159	97	57	175	121	78

* 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 with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

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.

Fertilizer

"Agricultural Mineral Sales as Reported to Date for Quarter Ended September 30, 1945," Bu. of Chemistry, Dept. of Agr., Sacramento 14, Calif., FM-118, Nov. 7, 1945.

"Commercial Fertilizer Sales As Reported to Date for the Quarter Ended September 30, 1945," Bu. of Chemistry, Dept. of Agr., Sacramento 14, Calif., FM-119, Nov. 7, 1945.

"Tonnage of Different Grades of Fertilizer Sold in Delaware 1944," Dept. of Agron., Agr. Exp. Sta., Newark, Del., C. E. Phillips.

"Influence of Commercial Fertilizers on Idaho Potatoes," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 265, Aug. 1945, H. W. E. Larson and H. K. Schultz.

"Commercial Feeds, Fertilizers and Agricultural Liming Materials," State Insp. & Regulatory Service, College Park, Md., No. 195, Aug. 1945.

"Fertilizer Inspection, Analysis and Use; 1944," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 493, Aug. 1945, M. F. Miller, L. D. Haigh, E. W. Cowan, and J. H. Long.

"Fertilizer Sales in Ohio," Dept. of Agron., Ohio State Univ., Columbus, Ohio.

"Effect of Ammonium Nitrate As a Fertilizer for Spinach," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-288, Oct. 1945, H. J. Harper and F. B. Cross.

"Distribution of Fertilizer Sales in Texas for 1944-45," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 960, Sept. 24, 1945, A. D. Jackson.

"Selecting Fertilizers," U.S.D.A., Washington, D. C., Cir. 487, Aug. 1945, Albert R. Merz.

Soils

"Save the Soil," Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 370, June 1945, N. P. Tedrow.

"Suggestions on Erosion Control," Agr. Ext. Div., Univ. of Ky., Lexington, Ky., Cir. 406, July 1945, George Roberts.

"Relation of the Physical Properties of Different Soil Types to Erodibility," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Bul. 357, May 1945, T. C. Peele, E. E. Latham, and O. W. Beale.

"Conserving Soil and Moisture in Orchards and Vineyards," U.S.D.A., Washington, D. C., F.B. 1970, Sept. 1945, John T. Bregger and Grover F. Brown.

"Some Soil Properties Related to the Sodium Salt Problem in Irrigated Soils," U.S.D.A., Washington, D. C., T. Bul. 902, Sept. 1945, Robert Gardner.

Crops

"Improving California Ranges," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 129, April 1945, Burle J. Jones and R. M. Love.

"Spring Wheat Production in Colorado," Agr. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., Bul. 487, Dec. 1944, D. W. Robertson, Dwight Koonce, J. F. Brandon.

"Prairie, A New Soft Winter Wheat for Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 513, July 1945, O. T. Bonnett, C. M. Woodworth, G. H. Dungan, and Benjamin Koehler.

"The Louisiana Farmers' Almanac 1945," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., Cir. 236, Jan. 1945.

"Production of Tablestock Rutabagas in Michigan," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., C. Bul. 197, June 1945, B. R. Churchill.

"The Hatch Dairy Experiment Station Farm," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 488, June 1945, C. W. McIntyre and A. C. Ragsdale.

"The Ability of Certain Legume-Grass Mixtures to Withstand Grazing," Agr. Exp. Sta., N. M., College of A. & M., State College, N. M., P. Bul. 1007.

"Alfalfa Production Investigations in New Mexico," Agr. Exp. Sta., N. M. College of A. & M., State College, N. M., Bul. 323, June 1945, Glen Staten, R. S. Stroud, and John Carter, Jr.

"Research and Farming," Agr. Exp. Sta., Univ. of N. C., Raleigh, N. C., A.R. 67, 1944.

"The Work of a Farm Forester," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., E. Fold. 60, July 1945, R. W. Graeber.

"Annual Reports of the Ohio Agricultural Experiment Station 1939-1943," Ohio Agr. Exp. Sta., Wooster, Ohio, A.R. 59th-62nd, Bul. 658, May 1945.

"Cherry Rootstocks," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 319, May 1945, Francis M. Coe.

"What's New in Farm Science," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., A. R. 61, Part 2, Bul. 466, May 1945.

"Grading Soft Red Winter Wheat at Country Points," U.S.D.A., Washington, D. C., AIS-33, Oct. 1945.

"The Water Requirement of Alfalfa," U.S. D.A., Washington, D. C., Cir. 735, Sept. 1945, Carl S. Scofield.

Economics

"Georgia Farm Prices 1910-1943," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Bul. 239, March 1945, G. B. Stong, J. C. Elrod, and W. E. Hendrix.

"Postwar Program for Idaho Timber Production on the Forest Lands," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 99, May 1945.

"Postwar Program for Idaho, The Farm Woodlands," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 100, May 1945.

"Cost of Producing Milk in Northern Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 511, June 1945, R. H. Wilcox and C. S. Rhode.

"Financial Position of a Representative Group of McHenry County Farmers in the Dairy Region of Northern Illinois 1940-1942," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 512, June 1945, B. D. Parrish and L. J. Norton.

"Postwar Farm Jobs and Farmers' Purchase Intentions," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 592, Oct. 1945, A. T. Anderson and R. C. Ross.

"Complete Costs and Farm Business Analysis on 24 Farms in Champaign and Piatt Counties, Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AE. 2334, July 1945, R. H. Wilcox and J. R. Harris.

"Suggested Adjustments in Kansas Agriculture for 1946," Agr. Exp. Sta., Manhattan, Kansas, Rpt. 27, July 1945.

"Wartime Land Market Activity in Northern Nevada," Agr. Exp. Sta., Univ. of Nev., Reno, Nev., Bul. 174, June 1945, H. V. Stonecipher, Howard Mason, and Dora Dunn.

"Facts for Prospective Farmers and Ranchers in South Dakota," Agr. Exp. Sta., S. Dak. State College, Brookings, S. Dak., Cir. 59, June 1945, C. R. Hoglund.

"Crop and Livestock Adjustments by Production Areas in South Dakota," Agr. Exp. Sta., S. D. State College, Brookings, S. D., AE-Pamph. 12, May 1944.

"An Appraisal of South Dakota Production Adjustments in Agriculture, Wartime & Suggested 1945," Agr. Exp. Sta., S. D. State College, Brookings, S. D., AE-Pamph. 13, July 21, 1944.

"Post-War Farming Adjustments and Opportunities in South Dakota," Agr. Exp. Sta., S. D. State College, Brookings, S. D., AE-Pamph. 14, Nov. 1944, C. R. Hoglund.

"Agricultural Production Texas 1946," Agr. Exp. Sta., College Station, Texas, Nov. 1945.

"Financing Truck Crops in Three Eastern Virginia Counties," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 369, April 1945, Harry M. Love.

"Agriculture's Wartime Production Capacity for 1946, Washington," Agr. Exp. Sta., State College of Wash., Pullman, Wash., A. E. 8, July 1945.

1946 Agricultural Conservation Program Bulletin," U.S.D.A., Washington, D. C., ACP-1946, Oct. 12, 1945.

"Committeeman's Practice Handbook, 1946, NCR-46-1, Ind., Ia., Mich., Minn., Mo., Ohio, Neb., S. D., Wis.," U.S.D.A., Washington, D. C.

"Price Spreads Between Farmers and Consumers for Food Products 1913-44," U.S.D.A., Washington, D. C., M. P. 576, Sept. 1945.

"What Peace Can Mean to American Farmers," U.S.D.A., Washington, D. C., M. P. 582, Oct. 1945.

"Wages of Agricultural Labor in the United States," U.S.D.A., Washington, D. C., T. Bul. 895, July 1945, Louis J. Ducoff.

"Income Parity for Agriculture," U.S.D.A., Washington, D. C.

Soybeans Need Lime, Phosphorus, Potash

By A. L. Lang

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(Reprint from Soybean Digest, September 1945)

LIMESTONE is the number one requirement of soybeans on acid soil. Even though soybeans are well adapted to a wide variety of soil conditions and perform better than most cereals on acid soils, still they are sensitive to mineral deficiencies and respond well to properly used soil amendments.

In 1944 the 71 million bushels of soybeans harvested in Illinois took from the soil almost twice as much calcium as the 400 million bushel corn crop. At the same time they removed more potassium and one-half as much phosphorus as the corn. The 71 million bushels of soybeans removed from the soil 120 million pounds of calcium, phosphorus, and potassium, while 400 million bushels of corn removed only 20 million pounds more or 140 million pounds of the same elements. In terms of liming and fertilizing materials the 1944 Illinois bean and corn crop removed from the soil calcium, phosphorus, and potassium equivalent to 20,000 tons of limestone, 320,000 tons of rock phosphate, and 200,000 tons of potassium chloride. Even at the present time when more fertilizing materials are being used than ever before in the history of the country landowners and operators are falling far short of returning to the soil the plant food removed by the corn and soybeans alone.

No wonder thinking people are concerned.

But let's blame the culture, not the crop.

The high mineral requirement of the soybean plant and its inherent ability to forage its nutrients beyond the range and scope of other crops tend to give it an undeserved bad reputation for being a soil robber or depleter. But, as a matter of fact, when truly evaluated, *that inherentability of the soybean plant to ferret out plant nutrients that other crops cannot reach makes it surprisingly suited to the Cornbelt cropping system.* The soybean follows the corn crop as effectively and in the same manner as the porker follows the steer in the feed lot. If the steers are well fed the hogs need very little attention. Likewise, the soybean—if the corn crop is well fed, the bean crop will need little or no fertilization.

The problem, then, of returning plant food removed from the soil by the soybean crop becomes not one of direct application applied for the plant itself, but rather a matter of determining the needs of the entire cropping system and making the applications to those crops which can use them most effectively.

In analyzing the needs of a typical Cornbelt rotation including corn, soybeans, small grain, and legume hay for a heavily cropped level to rolling prairie soil, many factors need to be considered. The key to high productivity on such a soil when measured in bushels of corn and soybeans is the amount of legumes that can be plowed down preceding the growing of the corn crop. The legume supplies the large quantity of nitrogen without which the corn crop cannot make maximum yields. In addition, the legume supplies organic matter which in turn gives tilth, aeration, and water-holding capacity to the soil, all of which are as vital as minerals supplied through fertilization. The amount of a legume which can be grown is largely determined by the nutrient-supplying power of the soil and so the first efforts to soil improvement should be directed to and for the legume hay pasture or manuring crop. *When sufficient limestone, phosphate, and potash are applied to meet the maximum requirements of the legume forage crop in the rotation, grain crops like corn and soybeans will be amply cared for, provided enough of the forage crop is returned to the land in either green or animal manures.*

For the average Cornbelt soil this means 2 to 4 tons of ground limestone every 8 to 10 years; for most soils it also means 1,000 to 1,500 pounds of finely ground rock prosphate every 8 to 12 years or its equivalent in superphosphate, 500 to 800 pounds an acre each rotation. Where potassium is shown to be deficient by test, then 200 to 400 pounds of potassium chloride per rotation will do the job either all applied for the clover or divided between the clover and grain crops.

This outlined fertilizer program for soybeans has been proved to be effective by more than 30 years of results from the many permanently established outlying soil experiment fields in Illinois. It is simply and easily put into practice by owner and tenant operators alike.

The Fertilizer Rate Problem

(*From page* 18)

than the entirely too common practice of applying whatever amount or kind of fertilizer may be conveniently obtained. After consideration of the possible fertilizer needs to produce a good crop increase, due consideration must be given to the value of the increase. If 10 bushels can be added to a 20-bushel wheat yield, a relatively small fertilizer application is all that is economically justified. If, on the other hand, 5 tons can be added to a 10-ton yield of green beans while the price is more than $100 per ton, the cost of the fertilizer can be forgotten. All that is needed then is the courage to go out and apply what common sense and one's best judgment signify should be used. With adequate attention to proven information relative to fertilizer rates and usage, much increased production and considerable increase in profits could be added to the present level of production and income.

The Sources of Potash for Flue-Cured Tobacco

(*From page* 22)

A well-nourished, flue-cured tobacco plant.

ash in the fall and early spring is strongly indicated. Table 3 contains data for the 1941 crop, which was preceded by a winter and spring with unusually light precipitation. There is no indication there that the efficiency of potash was lowered by having been applied the previous fall.

None of these data, including those shown in Table 4 for the three years (1942-44), would indicate a likelihood of muriate of potash adversely affecting the grade of leaf, particularly if applied in the early spring or the previous fall. In order to ensure comparable yields it would seem that broadcast applications made previous to the time of transplanting tobacco would have to be increased considerably depending on the length of time intervening.

TABLE 4.—AVERAGE RESULTS FOR THREE YEARS WITH DIFFERENT SOURCES AND TIMES OF APPLYING POTASH FOR FLUE-CURED TOBACCO 1942-1944

Treatment	Source of potash and time of application (80 lbs. K_2O per acre)	Grade index ¢	Yield per acre lbs.	Crop index $
A	Muriate of potash	24.1	1367	330
B	¼ potash–muriate ¾ potash–sulphate	25.0	1331	333
C	Sulphate of potash	24.5	1363	334
D	Muriate of potash (120 lbs. K_2O per acre) one month before transplanting	24.6	1382	340
E	Muriate of potash (160 lbs. K_2O per acre) previous fall	25.5	1315	336

Soil samples taken periodically, beginning at the time the muriate of potash applications were made in the fall of 1940 and spring of 1941, respectively, were tested for the presence of chlorine using Spurway methods. In general, these tests indicated a more rapid disappearance of chlorine than potassium. The tests failed to show the presence of chlorine at transplanting time on the limed area where muriate of potash had been applied the previous fall while on the unlimed area chlorine was found present six weeks after transplanting. At the latter date higher amounts of chlorine were present when the muriate of potash was applied in the early spring than when it was applied the previous fall.

Burn tests were carried out on representative samples of cured leaf from each plot in 1940. Analysis of the results from 80 'burns' for each treatment revealed no significant relationship between duration of burn and fertilizer treatment. It may be explained that an entirely satisfactory technique

A group of agriculturists inspecting a tobacco fertilizer test plot in Norfolk County, Ontario.

for testing the burning quality of unmanufactured flue-cured tobacco leaf has not been developed. Burning quality of Canadian-grown flue-cured tobacco is generally regarded as excellent, however, and the present work gives no indication that this reputation would be jeopardized through somewhat fuller use of muriate of potash as a source of this nutrient.

Crop Production Horizons

(*From page* 15)

I am thinking right now of our old dependable hay crop, timothy. Even with all the educational effort poured into our campaigns for more acres and better yields of alfalfa and clover, we find on our Wisconsin farms nearly two million acres of timothy and other grass hays. In some areas, the physical factors of soil tillage and rotation make it difficult to keep one-third to one-fourth of our crop acreage in legumes. We know that the chief limiting element in the production of maximum yields of timothy is nitrogen. This past year (1945) the writer carried out a large number of demonstrations with nitrogen fertilizer applied as a top-dressing on old timothy meadows. Most of these trials were conducted in the Lake Superior district of northern Wisconsin where a good 75 per cent of all the hay harvested by farmers is timothy and quack grass with perhaps 10 per cent to 20 per cent of clover. The soil type in this area ranges from heavy clay to sandy loams.

The response of these old timothy meadows to nitrogen was amazing. Ammonium nitrate (33 per cent) was applied at 200 lbs. per acre in the early spring as a top-dressing. In every case (27 demonstrations conducted) the increase in yield was considerably more than enough to pay for the fertilizer—in fact, the average increase for all of these acre demonstration plots was 2,185 pounds of hay. Not only a ton more hay per acre, but this nitrogen-treated hay was leafier, darker green in color, and higher in its protein content. (See Table 3.)

Figuring the value of this better quality timothy at $20 per ton, we show an average profit of $15.85 over and above the cost of the fertilizer. Putting it another way, it appears that we can produce this extra ton of more palatable hay at a cost of about $5.50. In many cases, we doubled the yield which amounts to the equivalent of doubling the size of the farmer's hay acreage, and this means a lot to our northern Wisconsin farmers operating on their small farms with their 30-40 and 50 acres of crop land.

Here again I must emphasize the fact that the continuous use of nitrogen fertilizer year after year on these

TABLE 3.—AVERAGE OF 27 DEMONSTRATIONS ON TIMOTHY (AMMONIUM NITRATE APPLIED AS A TOP-DRESSING)

Treatment and rate per acre	Average yield per acre	Average increase per acre	Cost of fertilizer	Value of increase	Profit over cost of fertilizer
Ammonium nitrate at 200 lbs.	4921 lbs.	2185 lbs.	$6.00	$21.85	$15.85
No fertilizer	2736				

old timothy and grassland meadows will eventually deplete the reserves of minerals. True, most of these timothy meadows are plowed up and reseeded occasionally and at such times farmers should apply liberal amounts of phosphate-potash fertilizers. These fields should be limed if acid. The occasional application of phosphated manure to these old timothy meadows will help to maintain adequate levels of phosphorus and potash.

There is still another place where we are now recognizing an opportunity for increasing the yields of farm crops through the use of nitrogen fertilizers. We in Wisconsin have finally come to the use of nitrogen on grain (both for fall-seeded wheat and rye and spring grains). For many years we have discouraged the use of nitrogen in fertilizers for spring grain. But now comes Vicland oats into the picture. This new variety of oats which is resistant to rust and smut and a high yielder is inherently short-strawed. Wisconsin farmers in 1945 grew over 2½ million acres of this new variety. Where grown on our sandy soils and on the light-colored silt and clay loams, in average to low fertility, it makes a poor growth of straw, too short in fact to produce maximum yields. Vicland oats will make plenty of straw on fields containing adequate amounts of nitrogen. I am, therefore, convinced that Wisconsin farmers could use nitrogen fertilizers with profit on at least one-half or more of the oats grown in Wisconsin. And not only on our Vicland oats but on barley where grown on low-fertility, nitrogen-deficient soils. For several years we have recommended the top-dressing of rye and winter wheat with nitrogen fertilizers in the spring.

There is the danger, of course, of producing too much straw, and in dry seasons we may thus jeopardize our seedings of clover or alfalfa. A farmer must use good judgment and discretion in his use of nitrogen fertilizers. One point should be made clear at this point in our discussion relative to the use of nitrogen on the grain crop. Bear in mind that we must first of all supply adequate amounts of phosphate, potash, and lime as basic treatments. When the grain and legume requirements for these minerals are satisfied, we may then consider the use of nitrogen.

This past year (1945) we carried out a number of demonstrations where ammonium nitrate was applied at rates of from 60 to 70 pounds per acre as a top-dressing on plots which had been previously treated with 0-20-0 and 0-20-10 or 0-20-20. The results are summarized in Table 4.

TABLE 4.—AVERAGE YIELDS FOR EIGHT PLOTS—1945—IN BAYFIELD, ASHLAND, IRON, AND PRICE COUNTIES WHERE A COMPARISON WAS MADE OF 0-20-0 WITH 0-20-10 OR 0-20-20, WITH AND WITHOUT AMMONIUM NITRATE. (AMMONIUM NITRATE APPLIED AS A TOP-DRESSING AT AVERAGE RATE OF 63 LBS. PER ACRE AFTER SEEDING.)

Treatment (Av. for all plots)	Crop	Yield per acre grain	Yield per acre straw	Bushels increase grain	Pounds increase straw	Value of increase grain & straw	Cost of ferti-lizer	Net profit per acre
265 lbs. of 0-20-0	Oats	49.6	1880	13.4	371	9.64	3.63	6.01
265 lbs. of 0-20-0 plus 63 lbs. of ammonium nitrate	Oats	58.2	2361	22.0	852	16.43	5.36	11.07
265 lbs. of the average of 0-20-10 & 0-20-20 plots	Oats	59.4	2314	23.2	805	17.09	6.02	11.07
265 lbs. of 0-20-10 & 0-20-20 plots (average) plus 63 lbs. of ammonium nitrate	Oats	67.2	2791	31.0	1282	23.35	7.75	15.60
No fertilizer	Oats	36.2	1509	......	......	......	......	......

In most every trial we observed a marked increase in the growth of straw on the plots top-dressed with ammonium nitrate. In no case on the plots conducted in 1945 did we seriously hurt the "catches" of clover or alfalfa.

The results tabulated in Table 4 definitely show a substantial profit from the nitrogen.

When it comes to rye, wheat, and oats grown on sandy soils in dry years, I am certain we would definitely hurt our seedings of clover and alfalfa. And here is a suggestion I would offer to farmers operating on sandy farms. If the size of your farm permits, grow, let's say, part of your grain *for grain* and omit your legume seedings. Fertilize liberally with nitrogen, phosphate, and potash. Make these acres produce maximum yields of grain. In turn withhold nitrogen from the acreage you are seeding to legumes and grasses. In fact, cut down on your nurse crop rate of seeding and give these fields liberal treatment with phosphate-potash mixtures. In the case of fields of oats, barley, rye, or wheat grown for grain and where legume seedings are omitted, we can use fertilizers relatively higher in their content of nitrogen—as for instance, the 10-6-4 or 8-8-8. Where, however, we are seeding down with legumes cut down on nitrogen and use mixtures relatively higher in phosphate and potash such as the 3-12-12, 0-20-20, or even 0-10-20.

Plow Sole Fertilizers

This story would not be complete if I did not say something about the opportunity for increasing the yields of corn and other row crops on low fertility fields through the application of liberal amounts of a balanced plant food by the plow-sole or deep-placement method.

In our effort to achieve the ultimate goal of abundant production of all crops grown on our farms through a program of lime-phosphate-potash and legumes, some of us have failed to fully recognize the immediate opportunity for increasing yields on land where no manure is available and where little or no fertilizer has ever been used in the grain, legume, corn rotation. Thousands of farmers every year are wearing out their machinery and expending their energies on acres and acres of impoverished soils where crop yields are low and quality poor. And so I ask the question, "Why not give these farmers a commercial fertilizer substitute for manure?" The answer to this question is our recommendation of such grades of fertilizer as 8-8-8 or 6-6-18 at rates up to 1,000 pounds per acre for corn, sugar beets, tobacco, cabbage, tomatoes, and potatoes. Where applied with an attachment on the plow or placed in bands by other devices at depths of from six to eight inches, these high-nitrogen fertilizers will make possible the production of good crops on well-aerated soil. I cannot see anything wrong with this idea. It is a short cut to higher yields and lower production costs. Certainly we do recommend that farmers rotate their crops and include legumes in the rotation. Organic matter and good soil aeration are important. We caution against the plowing under of high-nitrogen fertilizers on those heavy-textured soils where the tilth is poor or where compaction has resulted from plowing heavy soils when too wet.

In Wisconsin there are thousands of acres of well-aerated but low fertility soils, where the liberal application of 8-8-8 or 6-6-18 will produce profitable increases in the yields of corn and other crops. In our plow-sole demonstrations carried out in Wisconsin during the past four years, we have produced increases in the yields of corn ranging from 10 to 70 bushels per acre through the application of from 700 to 800 pounds of 8-8-8 fertilizer. Profitable increases in the yields of potatoes, sugar beets, tobacco, and rutabagas have been shown in numerous demonstrations.

The farmer himself will eventually have to answer the questions, "How much fertilizer should I apply per acre?" and "Does it pay?" Prices for the crop he grows together with the cost of the fertilizer, as well as the amount of fertilizer he applies per acre and finally the increases which he is able to obtain from its application, will give the farmer his answers. Our job is one of determining the most effective method of applying large amounts of fertilizer. The deep placement of plant food in bands down in the moist soil where the feeding roots of growing crops are able to make good use of this plant food during the midsummer period of peak demand is our present answer to the question of the most efficient method of feeding corn and certain other crops with commercial fertilizer. We still recommend some hill or row "starter" fertilizer even where the heavier applications of complete balanced plant food are plowed under or placed deep by the plow-sole or other methods.

Supplies of Nitrogen Abundant

We now have in the United States and Canada some 13 or 14 synthetic ammonia plants, most of them built during the past four or five years. These plants have been turning out vast quantities of ammonium nitrate, a material used in the manufacture of explosives. But strange as it may seem, this same ammonium nitrate used as an ingredient in gunpowder and loaded into bombs for the killing of men and the destruction of property can also be used to produce farm crops. Abundant supplies of ammonium nitrate or other nitrogen fertilizers such as ammonium sulphate, nitrate of soda, calcium cyanamid, and urea will be available in the years to come, and with this increased capacity for nitrogen production in this country comes a new horizon in our potential crop production possibilities.

Yes, we have poured billions of dollars into the World War II in order to protect ourselves against the aggression of those powers which threatened our very existence. Let us now bear in mind that our future and ultimate security are of equal importance. We cannot continue to exploit our greatest source of wealth and well-being. We must continue to battle the forces of nature and of human indifference and carelessness in this great program for the conservation and preservation of our greatest national heritage—the soil. "To Save our Soil is to Save our Country."

Potash Increases Tomato Yield and Quality

(*From page* 26)

tion to his regular application he applied 200 pounds of muriate of potash per acre as a side-dressing at the last cultivation. Soil samples taken from the several fields, as might be expected, showed wide variations, but most of them showed potash to be Low or Low plus with a pH ranging from 5.4 to 6.8.

This study was carried on for three years, from 1939 to 1941, inclusive, and each year the potash plots showed a substantial increase in yield over the plots not receiving the extra potash. W. I. Boyd, Fieldman, in his annual report for 1941 has this to say: "The gain in yield for the 9 who kept records ranged from 12 baskets per acre to 123 baskets per acre for an average gain of 65 baskets" (60 baskets to the ton). His report continues, "This year was the second year to carry on this project in this locality. The 1940 project which resulted in an average gain of 61 baskets per acre created considerable interest in the use of potash among our growers. The 1940 project caused us to sell fully three times more potash than ever before." Incidentally the first year's work was confined to growers in the Houston area and Mr. Boyd alludes to growers in the Wyoming section of the State or those growers who deliver their tomatoes to the Wyoming plant.

Dr. W. J. Dufendach, Manager of

the Houston Plant of Libby, McNeil and Libby, reports, "During the season of 1940 I found that the use of 200 pounds of muriate of potash per acre above the regular fertilizer treatment increased our quality from 12 to 16 per cent."

The three years work might be summarized as follows:

Year	No. of growers	Baskets increase from potash
1939	9	69
1940	19	77
1941	22	40
Baskets increase, 3 years		186

Average gain per 200 pounds of muriate was 62 baskets or over a ton per acre.

A typical report on a year's work is taken from a report compiled by Kenneth Baker of the Delaware Extension Service—1941 project:

Number of cooperators	19
Yields per acre	533 with extra potash vs 456 without the potash
Costs per acre	$80.61 vs $78.51
Returns per acre	$127.92 vs $106.21
Net profits per acre	$47.31 vs $27.70

In addition to the larger group selected to demonstrate that extra potash would pay several other growers were asked to test out the use of cyanamid with and without potash. Clifford Johnson reported as follows:

	Baskets
Check	91
200 cyanamid	292
400 cyanamid	223
200 muriate of potash	311
200 of each	360
400 cyanamid plus 200 muriate of potash	320

John Miller:

	Baskets
Check	324
200 cyanamid	334
200 muriate of potash	410
200 of each	432

The above treatments were given in addition to regular fertilizer applications. For instance Mr. Johnson applied 800 pounds of a 3-8-10 mixture per acre broadcast while Mr. Miller applied 1,000 pounds of superphosphate per acre plus 12 tons of manure.

It will be noted from the above report that muriate of potash showed a very distinct increase in the yield; in Mr. Miller's case it showed an increase of 86 baskets. The combination of 200 pounds of cyanamid plus 200 pounds of muriate of potash seemed to be the best amounts under the conditions of this test.

That potash alone increases yields is also demonstrated by work that Dr. Jackson B. Hester did at the Campbell Soup Company in 1940. The following table is printed with the permission of Dr. Hester:

FERTILIZER TREATMENT

Plowed Down		Side-Dressed			
Cyanamid (lbs.)	0–0–50 (300 lbs.)	0–0–50 (300 lbs.)	10–10–15 (750 lbs.)	10–0–15 (750 lbs.)	10–0–30 (750 lbs.)
0	12.26 Tons	15.37 Tons	10.66 Tons	11.96 Tons	11.37 Tons
100	15.71 "	14.00 "	13.00 "	12.66 "	10.98 "
200	13.65 "	16.68 "	12.12 "	11.26 "	11.32 "
400	12.48 "	12.96 "	10.41 "	12.65 "	13.10 "
600	14.17 "	14.25 "	13.24 "	14.18 "	12.86 "

The land received 1,000 pounds of superphosphate before plowing. It will be noted from the above table that 200 pounds of cyanamid plowed down plus 300 pounds of muriate of potash applied as a side-dressing gave the best yield—almost 17 tons per acre, but it should also be noted that 300 pounds of muriate applied as a side-dressing without any cyanamid produced 15.37

tons per acre. This yield was higher than any yield when NPK or NK were applied as side-dressings and stood third in yields of all plots. The 0-0-50 (potash) was applied at rate of 300 pounds per acre while the other mixtures were used at a 750-pound rate per acre.

High-potash treatments not only improved the quality but also resulted in more early fruit. This was substantiated by Dr. R. P. Thomas, University of Maryland, who reported that it was very noticeable that high potash produced more early fruit and that nitrogen alone and manure tended to decrease early ripening. "The heavy application of potash, that is doubling the amount in the mixture, gave very large increases in fruit which had been picked by the middle of the season." Dr. Hester states: "It has been observed that the fruit on plants getting a large amount of potash matures dark red and carries a high amount of sugar and acid which is a factor in high quality."

In cooperative work with growers in New Jersey it was found that potash pre-applied, that is, applied some time before the plants were set, produced more early fruits than did the potash which was used as a side-dressing, but the plants with the side-dresser remained green longer in the season and the resulting crop was larger than was that on the pre-applied plots. This tendency to early maturity was also noted in cooperative demonstrations with growers in Talbot County, Maryland, where the plots getting 18 per cent potash produced 94 baskets per acre before any fruit was picked from the 6 per cent potash plots.

Incidentally peppers which are considered in the same class as tomatoes in reference to their fertilizer needs were under tests conducted by Agricultural Students at the Bridgeville, Delaware, High School with the following results:

	Baskets
(1) Check—500 pounds of a 3-8-10	210
200 pounds muriate of potash side-dressed in addition to the above	336
(2) Check	246
200 pounds muriate of potash as side-dressing	306

These typical examples showed increases from the 200 pounds of muriate of potash per acre of 126 and 60 baskets, respectively, under the conditions of soil and climate under which the above reported fertilizer tests were conducted, tomatoes as well as peppers have shown significant increases in yields and returns per acre from liberal applications of potash as a side-dressing. Growers throughout the area have readily adopted the practice and regard this extra fertilization as essential for bigger yields and better quality.

A New Machine for Deep Fertilization

(*From page* 25)

chine he is assembling this winter. Even though the heel opening will be larger, the material will flow at the same rate for the amount is governed by the slide openings in the box.

When you look at the photos of the machine, it appears as a factory-built unit. However, it was made from available new material. It did a fine job for the large amount of fertilizers the Thorps used last Spring. A total of 120 tons of 8-8-8 was used for deep placement. That would have taken a great deal of time if applied through the former small fertilizer box. By using the Thorp attachments, neighboring farmers reported fertilizing as high as 20-30 acres per day.

Just about every farm has a field cultivator. The local farm repair shop could easily assemble the parts necessary to turn that cultivator into a deep-fertilizing machine.

Although many farmers may disapprove another operation in preparing the ground, there are decided benefits. To prevent excessive leaching of plant food, a good practice is to fertilize just a week or two before seeding or planting. Good plowing time is late fall and very early spring and so a farmer stands to benefit by separate plowing and fertilizing operations.

Because of poor weather conditions, as was noticed in several sections last spring, a farmer must change his crop plans. Thus he benefits by late fertilizing for he can use the correct analysis for the chosen crop and still be assured of a profitable yield.

A New Legume for the South

(*From page* 8)

ducted in 1942 and 1943 by the Mississippi Extension Service show an average yield of 11,719 pounds of green material per acre where basic slag or superphosphate and lime were used. When 100 pounds of muriate of potash were added, the yield was increased to 19,669 pounds of green material per acre. The results are shown in the table below:

	Lbs. green wt.
1. J. M. Kimbrough, Lexington, Miss.	
250 lbs. superphosphate	5,445
250 lbs. superphosphate 100 lbs. muriate of potash	9,692.1
250 lbs. superphosphate 300 lbs. muriate of potash	13,939.2
2. R. M. Branch, Goodman, Miss.	
500 lbs. lime 250 lbs. superphosphate	5,227.2
250 lbs. superphosphate 100 lbs. muriate of potash 60% 500 lbs. lime	11,325.6
3. R. M. Branch, Goodman, Miss.	
500 lbs. lime 250 lbs. superphosphate	7,187.4
500 lbs. lime 250 lbs. superphosphate 100 lbs. muriate of potash 60%	16,661.7
4. H. W. Vandiver, Cruger, Miss.	
No treatment	15,681.6
100 lbs. muriate of potash	28,749.6
5. W. S. Pittman, Winona, Miss.	
500 lbs. basic slag	11,107.8
500 lbs. basic slag 100 lbs. muriate of potash 60%	16,226.1
6. C. S. Hamer, Kilmichael, Miss.	
500 lbs. basic slag	16,988.4
500 lbs. basic slag 100 lbs. muriate of potash 60%	28,636.3
7. Scott Wafford, Mantee, Miss.	
500 lbs. basic slag	11,211
500 lbs. basic slag 100 lbs. muriate of potash 60%	14,592
8. J. E. Scarbrough, Cumberland, Miss.	
200 lbs. superphosphate	20,908
200 lbs. superphosphate 100 lbs. muriate of potash 60%	31,472

Fertilizing helps to make a better winter growth and therefore increases the yield of green manure in the spring. Applying the superphosphate and muriate of potash to the peas is probably as effective as to apply it to the crop which follows the peas.

Harvesting

Harvesting is best done with a combine if the wild peas are planted on well-prepared, smooth land, and if there are no weeds. If the peas are dry, the combine may be run over the field and the peas sacked as they come out of the combine. The peas may then be stored in a dry, well-ventilated storage room. Precaution should always be taken to prevent heating or molding. If the peas are sacked, the sacks should be stood up in a single layer in the storage room. If the peas contain an unusual amount of moisture, they should be spread out in a thin layer on a tight floor where they remain until dried sufficiently to keep in sacks.

In some instances there are too much

Johnson grass and too many weeds to harvest the peas with a combine, in which case it becomes necessary to cut them with a mower, rake in wind-rows, and from the wind-rows shock and stack. Threshing is then done from the stack. This is the safest and probably the cheapest way to save wild winter pea seed, as the seed will be completely dried before threshing and therefore there will be no danger of heating or molding. By using this method, it is possible to cut before the peas begin to shatter and consequently more peas are saved. Cut at the proper time, few peas will shatter in the process of curing and placing in the stack. If a good thresher is available there is little doubt that this is the best method of harvesting.

The Use of Clover in Rotation on Rice Land in Louisiana

(*From page* 19)

Lake Charles silty clay loam—is deep, fine-textured, and takes in water slowly. The dark gray silty clay loam surface soil is about eight inches deep and is underlain by a medium-to-dark gray silty clay or clay subsoil. Developed under a grass cover, the soil originally had a good supply of organic matter.

Rice has been the farm's principal crop for the last 25 years, under a system of alternate years in crop and pasture. The pasture consisted of rice crop residue and voluntary stands of native grasses and weeds.

The amount of organic matter in the soil declined under the system until the operators noted the change in soil structure. This became evident as the land became harder to work. Further, Mr. Dugal said that there had been a gradual but steady decline in yields during the last quarter of a century.

The first seeding of white clover, preceded by application of 350 pounds of 20 per cent superphosphate fertilizer per acre, was in rice stubble on a 50-acre field or "cut" in November 1943. This field is now in rice and, according to Mr. Dugal, the crop is noticeably better there than on the other land. The use of white clover is given credit for the improvement.

Two 50-acre "cuts" and one of 20 acres were seeded to white clover in 1944, each given an application of 250 pounds of 20 per cent superphosphate per acre. One of the 50-acre "cuts" was disked three times, fertilized, and packed with a cultipacker before seeding. The remaining two "cuts" were seeded directly on rice stubble. Seeding was begun the first week in November and completed in the first week in December. Ten pounds of seed were sown per acre. Fifty per cent muriate of potash was also applied at the rate of 100 pounds per acre on two acres.

The areas seeded the first of November made better growth than those seeded in early December. This is taken to indicate that seeding in the latter part of October will give best results in this area. Production was at least as good where the clover was seeded in rice stubble as it was where the land had been disked and packed.

Results on the two acres where potash was applied have caused Mr. Dugal to decide to use it on all future white clover seedings. The growth and seed yield were much heavier there than on any other part of the farm, he reports. He also said that by August this year those two acres were the only ones where there was a good stand of clover for grazing. All of the clover had been grazed, but the plants in the other 118 acres had died during July.

Production from the 120 acres of white clover, not including the grazing, amounted in 1945 to 13,000 pounds of clean No. 1 seed valued at 70 cents a pound ($9,100), 1,800 pounds of less clean and adulterated seed valued at 40 cents a pound ($720) which Mr. Dugal expects to use on the farm, and 1,100 bales of hay valued at $1.25 a bale ($1,375). This totals $11,195, or over $93.00 an acre.

In addition, Mr. Dugal is of the opinion that as much seed shattered out and remained in the fields as was harvested. A field examination made August 10 revealed that there was enough seed on the ground to assure a good second-year stand.

Thus, the three purposes for introducing white clover into the crop rotation are accomplished—production of a salable crop when rice is not grown, improved pasture for livestock, and higher rice yields following clover through soil improvement by use of a legume in the rotation.

On the basis of this experience, it is believed that white clover and lespedeza should be a definite part of the cropping systems for rice-livestock farms in the Coast Prairie area. It also seems amply demonstrated that the use of phosphate and potash fertilizers will usually be necessary to produce maximum yields and in many cases to produce even profitable yields of white clover.

Tomorrow

(*From page* 5)

while to take the second course is to be cowardly and negative.

If I toted this philosophy out to Main Street to chat about it with the boys I know best, I think they would be brave and honest about the propositions facing us. I imagine they would take the following attitude:

The gang who usually start wars are the ones who take little risk in fighting them. The peace-loving farmer never seeks a war with country dwellers in other lands—as Thomas Carlyle pointed out a long time ago, without getting much results I fear. It is usually the ambitious money barons, the plotting diplomats (or the blundering ones), the scheming politicians who can't curb their tongues, the half-baked meddlers, and the power-drunk dictators who cajole or frighten their people into the catastrophe of licensed carnage. As a rule, such geezers never smell much gun-powder. They let farm and factory workers shoulder arms.

But now things may be different. If the atomic bomb is only half what they say it is and the production secret leaks out, these war-mongers are going to think a couple of times before they get sassy. Any taste of this new-fangled warfare will sour their stomachs. They won't be so able to dodge it. Their own necks will be perpetually extended. They won't be able to hide somewhere and do their bit with slogans and false alarms. But at best that's a poor way, too, in which to bring about peace.

I wish there was some money available to make real first-hand educational methods work in furtherance of peace. Probably the new big international bank scheme or any of the UNO programs falls short of getting this done among the common people, the ones who have to face the brunt of battles. So far a lot of this paper work is 'way over our heads.

Too many of the commentators and columnists and chitter-chatters horn in on subjects which they know less about than the common folks, and by dint of their racket and din they manage to get everybody confused and distraught. Nothing dispells misunderstanding so fast as to have folks get acquainted.

So if we could set up some kind of international good will fund to help pay the expenses of a few farmers and factory workers to travel back and forth from country to country at intervals—traffic both ways and in all directions—it might rid us of some prejudice. The radio and the newspaper and trade magazine columns might report their trips and give space to their experiences. Neighborhood gatherings would listen to their reports and look at their photographs.

Let them go into the homes and working places of foreign lands without being directed or propagandized. Of course, our own returning soldiers have had some valuable lessons in world unity, but the impressions gained in wartime under disrupted conditions are not as reliable as an exchange of views during the lulls of peace when more war clouds gather.

I would not hand-pick these citizen ambassadors by any favored political, religious, or racial method. I would let nominations for such missions be in the hands of groups by industrial and regional lines, and give them passports, funds to travel modestly, and require strict accounting of expenses. If the Government balked at such overseas missions, maybe some rich corporation or association of commercial agencies might like to test it.

ON this end we could set up welcome committees composed of similar groups of people to handle these foreign citizen ambassadors. Air travel will soon make such trips less costly and lengthy. If we brag so much over the smallness of the world in distance and time, why not cement its parts more securely?

Now to keep on with this educational theory, why not put into our high schools a new course in world affairs and world relations? In the past six months so much good has been done, on paper anyhow, toward a better understanding, that we can't afford to let it molder in the files.

Fetch out those Bretton Woods organizations, the Food and Agriculture Organization, the Export-Import bank loans, the credit to Great Britain, the progress of UNRRA, and the Big Three conferences. Get a teacher to "hone up" on the topics or send to the State Department for references. Have class work in the high school daily on these momentous milestones. Give exams on them, encourage interclass debates about them. Hang up a trophy for the kids who show extreme skill in understanding and explaining these clearly. Make these affairs ours. Right now they belong to a Mr. Stettinius or a Mr. Byrnes or else we just dismiss them with a yawn and look for the current hog market and the comic strips.

IF we got an order to assume some grave responsible task or shoulder some special assignment because we were known to be without question the strongest and most able ones to undertake that task, would we go off on a wild spree or hide out and shudder to avoid it? I expect that parallel goes as much for the nation itself as it does for us. Our country can't dodge its responsibility for world leadership either. We suddenly find ourselves on top of the heap. What are we going to do about it?

First, it strikes a lot of us ornery outlanders that we mustn't start off by thinking we alone are the morale creme de creme, or that our righteousness is the acme of perfection which all must imitate. Nor may we assume blindly that our economic system is something to dose every other country with.

Second, let's not be too apologetic or critical either of our vantage point. Maybe our form of democracy and our brand of economic management is cock-eyed in places, but above all else it is geared to deliver the goods and get the most there the first. By finding a way to keep that same old machine running without friction in normal times we can do ourselves and the rest of the world a favor.

This isn't the first and only time we have been stalled on dead center with lots of jobs waiting for the old flywheel to turn. America has a habit of prolonging internal strife and bickering just for the fun of it, I guess. But it won't last forever. The disagreers will get weary of getting nowhere fast, and by and by they will come in and settle things by compromise. Let's just hope the stalling and jawing won't get contagious and infect the farmers too widely, or else a lot of us will miss more than pineapple and butter on the table.

Ten chances to one the key that finally unlocks the closed doors to progress and unbars the deadlocks among us will be produced from the mind of some individual, some person skilled in certain lines. That's why I refuse to believe that we must grope around in the dark eternally as victims of an over-organized era. The individual thinks things out from pressure—the kind of mass pressure we are feeling everywhere now.

I suppose most of us on the sidelines feel that what we do or say or hope for will not bring about a millennium. Yet we have much more of a loud say-so as individuals than a majority of the citizens of other countries. It is in our own work-a-day expressions and ideals that we give incentive to those best able to lead and inspire us. You can bet on one thing—that if we ourselves out here in the mob forget to act right and plan square and fair, we are laying ourselves open to bad leadership.

SO I repeat that the bright dawn of tomorrow shines for us ordinary geezers regardless of what office we hold or aspire to. Not only do we make up the vote and pressure of mass opinion, but we are quite apt to hatch out a prodigy in our midst with enough pep and zip to think up a new way out of old troubles.

So with this echo of a resolution flung at you, I take a bow and wish you all a New Year of surging activity in behalf of making the world safe for decency.

Little Willie had gone to bring the kittens in. His father, hearing a shrill meowing, called out: "Don't hurt the kittens, Willie."

"Oh, no," said the youngster, "I'm carrying them very carefully by the stems."

Mandy surrounded by her brood was talking to a spinster settlement worker. "Yes'm, birth control am all right for you all, but me, ah's married, an' doan need it."

The discharged sergeant walked into the barber shop, draped himself into the barber chair and without a second glance said to the barber: "Shave and a haircut."

The barber picked up the brush and started to lather the face. He stopped in the middle of the operation, a smile of enormous proportions spreading over his face as he reached for the razor:

"Well," he said heartily, "If it isn't my old sergeant!"

First Window Washer: "Look at that guy in there kissing another man's wife. Let's go in after the big bum!"

Second Window Washer: "All right, how soon do you think he'll leave?"

"Is that girl's dress torn, or am I seeing things?"

"Both."

An author bought a farm in upper New York State because he thought it would be a good place to write. When an inquiring neighbor asked, between spurts of tobacco juice, what crops the stranger intended to raise, the author was momentarily stumped. Then he happened to recall what his wife had said about the city being no place to bring up children.

"I'm going to raise children," he said brightly.

The farmer spat meditatively. "Around here," he said, "we look on that as a sideline."

Private: "I bought her a fine dinner, took her to the best show in town, then to a night club, and do you know what she said?"

Corporal: "No."

Private: "Oh, you've been out with her, too."

A young mother had just unburdened herself and told her son the facts of life. At the end she said, "Now, if you want to know anything, ask me."

The boy appeared in serious thought, then gravely turned to his mother and said, "How do they get the Saturday Evening Post out on Wednesdays?"

"Winter draws on," Josh remarked absently as he tucked Maggie into his cutter for an old-fashioned sleigh ride.

"Is that any of your business?" replied Maggie, icily.


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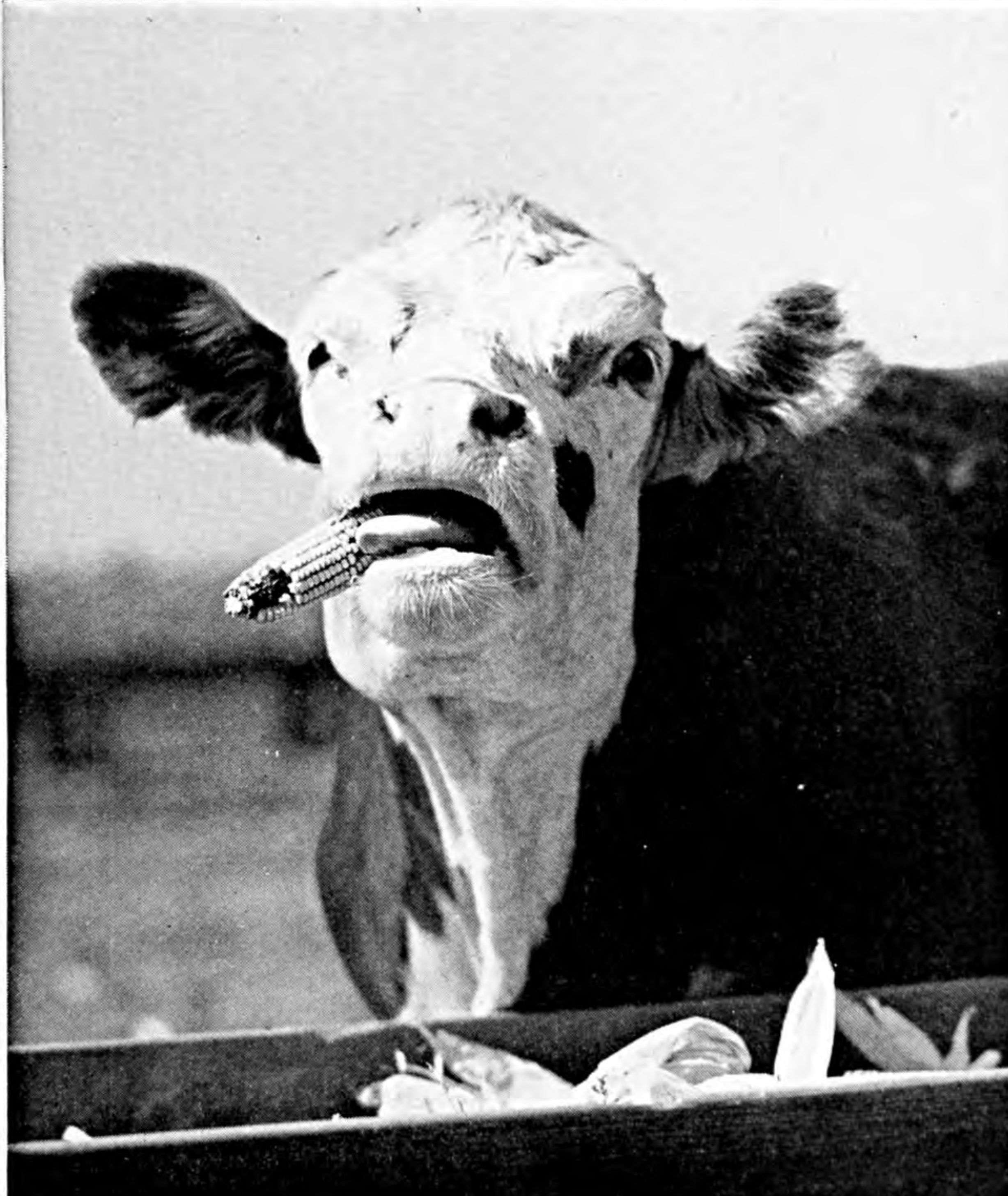

The Pocket Book of Agriculture

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.

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The American Potash Institute, Inc.

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Reliving a . . . . . .

TENDERFOOT TALE

Jeff McDermid

THE showing of a current roistering western film called "Dakota," prompts this unreeling of a "post-view" glimpse of a raw and shrinking tenderfoot who helped "settle" the Trans-Missouri buffalo grass empire, but who returned to the Lake States without riding a cow pony or heating a branding iron.

This exclusive historical tidbit deserves no place in the archives of the border country but it remains a vivid memory to an erstwhile youth who dared to cross the range country wearing a blue serge suit, patent leather shoes, and an iron-crowned derby, the uniform of his high-school graduating class of 1907.

This questionable raiment for a pioneer was, however, somewhat counterbalanced by the stewardship of two large pine boxes, a fair-sized trunk, a yellow mongrel dog, and a bewildered and agitated mother. When the anxiety complex of the mother and the inexperience of the youth are added to the captious and erratic behavior of the dog, abroad in a far country, as well as the constant alarming signs of structural weakness and leakage in the baggage boxes, the net result spells suspense and adventure.

It is well to warn readers that there is nothing in this hegira or the establishment of forgotten facts which claims any competition with Dan Casement or other votaries of rangeland progress. I am reviving this romantic interlude for no other than pastime purposes, and the only distinctive thing about it is that one so green and callow should have survived the wrath of the wranglers or the lariats of the ranch hands whose short pastures were threatened by an unwelcome army of Midwest settlers—making the last great migration into the last remaining unplowed zone of the Great Plains.

IT all began in the summer of 1906, when the itch to assert his special privilege under the Homestead Act came to a retired Midwest farmer who had worn a blue uniform in the unpleasant debate of 1861-65. You may recall that old soldiers of the north had certain rights of eminent domain accorded them so that they might shorten their length of residence on newly opened lands upon "proving up" and payment of a nominal acreage fee.

The burden of some three score and six years did not deter this venturesome sand-land resident in his resolve to get title to a quarter-section of deep, rich, upland prairie, the kind of land his own father had passed up in 1845 while searching primarily for timber and water to make his homesite. This and the natural resistance of an active man against the rust of retirement combined to send him forth alone to file on his claim in Pennington County, South Dakota.

(Meanwhile I see by the papers that sundry U. S. Senators upon attainment of undisputed seniority at ages seventy to eighty are quarreling somewhat over the advisability of resigning. It's too bad that some of them cannot find some new and unlikely goal for their vestiges of vigor just as this Old Soldier of mine braved bachelor fare and drafty shacks to prove his faith in himself and America.)

Be that as it may, the good old G. I. of the Victorian era set forth without consulting his Grand Army post or without looking for cheap Government loans, and minus the advice of the Department of Agriculture, the Farm Security offices, or any resident county agents or local first-aid committees.

Of his exploits and privations in the west we heard but little as he was a slow hand with the pen, but with the coming of graduation week in a sticky humid June time, word reached us to rent the Midwest place and "fall in" for the westward ho in a hurry. This brings me back to the starting point, except to explain why the dog went too.

IT was intended to "farm out" the canine for a couple of years—a regretful decision to make after divers vacation days of comradeship and loyalty had practically given Major full rank in our humble outfit. He was a complex crossbreed, resembling a pug dog in front, a terrier in the middle, and a beagle behind. But on the night we boarded the Pioneer Limited Express for St. Paul and beyond, the dog escaped and arrived on the baggage platform in time to be checked with our emigrant luggage and placed in the car with the boxes.

For once the judgment of a lowly cur excelled that of the genus homo. If there ever was a time when the enthusiasm and inquisitive ardor of a worryless animal came in good stead against homesick boredom and anxiety, this was such an occasion. A kid on a claim in a virgin vastness, tumble weeds, and blowing prairie grass brushing the low clouds bending down to those high plateaus; no old chums to rally with, and some sickness in the shack—then indeed a dog's tagalong tendency made each long walk a happy one.

That he remained on the job until the end and then returned to his old posts and perquisites in the Midlands after all the papers were certified and the land was sold is a testimonial to his rugged nondescript constitution and his native loyalty. That he sleeps on his native heath with no fitting marker is evidence of man's forgetfulness.

All one can do to atone for such neglect of a friend is to remark with candor that some accepted friends since acquired over a span of seasons have fallen short of the unselfishness and honesty of this mongrel, whose bones have long since yielded lime and phosphate for the soil in which he dug so many gophers. Animals, they say, have no souls, but there is something left in the wake of good ones that "marches on" to beat Old John Brown at his darndest.

Well, taking dog and Ma and the household treasure out across the plains of Minnesota and eastern Dakota to Pierre in the gumbo valley was no great test or trial. The ruckus began at the muddy Missouri where a ferry was used to land our cargo on the west bank ready to take the new line of steel and slow motion halfway to the promised land. At Cottonwood there was a

break of over fifty miles of unfinished railroad. We slept for a night of expectancy in a rude frontier construction gang settlement and got our breakfast menu of sour-dough biscuits and bacon served at a sage-brush chow house. The dog and I relished this fare better than our frail mistress, whose courage was kept firm by the seeing and believing of things but scantily learned from Bret Harte's books or grade school geographies.

From here on I lose the trail of accurate remembrance of people's names encountered on this eventful journey west. Had I then possessed the talent for noting names, initials, and titles since acquired in news writing, the characters of those fresh acquaintances would be properly tagged to give them actual locale and proper credit. Maybe I really met some friend of Buffalo Bill or Constable Hickox, or some founder of Dakota destiny en route—but this fault is too late to rectify.

AT any rate, picture for yourself a gawky high school product arrayed in aforesaid unsuitable style, clutching a stiff derby in the wanton wind, traveling on the driver's seat of a regular old wild west stage-coach drawn by six horses. (I had seen one just once before that, during the thrills of a Cody cowboy and Indian classic on the county fairgrounds at home.)

The laconic and stoical rein-boss beside me was a veteran stage-coach Jehu. He had all the flair and feeling in his clothes and manner that I lacked. I was too dazed and excited to inquire his name. His chief and sole delight was to chew tobacco appetizingly and to warn me of possible trouble for passengers and plunder when we made sundry fords of the Teton or Bad river. It was a quicksand region, he advised, very treacherous and ticklish for old-timers and tenderfeet alike; and coaches burdened with baggage had been known to flounder to the bottom, with miraculous rescues common and frequent.

His unerring whip-lash leaped out in emphasis to flick a horn fly off the lead nigh horse's ear, and he answered my Indian warpath query by a sullen and guarded hint that there were six-shooters in the equipment but no special guard with Sharp's rifles to scan the horizon for feathered fiends.

I hasten to assure you that we made the fords safely—albeit a bit shaken and bounced about going down and coming up those steep banks of the Bad, on its meandering course through the dog-towns and draws. I counted four spoons and two salt-shakers missing from our battered boxes when we reached the junction point at evening; but Ma and the dog were right side up. They had shared the inside seats with a school ma'am and a feed salesman whose interest in each other kept the journey lively and romantic.

(*Turn to page* 50)

Profit on Mississippi Soils From One Ton of Potash Under Cotton

By C. Dale Hoover

Department of Agronomy, Mississippi State College, State College, Miss.

POTASH must be applied along with nitrogen and phosphate to most of the soils of the hill section of Mississippi and to soils in or near the foothills of the Yazoo-Mississippi Delta in order to obtain the most profitable yields of cotton, according to a summary of all cotton fertilizer analysis tests which have been conducted by the Mississippi Agricultural Experiment Station during the period 1925 to 1942.

Mississippi used an average of 10,087 tons of potash (K_2O) annually for the 6 years (July 1, 1937 to July 1, 1943), according to the records of the State Department of Agriculture. This tonnage is equivalent to 16,960 tons of 60 per cent muriate of potash, and represents an annual expenditure of $848,000 for potash in Mississippi, if 60 per cent muriate of potash is valued at $50 per ton.

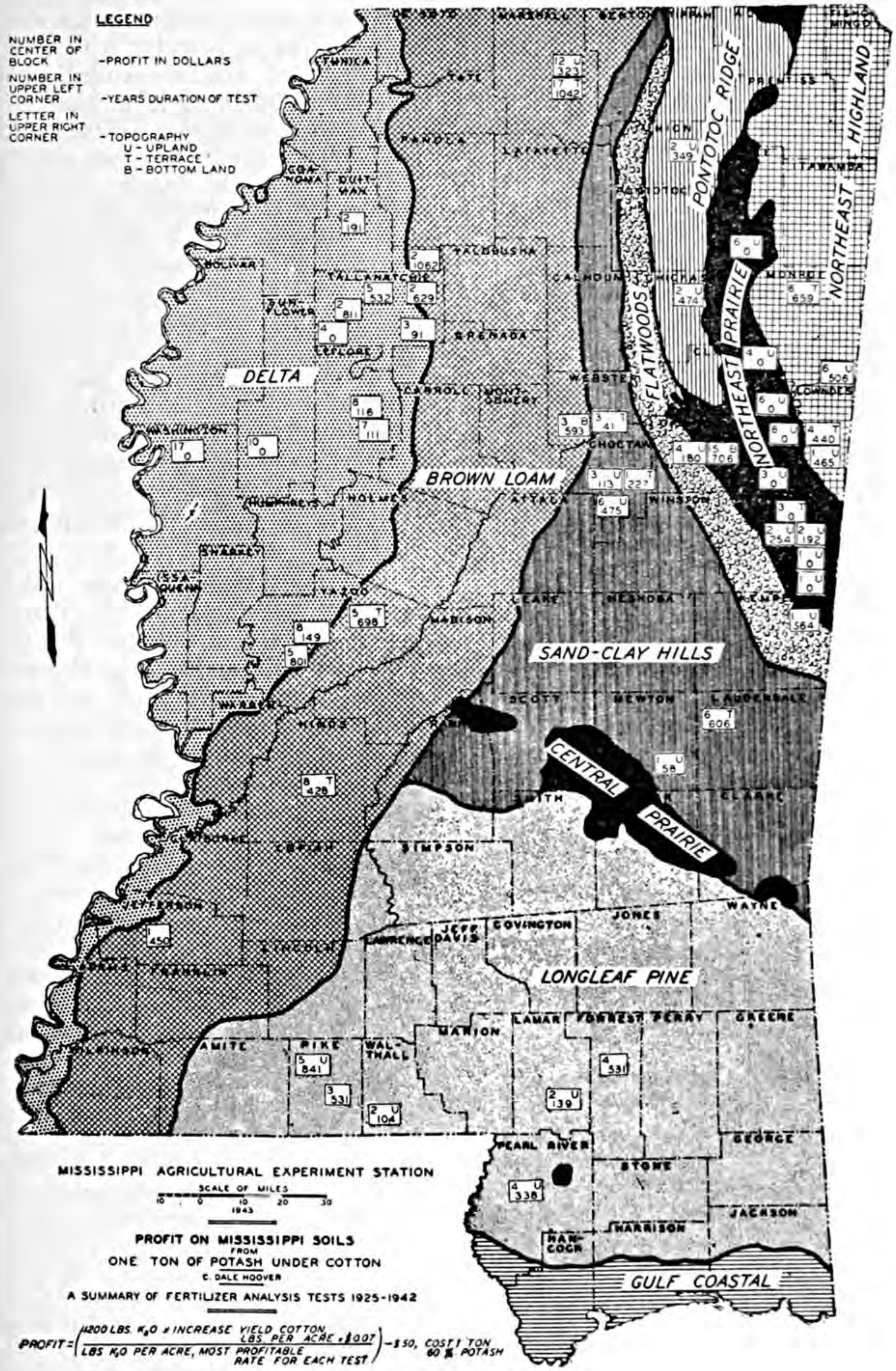
It is estimated that over 75 per cent of the potash purchased in Mississippi for the 6 years was used in the fertilization of cotton. Since such a large percentage of the total potash sold in the State is used under cotton, and since cotton is the major crop in this State, results of all fertilizer analysis tests with cotton have been summarized and profit from increased yields due to potash have been calculated for all of the tests. In all tests the response to potash has been obtained in conjunction with some standard rate of nitrogen and phosphate application.

Results of the various tests have been placed on a soils map of the State in order to obtain a better picture of the relative profit from the use of one ton of potash under cotton within and between the various soil areas. All of the data presented have been published in various bulletins and information sheets, but no summarization of them has ever been made. The map, therefore, shows not only the response of some of the soils of Mississippi, to potash, but presents a picture of the approximate location of every fertilizer analysis test conducted in Mississippi during the period 1925 to 1942. It also shows the length of time each test was carried out, and for the hill section it includes, where possible, the topography of the areas upon which the tests were conducted.

The large figures in the center of each block on the map give the profit in dollars from the use of one ton of 60 per cent muriate of potash when used at the rate found to be most economical for the test in question. According to the formula used to calculate profit, the increased yield of cotton due to the use of one ton of potash is valued at 7 cents per pound minus $50 (the cost of one ton of potash).

Method of Calculating Profit

As an example of how the profit was calculated, on the Central Station Farm at State College, the average increase for a 15-year period (1925-1939) from 600 pounds of 4-8-8 (8 units of potash) over 600 pounds of 4-8-0 (no potash) has been 432 pounds of seed cotton per acre. The average yields for the above treatments were 794 pounds from the 4-8-0 treatment and 1,226 pounds seed


LEGEND
NUMBER IN CENTER OF BLOCK - PROFIT IN DOLLARS
NUMBER IN UPPER LEFT CORNER - YEARS DURATION OF TEST
LETTER IN UPPER RIGHT CORNER - TOPOGRAPHY
U - UPLAND
T - TERRACE
B - BOTTOM LAND
DELTA
BROWN LOAM
PONTOTOC RIDGE
NORTHEAST HIGHLAND
NORTHEAST PRAIRIE
FLATWOODS
SAND-CLAY HILLS
CENTRAL PRAIRIE
LONGLEAF PINE
GULF COASTAL
N
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
SCALE OF MILES
10 0 10 20 30
1943
PROFIT ON MISSISSIPPI SOILS
FROM
ONE TON OF POTASH UNDER COTTON
C. DALE HOOVER
A SUMMARY OF FERTILIZER ANALYSIS TESTS 1925-1942
PROFIT = (1200 LBS. K2O x INCREASE YIELD COTTON LBS. PER ACRE x $.007 / LBS K2O PER ACRE, MOST PROFITABLE RATE FOR EACH TEST) - $50, COST 1 TON 60 % POTASH

cotton per acre from the 4-8-8 treatment. One ton of 60 per cent muriate of potash contains 1,200 pounds of potash expressed as K_2O; therefore 1,200 (2,000 x 60 per cent) is used in the formula. Since the average yield from 600 pounds of 4-8-12 was 1,248 pounds of seed cotton as compared to 1,226 pounds from the 4-8-8 treatment, the latter was considered the most economical rate of application of potash for this test. Six hundred pounds of 4-8-8 fertilizer contains 600 x 8 per cent (last figure in 4-8-8 fertilizer stands for the percentage potash as K_2O) or 48 pounds potash (K_2O) per acre. The number of acres one ton of 60 per cent potash will fertilize at the above rate is then determined by dividing 1,200 by 48, which gives 25. Then, 25 x 432 pounds seed cotton increase per acre equals 10,800 pounds seed cotton increase from 25 acres due to one ton of potash. If this increase is then multiplied by 7 cents (10,800 x 7 cents) and the cost of one ton of potash subtracted from the result ($756—$50), a profit of $706 is obtained, which corresponds to the figure in the center of the block for this test as shown on the map.

On those locations where increase from potash was less than 25 pounds of seed cotton per acre, potash was considered unprofitable, and for all such tests the profits is shown as 0. While fluctuations in the price of seed cotton, labor, ginning, and potash materials will affect the actual profit in dollars from the use of one ton of potash under cotton, the figures as presented give a rather accurate picture of the relative profit from the use of one ton of potash under cotton in the various sections of the State where tests have been conducted.

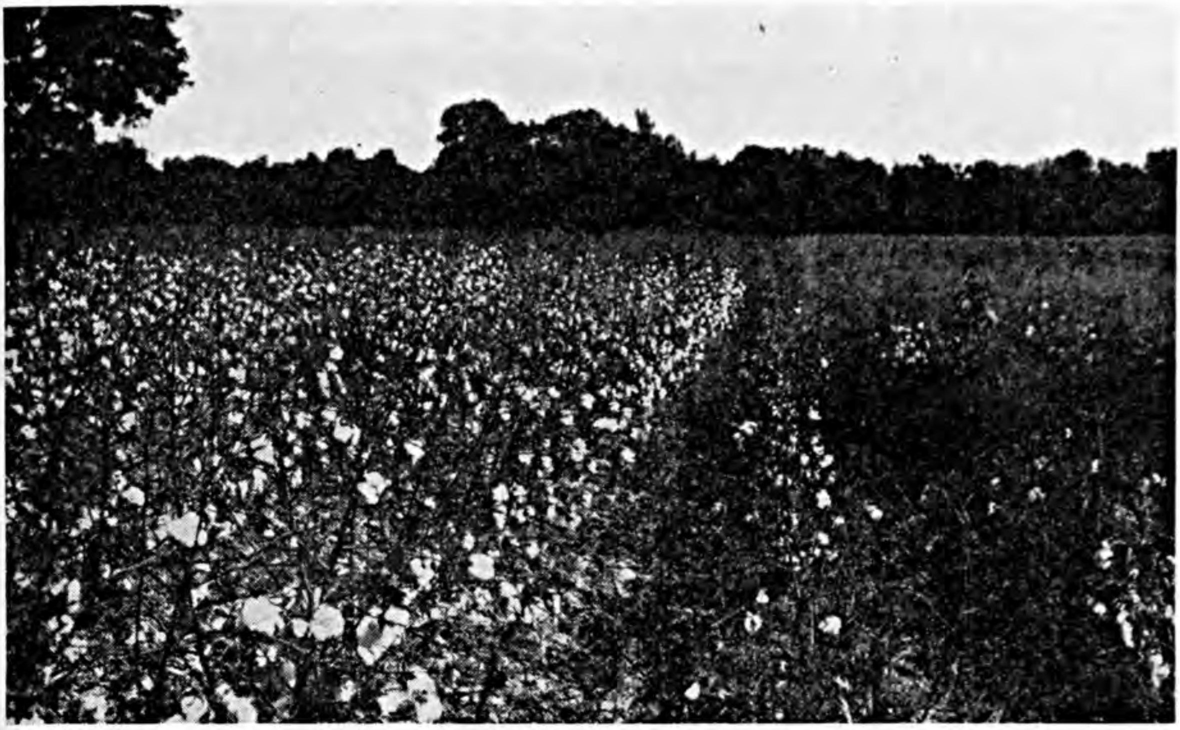
It should be pointed out that in some areas in which not more than 24 pounds of potash per acre, expressed as K_2O, are recommended for cotton (600 pounds of 4-8-4 or its potash equivalent), the profit from one ton of potash may be more than for other areas where higher rates of potash are recommended. This increased profit is due to a greater increase in the yield of seed cotton per pound of K_2O where the 24-pound rate is applied. No attempt has been made to obtain a reliable estimate of the average profit per ton of potash under cotton for the State as a whole, but a weighted average has been worked out for the profit from one ton of potash for the various soil areas based on the tests conducted within the respective areas.

As shown in the legend on the map, the number in the upper left-hand corner of each block indicates the years, duration of the test and the letter in the upper right-hand corner, wherever it occurs, indicates the topography upon which the test was located.

Response to Potash by Mississippi Soils

From the 11 analysis tests which have been conducted in the Yazoo-Mississippi Delta, it is evident that the response to potash has been obtained mainly in the eastern part, and that the long-time tests at Heathman and Stoneville have shown no response to potash. These data indicate, no doubt, that a response could be expected from potash under cotton on most of the soils near the foothills of the Delta. If the tests at Stoneville and Heathman are omitted and a weighted average, which gives more emphasis to results obtained over a long period of time than to those obtained over a short period, is calculated, the average profit from one ton of potash under cotton is $269.

The eight tests which have been conducted in the Brown Loam show that the terrace and bottomland soils are especially responsive to potash. It has been largely on the basis of these results that the ordinary fertilizer recommendations for cotton on upland soils of this area have been 4-8-4 or 6-8-4, while a 4-8-8 or a 6-8-8 has been recommended for terrace and bottom soils. A weighted average for the response to potash in this area shows a profit of $682 for the use of one ton

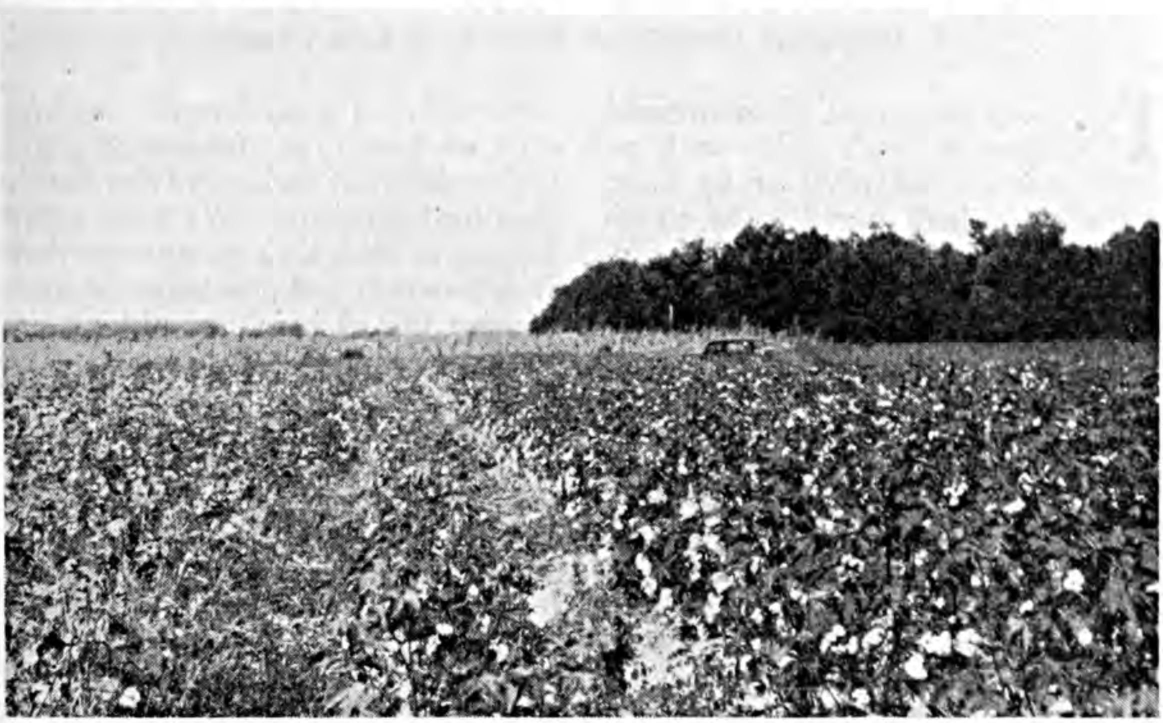


The cotton on the left was fertilized with nitrogen and potash; that on the right with nitrogen only. This is an example of a deficiency of potash with cotton on a soil in the foothills of the Yazoo-Mississippi Delta.

of 60 per cent muriate of potash under cotton.

From the six different locations at which tests have been conducted in the Longleaf Pine area, the response to potash has been considerably lower than the average figure for the Brown Loam. Considering the size of this area, there have been fewer tests conducted than for some of the other areas. The best estimate, however, which can be obtained from the tests which have been carried out shows the profit from one ton of potash under cotton to be $488.

(*Turn to page* 49)



The cotton on the left was fertilized with 600 pounds of 6-8-0 per acre; that on the right with 600 pounds of 6-8-8 per acre. Potash increased the yield of seed cotton 356 pounds per acre as an average for a period of five years.

Attachments for the placement of fertilizer on the furrow bottom can be mounted on most any make of plow. Here the equipment is mounted on a Ford Ferguson set of plows.

Plow-Sole Placed Plant Food For Better Crop Production

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

THE deep placement of commercial fertilizers in bands either with an attachment on the plow or by other methods has been found to be an effective, efficient, and safe way of supplying large amounts of plant-food nutrients for corn and certain other crops.

An application of from 700 to 800 pounds of 8-8-8 per acre supplies approximately the same amount of plant food as is contained in six to seven loads of reinforced barnyard manure. (By reinforced, we mean manure to which from 20 to 30 pounds of 20% superphosphate have been added to each ton.) The reinforcing of manure with superphosphate is a practice that has been recommended by experiment station authorities for many years.

Manure is a good fertilizer and for years we have urged farmers to guard against the waste and loss of its valuable plant-food nutrients. We have urged farmers to haul their manure to their fields promptly and thus make the most effective use of it in replenishing the productiveness of their cropland. The fertilizer value of all manures produced annually by Wisconsin livestock is said to amount to $100,000,000. However, losses of nutrients, due to careless and wasteful methods of handling, amount to some 35 to 40 million dollars each year. As an offset to the annual losses incurred in the feeding transaction plus those losses sustained in the handling of manures, our Wisconsin farmers are now buying and applying some 250,000 tons of commercial fertilizers. (Losses of nitrogen in manure are partly offset by gains from the growing of legumes.) But even 250,000 tons of commercial plant food, presently used by Wisconsin farmers and costing some eight million dollars, fall far short of balancing our soil fertility budget. And so it does appear that the feeding of crops to livestock and the return of the manure produced to our soils have not maintained the productiveness of Wisconsin farm land. The very fact that losses of plant food in a livestock system of farming are high and that these losses have been going on for many years is the reason why our soils are running so low in their reserves of available phosphorus and potash and why our crops are responding so generously to fertilizer treatment.

A Fertility Program

For many years we have been recommending a fertility program about as follows: The liming of every acre of acid soil on the farm and the application of from 200 to 300 pounds per acre of a phosphate or phosphate-potash fertilizer such as 0-20-0, 0-20-10, or 0-20-20 at the time of seeding down. For corn in the rotation, we have advised the application of 100 to 150 pounds per acre of 3-18-9 or 3-12-12 fertilizer in the hill or row as a supplement to stable manure. In my judgment, this is a well-rounded soil fertility program.

But this program in Wisconsin is just now getting under way. There are thousands of acres of land planted to corn and other crops every year where manure is not available and where no commercial fertilizer has ever been used in the grain-hay-corn rotation. And so I ask the question, "Why not give our farmers a commercial substitute for manure?" The fertilizer grade, 8-8-8, is the chemist's answer to the farmers' demand for a well-balanced plant food and, where plowed under with crop residues or green manure and placed in bands at a depth of from six to eight inches by any means which the agricultural engineer has yet devised or may be able to design, comes about as close to the plowing under of manure as anything we have yet conceived.

Most of us agree that manure reinforced with phosphate is an ideal fertilizer for corn and for many other nonleguminous crops where grown on average upland mineral soils. Most farmers plow their manure under for corn. What is wrong with plowing under 8-8-8 as a substitute for stable manure? Certainly we wouldn't suggest removing part of the nitrogen or potash from manure in order to make it a 1-2-1 ratio. Therefore, why isn't the 8-8-8 or similar 1-1-1 ratios a legitimate fertilizer to use for corn on highland mineral soils where manure is not available.

It is true the 8-8-8 grade does not meet the requirements of all crops on all types of soils. The N-P-K ratio must be adjusted to meet varying situations. On the dark-colored organic soils we should use relatively more potash and less nitrogen. For such special crops as sugar beets, potatoes, cabbage, carrots, and tobacco which have high potash requirements, we suggest mixtures with relatively more K_2O. In Wisconsin, we have included a 6-6-18 grade on our recommended list to meet the requirements of these special crops where heavy applications of commercial fertilizers are used as a substitute for manure.

We, of course, recognize the fact that manure is a source not only of plant-food nutrients, but of organic material. It takes a ton of reinforced (phosphated) manure to supply the equivalent amount of plant food contained in 100 pounds of a 10-10-10 fertilizer. It is true the organic matter supplied in a ton of manure does add to its value and gives manure an advantage over commercial plant foods.

Where these heavy applications of commercial fertilizers are plowed under or applied on the plow-sole or placed at depths of from six to eight inches by other devices, best results are usually secured where the soil is supplied with plenty of organic matter and is in a good state of tilth. The plowing under of crop residues or second crop clover and the building up of the humus and organic-matter content of the soil permit such soils to "breathe." Thus organic matter in the form of crop residues and green manures incorporated with our soils does to some extent compensate for the organic matter factor and the superior results attributed to manure.

This matter of soil ventilation and aeration is important. Dr. G. N. Hoffer in articles which appeared last year in Better Crops with Plant Food under the titles, "Fertilized Corn Plants Require Well-Ventilated Soils," and "Some Whys and Wherefores For Air-Conditioning Soils" (now available through the American Potash Institute as reprints A-1-45 and G-2-45) explains in clear and understandable language the reasons why some farmers have failed to see response from the application of large amounts of high-nitrogen fertilizers on wet or poorly aerated soils.

"Negative response or poor results," says Dr. Hoffer, "occur mostly in heavy-textured soil either because of poor drainage facilities or because the tilth or porosity of the soil has deteriorated due to a depletion of the organic matter. The growing roots of corn, need free oxygen." We, therefore, caution against the plowing under of high-nitrogen fertilizers on those heavy-textured soils where organic matter has been depleted and where compaction has resulted from plowing a heavy soil when too wet. We know, however, that crop rotation and the plowing under of organic residues will keep our soils open and well aerated. The application of stable manure helps to accomplish this.

Certainly in any good system of soil and crop management, farmers should rotate their crops. And again I say that the regular and systematic use of phosphate-potash fertilizers should be a part of every Wisconsin farmer's program of soil-building. We urge the application of from 200 to 500 pounds of 0-20-10 or 0-20-20 per acre at the time of seeding down. Where such practices are followed and legumes are grown and fed on the farm and where all the manure produced is carefully preserved and returned to the cultivated fields, there isn't much place on such farms for plow-sole fertilizing. An application of from 100 to 200 pounds of starter fertilizer per acre applied with an attachment on the corn planter is about as far as I would go in my recom-

An 8-8 8 fertilizer applied at 800 pounds per acre on the plow-sole increased the yield of silage corn by eight tons per acre on the farm of Alwin Williams, Marshfield, Wisconsin. (Spencer silt loam).

mendations on such farms. In other words, if we have built up the level of fertility on our farms to a point where we can normally expect 60 to 70 bushels of corn per acre, there is less need for plow-sole fertilizing, at least for the corn crop.

But we know that this high state of fertility does not exist on very many fields of the average Wisconsin farm. There are hundreds of thousands of acres of corn every year that are making less than 40 bushels per acre. The average yield of corn in Wisconsin for 1945 was 40 bushels, and while on the one hand there were many thousands of acres that made yields of 70, 80, and 90 bushels per acre, those high yields are brought down to the 40-bushel level when averaged in with the thousands of acres of corn that made from 20 to 40 bushels per acre.

What should we as agronomists tell those farmers who are growing corn on fields that make less than 40 bushels per acre? Should we tell them to wait until they have limed and fertilized every acre of their cultivated cropland and have gone through two or three crop rotations in a long-time, soil-building program? Or, should we tell them about a short cut to high yields through the liberal use of commercial plant foods? The smart farmer isn't going to wait for 10 years to arrive at this 65-bushel-per-acre level of fertility. He is going to take the short cut and get his fields into high production now. We know, too, that the residual effect of fertilizers applied at rates of 700 to 800 pounds per acre will more quickly enable the farmer to achieve better crops of grain and legumes in the rotation.

Residual Effects

Right here is a good place to discuss this matter of residual effect of plow-sole fertilizer. Just how much residual carry-over can be expected from, let's say, an application of 800 pounds of 8-8-8 to the corn crop. In 800 pounds of 8-8-8 we are supplying 64 pounds each of nitrogen, phosphoric acid (P_2O_5), and potash (K_2O). The chemist tells us that a 75-bushel crop of corn (grain, fodder, and cobs) requires approximately 120 pounds of nitrogen, 42 pounds of phosphoric acid (P_2O_5), and 80 pounds of potash (K_2O). Where the corn crop is grown on rather low fertility soil (a field that in southern Wisconsin would only make 30 or 40 bushels per acre) we can assume that most of the nitrogen applied in this 800 pounds of 8-8-8 will have been used up the first year. But, I think it is safe to say that one-half of the 64 pounds of phosphate and potash is left as an unused residue, and therefore becomes a residual to succeeding crops. If this is true, then there is actually a carry-over of 32 pounds each of P_2O_5 and K_2O which is equivalent to 150 pounds of 0-20-20. This isn't a large carry-over but it is at least comparable to the residual carry-over from a 300-pound application of 0-20-20 applied to grain and legume seedings. And we have talked for years about the residual benefits to clover and alfalfa from applications of 300 pounds of fertilizer used at the time of seeding down. We show in our experimental records increases of a ton or more clover or alfalfa due to this residual effect.

You will immediately ask, "Why use this excess of phosphate and potash on corn?" My answer is: "Let's play safe and be sure that we are supplying adequate amounts of all plant-food nutrients." The maturity factor of corn must be reckoned with, too. We know that phosphorus backed up with adequate supplies of potash does push maturity. Furthermore, I do not think we should quibble about a little excess of phosphate or potash that we leave in our soil when for 30 years we have all been preaching the doctrine of building up the reserves of these mineral elements in our soils.

I would advise a farmer to apply from 150 to 200 pounds of a 0-20-10, 0-20-20, 3-12-12, or 4-12-8 per acre on small grain and legume seedings the year following corn even where he plow-soled from 800 to 1,000 pounds of 8-8-8 the previous year. This fertilizer for grain, where drilled with the seed, is just as much needed as the starter fertilizer we have advised for corn as a supplement to manure or plow-sole treatment. I am suggesting to farmers that they plow somewhat shallower for grain following plow-sole or plow-under fertilizer on corn. We thus leave the residual banded fertilizer on the furrow bottom where again it is in a most advantageous relationship to moisture supplies and the feeding roots of both grain and legumes.

In connection with the residual effect of fertilizer applied on the plow-sole, I quote from a letter recently received from County Agent John Zahorik, Alma, Wisconsin. "Last year," he writes, "we tried some plowing under of 8-8-8 at 600 pounds per acre. The field was sown to oats this spring and seeded down. One could see the difference in the strip that had the residual carry-over. The grass seeded down, mostly clover, was way up in the bundles and when the grain was shocked, one could see the difference in the grass stand as far as the eye could see."

But again I am not making any great claims for this residual carry-over. I am thinking about maximum yields of ripe corn, and I shall stick to the 8-8-8 or similar 1-1-1 ratios for corn on high-land mineral soils and shall continue to recommend it to farmers as a substitute for manure.

The question is frequently asked by farmers, "What about plow-sole fertilizers for small grain and legume seedings?" And again I tell them that on low fertility fields and where larger than the usual 200- to 300-pound applications of fertilizer are warranted, this plow-sole method may be found advantageous. A demonstration on alfalfa previously reported by the writer in Better Crops with Plant Food was checked again in 1945 and yield data were taken on the second-year alfalfa crop. The striking differences in the yields were repeated. (See Table 1.)

A report on similar trials with plow-under fertilizer for alfalfa is reported by Dr. A. R. Midgley, Research Agronomist of the Vermont Agricultural Experiment Station. His report was summarized in the Potash News Letter of October 1945, as follows: "While two years of work on two soil types favored shallow placement of fertilizer for alfalfa (possibly due to the greater amount of rainfall in 1943 as compared to 1944) plowing under of fertilizer has given greater response during the third year with more vigorous alfalfa and promise of greater longevity. There was a marked advantage in applying fertilizer with manure rather than spreading each separately. In new seedings of alfalfa in oats, when both 400 and 800 pounds of 3-12-6 fertilizer were used, there was a marked advantage in applying fertilizer on the bottom of the furrow, and the next best result was obtained by drilling the fertilizer on top of the soil before plowing. Both methods were superior to the broadcast application after plowing."

TABLE 1.—RESULTS OF PLOW-SOLE FERTILIZER ON GRAIN AND HAY

Name and address of co-operator and soil type	Treatment and how applied	Yield of grain 1943	Yield of hay 1944	Yield of hay 1945	Value of increase grain & hay	Cost of fertilizer	Profit over cost of fertilizer
Edwin Klahn, DeForest Carrington Silt Loam	450# 0-20-0 on plow-sole	55.7 bu.	(alfalfa) 4275#	No	yield	data	for 1945
	450# 0-20-20 on plow-sole	81.8 bu.	(alfalfa) 4750#	7700#	$66.57	$11.37	$55.20
	No fertilizer	49.8 bu.	(alfalfa) 2925#	5250#			

(Hay yields for 1944 and 1945 represent two cuttings.)

Rutabagas respond amazingly to plow-sole fertilizer treatment on the Harold Wymore farm at Ashland, Wisconsin. (Superior red clay). The yield on the plot receiving 800 pounds of 8-8-8 per acre on the plow-sole plus 300 pounds of 3-12-12 (applied broadcast after plowing) was 9.62 tons per acre. The plot receiving 300 pounds of 3-12-12 only (applied broadcast after plowing) yielded 5.08 tons per acre.

The advantages of deep placement of commercial plant food have been repeated over and over again in the numerous articles that have appeared in recent years in the farm press and the advertising leaflets put out by farm implement and fertilizer manufacturers. We need not repeat them here except to point out that the banding of the fertilizer on the furrow bottom does show a distinct advantage over broadcasting and plowing under since phosphate fixation is reduced to a minimum and the availability of all plant-food nutrients is enhanced by improved moisture relationships. Dr. George D. Scarseth and his associates in Bulletin 482, "How to Fertilize Corn Effectively in Indiana," have presented convincing evidence on this point. Increases in the yield of corn due to banding on the plow-sole versus broadcast and subsequent plow-under show gains of 10 to 14 bushels in favor of plow-sole banding. Nevertheless it is true that farmers will get good results even where the fertilizer is broadcast first and then plowed under.

The large farm operator has complained that application with the attachment on the plow slows down his operations. But it is also true that it takes time to apply the fertilizer in a separate operation. We do recognize the fact that plowing is an operation that must be done during relatively short periods in the spring or fall and even then, only when the land is fit to plow.

The problem of getting this 8-8-8 fertilizer down deep in the soil and still keep it in bands to thus avoid fixation of the phosphate was tackled by a large operator in Illinois in 1945, Claude W. Thorp and his son Carl of Clinton, Illinois, who were sold on the deep-placement idea and the banding of the fertilizer. They had previously used the conventional plow-sole attachment for plows and had done a little experimenting themselves by the way of comparing broadcast before and after plowing versus the plow-sole method. In their large operations (120 tons of 8-8-8 applied in 1945) the plow-sole method as followed in 1944 was too slow. So after talking the matter over with R. H. Wileman, Agricultural Engineer at Purdue University, Carl

Thorp and his father proceeded to design a machine that would get this fertilizer down to a depth of seven or eight inches and still keep it in bands. Professor Wileman had a hand in the design of the first attachments made for plows and was already working on this new idea when the Thorps interviewed him last spring. The machine they designed is simple—a fertilizer hopper with positive feed, mounted on a field cultivator. The spring tooth shovels of the field cultivator open the furrows, and the fertilizer tubes deliver the plant food to a special heel back of these cultivator shovels at the desired depth and place it in bands 9 or 18 inches apart. This machine permits the application of fertilizer after the land has been plowed and disced. A more complete description of this improvised machine was presented in an article by E. W. Nordlinger, Crops Editor for the Food Packer magazine, in the January issue of Better Crops With Plant Food.

The small farmer, however, will continue to use the regular attachment for his plow. More and more farmers in Wisconsin are applying their fertilizer in the fall when time is not such an important element as when all the plowing and fertilizing are left until spring.

Results of Demonstrations in 1945

In 1945 a total of some 50 or 60 plow-sole fertilizer demonstrations were conducted. Many of these demonstration plots were set up directly by county agents. The results in 1945 ranged from poor to outstanding. A wider range of crops was used in our 1945 test plots than in previous years. The results on corn were much the same as reported in previous years—1942, 43, and 44. Increases in yields due to plow-sole treatment ranged from 10 to 40 bushels per acre. My observations this past year coincide with those of previous years, namely, that on fields where the fertility level is above average or high you will not see any marked response to fertilizer treatment. On those fields where the fertility level is low and where manure is not available, profitable returns can be expected.

A number of trials were carried out on potatoes, sugar beets, rutabagas, and sweet corn. The results of a selected

(*Turn to page* 39)

O. D. Brace and Son, Janesville, Wisconsin, cooperated in a plow-sole demonstration on corn in 1945. The large field selected (Miami silt loam) received a light application of manure. The response to fertilizer treatment was: No fertilizer—27.6 bu. per acre; 2-12-6 at 125 lbs. per acre in hill—35.1 bu. per acre; 2-12-6 at 125 lbs. in hill plus 825 lbs. 8-8-8 on plow-sole 55.6 bu. per acre.

Fig. 1. Lettuce grown from seed. Without borax, left, the seedlings turned yellow and completely died when less than two inches high. With borax, right, excellent growth was obtained.

Boron Deficiency of Lettuce

By A. R. Midgley and D. E. Dunklee

Vermont Agricultural Experiment Station, Burlington, Vermont

A YELLOWING of lettuce heads has been observed in some Vermont gardens for at least five years, but it has probably occurred for a much longer period. The yellowed lettuce rotted in the center of the head and then died instead of producing a seed head in the normal way. Occasionally this trouble produced a 20 per cent loss of the crop. On one occasion, a truck gardener failed to harvest a single marketable head because of this trouble. These deficiency symptoms have appeared in both head and loose-head varieties.

The writers have suspected for a long time that the yellowing was often caused by a boron deficiency, but were unable to prove it. However, they have reported a marked growth response from use of boron on lettuce (2) and alfalfa (1).

The present experiments were conducted in the greenhouse and in the field. Pots, most of them holding a bushel or more of soil, were used. Some of the pots used were barrel-sized metal ash cans, 18 inches in diameter and 2 feet deep, with holes in the bottom for drainage. Large asphalt-painted wooden boxes were also used. Some pots were sunk in the ground, while others were not.

A soil known to have a high capacity to fix boron was purposely used in this study, because it produces severe boron-deficiency symptoms in spite of possible contamination from containers or from impurities in water and the ordinary commercial fertilizers used. Thus, deficiency symptoms could be easily produced and studied. Sand cultures were purposely avoided because they are artificial and because it is more difficult to obtain severe boron deficiencies on sand.

The soil used was obtained from Breadloaf, Vermont, where a high boron-fixing organic soil is found near the highway in large enough quantities to be obtained by the truckload. This soil is essentially the heavily leached A horizon of a podzol soil. When limed to neutrality, it soil fixes considerable amounts of boron out of reach of crops. The organic matter in it functions somewhat like organic zeolites in absorbing cations and anions similar to certain water softeners. This soil organic matter seems to be activated into hanging onto boron and thus decreasing its availability to plants when heavily limed.

The soil in all pots was limed to approximately neutrality with ordinary ground limestone and then fertilized with an ordinary 8-16-16 commercial fertilizer at 1,000 pounds per acre. Epsom salt was added at a rate of 200 pounds per acre to supply magnesium. The amount of fertilizer required was calculated for all of the soil and mixed with it. Except for boron, all pots were limed and fertilized exactly alike.

Fig. 2. A boron-deficient lettuce plant affected with yellow heart. The leaves forming the center of the head were abnormally butter yellow in color, whereas the outer ring of leaves remained healthy and green. A normal head at this age was all green.

Borax was added to some pots at the rate of 100 pounds per acre. This rate has been found necessary for good growth on this high boron-fixing soil. Other pots were left entirely without borax. Still others received from two to eight pounds per acre to moderate the severe boron deficiencies expected.

Lettuce of Hansen variety was used in these experiments because it is known to be readily susceptible to the trouble being studied. Some pots were planted with lettuce seed. In others, transplants from two to six inches high were placed in this soil in order to cut off their supply of boron. This allowed one to study boron-deficiency symptoms at different stages of growth. Transplants were grown in the greenhouse and only healthy, normal plants were used. In all comparisons, only transplants of equal size and character were used.

Death of Seedlings. When lettuce seed was planted on this soil which received no borax, most of the seedlings were so lacking in vigor they soon died (Fig. 1). Some plants which grew about two inches high soon turned straw or bronze color and finally died. Bronzing of leaves is often a symptom of boron deficiency in lettuce, although it probably does not occur as frequently in the field as yellowing. Normal plants were produced on soil receiving borax.

A number of trials have shown that it was impossible to produce sizeable plants without boron when seeds were planted on this soil. It was necessary, therefore, to apply a small amount of boron to moderate the deficiency or to transplant seedlings from normal soil, after they reached the desired stage of growth.

Yellow Heart or Yellows. Plants grown from seed on this soil

Fig. 3. Lettuce transplants of the same age. without borax, left; with borax, right. The boron-deficient plant was affected with both multiple branching and rosette due to death of the first growing point and of subsequent growing points. Lack of borax prevented further growth.

with a small but inadequate amount of boron produced small heads with leaves of butter yellow instead of the normal green color (Fig. 2). The outer leaves usually remained a healthy green, but the portion of the head affected with yellowing usually rotted later on.

Rotten Heads. As the trouble progressed, some of the boron-deficient heads became brown or black with a slimy rot. Sometimes heads were rotten in the center only, with green leaves around the periphery; at other times the whole head rotted. The slimy stage is undoubtedly due to an invasion of secondary microorganisms after the central growing portion had become weakened from lack of boron. The kind of invading organisms was not determined.

Dieback. Marked dieback was obtained when transplants were grown without borax. One or more growing tips of the plant died, the number depending on the age of the plant at the time when the deficiency stopped the growth. Dieback was sometimes obtained before the head was formed, at other times when the lettuce was six inches high, and at different stages up until the formation of seed (Fig. 3). When dieback overtook the plant in the early head stage, heart-rot resulted, but if insufficient boron was available late in life, the resulting plant looked as though its seed branches had been cut off and the wounds had become infected, as they had a slimy appearance (Fig. 4). Borax fully prevented the dieback of lettuce at whatever stage it occurred. Dieback has been found frequently in Vermont gardens, often without other symptoms of boron deficiency being present.

Rosette. Plants grown without borax occasionally formed "rosettes." In such plants there is an excessive leafy growth with shortened spaces (internodes) on the stalk between the leaves. This did not occur in plants receiving borax.

Multiple Branching or "Witches Broom." In plants without borax, a burst of growth frequently followed dieback and the lettuce took on a broom-like appearance, looking like a whisk broom standing on its handle. The excess branches grew for various lengths of time before dieback also overtook them. There was no multiple branching on plants receiving borax. This multiple branching has been recognized quite frequently in gardens and it is often associated with yellowing and yellow heart. Sufficient boron has corrected these conditions.

Lack of Seed. Viable seed was seldom produced on plants receiving no borax, but with it a good yield was obtained. This is similar to many other plants in this respect. Lack of seed production is quite characteristic of boron deficiency and is frequently seen in the field without any other sign of a need for borax being present.

Knotted Roots. Lack of boron caused the roots of boron-deficient plants to become brown, knotted, and dwarfed in varying degrees. Such roots had a brown, seared appearance as compared with roots of boron-fed plants, which were white and vigorous.

Chemical Analysis. An attempt was made to see if boron deficiency of lettuce could be diagnosed by chemical analysis of the leaves. Yellow leaves taken from boron-deficient plants in the field were compared with leaves from healthy plants on a dry weight basis. Six analyses of healthy plants and six of boron-deficient plants were made. Leaves of healthy plants contained 35 parts per million of boron. Yellow leaves from boron-deficient plants contained 14 to 28 parts per million of boron. Thus, it is quite easy to detect boron deficiency of lettuce by chemical analysis. However, there may be borderline cases in which chemical analysis would not be reliable.

Fig. 4. Lettuce grown from small transplants. No borax, left; with borax, right. Boron deficiencies here are dieback, as indicated by black, rotten tissue where the branches emerge, and multiple branching, as shown by the three branches. Compare with the single stalk on the boron-fed plant. The boron-fed plant is normal except that it was slightly wilted and dry when the picture was taken.

Discussion

Other investigators have recognized that lettuce needs boron (3), (4), (5), (6). Apparently few, however, have suspected how numerous and diverse the symptoms of boron deficiency are. When grown under similar circumstances, lettuce exhibits symptoms of boron deficiency that are similar to those seen in alfalfa and some other plants.

Many phases of boron deficiency in lettuce have been obtained. In these experiments, lack of boron overtook lettuce plants at many stages in their development. Sometimes the phases occurred singly; sometimes several occurred in the same plant.

From these experiments the authors conclude that the yellowing and dying of lettuce plants in many Vermont gardens is due to a deficiency of boron (Fig. 5). The need for borax in fertilizers used for growing lettuce in Vermont is thus indicated. How widespread the need is for using boron on lettuce grown elsewhere is not known.

Just what rate of borax should be used in fertilizers for lettuce is not well established, although present evidence indicates that, in general, lettuce will tolerate *broadcast* applications of borax up to at least 30 pounds per acre in Vermont. However, 20 pounds per acre may be nearer the correct rate on some soils. Such an amount would probably last for several years. The borax should be broadcast and then harrowed into the soil. Attempts have been made to supply borax to plants in the garden showing symptoms of boron deficiency by spraying or watering. This is helpful only if applied while plants are young because if the growing points or heads are weakened, they are more susceptible to rot organisms. Preventing boron deficiency of lettuce plants by using borax in the fertilizer seems to be much more effective than attempting to cure it after symptoms appear.

It is probable that fertilizers con-

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Fig. 1. Corn on June 14, 40 days after planting. Plants in left row received 50 pounds of potash per acre at planting. Those in right row received none and are starved for potash.

Correcting Potash Deficiency in Growing Corn

(A popular version of Circular 93 of the Tennessee Agricultural Experiment Station)

By John B. Washko

Agronomy Department, University of Tennessee, Knoxville, Tennessee

THAT legumes as a group are heavy feeders on potash and that large amounts of this nutrient are removed from the soil when legumes are harvested are facts often overlooked. Under conditions where the legumes are harvested for hay and continue to be removed from the land, the potash supply in the soil is eventually depleted. Unless replenished by the use of potash salts, commercial fertilizer, or barnyard manure, potash then becomes a limiting factor in the growth of the crop to follow. This usually is corn, since it commonly follows legumes in the rotation.

If the supply of available potash in the soil becomes so low as to fail to meet the plant requirements for normal growth, the corn develops characteristic potash-deficiency symptoms. In young plants the symptoms are a stunted growth and a yellowish-green or yellow discoloration of the leaves. Frequently, the leaves are streaked with yellow or their edges and tips are dry and appear scorched or fired (Fig. 1).

The symptoms are similar in older plants, but the marginal browning of the leaves is more conspicuous. When the deficiency is pronounced, the plants are dwarfed and weak and frequently lodge (Figs. 2, 3, and 4), and are an easy prey to disease organisms. Obviously the grain production of such plants is low. If ears are produced, they may be only nubbins with grain of poor quality (Figs. 5, 6, and 7).

Fig. 2. Corn on August 11, 98 days after planting. Plants on left are suffering from lack of potash. Plants on right received 25 pounds of potash per acre on June 14, 40 days after planting.

During the course of an investigation comparing different phosphates on several soils in East Tennessee, a series of plots was placed on a soil which brought out the relationship as outlined. This field had been in Korean lespedeza for the preceding two crop years. Indications were that it had previously been "cropped hard." When it was planted to corn in 1944 severe potash-deficiency symptoms developed on this crop, as illustrated by figure 1. The only fertilization applied to the corn was 100 pounds per acre of a 20-percent superphosphate in the row at the time of planting. The soil was a Fullerton cherty silt loam and showed considerable variability within the field. Soil samples obtained in this field tested very low in potash.

When potash starvation is detected in corn, as in this instance, the application of a potash salt is recommended. Information has been lacking, however, as to the amount to use—in particular for potash-starved corn at different stages of maturity.

Since an unusual opportunity to study this problem was presented in this field, three potash-fertilization tests were put out, each on a different date. The rates of potash applied were as follows: 0, 25, 50, and 100 pounds per acre. Nitrogen in the form of ammonium

Fig. 3. Corn on August 11, 98 days after planting. Plants on left received no potash. Those on right received 50 pounds of potash per acre 40 days after planting.

Fig. 4. Corn on August 11, 98 days after planting. Plants on left received 100 pounds of K_2O per acre 40 days after planting. Those on right received none.

Fig. 5. Plot yields of corn fertilized with potash June 14, 40 days after planting. Left to right: 0, 25, 50, and 100 pounds of potash per acre.

Fig. 6. Plot yields of corn fertilized with potash July 3, 59 days after planting. Left to right: 0, 25, 50, and 100 pounds of potash per acre.

Fig. 7. Plot yields of corn fertilized with potash July 17, 73 days after planting. Left to right: 0, 25, 50, and 100 pounds of potash per acre.

nitrate was applied to all plots at the rate of 30 pounds of nitrogen per acre, so that this element would not be a limiting factor in plant growth. The fertilizer materials were applied by hand in small furrows along the corn rows approximately 2 inches deep and 2 to 3 inches away from the plants, and then covered. The first test was put out June 14; the second, July 3; and the third, July 17—40, 59, and 73 days respectively after corn planting. These fertilizer applications were made during a period of one of the most severe drouths in Tennessee history. June had only .20 inch of rainfall and July 1.40 inches.

Despite the dry weather, the potash-starved corn responded to potash fertilization. The corn fertilized June 14, 40 days after planting, showed the greatest improvement and produced the highest yields; the second date of application, July 3, 59 days after planting, was next best; and the third date, July 17, or 73 days after planting, was poorest. This last application, while giving some correction of potash deficiency, was too late for good results.

An application of 25 pounds of potash per acre resulted in a marked improvement in the corn plants, as indicated by figure 2. When compared with the untreated plots, this rate increased yields of shelled corn 12.2 bushels, 12.7 bushels, and 3.0 bushels per acre when applied 40, 59, and 73 days respectively after corn planting, as shown by table 1. Increasing the rate of potash to 50 pounds per acre resulted in a further increase of 12 bushels per acre over the 25-pound rate only when applied 40 days after planting. At the second and third dates of application, the 50-pound rate produced approximately the

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Secretary Clinton P. Anderson of the U. S. Department of Agriculture presents the deed to "Thank You Farm" to Corporal Atkins, who is wearing the Congressional Medal of Honor.

"Thank You Farm"

By T. S. Buie

Regional Conservator, Southeastern Region, Soil Conservation Service, Spartanburg, South Carolina

IN the Caraballo Mountains of Luzon 24-year-old Corporal Thomas Eugene Atkins helped to defeat one enemy of his country. That happened last March 10 when he held an outpost foxhole against repeated, savage thrusts by the Japanese, slew 44 of them, and won the Congressional Medal of Honor.

Near his beloved Blue Ridge Mountains in northern Spartanburg County, South Carolina, Farmer Thomas Eugene Atkins has started another fight against an enemy of his country. This time, like thousands of other farmers, he is fighting soil erosion in a battle less spectacular but no less important than the one against foreign aggression.

Between March 10, when Atkins lay with a bullet-shattered hip in a foxhole, two dead buddies beside him, and fired at the enemy until he had burned out three rifles, and November 14 when he took over a 62-acre farm, there happened an event as typically American as the 24-year-old hero's courage.

To Gene Atkins it is a fairy story that came true. This slender, soft-spoken man is a sharecropper's son, and a sharecropper's life seemed in store for him when he returned from the Pacific.

But the people of Spartanburg County were grateful to Gene for what he did as a member of the famous 32nd (Red Arrow) Infantry Division. Led by the country doctor who had been family physician to the Atkinses for two decades, by a village banker, and the wide-awake publisher of the Spartanburg Herald-Journal, the friends and neighbors of the war hero bought a farm and built a Mt. Vernon style cottage on it for Gene and his bride. It is called "Thank You Farm."

When Secretary of Agriculture Clinton P. Anderson came to Spartanburg County November 14 to present the deed to Gene, more than 1,500 persons packed the Gramling School auditorium in spite of cold, rainy weather.

It was a program that honored Gene and the other service men from the county who had helped to save the Nation from foreign foes. But it was also a program that pointed to the battle at home for the land—the battle against soil erosion and soil depletion.

John G. Landrum, the village bank president who served as chairman of the "Thank You Farm" purchasing committee, summed up the purposes of the meeting when he opened the program. He said:

"Corporal Atkins is but a symbol of all Spartanburg County boys. Many others have distinguished themselves, some even making the sacrifice of their lives. Manifestly, we cannot honor all of them this way, but our tribute today is meant for them also. . . . This is also a great day for the farmers of the County. Farm agencies representing the basic interest of the farmer have made their contribution to the improvement of agricultural methods in this region. For this work we are indebted to the Broad River Soil Conservation District and the agencies cooperating with it—the Soil Conservation Service, the Extension Service of Clemson College, the vocational teachers and their students, and the State Forestry Commission."

When Chief H. H. Bennett of the Soil Conservation Service Service spoke, he emphasized that "this is not our show." Said the Chief:

"It was Gene Atkins, who was too tough for the Japs to lick, who came home with his heart set on farming, and who decided to farm this new place of his the safe, conservation way. It is Gene Atkins, his South Carolina neighbors, and tens of thousands like them in the other 47 states who are going to safeguard our country's agricultural land from this other enemy—unnecessary soil erosion—and keep it permanently productive."

The Secretary of Agriculture told Gene and the audience: "You must continue your great soil conservation work, for according to all signs—unmistakable signs—the South is on the threshold of an industrial-agricultural revolution that may shake its economy right down to the cotton roots on Gene's farm. . . . Gene, I'm happy as a member of the President's Cabinet to hand you this deed to 'Thank You Farm.' May God bless you, Gene, as this community has blessed you."

His voice choking with emotion, the war hero replied: "I want to thank Dr. Walden and all those who made this possible. Thanks for making my dreams come true. Many others have fought and bled and suffered for the same things I did. I don't feel worthy, but with God's help I'm going to do the best I can to make this land better."

Dr. A. R. Walden, to whom Gene referred, is the country doctor who wrote to Publisher William A. Townes of the Spartanburg Herald-Journal:

Dr. H. H. Bennett pauses after a study of the conservation program being established on "Thank You Farm" to read the cornerstone dedication at the residence.

"Editorials and medals are fine, but they will not help him greatly in earning a living after the heat of war is over. My proposal is for a number of us to show our appreciation by buying him (Corporal Atkins) a home."

Dr. Walden enclosed with his letter his check for $100. Townes liked the idea, added $100 of his own money and $100 for the newspapers to help buy a "Thank You Farm." The same day Ben Gramling, merchant and farmer who knew Gene as a boy, pledged $100. Radio Stations WSPA and WORD of Spartanburg joined the campaign.

Supervisor E. C. McArthur of the Broad River Soil Conservation District read the story about "Thank You Farm" and offered all the services of the district in helping to select and plan the farm for soil and water conservation. Chairman Landrum accepted McArthur's offer because, as the Landrum bank president expressed it, "We want Gene to have a good farm, and then to give him all the help possible in keeping the land and making it better."

As the "Thank You Farm" campaign started, Gene was married to Vivian Rollins, the farm girl with whom he used to pick cotton and who had accepted the proposal he had written from the Pacific.

Then Gene, his bride, and his parents, Mr. and Mrs. Cleve Atkins, went to Washington. There, Gene received the Congressional Medal of Honor from President Harry S. Truman. The president told the sharecropper's son, "I'm glad you are a farmer and will have a farm of your own. I was a farmer myself."

By the time Atkins returned from Washington and had received an honorable discharge from the Army, $7,500 was in the bank for "Thank You Farm." Most of the money came in quarters, half-dollars, and dollars from people who wanted to share in the tribute to the war hero.

In the meantime, Soil Conservation Service technicians at the request of District Supervisor McArthur had made soil conservation surveys and land capability maps on all the farms offered for sale to Chairman Landrum and the farm buying committee: County Agent Joe Frank Jones, Publisher Townes,

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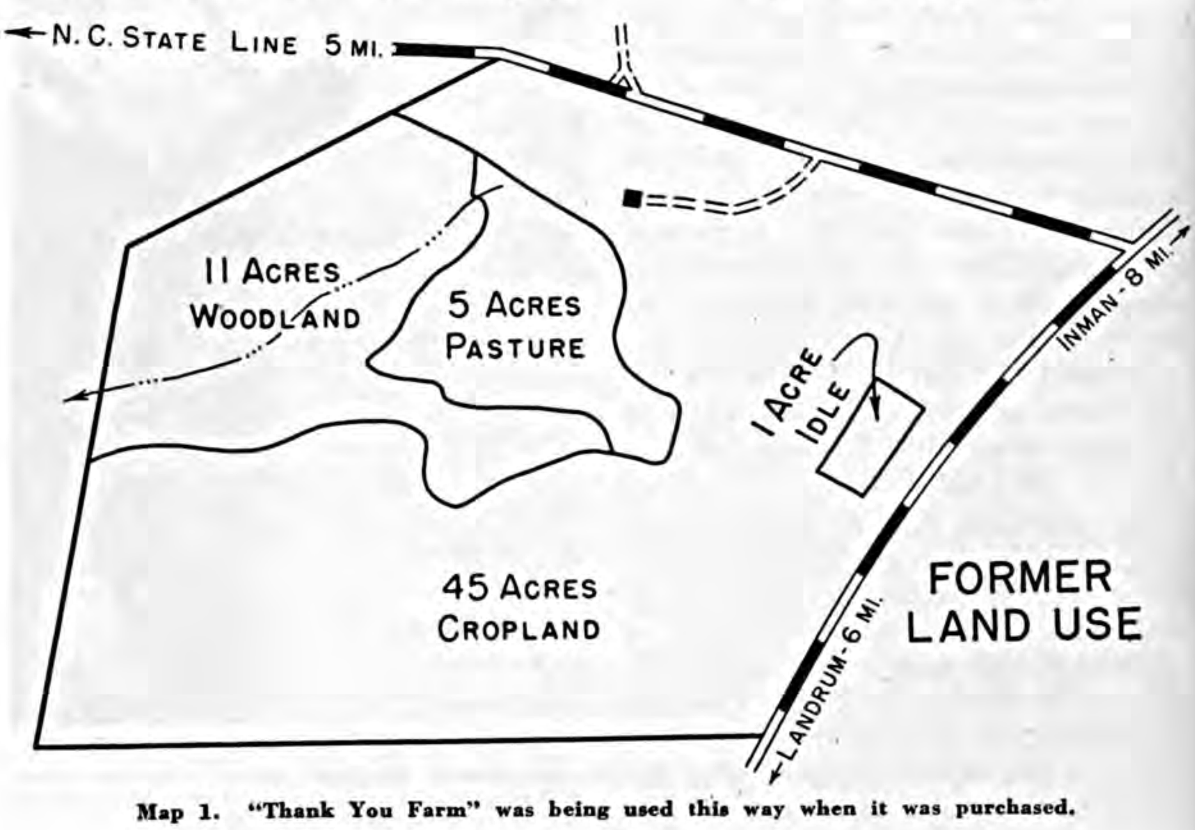


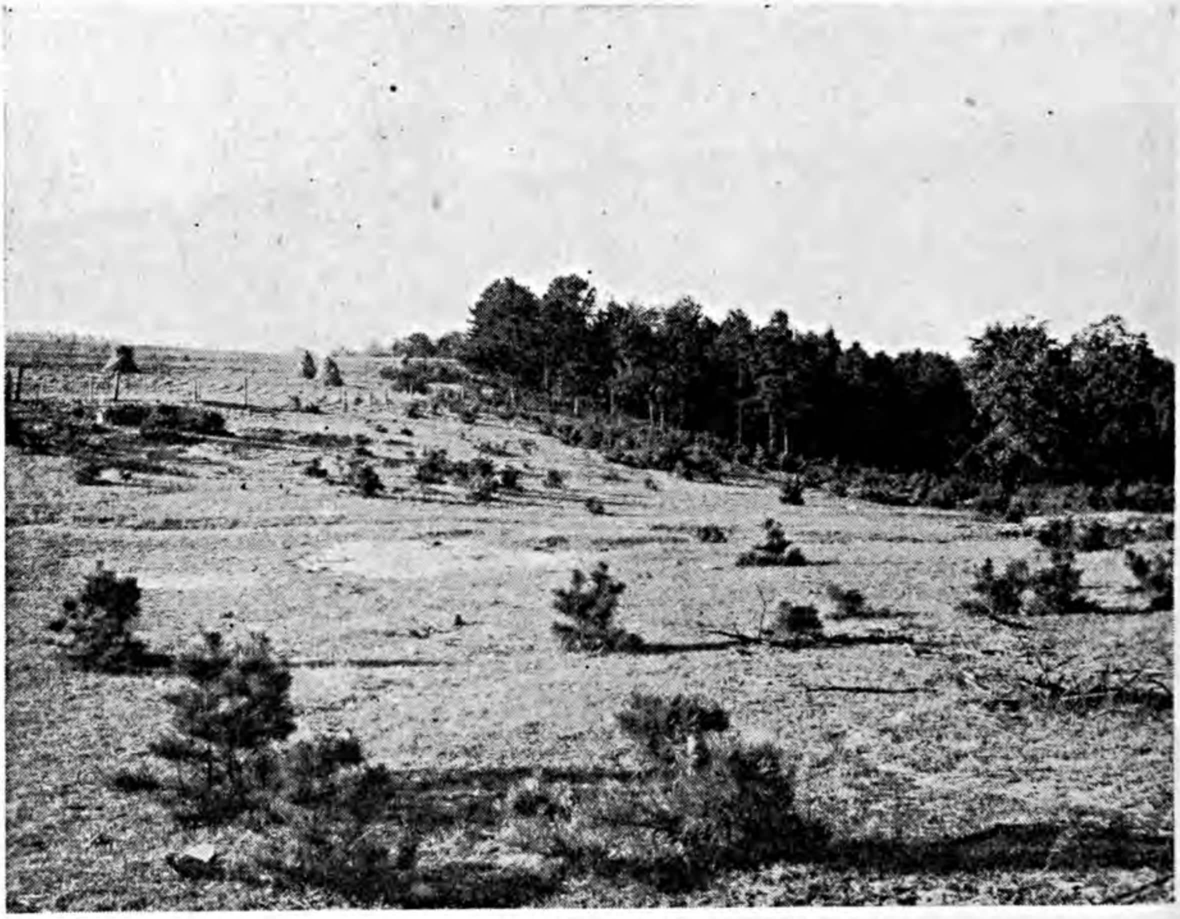
Map 1. "Thank You Farm" was being used this way when it was purchased.

Above: First step in planning the farm for soil conservation was a soil survey made by Jackson Bennett, assigned by the Soil Conservation Service.

Below: District Conservationist J. H. Talbert (right) goes to the farm with Corporal and Mrs. Atkins to help work out the complete farm conservation plan.

Above: This natural draw, Talbert points out, will make a good site for a sericea meadow into which terraces may be emptied.

Below: The eroded pasture land, little more than idle land now, can be turned into profitable use with kudzu. (See next picture.)



Above: The land is being prepared on the contour for the planting of kudzu crowns. (Compare with picture, bottom last page.)

Below: A wildlife border between the steep land in woods and the cultivated field is being prepared for planting to sericea and bicolor lespedeza.

Above: This field is being prepared for the seeding of small grain in alternate terrace intervals. The small grain will be overseeded with lespedeza.

Below: Small grain is being drilled on the contour in the terraces of this field which will be kept in cultivation.

The Editors Talk

Agricultural Science

The march of progress in the science of agriculture is steady but so relatively slow as compared to other industries that its tremendous importance and effects are often lost to public consciousness. The very nature of the long experimentation necessary in plant and animal breeding, soil and fertilizer problems, and the myriad other phases of science involved in an improved agriculture does not produce "atomic" explosions to startle and awake the public to the alertness of our agricultural research workers and the value of their work.

It is gratifying, therefore, to have the annual reports from officials working in these fields. Such a report is one from Dr. Robert Salter, Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, which has been summarized in a recent publicity release by the Agricultural Research Administration of the U. S. Department of Agriculture.

Dr. Salter covers in his report, the release says, a wide variety of results of research work, including new compounds for weed control and for various unusual purposes, soil and fertilizer problems, and new machines for production and processing, as well as the development of new varieties that make it possible for farmers to produce higher-yielding crops which overcome such hazards as diseases and cold.

As a part of the year's research, much of which was in cooperation with State Experiment Stations, results of more than 24 new varieties of crop plants were announced and described. The report gives more importance, however, to the demonstrated value of the new varieties brought out within recent years (those that have now become well established on farms where they have been found superior to those formerly in use). Not only did new varieties prove of great value in the country's critical period, but as their use spreads and as still better varieties come out, production continues to increase.

"This year," says Dr. Salter, "it has been estimated, for example, that new varieties of wheat distributed to farmers since World War I added 100 million bushels to the 1944 crop of hard red spring wheat. In a similar recent appraisal it was estimated that five improved varieties of rice grown on 48 per cent of the southern rice acreage in 1944 gave yields 13 per cent higher than the standard old varieties and added nearly $10,500,000 to the growers' income."

More hybrid corn varieties have been developed for certain areas, especially the South. Hybrid corn last year represented 64 per cent of the total planting and is estimated to account for two-thirds to three-fourths of a billion bushels a year. New, better adapted varieties that are reported from time to time increase the hybrid acreage and tend to raise these figures.

Another field in which Dr. Salter's report indicates increasing efficiency in crop production is cotton growing in one-variety communities, a method put in effect over a 20-year period to provide better and more uniform fiber. By 1944 the number of these communities in the cotton belt had increased to 2,194 in 581 of the South's 775 cotton counties. The 300,000 growers who participate in the one-variety program have been making an extra cash return of $8 an acre a year on their more than 7,000,000 acres of cotton, a total annual gain of $56,000,000.

Other gains resulting from this bureau's recent research include: Better understanding of the use of crop residues in dry farming; new methods of handling grain and other farm products in storage; progress in mow-curing of hay and peanuts; various new designs of machines for field work and preliminary processing of farm crops; progress with alfalfa, grass, and other forage crops; new knowledge of tree diseases, new sprays to prevent pre-harvest drop of apples and pears; improvements in nut growing; new ways with vegetables; a widely-adapted hybrid green onion; hybrid tomatoes; more potato varieties; new ways of propagation from cuttings and seed; and improvements in shipping tomatoes under refrigeration.

Calling attention to a wide variety of research on problems of soils and fertilizers, Dr. Salter's report gives emphasis to the economic importance of results of fertilizer experiments in North Carolina that have shown the possibility of doubling the corn yield there within 10 years, a "new finding in a familiar field." This result leads him to comment that "until principles of science are applied on the farm, their value to agriculture is unrealized." He then relates that in this corn example there was an instance in which on one farm 120 pounds of nitrogen to the acre, combined with hybrid seed and closer spacing in planting, brought the yield from 19 bushels up to 107 bushels. "The cost of the corn increase," he says modestly, "farmers can well afford to pay."

"Rest Cures" Worn Out

J. C. Hackleman, Professor of Crops Extension at the University of Illinois College of Agriculture, is credited with the statement that "the notion of giving worn-out farm land a 'rest cure' has fortunately just about passed." At one time, he says, farmers thought that if they put "tired acres" into pasture, the land could be rested two or three years and would come back, like a man following a good vacation, as fresh and vigorous as ever.

Calcium leaches out of the soil, and every ton of beef, pork, mutton, or milk produced on these pastures removes nitrogen, phosphorus, potassium, and calcium or lime just as surely as does a crop of corn, oats, wheat, or hay, he explains. In addition, as these permanent pastures become less productive they provide less cover, and the result is more loss through erosion, until on rolling pastures the present crop is largely weeds or unpalatable weed grasses. At least half of the two million Illinois acres devoted to permanent pasture is just barely producing enough to pay the taxes.

But Professor Hackleman sees hope for these worn pastures and has five simple steps which will transform them into productive acreage in one or, at most, two years. The steps are to test the soil, treat it with needed minerals, disc these minerals thoroughly while preparing a reasonably good seedbed, reseed with a mixture of legumes and grasses, and control grazing for at least a year, giving the legumes and grasses a chance.

That the situation is not peculiar to Illinois is seen in a recently published estimate by officials in North Carolina that about 90 to 95% of the 1,450,000 acres in permanent pastures in that State need renovation with lime, fertilizer, and seed. Without doubt, pasture improvement programs will receive due emphasis this year.

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
January.....	20.20	41.9	158.0	190.0	107.0	146.0	17.10	52.80	....
February....	19.99	31.8	165.0	201.0	106.0	147.0	17.70	52.70	....
March........	20.24	21.4	171.0	207.0	107.0	148.0	18.10	52.00	....
April........	20.20	21.4	174.0	211.0	107.0	149.0	16.90	51.90	....
May.........	20.51	42.2	177.0	214.0	108.0	149.0	16.50	52.10	....
June.........	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July.........	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August.....	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October......	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November...	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
January.....	163	419	227	216	167	165	144	234	262
February....	161	318	237	229	165	166	149	234	223
March........	163	214	245	236	167	167	152	231	203
April........	163	214	250	240	167	169	142	230	259
May.........	165	422	254	244	168	169	139	231	193
June.........	169	512	258	251	173	170	134	233	269
July.........	171	563	263	262	174	165	130	244	244
August......	172	449	240	292	176	164	123	233	240
September...	175	432	198	236	174	164	120	228	159
October......	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January.....	180	363	208	237	171	174	132	226	249

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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	Fish scrap, wet acidulated 6% ammonia, 3% 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	$3.05	$3.37	$3.52
1922...........	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923...........	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924...........	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925...........	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926...........	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927...........	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928...........	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929...........	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930...........	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931...........	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932...........	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933...........	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934...........	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935...........	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936...........	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937...........	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938...........	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939...........	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940...........	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941...........	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942...........	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943...........	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944...........	1.75	1.42	7.68	5.77	3.34	4.86	6.71
1945							
January.....	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February.....	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March.......	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April........	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May........	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June........	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July.........	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August......	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September...	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October......	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November....	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December....	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1946							
January......	**1.75**	**1.42**	**7.81**	**5.77**	**3.34**	**4.86**	**6.71**

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922...........	113	90	173	132	117	140	142
1923...........	112	102	177	137	140	136	147
1924...........	111	86	168	142	145	107	121
1925...........	115	87	155	151	155	117	135
1926...........	113	84	126	140	146	129	139
1927...........	112	79	145	166	143	128	162
1938...........	100	81	202	188	173	146	170
1929...........	96	72	161	142	154	137	162
1930...........	92	64	137	141	136	12	130
1931...........	88	51	89	112	109	63	70
1932...........	71	36	62	62	60	36	39
1933...........	59	39	84	81	85	97	71
1934...........	59	42	127	89	93	79	93
1935...........	57	40	131	88	87	91	104
1936...........	59	43	119	97	89	106	131
1937...........	61	46	140	132	120	120	122
1938...........	63	48	105	106	104	93	100
1939...........	63	47	115	125	102	115	111
1940...........	63	48	133	124	110	99	96
1941...........	63	49	157	151	107	112	126
1942...........	65	49	175	163	110	150	192
1943...........	65	50	180	163	110	144	189
1944...........	65	50	219	163	110	144	191
1945							
January......	65	50	223	163	110	144	191
February.....	65	50	223	163	110	144	191
March.......	65	50	223	163	110	144	191
April........	65	50	223	163	110	144	191
May.........	65	50	223	163	110	144	191
June........	65	50	223	163	110	144	191
July.........	65	50	223	163	110	144	191
August......	65	50	223	163	110	144	191
September...	65	50	223	163	110	144	191
October......	65	50	223	163	110	144	191
November....	65	50	223	163	110	144	191
December....	65	50	223	163	110	144	191
1946							
January......	**65**	**50**	**223**	**163**	**110**	**144**	**191**

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14........	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922...........	.566	3.12	6.90	.632	.904	23.87	....	.508
1923...........	.550	3.08	7.50	.588	.836	23.32	....	.474
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	.524
1927...........	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928...........	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929...........	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930...........	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931...........	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932...........	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933...........	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934...........	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935...........	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936...........	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937...........	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938...........	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939...........	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940...........	.516	1.90	5.50	.517	.730	24.75	.573	....
1941...........	.547	1.94	5.64	.522	.780	25.55	.570	....
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								
January......	.650	2.20	6.10	.535	.797	26.00	.200	....
February....	.650	2.20	6.13	.535	.797	26.00	.200	....
March.......	.650	2.20	6.20	.535	.797	26.00	.200	....
April........	.650	2.20	6.20	.535	.797	26.00	.200	....
May.........	.650	2.20	6.20	.535	.797	26.00	.200	....
June.........	.650	2.20	6.20	.471	.701	22.88	.176	....
July.........	.650	2.20	6.20	.503	.749	24.44	.188	....
August......	.650	2.20	6.20	.503	.749	24.44	.188	....
September...	.650	2.20	6.20	.503	.749	24.44	.188	....
October......	.650	2.20	6.28	.535	.797	26.00	.200	....
November....	.650	2.20	6.40	.535	.797	26.00	.200	....
December....	.650	2.20	6.40	.535	.797	26.00	.200	....
1946								
January.....	**.650**	**2.20**	**6.40**	**.535**	**.797**	**26.00**	**.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	Kainit
1922...........	106	87	141	89	95	99	....	78
1923...........	103	85	154	82	88	96	....	72
1924...........	94	64	135	82	90	98	....	72
1925...........	110	68	126	82	90	98	....	74
1926...........	112	88	114	83	90	98	82	80
1927...........	100	86	113	90	97	106	89	89
1928...........	108	86	113	94	100	109	92	92
1929...........	114	88	113	94	101	110	93	92
1930...........	101	88	113	95	102	111	94	93
1931...........	90	88	113	95	102	111	94	93
1932...........	85	88	113	95	101	111	94	90
1933...........	81	86	113	93	91	104	91	86
1934...........	91	87	110	68	79	93	74	72
1935...........	92	91	117	58	72	89	68	75
1936...........	89	51	113	65	74	95	77	85
1937...........	95	51	113	71	79	102	85	93
1938...........	92	51	113	73	81	104	87	95
1939...........	89	53	113	73	79	101	87	93
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								
January......	121	61	125	75	84	108	83	....
February....	121	61	126	75	84	108	83	....
March.......	121	61	127	75	84	108	83	....
April........	121	61	127	75	84	108	83	....
May.........	121	61	127	75	84	108	83	....
June.........	121	61	127	66	74	95	80	....
July.........	121	61	127	70	79	101	82	....
August......	121	61	127	70	79	101	82	....
September...	121	61	127	70	79	101	82	....
October......	121	61	129	75	84	108	83	....
November....	121	61	131	75	84	108	83	....
December....	121	61	131	75	84	108	83	....
1946								
January.....	**121**	**61**	**131**	**75**	**84**	**108**	**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 materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
January	201	179	153	97	57	175	121	78
February	199	179	153	97	57	175	121	78
March	198	180	153	97	57	175	121	78
April	203	180	154	97	57	175	121	78
May	200	180	154	97	57	175	121	78
June	206	180	155	95	57	175	121	69
July	206	180	154	96	57	175	121	74
August	204	180	154	96	57	175	121	74
September	197	181	153	96	57	175	121	74
October	199	182	154	97	57	175	121	78
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	...	97	57	175	121	78

* 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 with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

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 Shipments in Arkansas by Counties for the Fiscal Year Ending June 30, 1945," Dept. of Revenues, Little Rock, Ark.

"Fertilizers for 1946," Maritime Fertilizer Council, Moncton, N. B.

"Guide for the Use of Borax in Fertilizers Only," Maritime Fertilizer Council, Moncton, N. B., Sept. 1945.

"Fertilizer Grades for Connecticut—1946," Agron. Dept., Univ. of Conn., Storrs, Conn., Dec. 20, 1945.

"Fertilizer, Feed and Seed Report, January-June 1945," State Board of Agr., Dover, Del., June 1945.

"Production of Artificial Manure," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 415, Sept. 1945, F. B. Smith and G. D. Thornton.

"Fertilizers, Fertilizer Materials and Rock Phosphate Used in Illinois During 1944," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1253, April 1945, E. E. DeTurk.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 305, April 1945, F. W. Quackenbush, O. W. Ford, A. S. Carter, H. L. Mitchell, C. M. Cohee, J. W. Jackman, L. C. Shenberger and H. C. Kennedy.

"Tonnage Showing the Different Grades of Fertilizer Shipped in the State of Louisiana From September 1, 1944 to August 31, 1945," Dept. of Agr. & Immigration, Baton Rouge, La.

"Report of Analysis of Commercial Fertilizers," Dept. of Agr. & Immigration, Baton Rouge, La.

"Inspection of Commercial Fertilizers and Agricultural Lime Products," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 126, Sept. 1945.

"Nitrogen Fertilizers for Fruit Trees," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 489, Aug. 1945, A. E. Murneek.

"Analyses of Commercial Fertilizers, Manures, and Agricultural Lime, 1944," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Insp. Series 17, Feb. 1945, C. S. Cathcart.

"Fertilizer Sales by Grades in Order of Tonnage July 1, 1944-June 30, 1945," Dept. of Agr., Raleigh, N. C.

"Inspection of Feeds and Fertilizers," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Contribution 676, April 1945, J. J. Havern and C. H. Stetson, Jr.

"Results from Fertilizer and Liming Experiments in a 5-Year General Farm Rotation," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. of Inf. 75, July 10, 1945, C. A. Mooers.

"Commercial Fertilizers in 1944-45," Agr. Exp. Sta., College Station, Texas, Bul. 674, Sept. 1945, G. S. Fraps and T. L. Ogier.

"The Inspection of Commercial Fertilizers and Agricultural Lime Products for 1945," Related Services Div., Univ. of Vt. & State Agr. College, Burlington, Vt., Report 1, Nov. 1945, L. S. Walker and E. F. Boyce.

Soils

"Some Major Factors in the Leaching of Calcium, Potassium, Sulphur, and Nitrogen from Sandy Soils," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 416, Sept. 1945, G. M. Volk nad C. E. Bell.

"Is the Moldboard Plow Doomed?" Dept. of Agron. Univ. of Ill., Urbana, Ill., AG1222, June 1944, R. S. Stauffer.

"Liming Soils in Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Fold. 137, Oct. 1945, Paul M. Burson.

"Missouri Program of Land Improvement," Univ. of Mo., College of Agr., Columbia, Mo., Cir. 303, July 1945.

"Peach Orchard Soil Management," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 476, Sept. 1945, C. O. Dunbar, R. D. Anthony and E. B. Kinter.

"Irrigated Pastures for Forage Production and Soil Conservation," U.S.D.A., Washington, D. C., F. B. 1973, Sept. 1945, J. G. Hamilton, G. F. Brown, H. E. Tower and W. Collins, Jr.

"Soil Survey—Bakersfield Area California," U.S.D.A., Washington, D. C., Ser. 1937, No. 12, Aug. 1945, R. C. Cole, R. A. Gardner, L. F. Loehler, A. C. Anderson, O. F. Bartholomew and J. L. Retzer.

"Soil Survey — Washington County, Virginia," U.S.D.A., Washington, D. C., Ser. 1937, No. 14, Sept. 1945, R. C. Jurney, S. S. Obenshain, E. Shulkcum, H. C. Porter, E. F.

Henry, J. R. Moore, R. E. O'Brien, and R. C. Jurney, Jr.

Crops

"Caley Pea Production and Uses in Alabama," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., Mimeo. Ser. 17, May 1945, K. G. Baker.

"Lettuce Variety Trials," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Mimeo Rept. 78, July 1945, A. E. Griffiths, R. C. Keswick, C. W. Van Horn and A. H. Finch.

"Excessive Field Exposure Coupled With Dryness of Lint May Be Responsible for Difficulties With 'Irrigated' Cotton," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Mimeo Rept. 79, Sept. 1945, R. S. Hawkins.

"1944 Arkansas Corn Yield Tests," Agri. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Rept. Ser. 1, April 1945, D. B. Shank and C. K. McClelland.

"Report of the Minister of Agriculture for the Dominion of Canada for the Year Ended March 31, 1945," Ottawa, Canada.

"Bush Fruits," Dept. of Agr., Dom. of Canada, Ottawa, Canada, Publ. 775, F. B. 131, Oct. 1945, D. S. Blair.

"Tobacco Substation at Windsor Report for 1944," Agr. Exp. Sta., New Haven, Conn., Bul. 487, July 1945, P. J. Anderson and T. R. Swanback.

"Culture, Fertilizer Requirements and Fiber Yields of Ramie in the Florida Everglades," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 412, July 1945, J. R. Neller.

"Legume Inoculation," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 417, Nov. 1945, F. B. Smith, R. E. Blaser and G. D. Thornton.

"The Kent and Zill Mangos," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 614, July 1945, G. D. Ruehle.

"The Home Orchard," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 542, March 1, 1945.

"Georgia Can Increase Peanut Production by Fifty Per Cent Without an Increase in Acreage," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 543, March 1, 1945.

"North Georgia Cotton Variety Tests, 1942 to 1944," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 552, Oct. 1945, W. W. Ballard.

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Plow-Sole Placed Plant Food for Better Crop Production

(*From page* 16)

number of these trial plots are shown in Table 2. (A complete report giving the results of all demonstrations conducted in 1945 will be furnished by the writer to anyone interested.)

After four years of demonstrations in Wisconsin, I am more convinced than ever that there is a place for these heavy-rate applications of fertilizer by the plow-sole or other deep-placement methods. The supply of manure on most farms is not sufficient to cover all fields planted to corn and other row crops. The 8-8-8 grade or similar 1-1-1 ratio of N-P-K is a good substitute for manure. Farmers have only recently discovered what commercial plant foods are really capable of doing where ap-

1945 Results of Plow-Sole Fertilizer Demonstrations in Wisconsin

TABLE 2

Corn yields are calculated on basis of 85% of a perfect stand (three stalks per hill) and 15% moisture basis. Sweet corn figured at $17.50 per ton (net); field corn at $1 per bushel; hybrid seed corn at $7 per bushel; silage at $6 per ton; potatoes at $1.50 per bushel, and rutabagas at $20 per ton.

Name and address of cooperator and soil type	Crop	Plot No.	Treatment and how applied	Yield per acre	Increase per acre	Value of increase	Profit over cost fertilizer
O. D. Brace Janesville Carrington Silt Loam	Field corn Checked 3½′ x 3½′	1	125# 2–12–6 in hill	35.1 bu.	7.5 bu.	$7.50	$5.89
		2	125# 2–12–6 in hill plus 825# 8–8–8 on plow-sole	55.6 bu.	28.0 bu.	28.00	9.07
		3	No fertilizer	27.6 bu.			
Potter Porter Evansville Carrington Silt Loam	Field corn Drilled 38″ spacing	1	125# 2–12–6 drilled	36.0 bu.			
		2	125# 2–12–6 drilled plus 700# 8–8–8 on plow-sole	69.7 bu.	33.7 bu.	33.70	19.00
Ed. Quinton Route 1, S. Milwaukee Miami Clay Loam	Silage corn Drilled	1	125# 2–12–6 drilled	10.18 tons			
		2	125# 2–12–6 drilled plus 700# 8–8–8 on plow-sole	17.00 tons	6.82 tons	40.92	26.22
Henry Burgess Shullsburg Tama Silt Loam	Hybrid seed corn Checked	1	125# 3–12–12 in hill	70.1 bu.			
		2	125# 3–12–12 in hill plus 700# 8–8–8 on plow-sole	82.5 bu.	12.4 bu.	86.80	71.10
Chas. Kennedy Fall River Sandy Loam	Field corn Checked 40″ x 40″	1	125# 3–12–12 in hill	61.4 bu.			
		2	125# 3–12–12 in hill plus 700# 8–8–8 on plow-sole	77.9 bu.	16.5 bu.	16.50	1.80
Alwin Williams Marshfield Spencer (Colby) Silt Loam	Silage corn Drilled	1	125# 2–12–6 drilled	5.44 tons			
		2	125# 2–12–6 drilled plus 400# 8–8–8 on plow-sole	7.78 tons	2.34 tons	14.04	6.64
		3	125# 2–12–6 drilled plus 800# 8–8–8 on plow-sole	13.44 tons	8.00 tons	48.00	31.20
Elmer Waldo Centuria (Polk County) Sandy Loam	Sweet corn Drilled	1	175# 3–12–12 drilled	5.586 tons	.686 tons	12.00	8.67
		2	175# 3–12–12 drilled plus 960# 8–8–8 on plow-sole	6.537 tons	1.637 tons	28.65	5.16
		3	175# 3–12–12 drilled plus 1200# 8–8–8 on plow-sole	6.546 tons	1.646 tons	28.80	.27
		4	No fertilizer	4.900 tons			
C. A. Friday New Richmond Fine Sandy Loam	Sweet corn Checked	1	100# 3–12–12 in hill	7532 lbs.	3922 lbs.	34.33	32.42
		2	100# 3–12–12 in hill plus 800# 8–8–8 on plow-sole	8184 lbs.	4574 lbs.	40.02	21.31
		3	800# 8–8–8 on plow-sole	6785 lbs.	3175 lbs.	27.78	10.98

Name and address of cooperator and soil type	Crop	Plot No.	Treatment and how applied	Yield per acre	Increase per acre	Value of increase	Profit over cost fertilizer
		4	No fertilizer	3610 lbs.			
A. N. Johnson River Falls Silt Loam (High fertility manured every year for past six years)	Field corn Checked	1	125# 2-12-6 in hill	66.2 bu.	3.0 bu.	$3.00	$ .60
		2	125# 2-12-6 in hill plus 800# 8-8-8 on plow-sole	71.0 bu.	7.8 bu.	7.80	−11.40
		3	800# 8-8-8 on plow-sole	64.2 bu.	1.0 bu.	1.00	−15.80
		4	No fertilizer	63.2 bu.			
Perley Haugerud Amery Fine Sandy Loam (No manure)	Hybrid seed corn Checked 40″ x 40″	1	125# 3-18-9 in hill	57.8 bu.	12.7 bu.	88.90	86.22
		2	125# 3-18-9 in hill plus 1200# 8-8-8 on plow-sole	84.6 bu.	39.5 bu.	276.50	248.62
		3	No fertilizer	45.1 bu.			
Joe Innis Cedar Sandy Loam	Potatoes (Chippewas)	1	500# 3-12-12 drilled with planter	79.7 bu.			
		2	500# 3-12-12 with planter plus 700# 6-6-18 on plow-sole	147.3 bu.	67.6 bu.	101.40	85.92
Harry Barr Gurney Fine Sandy Loam	Potatoes (Triumphs)	1	500# 3-12-12 drilled with planter	245.0 bu.			
		2	500# 3-12-12 drilled with planter plus 800# 6-6-18 plow-sole	324.0 bu.	79.0 bu.	118.50	100.80
John Cudd Beldonville Silt Loam	Potatoes	1	1000# 8-8-8 on plow-sole	244.0 bu.	58.0 bu.	87.00	66.00
		2	1000# 6-6-18 on plow-sole	274.0 bu.	88.0 bu.	132.00	109.88
		3	No fertilizer	186.0 bu.			
I. A. Jorgensen Warrens Sandy Loam	Potatoes	1	800# 6-6-18 on plow-sole	300.0 bu.	45.0 bu.	67.50	49.80
		2	No fertilizer	255.0 bu.			
Clem Gleissner 6225 W. Brown Deer Road Milwaukee 9, Wisconsin Miami Silt Loam	Sugar beets	1	200# 3-12-12 drilled with seed	11.94 tons			
		2	200# 3-12-12 drilled plus 900# 6-6-18 on plow-sole	15.19 tons	3.25 tons	40.62	20.71
Joe Van Ess T. of Humbolt, Brown Co. Kewaunee Clay Loam	Sugar beets	1	130# 3-12-12 drilled with seed	12.09 tons			
		2	130# 3-12-12 drilled plus 560# 6-6-18 on plow-sole	14.112 tons	2.022 tons	25.27	12.89
Harold Wymore Route 4, Ashland Superior Red Clay	Rutabagas Drilled, Rows 2½′ apart	1	300# 3-12-12 broadcast plus 800# 8-8-8 on plow-sole	9.62 tons	4.54 tons	90.80	74.00
		2	300# 3-12-12 broadcast	5.08 tons			

plied in the most effective manner and where liberal amounts of all three major elements are supplied. The demand for this 8-8-8 grade or similar grades will increase in the years to come. One Midwest manufacturer recently stated that he could have sold 30 thousand tons of 8-8-8 in 1945 had supplies of ammonium sulphate permitted.

The matter of drillability and physical condition is no longer a problem with the manufacturer. This grade can be made so that it will hold its granular form even after weeks of storage. The 8-8-8 is not a panacea for all crops or for all soils, but it does meet the requirements of corn and some other crops under many conditions in Wisconsin. The approved list of some 16 or 17 grades of mixed fertilizers offered for sale in Wisconsin gives the farmer a wide range of ratios from which to select the fertilizer best suited to crop and soil under any given set of conditions. I have previously suggested in this discussion the 6-6-18 grade for those crops with high-potash requirements. There are situations where the 10-6-4 grade may meet the requirements of both crop and soil. A farmer must fit the kind and amount of fertilizer he uses to his crop, his soil, and his pocketbook. In the past, we have been too conservative in our recommendations and farmers have been too stingy in their expenditures for fertilizers. We have talked perhaps too much about ultimate goals in our programs of soil improvement and have failed to recognize our current and immediate opportunities for larger yields. If we face the situation fairly and squarely and lay aside our prejudices, we may then see more clearly the actual opportunities for the profitable use of fertilizers on the millions of acres of farm land that now produce only half the yields they might if given adequate amounts of all the plant foods needed for maximum production. I am not talking less about the importance of a long-time, soil-building program, but I am talking more about making every acre produce as large a crop as it is inherently capable of every year.

Boron Deficiency of Lettuce

(*From page* 20)

taining from 5 to 10 pounds of borax per ton would help greatly in the prevention of boron deficiency of lettuce in Vermont gardens. The writers believe that all garden fertilizers should carry this small amount of boron because boron prevents so many garden troubles. A fertilizer containing this amount of boron can be drilled or *broadcast* on Vermont soils with no danger of toxicity from excess if less than a ton of fertilizer is used per acre. Rates of borax up to 90 pounds per acre have been *broadcast* in one Vermont garden before symptoms of toxicity became evident in lettuce.

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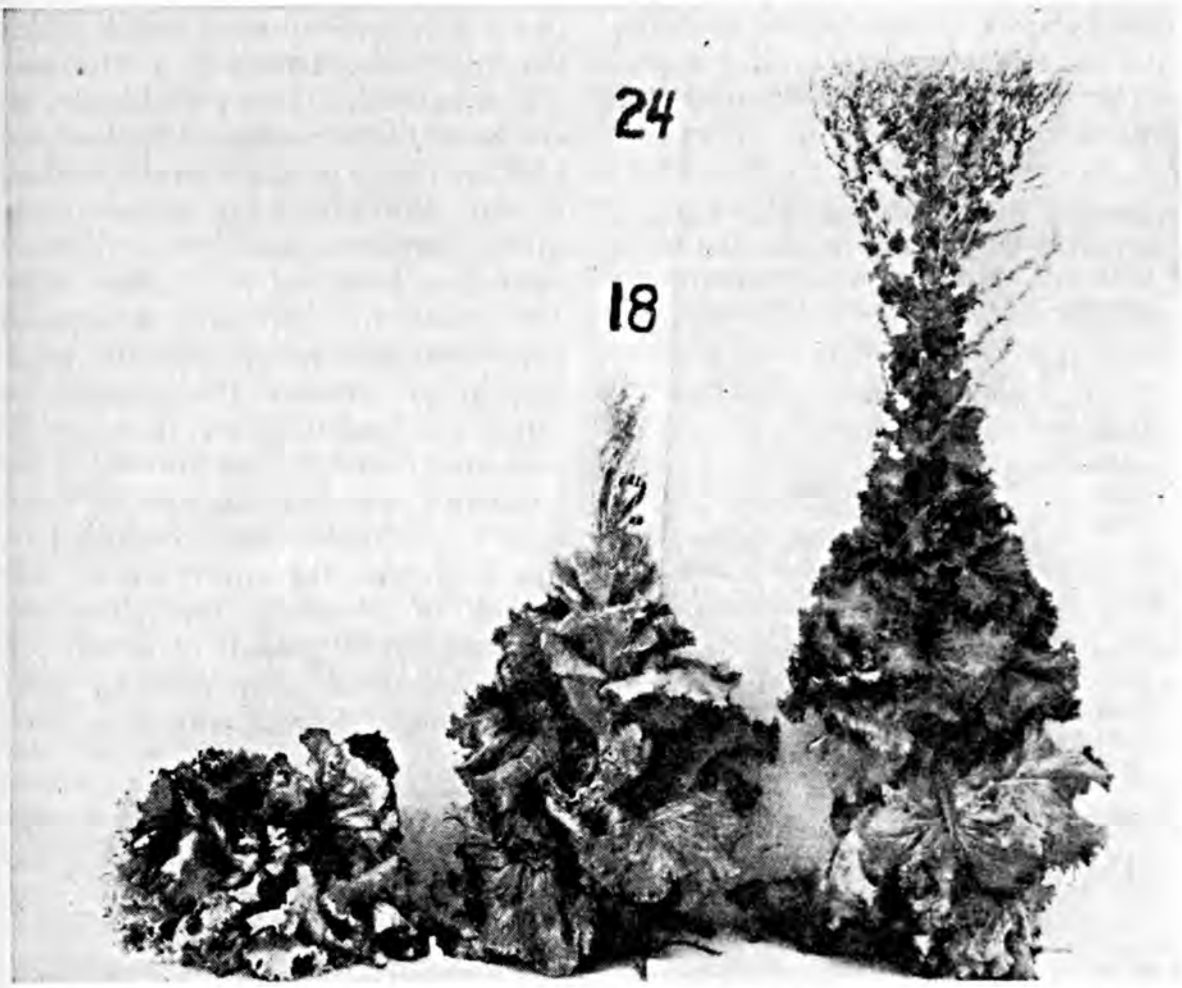


Fig. 5. Lettuce transplants from a garden. The two on the left were seriously in trouble for want of boron, contrasted with a normal plant, right, of the same age. Careful inspection of these plants revealed dieback, yellowheart, firing of the edges of the leaves, witches broom, and lack of flower buds. Rotten heart eventually would have developed in the head at the left if it had been left to grow in the garden.

Correcting Potash Deficiency in Growing Corn

(*From page* 23)

same yields as the 25-pound rate. The highest yields of corn at all application dates were obtained from the 100-pound rate. On the three respective dates of application this rate increased the yields of shelled corn by 27.1 bushels, 17.7 bushels, and 6.8 bushels per acre, as compared with the no-treatment plots.

The influence of the three rates of potash application on plant-deficiency symptoms is shown by figures 2, 3, and 4. These symptoms were largely corrected even where only 25 pounds of potash per acre were applied, as indicated when the potash was applied 40 days after planting. Potash applied 59 days after planting produced similar results. While some improvement was noted in corn fertilized with potash 73 days after planting, many of the plants and leaves were too far gone to recover.

Figures 5, 6, and 7 indicate the influence of potash on grain quality. The ears produced by potash-starved plants were largely nubbins, and the cobs were inadequately filled out. Not only did the plants receiving the potash applications yield more, but the ears produced by these plants were larger and better filled out than those of the potash-starved plants. Corn of better quality was produced by the higher applications of potash—50 and 100 pounds per acre.

TABLE 1. GRAIN YIELDS OF POTASH-STARVED CORN WHEN FERTILIZED WITH POTASH AT DIFFERENT RATES AND ON DIFFERENT DATES, KNOX COUNTY, 1944.

Potash applied per acre	Acre yields of shelled corn		
	40 days after planting, June 14	59 days after planting, July 3	73 days after planting, July 17
Pounds	*Bushels*	*Bushels*	*Bushels*
0	3.7	8.7	8.1
25	15.9	21.4	11.1
50	27.9	21.9	10.2
100	30.8	26.4	14.9

The recovery of the potash-starved plants after applications of potash under the drouth conditions of the 1944 season was remarkable. This probably can be attributed to the method of application. Had the potash been left on the surface, it could not have been carried down to the corn-root zone by the limited rainfall of June and July. Since only 100 pounds of 20-percent superphosphate were applied per acre, the question arises whether the phosphorus supply was inadequate and thus became a limiting factor in plant growth. This apparently was not the case in these tests, since another test[1] conducted in this field with the equivalent of 200 pounds of 20-percent superphosphate per acre and 50 pounds of potash per acre applied at corn planting gave yields almost identical with those here reported.

[1] The 1944 annual report on Cooperative Fertilizer and Phosphate Comparison Experiments. Tennessee Agricultural Experiment Station and Tennessee Valley Authority.

"Thank You Farm"

(*From page* 26)

Charles O. Hearon of the *Herald-Journal* staff; Otto Marlow, a farmer, and Cliff (Farmer) Gray of Radio Station WSPA.

After studying the colored maps and hearing Gene say he wanted a cotton, corn, small grain, and livestock farm, the committee chose a 62-acre farm six miles from Landrum. It had large blocks of Class II and Class III land suitable for a row-crop, small grain, and lespedeza rotation, a small tract of Class V-A land for bottomland pasture, some Class IV land that would grow the perennials kudzu and sericea lespedeza for hay and grazing, and some Class VI land for a farm woodlot.

Typical Piedmont land, this farm needed a complete soil and water conservation program to keep it productive.

J. H. Talbert, district conservationist assigned by the Soil Conservation Service to the Broad River District, worked with Gene in making the conservation farm plan.

Three maps are presented with this article to show the steps in the conservation planning of "Thank You Farm." Land use at the time the farm was purchased is shown on Map No. 1. Land capabilities, as determined by Soil Surveyor Jackson Bennett, are shown on Map No. 2. The soil conservation farming plan as worked out by Talbert and Atkins while they went over the farm field by field may be seen on Map No. 3.

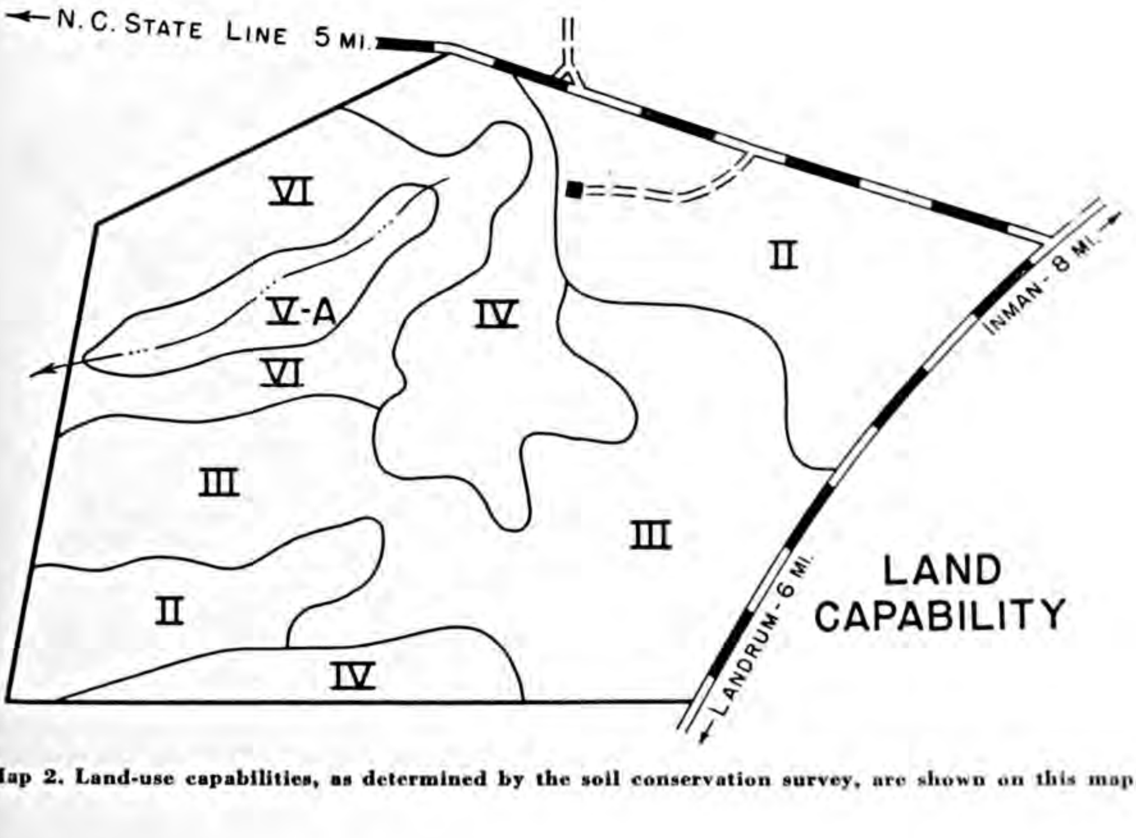
One of the factors in making a cropping program on a farm is the feed requirements of the livestock. Before beginning the land use planning, Atkins and Talbert discussed the number of livestock Atkins expected to have. Two mules had been given to the young farmer by a bottling company, and both would be needed as workstock. Atkins said he wanted to keep 4 or 5 cows for milk and butter, 3 or 4 hogs for meat, and about 100 laying hens for chickens and eggs. In determining which of several possible uses could be made of each land class, the pasture, hay, and grain requirements of the livestock were kept in mind.

First consideration in developing the plan was given to the areas suitable for cultivation—the Class II and Class III land shown on Map 2. Because both these land classes require terraces and contour cultivation as conservation practices, it was necessary to locate suitable water-disposal areas into which water from the terraces could be emptied. The sites for these areas were determined by locating the natural drainageways on the farm.

One of these drainageways started near the site of the new house that was being built under the direction of Major M. H. Tardy, who was an Alabama architect before he became engineer for the Army's Camp Croft at Spartanburg, and extended through the former pasture into a low area of woods. A two-acre meadow strip of sericea lespedeza was planned at the head of this natural "draw," as shown on Map No. 3. Another four-acre area to be planted to sericea—Field No. 1—was planned for a water-disposal area to take care of the water emptied from terraces in the remainder of the cultivated land.

Because it is a deep-rooted, perennial legume, sericea lespedeza will provide protection against erosion from the water concentrated by the terraces and emptied into the two-acre meadow strip and four-acre water-disposal area. Border strips of sericea, totaling one acre, along road banks also will be used for water disposal. Hay from these seven acres will furnish a part of the feed for farm livestock.

In addition to terracing and contour cultivation, contour strip cropping and crop rotations also are needed as conservation practices on Class II and Class



Map 2. Land-use capabilities, as determined by the soil conservation survey, are shown on this map.

III land. Once the terraces have been built, the strips can readily be established by planting alternate terrace intervals to clean-tilled crops and close-growing crops as shown on Map No. 3. Contour strip rotations can then be carried out by rotating the crops in the strips.

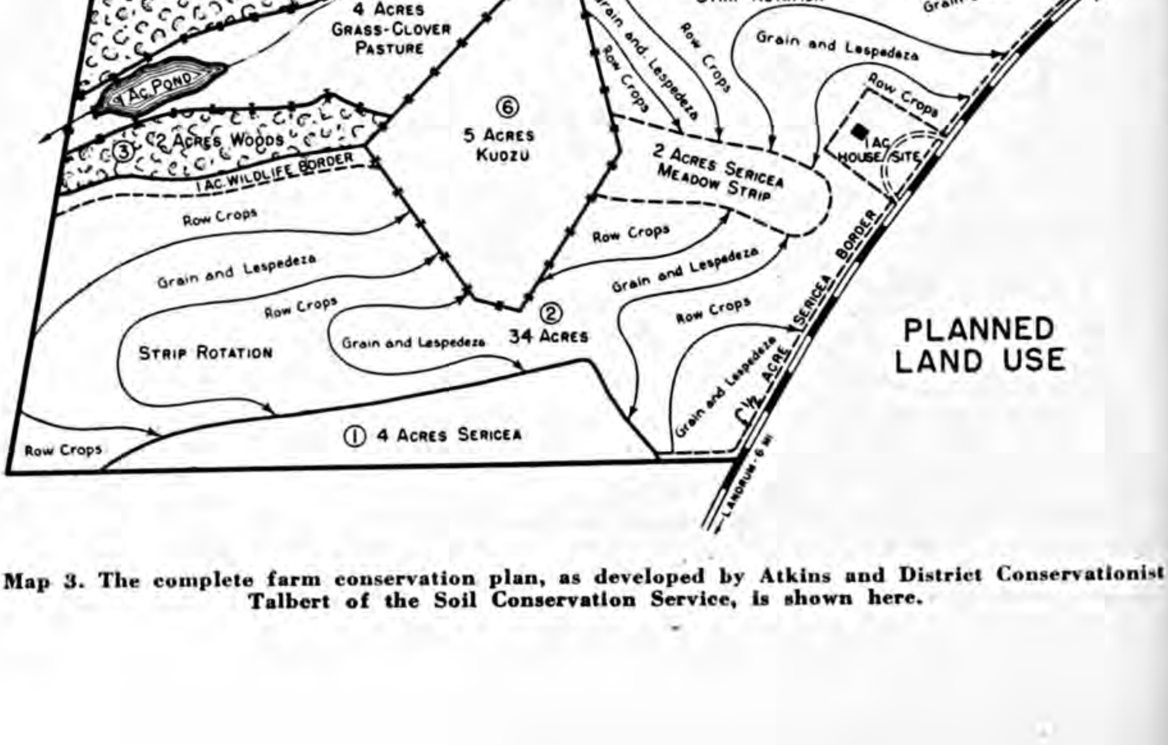
A four-year rotation of cotton, corn, small grain, and annual lespedeza was planned for 34 acres of Class II and Class III land in Field No. 2. The rotation will include 17 acres of row crops and 17 acres of small grain followed by lespedeza each year.

By producing most of his grain feed each year from fall-sown oats and barley in the small grain strips, Atkins will need only a small part of his row-crop land for corn; so only four acres were planned for this crop. Of the remaining 13 acres of row-crop land, 12 acres can be planted each year to cotton, which will be the main cash crop on the farm, and one acre to truck crops for home use. Annual lespedeza will be sown on the small grain strips in the early spring, thus giving two crops from the 17 acres in small grain-lespedeza strips each year.

The planting of one other small area will complete the treatment planned for Field No. 2. This will be a 30-foot-wide border strip for wildlife, comprising one acre between the cultivated land and the woods in Field No. 3. The border strip will include a 20-foot strip of sericea adjacent to the cultivated land and a 10-foot strip of tall-growing bicolor lespedeza next to the woods to furnish food and cover for birds and other small species of wildlife.

The area shown as woods on Map No. 1 is cut-over land. The woods consist of a scrubby growth of hardwoods and a few scattered pines. Because this is Class VI land, adapted among other possible uses to growing trees, two acres in Field No. 3 and four acres in Field No. 5 will be left as woodland and interplanted with pines to develop a fully stocked stand of desirable tree species.

A woodland management program for these six acres, including protection against damage by fire and grazing, is



Map 3. The complete farm conservation plan, as developed by Atkins and District Conservationist Talbert of the Soil Conservation Service, is shown here.

The residence built for Atkins and his bride goes up.

a part of the farm plan. By selective cutting and other good woodland management practices, the six acres left in woods will furnish a sustained yield of fuelwood, fence posts, and farm lumber to meet all the wood needs of the farm.

Between the two areas planned for woodland in Fields 3 and 5 is a low area of poorly drained land which had grown up in alders and a few poor-quality trees. This is Class V-A land, which is ideal for pasture if drained. A small stream, fed by several springs, flows through this area, making the drainage problem a simple one.

The old pasture is Class IV land. It is steep and badly eroded, and suitable only for perennial vegetation. A few small areas of adjoining Class III land will be taken in with this area and planted to kudzu. This will control the erosion and provide five acres of supplemental grazing or hay land adjoining the permanent pasture.

Thus Atkins will have 12 acres in three different kinds of pasture—grass and clover, sericea, kudzu—all in adjoining blocks. With the grain produced on his rotated cropland, this will furnish all the feed that Atkins will need for the cows, mules, hogs, and poultry he plans to keep.

Knowing the necessity of an abundant supply of plant food for perennials, Talbert recommended 100 pounds of muriate of potash per acre for both kudzu and sericea, 200 pounds of phosphate fertilizer an acre for the kudzu, and 400 pounds of phosphate fertilizer for the sericea. In improving the pasture, soil amendments recommended were 100 pounds of muriate of potash, 400 pounds of phosphate fertilizer, and one ton of lime an acre to speed the growth of white clover, Dallas grass, Bermuda grass, and annual lespedeza.

The barn which served the old tenant house on the farm is a large one and is in first-class condition. It is located at the edge of the proposed sericea pasture, through which access will be afforded for Atkins' livestock to all the grazing land planned for the farm.

There was one other thing that Atkins told Talbert he had his heart set on—a fish pond.

At the far end of the grass-clover pasture where the low Class V-A land narrows almost to a point between areas of steep Class VI land on each side, they found an ideal site for the dam.

A one-acre pond was planned. When properly stocked and fertilized, a pond that size should furnish 200 to 250 pounds of fish a year—as well as a lot of fun.

Before the plan was made, there were 45 acres of cropland, principally cotton and corn, with a small acreage of annual hay; five acres of eroded pasture overgrown with brush and weeds; and 11 acres of poorly stocked, cut-over woodland, three acres of which were low, wet land covered with alders and a scattered growth of low-quality trees. One acre, where the new house is being completed, was idle.

With a definite plan for putting every acre to its best use and treating all the land according to its needs, Atkins will have approximately the same acreage of cropland as before—46 acres—but with only 34 acres in cultivated crops, and 12 acres in perennials, including seven acres of sericea in Field No. 1 and five acres of kudzu in Field No. 6.

Instead of the five acres of unimproved pasture on steep, eroded land, he will have four acres of improved grass and clover pasture on fertile bottomland, three acres of sericea pasture, and five acres in kudzu that can be harvested for hay as cropland or used for grazing when needed.

As a part of the land use changes, the 11 acres classed as woodland will be reduced to six. But instead of a poorly stocked stand of low-quality trees, Atkins will have a thrifty stand of desirable tree species that will furnish all the wood products required on the farm.

And down at the far end of the pasture, where will be built the fish pond Gene has set his heart on, it won't be any trick at all of a summer's afternoon for him to throw in a line and catch a mess of fish for Vivian to cook for supper.

By the time Secretary of Agriculture Anderson gave the deed to Gene, most of the practices that could be placed on the land during the fall of the year had been established. Farm equipment dealers and agricultural agencies cooperating with the Broad River Soil Conservation District built the terraces, sowed small grain in alternate contour strips, shaped and seeded the meadow drainageway, set pine seedlings in the cut-over woodland, planted kudzu, prepared the wildlife border, and sloped

Atkins, after completing the conservation plan with Talbert's assistance, signs the cooperative agreement with the supervisors of the Broad River Soil Conservation District while District Supervisor E. C. McArthur looks on.

the road bank for the 15-foot border strip to be planted to sericea lespedeza.

As Bank President Landrum explained, "We have given Gene Atkins a farm and we have helped him to get started on a soil conservation program that will keep the land productive from here on out. Because every one will watch the way he farms his land, we believe that his soil conservation farming will be an inspiration and a demonstration for all the other farmers of our section."

We believe that Gene Atkins' soil conservation farming will be as much an inspiration for veterans who return to the land as his military deeds are for those who follow him in the uniform of his country.

Profit on Mississippi Soils From One Ton of Potash Under Cotton

(*From page* 9)

No fertilizer analysis tests with cotton have been conducted in the Gulf Coastal area.

The response to potash in the Sand-Clay Hills area as shown by the six tests which have been conducted has been quite variable. The average profit from one ton of potash under cotton calculated in the same manner as that for the other soils areas is $362.

Only two tests have been conducted in the Flatwoods and Pontotoc Ridge soil areas, respectively. These limited data show profits of $257 and $412 from the use of one ton of potash under cotton in the Flatwoods and Pontotoc Ridge areas, respectively.

Eleven tests have been conducted in the Northeast Prairie soil area. With two exceptions, all of these tests have been located on upland soils of heavy texture where potash is not ordinarily deficient for cotton production. A response to potash was obtained in 3 out of the 11 tests, but in 2 of these 3 only small increases in yield were due to potash. The only test which was located on bottomland soil was the test on the Central Station farm in which the profit was $706. Since only one bottomland soil was tested in this soil area, an average of the 11 tests is not indicative of the response of all soils of this area to potash under cotton. The average of 10 tests, excluding the test mentioned above, shows a profit of $26 from the use of one ton of potash under cotton.

As shown on the map, four tests have been conducted in the Northeast Highland area, two of which have been on terrace soils and two on upland soils. The response to potash in all four cases has been rather great, ranging from a profit of $440 to $659 per ton of potash used. From these four tests the average profit per ton of potash under cotton for this area is $542.

Summary

The data presented show that the greatest profit for any soil area of the State from one ton of potash under cotton is obtained on the terrace and bottom soils of the Brown Loam area, the average profit for this area being $682.

The other soil areas in descending order of profit from one ton of potash under cotton are: Northeast Highland $542, Longleaf Pine $488, Pontotoc Ridge $412, Sand-Clay Hills $362, Flatwoods $257, Yazoo-Mississippi Delta $269 (tests at Stoneville and Heathman omitted from average), and Northeast Prairie $26 (test on Central Station farm omitted from average).

While it is apparent from the data presented on the accompanying map that the estimate of the profit from one ton of potash under cotton for the various soil areas of Mississippi is based upon insufficient data to be the most reliable, it is considered to be the best estimate available until such time as it may be possible to conduct additional fertilizer analysis tests.

It is, therefore, concluded from the data presented that: (1) potash should be used under cotton in some sections of the State in rather large amounts, (2) in some sections of the State the use of only small amounts of potash under cotton will prove profitable, (3) in certain areas which represent only a relatively small part of the State, potash is not profitable under cotton, and (4) more fertilizer analysis tests are needed to determine the potash needs for parts of soil areas which as yet have not been tested.

Tenderfoot Trail

(*From page* 5)

A few accommodation cars were waiting on the new track which connected this eastern end of the line to the terminus at Rapid City—unaware of its destiny as the summer camp of Calvin Coolidge some years later. These rattling cars took us in halting fashion across the brown prairies to Owanka—said to mean "a place to camp" in the Sioux vocabulary. Here was the post-office we would call our own and the freight address to which various boxes of Chicago mail order merchandise would all arrive in due season.

Owanka was just a place to camp, all right. Located on a broad area along the cottonwood bottoms fringing a winding creek, there were four stores and a blacksmith shop, a small beanery, and a red depot with the home of the section boss adjacent thereto. A grubby, rough, and winding trail crossed the tracks north of the mart and leaped up a sheer declivity in alarming curves without barriers, to reach the tableland where presumptuous Iowa and Nebraska farmers had staked their claims. How the boys ever managed to drive their teams with wagons laden with lumber up that gumbo cliff from town still remains a mystery.

Anyhow, the Old Soldier was waiting there when we stiffly climbed down, and he as double-delighted with our coming, giving special welcome to Major, the unexpected member. He told us on the load going home that he had lived on beans so long that it reminded him of the siege of Vicksburg, and he was mouth-watering for some of Ma's best recipes. I gave little heed to the route we took, and Ma gave less because she was tuckered out completely. That straight road of three miles to our noble claim site was afterwards to be kissed by my aching feet for trips unnumbered, as there was no rural delivery yet and you earned every letter and circular they gave you.

The Old Soldier's pride in the shed-roof shanty on the prairie, with a good south view of the distant Bad Lands, was not at once shared by Ma. She was used to trees and bushes and weedy fence rows and corn fields and neighbors. Here in our new home there were no trees for miles, the bushes were absent too, and the fences caught and held rows of tumbleweed thistles which looked like sheep on a riotous windy day when they started to travel again.

For neighbors we had, of course, the piping meadow larks by day and the devilish cries of the coyotes by evening; and an occasional visit by some curious distant squatter who wanted to pause and see how that old veteran and his folks were standing the winter. Besides the normal chores of cooking over a small cast-iron stove heated with mill slabs and lignite coal, she could pass away the time resuming where she left off in rug hooking or quilt patchwork—but even this sort of gets monotonous betimes when the sun sinks low and the chance for a bit of company is slim.

On top of this, when your well is an

open one of dubious value and small rodents fall into it, and the mice come right in and take pot-luck with you, and the raw lumber is suspected of harboring quantities of bed-bugs, and the cellar storage is a dirt cave in the gumbo-like clay outside, and you settle in such a spot before the days of radio and you can only play dominoes to while away the Dakota darkness—well, something could be said, if not done, about it. One item of cheerful consolation there was, to be sure, you didn't get mixed up with the Donner Party or suffer with the Mormons or get killed in the Civil War.

Sending orders for and receiving packages of mail-order groceries was one event that brought some solace to our squatting. Finding proper storage places for the canned milk, bacon, raisins, tea, and rice was not so easy, unless we put them under the beds. Once when the Old Soldier and Ma took a trip to Rapid City, I undertook some fancy cookery, including a projected pudding made of tapioca. I made far too much of it by mistake and was still lunching on it when they returned. I figured that tapioca was what they had that time when they fed the Five Thousand. A little went a long ways.

WHILE waiting for the Great Day of Commuting to come, a brother of mine who served as clerk to the Agent on the Pine Ridge Agency got me a "position" in the general store run by a halfbreed trader of acumen and skill. Here it was my duty to sell groceries instead of buy them. Here I was obliged to sweep out mornings and devote the rest of my long day to a slow acquiring of the Sioux tongue, at least enough of the guttural expressions to satisfy the demands of the ordinary routine of barter.

I was proud just to be able to put my hand upward, palm outward, and to sing out in breezy style the usual slogan of the trader to his victim: "How, Kola, Tak-u-wa-chin." In Yankee language it meant "How-de-do, my friend, what can I do for you—or what do you desire?"

I waited on celebrities of the day on the Sioux reservation, including Standing Soldier, chief of police, Mrs. Plenty Horses, a shrewd squaw of property, and once at least no less a personage than Red Cloud himself, noted tribal chieftain who was engaged in combat with our cavalry in the days when Rain-in-the-Face made bad weather for Uncle Sam.

AFTER an interval of many long years away from the Ogalalla influence and memory fading for detail, the phrases I used to gibber easily to tribesmen in quest of everything from canned tomatoes to shoes and sugar have largely left me. The ones I do recall cannot be put down here without a challenge or a prosecution from the Commissioner of Indian Affairs. The letters of my alphabet fail me in trying to "letter and syllable it for you." But I count those hours well spent both on the reservation (where my complexion and facial topography made me akin to the brethren) and likewise on the lonesome claim amid the buffalo wallows.

It was the largest Indian reservation in the North. From it came many of the painted make-believe savages who toured the effete East to frighten the wits out of wild west show patrons in stagecoach holdups and the burning of cabins. Within easy reach of it was the shameful scene of the Wounded Kness butchery, following in the wake of the native religious Messiah affair. Shoshones often dropped in to chat with the remnants of the Sioux braves, and I watched their mystic and dignified sign-language with awe and appreciation. To a shallow-pated kid from a Midwest high school, this raw education on the edge of civilization was a tonic and a boost. If I had it to live over no doubt my time would be better spent in "research" and questioning, and I might even take on the reservation farm boss too, who was a sort of county agent to the red brethren before the pale faces ever thought of schooling and advising the farmer.

Some of the Sioux braves were sympathetic with the ranchers in opposition to the wave of agricultural settlement. They alike thought that the land was best for grazing and meat raising, and they said the plowed furrows were "wrong side up."

For the benefits derived from life on the claim there can be no financial balance cast. The Old Soldier never got any large accumulation of wealth out of his final sale of the land to a neighbor adjoining us. But he had had his fling and realized his ambition to take up some "Government land" offered as largesse to the war-weary veterans. He was then content to resume his reflective pipe on winter evenings in the Midlands and had one more stirring story to enliven his collection of well-embellished personal narratives. This experience was all he needed to round out a well-spent but humble and obscure life as an American—as he could testify to having been through two pioneer periods and a sizable war to boot. He had never been the consort of kings or the pet of politicians, and he never lapped it up at the trough of privilege. But he followed the path of his fathers and rests in the shade of their trees.

AND as for me, who shared that last big adventure which led to no glory or wealth, I guess my lesson lies in patience and confidence. Both patience and confidence came from the living out of the last epoch of westward migration, so as to feel kinship with the men who made history but seldom appear in it as heroes.

Perhaps, who knows, the time will come when folks will more fully sense the dignity and decency of those days of our nativity, even after we skim off the dross; and we shall begin to question whether some of the more recent public behavior is in tune with the legacy they left us.

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)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
E-2-42 Fertilizing for More and Better Vegetables
S-6-42 A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa
II-12-42 Wartime Contribution of the American Potash Industry
A-1-43 The Salt That Nearly Lost a War
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
M-3-43 Lespedeza Is Not a Poor Land Crop
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
PP-12-43 Commercial Fertilizers for Livestock Farms
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H-2-44 Efficient Fertilizers for Potato Farms
I-3-44 Doubling Production by Bettering Soils
K-3-44 Soil Tests Indicate Potash Levels
T-5-44 Southern Crops Show Need of Potash
X-6-44 Soil Management for Cannery Peas
AA-8-44 Florida Knows How to Fertilize Citrus
CC-8-44 Soil Fertility's Effect on Asparagus
KK-11-44 Growing Quality in Tomatoes
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QQ-12-44 Leaf Analysis—A Guide to Better Crops
A-1-45 Fertilized Corn Plants Require Well-Ventilated Soils
C-1-45 Fertilizers for Cotton and Corn Following Lespedeza
G-2-45 Some Whys and Wherefores for Air-Conditioning Soils
J-2-45 Potash for Legume Pastures in Florida
K-2-45 Plow-Sole Fertilizing on the Average Farm
L-2-45 Fish for Health, Recreation, and Politics
P-3-45 Balanced Fertility in the Orchard
Q-3-45 Earliness Counts with Austrian Winter Peas
R-3-45 Higher Corn Yields for North Carolina
U-4-45 New Ideas in Haymaking from New York Farmers
V-4-45 Yield and Quality of Cotton Can Be Improved by Boron
W-4-45 Fertilizing Golf Greens
X-4-45 Idle Acres in the Southeast Can Be Put to Work
Y-5-45 How Long Do the Effects from Fertilizer Last?
Z-5-45 Alfalfa—the Aristocrat
BB-5-45 Applying Experimental Work to Cotton Farming
DD-5-45 A Case of Combined Potassium and Boron Deficiencies in Grapes
EE-6-45 Balanced Sods in Orchards
FF-6-45 Orcharding from the Ground Up
GG-6-45 Know Your Soil
JJ-8-45 Plow-Under Practices
KK-8-45 From Scrub Pine to Broccoli on Cape Cod
LL-8-45 Fertilizing for Better Soybeans in North Carolina
MM-8-45 Red Clover Suggests Shortage of Potash
NN-8-45 The Effect of Borax and Lime on Quality of Cauliflowers
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
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THE AMERICAN POTASH INSTITUTE

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

A Few Whinnies

PRECAUTION

"Your neighbors are honest, I hope?" someone asked the old Negro.

"Yassir, dey is."

"But you keep that loaded shotgun near your hen coop."

"Dat's to keep 'em honest!"

Soldier: "Dearest, I love you terribly."

Girl: "You certainly do!"

TEXAS TABLE MANNERS

A Texas father was dining with his son in a Texas hotel, and in the course of dinner the son got into an argument with a cowboy. The cowboy called the son an offensive name, a very offensive name, and the young fellow grabbed his knife in his fist and started around the table to be avenged.

"Ain't ye got no table manners?" the old man hissed.

"But, pop, ye heered what he called me, didn't ye?"

"Yes, I heered all right, but that ain't no ground for yer fergittin' yer table manners. Put down that there knife and go at him with yer fork."

"What is a conscience?"

"Conscience is the thing that hurts when everything else feels good."

Father: "Did you put your penny in the Sunday School collection, son?"

Tommy: "No, dad, I lost it."

Father: "But this is the third week you've lost it!"

Tommy: "I know, but that other kid's luck can't last forever."

"I see," remarked young Mr. Jones, "that a man who speaks six languages has just married a woman who speaks three."

"That," replied the long-wedded Mr. Brown, "seems to be about the right handicap."

We are always glad for the man who takes himself seriously, because he creates so much laughter.

"How's the public sentiment out here?" asked the politician, who was passing through a rural community.

"Still goin' strong," answered the native. "There were sixteen cars parked in my lane last night."

TAKING A CHANCE

Magistrate: "What induced you to strike your wife?"

Husband: "Well, your honor, she had her back to me, the broom was handy and the back door was open, so I thought I'd take a chance."

A young girl talking to her grandfather, asked, "Grandfather, how old does a girl have to be to get married?"

Grandfather: "She must be old enough yet young enough, big enough yet little enough, wise enough yet dumb enough, weak enough yet strong enough, to chase a man until he catches her."

A pessimist is a man who feels that all women are bad. An optimist hopes so.

Better Crops *with* PLANT FOOD

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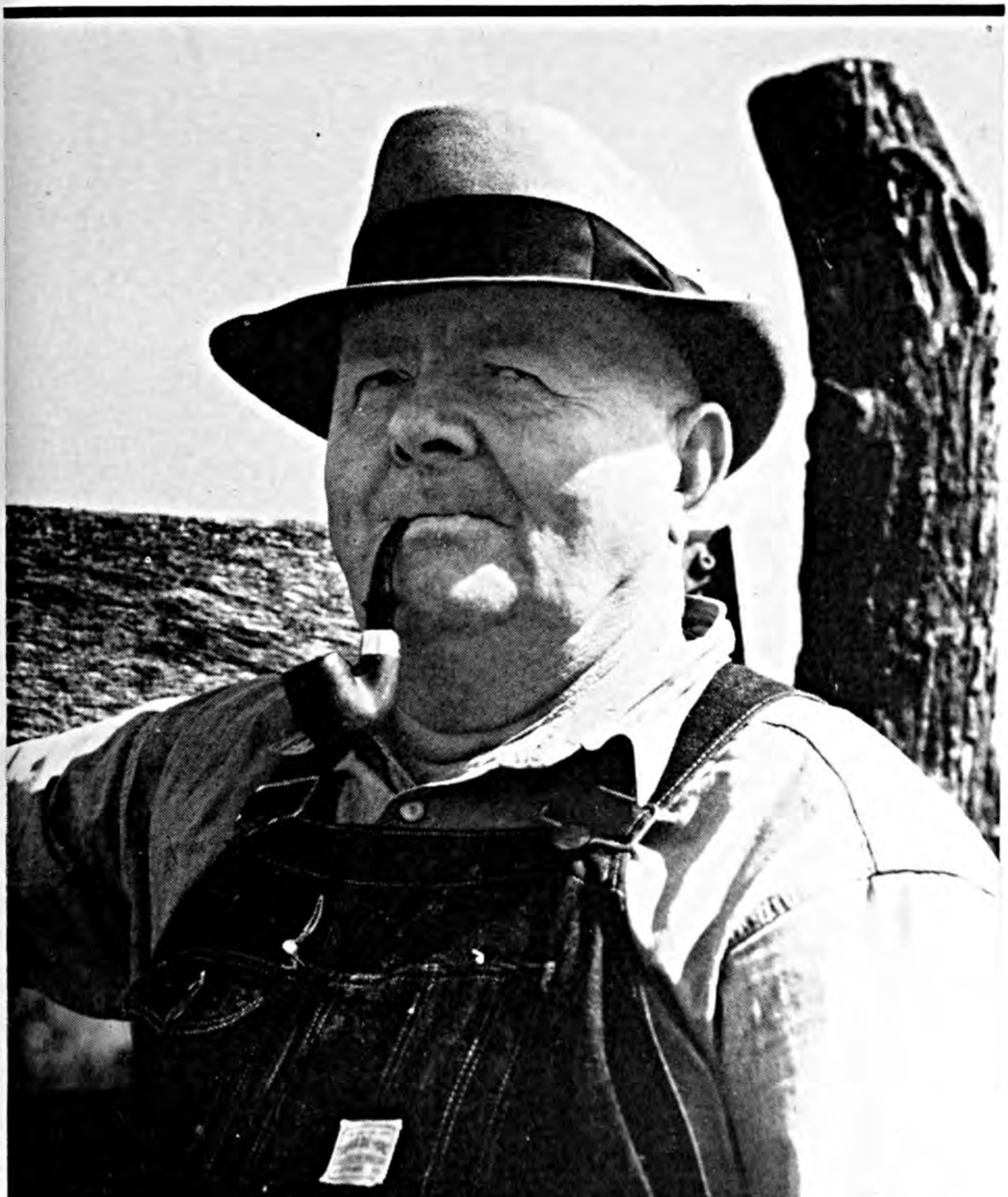

The Pocket Book of Agriculture

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.**

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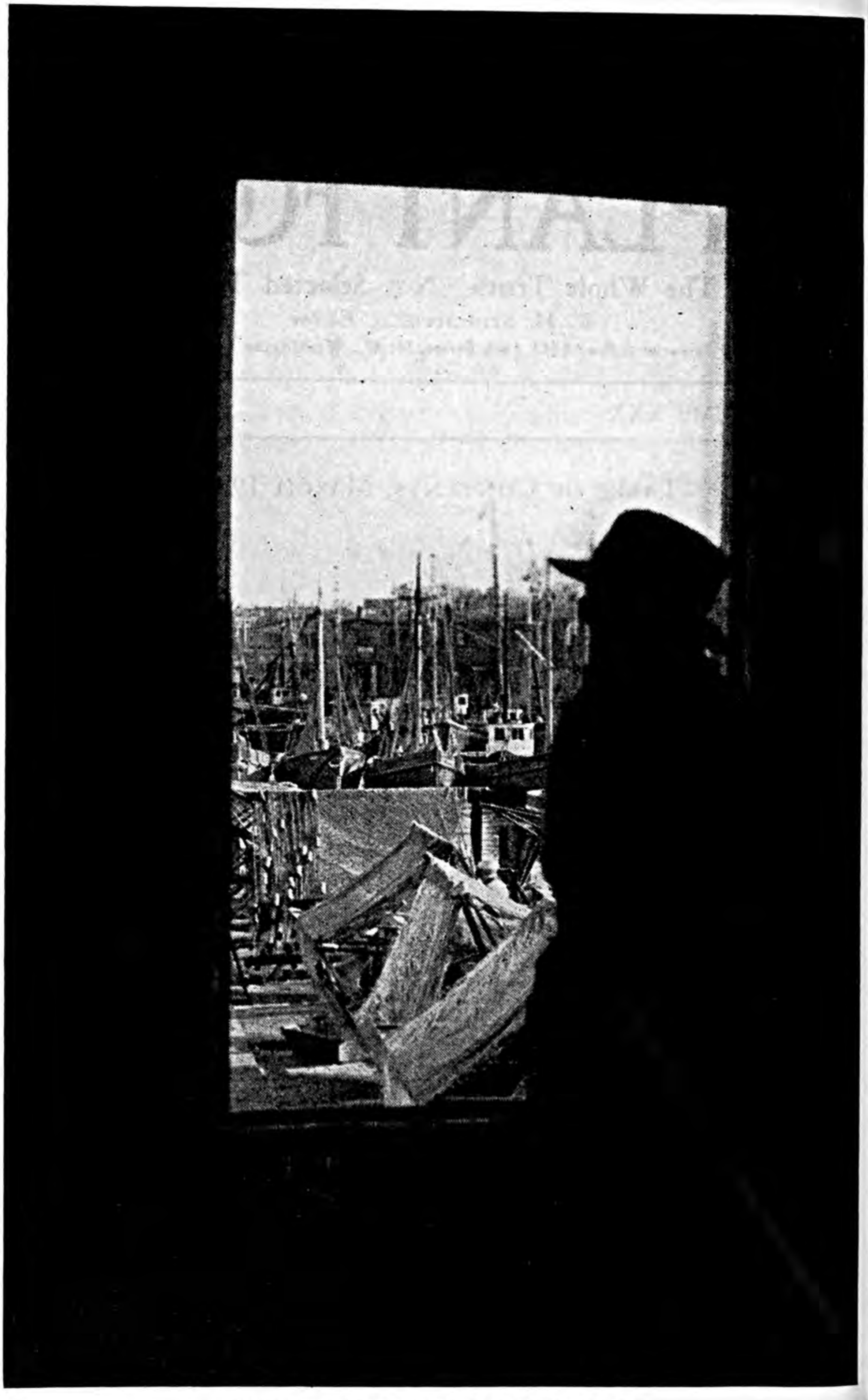

SOME IMPLEMENTS FOR FARMING THE SEA

Better Crops with PLANT FOOD

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VOL. XXX WASHINGTON, D. C., MARCH, 1946 No. 3

Some ideas for . . . . . .

WHEAT WINNOWINGS

Jeff McDermid

FASTING foreigners who derive from 50 to 80 per cent of their daily calorie needs from wheat and other cereals are gazing through the ruins of blasted farms and mills toward our abundant shores, where only 15 to 20 per cent of the daily calorie intake consists of "breadstuffs." So to us an oft-dreaded surplus crop becomes a new goal of endeavor.

This urgent humanitarian cry for succor puts wheat once more in the spotlight and makes an essay on it quite timely. If this call for relief had come to us back in the last years of the nineteenth century, our power to provide quick help would not have compared favorably with the facilities we now possess for delivery of wheat—barring present temporary railway congestion.

For in those days which many of us treasure in rural memory, our wheat crop was not really a commercial product on a specialized scale. The humid regions of soft winter varieties stretching from the Mississippi to the Atlantic and south to the middle borderlands, as well as parts of the moist Lake States and the northeast plateaus, were not extensive wheat areas, but farmers usually grew "more or less" wheat for themselves, their livestock, and for crop rotation purposes.

You remember how the old grist mills graced many a country brookside or lake edge, with dams and water wheels, flumes and gates, rock foundations, handtrimmed grinding stones, and a jolly, dusty miller taking toll from his farm customers. Artists and camera fiends found his institution about as picturesque as the w. k.

brawny smith's clanging shop. Directions given to strangers usually put in a mill as the guide and landmark, so common and widespread were those flour factories in our humble, self-sufficient, localized, provincial economy.

"Gone are the days" all right, and in the swift interval of a short lifetime those old mills have followed such former necessities as the hitching post, the kerosene lamp, and the family-sized three-holer into the inefficient and unmourned past. So likewise has our small-farm wheat production vanished and yielded to "wheat-ocean" ranches with combine flotillas bounding over waves of golden grain.

THERE have been ups and downs and cycles of lean and fat seasons among the wheat gentry, but aside from this, the marvelous panorama of progress and unending technical improvement and power marking the wheat kernels path from planter to pantry has become an epicurean epic, peculiar to this great land of gripers.

Serving the wheat grower, now characterized by the presence of 65 per cent or more of our total volume of wheat production in the western and northern Great Plains, are a legion of caterers and equippers, service agencies, cheer leaders, and advice givers. There are more sideline assistants on the wheat front than there were for all of agriculture in the not-too-distant past.

Wheat must be bred right to yield well against mid-continental weather and adversities too numerous to mention. Hence the army of plant breeders, seed selectors, hybridizers, geneticists, pathologists, and just plain seedsmen.

The wheat plant must grow in fertile and favorably balanced soil—potash, phosphate, nitrogen, lime, magnesium salts, humus—and so along come the chemists and the mechanical mixers and weighing outfits and the vast warehouses and demonstrators, the county agent "plotters" and the know-how dealers at the trackside.

The wheat plant must be seeded and harvested on large farms by few men. Here, in answer, have come all the resources of the drafting room, the laboratory, the motor designer and fuel expert, the gear and sprocket boys, and the rough-and-ready engineers—each season springing something newer, better, and faster, defying all but the aircraft industry to keep up the forward pace.

Again there are out-reaching agents to distribute and demonstrate and repair and maintain thousands of motorized and electric-connected, grain-reaping juggernauts, sweeping away with defiance all the threats with which the IWW "Wobblies" once scared the harvesters, and reducing the whole major production picture to a canvas of mural proportions.

Then we look in vain for the little mills and the horse-drawn loads of 50 to 75 bushels toiling to town, the five-acre wheat plots near the bean patch, and the old cow-manure rejuvenating system used of yore. As a matter of fact, there is one big reason we might forget which influenced this wheat turntable, and that is the way that the chinch bug, red rust, and the cow business divorced two-thirds of American farmers from commercial wheat culture.

AS a result of this shift in wheat growing from a selfsufficing and widely scattered industry to a strictly commercial one with only about a dozen states specializing in it, the utilization of the crop and its magnitude as well have both greatly changed.

We may have fewer states and fewer men engaged in actual wheat production these days, but we have more skilled employment and larger incomes from the wheat service industry as a whole than ever before. Moreover, the wheat kernel has been separated and screened over in modern practice so that the net result in late years has been less of it in toto for the human stomach and more of it for the feed bag. To carry this out further might entail much guesswork as to the relative net worth of wheat flour and the feed-offal residues, respectively, to sustain human energy, the flour by direct use and the coarse parts of the kernel for eventual use through livestock channels. But some progress in processing is clearer to demonstrate to human advantage than the flour and feed angle.

Better bred wheats and certified seed make it possible for about two square feet of land to raise enough cereal to make a loaf of bread. The old buhrstones of long ago are replaced by corrugated chilled steel rolls, each succeeding pair finer than the first, until finally the top grade patent flour goes through a set of silk mesh drums and receives its last polish of perfection and fineness. The selecting, grading, bolting, and dividing of the component parts of the berry—first and second clears, red dog, bran, shorts, and wheat middlings—are now controlled by a gigantic industry, with occupational and professional skill of the very highest order.

Gone are the primitive aspects of the wheat-milling game, but its romance remains as thrilling and inspiring as ever, in a different and a better way. Your granddad brought home country grist which contained chaff, weed seeds, bugs, dust, dirt, and disease spores, plus the fuzz from kernel coats all in one package. To be sure the present milling methods ordinarily get only about 50 per cent of the berry into the take-home flour sack, but most of the balance either returns as eggs, meat, or milk or gets onto the land as fertilizer.

Today the average normal rate of milling yields one barrel of flour from 139 pounds of wheat, or about 2.35 bushels of wheat. This 139 pounds of wheat when milled by 72 per cent extraction gives about 100 pounds of flour and 39 pounds of stock feed. Under the new 80 per cent extraction rate, there are about 111 pounds of flour and 28 pounds of feeding stuffs. This means about 11 per cent more flour yield and 25 per cent less feed production from each bushel of wheat under the emergency ruling to obtain greater human breadstuffs from wheat, at some expense to the livestock feeding fraternity.

RIGHT here we pause to adjust our thinking again. In the first World War there were two different situations facing Americans relative to wheat and flour than obtain at the end of World War No. 2. First, our acreages and yield and our surplus for export in 1915-20 were under par. We were just emerging from the isolated and scattered wheat culture era, lacked modern facilities for its improvement, and had a larger per capita rate of wheat consumption at home than we have had recently. This meant that one of the big food increase campaigns of the other war era was hitched to wheat, and once it got started as it did during the war, it was hard to stop it from running into astronomical tonnages.

Second, households in the other war period and for a few years after toted home bigger flour sacks and bought flour oftener than they do now. Even the farm wife has quit baking bread, imitating her city cousin in the weekly purchase of favorite brands at the convenient bread rack at the fancy food store. Consequently the bulk of the bread business belongs to the professional baker, and he is the one who transacts most of the heavy flour contracts with millers rather than the wholesale grocer and food jobber. Any move now toward conserving any vast amount of wheat simmers down to a deal with the bakers, leaving the consumer the privilege of eating fewer

(*Turn to page* 50)

Tomatoes Are A Field Crop In Western Ohio

By John Bushnell

Ohio Agricultural Experiment Station, Wooster, Ohio

TOMATOES grown for canning are an increasingly important crop in western Ohio. In the prewar decade, 1930 to 1940, the acreage doubled and, as expected, increased further during the war.

Only a small part of this acreage is found on specialized farms where tomatoes are the principal crop. The bulk of the crop is grown in small fields on general farms, where the tomatoes are an incidental cash crop.

This practice is economically sound. The individual farmer does not need to invest in special equipment to grow tomatoes, neither does he need to go out of his way to obtain plants in the spring or to hunt markets when the crop ripens. By long-established precedent, the grower contracts with a processor who buys the crop, supplies the plants, and loans the setting implements.

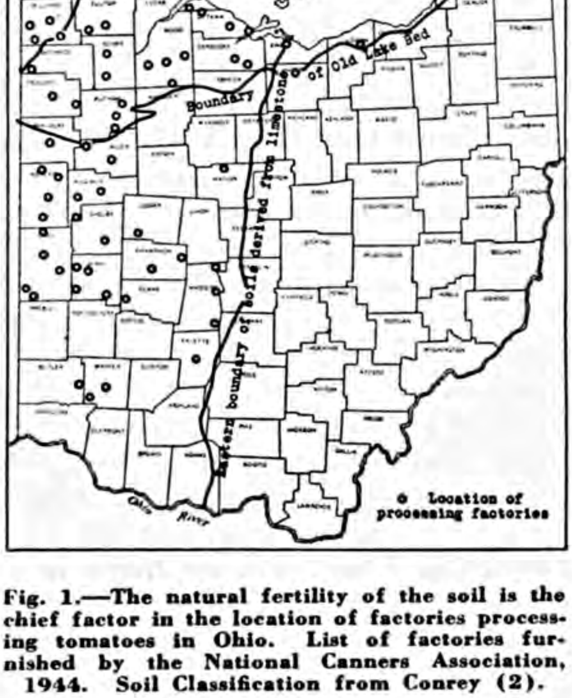

Fig. 1.—The natural fertility of the soil is the chief factor in the location of factories processing tomatoes in Ohio. List of factories furnished by the National Canners Association, 1944. Soil Classification from Conrey (2).

Except for the initial cost of the plants, which averages about $15 per acre, and some additional fertilizer, the expense and the labor involved in planting and cultivating tomatoes are similar to those of growing field corn. When a farmer considers the possibility of producing tomatoes he thinks of costs and returns in comparison with those from corn. In most seasons tomatoes have been more profitable than corn and in consequence more and more farmers have taken to growing a few acres.

The size of an individual farmer's planting depends in part upon his labor supply during the picking season. On grain farms this is a period of slack time between the harvesting of small grain and the harvest of corn. A farmer with one helper can ordinarily pick, load, and haul about an acre a day in addition to handling the routine work of the farm. Women and children often help pick. Tomatoes need to be picked once every five to seven days, hence, if the pickers cover an acre a day, five or six acres can be grown. During the peak of picking in Ohio the crop often yields five tons per acre. Thus from a five or six-acre field the peak of picking and hauling is only five or six tons per day. A truck of moderate size easily carries these in two loads.

The deduction that five or six acres make an economic tomato planting on an average farm is supported by the census reports. In 12 prominent Ohio

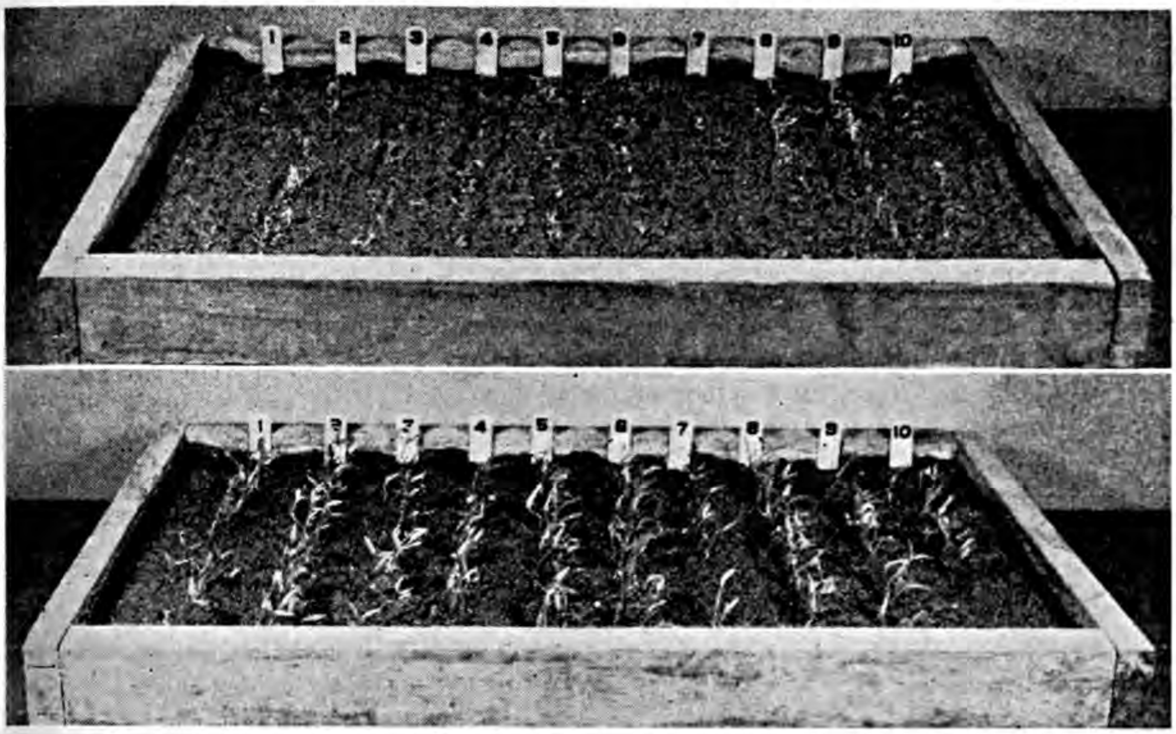

Fig. 2.—Tomato seedlings in flats held in refrigerators, above at 50°F. and below at 55°F., photographed 22 days after seeding. Ten varieties were planted to see if some would germinate more rapidly than others at these low temperatures. The differences were too small to be of practical significance.

tomato counties in 1939 there were 16,384 acres on 3,101 farms, an average of 5.28 acres per farm.

There is also in Ohio, as in other canning districts, a number of growers who plant tomatoes as their principal crop. To keep down diseases, tomatoes need at least a four-year crop rotation, hence the advisable limit of the acreage on a farm is one-fourth of the suitable land. These growers depend upon migratory labor, or draw upon nearby towns for help during the harvest season. The training and supervision of this seasonal labor are likely to be the most difficult phase of this large-scale type of tomato growing. In northwestern Ohio the climate and much of the soil are favorable for tomatoes; in this area large scale production seems destined to increase.

Soil and Fertilizer Requirements

Growing tomatoes for canning in Ohio is largely restricted to the western half of the State where soils were derived from limestone, (Fig. 1). These tomato soils not only have a higher calcium content than the eastern soils of the State but are much higher in available phosphorus. In the writer's opinion it is the available phosphorus rather than the calcium that makes possible the production of tomatoes as a field crop. There is abundant evidence in the literature that tomatoes require a specially high level of available phosphorus, or must be given a large application of high-phosphate fertilizer. The crop is successfully grown in eastern Ohio by market gardeners who think nothing of applying 1,000 to 2,000 pounds of fertilizer per acre, but such applications seem unreasonable to the general farmer. Consequently, the actual acreage grown as a field crop is restricted to the higher phosphorus soils.

The natural fertility of these soils, which are mostly dark-colored and predominantly of the Brookston series, is readily shown by laboratory tests. By Truog's test (4) the available phosphorus in samples from 50 fields averaged nearly 200 pounds per acre. The replaceable potassium by Thornton's test (3) likewise averaged about 200 pounds per acre. The current fertilizer applications on such soils range from 300 pounds per acre upward of 3-12-12, 0-12-12, or 0-20-20. The average application might be estimated at 400 pounds per acre, or about twice the amount currently applied to the corn crop. With these relatively small applications, yields of 15 tons per acre are not uncommon in favorable seasons.

Where no fertilizer is applied, phosphorus deficiency often shows in slow growth of the young plants, and toward the end of the picking season symptoms of potassium deficiency are sometimes seen. The tomato crop is a relatively heavy feeder on potassium. Chemical analyses of the fruits show that a 10-ton crop of tomatoes removes almost five times as much potash as a 50-bushel crop of corn. (Table 1).

TABLE 1.—FERTILIZER CONSTITUENTS REMOVED BY TOMATOES COMPARED WITH CORN.

	10 tons of tomatoes, fruit only	50 bu. of corn, grain only
	Lbs.	*Lbs.*
Nitrogen	40	45
Phosphoric acid	14	18.5
Potash	64	14

Although the actual average yield of tomatoes in Ohio is only 6.1 tons per acre, the skillful grower expects 10 tons, at least in favorable seasons. In view of the amount of potash removed by a 10-ton crop, our recommendation is to use a fertilizer high in potash, such as 0-12-12 or 0-20-20, and to apply enough at least to replace the amount removed by the fruit.

Recently, the plowing down of nitrogen ferilizer also has been recommended. Although the soil is dark-colored and relatively high in organic matter, the physical condition has deteriorated under past practices until the nitrification processes do not appear to proceed rapidly enough to supply the nitrogen needs of the plant. Nitrogen deficiency often appears by midseason. Plowing down 200 to 400 pounds of cyanamid or sulphate of ammonia has at least partly overcome this deficiency. (1).

Seeding Directly in the Field

During the past decade the growing of tomatoes by planting seed directly in the field instead of setting plants has been rather widely advocated in the Midwest. It is asserted that the plants growing directly in the field have an undamaged taproot, root more deeply, and survive drouth better than transplants. Moreover, such plantings escape the risk of infection from diseases that may be introduced on transplants. It is admitted that plants from direct seeding will fruit later and yield a ton or two less per acre, but the saving in initial cost compensates for lower yield.

It is true that tomatoes can be sown in mid-April and the seedlings will survive unless the frosts of May are severe. In early May 1945, seedlings in western Ohio survived a temperature of 29° F. and were damaged by 28° F. (Temperature recorded in standard Weather Bureau shelter, not actually close to seedlings). The principal difficulty in actual practice is not frost but weeds. Tomato seeds barely germinate at 50°, and grow only slowly at 55° F. Some weeds grow more rapidly and consequently outgrow the tomato seedlings. It is then very laborious to hoe out the weeds by hand, and the farmer simply disks up the planting and sets the field with transplants. In the writer's observations, more than half of the direct-seeded fields in western Ohio in 1945 were disked up and reset.

The possibilities of direct seeding have not as yet been critically studied in Ohio. Results of the tests shown in Fig. 2 and 3 indicate that seeding should be deferred until the soil is about 55° F. and that some phosphate fertilizer is needed, placed either directly in the row or not far from the seeds. Other tests indicate that the seedlings are very sensitive to the more soluble fertilizer constituents, hence any application of mixed fertilizer should

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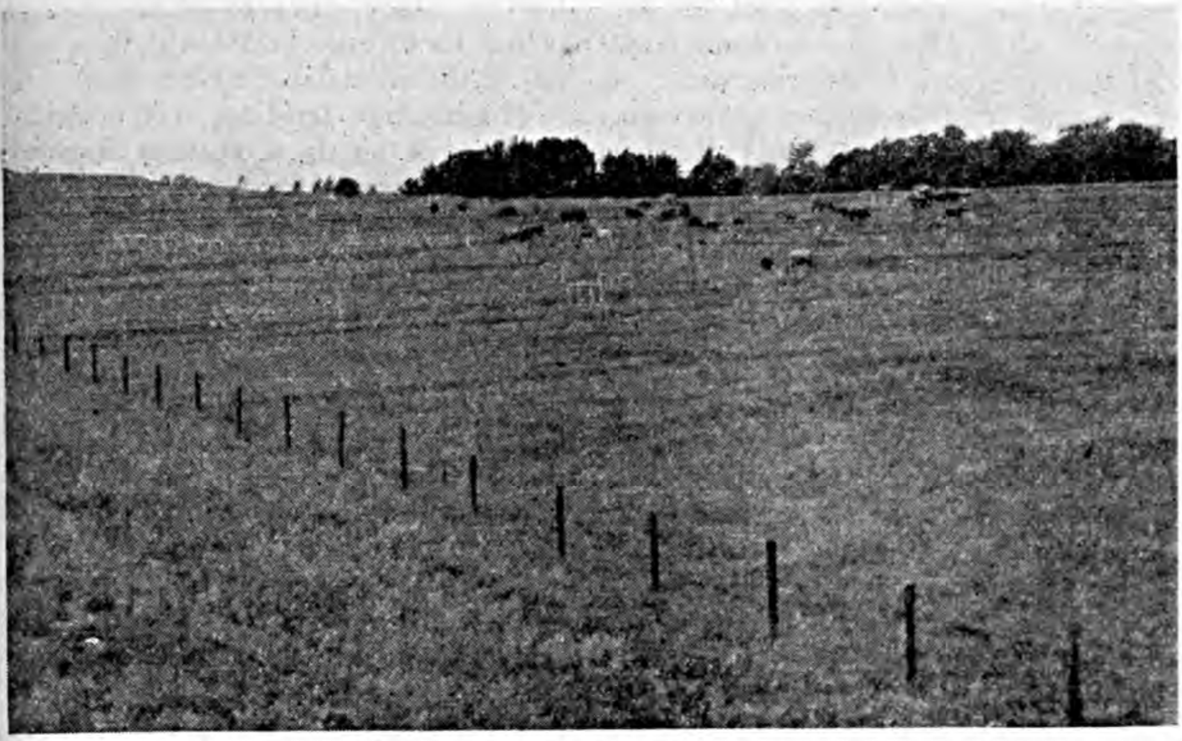

Dairy stock graze a good improved pasture on land retired from cultivation. This pasture contains lespedeza and white dutch clover. It has been fertilized with 40 pounds of muriate of potash, a ton of lime, and 300 pounds of a mixture of nitrogen and phosphate per acre.

Pasture Possibilities On Coastal Plain Hills

By Lester L. Loftin

Soil Conservation Service, Western Gulf Region, Fort Worth, Texas

THE experience of E. H. Lumpkin, dairyman of Minden, Louisiana, is proof that improved pastures can be developed profitably on Louisiana and Texas hill soils if they are built in the right way and maintained properly. Lumpkin has converted what used to be an average hill-land pasture with a carrying capacity of 7 acres for each animal to one with a carrying capacity of 1½ acres for each animal. His improvement practices have also increased the number of months out of each year that his pasture furnishes grazing.

With the help of Soil Conservation Service technicians assisting cooperators of the Dorcheat Soil Conservation District in pasture establishment and maintenance, Lumpkin has developed a very profitable enterprise out of his 135 acres of clover—grass and lespedeza—grass pastures. According to a recent report on a number of dairy farms in Louisiana, made by the USDA, Bureau of Dairy Industry, Lumpkin made a higher income for each dollar of capital invested in his dairy than any of the other operators. In another survey by the Bureau of Dairy Industry, Lumpkin had the second highest rate of profit on milk above the cost of feed required to produce this milk.

"The most important thing I did to bring about these results was to improve my pastures," Lumpkin says. "At one time I regarded my pasture land as being more or less waste land. I have converted this supposed 'waste land' into the most profitable land on my farm by following the recommended practices for pasture improvement. I have spent a great deal of money for lime, fertilizer, and seed, but I find that no other method of providing feed for livestock offers as great a return on the investment as improved pastures."

Building improved pastures of the sort Lumpkin has developed is a highly specialized farming practice. It must be understood thoroughly before it can be carried out successfully, he says. Lumpkin thinks pastures should be looked upon as a means of producing feed for animals the same as corn, hay, or any other feed crop.

The hill soils of the coastal plain region of northwest Louisiana and east Texas are inherently low in fertility. It takes a great deal of fertilizer to correct that condition. A check on about 500 soils samples, taken throughout Lumpkin's part of the State, shows that most of the hill soils there lack nitrogen, phosphorus, potassium, and calcium. The average amounts of phosphorus and potassium available for plants are less than half their minimum requirements for proper growth. The amount of calcium lime available was found too low in many cases to allow pasture plants to furnish bone-building qualities to the animals which eat them.

The average fertilizer recommendations made by the Louisiana Agricultural Experiment Station Soils Laboratory for a clover grass pasture on soils like Lumpkin's are 400 to 500 pounds of 20 per cent phosphate; 80 to 100 pounds of 50 per cent potash, and 1,000 to 3,000 pounds of lime an acre. The Soils Laboratory also recommends that these amounts be supplemented by liberal applications of additional phosphate and potash each year and periodic applications of lime.

If the land to be developed into improved pasture has been in cultivation for many years and the organic matter is depleted, barnyard manure needs to be added, legumes planted and plowed under, or some other method used to build up the organic content of the soil. A commercial fertilizer containing nitrogen is also a great help in getting grasses and clovers started in an improved pasture.

Proper fertilization causes two important changes in pastures: First, yields of both grasses and legumes are

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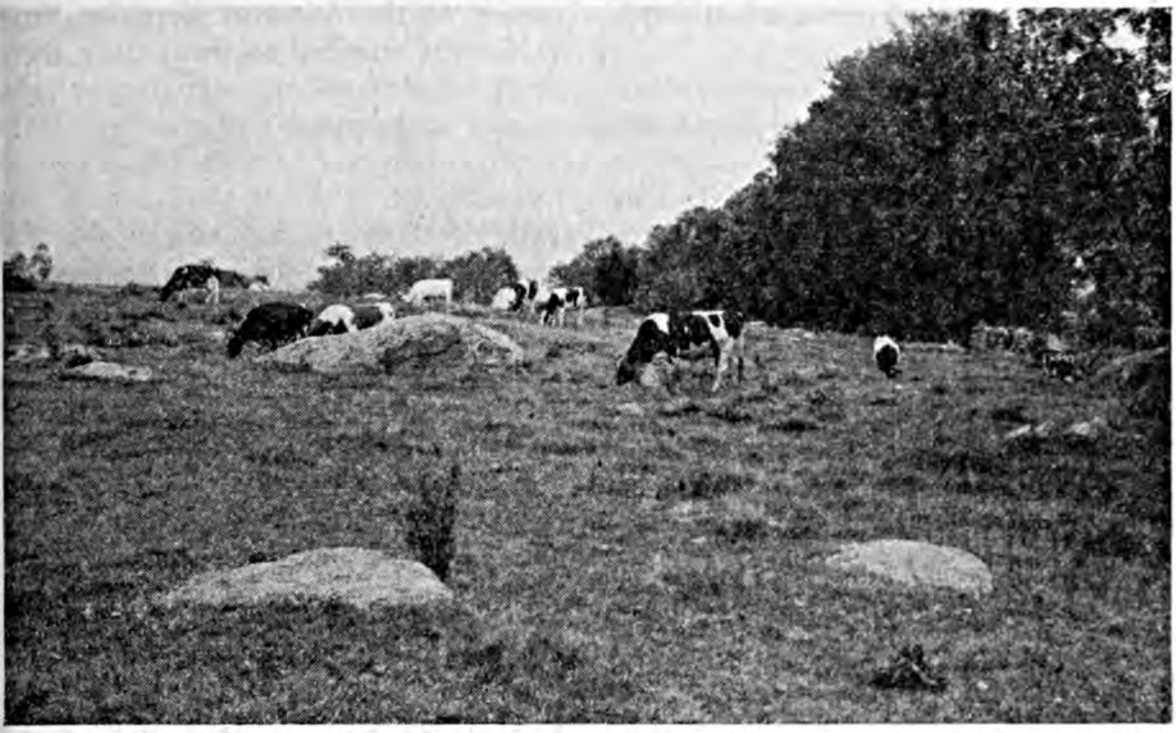
Erosion conditions have necessitated taking many Louisiana acres out of cultivation. Land of this sort can be utilized best as pasture in most localities.



Soil Conservation Service Photo

Lime and high-potash (8-16-16) fertilizer have produced good feed on this New England pasture; the cows know it.

The Story of Potash

By A. B. Beaumont

State College of Agriculture, Amherst, Massachusetts

FROM the precarious condition and doubtful prospects of a weak and unwanted infant to the full stature of a giant among the family of industrial chemicals has been the record of potash during the past 100 years. The story of potash has been told a number of times, but it has so much of interest and so many facets it will bear retelling, even at the risk of some repetition. It is interwoven with the story of the progress of the science of plant nutrition, practical crop production, and chemical technology. Wartime demands for increased food production only served to emphasize the importance of this element of nutrition.

Liberated in elementary form from one of its compounds in 1807 by Sir Humphrey Davy and discovered in large quantity in form of its soluble salts a quarter century later, potassium now occupies one of the leading positions among chemical elements in the world's commerce and industry. With some 90 per cent being used for fertilizer, agriculture easily gets the lion's share of the world's production of potash. The chloride, or muriate, is the principal form used in this way, although the sulfate and other potash salts are employed to some extent, mostly for specialized crops. The chloride, sulfate, chlorate, carbonate, and hydroxide, as well as smaller amounts of other potassium compounds, are used by the chemical and process industries. The hydroxide and carbonate forms are used as starting points in the manufacture of many chemicals important in the laboratory and technical processes, and in the making of soft soaps, pharmaceuticals, dyes, glass, and matches.

No one knows when or where farmers first learned that potash-containing materials helped the growth of plants. It is known that American Indians early discovered that plants grew better on spots where fires had burned, and in Europe and Asia wood ashes have been used for centuries to improve garden soils. There was a traffic in wood ashes for fertilizer as early as 1750 in which, according to the late Sir A. Daniel Hall, ashes produced from bean straw were sold for top-dressing grassland. Before the exploitation of the German potash deposits, commercial sources of potash consisted mainly of the "salt gardens" on the coast of France, in which potassic and other salts were made by evaporating ocean water, and wood ashes which were used as a soil amendment or leached for potash. Some crude potassium nitrate, made from niter beds, was imported from India.

The Mining of Potash

The German potash mines, whose product for nearly three quarters of a century dominated the world's potash trade, were discovered accidentally a century ago. At the quaint old town of Stassfurt in Saxony, which dates back to 806 A. D., the Prussian government in 1839 started drilling to see if workable deposits of common salt could be found. Deposits of this material deep in the earth were suspected at this place because for years common salt had been made here by evaporating salt brines obtained from springs and wells. Discovery of salt deposits in the Thuringian Basin, south of the Harz Mountains, had rendered the manufacture of salt from the weak brines of Stassfurt non-lucrative. When in 1843, at a depth of about 800 feet, a layer of salt containing considerable potassium and magnesium chlorides was found instead of pure sodium chloride which was sought, there was great disappointment.

For a number of years after the discovery of the Stassfurt deposits, little value was attached to them since their great importance to agriculture was neither appreciated nor known. After a time, however, potash began to be extracted on a small scale for use in various chemical industries. In the meantime, Liebig and others demonstrated the importance of potash in plant nutrition. Liebig was the proponent and able champion of the "mineral" theory, which emphasized the value of the so-called mineral elements, particularly potassium and phosphorus, for this purpose. He invented a patent manure of compounds of these elements but made the mistake of fusing the mixture with lime and calcium phosphate so that it would not too readily be leached from the soil. Although Liebig's emphasis on the value of the minerals in plant nutrition was a distinct service to agriculture, his misconception of the necessity of supplying nitrogen to crops and the vigor with which he affirmed it were a disservice.

In 1861 the mining of potash salts at Stassfurt began and steadily increased thereafter, until by the turn of the century something over one million tons of potash were being produced by German mines, and most of it was being used for agriculture. Until the beginning of World War I, Germany had a virtual monopoly on international potash trade, although workable deposits were known to exist in Alsace, Spain, and elsewhere. When the German supply of potash was cut off in 1915, the price in this country skyrocketed from $35 to $350 or more per ton for 50% goods. This was too much for the American pocketbook and caused fertilizer manufacturers to say, "Never again." Immediately steps were taken to develop American sources of potash known to exist, and by the opening of World War II domestic sources were well developed. Now, the United States has even become an exporter of potash on a small scale.

A story within a story is the potash history of Searles Lake, California.

Soil Conservation Service Photo

A 483-bushel-per-acre yield of potatoes on a New Hampshire farm shows what can be done with high-potash fertilizer (8-20-12) and soil conservation practices.

When in 1863 John W. Searles, a hardy prospector, for whom the lake was named, first viewed this briny water, little did he envision the modern industrial development now to be seen there. He staked out a claim and by crude methods prepared borax from the brine. In 1911 investigators from the U. S. Geological Survey and the Bureau of Soils found that the brine contained 34% of salts, of which 13% was potassium chloride and the remainder sodium salts of which the tetraborate, or borax, is the most valuable. The production of finished products at the ultramodern plant at Trona is one of the outstanding triumphs of the application of phase-rule chemistry. Dr. J. W. Turrentine writing in 1941 of the romance of Searles Lake states that when he first visited the plant in 1913, it could be reached "only by automobile over roads which were little more than desert tracks cut through mesquite and consisted of a crude work camp into which even water had to be hauled with trucks. Here now stands a chemical plant of great size, its process devised in terms of the intricacies of phase-rule chemistry, yet mechanized to the point of practical operation—robots functioning in response to the slightest changes in temperature and concentration. It is surrounded by a village green with tamarisk hedges and providing all the modern facilities of comfortable living, accessible by concrete highways instead of sand ruts of 28 years ago."

Although Searles Lake was the first outstanding potash producer of domestic potash and really "saved the day" for American consumers at a critical time, the greatest strides in potash production have been taken at Carlsbad, New Mexico, since 1926. For some time geologists had been aware that in the great Permiam Basin of the Southwest, characterized by deep, brick-red, laminated deposits, which strikingly catch the eye of the tourist, there were salt deposits. Sporadic borings had shown the presence of potash salts. In 1926, agents of the federal government found commercial deposits of sylvinite and halite near Carlsbad. Later investigators from federal and private agencies revealed at a depth of 1,000 feet a deposit of sylvinite equal to the best in Europe. The Carlsbad potash mines represent the nearest approach

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On the Walter Olson farm, Union County, South Dakota, in 1945, oats fertilized with nitrogen, phosphorus, and potash yielded 90 bushels per acre. The unfertilized yield was 40 bushels per acre.

Field Trials With Fertilizers In South Dakota—1945

By W. W. Worzella and Leo F. Puhr

Department of Agronomy, South Dakota State College, Brookings, S. Dak.

SUCCESSFUL agriculture is dependent upon the maintenance of soil fertility. The problem of maintaining the fertility of our soils is not new. Since the early settlers first tilled the soil, more fertility or plant food has been taken out of the soil than has been returned through soil-building practices. The high productivity of virgin soils has been attributed to their higher content of plant food and organic matter. Continuous cropping has depleted our soils of a considerable portion of their original plant food. This is especially true for the plant-food elements nitrogen and phosphorus.

Maintenance of the productive capacity of the soil requires the restoration of plant food through soil-improvement practices which include returning manure, crop residues, plowing under legume crops, and the application of fertilizer. Of the 10 primary elements essential for the growth of crops, only three may be deficient in soils, nitrogen, phosphorus, and potash. These elements or plant-food materials occur naturally in the soil in varying amounts, depending upon the type of soil and past soil-management practices. When the fertility of the soil is not high enough for maximum crop production, plant food may be added by the application of fertilizers. In order to determine the kind and quantity of plant food to apply to the soil, it is necessary to conduct field trials with fertilizers.

Therefore, experiments are being conducted on different soil types and with different crops to determine the fertilizer need of South Dakota soils.

Experimental Procedure

In 1945 field experiments were conducted on private farms in order to study the effect of the application of plant food in the form of fertilizer on the yields of crops. Soil fertility plots were located in 15 counties. The plots were so distributed that the locations would be representative of the major crop and soil areas. County Agents and Soil Conservation Service assisted in locating and making arrangements with the farm cooperators.

These plots were established on private farms by arrangement with the owner of the farm. The entire field including the plot is farmed in the usual manner by the farmer and the plots received no special cultural practices except the application of the fertilizer. The fertilizer applications and the samples of the crop taken for yield were made by members of the Experiment Station staff. From time to time during the growing season the plots were inspected to note the condition of the crop or any damage which may have occurred due to insects, hail, or excessive water, etc.

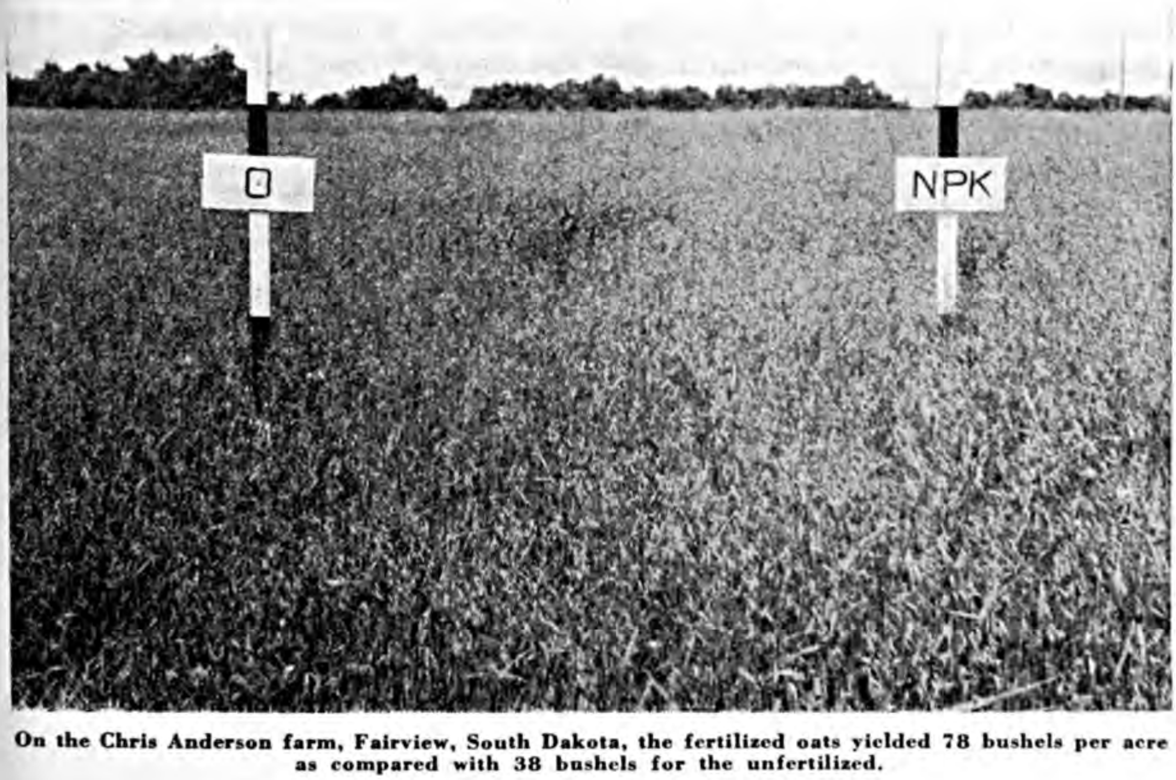
Fertilizers and Rate of Application

The plant-food elements, nitrogen, phosphorus, and potash, are the principal elements which enter into the make-up of commercial fertilizers. These three elements are sometimes called the primary elements of plant food because they are used heavily in crop production and may become deficient in soils. These elements may occur singly or in combination in commercial fertilizers. If all three elements enter into the composition of the fertilizer it is known as a complete fertilizer.

The plant food was applied to the fertilizer test plots in the following forms: nitrogen in ammonium sulphate, phosphorus in treble superphosphate, and potash in muriate of potash. The rates were 100 pounds ammonium sulphate, 100 pounds treble superphosphate, and 50 pounds muriate of potash, respectively per acre. The same rates were used whether the fertilizer was applied alone or in combination.

Fertilizers for Small Grains

The influence of various fertilizer treatments on the yields of small grains



On the Chris Anderson farm, Fairview, South Dakota, the fertilized oats yielded 78 bushels per acre as compared with 38 bushels for the unfertilized.

TABLE 1.—SMALL GRAIN YIELDS IN BUSHELS PER ACRE ON FERTILITY PLOTS

Treatment*	Rye	Barley	Wheat		Oats				
	Grant County	Day County	Grant County	Day County	McCook County	Clay County	Union County	Lincoln County	Average for Oats
None	21	37	39	23	81	61	40	38	55.0
N	22	47	42	29	69	75	56	62	65.5
P	27	46	42	32	88	59	58	38	60.7
K	26	39	42	28	92	61	47	39	59.7
NP	27	52	42	35	92	82	90	64	82.0
NPK	29	53	43	35	97	80	90	78	86.2

* N—Nitrogen, P—Phosphorus, K—Potash.

is shown in Table 1. Increases in the yields of small grains followed the application of fertilizer containing nitrogen and phosphorus.

While either nitrogen or phosphorus alone increased the yield, the largest increases were obtained when the two elements were applied together. In some instances potash gave some increase in grain yields, but the data indicate that South Dakota soils are relatively well supplied with potash for small grain production. For the oats crop the average increase in yield following nitrogen-phosphorus was 27 bushels and following nitrogen-phosphorus-potash the increase was 31.2 bushels. The fertilizer trials for small grains were conducted on several distinct soil types having considerable variation in fertility. For this reason the response to fertilizer varies in the different counties. The soils which were deep, dark, and level gave the least response, while the shallower, lighter colored soils developed on rolling land gave the most response. For this reason it will be necessary for farmers to be guided by the condition of their soil in determining the kind and quantity of fertilizer to be used on the small grain crop.

Fertilizers for Corn

The effect of fertilizer treatments on the yields of corn are given in Table 2. The largest increases in yield were obtained when the fertilizer treatment included nitrogen-phosphorus-potash. In the counties where corn reached maturity the effect of fertilizer treatment is more pronounced. This is especially true for Union and Lincoln counties. Nitrogen or phosphorus applied alone gave increases in every county where the corn ripened normally. Potash applied alone gave very little if any increase on corn. The

TABLE 2.—CORN YIELDS IN BUSHELS PER ACRE ON FERTILITY PLOTS

Treatment	Clay* County	Union County	Lincoln County	McCook County	Moody* County	Grant County	Average Bu./Acre
None	65	63	42	41	32	54	49.5
N	71	75	61	45	30	55	56.2
P	75	78	47	47	36	58	56.8
K	63	67	45	43	30	49	49.5
NP	60	85	55	48	33	59	56.7
NPK	69	80	61	51	34	64	59.8

* Corn very prematurely killed by frost.

TABLE 3.—POTATO YIELDS ON FERTILITY PLOTS

Treatment	Hamlin County	Codington County	Clark County	Average Bushels/Acre
	Bushels	Bushels	Bushels	
None	168	199	118	161.7
N	167	214	160	180.3
P	228	267	171	222.0
K	196	268	144	202.7
NP	248	287	174	236.3
NPK	260	298	175	244.3

average increase in corn yields for all counties was 7.2 bushels for nitrogen-phosphorus and 10.3 bushels for nitrogen-phosphorus-potash.

Fertilizers for Potatoes

Data in Table 3 give the results of fertilizer trials for potatoes. Each of the three major elements of plant food —nitrogen, phosphorus, and potash— increased the yields of potatoes when applied alone or in combination. However, the largest increases in yield were obtained by a combination of nitrogen-phosphorus and nitrogen-phosphorus-potash.

Yields of Hay and Grass Seed

The yields of hay and grass seed from variously fertilized plots may be

TABLE 4.—HAY YIELDS ON FERTILITY PLOTS

Treatment	Crested wheatgrass	Ree wheatgrass	Smooth bromegrass		Average Pounds/Acre
	Jackson County	Brookings County	Hand County	Deuel County	
	Pounds	Pounds	Pounds	Pounds	
None	748	4483	1625	1001	1964
N	1012	5450	1957	1717	2534
2N	1504	5266	3250	2353	3093
NP	1189	4702	2335	2097	2581
2NP	1388	5302	3223	3046	3240

TABLE 5.—GRASS SEED YIELDS ON FERTILITY PLOTS

Treatment	Crested wheatgrass	Ree wheatgrass	Smooth bromegrass		Average Pounds/Acre
	Jackson County	Brookings County	Hand County	Deuel County	
	Pounds	Pounds	Pounds	Pounds	
None	32	39	2	255	82.0
N	87	59	21	299	116.5
2N	124	59	60	419	165.5
NP	70	42	29	366	126.7
2NP	104	75	41	408	157.0

TABLE 6.—METHOD OF APPLYING FERTILIZER FOR CORN IN BROOKINGS COUNTY

Method of Applying Fertilizer *	Average Yield Bushels Acre
None	30.1
Broadcast on surface and disked in	36.0
Corn planter attachment	34.7
Broadcast on surface and plowed under	42.8
In plow furrow with plow attachment	45.8

* 250 pounds of 10-12-6 analysis fertilizer per acre were used.

seen in Tables 4 and 5. The application of nitrogen had the greatest effect on increasing hay yields. The heavier application of nitrogen produced the largest returns. Phosphorus was helpful only in Deuel county on the bromegrass. Grass seed yields were increased only with nitrogen fertilizer.

Methods of Applying Fertilizer for Corn

The effect of method of fertilizer application to crops is of considerable importance. In Table 6 are presented the results of various methods of applying fertilizer to the corn crop. The amount and kind of fertilizer applied was the same for each treatment. The results of this test for one year show that the placement of fertilizer in a narrow band in the plow sole with a fertilizer attachment on the plow is superior to all other methods. This method of application has the distinct advantage of placing the fertilizer where the soil is usually moist and where the plant roots may easily reach the fertilizer. The corn planter attachment which places the fertilizer close to the soil surface near each hill was found to be the least effective.

Fertilizers on Subsoil for Corn

It is frequently necessary to level land before irrigation practices can be carried out. This process results in removing the surface soil and exposing the subsoil. The subsoil is lacking in nitrogen and available phosphorus. In Table 7 are presented the effects of various soil treatments on the yields of corn. The data indicate that soil treatments which return nitrogen and phosphorus either in commercial fertilizer or manure are very effective in increasing the yields of crops growing on the subsoil.

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TABLE 7.—YIELD OF CORN UNDER IRRIGATION ON SUBSOIL IN LAWRENCE COUNTY

Treatment*	Average yield in bushels per acre on 15% moisture basis
No treatment	6.7
Nitrogen	4.5
Nitrogen-Phosphorus	51.1
Nitrogen-Phosphorus-Potash	40.4
¾ NPK + ¼ Manure	45.2
½ NPK + ½ Manure	39.2
Manure	41.8

* Manure applied at the rate of 25 tons/acre, ammonium sulphate 300 pounds, treble superphosphate 200 pounds, and potash 100 pounds.

This Louisiana French farmer and his wife cultivated and harvested nine acres of sweet potatoes which brought them over $3,500.

Sweet Potatoes Are Proving New Gold For The South

By Fred J. Hurst

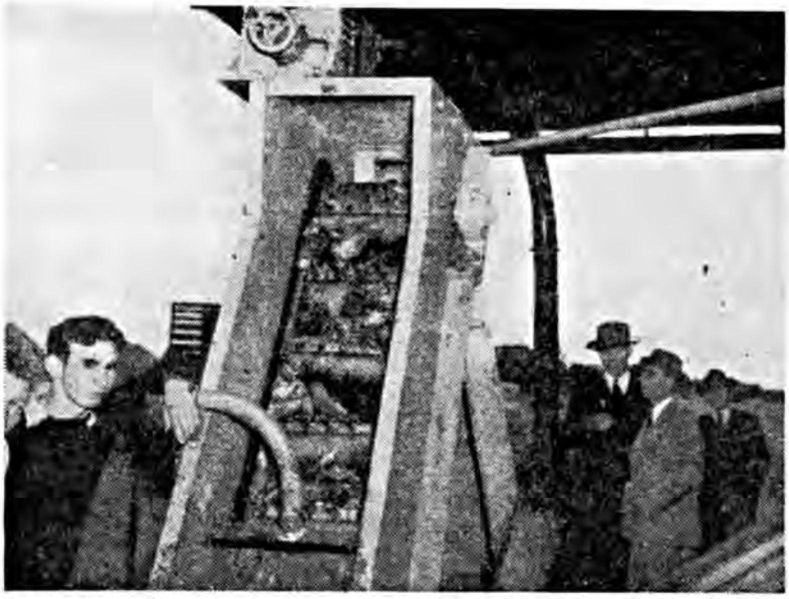
Farm Credit Administration, New Orleans, Louisiana

FOR thousands of southern farmers the long search for a crop to supplement cotton, produce more food, and improve income has ended. In the production of Unit One Porto Rico sweet potatoes, farmers have found a veritable gold mine. At the same time they are heaping up the nation's food supply and pouring new wealth into the channels of trade.

The richest "strike" has been in Louisiana. Production of sweet potatoes in the Bayou State is now big business. Marketings from the 1945 crop by truck and rail will total more than 6,000,000 bushels. Up to January 30, rail shipments alone totaled 6,356 carloads. Hundreds of thousands of bushels have been moved by truck. And hundreds of storage houses are still packed with potatoes. The volume now moving to market is limited only by the number of railroad cars available. Marketings will continue until June.

In addition, more than 25,000,000 pounds of dehydrated sweet potatoes have been exported under Lend-lease or shipped to American servicemen overseas. Large quantities of cull potatoes have been fed on the farm. The 1945 Louisiana crop is estimated at over 10,000,000 bushels, a gain of 2,724,000 bushels over the 1944 harvest.

Several other states produce about as many sweet potatoes as Louisiana, but the bulk of the crop is consumed on farms. Of the 9,832 carloads of sweet potatoes shipped to market from 15 states up to January 30, Louisiana



Showing washer-elevator at Perry, Georgia. The potatoes are washed, crushed, dried, and sacked.

shipped 6,356, or more than all the other states combined.

Through most of November and all of December and January, U. S. No. 1 and U. S. No. 1 and No. 2 mixed sweet potatoes sold at the ceiling price of $3.08 per bushel f.o.b. shipping point, and growers could not supply the demand.

With yields ranging from 150 to 250 bushels per acre in the commercial-producing areas like Lafayette, St. Landry, West Feliciana, and West Carroll Parishes, a veritable stream of gold was pouring into the State. At Sunset for example, a small town of 500 people in St. Landry Parish, local bank deposits passed the $3,000,000 mark, business flourished, and farmers were prosperous. In many other communities, the story is the same.

At St. Francisville, Opelousas, Sunset, and Carencro, Louisiana; Cullman, Alabama; and Perry, Georgia, dehydrating plants turned out sweet potato feed that found a ready market and met a local need for more carbohydrate feed. Experienced growers on adapted land are producing a good cash crop of No. 1 sweet potatoes for direct shipment to market, selling No. 2's to local plants for processing for food, and then harvesting cull potatoes equivalent to the feed value of an acre of corn.

The dehydrated potato feed is palatable, nutritious, easy to store, not subject to weevil injury and deterioration, and is high in vitamin content.

Feeding tests conducted by the Louisiana, Alabama, and Georgia experiment stations show that dried sweet potatoes are about equal to corn in feeding value. These results have led research authorities to predict that in a few years dehydrating plants for drying sweet potatoes will become as common as cotton gins and southern farmers will produce more of their needed carbohydrate feed.

During the past harvesting and marketing season, we visited the main commercial sweet potato growing areas in Louisiana, Mississippi, Alabama, and Georgia. On a 2,500-mile trip we talked with farmers, county agents, shippers, processors, and experiment station workers about growing, harvesting, processing, feeding, and marketing sweet potatoes.

All across these states everyone agreed that the need for greater farm diversification, the wartime demand for food, the breeding of better varieties, the development of modern methods of processing, and especially improvements in marketing and higher prices had brought farmers to a realization of the possibilities of sweet potatoes, where suitable soil is available and the crop is properly fitted in with other farm enterprises to provide desirable crop rotations and spread work throughout the whole year.

In all of the commercial areas, farmers are increasing production of sweet potatoes for food, for feed, and for industry. Growers and shippers are building more curing houses. More dehydration plants will be established in 1946. New mammoth size canning plants will be built. Producers are organizing to make further improvements in production and marketing. Whole counties and parishes are growing a single variety to produce more uniform, higher quality sweet potatoes. Some shippers have already tried marketing sweet potatoes in open mesh five-pound bags. The innovation has proved popular with city housewives.

Last year a $7,000,000 starch factory was built at Clewiston, Florida. Owners of one of the largest distilleries in the United States, who cooperated with Louisiana State University in testing the value of sweet potatoes for producing alcohol, announced that 56 pounds of dehydrated Porto Rico sweet potatoes produced 4.85 gallons of 190-proof alcohol and 56 pounds of Pelican Processor, a high starch variety, produced 5.44 gallons of 190-proof alcohol which graded higher than grain alcohol.

Louisiana State University found golden yellow sweet potato meal an excellent mix for making ice cream. The potato meal added plenty of rich color and increased the vitamin content of the cream. At Auburn, Alabama, where the experiment station established a small pilot plant and pioneered in making breakfast foods and other commercial products from sweet potatoes, a private company is now manufacturing sweet potato-cocoanut candy on a commercial scale. All of these developments indicate the growing importance of sweet potatoes in southern postwar agriculture and industry.

For the most spectacular development of sweet potatoes as a money crop, we cite the record of West Carroll Parish, Louisiana. In 1942 a few growers around Oak Grove were induced to plant a few acres of sweet potatoes for market. They produced and sold $10,000 worth of potatoes. The per-acre return was high.

In 1943, more farmers planted sweet potatoes. The acreage and production were increased. Sales of sweet potatoes jumped to $90,000. With two years of satisfactory returns behind them and an urgent wartime demand facing them, more farmers planted sweet potatoes in 1944. Marketings climbed to $250,000.

In the meantime, the Warriner Starch Company of St. Francisville built a 400,000-bushel capacity storage house at Oak Grove and in 1945 contracted with 1,040 farmers to grow around 5,000 acres of sweet potatoes. The crop brought growers approximately $1,000,000. Davie Pierce, business leader of Oak Grove and sponsor of the sweet potato program, reported that 23,000 acres of cotton in the parish brought producers only $1,500,000.

At the height of the marketing season it was impossible for Warriner Starch Company to handle promptly all of the sweet potatoes delivered to their storage plant and wagons and trucks blocked the town as growers waited to weigh and unload their potatoes. A big buyer in Texas who had a contract with the Government to dehydrate a lot of sweet potatoes was called in to help. Railroad cars were placed at all loading stations in the parish, potatoes were loaded in the cars in

Sweet potatoes are carefully sorted and graded to meet an increasing demand on the market.

bulk, and in a few days the situation was relieved.

Mr. Pierce likes to tell the story of Wesley Parker, a sharecropper of Pioneer, Louisiana. Wesley is said to be one of the best farmers in the parish. But he believed in sticking to cotton. To get him to try sweet potatoes his landlord had to guarantee Wesley that he would at least make as much money from an acre of sweet potatoes as he made from an acre of cotton.

In each of four years Wesley made more net money from sweet potatoes than from cotton. In 1945 he had 5 acres in potatoes and 7 acres in cotton. His No. 1 potatoes from 5 acres brought him $1,870; cotton from 7 acres brought him $878. He still has his No. 2 potatoes to sell.

And there is the story of Mece Stanford, who produced and sold $1,600 worth of cotton from 14 acres, but who pocketed $2,100 from sales of sweet potatoes from 7 acres.

How Many Acres?

The problem in West Carroll Parish now is to keep farmers from planting too large an acreage in sweet potatoes. Growers are urged not to plant more than one-fourth to one-third of their cultivated land in sweet potatoes and not to plant potatoes on the same land more than once in three years.

The growers are planting Unit One Porto Rico and Queen Mary, superior varieties developed by Dr. Miller, and they are following the recommendations of the state experiment station in planting, fertilizing, cultivating, and harvesting. Much of the soil in the parish is well suited to production of sweet potatoes, and the producers use 400 to 600 pounds of 4-12-4 or 4-12-8 fertilizer per acre to get high yields. The liberal application of high analysis fertilizers is one of the most profitable practices in producing sweet potatoes. The use of right amounts of potash is especially important.

One concern alone plans to install five dehydrating plants in West Carroll Parish in 1946 to dehydrate cull sweet potatoes for feed. A plant will be established in each of the five wards of the parish to place them close to farmers and reduce the length of the haul. The company also plans to build a large sweet potato canning plant at Oak Grove.

In West Feliciana Parish growers last year produced a half million bushels of sweet potatoes for market. The Warriner Starch Company with two large storage houses and food and feed dehydrating units and a canning factory at St. Francisville, and storage and shipping facilities at Epps, Jonesboro, and Oak Grove, Louisiana and Eudora, Arkansas, marketed several hundred cars of No. 1 sweet potatoes, dehydrated 21,000,000 pounds of No. 2 potatoes for food, canned thousands of bushels, and processed a lot of culls for feed. Other buyers at St. Francisville offered needed competition in maintaining price levels.

St. Landry with 32,000 acres was the leading parish in Louisiana. At Opelousas, J. F. Dezauche, who has facilities for storing two million bushels of potatoes and operates a canning factory and dehydrating food and feed plants, bought 100,000,000 pounds of potatoes. He shipped potatoes in carload lots all over the United States.

Mr. Dezauche, who has been handling sweet potatoes for 35 years, emphasizes the importance of uniformity and high quality, which he says have been largely responsible for the fine reputation of and demand for Louisiana sweet potatoes.

The value of a strong farm cooperative in maintaining satisfactory prices, not only for its own members but for other farmers within the range of the co-op's influence, was again demonstrated in 1945 by the Sweet Potato Cooperative at Carencro. This association consistently paid its members more money for potatoes than buyers who did not have the competition offered by a producers' association.

The demand for the storage and marketing service given by the Car-

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Fig. 1.—Corn grown on Tilsit silt loam in Laurel County, Kentucky, in a corn-wheat-mixed hay rotation where manure is applied for corn in amounts equal to the weight of crops removed. The limed plot on the left, fertilized with 400 pounds of 0-20-0 per acre for wheat, yielded 47 bushels of corn per acre; the unlimed, unfertilized plot on the right yielded 25 bushels.

Fertilizer Placement For Corn in Kentucky*

By G. L. Terman

Agricultural Experiment Station, Lexington, Kentucky

IN initiating studies of fertilizer placement for corn in 1944, the further need of data on different placements of equal amounts of plant food was kept in mind. Many purported tests of fertilizer placement have not really been tests of fertilizer placement. Some have been only a comparison of relatively large amounts of fertilizer plowed under or banded in the plow furrow with smaller amounts, usually applied at the row. A larger yield from the deep application, if obtained, does indicate successful response to a large application of fertilizer. It adds nothing, however, to our knowledge as to whether the same amount of fertilizer applied differently would have given equally good results.

Results from tests of different placements of an equal amount of plant food conducted in many states have been variable. Better results have usually been obtained from plowing under relatively large amounts of fertilizer for corn or placing it in bands in the plow furrow than from applications at the row or broadcast on the surface after plowing. These better results from deep application have usually been attributed to improved moisture

* The experiments reported in this paper were in connection with investigations by the Kentucky Agricultural Experiment Station and are published by permission of the director.

relationships beneath the surface. Poorer results from deep application, on the other hand, sometimes obtained on soils high in clay content or having poor structure, have been attributed by Hoffer (1) and others to poor aeration in the deeper root zone. Another important factor is the effect of the placement of the fertilizer on the date of tasseling and silking. Because of the pronounced effect of weather conditions at this time on corn yield, a slight advancement or retardation in maturity may markedly affect the final yield. With deep application, it has usually been found beneficial to reserve a part of the fertilizer for row application to stimulate early growth. This is especially desirable to allow earlier cultivation to control weeds.

Broadcasting fertilizer after plowing is objectionable because it stimulates growth of weeds. Banding of fertilizers, especially of phosphate and potash, whether applied at a deep or shallow depth, has usually been superior to broadcast application for the immediate crop. This is especially true of soils which have a high capacity for fixing phosphate and potash chemically in slowly available forms. In soils of low-fixing capacity, this is not so important. Fixation is undoubtedly a factor of major importance in explaining the difference in results of broadcast versus band application which have been obtained by different investigators and on various soil types. Too little attention apparently has been paid to soil texture, soil structure, aeration, soil-fixing capacity for phosphorus and potassium, adequate stands of corn, and climatic conditions in relation to tests of fertilizer placement.

When corn and other crops are grown in rotation, the total return from all crops must be considered in a fertilizer program. In most fertilizer placement tests it appears that too much emphasis has been placed on the effect of fertilizer on the immediate crop and too little emphasis on the effect on the crops of the rotation as a whole. It has been pointed out by McVickar and Gish (2) that although the response of the fertilized crop in a rotation to fertilizer is the greatest, the net effect on the rotation as a whole may be about the same, no matter where in the rotation the fertilizer is applied. In Kentucky where a rotation of corn, wheat, and hay has been used and manure returned for corn in amounts equivalent to the crops removed, ample evidence has been obtained showing (3) that it makes little difference as to corn yield whether fertilizer is applied for corn or for the wheat crop following.

1944 Tests

In 1944, six cooperative tests of placement of a complete fertilizer for corn were conducted. Fertilizer materials equivalent to 50 pounds of N, 40 pounds of P_2O_5, and 40 pounds of K_2O, or 500 pounds of 10-8-8 fertilizer per acre were applied in several different ways. Fertilizer mixtures were prepared from ammonium nitrate, superphosphate, and muriate of potash. A randomized arrangement of 1/80-acre plots was used. In addition to tests of placement of the complete fertilizer, these tests also included plots comparing 500 pounds per acre of 0-8-8, 10-0-8, and 10-8-0 fertilizer to determine which plant food was deficient in the soil.

The 1944 season in Kentucky was generally unfavorable for corn, although in some areas high yields were obtained. Drought and high temperatures at tasseling time resulted in poor pollination and consequently in low yields over much of the State. Drought injury, combined with the ever-present problem of soil variability, resulted in significant increases of ear corn from fertilizer, no matter how applied, in only one of the six tests. Actual decrease from fertilizer as compared with no fertilizer was obtained in some of the tests. This depression in yield probably resulted from early stimulation of corn growth by fertilizer and greater subsequent injury by drought. This view is substantiated by the fact that in all of the tests consistent, al-

TABLE 1.—YIELD OF EAR CORN FROM FERTILIZER OF DIFFERENT ANALYSIS AND PLACEMENT. MADISON COUNTY, KENTUCKY, 1944.

Amount and Placement of fertilizer [1]	Acre yield Bu.	Increase over no fertilizer
No fertilizer	64.8	....
500 lbs. 0–8–8, F. B.	70.9	6.1
500 lbs. 10–0–8, F. B.	81.2	16.4
500 lbs. 10–8–0, F. B.	69.3	4.5
500 lbs. 10–8–8, F. B.	78.5	13.7
500 lbs. 10–8–8, B.P.U.	66.7	1.9
400 lbs. 10–8–8, F. B.; 100 lbs. 10–8–8, hill	75.1	10.3
500 lbs. 0–8–8, F. B.; 500 lbs. 10–0–0, hill	87.2	22.4
500 lbs. 10–8–8, hill	96.4	31.6
500 lbs. 10–8–8, B. D. I.	70.9	6.1
Significant difference	5.8	5.8

[1] F. B.=Bands in the plow furrow; hill=two 8-inch bands, 3 to 4 inches to side of and slightly below the seed; B. P. U.=broadcast and plowed under; B. D. I.=broadcast and disked in after plowing.

though in some cases small, increases in yield of stover were obtained.

Significant increases of ear corn from fertilizer were obtained in a test in Madison County. In Table 1 are given the yield data from this test, together with the various placements of fertilizer compared in all tests. In this test the single crosses WF9 x 38-11 and K4 x L317 for producing Ky 103 hybrid seed corn were grown, the female on the plots and the male on the trim rows between plots. This cross withstood severe drought in July and, with adequate rains in August, produced high yields. The soil on which this test was conducted was a silty clay loam. It was high in available phosphorus and calcium but low in available potassium.

In general, most response was obtained from potash. Application of the complete fertilizer in side bands at the hill or application of the nitrogen at the hill with furrow placement of the phosphate and potash gave best results. Deep placement, especially broadcasting and plowing under, gave poorer response. Lack of proper soil aeration may have been the major cause of poor response in this test.

1945 Tests

In 1945 the same general types of experiments with minor revisions were

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Fig. 2.—Corn grown on limed Grenada silt loam in Livingston County, Kentucky, in a corn-wheat-legume hay rotation, where no manure is applied. The plot on the left, fertilized at acre rates of 300 pounds of 7-0-3 for corn and 500 pounds of 5-0-15 for wheat, yielded 37 bushels of corn per acre; the plot on the right, fertilized with 200 pounds of 7-5-3 for corn and 500 pounds of 5-8-15 for wheat, yielded 55 bushels.

Aiming For Higher Goals

By J. C. Holm

Teacher of Vocational Agriculture, Lapaz, Indiana

BACK in 1938 when land was selling at low figures, I decided to purchase a small farm and make it pay. My friendly neighbors suggested that this land had been rented and robbed until it was no longer worth farming and soon another mortgage would be on this worn-out, clay-loam soil.

In order to verify the soil needs, we consider (1) the physical needs and (2) the chemical needs of the crops to be grown. Before purchasing the farm, my rapid soil-testing kit had given me a key which indicated needs as follows: Plenty of potash plus phosphate and lime to raise the pH to 6-7. Such plants as wheat and timothy were sown, thereby giving me the second key. For fall-sown wheat I used an 0-20-20 fertilizer, applying 200 lbs. per acre. The same fall I noticed the potash and phosphate deficiencies. In the case of potash shortage, one notices the leaf drying or burning back from the tip; the phosphate shortage shows up in beautiful purple leaf margins. The next spring I sowed into the wheat a mixture of red clover, alsike clover, timothy, and alfalfa with 0-20-20 at the rate of 200 lbs. per acre. The next season this field produced one of the finest stands of clover one would care to see, yielding from 40 to 50 tons from 11 acres.

After the crops responded to a reasonable amount of potash and phosphate, I decided to see how erroneous was the old theory of "too much good commercial fertilizer burns out the land," which in my case has proved to be just plain false economy. Corn yields on the land had been only 25 to 30 bu. per acre, and less during drought years. The yield of more than 100 bu. of corn per acre resulted from land that really underwent an intensive program of rebuilding. Potash and phosphate were applied liberally and proved indispensable.

Fertilizers cannot have their full effect on crop yields if the soil is too low in organic matter. This is best supplied by plowing under a good sod to which has been previously added 10-20 tons of fresh barn manure per acre. The manure is reinforced in the gutter with 0-20-0 or 0-45-0, about 20-30 lbs. per load. On some occasions, one or two gallons of 50% potash are placed on the load for special spots which are low in potash.

Improved Pastures

During the spring of 1945, I gave 12 acres of hay and pasture land a dose of phosphated manure plus some special treatment on some of the poorest spots. I used in the grain drill 100 lbs. 45% treble superphosphate and 200 lbs. of 50% muriate of potash per acre. This field made such rapid growth of a mixture of alfalfa, timothy, and clovers that it was necessary to split the field into five acres for 15 cows to pasture and seven acres for hay, which made 88 bales of 80 pounds per bale per acre. The cows had knee-deep pasture for 90 days and were fed grain in the barn at each milking. The five-acre pasture produced in milk sold for May, 12,633 lbs.; June, 11,844; and July, 10,764 lbs.; or in milk checks, net $330.41, $308.00, and $291.22, respectively, not including the $128.45 subsidy. Without balanced soil fertility, this field might keep one cow per 5 to 10 acres with low milk production because of low or poor plant growth. These five acres actually pro-

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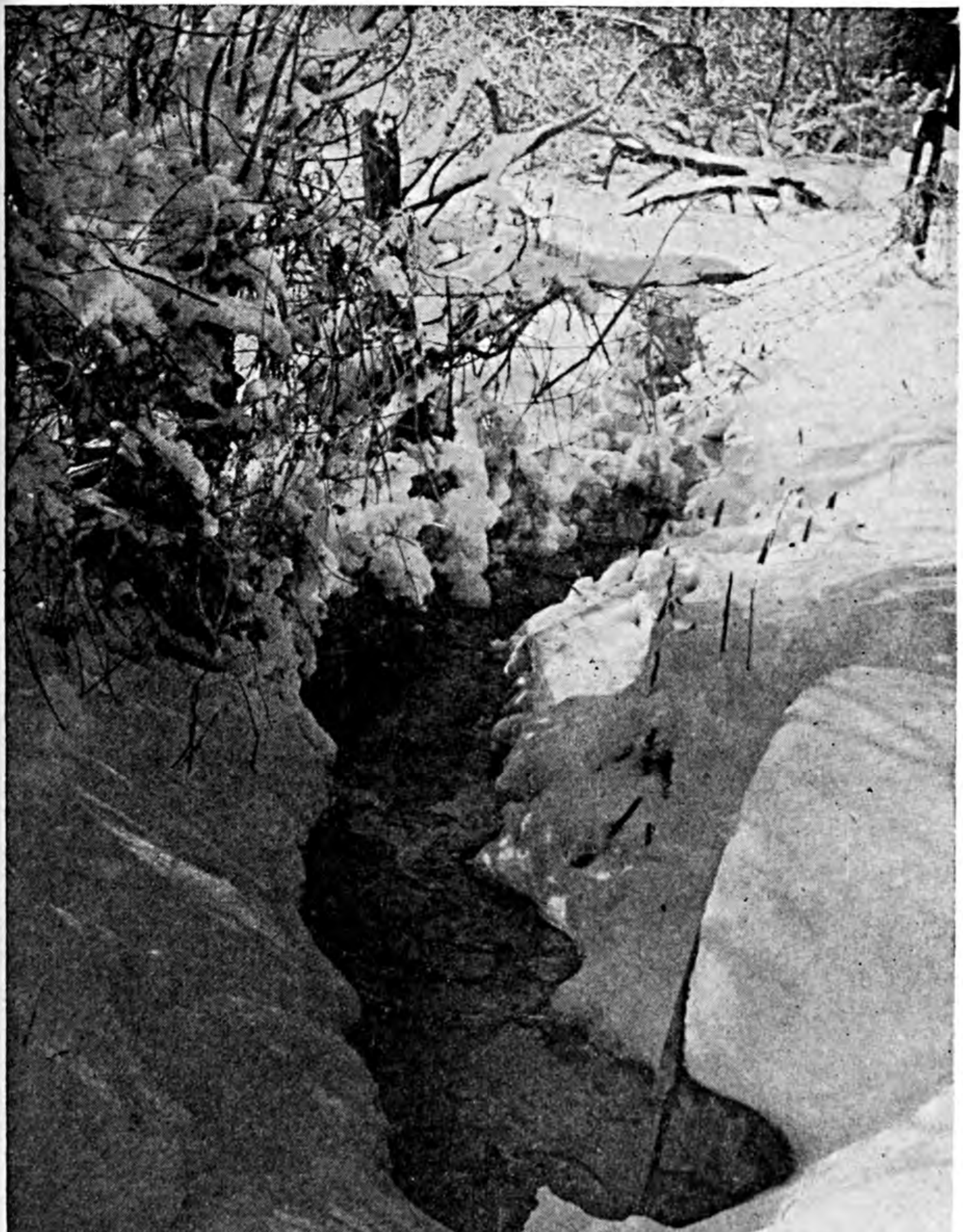
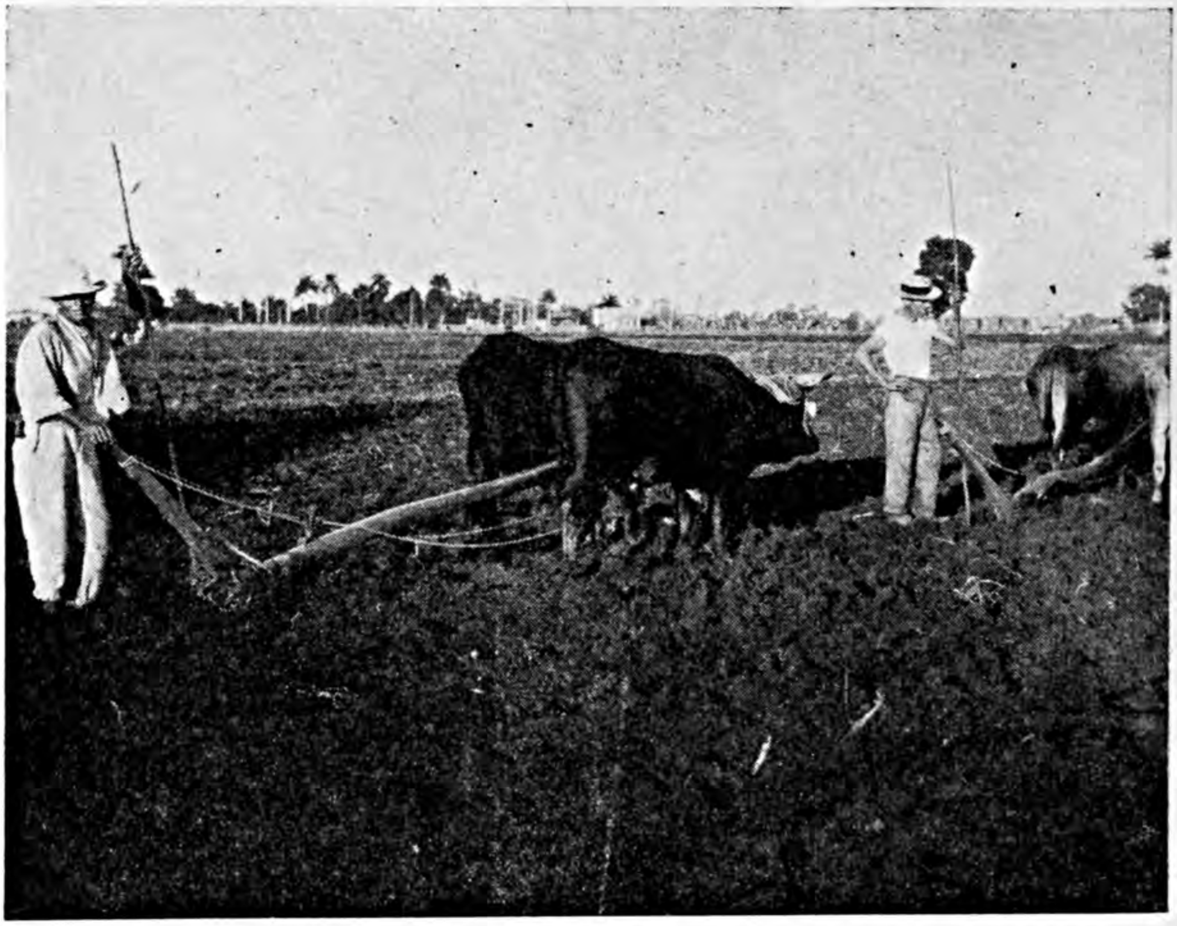
PICTORIAL

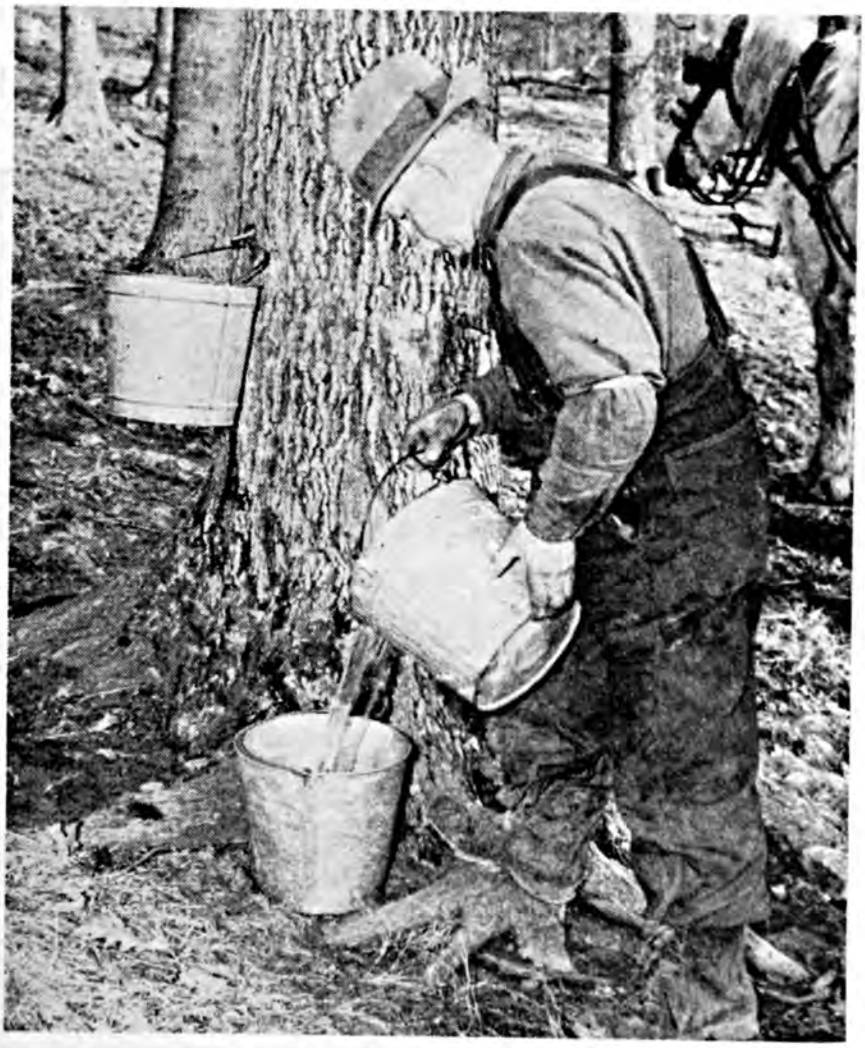


To Be Remembered on Hot Days

Left: Some animals are born to the silver platter.

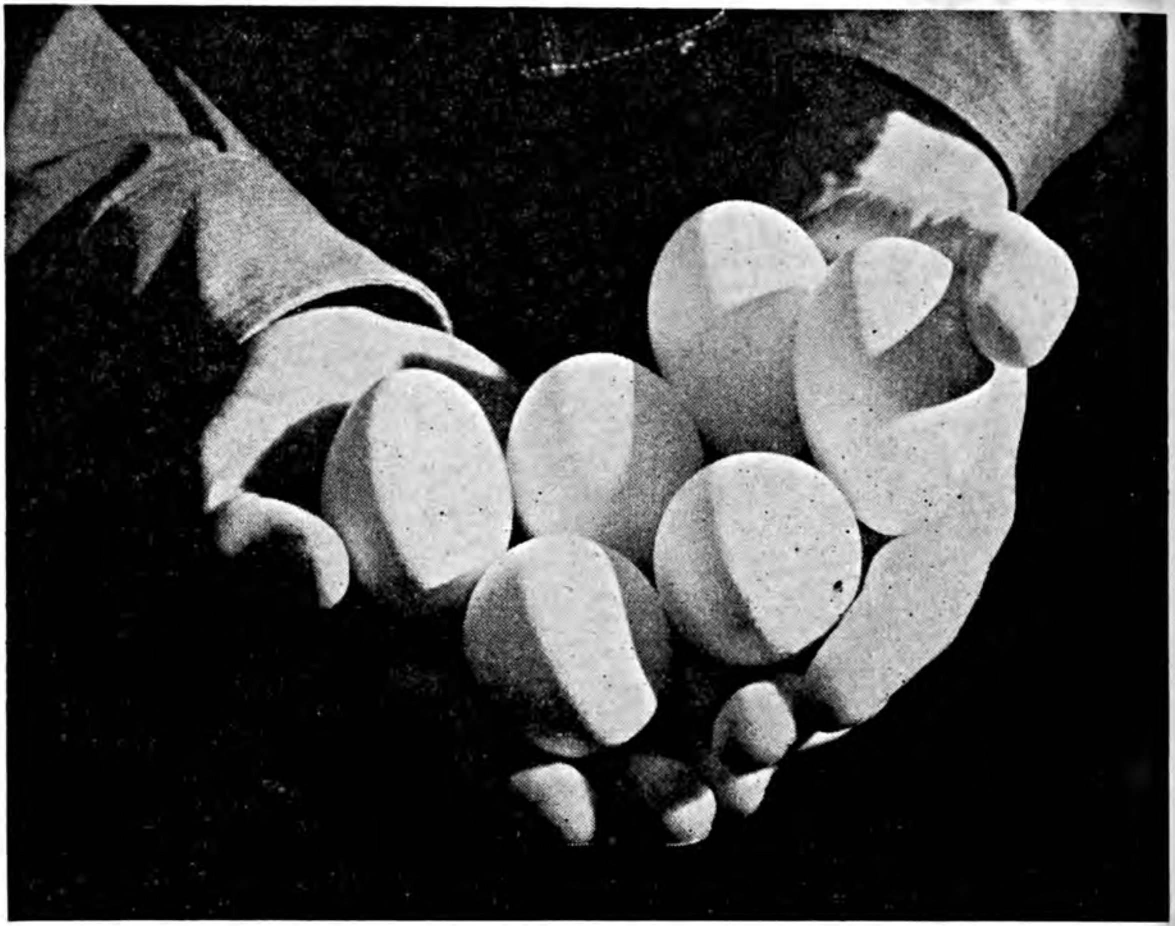
Below: While others must work for their living.



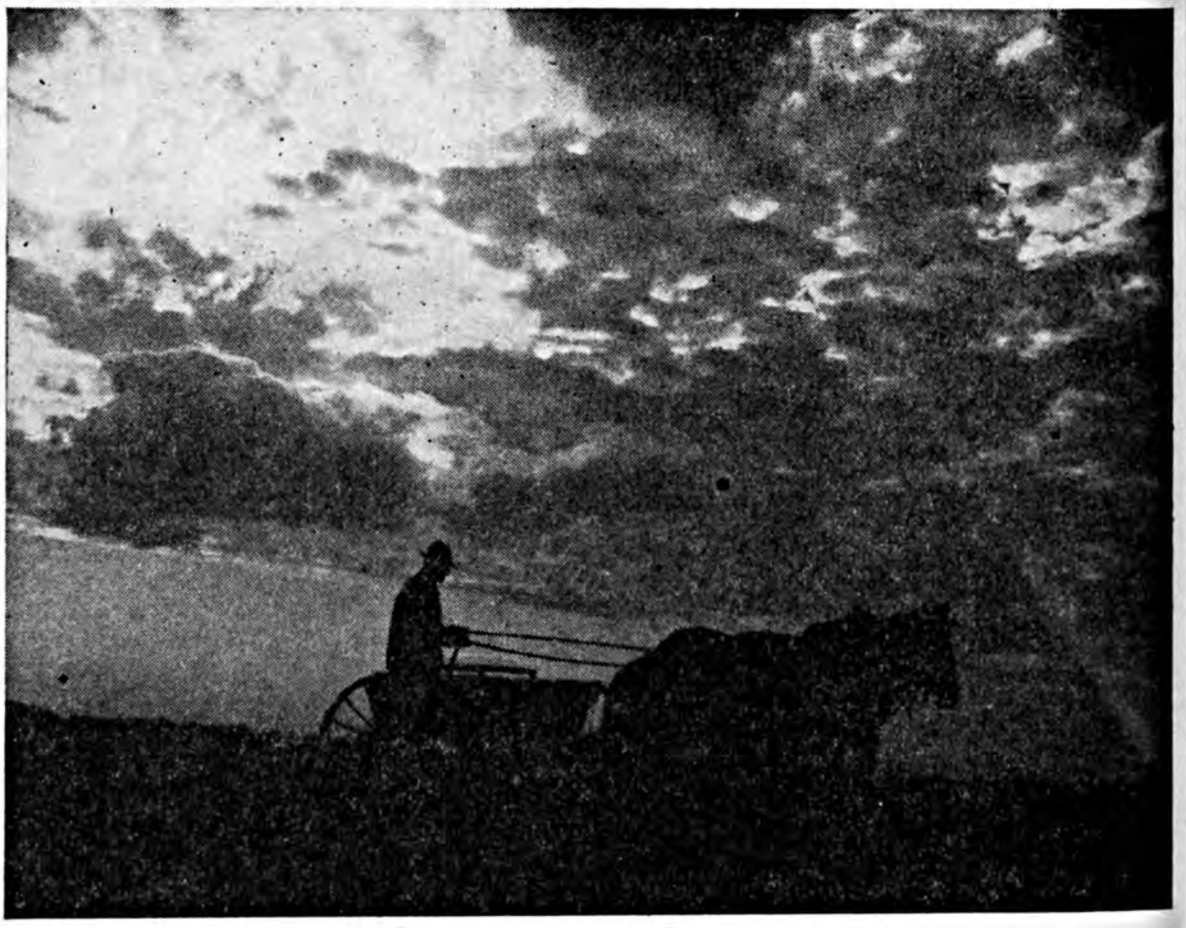


Above: Sugar maples—favorite trees in early spring.

Right: Best weather for sap flow is cold, stormy, blustery.



Studies in Black and White



The Editors Talk

Convening Again

After a two-year lapse, caused by war-travel restrictions, the Nation's specialists in soils and crops convened in Columbus, Ohio, February 26 to March 1. Taking up again the major problems concerning crop production in its various aspects and the trends which have developed through the unprecedented demands on the Nation's agricultural producers, it was apparent that the role of science in agriculture is even more important now than it ever has been before. It was a welcome sight to see back in the meetings numerous scientists who had been with the military forces or utilizing their specialized knowledge in technical lines, and appropriate recognition was given these men.

In the general program of the Soil Science Society of America major attention was directed to the problems of managing our soils of the Midwest and South, and concern over maintaining the productivity in these—our principal crop-producing sections—was quite apparent. In this general meeting, Dr. W. H. Pierre of Iowa presented a paper on the future problems in the management of cornbelt soils; Dr. H. J. Harper of Oklahoma discussed soil conditions and the future of Great Plains agriculture; and Dr. R. W. Cummings of North Carolina presented the agronomic problems in the agricultural reconversion of the South. The address by the President of the Agronomy Society, Dr. F. W. Parker of the U. S. Department of Agriculture, dealt with the nitrogen problem in soil management.

Pasture fertilization and management came up for special attention with two group meetings devoted to the fertilization of pastures, grazing problems, and pasture plants—thus showing the increased appreciation of the importance of this phase of agricultural production, too often neglected in the past. It is becoming more and more apparent that our pastures represent an important cash crop instead of merely being waste land on which animals are turned to fend for themselves.

Plant breeders presented the advancements they are making in improving the strains of our principal field crops. The amazing advances made in the production of hybrid corn have almost over-shadowed the progress constantly being made in other crops, such as oats, cotton, and forage plants. A whole session was devoted to a symposium on hard red winter wheat improvement. More and more soils and crops men are finding that for maximum results they must work together so as to realize the greatest possible benefits by supplying the increased plant-food needs of these improved varieties which make heavier drains on soil fertility. Conversely, it has been found that maximum realization of improved fertilization practices can be obtained only when the population of the soil, or stand per acre, is increased to the point where there are enough plants of high-producing capacity to utilize the additional fertilizer and thus capitalize on the increased potential producing ability per unit of land.

The broader aspects of agronomy in their relation to the future of this country and also world conditions were not neglected. Sessions were devoted to the design of long-time experiments, to the problems of teaching agronomy, and soil conservation planning. At a general meeting of the Society as a whole the international opportunities and responsibilities of agronomists were discussed by Dr. P. V. Cardon of the U. S. Department of Agriculture and the domestic by Dr. Richard Bradfield of Cornell University. Problems of renewing contacts and exchange of ideas with agronomists in other countries and especially in war-torn Europe were given consideration. A committee was appointed to facilitate the resumption of such normal exchanges and to aid in re-establishing agronomic research in Europe.

Numerous specialized groups met for papers on peat and muck soils and on the problems of forest soils. As usual one whole day was devoted to fertilizer usage and placement from the more immediately practical aspects in contrast to the no less important but more scientific relationships presented in the other papers. These discussions were on a broad basis and reviewed trends in the use of commercial plant foods, the progress made in fertilizer application, the needed improvements in present application machinery, and the foreseeable progress that is desired and expected in the next few years on vegetable crops, field crops, pastures, and orchards.

As in previous years, it was satisfying to see the advancement of science turned to practical application on current problems. It is to be hoped that nothing will prevent the normal continuance of these meetings.

Victory Gardens

Garden tools are out, sun-burned faces are appearing, and lame muscles are slowing up the "zip" of urbanites—for "Victory" gardens have been declared no less important this year than during the past four years. And Secretary of Agriculture Anderson says they will still be called "Victory" gardens. Why change the name? The war is over but the victory is not complete and will not be complete until the wounds have been healed, the good earth is in full production again, and the starving victims of the war are eating regularly. Besides, victory gardens are household words throughout the land, a name worth millions as businessmen measure good will.

The world conditions from which the necessity for no let-down in gardening springs are to be deeply regretted. Yet necessities are necessities and in meeting them it always helps to survey the benefits which may be involved. That in this case they are many is seen in the countless numbers of urban home-owners who had already planned to continue their gardens. The fresh quality of the produce, the healthful exercise, the community spirit, the saving in food bills—all were holding over from the days when the rake and hoe helped in "doing his part."

Victory gardens should be continued long after the "wounds have been healed," for while they are helping to sustain lives, they will continue to enrich lives. A new and timely concern over proper nutrition has been instigated—timely in view of the shocking numbers of young men rejected for service in the armed forces of the "world's best-fed nation" because of ills arising from improper diets. Timely, too, is the immeasurable and stimulating new interest in agriculture and its problems—an interest sorely needed in a better understanding of the economic welfare of the Nation.

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
February....	19.99	31.8	165.0	201.0	106.0	147.0	17.70	52.70	....
March........	20.24	21.4	171.0	207.0	107.0	148.0	18.10	52.00	....
April........	20.20	21.4	174.0	211.0	107.0	149.0	16.90	51.90	....
May........	20.51	42.2	177.0	214.0	108.0	149.0	16.50	52.10	....
June........	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July........	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August......	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October......	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November...	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
February....	161	318	237	229	165	166	149	234	223
March.......	163	214	245	236	167	167	152	231	203
April........	163	214	250	240	167	169	142	230	259
May........	165	422	254	244	168	169	139	231	193
June........	169	512	258	251	173	170	134	233	269
July.........	171	563	263	262	174	165	130	244	244
August......	172	449	240	292	176	164	123	233	240
September...	175	432	198	236	174	164	120	228	159
October......	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January.....	180	363	208	237	171	174	132	226	249
February.....	186	339	209	254	173	175	133	223	275

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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	Fish scrap, wet acidulated 6% ammonia, 3% 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	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944	1.75	1.42	7.68	5.77	3.34	4.86	6.71
1945							
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1946							
January	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	146	129	139
1927	112	79	145	166	143	128	162
1938	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	131
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944	65	50	219	163	110	144	191
1945							
February	65	50	223	163	110	144	191
March	65	50	223	163	110	144	191
April	65	50	223	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	110		
1946							
January	65	50	223	163	110	144	191
February	65	50	223	163	110	144	191

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
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	.524
1927	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
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								
February	.650	2.20	6.13	.535	.797	26.00	.200	....
March	.650	2.20	6.20	.535	.797	26.00	.200	....
April	.650	2.20	6.20	.535	.797	26.00	.200	....
May	.650	2.20	6.20	.535	.797	26.00	.200	....
June	.650	2.20	6.20	.471	.701	22.88	.176	....
July	.650	2.20	6.20	.503	.749	24.44	.188	....
August	.650	2.20	6.20	.503	.749	24.44	.188	....
September	.650	2.20	6.20	.503	.749	24.44	.188	....
October	.650	2.20	6.28	.535	.797	26.00	.200	....
November	.650	2.20	6.40	.535	.797	26.00	.200	....
December	.650	2.20	6.40	.535	.797	26.00	.200	....
1946								
January	.650	2.20	6.40	.535	.797	26.00	.200	....
February	.650	2.20	6.40	.535	.797	26.00	.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	Kainit
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
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								
February	121	61	126	75	84	108	83	....
March	121	61	127	75	84	108	83	....
April	121	61	127	75	84	108	83	....
May	121	61	127	75	84	108	83	....
June	121	61	127	66	74	95	80	....
July	121	61	127	70	79	101	82	....
August	121	61	127	70	79	101	82	....
September	121	61	127	70	79	101	82	....
October	121	61	129	75	84	108	83	....
November	121	61	131	75	84	108	83	....
December	121	61	131	75	84	108	83	....
1946								
January	121	61	131	75	84	108	83	....
February	121	61	131	75	84	108	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 materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922........	132	149	141	116	101	145	106	85
1923........	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944........	195	176	151	96	57	174	120	76
1945								
February..	199	179	153	97	57	175	121	78
March.....	198	180	153	97	57	175	121	78
April......	203	180	154	97	57	175	121	78
May......	200	180	154	97	57	175	121	78
June......	206	180	155	95	57	175	121	69
July......	206	180	154	96	57	175	121	74
August....	204	180	154	96	57	175	121	74
September.	197	181	153	96	57	175	121	74
October...	199	182	154	97	57	175	121	78
November.	205	182	156	97	57	175	121	78
December.	207	183	156	97	57	175	121	78
1946								
January...	206	184	156	97	57	175	121	78
February..	207	185	156	97	57	175	121	78

* 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 with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.**

** **The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

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

"Potash Standard Rotation Requirements," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1198a, March 1944, R. H. Bray.

"The Potash Problem in Illinois," Univ. of Ill., Agr. Exp. Sta., Urbana, Ill., AG1215, May 1944, R. H. Bray.

"Fertilizer Analyses and Registrations," Div. of Feed & Fert. Control, St. Paul, Minn., Sept. 1945.

Information Sheets—No. 327, Fertilizer Recommendations for Miss., 1945, Clarence Dorman; No. 331, Sources of Nitrogen for Oats in South Miss., T. E. Ashley; No. 332, Top Dress Oats With Nitrogen, Russell Coleman; No. 334, Nitrogen Side-dressing for Cabbage: Crystal Springs, E. L. Moore; No. 336, Sources of Nitrogen: Poplarville, 1943-44, T. E. Ashley & Russell Coleman; No. 337, Nitrogen Side-dressing for Tomatoes, E. L. Moore; No. 345, Fertilizing Young Tung Trees, S. R. Greer; No. 349, Calcium Silicate Slag as a Source of Agricultural Lime, J. L. Anthony, Agr. Exp. Sta., State College, Miss.

"1945 Fertilizer Recommendations for Wheat, Other Fall-Sown Grains, and Permanent Pastures," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, No. 257, Rev. July 1945, Earl Jones and Robert E. Yoder.

"The Need for Lime of Some East Texas Soils," Agr. Exp. Sta., A. & M. College of Texas, College Station, Texas, P.R. 963, Sept. 1945, J. F. Fudge and G. S. Fraps.

"The Availability to Plants of Phosphates Applied with Cattle Manure," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 525, Dec. 1945, Alvin R. Midgley and David E. Dunklee.

"Fertilizers for Irrigated Alfalfa," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Bul. 465, June 1945, H. P. Singleton, C. E. Nelson, and C. O. Stanberry.

"Commercial Fertilizers 1945," Wis. State Dept. of Agr., Madison, Wis., No. 257, April 1945, W. B. Griem.

Soils

"Soil Testing," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 617, Nov. 1945, F. B. Smith and Geo. D. Thornton.

"Carthage Soil Experiment Field 1911-1944," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG838, May 1945, F. C. Bauer, A. L. Lang, M. H. Nelson.

"The Morrow Plots," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG948, May 1945, F. C. Bauer and C. H. Farnham.

"Brownstown Soil Experiment Field 1945," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG953, April 1945, F. C. Bauer and P. E. Johnson.

"Ewing Soil Experiment Field 1910-1944," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1096d, April 1945, F. C. Bauer and C. J. Badger.

"Mumford Plots—Systems of Soil Treatment," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1150 Rev., April 1945, F. C. Bauer, A. L. Lang, and C. H. Farnham.

"Brief Description of Kendall County Soils," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1188, Jan. 1944.

"Do Not Burn Crop Residues," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1202, Feb., 1944, L. B. Miller.

"Soil Test Interpretation and Fertilizer Use," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1220, May 1944, R. H. Bray.

"A Guide to Soil Conservation District Organization in Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1230, Aug. 1944, E. D. Walker and W. F. Purnell.

"Enfield Soil Experiment Field 1912-1944," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., April 1945.

"Winter Legumes Save Soil Even After Turning," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 340, May 1945, Russell Woodburn.

"Potassium Needs of New Jersey Soils," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 721, Dec. 1945, F. E. Bear, A. L. Prince, and J. L. Malcolm.

"Soil Survey of The Dalles Orchard Area, Oregon," Agr. Exp. Sta., Ore. State College, Corvallis, Ore., Bul. 424 Sept. 1944, O. F. Bartholomew.

"The McKenzie and Muddy Creeks Irrigation Projects," Agr. Exp. Sta., Ore. State College, Corvallis, Ore., Cir. 168, June 1945, E. L. Potter, Alexander Joss, D. Curtis Mumford, and H. L. Thomas.

"Facts About Wyoming Soil Conservation

Districts," Agr. Ext. Serv., Univ. of Wyoming Laramie, Wyo., Cir. 89.

"Laying Out Fields for Tractor Plowing," U.S.D.A., Washington, D. C., F.B. 1945 (Rev.), Nov. 1945, C. D. Kinsman and L. A. Reynoldson.

"Physical Land Conditions," U.S.D.A., Washington, D. C., Phys. Land Survey No. 26, E. N. Steely.

Crops

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As a man grows older and wiser, he talks less and says more.

The spread doesn't seem to wait for middle-age, anymore.

Seek Tests For Quality

The harvesting and field handling of an edible farm product—whether it is to be marketed fresh, frozen, canned, or dried—determines in large degree how acceptable the product will be to the consumer. Not only are chemical analyses and physical tests being made to determine changes in the product at various stages, but a considerable group of research workers are seeking objective tests to detect quality changes during handling. What the scientist is after is the translation of his research findings into readily applied, comparatively simple tests that can be used in industry as aids for control during harvesting, handling, and processing of the commodity.—*H. C. Diehl, Bureau of Agricultural Chemistry and Engineering, U. S. Department of Agriculture.*

Aiming for Higher Goals

(*From page* 26)

duced 35,241 lbs. of milk, sold at $929.63 in 90 days.

My goal for 1946 is not for only 100 bu. of corn or three cows per acre, but with an abundance of balanced fertility, 10 lbs. of milk per acre daily or 400 lbs. of milk daily for 365 days. My aim shall be to make the corn, hay, small grain, and pasture, through the use of organic matter and lime, plus liberal amounts of potash and phosphate, produce milk, eggs, and meat that are high in minerals, proteins, carbohydrates, and vitamins for a better-nourished world.

Field Trials with Fertilizers in S. D.—1945

(*From page* 18)

Recommendations

The following general recommendations for fertilizer are made for South Dakota:

Crops	Amount per acre	Analysis
Small grains	100 to 150 lbs.	4-24-12 or 10-20-0
Corn	100 to 200 lbs.	4-24-12 or 10-20-0
Hay and pastures, and grass seeds	100 to 200 lbs.	20-0-0
Potatoes	300 to 500 lbs.	4-24-12

On soils prepared by leveling for irrigation heavy applications of fertilizer and manure must be used to produce a crop. About 200 to 400 pounds per acre of a complete fertilizer, containing a 10-10-5 analysis, plus manure and crop residues are recommended.

A combination of fertilizer-grain drill is recommended for applying fertilizers to small grains or grass seedings. For corn the placement of fertilizer in a narrow band in the plow sole with a fertilizer attachment on the plow has proven best. The corn planter attachment was found to be least effective. For potatoes the fertilizer attachment on the planter or plow sole application with the attachment on the plow is the recommended method.

In conclusion, it should be emphasized that commercial fertilizers are not a substitute for other well-established soil-management practices. Crop rotations including legumes and grasses, the return of crop residues, and the use of manure supplemented with commercial fertilizers constitute good soil management.—*Agronomy Department Pamphlet No. 6.*

The Story of Potash

(*From page* 13)

in this country to the German industry. Carlsbad potash is not a by-product nor is there one associated with it. In fact, the Carlsbad ores are so free from impurities that some of them need only to be crushed for use as a fertilizer, although most of the output is refined in order to give a more concentrated product.

Thus, within a generation since American manufacturers and farmers were suddenly caught short of potash, a great industry for producing this important commodity has been created. Although, according to present estimates, America does not have as large deposits of soluble potash as do Germany and some other countries, we have enough to last many years at the present rate of consumption. There is no need to worry about the immediate future to say the least.

It is in the field of agriculture that the greatest strides have been made in the use of potash salts. From the consumption of a negligible amount to the use of more than half million tons for fertilizer alone within 100 years is fair progress. This progress has not been made without considerable effort

Tobacco plots, Massachusetts Experiment Station, 175 pounds potash per acre used. For Connecticut Valley tobacco 6-3-6 is a popular grade of fertilizer.

on the part of research and educational agencies. There was no prior demand for fertilizer potash awaiting the development of a supply. The demand was created largely after the material became available, first mainly on the strength of nutritional theory and later on the basis of experimental evidence.

There is now abundant proof that many soils require additions of soluble potash to supplement the meager supply of available native potash in order to produce optimum crop yields. Some soils, of course, respond better than others to such application, and there is also a difference in the requirements of crop plants. It has been found, for example, that till and outwash soils of the Northeastern glaciated region of the United States need fertilizer potash for the production of many crops, including hay and pasture grasses and clovers, corn, potatoes, tobacco, asparagus, onions, and most vegetables. Also, marked response to potash has been obtained from many crops on soils of the Atlantic and Gulf Coastal Plains, on the residual soils of the Piedmont, other sections of the South, and in some parts of the West. The full story of the role of potash in plant nutrition cannot yet be told; the romance is still unfolding.

Tomatoes Are a Field Crop in Western Ohio

(*From page* 8)

be carefully placed some distance laterally from the seed.

Today, the common method of seeding in Ohio is to apply the fertilizer with a corn planter to which is attached a trailing garden seeder. This improvised method can hardly be expected to place fertilizer properly for seeds that are sensitive to contact with the soluble constituents. Clearly, special planting equipment is needed if tomatoes are to be grown successfully and reliably from direct seedings in the field.

A Glance at the Future

As a whole, the growing of tomatoes for processing, as a farm crop on the fertile soils of western Ohio, seems to be an entirely sound economic practice. The production has trebled in the past 15 years, and the limit is not yet in sight. In 12 prominent tomato coun-

Fig. 3.—Superphosphate (20 per cent) placed in the row increased the growth of tomato seedlings in Brookston clay loam. Labels indicate the rate in pounds per acre if the rows had been five feet apart.

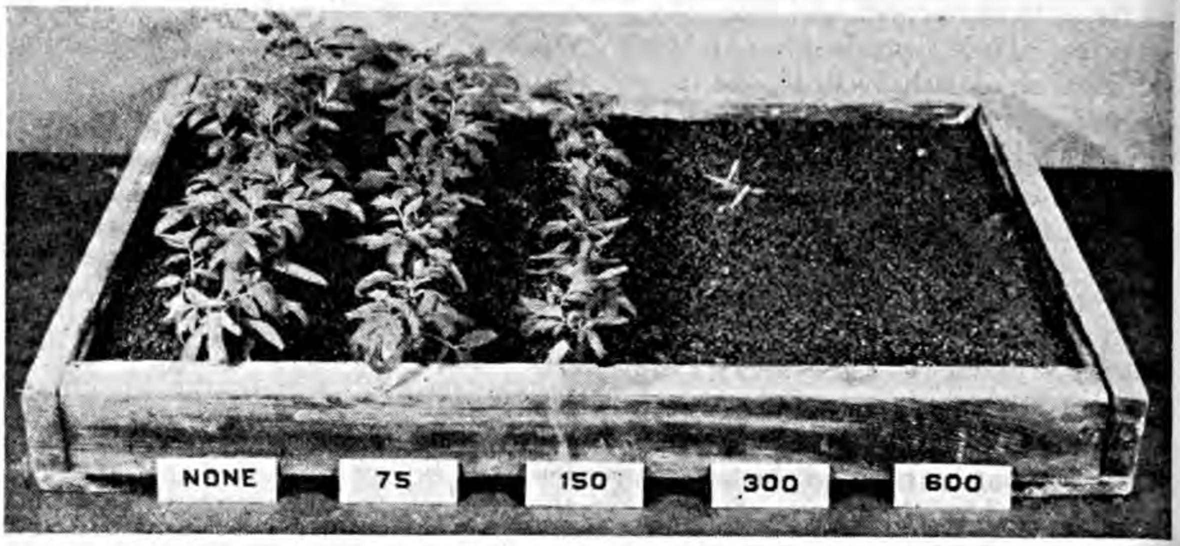

Fig. 4.—Sulphate of ammonia placed in two-inch bands about one-half inch under the seeds retarded germination and growth. Labels indicate the rate in pounds per acre if rows had been five feet apart. All rows in this flat received a uniform application of superphosphate at 300 pounds per acre.

ties, for example, the 1939 census reported 31,774 farms of which only 3,101 were growing tomatoes. This number has increased during war years but is probably still less than 4,000. In these 12 counties, then, not more than one farm in eight has been growing tomatoes in recent years. If factory capacity increases as it has in the past decade and if the farmer continues to find tomatoes more profitable per acre than field corn, there is every reason to predict that more farmers will grow tomatoes for processing in western Ohio.

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Fertilizer Placement for Corn in Kentucky

(*From page* 25)

conducted as in 1944. A systematic arrangement of two replications of 1/80-acre plots was used in which every fourth plot was an unfertilized check. Plant food equivalent to 625 pounds of 8-8-8, made up from ammonium nitrate, superphosphate, and muriate of potash, was compared in different placements. The tests included NP, NK, and PK mixtures to determine what plant food was limiting in the soil. Recommended varieties of hybrid corn were grown in all tests.

The 1945 season was generally favorable for corn throughout Kentucky, although drought limited yields in some areas. Marked increases in yield from fertilizer applications were obtained in five of the six placement tests conducted. These results are given in Table 3. In Table 2 are given the results from use of fertilizers of different analyses in five of the tests, together with a fertilizer test in McCracken County in which placement was not studied. Since this information is considered basic to an intelligent interpretation of results from tests of fertilizer placement, these results are discussed.

The first three tests listed in Table 2 were on soils along major rivers subject to flooding. These soils have been cropped almost continuously to corn for long periods with little or no application of manure or commercial fertilizers. Soybeans have been occasionally grown in rotation with corn and in a few years no crop was grown because of prolonged flooding. The soils at all three locations are depleted in nitrogen and organic matter because of cropping with soil-depleting crops. Chemical tests showed the soils to be very low in available potassium, extremely high in available phosphorus, and adequately supplied with calcium. The reason for the high content of phosphorus is difficult to explain considering the origin of these soils. Results from these tests indicate little or no response to phosphate and potash without nitrogen and in one case no response to nitrogen and phosphate without potash. Most response was obtained to the combination of nitrogen and potash, with some additional response to complete fertilization in two of the tests. In the Lyon County tests, much less response to fertilizer was obtained on land which floods frequently (No. 1) than on land which floods only occasionally (No. 2).

In the Christian County experiment, chemical tests showed the Hagerstown silt loam to be deficient in available phosphorus, but fairly well supplied with available potassium and calcium. The yield data indicate little response without phosphate, and best response to complete fertilizer. The soil in the Madison County experiment tested low in available phosphorus and potassium and was strongly acid. This soil had received some previous phosphate fertilization, and corn responded most to nitrogen, practically no response being obtained without it. The soil in the Grayson County test had been previously built up to a good level of fertility by application of phosphate and limestone and general good soil man-

TABLE 2.—YIELD OF EAR CORN FROM FERTILIZER OF DIFFERENT ANALYSIS, IN 1945. FERTILIZER WAS BROADCAST AND PLOWED UNDER IN ALL EXCEPT THE MCCRACKEN COUNTY TEST, WHERE IT WAS APPLIED IN ROW SIDE-BANDS.

Location of test and soil type	Average yield of unfertilized checks bu.	Av. increase over checks for fertilizer—Bu.			
		625 lbs. of 0–8–8 (PK)	625 lbs. of 8–0–8 (NK)	625 lbs. of 8–8–0 (NP)	625 lbs. of 8–8–8 (NPK)
River bottom silt loam soils					
Lyon County (1) (along Cumberland River)	55.5	−3.3	15.0	9.7	18.4
Lyon County (2) (along Cumberland River)	52.6	0.4	25.7	18.6	32.3
McCracken County (along Ohio River)	56.7	5.0	10.4	−0.8	10.9
Upland Soils					
Christian County (Hagerstown silt loam)	43.4	4.9	2.1	11.9	16.1
Grayson County (Tilsit silt loam)	47.6	2.9	1.5	7.0	5.3
Madison County (Johnsburg silt loam)	47.5	1.3	13.1	18.8	25.8

TABLE 3.—YIELD OF EAR CORN FROM DIFFERENT PLACEMENT OF FERTILIZER, 1945. AN EQUAL AMOUNT OF PLANT FOOD (625 POUNDS OF 8-8-8 FERTILIZER PER ACRE) WAS APPLIED IN DIFFERENT WAYS.

Location of test and soil type	Average yield of unfertilized checks bu.	Average increase over checks for fertilizer—Bu.				
		All broadcast and plowed under	500 lbs. broadcast and plowed under 125 lbs. at row	500 lbs. in furrow bands; 125 lbs. at row	All at the row	All broadcast after plowing and disked in
Lyon County (1) (along Cumberland River)	55.5	18.4	17.6	12.8	10.9	10.5
Lyon County (2) (along Cumberland River)	52.6	32.3	24.7	29.9	26.0	22.2
Christian County (Hagerstown silt loam)	43.4	17.3	11.5	18.6	14.3	11.4
Trigg County (Hagerstown silt loam)	52.0	22.1	17.2	26.8	12.6	9.2
Grayson County (Tilsit silt loam)	46.7	5.3	1.1	4.0	3.0	0
Madison County (Johnsburg silt loam)	47.5	25.8	29.6	28.4	21.0	14.4
Average, above 6 tests	49.8	20.2	17.0	20.1	14.6	11.3

agement. Because of this and some injury from drought, little response to fertilizer was obtained.

As shown in Table 3, corn in general gave better response in 1945 to deep placement of fertilizers—broadcast and plowed under or in furrow bands—than to surface applications—bands along the row or broadcast after plowing and disked in. Response of corn to row application of fertilizer may have been lowered by the methods used. In the Lyon and Trigg County tests there may have been some injury to the germinating seedlings, as the fertilizer was applied in a single band close to the seed at planting time. In the Christian and Grayson County tests, row fertilizer was applied in side bands in furrows along the row after the corn was up, which may have reduced its effectiveness somewhat. Response to fertilizer broadcast and disked in after plowing, however, should be representative of average conditions.

Conclusions

Although two years' results are not enough to justify definite statements, the results obtained indicate that applications of fairly large amounts of fertilizer in plow-furrow bands or broadcast and plowed under are satisfactory methods of applying fertilizers for corn on most soils. In contrast, however, it should be stated that some farmers in Kentucky have obtained little return from plow-furrow application of as large amounts as 1,000 pounds of 6-8-6, or similar fertilizer, per acre on corn. Along with the deep application, a part of the fertilizer should usually be applied at the row. With prospective increases in the supply of fertilizer attachments for turning plows, the method of furrow-band application offers a simple, low-cost means of applying fertilizer. Few corn planters in Kentucky, as well as throughout the southeastern region, are equipped with adequate fertilizer attachments, especially those for applying large amounts. Most other methods of application involve an additional operation, which adds to the cost of production.

The general problem of what plant food and how much to apply for corn involves other considerations. Where corn is grown in rotation with small grain and hay on soils of a fair to good level of fertility, it is the belief of the writer that most of the phosphate and potash should be applied for the small grain rather than for corn, in order to get maximum net return from the fertilizer used. In favorable seasons under Kentucky conditions heavy, direct fertilization of corn grown in such a rotation also may pay, but adverse weather conditions will often prevent the desired return. Many soils having a fairly low level of fertility should give a profitable response to direct fertilization of corn with moderate to large applications of fertilizer. Even on such soils, however, drought often prevents the desired crop response. Poorly drained soils or those subject to overflow, which are cropped nearly continuously to corn and on which crop rotation is not successful, also should give a profitable response. Profitable returns from heavy fertilization of hybrid seed corn, a high acre-value crop, can be expected. In these situations a complete, well-balanced fertilizer should usually give best results.

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Sweet Potatoes Are Proving New Gold for the South

(From page 22)

encro Cooperative reached a point in 1945 that forced the association to limit its membership, even after expanding its facilities. The association bought additional land, provided more storage space, doubled the size of the packing shed, and installed a dehydrating plant for processing cull potatoes for feed.

The association has the latest equipment for washing and waxing, grading, packing, labeling, loading, and shipping potatoes. The cooperative last year sold 240 carloads for over $300,000 and made savings of $31,470 before the payment of dividends on preferred stock.

The cooperative buys crates in carload lots from the cooperative box factory at Hammond. It also handles feed and fertilizer for its members, making substantial savings in this respect. Membership of the association increased from 60 in 1943 to 250 in 1945. The association has been financed by the New Orleans Bank for Cooperatives.

The Ossum Farmers Cooperative at Scott, Louisiana, also has been highly successful. This cooperative handled 100 cars of sweet potatoes during the first season in 1944 and made net savings of $10,128. It paid a 6 per cent dividend on preferred stock and credited the remainder to the members on a patronage basis.

Another producers' association which is making a good record is the Sweet Potato Growers, Incorporated, at Laurel, Mississippi, where around 1,000 members of the association and 600 4-H Club boys sold a half million dollars worth of potatoes from the 1945 crop. When we visited the cooperative early in November, the dehydrating plant was being operated at full capacity, two big curing houses were filled, other available storage space was packed, and deliveries to the plant had been temporarily halted.

W. M. Crumpton, general manager, said the cooperative would dehydrate 1,375,000 pounds of potatoes under Government contract and 250,000 pounds for the commercial trade.

The association was paying growers $42 per ton for grade 1 and grade 2 potatoes, plus an allowance for hauling. The amount of this allowance depended on the distance of the haul. Growers in Pike County, about 100 miles away, were paid $48.50 per ton. The association furnished crates.

Beginning in January No. 1 cured sweet potatoes will be graded and marketed. The cooperative has installed brushing, washing and waxing, grading and loading equipment.

The association is pioneering in marketing 40,000 bushels of carefully graded, high quality sweet potatoes in 5-pound open mesh bags through chain stores in Laurel, Hattiesburg, Jackson, and New Orleans. It is believed that this method of marketing will help to popularize sweet potatoes and increase the demand by consumers.

Another contribution to improved sweet potato production has been the work of 600 4-H Club boys in 12 counties. The club members, who have worked under direction of state and county extension agents and according to specifications of a written agreement with the association, have produced Unit One Porto Rico sweet potatoes in quantity for seed to help standardize this variety, simplify marketing, and get a higher price. They also demonstrated recommended practices in the production and harvesting of sweet potatoes. Representatives of the extension service and the association assisted the 4-H boys in giving 35 bedding and harvesting demonstrations.

Under the agreement, the cooperative furnished the boys with seed potatoes and served as marketing agent, accepting, storing, curing, grading, packing, and selling the potatoes.

The most efficient feed dehydrating plant we visited was at Perry, Georgia. It is one of three pilot plants built by Cleaver-Brooks Company of Milwaukee, which spent practically a year improving and perfecting the dehydrating equipment which is installed in a concrete, tile, and steel building. The plant is operated 16 hours a day with

J. E. Snowden, Mississippi Extension Marketing Specialist, left, and W. M. Crumpton, Laurel, display graded sweet potatoes. Crates are packed to the roof in curing houses.

This picture shows how dehydrated potatoes are carefully inspected before being packed in cans, crated, and shipped overseas.

two crews of four men each. It turns out a ton of dry feed per hour.

Sweet potatoes were dehydrated for producers for one-third toll. Three tons of raw potatoes produced about one ton of dried potato feed. Farmers with whom we talked said they were pleased with the results. Livestock liked the feed.

R. T. Tuggle, a successful farmer near Perry, told us that he had 20 acres in sweet potatoes in 1945. He harvested and sold 2,250 bushels for market at an average price of $1.40 per bushel. The buyer furnished crates and picked up the potatoes at the end of the rows.

After selling $157.50 worth of sweet potatoes per acre, Mr. Tuggle hauled 45,000 pounds of cull potatoes to the processing plant for drying. He was feeding the potato meal to both hogs and beef cattle with satisfactory results.

Georgia agricultural officials are proposing the establishment of 365 plants similar to the one at Perry which will dry any kind of feed crop. Each plant would handle the production from 2,500 acres of crops planted preferably within a radius of five miles of the plant.

The plants would furnish all harvesting equipment and harvesting crews, harvest, haul, and dehydrate the crops and deliver the cured product back to the farm. Crops to be grown would include kudzu, alfalfa, soybeans, cowpeas, lespedeza, sweet potatoes, and sorghum.

Each plant would cost about $28,000 for buildings and dehydrator, $6,600 for harvesting and hauling equipment, with about $15,000 needed for operating capital. Such plants could be built and operated by individuals, partnerships, corporations, or cooperatives.

Much of the value of the plants would come from harvesting and dehydrating crops in the green stage regardless of weather conditions and when the feed value of the plants is at the highest point. Under field conditions farmers frequently suffer heavy losses when crops mature during rainy periods. Forage crops may become too mature and woody, many of the leaves may be lost, and the entire crop damaged by rotting or bleaching.

Dehydration makes possible the harvesting of an entire crop without loss and when it is worth the most.

Pasture Possibilities On Coastal Plain Hills

(*From page* 10)

increased; second, the grasses and legumes produced become more nourishing. After the plants become richer in food value, they are more readily eaten by animals. The increase in food value can often be almost phenomenal, especially when improvement practices are carried out on soils which have been very deficient in nitrogen, phosphorus, potassium, and calcium.

Lumpkin has done an excellent job in carrying out an erosion control and soil improvement program on his farm. He has this to say about improved pastures. "Because of the low yields of our cultivated crops, our many erosion control problems, and the competition we have with the more fertile agricultural areas in the production of row crops, we farmers of the hill areas need to turn to something else for a good living. I find that improved pastures are one of our best methods of controlling erosion, bringing back the so-called, worn-out hill lands to productivity, and at the same time furnishing a profitable return.

"The South, with its 9 to 12 months of annual grazing, should be able to compete more successfully in the production of livestock with other sections of the United States which have a much shorter grazing season.

"I see by the reports that Louisiana imports beef and dairy products from other states when our State has pasture possibilities as good as practically any other state in the Union. I am sure that the establishment and maintenance of improved pastures will reverse this condition."

Wheat Winnowings

(*From page* 5)

slices of ready-cut bread and preventing loss and waste of it, as his main part in filling those hungry mouths abroad.

Nothing brings home to us more succinctly the major changes that have taken place in the channels of food distribution than this sudden light thrown on our inability to act individually in saving wheat flour appreciably. There may be one gain in it on the thrift side, and that advantage comes from the ability of the processors to combat weevils in stored flour much better than could the home-owners.

In the matter of improving the scientific food values of white flour and bread, our government began where the competitive instincts of the bakers left off. The very first war-food order issued from Washington in 1943 required the enrichment or reinforcement of all bakers' white bread by addition of the vitamins, thiamine, riboflavin, and niacin, plus one mineral, iron.

This resulted in seven times the thiamine, eight times the riboflavin, and four times the niacin and iron found in the fortified white bread compared with the normal loaf. Except for the riboflavin content, which is higher, these vitamins artificially added to flour just about restore the natural vitamin values of the wheat berry before it is milled into refined white flour. Of course, the protein volume of whole wheat flour is still superior to that of the patent article.

Despite the fact that we American consumers rely so much on meat and varied diets, and have so much more and better menus than the best afforded abroad, in general grain foods give us about as much protein as we get from meat, poultry, game, and fish together. Naturally protein coming from this source alone would fall short indeed of giving the body-building tone which, fortunately, we have thus far been able to secure from eggs, meats, vegetables, and milk. Habitual reliance on our part to a sturdy and healthful American diet throws us open to criticism as being indifferent and heedless of the plight of those who never have and maybe never will attain the stomach-satisfying standards we enjoy so thoughtlessly.

Before leaving the topic of fortified foods, let us recall that only 18 states thus far have mandatory laws to require enrichment with vitamins of all white flour and bread sold therein. However, the Council of State Governments is distributing a sample bill for use in states where similar laws are considered. They tell me in the home-ec sanctums that the ingredients needed to enrich all the bread and flour sold in this country in a year at 1945 prices would only dock a person 18 cents for the privilege of safeguarding digestion, heart action, nerve force, and that "all-in" feeling.

At the risk of serving "bread and milk" in this essay, it is also important to remember that when we can work and plan to save the best of the natural vitamins in our foods, like cow's milk, for instance, we will be charting a safe and sane course. It is well to observe that the dairy cows of America in a certain recent period are said to have produced three-quarters as much C vitamin, or ascorbic acid, as the citrus orchards of Florida and Texas and California combined. Somewhere in the picture the bulk of this vitamin disappeared, which leaves the job of the dairy scientist cut out for him, to find ways to prevent that great loss without throwing dead cats meanwhile at the oleo industry for adding 9,000 units of vitamin A per pound to its fatty compound.

In the midst of this rush of federal regulatory orders and critical comments by the feed and food interests and the community club campaigns to save waste fats and kitchen scrapings, it would do anybody a heap of good to talk over this foreign food situation with a veteran or an authority on nutrition.

In fact, some of our rural social clubs could easily cut out many kinds of cake, pie, and fancy fixings and hold a self-denial banquet—maybe serving just twice the average daily meal of a starving foreigner. As the speaker of the evening bring out the keen local boy who saw how slim the rations were in homes across the sea. Mawkish, sentimental palavering at such festivals and a big hog-feed afterwards on the sly are not in order. In these days of riding-machinery and electric gadgets and labor-savers, I know plenty of ruralites who could spare a pound of flesh around the belly without missing much. I hate to carry the idea further toward the metropolitan night-spots, as this paper is careful about the kind of descriptive terms used in embellishment of one's most heated thoughts.

Anyhow, I mention this fresh from a chat with a man from South Carolina who served awhile as county agent prior to working in Albania as agricultural rehabilitation director for UNRRA. He told how the peasants from the villages in the mountains there came down to the seacoast to meet the wheat-laden ships. By army truck the supplies were taken to the edge of the ranges and thence by donkey pack and pick-a-back through deep snowdrifts and glacier passes into the hinterlands of hunger.

It seems that busy village and prefecture committees had allotted this wheat beforehand, so that no family that still had two and a half bushels of it laid away might receive any of the new consignment. The Albanian farmer ate whole wheat or corn bread for his meals, and no sugar or coffee was on tap. The big boss-men of the prefecture, on entertaining special guests like our county agent, served three courses—goat-milk cheese, sour brine pickles, and mutton chops, plus some coarse black bread. Sometimes they had a little tidbit like plums in honey preserves saved up from happier and more tranquil times.

For the harvest of 1946, gleaned in May and June, the farmers planted Tenmarq, Cheyenne, and Barrt winter wheat sent from our shores and tilled and seeded the land with 50 Yankee-made tractors hitched to drills made in Racine or Peoria. One outfit using a ten-foot drill sowed several thousand acres on 24-hour shifts. Seed corn of hybrid vigor, the pride of Iowa corn-husking contests, was used to plant large areas for the last season's fairly successful crop in the northern Albanian provinces.

THE point I got from this chat was that the natives appreciated fully what we had sent them, at little real injury or cost to us, but they were often too busy and worn out to indulge in effusive praise. At least they have learned that we can organize to a degree for relief, even if it may not be as powerful and efficient as our capacity for ruin.

I wonder at this point if all our wishful welfare thinking and our good will toward hungry men can be quick and strong enough to overcome the stealthy and insidious approach of more warmongering motives. If all we can do is to build generations and save money with which to engage in more carnage and power politics, it brings to mind the ancient adage that men do not live by bread alone—even fortified bread.

"Now children," said the kindergarten teacher, "we'll draw what we'd like to be when we grow up."

At the end of twenty minutes everyone handed in a picture except little Butch McGurk. His paper was blank.

"Why Butch," remonstrated the teacher, "isn't there anything you want to be when you grow up?"

"Sure, teacher," replied little Butch. "I'd like to be married, but I don't know how to draw it."

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.

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Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
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THE AMERICAN POTASH INSTITUTE

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

The officer gazed sternly at the private who had been brought before him.

"Did you call the sergeant a liar?" he demanded.

"I did, sir."

"And did you go on to describe him as a pop-eyed, knock-kneed, good-for-nothing louse?"

The private hesitated. Then, with a note of regret in his voice, he replied: "No, sir, I forgot that."

Then there was the Scotchman who was beaten almost to death because he thought the sign on the door said "Laddies."

During a dieting ordeal, Fanny Hurst, the novelist, was out for her daily constitutional when she passed Irvin Cobb. The late humorist failed to recognize her.

"Why, Irvin," she called out, "don't you know me? It's the same Fanny Hurst."

Cobb turned slowly and surveyed her. "It may be the same Hurst," he said, "but it certainly isn't the same Fanny."

DOCTOR'S ORDERS

"Ralph, I thought that the doctor told you to stop all drinks."

"So what? You don't see many getting past me, do you?"

"Little boy, do both of your dogs have licenses?"

"Yeah. They're just covered with them."

Visitor: "So you call your canary 'Joe'. Does that stand for Joseph or Josephine?"

Johnny: "We don't know. That's why we call it 'Joe'."

ACQUIRED POLISH

Asked if a year of college had made any difference in his eldest son, a deep-South farmer reflected: "Well, he's still a good hand with the plow, but I notice his language has changed some. It used to be, 'Whoa, Becky! Haw! and Git up!' Now when he comes to the end of a row, he says, 'Halt, Rebecca! Pivot and proceed!' "

The reason most women don't look good in slacks is because the distance is too great between their hip pockets.

SUDDEN DROP

First G. I.: "The touch of the nurse's hand cooled my fever instantly."

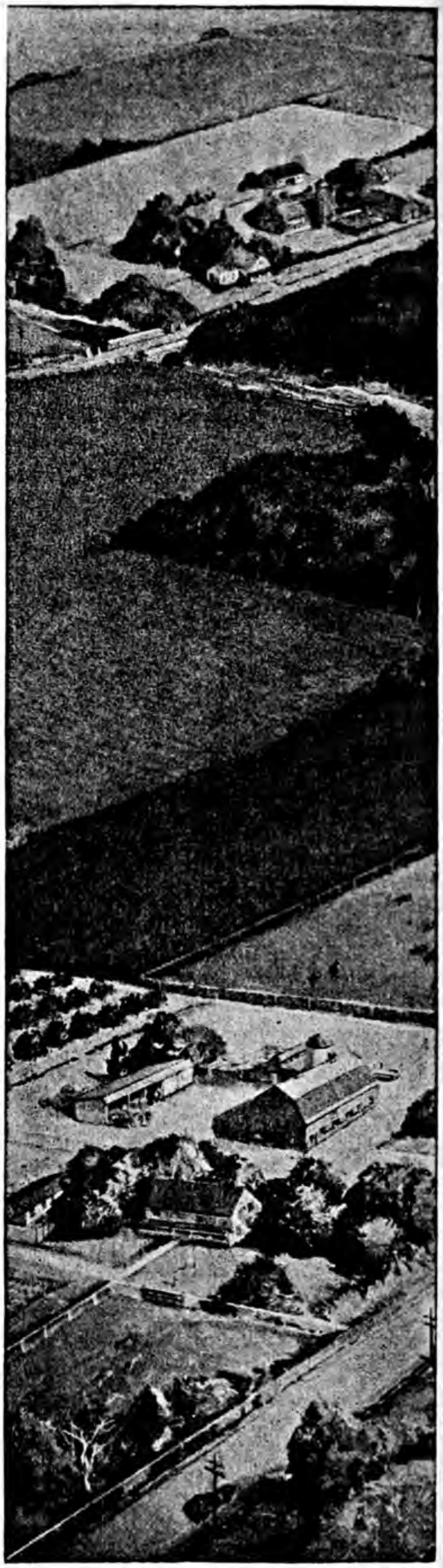
Second G. I.: "Yeah, we heard the slap all over the ward!"

Indian gals have a lot of fun with their beaux and errors.

Jimmy: "Daddy says there isn't another woman in the world like you, Momma."

Mother: "That's very flattering of him."

Jimmy: "And he says it's a good thing, too."



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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.

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- 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)

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.

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April 1946 10 Cents

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

VOLUME XXX NO. 4

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

Member Companies: American Potash & Chemical Corporation
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WAITING FOR SOMETHING TO HAPPEN!

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VOL. XXX WASHINGTON, D. C., APRIL, 1946 No. 4

Recognizing . . . . . .

RICE RESURGENT

Jeff McDermid

THE rise of rice in public significance has proceeded minus much acclaim until recent world famines have catapulted our continent into a major supplier of this great food staple, long associated with the tropics.

It only goes to show how things will happen when your back is turned. Hereabouts, at least in my familiar bailiwick, rice has spelled something to mix with raisins for a quick dessert pudding, or perhaps a traditional showering material with which to besprinkle the pathway of newlyweds. Of course, betimes some of us went down to the city and sampled chop suey or chow mein layered with mounds of flaky rice doused with "dragon blood" sauces, or peered into Ying Ling's shirt-tearing foundry to see him ladling rice from bowl to belly amid the soapsuds.

And as I said, the shift in rice production has been so gradual and unheralded by advertising pomp that some of us awoke with a bang yesterday to learn that Brazil and the United States are the greatest rice countries outside of monsoon regions of Asia. We also found out that rice is a staple diet for more of this world's hungry hordes than wheat, especially to those populations in areas subject to the worst recurrent famines as well as the most unreliable and unfair distribution systems known to mankind. As major suppliers of rice we can help correct the former evil, but only decent organization and local responsibility can mend the latter obstacle.

Time was, not so long ago, when we imported much rice. Now this country is not only self-sufficient in this cereal but, together with Brazil, our production accounts for nearly three-fourths of the commercial rice output of the western hemisphere.

No figures are at hand about our domestic use of rice as a whole beyond an estimate that each American manages somehow to get outside of six pounds of it in a year, possibly including that generous portion which finds its way to the pavement on wedding days and is lost forever to the stomachs of famished ones.

BY a little diligence I find that rice consumption takes on a decided regional complexion, and it "disappears" at a faster clip from stores in certain states compared to others and to the national average. Up in the stony and frigid hills of Vermont and New Hampshire the canny Yankees consume only about a tenth of a pound of rice apiece in the course of a year. In only eight states does the rice-consuming rate exceed that of the six-pound national level. Down in the Southland for some reason the per-capita eating of rice has risen to 30 pounds in Carolina and 40 pounds in the bayou zones of Louisiana. One must seek some reason besides economy in food for an excuse to explain that difference, as long as you find old New England boiling so little of a low-cost cereal. Anyhow, what they didn't eat in Rutland or Exeter helped this country jump its exports of the white grain in milled form from 70 million pounds in 1936 clear up to 490 million pounds last season.

What boomed the rice paddies and mills in our deltas was, of course, the disruption of overseas and inland transport from surplus Asiatic lands to oriental shortage areas that are customarily huge consumers of rice. The latest dope is that Asia's milled rice output this past crop year is 40 *billion* pounds below the prewar average. The Rising Sun aggression put the wet blanket on seeding and harvesting processes, robbed storages, and put the burden of supporting a wave of rice-hunger on the one single current harvest now under way in Asia.

Countries said to possess a total exportable margin amounting to about two billion pounds this season are notably Burma, Siam, and French Indo-China, whereas before the war the surplus from the big rice centers there created nearly 20 billion pounds of yearly reserves to ship outbound. In Formosa and Korea the rice gatherers will hardly glean enough to fill their own larders.

But in China, native habitat and traditional user of rice foods, the deficit staring them in the belly is the biggest in the whole Asiatic sector. All the old snarls and bungles affecting inland traffic combine to put chaos in the rice kettle there. Some provinces probably have a surplus and no reliable and modern ways or methods to haul it to places in direst need.

JAPAN used to beg, borrow, and steal over four billion pounds of rice every year from its colonies, added to which loss of resources the present crop there has failed and left them perilously short of enough to serve in homes and pagodas and geisha houses. Naturally, we of the minor rice-raising zones with our small percentage of the world's total production are utterly unable—try as we may by saving something on our diets—to contribute over a tiny driblet in the enormous stewpot now empty in the Orient.

And that isn't all of it either. Loss of work cattle and field equipment during the invasion of the Philippines has left the planters illy prepared to meet this surge of accumulated rice demand near home. In fact they never did either, being heavy importers and big eaters of rice before the war. Much of the same situation goes for British Malaya and the Netherlands East Indies, too. They are all busted on rice and know no substitute. As a cap sheaf to the stack of miseries clouding the picture we find India and Ceylon stricken by drought, which blasted their chances to feed themselves, let alone to share with neighboring destitute rice devotees.

So we have countries like Hawaii, with an annual rice consumption rising to 175 pounds per capita, as well as China, Japan, and the Philippines clamoring for aid in some form from somewhere. No wonder we come back into this hemisphere to scan the crop prospects ahead and see none too cheering outlooks for our being able to keep anywhere close to the world demand for rice in the present, as well as in the coming year.

I suppose we really cannot realize ourselves what dependence on a single crop or a limited one-item diet means to life and hope. We raise wheat, the staff of life, so-called, and yet we enjoy such a variety of other edibles all year long that it seems incredible to us that mid-continent Europe beckons to us for our crumbs to keep body and soul together. I presume it will be the same with our rice business—just a commercial thing, a chance to make money for awhile on hunger cycles—and then forget. But maybe we will let it sink in this time, how little there is between humanity and actual want, especially when we waste our substance on munitions and destruction.

Let's take a partial roll call of this hemisphere respecting rice outlooks for 1946 and run some risk while doing so of making advance guesses of climatic and pest hazards lying in wait to trip us up. Most of our farm folks living outside the natural rice-raising sections have paid no more attention to the ups and downs of the white kernel than they have to peanuts—and look what's happened to peanuts meanwhile.

We have been so much in the habit of swelling out our chests and thumping our ego with braggart yarns anent the red-meat belt, the hybrid-corn tonnages, the wheat harvest, and the pork and poultry business that we have neglected to find out a darn thing about the ability some of our brother farmers have to meet a world rice crisis.

Planting intentions for 1946, as summarized in recent national estimates from Arkansas, Louisiana, Texas, and California, show six per cent over the earlier goals and four per cent above the acreage of last year. Back in the fall of 1945 the trained-seal estimators figured that we could get along with about 19 million bags of milled rice that would require about 1,406,000 acres based on yield rates of about 46 bushels an acre with normal mill returns. Later, when the rice scare boiled out of the pot, they put up the goal slightly to 1,479,000 acres, but the planters reported signs afoot that about 1,575,000 acres would be sown this season. Inasmuch as rice growers somehow managed to break records in wartime on scarce help and short supplies, the facilities for raising rice this season should be no worse, they argue, and hence they will take a dare and do their durndest.

THANKS to Hank Wallace's statisticians in the Commerce Department, I am able to unload a few facts concerning South American and Mexican prospects for raising chop-suey mash. Compared with Asiatic tonnages it doesn't loom large, but it's an improvement anyhow.

Brazil's chief rice region is Rio Grande do Sul, and this coming season an increased seeding of 20,000 acres has been planted there, to make the

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Potash Losses on the Dairy Farm

By A. R. Midgley and K. E. Varney

Department of Agronomy, Agricultural Experiment Station, Burlington, Vt.

LIVESTOCK farming is one of the best means of conserving soil fertility. Most of the land is continually in hay and pasture, which reduces erosion and leaching losses to a minimum. In addition, with this system of farming it is possible to return to the soil a large portion of the plant nutrients that are removed in crops, but the theoretical and actual amounts that are so returned are quite different. About three-fourths of the plant-food elements contained in crops which are harvested and fed to livestock are excreted in manure, and only one-fourth are contained in milk and livestock.

However, to get the entire three-fourths back to the field for re-use by crops requires real thinking and planning and even then it is very difficult, if not impossible. This is primarily because of the difficulty in handling manure without excessive losses. In the case of potash, both leaching and run-off losses are often very large because most of the potash is water-soluble and present in the urine.

Dairy farmers spread a considerable amount of manure during the winter on ground that is frozen and covered with snow. Frozen land is impervious to water and considerable run-off occurs in the northern states during the spring thaws, especially if they are accompanied by rain.

The relationship between precipitation and run-off during the late winter and early spring at Burlington is shown in Fig. 1. In general, the greatest run-off occurs during March, but it is evident that considerable snow evaporates during the winter because the amount of run-off is much less than the total precipitation (rain and snow) during this time. To determine run-off losses from manure spread during the winter, studies were conducted covering periods ranging from three to six years.

A series of enclosures (with no tops or bottoms) were constructed in 1935 on 10 and 20 per cent slopes at the University Farm to catch all the water which runs off the surface (Fig. 2). Duplicate samples of the run-off liquid were obtained for analysis after each thaw.

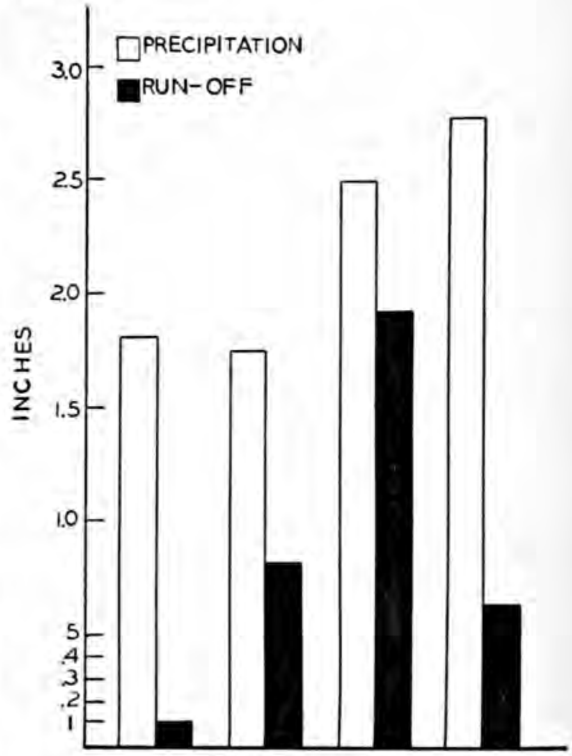

Fig. 1.—Average precipitation and run-off at Burlington, Vermont, over a six-year period. Greatest loss occurs in March during the spring thaw.

Fresh cattle manure was usually spread within these enclosures in late December or early January at a rate of 10 tons per acre. Since superphosphate is often used in the stable gutter, its effect on manure run-off was also studied, as well as the effect of adding limestone to phosphated manure at the time of spreading. Superphosphate was used at the rate of 50 pounds, and limestone at the rate of 100 pounds, per ton of manure. Nitrogen, phosphorus, and potash losses were determined, but only the potash losses will be considered here.

Potash Run-off Losses

Most of the potash contained in cattle manure is in the urine. It is very soluble and therefore subject to run-off, which accounts for the large losses reported in Table 1.

When superphosphate was added to the manure, potash losses were usually increased. This seems to be due to the replacement of some of the potash in the exchange complex of manure by the calcium in superphosphate, which contains nearly 60 per cent calcium sulphate. Furthermore, superphosphate helps to retain some ammonia in the manure and this ammonia is also free to replace some potash which was originally held in the solid exchange material of manure. This replaced potash then becomes soluble and susceptible to run-off.

When ground limestone was added to phosphated manure at the time of spreading, potash losses were reduced. The reason for this is not clear although it has long been known that heavy liming may greatly reduce the solubility of potash in soils and often its availability to plants. Thus, while neutral or acid calcium salts (sulphates, phosphates, etc.) may increase potash solubility and susceptibility to run-off, the carbonate and hydroxide forms seem to reduce them.

TABLE 1.—POTASH RUN-OFF LOSSES PER ACRE FROM 10 TONS OF MANURE

Plot treatment	Potassium losses expressed in pounds of 50 per cent muriate of potash						
	1936	1937	1938	1939	1942	1943	Average
Plots on 20 per cent slope							
No treatment	.1	.1	0.0	.5	......	......	.1
Manure only	26.8	33.6	39.8	53.4	......	......	38.4
Manure and superphosphate	30.1	35.0	40.6	60.3	......	......	41.5
Plots on 10 per cent slope							
No treatment	.6	0.0	0.0	.8	.1	.1	.2
Manure only	60.5	71.8	34.0	100.2	16.0	47.0	54.9
Manure and superphosphate	69.4	68.2	35.1	105.0	25.0	71.0	62.3
Manure and hydrated lime	......	......	......	......	20.0	70.0	45.0

These results indicate that the degree of slope may be a minor factor, because frozen ground is impervious to water and any slope may cause wash-off. The greatest factor is the amount of snow present at the time of the thaw. The location of the plots on the 10 per cent slope allowed them to accumulate more snow than plots on the other slope. This and the fact that some of the records were taken during different years account for the differences. Taking all trials on both slopes, manure alone (without amendment) gave an average yearly loss of potash equal to 46.6 pounds of 50 per cent potash for each 10 tons of manure used.

These field results show that substantial amounts of potash may be lost from run-off during the winter, especially on an average dairy farm. Good dairy cattle will usually produce a ton of manure per month. Since they are

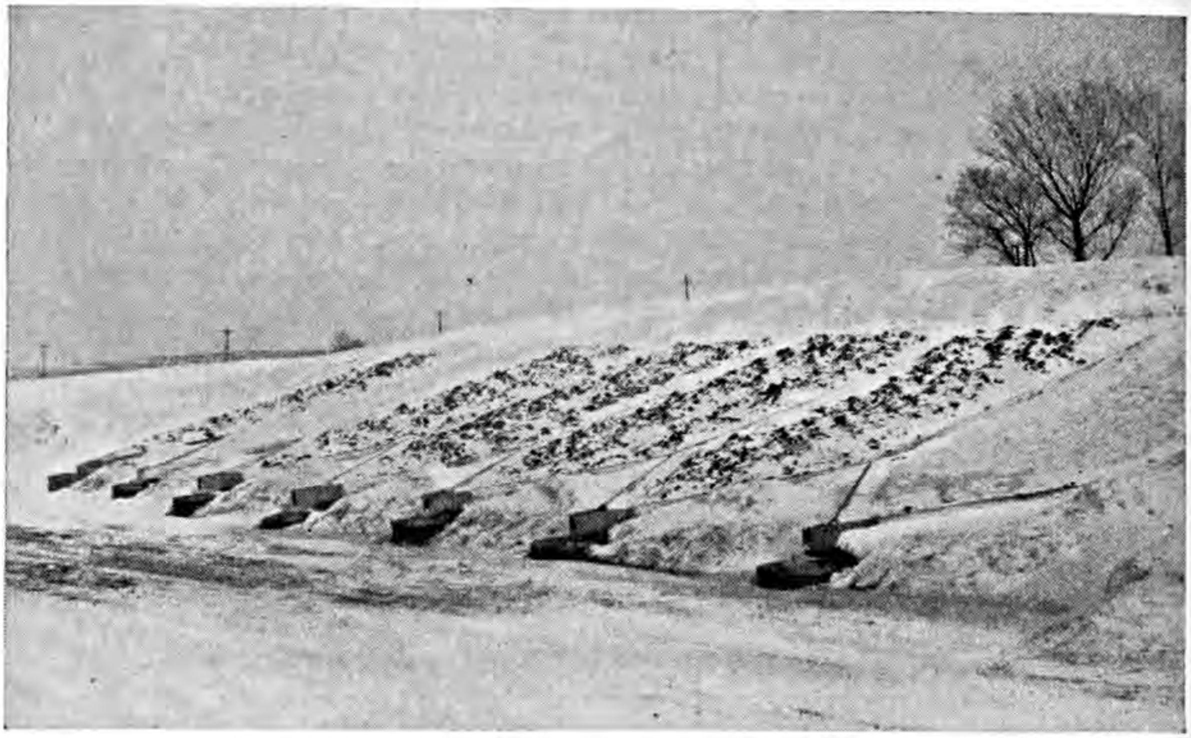

Fig. 2.—Winter view of run-off plots on 20 per cent slope. Manure applied on snow last of December. Two plots without manure are visible.

often in the barn at least six months of the year, a one-man dairy farm of 15 cows will produce 90 tons of manure during the period the cows are stabled. The annual loss from this amount of manure would be equal to about 420 pounds of 50 per cent potash.

A number of laboratory trials were also conducted using small artificial run-off pans (Fig. 3). These rectangular-shaped pans with an outlet tube at one corner were of sufficient size to accommodate 500 grams of manure, spread at a rate equivalent to 10 tons per acre. The bottom of each pan was covered with an equal amount of snow and then the treated or untreated manure was spread over this. The pans were then set outside under freezing conditions for 10 days before sufficient additional snow was added to give about 1,500 cc. of run-off liquid when the pans were brought indoors and the snow allowed to melt.

The liquids obtained from the pans receiving different manure treatments were comparable in color to the liquids obtained under field conditions, except that thev were darker and contained more soluble organic matter. Run-off water from untreated manure was about twice as dark as from manure receiving superphosphate. This is due to the precipitating effect of the calcium salts contained in superphosphate. Potash run-off losses under these laboratory conditions are shown in Table 2.

While these laboratory trials show greater losses than would ordinarily result under field conditions, yet it is evident that large amounts of soluble potash may wash off the frozen, impermeable ground if sufficient melting snow is present. Without superphosphate, over 50 per cent of the total potash contained in manure readily runs off. With superphosphate, even greater amounts were lost, while the addition of limestone to the phosphated-manure reduced the loss.

Of course, larger amounts of potash could have been removed from this manure with additional melting snow. However, on the above basis, the 90 tons of manure produced on a 15-cow farm during the winter contain at least 900 pounds of 50 per cent potash which are subject to run-off under severe conditions. Such losses seldom occur in practice but these figures indicate a big

TABLE 2.—POTASH RUN-OFF LOSSES FROM 10 TONS OF MANURE UNDER LABORATORY CONDITIONS

Treatment per ton of manure	Potash losses expressed in lbs. of 50% muriate of potash
Manure only	100
Manure and superphosphate	131
Manure and superphosphate with 100 lbs. of limestone added while spreading	105
Manure and superphosphate with 200 lbs. of limestone added while spreading	101

NOTE: Ten tons of manure contained an equivalent of 180 lbs. of 50% muriate of potash.

potential leak in the maintenance of potash on a dairy farm.

Summer Potash Losses

The manure produced by cattle while on pasture during the summer is poorly distributed and utilized by plants. Much manure is deposited in lanes and roadways leading from pasture to barn, as well as near streams, trees, and other shady places. Unfenced woodlots also receive large amounts of droppings on land which is unsuited for growing pasture herbage. Since much of this manure is derived from vegetation grown on the better land, some of the potential producing capacity of the manure is lost to poor land by this process.

Even when the manure is deposited on good pasture land, its high concentration and poor distribution greatly reduce its efficiency. This becomes evident from the following data.

Cows on pasture deposit an average of about three pounds of urine or 1½ quarts at a time. Of course this amount varies greatly and large cows may produce considerably more. The spots receiving such deposits are very evident

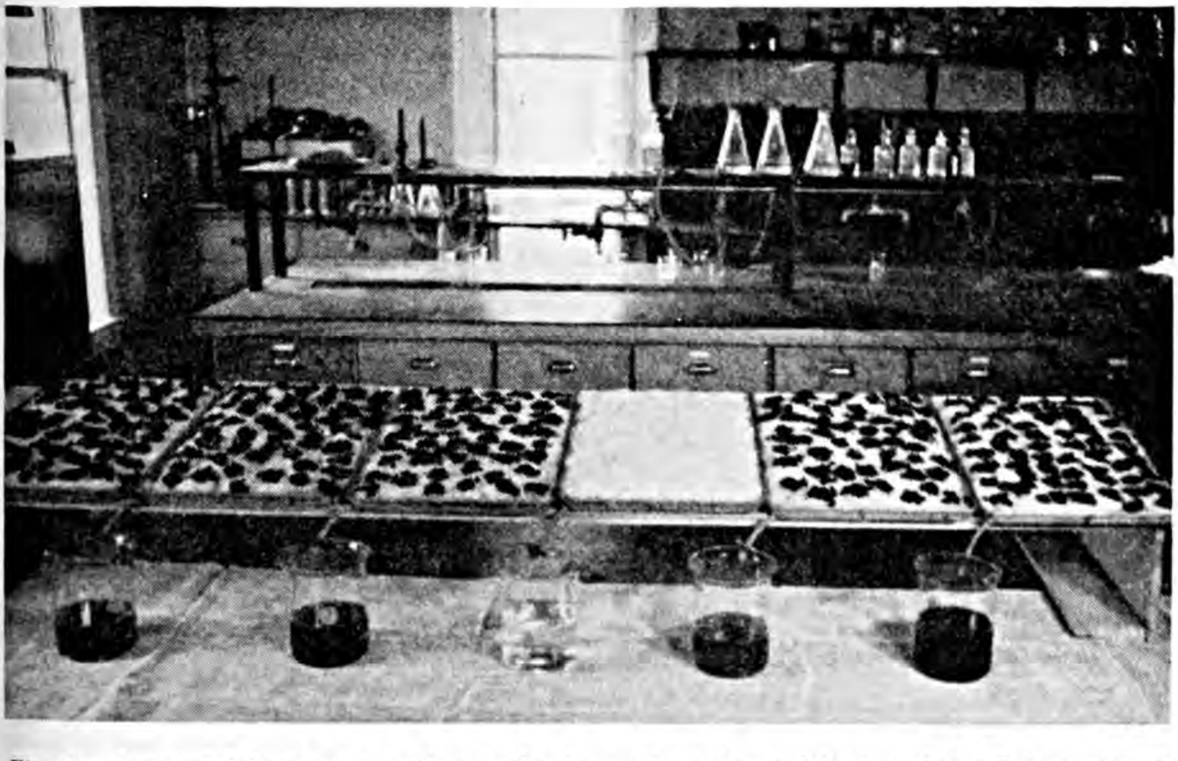

Fig. 3.—A set of laboratory run-off pans showing outlet tubes and beakers for collecting run-off liquid. The pan in center received snow only.

during the summer and fall, as seen in Fig. 4. The total area included in one of these urine spots varies greatly, but an average of 50 measurements showed them to be 23.3 inches in diameter. The above amount of urine on an area of this size is the equivalent on an acre basis of about 556 pounds of nitrogen, 6 pounds of P_2O_5, and 601 pounds of K_2O, or about 5,560 pounds of a 10-.1-11 fertilizer per acre. This is a very poorly balanced fertilizer as it contains practically no phosphorus. The nitrogen and potash, on the other hand, are so excessive that leaching losses no doubt occur on many light soils.

The vegetation around these spots has also been found to be poorly balanced and this no doubt is one reason why cattle often refuse to eat it. Samples of Kentucky bluegrass growing on urine spots were compared to similar grass growing a foot or so away with the following results:

	% on dry wt. basis		
	N	P_2O_5	K_2O
Bluegrass away from urine spots	1.88	.66	1.39
Bluegrass on urine spots	5.30	.57	3.30

The urine spots produced bluegrass with nearly three times as much nitrogen and over two times as much potash as did similar grass near by. The nitrogen-potash content of grass grown on the urine spots is thus considerably higher than that ordinarily reported for well-fertilized pasture grass or even clover. (Using the factor 6.25, the protein content would be about 33 per cent.) The phosphate content is quite normal, but it is very much out of balance in relation to the high nitrogen and potash content of this grass.

Some workers have assumed that the odor around these areas is the main reason why cattle often refuse the vegetation. It is not very likely, however, that the urine odor persists after the first rainstorm. The flavor of this excessive nitrogen-potash grass may be the real cause. Is it any wonder, when the grass is grown on land receiving fertilizer at the rate of 5,560 pounds of a 10-.1-11 fertilizer per acre?

Quite often both feces and urine are deposited on the same area, which fur-

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Fig. 4.—Manure droppings on pastures are evidenced by increased plant growth. The nitrogen phosphorus, and potash content of the urine deposited on these areas is equal to about 5,560 lbs. of a 10-.1-11 fertilizer. These excessive amounts of nitrogen and potash are poorly used by plant and soil and contribute to their loss on the dairy farm. The vegetation on these areas is poorly balanced and not relished by grazing cattle.

Sweet corn in the foreground, fertilized with 1,000 pounds of 0-8-0, yielded 3.2 tons per acre. Corn in the background, fertilized with 0-8-8, yielded 5.7 tons per acre.

Muck Soils Produce Quality Sweet Corn For Canning

By N. K. Ellis

West Lafayette, Indiana

SWEET CORN can be grown profitably and satisfactorily as a regular crop in the rotation on Indiana muck soils. It is better adapted to a short crop season than field corn.

Another advantage is that sweet corn for canning is harvested early and permits the seeding of a winter crop of rye. The stubble and stalks are disced and the field is seeded to rye with no other preparation. The corn residues rot sufficiently under these conditions and cause no difficulties with the spring plowing. Narrow-row crops such as onions, carrots, and beans are planted in fields which have had this treatment. With field corn the story is different. The amount of refuse left following field corn makes it practically impossible to plant narrow-row crops unless most of the old stalks and stubble have been removed. The readily decomposed sweet corn residues plus the rye cover crop make an ideal cover and green manure crop for such soils.

The profitable production of sweet corn on muck soils depends, of course, on the soil fertility, the variety, and the spacing. Of these, fertility is of great importance and it is necessary to use fertilizers containing a high percentage of potash.

TABLE 1.—RELATION OF YIELD OF SWEET CORN TO THE ANALYSIS OF FERTILIZER USED ON MUCK SOIL *

Fertilizers used**	Tons per acre	Increase tons
Effect of potash		
1. 0–0–0	3.7	....
2. 0–0–24	4.8	1.1
3. 0–8–24	6.1	2.4
4. 0–8–40	6.1	2.4
Effect of Phosphorus		
5. 0–0–0	3.7	....
6. 0–8–0	3.2	–.5
7. 0–8–8	5.7	2.0
8. 0–8–24	6.1	2.4
9. 0–16–24	6.2	2.5
Effect of Nitrogen		
10. 0–8–24	6.1	....
11. 4–8–24	6.0	–.1

* Average of 9 years.
** Rate of fertilizer application 1000 lbs. per acre broadcast.

The importance of potash for sweet corn on muck soils is shown by the yields in Table 1. When used alone, it increased the yield over the unfertilized check by 1.1 tons per acre. Phosphorus, in addition to the potash, increased the yield another 1.3 tons, showing the need for both plant-food materials. However, when phosphate was used alone, the yield of corn was depressed. When potash was used in fertilizer mixtures higher than 24 per cent, with eight per cent phosphate, no additional increase was obtained. Phosphates higher than in 0-8-24 gave no appreciable increase. Nitrogen in 4-8-24 resulted in no increase in yield over 0-8-24.

It is believed that 1,000 pounds of fertilizer per acre are more than a sweet corn crop can utilize economically, and the data indicate that row application is superior to broadcast. From observations, it appears that 250 pounds of fertilizer per acre are not enough and that 1,000 pounds are too much. Five hundred pounds of 0-9-27 applied in bands beside the row gave a higher yield than 500 pounds or 1,000 pounds broadcast, or when the fertilizer application was split, with half of it being plowed down and the other half applied in bands beside the row.

As a rule, muck soils hold more moisture than other soils and so if sufficient fertilizer is supplied the crop, one would expect the yield to be related to the number of plants growing in a given area. In this trial plot it will be noted that where the corn was planted

To save hand labor, mechanical pickers for sweet corn are being developed.

TABLE 2.—RATE AND PLACEMENT OF FERTILIZER * FOR SWEET CORN 1945

Treatment	Yield in tons per acre
500 lbs. broadcast	4.3
1,000 lbs. broadcast	4.9
250 lbs. beside row	3.9
500 lbs. beside row	5.8
250 lbs. plowed down / 250 lbs. beside row	5.2
500 lbs. plowed down / 500 lbs. beside row	5.3

* Fertilizer commercial 0-9-27.

in hills with three stalks per hill (Table 3), the yield increased from 5.4 tons per acre on the 42 x 36 inch planting to 6.7 tons on the 36 x 30 inch spacing. This means that the space allowed for each stalk was reduced from 3.5 to 2.5 square feet per plant. When the sweet corn was drilled in the row, one stalk every 12 inches, the yield was further increased over one-half ton per acre. It is apparent that for this soil, the spacing limit was reached when the area for each plant was reduced to approximately 2.5 square feet.

The yield was slightly reduced and the number of marketable ears also reduced, when drilled in the row eight inches apart. This may be because some ears were too small to harvest or there were more barren stalks. It appears from this data that the latter is the case, since single stock planting resulted in an increased number of ears per acre over the number of stalks per acre. Comparing the column on the theoretical number of stalks per acre to that of the actual number of ears per acre, Table 3, there are more ears than stalks on the wider spacing, but when only two square feet were allowed per plant, there were fewer ears than stalks. This evidence supports the theory that drilling is the best method of planting a sweet corn crop and on similar muck soils, drilling in 36-inch rows and at intervals of not to exceed 12 inches in the row would be the best.

TABLE 4.—COMPARISON OF SIX VARIETIES OF SWEET CORN GROWN ON MUCK SOIL, NORTHERN INDIANA MUCK CROPS FARM, 1945

	Tons per acre
1. Golden Cross Bantam	4.2
2. Hoosier Bantam	5.0
3. Purgold	4.3
4. Golden Cross Bantam (red tassel)	3.6
5. Illinois 10	4.3
6. Iowana	4.1

Spacing 36 x 36 inches in hills, 2 stalks per hill.

Generally speaking, yellow corns requiring about 85 days to maturity make a more satisfactory crop on muck soils than the white sweet corns which require 95 to 100 days for maturity.

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TABLE 3.—RELATION OF YIELD TO SPACING OF SWEET CORN ON MUCK SOIL 1945

Spacing	Sq. ft.* per hill	Sq. ft. per plant	Theoretical number of stalks per acre	Tons per acre	Pounds per ear average	Ears per acre
42 x 36	10.5	3.5	12,445	5.4	.76	14,720
36 x 36	9	3	14,520	6.4	.77	15,755
36 x 30	7.5	2.5	17,424	6.7	.78	17,020
36 x 24	6	2	21,780	6.6	.77	17,020
36 x 12	....	3	14,520	7.3	.72	20,700
36 x 8	....	2	21,780	7.1	.73	18,975

* 3 stalks per hill.
Fertilizer 450 lbs.—60% potash (KCl.) plowed down
500 lbs.—0-9-27 broadcast

Fig. 1.—Soil erosion has removed the greater part of the soil. Alfalfa will not grow unless the soil is fairly deep.

Alfalfa in Mississippi Decreased as Soil Fertility Declined

By H. B. Vanderford

Soils Department, Mississippi State College, State College, Miss.

ALFALFA production in Mississippi has always been confined to the more fertile sections of the State and on soils that were high in lime. Prior to the initiation of alfalfa in the Mississippi Delta, the acres of land devoted to this forage crop were largely in the Black Belt section.

This Belt of heavy-textured, prairie-like soils is a crescent-shaped strip of land that is approximately 30 miles wide and extends from northeast Mississippi in a southeasterly direction to east central Mississippi, where it enters Butler County, Alabama. Soft marine limestone is the predominating parent material of the dark soils, although other geological strata are found interspersed throughout the area. The Black Belt soils comprise a great part of Monroe, Clay, Lowndes, Noxubee, and Lee Counties. The soils may be conveniently grouped into two general groups: the dark soils and the "Post Oak," or brown and yellow soils. Unfortunately, a small part of the area in Mississippi is comprised of dark soils. The "Post Oak" soils are acid in reaction and not well adapted for the production of alfalfa. The dark soils are about neutral to alkaline in reaction, and, if not severely eroded, will generally produce this legume.

History of Alfalfa Production in Area

From the best information available, alfalfa was introduced in Mississippi

TABLE 1.—ACREAGE OF ALFALFA GROWN IN BLACK BELT COUNTIES OF MISSISSIPPI[1]

County	Acres planted			
	1909	1919	1924	1939
Monroe	1,183	5,154	337	1,690
Clay	1,632	2,820	23	207
Lowndes	1,268	2,504	585	333
Lee	745	1,905	484	798
Noxubee	1,018	898	230	281
Chickasaw	328	343	41	234
Oktibbeha	294	65	6	119

[1] Figures taken from U. S. Census Reports.

about 1890. Some was planted near Strong Station in Monroe County about this date and production gradually spread throughout the prairie counties. According to U. S. Census, the acreage planted increased rapidly during the 10-year period of 1909-1919 in the Black Belt section. It is difficult to tell from the census reports when the peak was reached, but according to leading farmers who once grew much alfalfa, it was near 1915.

About the year 1919 the farmers began to report that their alfalfa was failing. This is clearly shown by the fact that during the 5-year period from 1919-1924 the acreage planted decreased over 77 per cent. Complaints were made that yields were very small, that alfalfa did not live long, and that some strange unknown disease was destroying it. As a result, less land was planted to this fine forage.

The decrease in acreage planted to alfalfa in the prairie counties of Mississippi from 1919 to 1924 is shown in Table 1. In 1919, Clay, Lowndes, and Monroe Counties produced 10,478 acres. Five years later these same counties produced only 945 acres. This indicates that something drastic had happened and alfalfa almost passed out of the agricultural picture.

Alfalfa Requires High Fertility

Alfalfa is a plant that will not tolerate a wide range in soil fertility, and the fertility level of soils can be generally estimated by knowing whether or not the crop will grow on them. The chemical composition of alfalfa hay is shown in Table 2 along with that of some other hays. The mineral content, in general, is high, since alfalfa will grow only on soils high in minerals. The percentage potassium according to these data was 2.3%, or in terms of potash (K_2O) this would be approximately 2.80%.

Assuming that four tons of alfalfa hay are produced on an acre of land, enough potash would be removed in one year to be equivalent to approximately 450 pounds of 50% muriate of potash. If the alfalfa was grown for four years on the same land, the potash supply in the soil would be greatly decreased.

The calcium and phosphate contents in this forage are also high and are indicative of the fertility that must be

TABLE 2.—MINERAL CONTENTS OF SOME FORAGE PLANTS[1]

Crop	% K	% Ca	% P
Alfalfa	2.37	2.45	.36
Soybeans	1.25	1.05	.21
Lespedeza	.94	1.44	.31
Redtop	1.52	.31	.25
Johnson Grass[2]	......	.76	.27

[1] Data taken from U.S.D.A. Misc. Pub. No. 369. 1941.

[2] Analyzed by Mississippi Experiment Station Chemist.

TABLE 3.—ANNUAL ACRE YIELDS OF AIR-DRY ALFALFA HAY IN TONS PER ACRE PLANTED IN THE SPRING OF 1928[1]

Treatments	1928	1929	1930	1931	1932	Average
Check	0.90	1.89	0.99	2.16	2.23	1.63
20 tons stable manure	2.09	3.20	1.72	3.55	3.19	2.75
20 tons stable manure and 500 lbs. superphosphate (16%)	2.03	3.25	1.91	3.95	3.78	2.98
20 tons stable manure and 500 lbs basic slag	2.19	3.84	1.89	4.21	3.77	3.18
1,000 lbs. superphosphate	1.29	2.81	1.15	2.68	2.78	2.14
1,000 lbs. basic slag	.83	2.60	1.09	2.50	2.70	1.94
10 tons of stable manure	1.91	2.87	1.36	2.85	2.76	2.35

[1] Data taken from U.S.D.A. Tech. Bul. No. 419. 1934.

delivered by a soil in order to produce good alfalfa. The mineral contents of soybeans, lespedeza, and red top are considerably less than that in alfalfa. Consequently, they will grow on soils relatively low in fertility.

Decline in Acreage

Many of prairie-like soils of Mississippi were once very fertile and before accelerated erosion had wrought such a toll of the land, they were fairly deep. One farmer reported that he grew alfalfa for a number of years, but finally a hard layer was formed in the soil and the crop failed to grow because the roots could not penetrate the hardpan. Another reported that Johnson grass invaded his alfalfa field and destroyed the stand. The common report was that a strange disease was destroying the crop.

These testimonies pointed toward the fertility of the soils which had been decreased by soil erosion or crop removal and leaching to a point below the alfalfa standard. Many of the once dark-colored fertile fields are now barren lime rock as a result of man-induced sheet erosion. Alfalfa is a deep-rooted plant that requires a deep soil in addition to a high fertility level. Figure 1 shows results of erosion in this area.

In order to answer the question of why alfalfa refused to grow in the various counties of Mississippi where it had once grown well, a branch experiment station was established near West Point, Mississippi, in 1925 to study the problem. Some data gathered by this branch station are given in Tables 3 and 4. The data from this study indicate definitely that soil fer-

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TABLE 4.—ANNUAL YIELDS OF ALFALFA HAY IN TONS PER ACRE PLANTED IN SPRING OF 1926[1]

Treatments	1926	1927	1928	1929	Over
No treatments	0.23	1.97	1.13	0.79	1.03
20 tons stable manure	0.79	4.53	3.79	3.76	3.22
10 tons stable manure and 500 lbs. superphosphate	0.65	4.54	4.39	3.55	3.28
500 lbs. superphosphate	0.37	3.46	3.02	1.96	2.20
1,000 lbs. basic slag	0.40	4.02	2.85	2.25	2.38
2 tons ground limestone	0.40	2.63	1.62	1.29	1.49

[1] Data taken from U.S.D.A. Tech. Bul. No. 419. 1934.

Soil Conservation Districts and District Supervisors in South Carolina

(An address by E. C. McArthur, President, at annual meeting of the South Carolina Association of Soil Conservation District Supervisors, Columbia, S. C., January 18, 1946.)

GROWTH and progress are the results of functioning. The harder the conflict, the more glorious the triumph. Having experienced conflict and tasted victory, I feel that it is appropriate to discuss accomplishments of soil conservation district supervisors and progress made in soil conservation districts since the passage of the Soil Conservation Districts Law in 1937, and, particularly, since the organization of this Association in 1940.

In claiming accomplishments for soil conservation district supervisors and progress of districts, I wish to give full consideration to the very able assistance we have had in carrying on affairs of soil conservation districts.

First, I point to the South Carolina Soil Conservation Committee which has worked with supervisors in organizing districts and in helping us to understand the Law and our own duties and responsibilities. In helping to develop supervisors, the Soil Conservation Committee has developed itself; it has a fuller conception of the Soil Conservation Districts Law, the purpose of soil conservation districts, and the need for coordinating efforts of agricultural workers and every citizen in helping farmers to solve their farming problems. A booklet entitled, "Soil Conservation Districts in South Carolina," compiled by the State Committee, bears me out in this statement. This booklet has furnished valuable information to citizens as to the eroded condition of our soil and the purpose of districts to save it.

The Extension Service has performed a much needed service to farmers by acquainting them with the district purpose, duties of supervisors, services they may obtain through districts, services they, themselves, may render other farmers, and crops with which to maintain and improve the fertility of our soil.

Soil Conservation Service has cooperated with supervisors in helping farmers of the districts by making soil surveys to determine the type of soil to be dealt with on each farm; in assisting farmers plan their farms in order that each acre may be put to its best use; in selecting the crops most suitable to the needs of the farm family and to the soil; and in bringing back into profitable production idle lands that were, each year, becoming more of a burden and a threat to each farm. Approximately 12,000 farms have been planned to date, covering approximately two million acres.

Cooperation

County Agents have assisted district supervisors in holding meetings and in many other ways have helped supervisors to perform their duties. Also, agricultural teachers, Farm Security Administration, AAA, Production Credit Association, our state colleges, the State Department of Education, Bankers Association, individual bankers, farm machinery dealers, civic groups, newspapers, business men, educators, Farmers' Organizations, Farm Bureaus with Mr. E. H. Agnew as leader, The Grange,

S. C. Agriculture Commissioner Jones, S. C. Agricultural and Industrial Commission, and individual citizens have helped soil conservation district supervisors to do the job. And while we are about it, let us not forget to mention Future Farmers of America and 4-H Club groups who have rendered farmers worthy service through soil conservation districts.

Believing the philosophy of the Soil Conservation Districts Law will do much to bring each farmer into the agricultural picture, give him a broader view and deeper understanding of the need for soil conservation, as well as a deeper interest in cooperating with other farmers to achieve soil conservation, thus making democracy work, supervisors have bent their energies to spread that philosophy to farmers. Soil Conservation District Supervisors realize the need for saving the soil, our basic economic resource, but we believe it is of more importance to rehabilitate a human being than an eroded farm. However, knowing that the two go hand-in-hand, we have come to believe that our greatest accomplishment has resulted from the assistance we have been to the small farmer in establishing himself and his farm on a sound basis. May I tell you of a few of these instances?

Proof of Aid

A lady in Anderson County found herself, upon the death of her husband, with several children to educate and a run-down, eroded farm as her chief source of income. Necessity and the will to do caused this lady to attempt to fulfill her responsibility to her family with what she had at hand. District Supervisors and agricultural workers willingly came to her rescue and the living testimonies of educated children confirm what has been said and written about conservation practices paving the way for increased production and farm incomes.

A man bought a farm in 1940 in Chester County, requested a plan on it in 1942, and began putting conservation practices on his ground in 1943. The farm was purchased for $5,100 and appraised by F. S. A. in 1945 at $8,500. His income in 1943 was $1,580.00; in 1944, $2,600.00; and in 1945, $3,500.00. He says, "The future looks bright."

An illiterate farmer in Marion County started conservation farming in 1943. Skeptical neighbors poked fun at him for his crazy farming, but stopped when the red spots on the sloping land disappeared and changed to large stacks of lespedeza hay. This man said, "My boys won't grow up without no education. They are going to school and these new things you fellows are helping me with will see to that, too."

Horry Soil Conservation District has played an important part in the life of a small farmer near Conway. Increased quantity and quality of tobacco, he attributes to crotalaria preceding the tobacco. Much idle land has been brought back into production with a good drainage system. This cooperator is very pleased to have the added income to apply to taxes and other obligations.

A negro farmer in Lee County grins broadly as he tells of increasing his corn yield from 6 to 15 bushels by using conservation methods. Another negro farmer in that county praises his district plan and the supervisors of Lynches River Soil Conservation District. He says, "When the plan was written, I owed $500. I still owe $400, but have bought and paid for a separate tract of 27 acres—all in three years' time."

There is a young man in Greenville County whose plans to become a doctor were frustrated by the death of his father. Sick at heart, he took over the farm which was fast becoming a problem because of accelerated erosion caused by misuse of the land. Through the district channel, this young man received so much assistance from all cooperating agencies that a new vista of life opened to him and as he latched on to improved farming methods and saw increased yields, increased income, and increased value of his farm as a result, he became proud of the job he

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A demonstration of tissue tests on the farm of J. R. Renick, Logan County, Ohio, during the growing season of 1945.

Plow-Under Fertilizer Ups Corn Yields

By E. P. Reed and F. J. Salter

Department of Agronomy, Ohio State University, Columbus, Ohio

CORN is distinctly an American crop, for in the history of all other countries we do not find records of corn until after the discovery of America.

Corn-growing practices from the earliest days, when the Indian squaw used a crooked stick as a cultivating tool and one fish in the hill for fertilizer, have undergone remarkable changes up to the present-day use of mechanized tillage and harvesting equipment, the application of larger amounts of fertilizer both in the row and furrow bottom, and the planting of carefully bred adapted hybrids.

The up-to-date corn grower believes that the observance of a five-point program is necessary to produce high corn yields, such as:

1. An adequately drained soil well stocked with organic matter.
2. Ample fertilization with nitrogen, phosphorus, and potash so placed in the soil as to give maximum availability of nutrients throughout the growing season.
3. The planting of the best adapted hybrids at or near the optimum date.
4. Adjusting the planting rate to the productivity level of the soil, including its fertility treatments.
5. Timeliness and adequacy of all tillage operations.

Development and Changes in Method of Fertilizer Application

Twenty-five years ago the favorite fertilizer for corn was manure supplemented with a broadcast application of superphosphate. When manure was not available, a complete fertilizer was broadcast. Studies by a number of experiment stations in the Corn Belt indicated that fertilizers placed in the hill or row led to rapid development of the corn plant in its early growth and hence earlier maturity. Such treatments were considered to supplement the broadcast applications of manure or fertilizers or both and not to take the place of them. It was soon found that many of the planter attachments placed most of the fertilizer in contact with the seed. This method, especially with heavier rates of application, resulted in reducing the stands from 20 to 50 per cent, thus offsetting the expected benefits of localized fertilizer placement.

In the early 1930's manufacturers rapidly developed improved fertilizer distributors, and additional field studies showed that the total amount and grade of fertilizer could be safely placed in the hill or row. This method of fertilization proved highly satisfactory as long as we were satisfied with yields of 70 to 80 bushels per acre on most of our best corn soils. It was observed, however, that the benefits of such placements of fertilizer fluctuated with the type of season. In dry years yield increases were negligible while good results came with years of average to abundant rainfall. Dry conditions rendered the fertilizer inactive for a considerable time due to shallow placement. This brought about studies of methods of applying the fertilizer to obviate these periods of inaction of the fertilizer. The desires to push yields to higher levels also came in with the use of corn hybrids and their greater response to higher fertility conditions. Plow-under fertilizer placement offered a solution to these problems. In this fashion heavier applications could be made safely and the fertilizer was in a moist soil at all times. The report which follows is part of the study of this effort to get maximum yields.

Field History and Plan of Demonstration

The objective of these demonstrations was to determine the effect of thicker rates of planting and heavier fertilizer applications on the yield and quality of corn grain. These demonstrations were conducted under average

Weighing corn from the Arthur Morton plots, Preble County, Ohio—center, check plots—left, nitrogen alone—right, 8-8-8 plots.

farm field conditions on the various soil types found in the State.

Six hundred pounds of 8-8-8 per acre plowed under in bands on the furrow bottom were compared with 250 pounds of ammonium sulphate per acre and with no plow-under fertilizer. All three plots received uniform hill or row applications of fertilizer.

Two rates of planting were made on each plot receiving different fertilizer treatment. One-half of the area was planted to the lighter rate, 3 kernels per hill, and the other half to the heavier rate, 4 kernels per hill, or the equivalent rates in drilled corn of 14-inch and 10-inch kernel spacing in the row. With expected losses from various causes, the resulting stands would approximate an average of 10,000 plants and 13,000 plants per acre, respectively.

The corn hybrid planted on the demonstration plots was the same as that planted in the remainder of the field. All the hybrids grown were adapted to the area and were selected by the cooperating farmers.

A field history was secured for each demonstration. This record included soil type and analysis, crops grown, and the lime, fertilizer, and manure applications for the past three years. The immediately preceding crops in all of the demonstrations ranged from corn (27 per cent), timothy sod (7 per cent), small grains and soybeans (10 per cent each), alfalfa-clover-timothy and sweet clover sods (47 per cent) to one field of manured alfalfa-clover-timothy sods.

The soil types on which the corn was grown were in the early and late Wisconsin glacial drift and the lake plain area. They were about equally divided between light colored silt, sand, and silty clay loams and the dark colored heavy soils of clay, clay loam, and silty clay loam texture.

Plant Tissue Tests

The tissue tests for nitrates, phosphate, and potash were made at the early tassel stage on the heavy plantings of all plots. A summary of these findings is in the following table:

TABLE 1.—TESTS, EXTENDING FROM JULY 23 TO AUG. 3, 1945

Fertilizer Lbs. Acre Row: 229# single strength Plow under: 600# 8-8-8 Plow under: 250# Am. Sul.	Nitrates % Showing			Phosphate % Showing			Potash % Showing		
	High	Med.	Low	High	Med.	Low	High	Med.	Low
Row only..............	25	27	48	67	25	8	65	26	9
Row + 8-8-8..........	60	18	22	83	10	7	70	19	11
Row + Am. Sul.........	68	25	7	80	13	7	66	28	6

Comments and Conclusions Based on These One-Year Tests

1. The check or row-fertilized plots show a low available supply of nitrates as compared to phosphate and potash.
2. The nitrates are lower than phosphate and potash even on the 8-8-8 and nitrogen-treated plots.
3. The potash is lower than the phosphate on both the 8-8-8 and nitrogen-treated plots, showing the need for added potash.
4. Many of the high tests at this stage of the plant's growth will be lowered as the corn ear develops and matures.
5. When nitrates become limiting factors in plant tissue development, the limited growth leads to accumulations of unused phosphate and potash.

Comparative Yield Evidence

In an attempt to further evaluate the practice of applying large amounts of fertilizer in bands in the plow furrow bottom for increased corn production, 17 growers in western Ohio cooperated in the program in 1944 and 33 in 1945.

Unfortunately, due to extreme drought conditions in 1944 and excessive rains in early June in 1945, the stands of corn and uniformity of plant growth were seriously affected. This condition, in addition to difficulty or failure to properly adjust the fertilizer distributor to apply the required amounts of fertilizer, eliminated 9 of the 17 tests in 1944 and 13 of the 33 trials in 1945. Therefore, the yield results in the following tables are for 8 trials in 1944 and 20 trials in 1945.

Summarized Statement of Conclusions Based on 1944 and 1945 Results

1. Hill or row applications of fertilizer alone are not adequate for maximum yields.

2. Row fertilizer plus nitrogen alone plowed under has resulted in yield increases approximately the same as from

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TABLE 2.—PLOWING UNDER FERTILIZER FOR CORN DEMONSTRATION—1944

Plants per Acre and Yield in Bushels of Shelled Corn per Acre at 15½% Moisture

Soil Type	Light Planting Rate						Heavy Planting Rate					
	Fertilizer Treatment											
	Row		Row+8-8-8		Row+Nitrogen		Row		Row+8-8-8		Row+Nitrogen	
	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield	Plants	Yield
Brookston	9272	69.3	9764	73.7	10644	71.5	10781	56.9	11624	65.2	12016	74.0
Brookston	8939	50.0	9801	63.0	9723	61.6	11488	55.0	11761	59.6	10977	60.7
Brookston	8690	55.8	8646	71.4	8998	60.6	11088	62.8	10934	65.5	11264	70.4
Pandora	11729	96.6	11837	99.1	11837	101.5	15313	85.0	15964	96.6	14335	104.1
Brookston	10095	83.7	10683	93.7	11075	94.4	19210	54.0	18720	73.1	19406	71.7
Brookston	12100	64.4	12221	98.0	11979	100.3	14278	74.2	14278	92.8	15004	94.3
Average	9805	69.8	10492	83.2	10709	81.6	13693	64.6	13846	75.5	13833	79.2
Russell	8300	65.9	9600	92.5	9300	88.3	11600	75.5	12200	88.4	12200	88.6
Crosby	8233	56.8	8625	59.6	8625	62.1	12349	52.2	13043	69.3	13043	68.9
Grand Average	9545	67.8	10147	81.1	10271	80.0	13263	64.4	13540	76.4	13530	79.1
Average increase over check				13.3		12.2				12.0		14.7

TABLE 2A.—THE EFFECT OF TREATMENT ON YIELD—1944

Planting Rate	Treatment, Yield, and Increases in Bushels per Acre				
	Row Only	Row+8-8-8		Row+Nitrogen	
Plants per Acre	Yield	Yield	Increase	Yield	Increase
8,000 to 10,000	59.6	72.1	12.5	68.2	8.6
10,001 to 12,000	71.8	76.8	5.0	83.1	11.3
12,001 and over	66.0	86.4	20.4	83.6	17.6

TABLE 2B.—THE EFFECT OF RATE OF PLANTING ON YIELD—1944

Treatment	Rate of Planting, Yield, and Increases in Bushels per Acre				
	Plants/Acre	Plants/Acre		Plants/Acre	
	8,000–10,000	10,001 to 12,000		12,001 and over	
	Yield	Yield	Increase	Yield	Increase
Row only	59.6	71.8	12.2	66.0	6.4
Row+8-8-8	72.1	76.8	4.7	86.4	14.3
Row+Nitrogen	68.2	83.1	14.9	83.6	15.4

TABLE 2C.—FERTILIZER, RATE OF APPLICATION AND COST PER ACRE—1944

Fertilizer	Grade	Av. Lbs/Acre	Av. Cost/Acre*
Row only	Single Strength	222	$3.37
Plow Under	8-8-8	600	$12.04
Plow Under	Am. Sul.	250	$4.83

* 1944 Spring Cash Price.

Fig. 1.—Sweet clover growing on land treated with crop residues, lime, phosphate, and potash. Spring growth on a southern Illinois experiment field near Newton.

Potash Treatment Makes Better Sweet Clover

By H. J. Snider

Soil Experiment Fields, University of Illinois, Urbana, Illinois

SWEET CLOVER is a vigorously growing plant, but is sensitive to shortages of fertility elements in soils. Such soil deficiencies may affect the development of the plant and in addition may influence the nitrogen and mineral content of the crop. Sweet clover may be observed growing rather luxuriantly along road-sides, in gravel pits, and in other similar locations usually not associated with productive soils. This habit of growth may lead to the conclusion that this legume may not be seriously affected by the lack of suitable fertility balance in soils where it grows.

Sweet clover is widely accepted as a desirable legume for soil improvement mainly because of its heavy growth, adaptability to various nurse crops, and its ability to withstand adverse weather conditions. Wherever sweet clover thrives, it produces a more luxuriant growth than most any other clover and makes this growth relatively early in the season. This large volume of growth is usually very gratifying, considering the several uses of the crop, such as, soil improvement, grazing, hay, silage, seed production, and in some cases a honey crop.

Total growth of sweet clover including both roots and tops may be relatively large, but its value as a soil-building crop and its feeding quality may be seriously affected by unfavorable soil conditions. Biennial white sweet clover grown on highly productive dark-colored soils in some Illinois tests averaged

10,350 pounds of dry roots and tops an acre at full bloom stage. This amount of material was found to contain 239 pounds of total nitrogen in the acre growth. The same type of sweet clover on less productive light-colored soils made a growth amounting to 12,430 pounds of roots and tops which contained in the acre growth only 128 pounds of total nitrogen at full bloom stage. This represents a large difference in nitrogen content of sweet clover grown on these two soils, and a large part of this difference must be attributed to unfavorable conditions in the light-colored soil which apparently hindered nitrogen fixation and nitrogen uptake.

Differences in composition of sweet clover due to soil variation may be further illustrated by results from eight Illinois experiment fields (Table 1). Four of these fields are located on rather highly productive dark-colored soils in central and northern Illinois and four are located on the less productive light-colored soils of southern Illinois. These dark-colored soils had a total nitrogen content which averaged 4,100 pounds in the top soil. These soils were previously limed and had a reaction of pH 6.2 and a replaceable calcium content of 6,000 pounds an acre. The replaceable potassium content of these dark soils averaged 190 pounds an acre. The light-colored soils averaged 2,100 pounds an acre of total nitrogen and had a reaction of pH 6.3 where limestone was added and a replaceable calcium content of 2,800 pounds an acre. The replaceable potassium content of these soils where no potash treatment was applied averaged 80 pounds an acre, an amount which is relatively low for Illinois soils.

Average acre yield and composition of sweet clover tops and roots from both dark-colored and light-colored soils showed beneficial effect of potash applications (Table 1). Since the light-colored soils were quite deficient in available potassium, the acre yield of tops and roots was considerably higher on land where potash treatment was given (RLPK) in comparison to the land where it was withheld (RLP). Acre yield on the light soil was much lower where potash treatment was withheld than was the yield for a similar treatment (RLP) on the dark soils. The acre yield was relatively high on both soils where potash treatment was applied. The light-colored soils apparently had the advantage in larger yield, which was probably due to a slightly longer growing season in the more southern location.

The nitrogen content of sweet clover grown on the four fields located on the

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TABLE 1. YIELD AND COMPOSITION OF SPRING GROWTH OF SWEET CLOVER REPRESENTING TWO LARGE SOIL AREAS IN ILLINOIS.

EACH VALUE IS AN AVERAGE OF RESULTS FROM FOUR EXPERIMENT FIELDS IN THE AREA INDICATED.

Soil Treatment	Tops Roots lbs./A	N	P	K	Ca	Mg
		Pounds per ton				
Dark-colored soils						
RLP	1,810	87.3	6.2	25.6	16.6	9.7
RLPK	2,040	89.4	5.6	31.6	15.4	9.1
Light-colored soils						
RLP	1,070	52.7	5.4	15.1	32.3	10.4
RLPK	2,450	41.9	5.2	25.7	29.9	9.1

Tops and roots were obtained for analysis at time of plowing under for green manure. Plow-under dates ranged from April 20 to May 16.
R—crop residues turned back.
L—limestone
P—phosphorus
K—muriate of potash

Potash Pays Good Dividends in Louisiana

By R. A. Wasson

Department of Agronomy, University of Louisiana, Baton Rouge, Louisiana

JUST a few years ago our corn crop was mostly fertilized with straight nitrogen materials and rarely at rates exceeding 30 pounds of nitrogen per acre. In the light of our present knowledge on the subject of fertilizers for corn, the recommendations are on a per-acre basis—50 to 60 pounds of nitrogen, 30 pounds available phosphoric acid, and 30 pounds available potash. These recommendations apply to all soils except heavy alluvial types. In order to prove the practical value of these recommendations, the agricultural extension service conducted 108 fertilizer result demonstrations in 1945. These demonstrations were carefully supervised throughout and the records, as follows, were most encouraging: The average per-acre yield on all demonstrations was 48.1 bushels; the check plots averaged 32.5 bushels; and the average net increase was 16.6 bushels, or 51 per cent in favor of the recommended fertilizer.

In all cases, 375 pounds of an 8-8-8 mixture per acre were applied prior to planting and 125 pounds of nitrate of soda per acre were applied as a side-dressing when the corn was about six inches high. The check plots, in all cases, were fertilized according to prevailing practices on the farms where the demonstrations were conducted. For the most part these locally used materials consisted of 200 to 300 pounds of a 4-12-4 or 5-10-5 mixture supplemented with from 125 to 150 pounds nitrate of soda per acre as a side-dressing. The fact that the checks were fertilized in this manner emphasized the value of the additional potash used on these demonstrations. When these 108 demonstrations were separated into type-of-soil areas, the results were as follows:

Upland Coastal Plain (Hill) Soils

On 76 demonstrations, the average yield on the recommended fertilizer plots was 46.4 bushels per acre. The check plots receiving common, local fertilization averaged 32.4 bushels. The average net gain in favor of the recommended fertilizer was 14.0 bushels per acre or 40.4 per cent.

Terrace (Bluff) Soils

Twenty-three demonstrations averaged 44.6 bushels per acre for the recommended fertilizer and 34.4 bushels on the checks. The average net increase of demonstrations over checks was 10.2 bushels or 29.6 per cent.

Alluvial (River Bottom) Soils

Nine demonstrations averaged 51.3 bushels per acre. Checks averaged 38.0 bushels. The average increase was 13.3 bushels per acre or 35.0 per cent.

From these demonstrations and other related sources of information, it seems assured that a high-grade, complete fertilizer under corn, as a starter, gives very profitable increases in yields, provided the fertilizer used supplies at least 30 pounds of available phosphoric acid and 30 pounds of available potash per acre. In all cases, the available nitrogen should be brought up to 50 to 60 pounds per acre.

Cotton

The year 1945 was an extremely unfavorable year for cotton in Louisiana.

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Rich Fog in the Hollows

By George D. Scarseth

Director of Research, American Farm Research Association, Lafayette, Indiana

RECENTLY my good friend, G. N. Hoffer, of plant tissue test and potash fame gave me some facts about carbon dioxide that are as startling, interesting, and important in connection with growing crops as penicillin is in curing some diseases. While it is a well-known fact that dry vegetable matter or crop materials contain about 45 per cent carbon, no broad attention has been given to the available supply of this element to our common crops. It is also well known that plants obtain their carbon in the form of the gas, carbon dioxide, which is present in our ordinary air in about .03 per cent and that the plants take in this gas largely through the leaves. Hoffer points out that if a corn crop is to produce 50 bushels of corn per acre the volume of air over the acre that must enter the plants would be equal to a height of over 6,000 feet. Of course, the plant does not use the particular air that is directly above it to this height but uses the air that blows across the fields constantly bringing in a new but very diluted supply.

Carbon Is the Element of Life

Ordinarily we think of plant requirements in terms of fertilizer nutrient elements, water, and favorable temperatures, but it is quite apparent that the plant may have a very difficult time under some conditions in obtaining an adequate supply of carbon which must be taken in as carbon dioxide. However, nature has provided a marvelous mechanism for releasing carbon dioxide when vegetable or organic matter decays so that the atmosphere may be enriched and plants can continue to grow. Man, animals, plants, and micro-organisms play the leading roles in this great drama. All these give off carbon dioxide in both their life processes of growing when they oxidize or burn carbonaceous materials to carbon dioxide and again in the process of decay after death when the carbon dioxide is further freed from its complex organic compounds that made up the bodies. While plants release carbon dioxide from their roots in growing, they also absorb it through the leaves and convert it in combination with water and other compounds into plant substances. In this case the sun furnishes the energy and we call the process photosynthesis.

In virgin jungles, forests, or prairies the balances between the arresting and freeing of carbon dioxide seem to be a well-balanced proposition. In our farming operations we frequently upset this balance through practices that destroy excessive quantities of organic matter; then it appears we are in for trouble.

Scientists have recently shown that the amount of carbon dioxide released daily from a high-organic prairie soil in Illinois and Iowa is equal to about 1,100 cubic feet or about 38 pounds of carbon. Hoffer points out that this amount is sufficient to meet the carbon requirements of growing plants to produce 80 bushels of corn per acre. This brings up the thought that perhaps on soils that are low in organic matter the amount of carbon dioxide released daily from the soil is not enough along with that which is ordinarily in the air to produce an extra big corn yield even though the supply of nutrient elements and moisture were abundant and ideal.

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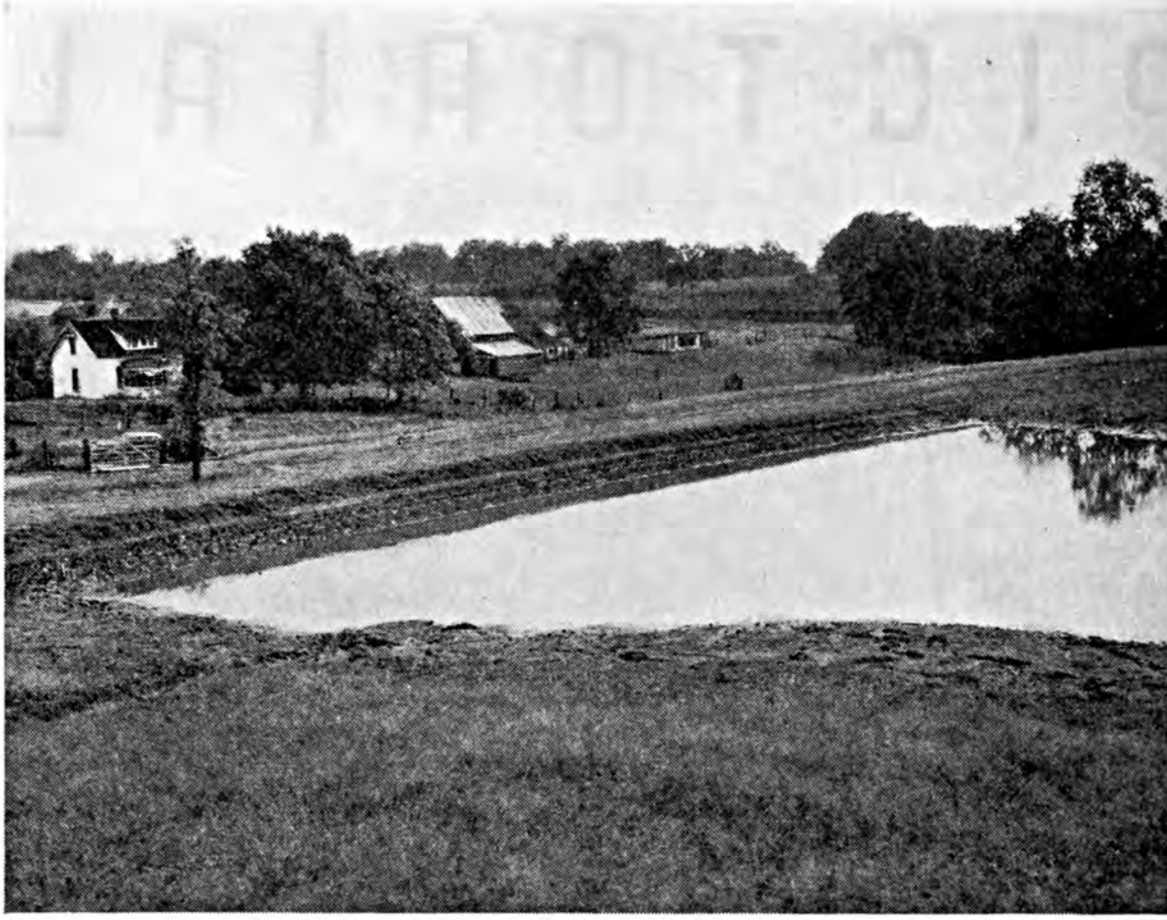
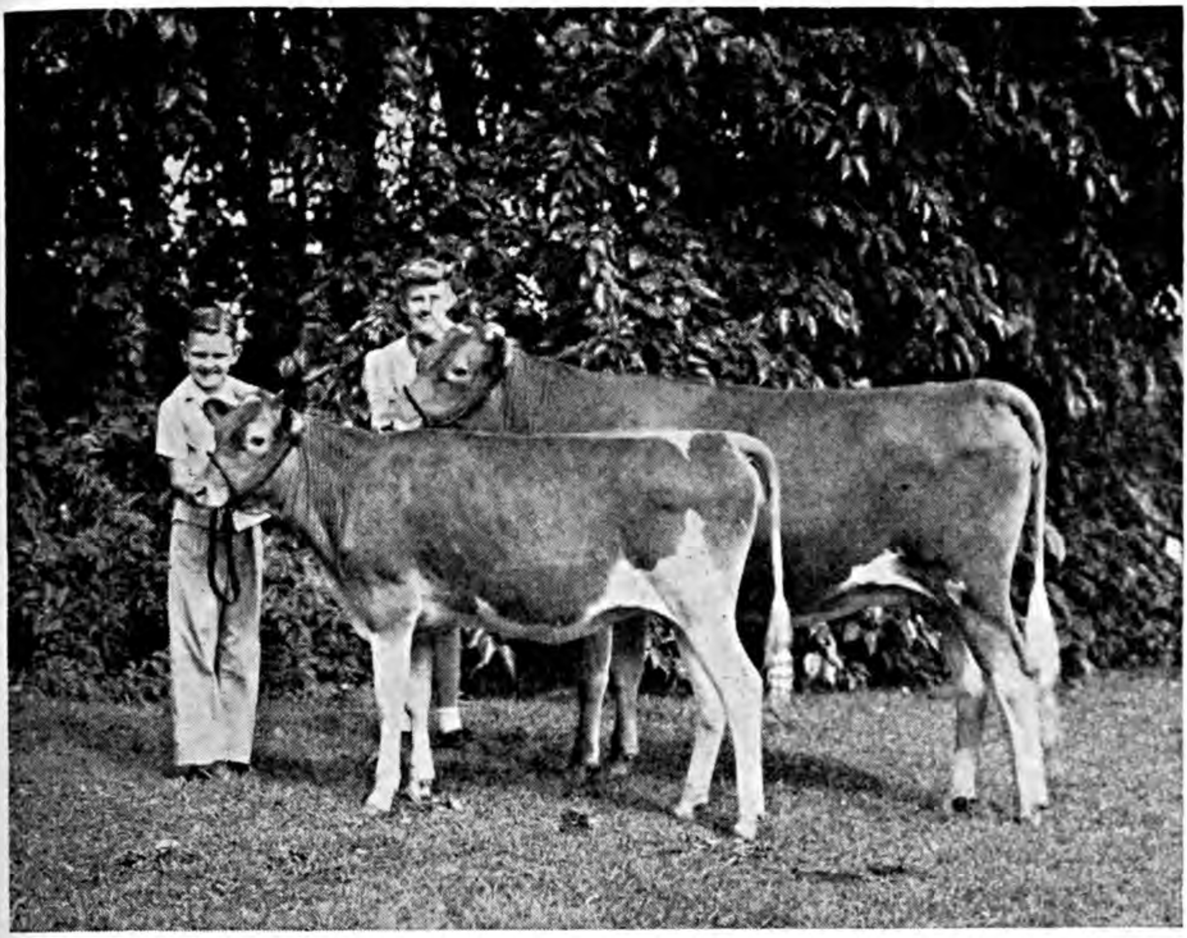
PICTORIAL

FRECKLES—ONE OF THE FIRST CROPS TO SHOW IN THE SPRING.



Above: The possibility of more farm ponds is now receiving much attention. They not only furnish fish for better diets, but opportunities for wholesome recreation.

Below: On the farm of Lewis Clark, White County, Indiana, the fertilizer being poured into this hopper will be applied on the plow sole.



Above: Healthy children and healthy farm animals are the mainstay of American agriculture. The 4-H Clubs annually enroll thousands of both.

Below: This field of young wheat in Tippecanoe County, Indiana, received 300 lbs. of 3-12-12 fertilizer per acre. Check plot in the foreground received no fertilizer.

Above: A county agent shows some 4-H Club boys that fertilizer has to be put where it will be handy for the plant.

Below: Proof in hand—fertilizer did make a difference—left, fertilized; right, no fertilizer.

The Editors Talk

Recognizing Youth

"All young men and women in the world today face the challenge of unsettled times and new problems—but also of new ideas and great new opportunities." Thus spoke President Truman in a message to all 4-H Club members in the United States early this year. Declaring that the eyes of the young men and women of the world are on the youth of the United States, searching for example, ideas, and ideals, he urged all rural young people to take an active part in their own local 4-H Club program in 1946 and in years following. "This is one of the ways," he said, "in which we can build the kind of youth the United States needs—strong, skilled, informed, and articulate—and it is one of the important means we have of demonstrating to the world what youth can accomplish through practical democracy and good citizenship."

During the past several years our agricultural colleges and experiment stations have worked tirelessly in bringing the science of agriculture to our rural youth, both by demonstration and literature. A recent illustration of the extent of this recognition of youth and the cooperation involved in providing them with understandable information is seen in a new circular, No. 4H-48, published in October 1945 by the Wisconsin College of Agriculture under the title "My Story: Growing Potatoes as a 4-H Project." It was planned for the use of boys and girls in Wisconsin club work; however, because the information is up-to-the-minute scientifically and includes some of the standard practices of experienced potato men, it may be read by some of the elders as well.

The circular is profusely illustrated, and two of the photographs are reproduced on the opposite page in this issue. The story tells in the first person how one boy became interested in growing potatoes as a profession, but first decided to learn the fundamentals in club work. He was aided by his parents, by his county agent, the club leader, and by neighbors and friends in learning his business.

The scene is laid in Waupaca county, Wisconsin, where the county agent is Victor Quick. The boy, named Jim, is a son of the Pomerening family living near New London on a dairy farm. Others in the family are Cal, an older brother, and Faith, the little sister. Harold Gretzmacher, a neighbor boy, also takes part in the story. The pictures tell the story of the project from start to finish and include illustrations of potato diseases and potato pests.

The picture of the family home "Breezy Hill" was painted in water color by Byron C. Jorns, Wisconsin water color artist, who is illustrator for the publications of the Wisconsin College of Agriculture. Mr. Jorns also designed and painted the unusual cover of the circular and planned the groupings of the pictures. The water color of the home now hangs in the Pomerening parlor.

The subject matter for the circular was prepared and approved by potato specialists and research men of the College of Agriculture, including J. G. Milward, veteran potato man of the State; G. H. Rieman, H. Darling, T. C. Allen, K. C. Berger, J. W. Brann, R. E. Vaughan, and V. H. Quick. The 4-H Club Department, assisted by Miss Grace Langdon of the Department of Agricultural Journalism, put the material into the simple, narrative style suited to the use of club young people. Photographs for the circular were specially taken by Homer Montague, university photographer.

The booklet will be used by 4-H Club members throughout the State as a text in their work in potato growing this year. It is being sent to all agricultural extension editors by Lester Schlup, Chief of the Division of Extension Information, U. S. Department of Agriculture, as an example of a new approach to 4-H Club literature.

We have a fine youth in America—the finest in the world. It is such faith in and recognition of it by our men of science and experience as detailed above which make the eyes of the young men and women of the world turn to the youth of the United States, "searching for example, ideas, and ideals."

Carbon Dioxide—A Plant Nutrient

In connection with the increasing interest in soil aeration as a necessary consideration in optimum plant growth, more attention may be given to the supply of carbon dioxide available to the plant. It might be thought that with the large supply in the air, carbon dioxide would be one factor which would not cause worry in crop yields.

The article by G. D. Scarseth appearing on page 26 of this issue quotes observations by G. N. Hoffer on the magnitude of the carbon dioxide requirement of the crop in relation to the amount available in the air over the crop. Carrying the observations further, it was pointed out that carbon dioxide produced in the soil may be a factor in crop growth and that some of the practices designed to improve organic matter relationships in the soil may have had at least part of their value in their fostering carbon dioxide production.

Discussing the atomic constitution of corn plants, Dr. Hoffer calculated that approximately 45% of the composition of these plants consisted of carbon; 44% oxygen; 6% hydrogen; 1.5% nitrogen; 0.9% potassium; 0.2% of phosphorus, calcium, magnesium, and sulphur. Other elements such as iron, manganese, and boron are in lesser amounts.

In order to produce carbon dioxide in the soil as the result of the decomposition of organic matter, oxygen is needed and at least a good part of this will have to come from the soil air. Here is another important function that soil aeration serves in the growing of crops.

It was suggested that the carbon dioxide in muck soils may account for the excellent crop responses to fertilizers applied to these soils. Similar crops fertilized in mineral soils with lesser amounts of organic matter do not produce the quality obtained in muck. All green plants, including forests and weeds compete for carbon dioxide in the air. It is also dissolved in rain and all bodies of water. Hence it seems as if the crops grown in well-aerated soils rich in active organic matter should be directly benefited. In any event, fertilizers are most effective under such conditions.

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
March.......	20.24	21.4	171.0	207.0	107.0	148.0	18.10	52.00	....
April........	20.20	21.4	174.0	211.0	107.0	149.0	16.90	51.90	....
May........	20.51	42.2	177.0	214.0	108.0	149.0	16.50	52.10	....
June........	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July.........	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August......	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October......	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November...	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March.......	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
March.......	163	214	245	236	167	167	152	231	203
April........	163	214	250	240	167	169	142	230	259
May........	165	422	254	244	168	169	139	231	193
June........	169	512	258	251	173	170	134	233	269
July.........	171	563	263	262	174	165	130	244	244
August......	172	449	240	292	176	164	123	233	240
September...	175	432	198	236	174	164	120	228	159
October......	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January.....	180	363	208	237	171	174	132	226	249
February.....	186	339	209	254	173	175	133	223	275
March.......	183	319	225	269	178	179	137	211	283

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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	Fish scrap, wet acidulated 6% ammonia, 3% 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	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944	1.75	1.42	7.68	5.77	3.34	4.86	6.71
1945							
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1946							
January	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	146	129	139
1927	112	79	145	166	143	128	162
1938	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	131
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944	65	50	219	163	110	144	191
1945							
March	65	50	223	163	110	144	191
April	65	50	223	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	110	144	191
1946							
January	65	50	223	163	110	144	191
February	65	50	223	163	110	144	191
March	65	50	223	163	110	144	191

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
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	.524
1927	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
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								
March	.650	2.20	6.20	.535	.797	26.00	.200	
April	.650	2.20	6.20	.535	.797	26.00	.200	....
May	.650	2.20	6.20	.535	.797	26.00	.200	....
June	.650	2.20	6.20	.471	.701	22.88	.176	....
July	.650	2.20	6.20	.503	.749	24.44	.188	....
August	.650	2.20	6.20	.503	.749	24.44	.188	....
September	.650	2.20	6.20	.503	.749	24.44	.188	....
October	.650	2.20	6.28	.535	.797	26.00	.200	....
November	.650	2.20	6.40	.535	.797	26.00	.200	....
December	.650	2.20	6.40	.535	.797	26.00	.200	....
1946								
January	.650	2.20	6.40	.535	.797	26.00	.200	....
February	.650	2.20	6.40	.535	.797	26.00	.200	....
March	.650	2.20	6.40	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

	Superphosphate	Florida	Tennessee	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts	Kainit
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
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								
March	121	61	127	75	84	108	83	....
April	121	61	127	75	84	108	83	....
May	121	61	127	75	84	108	83	....
June	121	61	127	66	74	95	80	....
July	121	61	127	70	79	101	82	....
August	121	61	127	70	79	101	82	....
September	121	61	127	70	79	101	82	....
October	121	61	129	75	84	108	83	....
November	121	61	131	75	84	108	83	....
December	121	61	131	75	84	108	83	....
1946								
January	121	61	131	75	84	108	83	....
February	121	61	131	75	84	108	83	....
March	121	61	131	75	84	108	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 materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922........	132	149	141	116	101	145	106	85
1923........	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944........	195	176	151	96	57	174	120	76
1945								
March.....	198	180	153	97	57	175	121	78
April......	203	180	154	97	57	175	121	78
May......	200	180	154	97	57	175	121	78
June......	206	180	155	95	57	175	121	69
July......	206	180	154	96	57	175	121	74
August....	204	180	154	96	57	175	121	74
September.	197	181	153	96	57	175	121	74
October...	199	182	154	97	57	175	121	78
November.	205	182	156	97	57	175	121	78
December .	207	183	156	97	57	175	121	78
1946								
January...	206	184	156	97	57	175	121	78
February..	207	185	156	97	57	175	121	78
March....	209	186	158	97	57	175	121	78

* 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 with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

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.

Fertilizer

"Agricultural Mineral Sales as Reported to Date for Quarter Ended December 31, 1945," Dept. of Agr., Bur. of Chem., Sacramento 14, Calif., FM-122, March 6, 1945.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended December 31, 1945," Dept. of Agr., Bur. of Chem., Sacramento 14, Calif., FM-123, March 6, 1945.

"Panel on Fertilizers and Soil Amendments," Agri. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., Misc. Ser. No. 290, Dec. 1945, R. H. Tucker.

"Homemade Lime and Fertilizer Spreaders," Coop. Ext. Work, State of Dela., Newark, Dela., Mimeo Cir. 39, Feb. 1945, C. E. Phillips.

"Fertilizer Recommendations for Field Crops in Iowa," Ext. Section, Agron. Dept., Iowa State College, Ames, Iowa, Pamphlet 112, H. B. Cheney and H. R. Meldrum.

"Minor Plant Food Elements," Ext. Serv., Clemson, S. C., C. G. Peebles.

"Field Trials with Fertilizers in South Dakota 1945," Agr. Exp. Sta., S. Dak. State College, Brookings, S. Dak., Pamphlet No. 6, Dec. 1945, W. W. Worzella and Leo F. Puhr.

"Correcting Potash Deficiency in Growing Corn," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 93, Dec. 1945, John B. Washko.

"Pasture Fertilization Experiments at Reymann Memorial Farm," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 324, Nov. 1945, F. W. Schaller, G. G. Pohlman, H. O. Henderson, and R. A. Ackerman.

Soils

"Soil Testing: A Review of Principles and Procedures," Agron. Dept., Iowa State College, Ames, Iowa, Agron. 36.

"Effect of Weathering on Houston Black Clay," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 356, Oct. 1945, Russell Woodburn.

"Major Soil Areas of Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 304, Aug. 1945, H. H. Krusekopf.

Crops

"Annual Reports—54th and 55th—January 1, 1943—December 31, 1944," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala.

"Corn Hybrids Recommended for Production in Ontario—1946," Dom. of Canada, Dept. of Agr., Ottawa, Suppl. to Pamphlet 22, Feb. 1946.

"Grain Corn Trials Mt. Carmel and Windsor, Connecticut 1945," Agr. Exp. Sta., New Haven, Conn., R. P. 45G1, D. F. Jones and O. E. Nelson, Jr.

"Growing Fruits for Home Use," Coop. Ext. Work, Univ. of Dela., Newark, Dela., Bul. 45, June 1945, A. L. Kenworthy, P. L. Rice, and S. L. Hopperstead.

"1944 Annual Report to Delaware Farmers," Agr. Ext. Serv., Univ. of Dela., Newark, Dela., Bul. 46, June 1945.

"Chufas in Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 419, Jan. 1946, G. B. Killinger and W. E. Stokes.

"Modernizing Cotton Production in Georgia," Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 523, June 1945, E. C. Westbrook.

"Varieties of Fruits for Indiana," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., Leaf. 27, 1945.

"Effect of Certain Summer and Winter Legume Crops in Improving Corn Yields in South Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 396, Sept. 1945, H. B. Brown.

"Louisiana Creole Onion Best for Bulbs and Seed," Agr. Ext., La. State Univ., Baton Rouge, La., Cir. 242, 3rd Ed. Oct. 1945, Joseph Montelaro.

"A Preliminary Report of Certain Tests Conducted by the Crops and Soils Department of the Louisiana Experiment Station 1945," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., W. G. Taggart.

"Landscaping the Farmstead," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 250, March 1946, Leon C. Snyder.

"Suwannee, A New Home-Garden Strawberry," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 123, Sept. 1945, N. H. Loomis and George M. Darrow.

"Winter Legumes with Tung Trees," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 354, Sept. 1945, S. R. Greer.

"Cabbage Variety Tests: Poplarville, 1944-1945," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 355, Sept. 1945, T. E. Ashley.

"Small Grains Test, Stoneville, 1945," Agr. Exp. Sta., Miss. State College, State College, Miss., Serv. Sheet 398, Sept. 1945, P. W. Gull.

"Alfalfa in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 492, Aug. 1945, W. C. Etheridge and C. A. Helm.

"Better Pastures for North Carolina," Agron. Dept., Univ. of N. C., Raleigh, N. C., Cir. 286, Nov. 1945, E. R. Collins, W. W. Woodhouse, R. L. Lovvorn, and H. Brooks James.

"Performance Tests of Corn Varieties and Hybrids, 1945," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-292, Feb. 1946, James S. Brooks.

"Growing Tomatoes in the Home Garden," Agr. Ext. Serv., S. Dak. State College, Brookings, S. Dak., War Food Ser. No. 5, March 1945, Edward O. Olson.

"Tennessee Luscious Red Raspberry," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 92, Oct. 1945, Brooks D. Drain.

"Tomato Variety Test in the Wichita Valley," Agr. Exp. Sta., A. & M. College, College Station, Texas, P.R. 975, L. E. Brooks and V. I. Woodfin.

"The 1945 Official Virginia Varietal Tests of Corn Hybrids, Barley, Oats, and Wheat," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 383, Dec. 1945, M. H. McVickar and T. M. Starling.

"The Growth and Composition of the Tops of Peach Trees in Sand Culture in Relation to Nutrient-element Balance," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 322, Sept. 1945, D. S. Brown.

"Results of Hybrid Corn Yield Trials in West Virginia for 1945," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Mimeo Cir. 56, Feb. 15, 1946, J. L. Cartledge, R. J. Friant, C. C. Lima, R. M. Smith, and D. R. Browning.

"Twenty Fifth Annual Report Wood County Extension Service," County Agr. Agent, Wisconsin Rapids, Wis., 1945, H. R. Lathrope, Cecelia M. Shestock, E. E. Anderson, and Elmer Miller.

"Mechanical Treatments for Increasing the Grazing Capacity of Shortgrass Range," Agr. Ext. Sta., Univ. of Wyo., Laramie, Wyo., Bul. 273, June 1945, O. K. Barnes and A. L. Nelson.

"Report of the Administrator of Agricultural Research 1945," U.S.D.A., Washington, D. C.

"Report of the Chief of the Office of Experiment Stations, Agricultural Research Administration, 1945," U.S.D.A., Washington, D. C., Sept. 15, 1945.

"Report of the Chief of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, 1945," U.S.D.A., Washington, D. C., Sept. 28, 1945.

Economics

"A Farm Management Analysis of Dairy Farming in Putnam County, Georgia, 1944," Ga. Exp. Sta., Experiment, Ga., Bul. 244, Oct. 1945, J. C. Elrod and W. E. Hendrix.

"An Economic Study of the Sweet Potato Enterprise in the North Louisiana Upland Cotton Area in 1943," Dept. of Agr. Econ., La. State Univ., Baton Rouge, La., Bul. 395, Aug. 1945, Leo J. Fenske and J. Norman Efferson.

"An Economic Study of Peach Production in Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 398, Nov. 1945, Frank D. Barlow, Jr.

"Development of the Dairy Industry in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 422, July 1945, D. W. Parvin.

"Balanced Farming Workbook," Coop. Ext. Work, Univ. of Mo., Columbia, Mo.

"Oklahoma Farm Real Estate Activity 1941-1944," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-291, Feb. 1946, Randall T. Klemme and Erwin C. Ford.

"A Statement on Farming in Rhode Island," Coop. Ext. Work, R. I. State College, Kingston, R. I., Mimeo. Cir. 39, Jan. 1945, J. L. Tennant and G. E. Bond.

"The Agricultural Outlook, South Carolina 1946," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 277, Feb. 1946.

"Information Basic to Adjustments in Rice Production in Texas," Agr. Exp. Sta., College Sta., Texas, Bul. 676, Nov. 1945, A. C. Magee and C. A. Bonnen.

"Trend in the Sales Price of Farm and Ranch Lands in Texas 1920-1944," Agr. Exp. Sta., A. & M. College, College Station, Texas, P.R. 971, Nov. 1945, L. P. Gabbard, Erwin C. Ford, and J. Lambert Molyneaux.

"Strawberry Cost Study," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Mimeo Cir. 330, June 1945.

"Report of the Chief of the Bureau of Agricultural Economics, Fiscal Year 1945," U.S.D.A., Washington, D. C., Sept. 1, 1945.

"Looking Ahead with Cotton," U.S.D.A., Washington, D. C., Misc. Publ. 584, Dec. 1945.

"What Peace Can Mean to American Farmers, Agricultural Policy," U.S.D.A., Washington, D. C., Misc. Publ. 589, Dec. 1945.

"Handbook on Major Regional Farm Supply Purchasing Cooperatives 1943 and 1944," Farm Credit Adm., U.S.D.A., Washington, D. C., Misc. Rept. 89, Oct. 1945, Joseph G. Knapp and Jane L. Scearce.

Her: "Don't you think a man has more sense after he's married?"

Him: "Yes, but it's too late then."

"So you bought a home in the country?"

"Yes. Five rooms and a path."

Sugar From Research

Scant sugar supplies would have been even scantier during the war years—and this year, too—but for two distinct but related research activities by the U. S. Department of Agriculture in the years between the wars.

When war disturbs sugar imports, the domestic supply of beet sugar is increasingly important. In World War I, sugar beet production was complicated by difficulties in getting beet seed from Europe, where most of the American supply had been grown because of lower labor costs. In World War II, the beet farmer had better varieties to grow. For planting in the West he had the U. S. varieties resistant to the devastating disease, curly top, that is transmitted by the beet leafhopper. This was a result of research that is continuing with view to further improvement of disease resistance.

The other research made possible an ample seed supply of these adapted varieties grown here in the United States. The sugar beet normally requires growth in two seasons to produce a seed crop. The old practice was to grow beets for a season, dig them, store them over winter, replant them in spring, and harvest seed the second summer. This system called for so much hand labor that European growers with lower labor costs, essentially monopolized beet seed production.

In cooperative work at the New Mexico Agricultural Experiment Station, State and Federal scientists observed in 1922 that fall-planted sugar beets remained alive over winter in the mild climate and produced seed the second year without need for storage and replanting. By 1928 the system of seed growing by wintering beets in the field had been developed, and Federal experimenters have since adapted the method to other areas. Most of the operations have been mechanized so that beet seed production costs in the United States compare favorably with those of hand-grown crops abroad.

The Department of Agriculture has figured up the costs of developing this new method of growing sugar beet seed. It cost about $400,000, for part-time work of two men in the initial period from 1922 to 1928, and part-time work of about 10 men since then in extending its scope. The value of the discovery is estimated at fully $1,500,000 a year —every year. This is a continuing gain, and is based, not on the value of the sugar crop that is a result, but only on the value of the beet seed produced as a result of the work.

Alfalfa in Miss. Decreased As Soil Fertility Declined

(*From page* 16)

tility is a controlling factor in the successful production of alfalfa, and that the strange malady that killed alfalfa was low soil fertility. Ten tons of manure per acre increased the yields over the five-year period from 1.63 to 2.35 tons per acre. This was more than either superphosphate or basic slag produced alone. Twenty tons of stable manure was still superior to the 10-ton application. Twenty tons of manure and 500 pounds of basic slag produced the highest yield, which was 3.18 tons of alfalfa hay per acre. The manure, being a good source of potash and nitrogen, supplied most all of the nutrients needed except phosphate. The soil used for this experiment was Houston Clay, one of the principal dark soils, and was naturally well supplied with lime.

Data from another test started in the spring of 1926 are given in Table 4. These data again show that when fertility is added to the soil, alfalfa can be produced. Twenty tons of manure produced yields about equal to the yields produced by 10 tons of manure and 500 pounds of superphosphate. Basic slag is sometimes referred to as a "foolproof" fertilizer for legumes, but in this test it was not sufficient in fertility value to produce alfalfa yields equal to that produced on plots receiving stable manure.

At the time of these experiments, manure and phosphate seemed to supply the needed fertility elements. In recent years it has been found that potash and boron also are necessary for the most efficient production of alfalfa on some soils. Figure 2 shows alfalfa growing on a soil low in fertility after it has been treated with manure, lime, superphosphate, potash, and borax. Many of the fairly deep, well-drained soils will produce alfalfa, provided the fertility required by this crop is added.

The acreage planted to alfalfa in the prairie counties at present has increased some since 1924, by virtue of added fertility, but it is still far short of the acreage planted in 1919. The production of the crop in this area is largely confined to the fertile alluvial and colluvial soils; and even on these soils, potash, phosphorus, and boron are usually necessary for high yield and longevity of stands. By taking care of the fertility problems, good alfalfa yields have recently been produced on some fields for six successive years without difficulty. This is probably as long as one field should remain continuously in this crop.

The failure of alfalfa to grow on land where it has once grown successfully was a signal that the fertility of the soils was below the level required by this legume. This should have been a warning to the farmers that the soils were sick and needed doctoring as well as protection from erosion. Instead

Fig. 2.—Alfalfa grew on a poor soil after manure, lime, potash, phosphate, and borax had been applied.

Fig. 3.—Gently rolling topography, pastures, and dairy cows are characteristic of the Black Belt.

they sought new plants that would grow on soils low in fertility and, consequently, contain little mineral elements in the forage.

The plant, after all, is an expression of the fertility level of the soil and a serious mistake can be made by directing full attention to selection of plants that will grow on poor land and neglecting the soil problems. The plant has the ability to manufacture carbohydrates by using the raw materials of air and water in the presence of sunshine, but the only source a plant has for important minerals is the soil. Naturally, if the soil is low or deficient in minerals the plant, if it grows, must be low in the same.

In farm management some thought should be given to the fertility that is delivered by the soil to crops as well as bulk or tonnage per acre. Continued plant selection as crops fail to grow may eventually reduce the soil fertility to a level where only poverty vegetation will survive. An effort many years ago to maintain the fertility level of the soil near the alfalfa standard would have paid great dividends on many farms throughout the Black Belt section. Much attention has been given lately throughout the country to saving the body of the soil. It is high time for some attention to be given to saving the "soul" of the soil (fertility) as well as the body.

Plow-Under Fertilizer Ups Corn Yields

(*From page* 22)

the 8-8-8 where both were plowed under at the 50 pounds/acre nitrogen level.

3. Nitrogen fertilizer plowed under is more efficient in terms of unit cost than 8-8-8 plowed under when residual effect is not considered.

4. Significant increases in yield have been obtained from the treatments on

TABLE 3.—PLOWING UNDER FERTILIZER FOR CORN DEMONSTRATIONS

1945

Plants per Acre and Yield in Bushels of Shelled Corn per Acre at 15½% Moisture

Soil Type	Light Planting Rate						Heavy Planting Rate					
	Fertilizer Treatment											
	Row		Row +8-8-8		Row +Nitrogen		Row		Row +8-8-8		Row +Nitrogen	
Rimer	8629	79.0	9920	83.0	8897	87.3	11826	86.3	11826	97.2	12694	95.9
Fincastle-Brookston	8379	96.1	8885	101.6	8319	92.7	11121	97.5	11416	111.0	10708	108.0
Fincastle	11368	65.1	10074	72.5	11564	83.5	14863	68.8	15288	97.0	15190	97.2
Clyde	8557	65.2	8210	78.5	8230	76.9	8936	70.4	11270	84.3	10780	92.1
Crosby-Brookston	10705	73.5	9114	87.7	9548	84.8	11934	82.8	12477	84.9	12477	113.9
Belmore	10910	75.7	11146	99.8	10976	85.4	13850	78.8	13622	92.5	14210	95.9
Clyde	13850	65.7	13720	74.9	14308	99.1	16660	72.1	18620	75.8	16856	88.0
Fincastle-Blanchester	7788	66.9	7080	68.4	7257	82.0	12390	84.0	12036	91.4	11328	92.6
Brookston	8938	71.4	8584	71.9	7876	70.4	9027	71.5	11151	76.7	10885	76.1
Miami	10388	69.7	10878	65.2	10976	69.8	14151	66.4	14210	86.0	14504	77.8
Fulton	8428	43.6	11270	60.8	8722	63.4	9996	58.2	9800	62.7	10878	75.8
Brookston	10692	64.1	12054	70.2	11074	73.2	15043	61.4	16266	75.4	16562	87.6
Berrien	10662	103.4	11662	119.1	10878	110.1	13751	106.8	14112	123.9	13720	108.3
Paulding	10845	78.9	11564	89.6	10094	84.6	13037	74.6	14210	103.5	14602	89.3
Fincastle	10244	97.0	11495	115.4	10285	105.1	14155	114.7	14032	119.9	14641	127.7
Miami-Brookston	11212	76.4	11858	105.3	12342	93.5	14600	78.0	14032	114.3	13648	111.1
Miami-Brookston	9146	91.2	8428	84.3	9212	88.2	10877	79.6	11368	100.6	11760	88.3
Brookston	12020	67.2	12054	83.0	12052	79.4	14543	66.0	14798	76.1	14896	68.3
Nappanee	9506	68.4	9506	82.2	9310	63.7	10682	68.4	11956	89.5	12544	82.8
Miami-Brookston	8199	68.4	8624	73.9	7840	65.9	9571	70.7	9310	80.8	10780	80.8
Average	10023	74.3	10306	84.3	9988	82.9	12550	77.8	13090	92.1	13182	92.8
Average increase over check				10.0		8.6				14.3		15.0

TABLE 3A.—THE EFFECT OF TREATMENT ON YIELD

1945

Planting Rate	Treatment, Yield, and Increases in Bushels per Acre				
	Row Only	Row +8-8-8		Row +Nitrogen	
Plants per Acre	Yield	Yield	Increase	Yield	Increase
8,000 to 10,000	70.8	79.5	8.7	77.5	6.7
10,001 to 12,000	79.8	91.9	12.1	87.5	7.7
12,001 and over	77.2	91.2	14.0	94.6	17.4

TABLE 3B.—THE EFFECT OF RATE OF PLANTING ON YIELD

1945

Treatment	Rate of Planting, Yield, and Increases in Bushels per Acre				
	Plants per Acre	Plants per Acre		Plants per Acre	
	8,000 to 10,000	10,001 to 12,000		12,001 and over	
	Yield	Yield	Increase	Yield	Increase
Row only	70.8	79.8	9.0	77.2	6.4
Row +8-8-8	79.5	91.9	12.4	91.2	11.7
Row +Nitrogen	77.5	87.5	10.0	94.6	17.1

TABLE 3C.—FERTILIZER, RATE OF APPLICATION AND COST PER ACRE

1945

Fertilizer	Grade	Av. Lbs/Acre	Av. Cost/Acre*
Row only	Single strength	229	$3.66
Plow under	8-8-8	600	$12.04
Plow under	Am. Sul.	250	$5.34

* 1945 Spring Cash Price.

soils of high fertility level as well as on poorer soils.

5: To obtain maximum returns for large applications of fertilizer, it is necessary to maintain a planting rate of 12,000 to 14,000 plants per acre.

6. The lack or excess of soil moisture at critical growth periods may completely overshadow responses from added plant-food nutrients.

Soil Conservation Districts and District Supervisors

(*From page* 18)

is doing and of his career as a farmer. He realizes fully that farming is a science that equals the science of medicine or even that of modern warfare not only in application, but in results.

If helping a man to a better way of life is accomplishment; if working for the perfecting of a better agriculture is a worthy endeavor; if coordinating our efforts with those of agricultural workers and individuals is service, then I may safely say that soil conservation district supervisors of South Carolina have made some contribution to mankind of this and future generations.

Like Richard Rumbold, I never could believe that Providence had sent a few men into the world ready booted and spurred to ride, and millions of others ready saddled and bridled to be ridden. All down the ages, we have heard the cries of the persecuted and underprivileged peoples. We have them ever before us in our own State and Southeastern Section. We have learned that there is no prosperity for the masses in slavery. We have experienced depression and prosperity; we have breathed the breath of freedom and found it good.

There is opportunity in the South, beginning with our wonderful climate and natural resources. The South has capital and management experience. It has talent and great potential wealth that awaits the unleashing of this talent. The South has for the past seven years had what we like to think is another asset—Soil Conservation Districts—through which each farmer has an opportunity to enter into the making and effecting of agricultural policies. By means of these districts, we supervisors see a perpetuation of that freedom we prize so dearly—that freedom which we are not willing to exchange for anything—certainly not for temporary security, nor even the salvation of our soil for we do not believe that freedom nor soil conservation can be attained by increasing governmental control, but only by understanding, aggressive activity, ingenuity, and cooperation of each individual farmer; for the prosperity of one farmer is more or less dependent upon that of his neighbor and the prosperity of communities and towns depend upon the type of agriculture that surrounds them.

Development does not come by coddling an individual or a nation. Nor does cutting the pattern of an individual's life develop initiative which leads to accomplishment and progress and individual freedom and strength of character.

Yes, we want soil conservation and the permanent agriculture that will result. Yes, we want the better way of life for our children's children. That is the goal of soil conservation district supervisors and the agricultural workers and friends who cooperate with us in assisting farmers to save soil resources through soil conservation districts. But, we want it through understanding of the need of saving soil, done voluntarily because of our acceptance of a trust placed in us by the Lord to pass the land on in better condition than we received it, with the joy that will result from a job well done and not by compulsion at the commands of a dictator which will take away our freedom in planting when and where; in selling and buying when, where, and at what prices.

Supervisors of soil conservation districts offer districts to the South to be added to her other opportunities, believing that the development of the South will be hastened along agricultural and industrial lines; thereby enabling our South to make a greater contribution to the development of America and the world. Soil conservation district supervisors will take new hope from the progress made in the last five years. There is no limit to what we may achieve in saving soil and the benefits resulting, for in America there is no limit to achievement. We are free men. Let us cherish that freedom and foster it in the service we offer as soil conservation district supervisors until the philosophy of democracy is understood down to the grass roots, and each farmer avails himself of the privilege of making democracy work by understanding the need for his own participation in agricultural affairs of the district, the State, the South, and the Nation.

Potash Treatment Makes Better Sweet Clover

(*From page* 24)

TABLE 2. YIELD AND COMPOSITION OF SWEET CLOVER AT TWO GROWTH STAGES WITH DIFFERENT SOIL TREATMENT

Part of Plant	DM lbs/A	Percentages		
		N	P	K
Lime				
May 15				
Tops	1,490	2.94	.14	.90
Roots	630	1.51	.10	.25
June 25				
Tops	5,640	1.34	.09	.52
Roots	1,460	1.01	.06	.32
Lime-Potash				
May 15				
Tops	2,730	2.65	.13	1.52
Roots	900	1.44	.08	.65
June 25				
Tops	5,280	1.49	.10	1.11
Roots	1,920	1.03	.05	.36
Lime-Phosphate				
May 15				
Tops	3,020	3.10	.41	.65
Roots	1,370	1.95	.34	.12
June 25				
Tops	5,630	1.97	.26	.44
Roots	1,490	1.28	.28	.09
Lime-Potash-Phosphate				
May 15				
Tops	4,200	2.84	.40	1.73
Roots	1,580	1.80	.32	.47
June 25				
Tops	10,150	.94	.19	.92
Roots	2,280	1.41	.19	.40

dark-colored soils was nearly twice that which was grown on the low-nitrogen, light-colored soils. In all tests the sweet clover was thoroughly inoculated and had been grown on the land over a period of years, usually as a plow-under crop in a four-year rotation. Sweet clover grown on the dark soils was also slightly higher in phosphorus and considerably higher in potassium than that from the less productive light-colored soils. Calcium content was the reverse of that of potassium, because of the relationship existing between these two elements in plants of this type.

The need of sweet clover for a balanced fertility condition in soils is further illustrated by yield and composition results in Table 2. These data are for sweet clover grown on a light-colored southern Illinois soil. In an untreated condition this land was very acid, decidedly deficient in total nitrogen, and very low in available phosphorus and potassium.

In this field test (Table 2) lime applications alone gave a good stand and a reasonable growth of sweet clover as indicated by the dry weight of tops and roots which amounted to 7,100 pounds an acre June 25 at full bloom stage. Both potassium and phosphorus

Fig. 2.—Sweet clover growing under the same conditions as shown in Fig. 1 except potash was omitted from the treatment.

were deficient in the top growth on the lime-only treatment at both stages of growth May 15 and June 25. The potassium deficiency in the top growth was overcome where potash was added to the soil in addition to lime. Phosphorus deficiency was likewise overcome where phosphate was added in addition to lime, but the maximum growth and balanced composition were not obtained until the fertility elements in the soil were balanced by a combination of lime, potash, and phosphate. This combined treatment supplied sufficient potassium and phosphorus to give a relatively high content of these elements at the plow-under time of May 15 and at the full bloom stage of June 25.

When the phosphorus content of hay or forage is as low as .09 to .14 per cent as indicated in Table 2 on unphosphated land, it is too low for desirable feeding quality. Livestock fed too much and too long on this type of feed will in a relatively short time suffer serious consequences. This condition has been brought out by various results of extensive research in animal nutrition.

Rich Fog in the Hollows

(*From page* 26)

Rich Air for Plants in the Hollows

Carbon dioxide is a heavy gas. It is so heavy that when a silo is opened there is danger of suffocation for the person who enters the silo before doors have been opened to drain out the gas. Carbon dioxide will flow like water even though you cannot see it; high school students will recall how they can pour the gas from one beaker to another. We can draw the conclusions that it will flow from the higher ground to the depression areas. If the carbon dioxide gas were to have a red color one would probably see a thick red fog in the depression areas on a warm summer day when a lot of decomposition or rotting of organic matter is taking place in the ground. One would probably see the hilltops and knolls standing out clearly because the air drainage would flow the carbon dioxide away. Perhaps it is a shortage of carbon dioxide on the hilltops that causes crops to be smaller on such places even though exceedingly heavily fertilized. We know that nutrients are carried in erosion materials and water run-off to depression places to enrich the soil in the hollows, but perhaps the extra richness in the hollows comes in part from the enriched carbon dioxide that undoubtedly occurs in such places, carbon dioxide that has flown into the depression as well as that which was formed there by virtue of a richer organic content in the soil.

If the carbon dioxide gas were red, it would be a spectacular sight on a warm summer day following a shower of rain to see it virtually billowing out of the soil in proportion to the organic matter decomposing in the soil. In the soil areas that contained a high quantity of organic matter, the evolution of carbon dioxide would be great and there the red gas would become thick. In the poorer spots of the field where the organic matter was more deficient, the evolution of this gas would be less; and on eroded areas where the subsoil was exposed where there is no organic matter, there would be no gas evolved. The summary of this whole story is that organic matter has virtues far beyond the simple ABC's of good farming practices. Organic matter probably enriches the atmosphere above the ground in addition to improving the moisture supply, porosity, available nitrogen, and other nutrient elements so that undoubtedly plants can grow faster and bigger because of the organic matter in the soil.

Potash Pays Good Dividends in Louisiana

(*From page* 25)

Most farms made only a bottom crop and under these adverse growing conditions, naturally the fertilizer used on cotton demonstrations was severely handicapped in its efficiency. In spite of this, the following summary on 83 cotton fertilizer demonstrations tells a convincing story. All demonstrations received 600 pounds of an 8-8-8 mixture per acre prior to planting. The average yield of seed cotton for all demonstrations was 1,248 pounds. Check plots averaged 829 pounds. The average net increase was 419 pounds or 50.5 per cent. (Note: All check plots were fertilized at the rate and grade commonly used on the cooperator's farm.)

Upland Coastal Plain (Hill) Soils

Fifty-four of these demonstrations were located on hill soils and the average yield for the demonstrations was 1,098 pounds seed cotton per acre. The checks averaged 696 pounds. The average net increase for the recommended fertilizer was 402 pounds or 57.7 per cent.

Terrace (Bluff) Soils

Seventeen demonstrations averaged 1,583 pounds. Checks averaged 1,154 pounds. The average net increase per acre for the demonstrations was 429 pounds or 37.1 per cent.

Alluvial (River Bottom) Soils

Twelve demonstrations averaged 1,447 pounds. Check plots averaged 964 pounds. The average increase was 583 pounds per acre or 60.4 per cent. (Note: These alluvial land demonstrations were located on the lighter, or sandy loam type soils.)

Thus it can be seen that cotton yields may be increased up to 60 per cent, even in an unfavorable season, by using the right grade and quantity of fertilizer. Also, when ample plant food is provided, there is no great difference in yields on hill, terrace, and alluvial soils.

Sugarcane for Sugar

Louisiana grows about 350,000 acres of sugarcane for sugar. For many years, as well as at the present, the crop has been largely fertilized with straight nitrogen materials. Within the past three or four years it has been found that much of this sugarcane acreage responds profitably to liberal applications of phosphoric acid and potash. To illustrate this, one result demonstration gave the following:

Treatment	Amount fertilizer per acre (lbs.)	Sucrose (per cent)	Increased sugar per acre (lbs.)	Increased value per acre (dollars)
0–0–0	check	12.93	....	....
12–0–0	225 nitrate	12.35	194	10.10
12–8–0	300	12.03	839	41.11
12–0–12	300	14.23	1,324	56.15
9–6–9	400	12.26	972	44.07

Out of 10 potash demonstrations reported, nine of them showed increases in sucrose content ranging from .3 up to 1.88 per cent. To give an idea of the significance of this extra sucrose, an increase of .5 per cent sucrose in 100 tons of cane increases the value of the cane in an amount equal to the full value of 10 tons. Potash did not increase the tonnage per acre to an appreciable extent, but the increase in sucrose content due to potash is highly significant.

Pastures

Liberal applications of potash, particularly on lighter soils low in organic matter, have greatly increased the growth of clovers and lespedeza. In practically all cases it was observed that cattle with free choice did most of their grazing on the potash-treated areas. Also, the plants receiving a liberal supply of potash were a darker green color and withstood mild, dry weather to a greater extent than where little or no potash was used. On one good demonstration on terrace (bluff) type soil, the potash-treated part of the pasture was grazed clean by late June, while the growth on the remainder of the pasture, which received no potash, was from four to six inches high. The many good effects from potash on the ligher soils, low in organic matter, have resulted in the present pasture recommendation of 400 pounds of a 3-12-12 or 0-12-12 mixture per acre. On darker colored soils with more organic matter, the recommendation is to use 400 pounds of a 4-12-8 or 0-14-7 mixture per acre.

Potash-treated lespedeza demonstrations gave an average increase of about 30 per cent or one-half ton of cured hay per acre. One seed-harvest demonstration on Lintonia silt loam soil boosted the seed yield from 8 to 14 bushels per acre, or 75 per cent in favor of the potash treatment.

Sweet Potatoes

One sweet potato potash demonstration on Lintonia silt loam soil gave a 50-bushel-per-acre increase where 100 pounds of potash were used in addition to 200 pounds of 4-12-4 per acre. The check plot received 200 pounds of 4-12-4.

Many areas of the State where 10 years ago it was said no potash application was needed now show a very profitable response to liberal potash applications. The reasons are obvious. These soils are getting older, the topsoil thinner and more devoid of organic matter, impervious hardpans have developed at plow-sole depth, and the natural reserves of potash have been used up, washed away, and leached out. A recent estimate on the plant-food needs of the State indicates that we could profitably use at least 45,000 more tons of potash than are now being used. The general feeling is that the use of more potash for Louisiana crops will develop both rapidly and extensively.

Muck Soils Produce Quality Sweet Corn for Canning

(*From page* 13)

Over a period of years, Golden Cross Bantam has proven to be as well or better adapted to production on muck soil than any other hybrid sweet corn. A comparison of six yellow hybrid corns, five of which are commonly grown in sweet corn canning areas, is listed in Table 4. There was no significant difference between the yields of Golden Cross Bantam, Purgold, Illinois 10, and Iowana. Golden Cross Bantam with red tassel produced .6 tons less than the regular Golden Cross Bantam. An unreleased hybrid, Hoosier Bantam, produced .8 tons more than Golden Cross Bantam.

Potash Losses on the Dairy Farm

(*From page* 10)

ther increases the amount and waste of the fertilizer elements. The greatest vegetative growth in such cases, however, is due to urine because the most soluble and active ingredients in the feces are removed during digestion, before voiding. On an equal weight basis, urine contains about 13 times as much potash and three times as much nirogen as the solid feces, all of which is very soluble and readily available to plants. This may seem surprising in view of the large amount of water contained in urine.

It is difficult to estimate summer losses of potash caused by leaching, poor distribution, and excessive concentration of manure while cattle are on pasture. A conservative figure would seem to be about 10 per cent. If cattle are on pasture six months of the year and each animal produces six tons of manure, 15 cows would produce 90 tons of manure. The potash content of this manure produced while cattle are on pasture would be at least 10 pounds per ton or 900 pounds of K_2O. A 10 per cent potash loss would be equal to the potash contained in 180 pounds of 50 per cent potash.

Potash in Milk and Grain

The composition of milk varies with the kind of animal,[1] period of lactation, etc., but according to studies in Pennsylvania, milk contains an average of

[1] Forbes, E. B., et al. *Mineral requirements of milk production.* Pa. Bul. 319 (1935).

0.166 per cent K_2O. On the basis of 5,500 pounds of milk, which is the average production per cow on many dairy farms, it would require 9.1 pounds of K_2O to supply that which is removed in the milk from one cow. Milk from a 15-cow dairy farm would thus contain 137 pounds of K_2O or 274 pounds of 50 per cent potash.

In order to produce this milk, most dairymen feed large quantities of grain or dairy ration. In Vermont the better dairymen feed about one pound of grain ration to four pounds of milk (more in winter, less in summer). Therefore, to produce 5,500 pounds of milk per cow, farmers feed about 1,400 pounds of grain concentrate. The potash content of this concentrate varies somewhat with materials used, but a ton of 16 per cent dairy ration[2] contains about 12.8 pounds of K_2O. On the above basis, 15 dairy cows will consume 21,000 pounds of grain ration containing 270 pounds of 50 per cent potash.

Farmers who grow their own concentrate would have to purchase this amount of potash each year to balance the potash sold in milk. In Vermont, most of the concentrate is purchased because the land is needed to produce sufficient pasturage for summer use and hay and ensilage for winter feed. As long as farmers produce this amount of concentrate, they are able to balance the potash sold off the farm as milk.

The above calculations do not take into account grain purchased for calves and dry stock, but this does not much more than balance the potash contained in the bodies of old and young animals sold off the farm each year.

Summary of Potash Losses

Winter run-off losses. A 15-cow farm will produce at least 90 tons of manure during the winter months. If this is spread on frozen ground, which is impervious to water, the spring thaw may cause a loss of potash equal to 420 pounds of 50 per cent potash. However, on most dairy farms, it is quite likely that this figure should be cut in half because the greatest losses occur on manure spread on frozen meadows and pastures during a three-month period (December, January, and February). Much of the soluble nutrients in manure spread before this time soaks into the ground. When manure is spread after February or March, most of the snow has gone and run-off is less. Furthermore, spreading manure on fall-plowed land which has a rough surface and many depressions also reduces this loss. However, even though the estimated losses are reduced by one-half, they are equivalent to the potash contained in 525 pounds of an 0-20-20 fertilizer.

Summer losses. When dairy cattle are on pasture, the manure is poorly distributed and its high concentration of nutrients over small areas greatly reduces its crop-producing efficiency. It has been estimated that the amount of potash lost each year on a 15-cow farm in manure deposited on waste areas together with that lost by leaching and poor utilization around urine spots is equivalent to that contained in 180 pounds of 50 per cent potash, or in 450 pounds of an 0-20-20 fertilizer.

Potash removed in milk. Each cow on a fairly good dairy farm will produce yearly about 5,500 pounds of milk. The potash content of milk varies somewhat but contains an average of about 0.166 per cent K_2O. Thus, the milk produced on a 15-cow farm contains potash equivalent to that contained in 274 pounds of 50 per cent material or in 685 pounds of an 0-20-20 fertilizer.

Total potash losses. The above figures make a total loss equal to the potash contained in 1,660 pounds of an 0-20-20 fertilizer (winter run-off, 525 pounds; summer losses, 450 pounds; and losses in milk, 685 pounds). It is quite likely that these figures are on the conservative side because over 95 per cent of the total potash in manure is soluble and subject to loss. The above figures on losses, exclusive of those sold in milk, represent only about

[2] Ration No. 1, *Morrison's Feed and Feeding*, P. 1017 (1939).

10 per cent of the total potash contained in the manure, which is a low service charge or loss for handling such large amounts of soluble potash.

Potash purchased in grain. Most dairymen feed large quantities of grain or concentrate. The potash content of this concentrate is about equal to that contained in 270 pounds of 50 per cent potash or that in 675 pounds of an 0-20-20 fertilizer.

Potash needed to make up losses. In general, it seems safe to conclude that it would be necessary to purchase and apply the following amounts of potash to maintain the potash on an average dairy farm of 15 cows at its present level. If grain is produced on the farm, it will be necessary to purchase potash equivalent to that contained in 1,660 pounds of an 0-20-20 fertilizer per year. If the grain is purchased, 975 pounds of a similar potash fertilizer will be required each year.

Rice Resurgent

(*From page* 5)

prospective harvest hit well above half a million acres. It is likely that from such an increased area to rice there will be fully 350,000 metric tons produced in hulled form. In Brazil, the allocation of domestic and export rice crops is directed by the officers of the Rice Institute. But after saving out 60,000 metric tons for their own use and for seed, the rest is expected to be shipped to other neighboring countries and to Great Britain—although the latter country temporarily laid off rice consumption to allow its share to be used in the big relief effort.

Down in the Santiago section where the Dominican Republic's big rice-growing is centered, the speculative fever has caught hold of the future market in spite of larger acreages and good outlook for a heavily increased output of irrigated and dry-land varieties. Cuba is also actively watching the chances to obtain rice in that zone. Consumers in the capital city of the Republic paid as high as 12 cents a pound early this spring for rice, all of which shows that a widespread price-kiting psychology has been evident in surplus rice regions, as well as in our own wheat sections since the world shortage of the basic breadstuffs became known. The very fact that rice is the staff of life for at least half the inhabitants of the globe means that a boom could easily become a bust, and selfish interests could defeat their own ends by expansion.

Mexico this season will probably plant about 200,000 acres to rice, or about a third of the area which Brazil contemplates harvesting. Reports from there indicate that they will need all they can raise this year without filling export orders, as supply in stores was short this winter in over half the country.

If the growers of rice and the investments in all our rice industrial developments were as enormous and basic as our vast wheat empire presents in those respects, the temporary world hunt for this cereal might threaten us with an unwise and risky boom. But probably within two years or even less, the recovery movement in the cheap and rapid tropical rice-raising countries of Asia will be such as to return us to a normal attitude.

That attitude was simply this—that since 1920, up to the war years, the acreage of United States rice culture declined about half. Growers felt that unless a big increase could be had in per-capita consumption here, or unless our production costs could be severely reduced by the breeding and use of higher-yielding varieties, the boosting of rice investments here would be unable to meet Oriental volume at cut prices.

To buttress and defend our rice expansion with scientific research is logical. This apparently requires attack in at least three ways: (1) To make rice more attractive and palatable for humans and more economical and useful in its by-products for livestock; (2) to breed strains that will make our domestic growers better able to compete with yields of over 100 bushels an acre in Spain, 90 bushels in Italy, 80 bushels in Japan, and 60 bushels in Egypt, compared with 45 or 50 bushels average in this country; (3) to devise new industrial uses of rice straw and its hulls, starch, and polish.

No doubt further research in soil fertility requirements will parallel the program of providing us with better varieties from yield, disease-resistance, and milling quality. Popular conceptions of low, marshy, boggy waste-land as the best plantations for rice need to be corrected. On the contrary, rice thrives on rather level upland prairies, suitably located for irrigation to provide the water-bath levels required, plus the need for an average mean temperature during the whole length of the growing season which is close to 70° F.

TAKING up the food-value angle first, it has long been contended that polished rice lacking the bran coat is deficient in the B-1 vitamin, or thiamine. Beriberi and similar nutritional ailments of a serious nature are hastened in their development where polished rice is the mainstay. Naturally, here where we get such a wonderful variety of protective foods this deficiency in polished rice is not so serious, but this does not alter the case for finding ways to make rice foods retain all their best natural values.

Just lately news has been released by the Army about the new rice preparation process discovered by a guy who had never seen a rice field until 1938, when he visited California growers whom he found in despair over declining demand for their product. This man who is a Persian-American, Milton Yonan-Malek, soaks field rice in properly temperatured water which opens the pores of the kernel, whereupon a steam-jet pressure system blasts the brown bran layer inside the tissues of the grain. As the rice dries and hardens the vitamin content is locked inside.

FINALLY, the outer husks are removed, leaving a grain which is darker, of almost transparent amber color, and much harder than ordinary mill-polished rice. The Army, the National Research Council, and California college workers have tested and approved the method, so that before long we may all be familiar with "Malekized" rice and find it means larger domestic sales, too. This is because it is said to be more fluffy and uniform when cooked, regardless of variety used.

Experimental rice culture had its start in 1685 down in the Carolinas, where they grow hardly any these days —the zones of production having shifted completely across the southern map to the Gulf and Delta sections, on up to Arkansas, and west to California.

Through a century and a half the main reliance upon rice culture rested with Carolina White and Gold varieties. It remained for that noted plant explorer and father of extension work, Seaman A. Knapp, to bring in the first real Asiatic varieties, in the early nineties. Of the thousands of imported varieties and selections bred from them in our efforts to find bonanza rice sources, very few ever proved worthy of general use under our conditions.

Yet at branch station farms devoted to rice studies and with painstaking cooperation from commercial people and pioneer growers, a few stand-by sorts have been tested. Each year sees new attempts to "make the best better."

If one called the roll of leading rice-plant developers and variety introducers, it would include a group of alert individuals who were happy to do something positive for an infant industry in search of "a home."

The list would carry the names of S. L. Wright, grower of Crowley, Louisiana, whose Blue Rose, Prolific, and Pearl contributed much to stability; and several Federal and State genetic workers, including Charles E. Chambliss, Jenkin E. Jones, J. M. Jenkins, and E. L. Adams.

Much could be said on the side as to the modest and retiring way that such men conduct their devoted quest. In some of our more prominently mentioned crops, success in breeding brings wide acclaim and much renown. With rice, however, as with honeybees and goats, only a small clientele linger around to hear and see what new things have come to light.

ONE might be confronted with a query from the big bread-basket centers of this land as to what significance there can possibly be in better rice-raising, when rice is confined by necessity to restricted places of culture.

That I cannot answer to satisfy the majority. But we certainly know that to engage in public work which will stabilize any staple crop in Dixie is bound to re-act in a protective, although indirect way, for other farm areas.

This country should aim to perfect each region's best natural possibilities, so as not to compete too much with each other on a few major products. In this effort we need a comprehensive plan and a recognition by all of what each is contributing or may contribute. Too often all we have is suspicion of log-rolling and sectional strife. That's no mood to be in if we are to stand by as a big reservoir of food, varied and ample enough to lend a real helping hand in times of suffering like this.

The confident young man stopped in the apartment house hallway to call through the telephone. "Hello, baby," he said. "This is Gideon."

"There's so much noise on the line, I can scarcely hear you," came the voice of a gal on the other end of the line. "Who did you say it was?"

"Gideon, honey. G for gin, I for ice, D for drinking, E for excitement, O for ornery-eyed and N for necking. Got that, honey?"

"Well," answered the gal, "not all of it—but come on up anyhow."

What a pity human beings can't exchange problems. Everyone knows exactly how to solve the other fellow's.

"F-e-e-t," the teacher exclaimed. "What does that spell, Albert?"

"I dunno."

"Well, what is it that a cow has four of, and I have but two?"

So—Albert told her.

CURED

"Join us in a little game of stud, Colonel?"

"Sir, I do not play stud."

"I beg your pardon, I had an idea you did."

"Yes, I once had that idea myself."

A retired business man asked his six sons to Sunday dinner. As they sat down to eat, he said he had not made a will but was going to give $10,000 to his first grandchild. After asking the blessing he looked up to find he was the only one left at the table.

PHEW!!

Two buck privates paused by the roadside to look at a dead animal.

"It has two stripes—what is it?" said one.

"That settles the question," said the other. "It's either a skunk or a corporal!"

"You say he left no money?"

"No, you see he lost his health getting wealthy and then lost his wealth trying to get healthy."

Teacher: "What's the difference between caution and cowardice?"

Tommy: "Caution is when you're afraid, and cowardice is when the other fellow's afraid."

The Sunday school teacher asked her class to write down the names of their favorite hymns. All the scholars busied themselves with pencil and paper and presently handed in their papers. All except little Jane. "Come, Jane," said the teacher, "write down the name of your favorite hymn." Jane wrote, and with downcast eyes and flaming cheeks, handed the teacher a slip of paper bearing the words, "Willie Smith."

There's nothing like a wedding
To make a feller learn,
At first he thinks she's his'n,
But later learns he's her'n.

Beneath this tomb lies Murphy.
They buried him today;
He lived the life of Riley
While Riley was away.

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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.)

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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)

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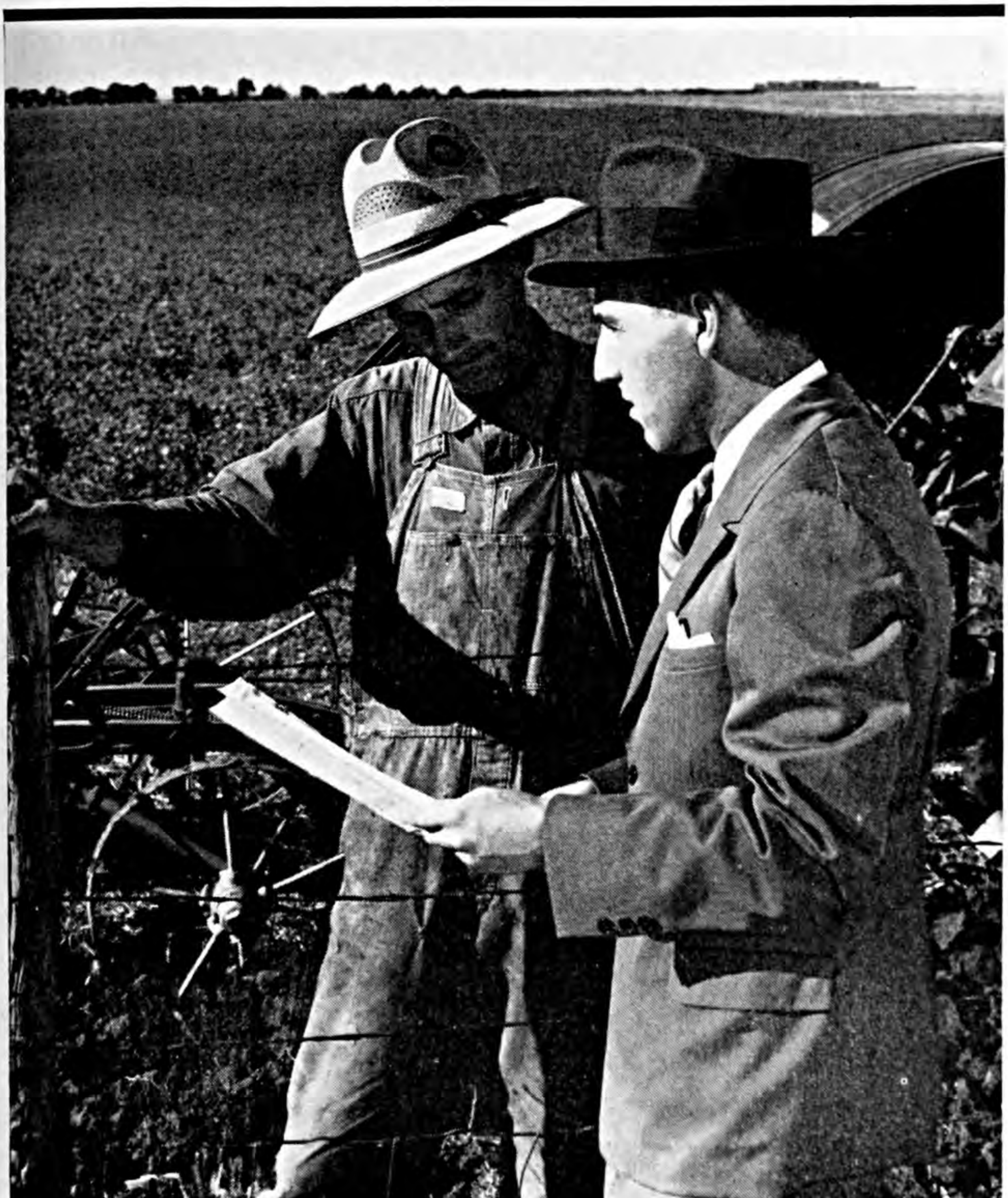

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VOLUME XXX NO. 5

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THE ROMANCE OF THE BLOSSOMS

Better Crops with PLANT FOOD

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Let's Consider . . . . . .

PARITY AND CHARITY

Jeff McDermid

THE chaste moon of Charity has temporarily eclipsed the blazing sun of Parity in our agricultural astronomy. Since the world food plight soaked into our domestic landscape like a sudden flood, the protagonists of parity at any price limit have behaved decently indeed toward the upsurge in demand for bread grains, fats, and oils. They have endorsed the program of famine relief in general, with a few reservations on administrative details and in respect to keeping a proper balance between cereal growing and consumption and grain feeding and livestock raising.

Of course, it is understood that in thus dealing gently with charity we won't neglect our pet parity principles to the point of complete extinction, meaning that farmers will get the current price levels consistent with the ideology and formulae inherent in the parity theory. In fact, by virtue of the bonus being paid for bin scrapings of corn and wheat, the growers of these grains will wind up the season with parity plus—and it will be through a bona fide transaction instead of a sneaking, black-market evasion game.

Inasmuch as it is felt behind the scenes that this famine situation is not something that the 1946 harvests will cure, and that foreign exports will tax our reserves to the limit for a couple of years more, one is obliged to admit that the moss-grown surplus bogey may not give us the hee-bee-jeebies for awhile at least. Whether its gibbering, ghoulish presence will be forever banished by the ambitious hopes of Food and Agriculture Organization is another problem not yet ready for a direct reply. To be sure, their arguments and world-vision planning emphasize the shame of surplus fretting and frustration, but the "how-to-do" is another thing.

And after all, I don't believe I've read a booklet in some time that touched me on the sane side or made me burp more "amens" than the FAO screed put out by Gove Hambidge and staff a few weeks back. If we can get something going along the lines therein suggested, and keep our present charity mood and world brotherhood feeling alive long enough to forestall those back-washes of ennui and forgetfulness, maybe this is going to turn out fine after all.

THAT old surplus spectre was a nightmare of hag-ridden dreams for more years than I can reckon without consulting BAE's latest reviews. We got so tough and disgusted that we classed surplus foods along with weeds, which are simply perfectly good plants that are slightly out of place. That surplus fetish did more to halt the progress of efficient agriculture than all the moon-phase and weather-sign traditions ever hatched. It made county extension folks quiver with anxiety every time they told ruralites how to banish bugs on their broccoli or drive weevils out of their wheat. All anybody could do to counteract it was to point to cost-saving per unit of this and that following the use of modern methods, including fertilizers. It drove more kids off the ranch than hard work. It was a one-sided outlook, too, because usually it related solely to the farm and seldom to the consumer, except that we all wished for some way to extend the stomach and appetite to keep pace with the tractor and the improved fertility.

Charity at home, that old motto of bygone days, had little place in most of the schemes for handling the surplus, except for the school-lunch and food-stamp plan. We paid producers to the limit to reduce or adjust their acreage, thinking only of the dark clouds of storage reserves in relation to active cash demand on the barrel head. We discounted the virtues of having a safe surplus with which to feed our hungry and ill-nourished generation, or at least we did that until Henry Wallace trotted out his Pharaoh story again and proposed an ever-normal granary. The actual need was far greater in some places here in the 1932-34 period than it is in some areas abroad today. Yet we did not cut much of a hullabaloo over it at the time or ask Hoover to scout around for us. (That *would* have been queer at the time, I admit.) Anyhow we almost forgot our own helpless widows and orphans and just yawped at the Government for making emergency jobs to provide them with a meal ticket to share the surplus.

The growth of the surplus scare has marched along steadily with the increase in nonfarm populations who ate more than they produced, and the accompanying decline of the God-fearing working force on farms. Maybe there's a reason for it. Economists have many on tap. Principally the blame for the surplus threat is hung on the contracting stomachs of the shiftless and luxury-loving urbanite, whose bulging pay envelopes even in plenteous times could not absorb the rich outpouring from the modern agrarian horn of plenty. Golf helped some, it is true to give those shut-in lads the exercise they needed to cry for ham and eggs, but the trouble was some of them did not play enough golf; and if they tried to get limber and hungry on ordinary gardening done in approved fashion, the stuff they toted home only resulted in less demand for the proteins currently sold by the farmers. On top of all that mess, the producers and processors got organized against each other and started hollering by radio and magazine in behalf of competing crops.

BESIDES these complications, we started to boom a greater variety of viands. Old-timers conquered the continent on a few rough staples, but the latter-day saints preached variety, so we all fell in and followed the trail of proteins from many sources and vitamins galore, not to mention minerals and just plain appetizers. That was all right, nutritionists said so. From the farm standpoint it was pretty sound too, because it caused more diversification within limits. So both consumers and producers on the face of it were satisfied with variety food preachments. But when as aforesaid the ice cream,

the citrus, the prune, the apple, the milk, the cheese, and the meat boys all got to offering clamoring claims for consumer attention, the net result may easily have been decidedly nil on a bewildered belly, shrunk far below what the capacities of the ultimate consumer should be.

Oh, sure, and I have even seen the dairy breeders wrangle a lot about the respective merits of respective breed milks, rather than to join forces to see how much more economically and regularly they might serve the early morning trade.

Which brings me smack up against that bumbling reason for surplus accumulation, known as inefficient and costly distribution. The complexities of the distribution machinery crisscrossing the land, the web of needless duplication, the waste and the loss—all helped to make the farmer's productive efforts less effective. Even the well-intentioned plans of cooperative marketing associations to bust open this bottleneck do not have the verve and flavor they possessed a decade and more ago. Most folks smile with disdain now when somebody argues that the route from producer to consumer can be shorn of some of its velvet. Except for breaking up a few racketeering elements now levying shameful toll, the dollar-and-cent savings do not appear so likely to happen—at least not so much as back when they asked rural audiences "What happens in the dark?" It happens in broad daylight now, especially the influences of labor unions on merchandising costs.

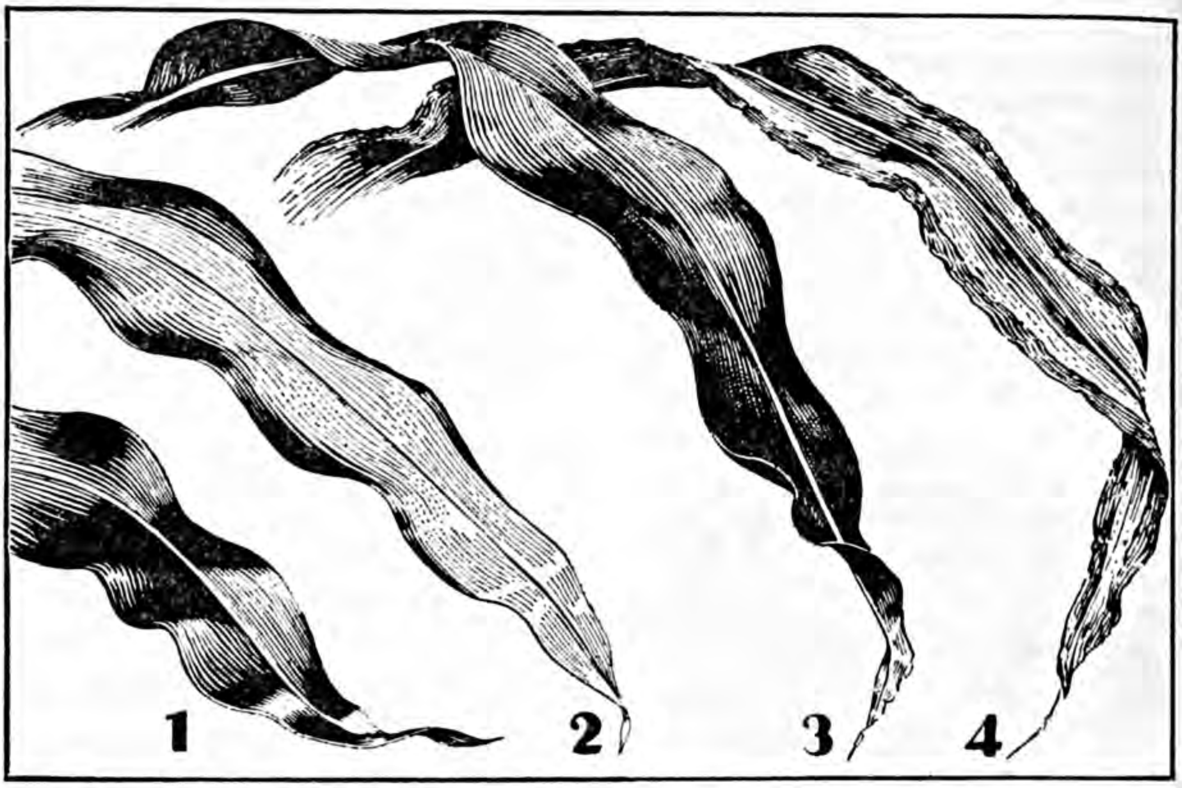
But now after a long war and much waste of food in army, navy, and overseas shipment, and little real thrift at home, we seem to face a temporary period of depleted reserves. Whether we must find the answer in more regimentation on farms and more rationing in cities is not my province to answer.

For the moment we shift our concept of parity from the pocketbook and the price level to the field of adequate human nutrition. We ask what parity means in terms of life sustenance and growth. We even ask that about ourselves in contrast to the more meager diets of those in a less bounteous land. Some of us test the food-parity principle through the use—for just a little while —of meals fashioned on the same level of calories and proteins that hungry Hungarians get.

I HONESTLY think this is rather fortunate. If this world conflict had closed without misery and hunger, no chance for the rise of vital humanitarian ideals would have occurred. I suppose other wars ended this way too, but then the world was wider and such suffering was remote and alien. Now we are neighbors one with another, thanks to science and education. Moreover, the returning veterans translate affairs abroad in ordinary home fashion and bring us nearer to the needy than ever before. It was truly said that America had its citizens in every clime during the war, and hence we are now "encompassed about with a great cloud of witnesses." This again helps to write a firmer peace, after the hungry are fed.

Economists last winter conducted a

(*Turn to page* 50)



Typical effects of plant food hunger, contrasted with normal leaf. No. 1—A healthy corn leaf; No. 2—Nitrogen starvation; No. 3—Phosphorus deficiency, chiefly indicated by a purplish hue, often very noticeable on under side as well as top, and a "firing" of the leaf tip; No. 4—potash hunger.

Learn Hunger Signs of Crops

By E. E. DeTurk

Department of Agronomy, University of Illinois, Urbana, Illinois

IN the field of human medicine, many diseases, such as rickets and pellagra, have been recognized for a long time. Physicians and research men spent years and years trying to find the microbes which caused these diseases. But in the end it was found that they were deficiency diseases, the result solely of the lack of certain essential foods. Similarly, many signs of ill health in crop plants were studied by the plant pathologists, who tried to find microbes on which to place the blame. It was a great step forward when agricultural research workers learned to catalog certain plant maladies as due to fungus or bacterial infection on the one hand, and others as due to maladjusted nutrition. The job is not done. In far too many cases our reply to Mr. Jones or Mr. Brown, who has sent us a specimen is "We do not know."

Balanced Plant Nutrition

Malnutrition signs in plants are nearly always traced to improper nutritional balance, usually a shortage of some nutrient requirement, less often a toxic or poisonous effect of too much. Just what do we mean by the well-balanced condition in the soil that we may call ideal?

It has been known for upwards of a century that some 10 chemical elements are absolutely necessary for the normal growth and reproduction of the common crop plants. The list of these elements, written by the chemical symbols, was immortalized 40 years ago by the late Cyril G. Hopkins in the well-known C-H-O-P-K-N-S—Ca-Fe-Mg, translated, "C. Hopkns Cafe, Mighty Good, from which the I (iodine) was omitted through modesty."

Time and further investigations as well as accidental discoveries have added to this list of necessary plant-nutrient elements four others: Boron (B), Manganese (Mn), Copper (Cu), and Zinc (Zn). These four, as well as iron, are required in such extremely small amounts that they are known as trace elements, because only traces of them are needed. They are also sometimes called minor elements, but we would soon learn, if they were completely absent, that they are of major importance just as truly as phosphorus or nitrogen.

For normal growth these various elements are required in greatly differing amounts. For example, in the average healthy corn plant there is about six times as much nitrogen as phosphorus, 30 times as much nitrogen as of iron, and 1,500 times as much as of copper. What I am coming to is a definition: A well-balanced soil, as to plant feeding, is one that will deliver these different "plant-food" materials into the crop in the *right proportions.* It does *not,* of course, supply them in *equal amounts.*

The accompanying table indicates approximately the amounts of the 14 known essential elements in a 100-bushel crop of corn with the accompanying stalks and leaves.

100 bushels of corn (5,600 lbs.) with its stover (6,000 lbs.) contains:

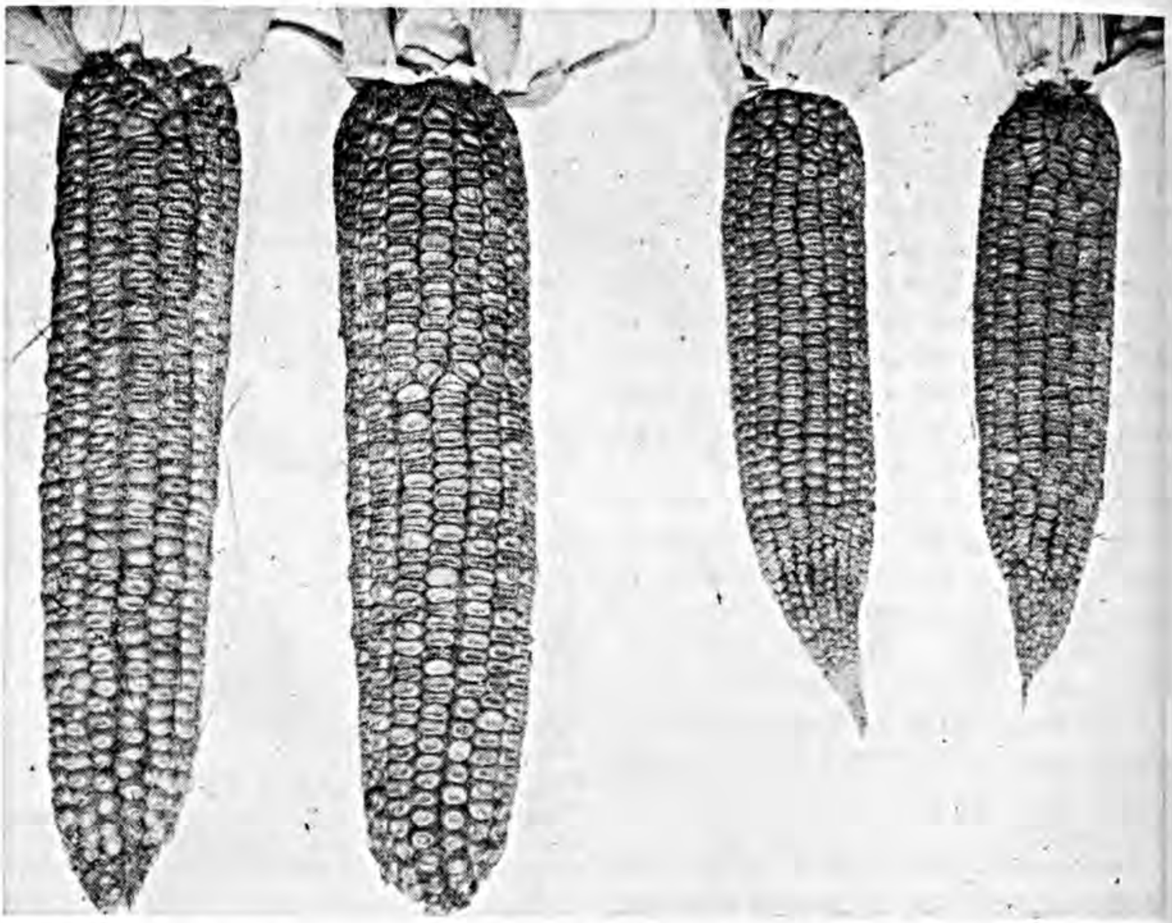
	Pounds
Carbon*–C	5,130
Oxygen*–O	4,560
Nitrogen–N	150
Hydrogen*–H	93
Potassium–K	80
Phosphorus–P	25
Calcium–Ca	22
Sulfur–S	16
Magnesium–Mg	15
Iron–Fe	5
Manganese–Mn	4
Boron–B	0–3 oz.
Copper–Cu	0–1½ oz.
Zinc–Zn	0–1½ oz.
Dry Matter	10,100
Water	1,500
Total	11,600

* Carbon, oxygen, and hydrogen, which the plant obtains from the air and water, amount to 97 per cent of the total weight; the others only 3 per cent. A little of the oxygen comes from the soil in the form of phosphate, HPO_4, nitrate, NO_3, etc.

Phosphorus

In the long slow process of soil formation the weathering of phosphate minerals, together with action of plant roots of the native grass or forest vege-

Left: Corn plants grown out-of-doors in sand cultures (large containers, 10" x 24", 100 lbs. sand), planted 6-5-34 with full, adequate nutrient supply. Center: Same as left except the full, adequate phosphate supply was completly discontinued after the first seven weeks, otherwise complete to the end. Right: Same as center except phosphate supply cut off after five weeks, no normal shoots formed.



Ears to left are from plants receiving nitrogen, phosphate, and potash fertilizer; right, from plants receiving nitrogen and phosphate only. Tapering ears indicate potash deficiency.

tation, released phosphorus, much of which was taken up by these plants and returned to the upper foot or two of soil as part of the organic matter which accumulated through the centuries. This process has gone on so far that today in the dark-colored prairie soils of Illinois from 35 to 60 per cent of the total phosphorus in the plow depth is organic phosphorus. That is, it is part of the organic matter, and is set free for crops as the organic matter decays. Forest soils and the gray prairie contain from 25 to 40 per cent of the total in the organic forms. This is one of the most important forms of soil phosphorus for feeding crops. A century of farming in Illinois, much of it with little or no attention to preserving fertility, has destroyed from a third to half of the virgin soil organic matter, and with it has gone this valuable source of gradually available phosphorus.

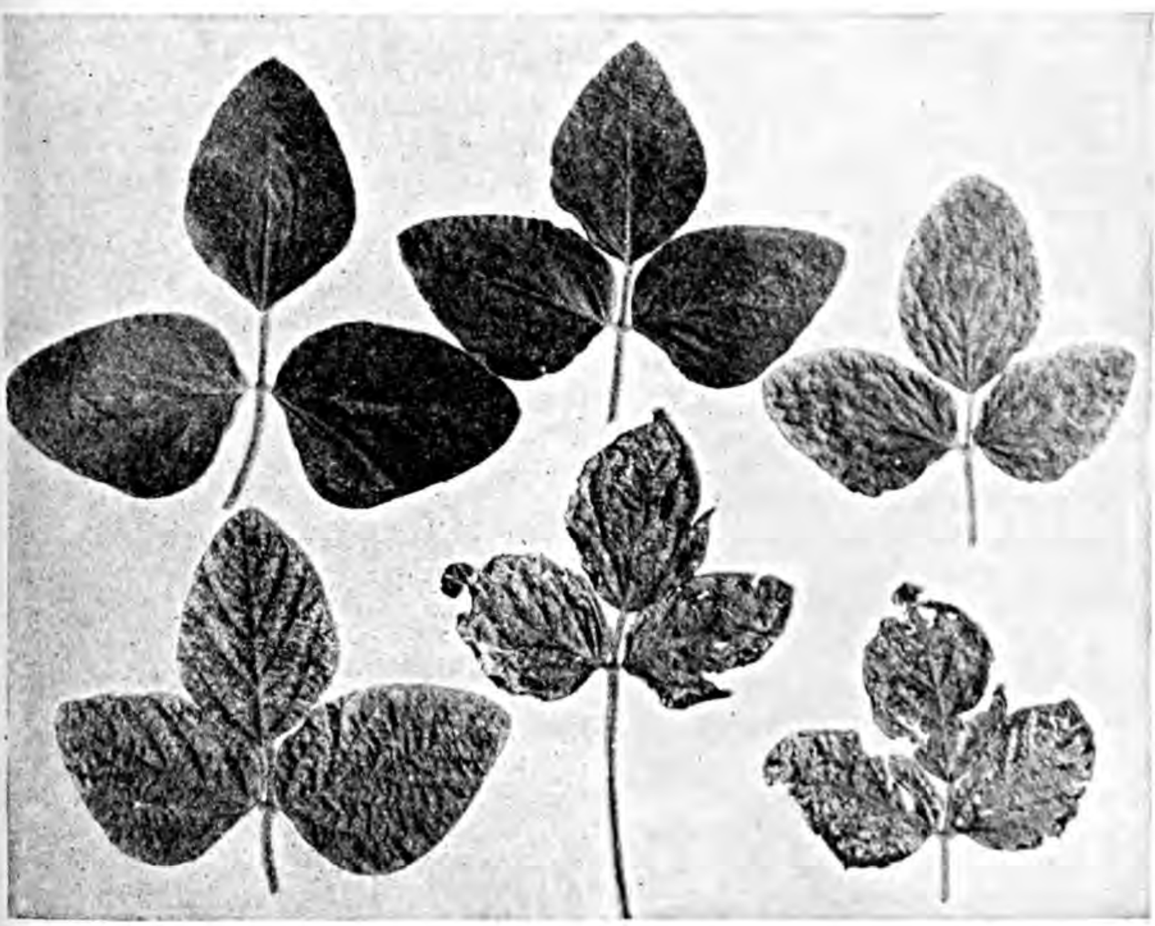
The second important phosphorus source for crops is that which has been absorbed by the clay in the soil. That which was released during soil development, which growing plant roots failed to pick up, was stopped by absorption on the clay, so that the rate of loss in drainage water was and is today very slow. This supply absorbed by the clay has also been greatly reduced by hard cropping.

In general, silt loam and clay loam soils, when placed under cropping conditions, become deficient first in phosphorus or phosphorus and nitrogen, and they become deficient in potassium much later. These groups of soils include a large proportion of the land devoted to farming, especially in Illinois and neighboring states.

Recently I visited a farm in central Illinois on Flanigan silt loam, which is slightly rolling brown prairie. It has been just farmed for many years—perhaps you would rather say "mined." It had not grown clover for many years and the chemical phosphorus test showed no blue color whatever. The potassium test, on the other hand, showed from 200 to 350 pounds an acre. The small yields brought about by exhaustion of the phosphorus and nitrogen reserves in this soil have been too low to encroach seriously on the more abundant native potassium reserves.

The corn on this farm stops growing in June and after a few days a reddish-purple color appears along the central portion of most of the leaves covering the entire width. After a week or 10 days when a few of the leaves have died, the rest regain their normal green color and during the remainder of the season specific symptoms of phosphorus shortage rarely appear.

The main reason for the symptom appearing during the seedling stage of growth is its manner of phosphate "feeding" on the principal forms of soil phosphorus which it must use—organic phosphorus and that absorbed by the clay—and this is true of all plants, not merely corn. Neither form of phosphorus is appreciably water-soluble, nor does it move in the soil. The roots must come to the phosphorus and contact the particles. The available phosphorus supply throughout the soil mass thus becomes honeycombed by the advancing roots while the absorbed phosphorus in the soil between the roots remains virtually intact and undisturbed to the end of the growing season. As a result, only a small percentage of the available phosphorus is removed by a growing crop, and the soil test is nearly as high at the end of the growing season as at the spring planting time. Also, the amount of phosphorus accessible to the plant is proportional to the size of the root system, increasing from almost zero at the seedling stage up to as much as two miles of roots can reach, by spreading through a cubic yard or so of soil, at tasseling time. It is easy now to see why



The foliage of soybean plants deteriorates rapidly when the supply of available potash becomes deficient during the growing season. The leaves first turn yellowish green and become crinkled.

the seedling stage, when the roots contact only a few ounces—maybe even less than one ounce—of soil is the time for severe deficiency symptoms to develop, unless there is a concentration of available phosphorus right at the hill.

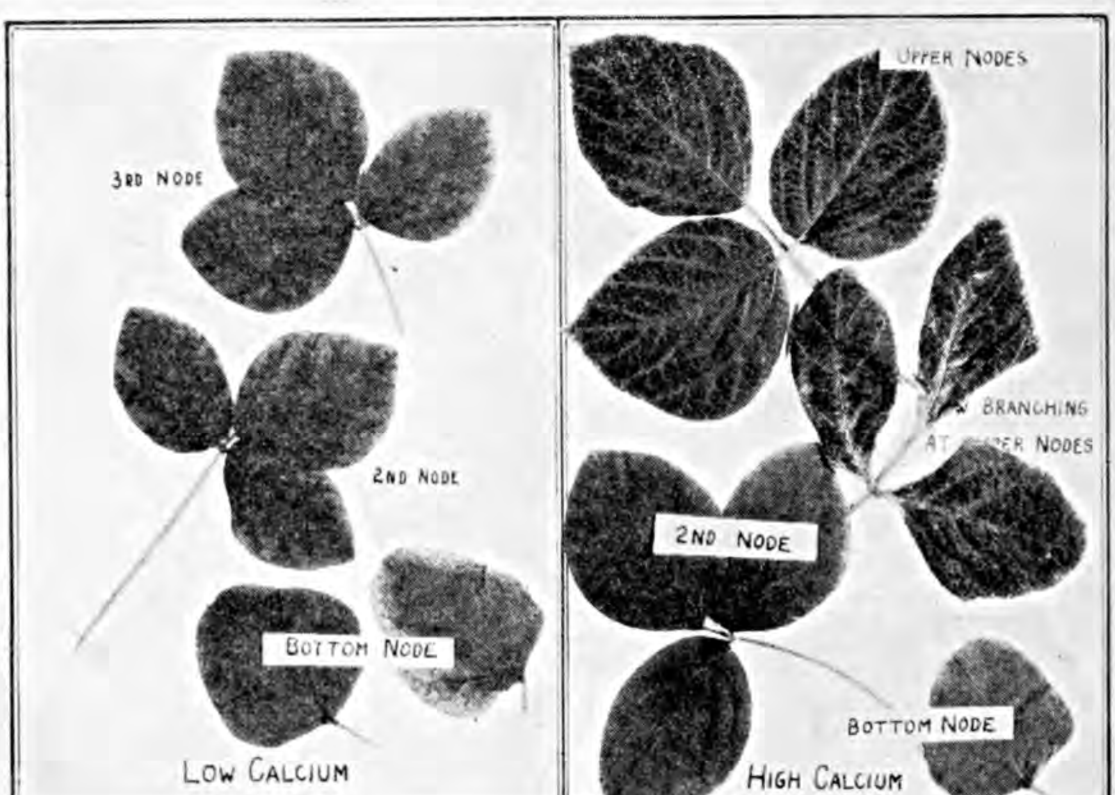
The principal hunger signs in older corn are not easily seen—slow growth, later earing, smaller plant size, and smaller yield of ears in extreme cases.

Aside from a deficient supply of phosphorus in the soil, destruction of corn roots in the seedling stage by insects, principally the grub of the grape colaspis or "clover worm," results in purpling of the leaves. Chemical analysis of the plants shows that this, too, is phosphorus starvation. The phosphorus in these plants is only about half the amount present in healthy corn.

It is difficult to overemphasize the critical importance of the seedling stage of all plants—a time when their root systems are too small for adequate contact with the soil supply of non-movable plant-food materials. Plants stunted as seedlings never recover later and the yields suffer, even though the starvation signs disappear. This is one reason for the benefits from starter fertilizers—small amounts applied by means of attachments on the seed drill or corn planter.

In unusual situations of extreme phosphorus shortage, corn leaves may remain purple long after the seedling stage. This has been observed as late as August in a long-farmed, forest, hill-soil underlain by bedrock at 24 to 30 inches in southern Indiana. Nitrogen was equally deficient and nitrogen hunger signs were equally pronounced along with the phosphorus symptoms on the same plants.

The formation of purple pigment in plants is an inherited characteristic possessed by nearly all lines of corn and many other species of plants. A few inbred lines of corn have been found, such as CC5, whose leaves never become purple. The plant breeders would say these plants have no gene for forming the purple pigment. These



Soybean leaves showing calcium starvation at left; toxicity from super high concentration at right. (Sand culture)

plants show no symptoms in the early stages of phosphorus starvation when they should turn purple. A little later if the shortage continues, the lower leaves turn yellow at the tip and down the middle rib followed after a lag of a week or more by death of the leaf tissue and turning brown. The edges of the leaves stay green longest. This "firing" progresses from the lowest leaves upward and is practically identical with the symptoms of nitrogen starvation; but it is rarely if ever seen in the field because soil phosphorus deficiency rarely becomes severe enough. So you are safe in considering this yellowing and firing in the field as due to lack of nitrogen rather than of phosphorus.

What one sees as symptoms is a reflection of what is happening inside the plant. About half of the phosphorus in a growing plant is in the same simple, water-soluble form as when first taken up from the soil. It is being saved up for the reproductive stage when it will be rushed into the young developing seeds. The other half is changed into the complex organic structure of the living plant cells, chiefly in the nucleus of these cells where indeed many of the most important life processes are started and carried on.

Now when the supply from the soil slows down or stops, the older lower leaves which have already performed a fair share of their purpose in life easily give up their surplus, a soluble phosphorus, which is moved to the growing tip at the top of the plant with no ill effects and no loss of color from these older leaves. But when the soluble phosphorus has all been moved out and the life substance of the leaf itself starts breaking down to give up its phosphorus, the green color of health fades out, the yellow which was there all the time is unmasked so that it is now visible, and soon the leaf dies. However, the growing tip and younger leaves have been kept alive. The plant, though crippled, is still able to function.

A serious crisis may be met when reproduction starts. When the newly fertilized ovules begin to develop into seeds, a larger supply of phosphorus is quickly called for. If the soluble reserve in the leaves and stems has been used up to keep the plant alive and growing, the leaves may yellow and die within a few days, and seed production will be greatly reduced and the quality poor.

I have discussed this one symptom in detail because in understanding this one, we have established some milestones and can pass along with mere mention of variations in our study of other deficiencies.

Before leaving phosphorus you may wish to ask, what about the rich black soils, mostly clay loams, that have never yet needed phosphate additions, and look as though they never will. We merely need to note that these soils were much better endowed than the average with both organic matter and clay, the two great absorbers and preservers of soil phosphorus. They are all vulnerable—some are deficient now, others soon will be, and all of them eventually.

Potassium

In the soil the situation of potassium is in some ways similar to that of phosphorus. It is not able to move through the soil, following water movement, because, like phosphorus it is absorbed on the surface of clay particles so that plant up-take of potassium requires that the roots come in contact with the soil supply. In other words potassium feeding is by root contact and only the film of soil immediately surrounding the roots is denuded of its available potassium, which is perhaps $\frac{2}{3}$ as high in the entire root zone at the end as at the start of the growing season.

But the condition of soil potassium differs from that of phosphorus in an important respect. One of the common varieties of soil clay is itself a potassium mineral, and contains potassium atoms throughout its interior much as the printer's ink in a book is distributed in layers between the book leaves, with the marginal spaces partly or wholly free of potassium, where it has been weathered out by water action, as the marginal spaces in the book are free of printer's ink.

This is the soil reserve from which comes the supply that has maintained the potassium fertility of many soils through a century of cropping. But it will not last forever. It is the widening of those low potassium margins of the clay particles, along with the complete breakdown eventually to ultra-fine clay which is nearly devoid of potassium, which is bringing more acres of Illinois Corn Belt soils into the potassium deficient class every year. Let us examine these different soil areas.

The level grassland and forest soils of southern Illinois have seen exceedingly exhaustive weathering during the ages of soil formation with two definite effects on potassium fertility. The dirt is the long-continued leaching, which, even at a slow rate, eventually removed in drainage waters much of the more available soil potassium. That is, it wore down the potassium supply in the clay particles. During the same time much of the potassium-containing clay was moved down into the subsoil where it formed a tight clay-pan which few roots can penetrate. To be sure, phosphorus, calcium, nitrogen, and possibly magnesium have become deficient, too, and with low balanced fertility, as we have seen, hunger signs are not pronounced, even with 25-bushel corn yields. But when soil improvement is begun by the use of limestone, phosphates, and nitrogen through legumes, but with the neglect of potassium, then potassium hunger signs are quickly brought on, as can be seen on many southern Illinois farms on which the owner has conscientiously carried out the incomplete lime-phosphate-legume program.

Another soil group of typically potassium-deficient soils includes the peats and mucks. These soils are composed almost entirely of organic matter. The potassium in plants is all soluble in water at all stages of growth. It is never, so far as is known, a part of the living tissues of plants. But it is just as necessary as the man on a tractor. He is not a part of the tractor at all, but it does not plow corn without him. Potassium is not a part of the organic tissues of the plant, but the plant cannot live without it. It is now easily seen that as swamp soils were developing, most of the time in water, the potassium was dissolved and washed away. Mucks and peat soils contain only from $\frac{1}{10}$ to less than $\frac{1}{20}$ as much potassium as the adjacent upland soils, and they also lack the clay which if present would greatly retard the loss of the potassium by absorbing it.

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Alfalfa shows boron deficiency by a yellow chlorosis affecting first the upper part of the plant. The surest symptom is death of the terminal bud of the main stem and growth of upper branches until they resemble a rosette.

I Saw It Happen in the Soil-Testing Laboratory

By Ivan E. Miles

Soil Testing Division, Department of Agriculture, Raleigh, North Carolina

WITH the enormous amount of soil-testing work being done and the tremendous interest together with the urgency in need for this type of work, it is felt that the workers in this field might profit by swapping observations. This article has been prepared with this in mind. As a basis for these observations, 65,000 samples have been tested in this laboratory during its five years of existence.

Personnel

In the beginning, the laboratory was manned by graduates of an agricultural college, majoring in agronomy or general agriculture. The manpower shortage brought on by the war made it imperative to use girls. Some of these girls were poorly trained in chemistry. However, by careful selection of those who had a sense of the importance of details, and by exercising considerable care and patience in their training, it has been found that they can do very satisfactory work. Actually, they have done so well that it is anticipated that ultimately, even under normal conditions, girl technicians will be used in the laboratory with only one well-trained chemist supervising the work. The supervisor may not have to give more than one-third of his time to this particular phase of the work. Of course, the agronomist will have to classify the soils as to texture and drainage, and make such other notes on the physical characteristics of the soil as deemed necessary. This type of set-up would necessarily require considerable supervision; but the over-all cost is greatly reduced.

Fig. 1. Girls who have a sense of the importance of details have been trained to do very satisfactory work in the laboratory.

Sampling

Sampling very probably is the weakest link in the whole soil-testing program in North Carolina. The soils of this State vary from the rough stony out-crop of the Appalachian mountains to the muck soils of the coast approaching sea level. Even within a small field —all of the same type—there are tremendous variations. Under the conditions that exist in this State, the procedures set forth for collecting soil samples by the Florida, Kentucky, and Colorado Agricultural Experiment Stations would often result in very poor samples. Eight to 10 sub-sample units, composited into one sample, could easily be very misleading.

There is nothing unusual about the field shown in Fig. 2. In fact, insofar as appearance is concerned, perhaps most fields of the State would be more variable than this one. It is interesting to note that in the 20 samples taken within this field the pH varied from 6.1 in the case of one sample to a pH of 5.1 in the case of another. Furthermore, the extremes in potash and phosphorus varied from high to low. The composite sample gave an intermediate test—with the possible exception of potash, which appeared to be approaching the upper range. The field is probably too large for one sample. The instructions in North Carolina for collecting soil samples designate that, if the field is larger than 10 acres, it should be divided into five-acre units; perhaps five acres will be large enough in all cases. The instructions for collecting soil samples also designate that a minimum of 15 sub-samples be composited to represent the field.

Distribution of Samples

The testing of soils as a basis for the liming and fertilization program naturally has its greatest appeal to the farmer immediately before planting time. When the laboratory was first started, there were tremendous peaks in our work, most of it coming in the late winter and early spring. A much smaller peak came in the fall; and the remainder of the time, the work was fairly light. Obviously, this would make for several problems. More personnel was needed during the peaks of the work than during the remainder of the year; and since the personnel generally had to be trained, this was quite a problem. Furthermore, the farmer usually wants the report upon his soils immediately after submitting them to the laboratory. If he has to wait too long, he loses interest and goes ahead and buys his fertilizer and lime. Considerable effort has been made to show the farmer that, if the sample is taken properly, in most instances it can be collected well ahead of time without very greatly affecting the results of the test. As a result of this effort, together with the recent necessity for buying fertilizer early, the samples are better distributed over the year at the present time. For instance, during the last half of 1945, there were over 8,000 samples tested. This type of distribution enables

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Fig. 2. The field from which 20 samples were collected did not look unusual.

Recipe for Writing the AG News Story

By Marjorie B. Arbour

Agricultural Extension Editor, University of Louisiana, Baton Rouge, Louisiana

THERE'S no surer way for a novice to do a good job than by following a recommended recipe. Old colored mammies and experienced heads might depend on the unreliable system of unmeasured pinches and dashes in making various concoctions, but the inexperienced always does well not to rely too much on ingenuity.

A recipe for writing the ag news story built around this idea, would include the following:

1 quart of WHO
1 cupful of WHAT
1 tablespoonful WHEN
1 teaspoonful WHERE
1 dash of HOW
1 pinch of WHY

Directions: Supply the answer to all these questions. Select the most significant fact in the story with which to start. Mix together in LEAD paragraph and you'll have a synopsis of the event.

"WHO" Adds Tang to the Story

WHO—an important ingredient—is probably one of the most fascinating questions in the English language. Each name carries its own audience. When you start taking your notes, get all the names that figure in the event.

Always identify. Example: John Jones, veterinarian, will help to vaccinate pigs entered in the fall Livestock Show. All members are urged to have their animals at the schoolhouse at 10 o'clock Thursday morning, July 14.

"WHAT" Keeps Story from Falling Flat

Simply to include a WHAT is not sufficient. Make sure that your WHAT tells the reader just what the story is about. Too often reporters tell only half of the WHAT. For instance: H. C. Lecompte, county agent, gave a demonstration to club members, etc. Giving the demonstration is the WHAT all right, but it doesn't tell specifically WHAT took place. Better to say—How to plant hybrid corn was demonstrated, etc.

Measure "WHEN" with Extra Care

Never fail to get the exact time that figures in the event. If the story is an advance account, (that is, one written before the scheduled event happens), the exact hour plus the day and date should be given. We all look to the paper to check on the WHEN of a coming event. For example: How to write news stories will be explained by J. W. Smith, extension editor, at a meeting of adult and 4-H reporters to be held at the Library Monday afternoon, April 14, at 2 o'clock.

Put in Proper Amount of "WHERE"

In the advance story the WHERE must be more specific than in the follow-up story. Persons planning to take part in the event need the exact information as to WHERE the meeting will be held. Too many stories contain incomplete WHERES. For instance the WHERE is frequently answered this way: How to use electricity economically will be demonstrated on the campus of the State University, etc.

The University campus covers acres. It's an easy matter to kill an hour's time looking for the place of the meeting when it is stated indefinitely. Give the name of the building. Go further and state the name, or number, of the room. To answer the WHERE in the advance story, write it in this manner: How to use electricity economically will be demonstrated by James Hall, engineer, in room 203 in the Engineering Building on the University Campus, Saturday morning, June 26, at 10 o'clock.

"HOW" and "WHY" Like Salt and Pepper

The addition of the HOW and WHY means a better flavor to the story. If the story admits of the use of the HOW, the chance for writing a tastier LEAD is greater. In some stories, however, the HOW is implied, for instance—seldom does the newspaper tell HOW a speech was delivered. If a specialist gives a demonstration on vaccinating a hog and uses a live animal, this addition of the HOW helps the LEAD: Using live hogs in the demonstration, John Smith, county agent, showed a group of farmers how to successfully vaccinate hogs for cholera. The demonstration was held on the Jones farm, June 24.

WHY, as mentioned before, is in the same class with HOW. It is also implied in many LEADS. A LEAD, including the WHY has more flavor. Example: If the ground is fertile it is advisable to use only about five pounds of a standard-grade fertilizer per 100 sq. ft. in gardens, advises Edward Lott, assistant county agent.

Here Lies the Body!

That part of the story which follows the LEAD (the first paragraph) is called the Body. It is composed of details of the main facts mentioned in the LEAD. Just how many paragraphs you devote to the minor facts depends on the importance of the story. Keep paragraphs within 100 words in length. Sentences should not exceed 16-18 words. Always start each paragraph and each sentence with a significant item.

There are many other points that might be stressed in using this recipe for writing the ag story. Try your hand at "cooking up a story." Try and then try again. Remember the first airplane would not fly.

Success will crown your efforts if you'll "keep your fingers in the dough." Keep them there until you're satisfied that the finished product will be well done!

Efficient Fertilizers Needed for Profit in Cotton

By W. L. Nelson

North Carolina Agricultural Experiment Station, Raleigh, North Carolina

COTTON is in the spotlight at the present time. One of the fears which is being expressed for its future is related to its inability to compete with other crops from the standpoint of profits per acre. This phase of the problem demands that we devote our efforts to increasing the efficiency of production of cotton.

There is a reason, or reasons, why a given acre of cotton does not produce two or even three bales of cotton. The weather is perhaps blamed more often than any other one factor. In the Coastal Plain area the boll-weevil damage is the next best excuse presented. Additional reasons are not so specific, however.

The majority of the cotton farmers use adapted cotton varieties, realize the importance of good stands, and in general do a good job of cultivation. The practice of supplying an ample amount of all the nutrients is usually overlooked, however. In observing the growth of cotton in farmers' fields, many evidences of inadequate fertilization are seen. Even then, only the most pronounced deficiencies can be discovered by visual methods.

Some of the general effects of nutrients on yields, obtained the past few years by the North Carolina Agricultural Experiment Station, follow.

Proper Fertilizer Placement

One of the first steps in proper fertilization of cotton is to obtain the maximum efficiency from the nutrients supplied. The results presented in Figure 1 show the importance of band-

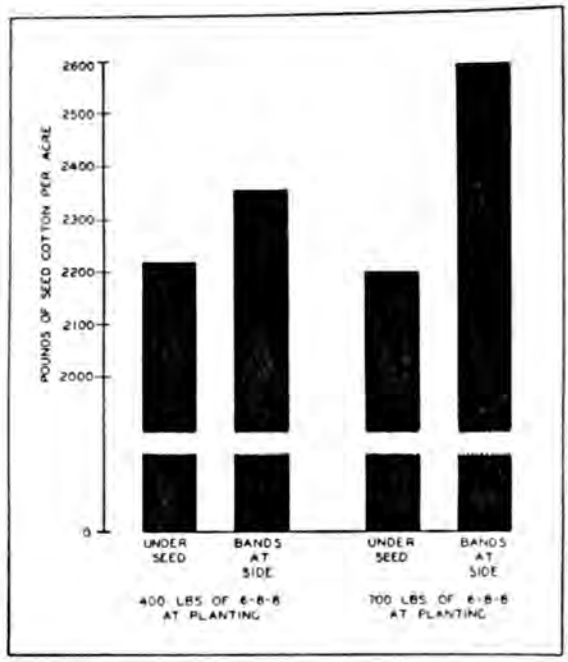

Fig. 1. Band placement makes for more efficient use of high amounts of fertilizer on cotton.

placement of fertilizer in obtaining benefits from greater amounts of fertilizer.[1] With 400 pounds of 6-8-8 at planting band-placement, as compared to under-seed placement, increased the yield of seed cotton 134 pounds per acre. With under-seed placement there was no benefit from higher amounts of fertilizer at planting. With the band method of placement, however, 700 pounds of 6-8-8 gave a substantial increase in yield with an advantage of 393 pounds of seed cotton being obtained.

Hence, if one of the factors limiting yields is an inadequate supply of nutrients, maximum returns from additional

[1] J. J. Skinner, W. L. Nelson and C. W. Whittaker. Effect of salt index, analysis, rate and placement of fertilizer on cotton. J.A.S.A., 37: 677-688. 1945.

Fig. 2. Cotton growth on September 15—left, 60-50-0; right, 60-50-90. The yields were 988 and 1,550 pounds of seed cotton respectively. Norfolk very fine sandy loam (0.04 m.e. exchangeable potash).

amounts of fertilizer can be obtained only with proper placement.

Potash

The need for adequate amounts of potash for cotton has been widely recognized. (See Fig. 2). The removal of potash by cotton is low, as a two-bale crop removes only about six pounds of K_2O in the lint and 22 pounds in the seed. Oftentimes, however, cotton is grown in rotation with crops which remove rather high amounts of potash. The cotton plant is a weak feeder for potash and hence the potash must be supplied directly to the cotton crop.

The importance of the distribution of potash in a cotton-peanut rotation is shown in Figure 3.[2] The experiments were conducted for a period of six years. Direct applications of potash to cotton were more effective than applying part to cotton and part to peanuts. On every soil 48 pounds of K_2O directly on the cotton gave the highest yield. The yields of peanuts were not affected significantly by the potash applications.[3]

In addition to the effect of potash on the production of lint, the effect on the composition and yield of the cotton-seed must be considered. The percentage of oil in the seed was increased from 15.6% with no K_2O (adequate nitrogen) to 18.2% with 60 pounds of K_2O per acre. (See Fig. 4.) With 90 pounds of K_2O (not shown in Figure 4) the oil content was increased to 19.0%. The total amount of oil was increased 60 pounds per acre with 60 pounds of K_2O. The percentage of nitrogen in the seed was decreased by the additions of potash but there was practically no effect on the total amount of nitrogen per acre. (See Fig. 5.) The yields of seed cotton for 0, 30, 60, and 90 pounds of K_2O per acre (with adequate nitrogen) were 1386, 1494, 1751, and 1794 pounds per acre, respectively.

Nitrogen

Of the three major nutrients nitrogen is the nutrient removed in greatest amount in the cotton crop. A two-bale

[2] J. J. Skinner, W. L. Nelson and E. R. Collins. Potash and lime requirements of cotton grown in rotation with peanuts. J.A.S.A., 38: 142-151. 1946.

[3] Colwell, W. E., and Brady, N. C. Soil Fertility studies with peanuts, N. C. Dept. Agr. Bul., Fall 1942-Spring 1943. (Page 54.)

crop of cotton removes 50 pounds of nitrogen in the seed alone and an additional 15 pounds in the lint. The estimated quantity of nitrogen used per acre on cotton in North Carolina in 1943 was 25.6 pounds.[4] This means that on most of the cotton soils sufficient nitrogen was added for about one bale of cotton and that a large share of the cotton was suffering from nitrogen deficiency. Unless the cotton is grown after legumes turned under or on dark soils which will furnish some nitrogen, a two-bale crop cannot be expected.

An average of the data from experiments covering long periods in the fertilizer-using section of the Cotton Belt shows that yields of seed cotton were increased by increments of nitrogen up to 48 pounds per acre.[4] The data for larger applications were not given.

The winner of the 1945 five-acre contest in North Carolina produced 1,416 pounds of lint per acre. He turned under a heavy lespedeza sod in December and applied a total of 800 pounds of 4-10-6 before planting. Two hundred pounds of nitrate of soda were side-dressed. This is a total of 64 pounds of nitrogen per acre in the fertilizer alone.

In addition to the effects of nitrogen on the yield of lint there is an effect on the cottonseed. Sixty pounds of nitrogen per acre, as compared to 35 pounds, decreased the oil content of the cotton-seed but still increased the total amount. (See Fig. 4.) With adequate potash, additions of nitrogen increased the percentage of nitrogen in the seed as well as the total amount. (See Fig. 5.) The yields of seed cotton for 10,

[4]J. J. Skinner. Use of commercial fertilizers in cotton production. U. S. D. A. Circular 726. 1945.

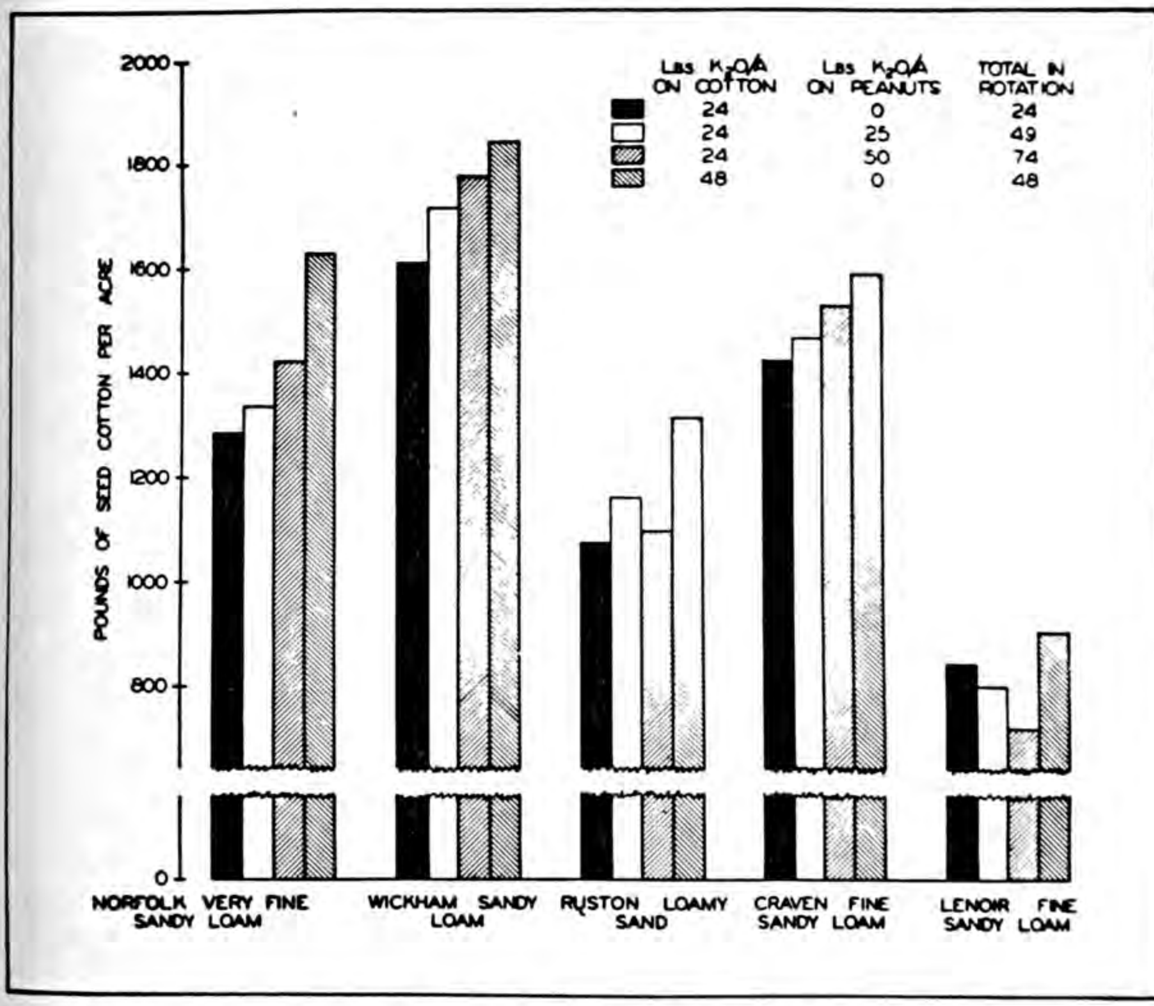

Fig. 3. In a cotton-peanut rotation applying all the potash on the cotton is more effective than applying part on the cotton and part on the peanuts.

35, and 60 pounds of nitrogen per acre (with adequate potash) were 959, 1482, and 1751 pounds per acre, respectively.

One of the reasons for the inadequate nitrogen fertilization of cotton is that the growers, in the Coastal Plain at least, are afraid of too much weed in a severe boll-weevil year. There is probably no one general practice which would do more to start North Carolina cotton yields climbing than a program of boll-weevil control. If the grower knew that he could check the boll-weevil for a few days at the time the cotton plant was setting bolls, he would not be so hesitant to use those practices which would give him more growth.

Phosphate

A two-bale crop of cotton will remove approximately 30 pounds of P_2O_5 in the lint and seed. While the response of cotton to applications of phosphate is related to the content of soluble phosphorus in the soil, phosphate tends to hasten the maturity of the cotton, and responses occur more frequently in years of severe boll-weevil infestation.

The responses from applications of phosphate in some experiments in 1944 and 1945 are shown in Table 1. In the first three experiments, 60 pounds of P_2O_5, as compared to 20 pounds, increased yields at two locations under conditions of severe boll-weevil injury. The soils contained 8 and 43 p.p.m. of soluble P, respectively. The soil at the third location contained 43 p.p.m of P but there was little weevil injury and no yield response.

On Cecil gravelly loam, a Piedmont soil, there was only a trace of soluble P in the soil. (See Table 1.) In 1944 and 1945, 100 pounds of P_2O_5 per acre increased the yields of seed cotton 598 and 883 pounds, respectively. At another location, on Norfolk sandy loam (Table 1), the soil contained 18 p.p.m. In 1944, with little weevil injury, there was practically no response to phos-

(*Turn to page* 40)

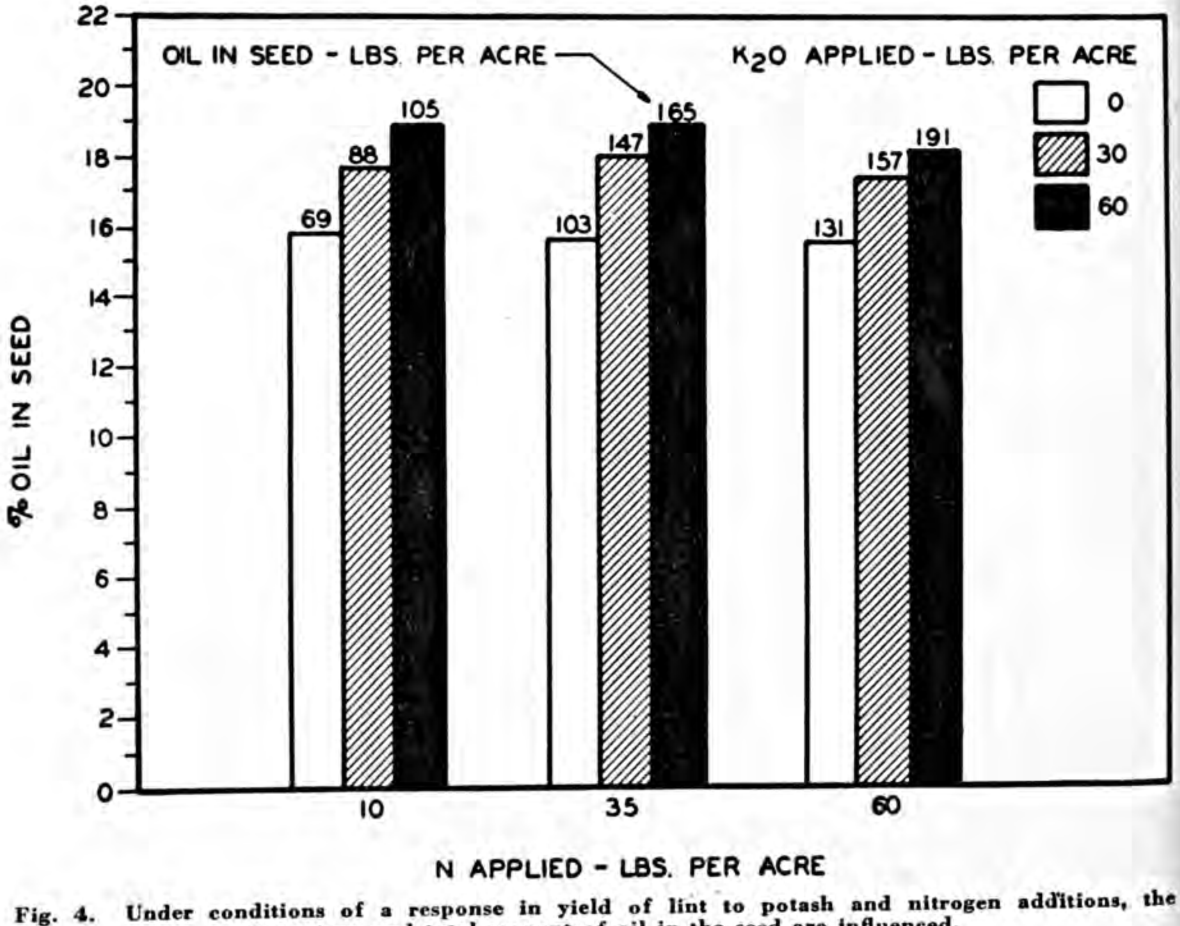

Fig. 4. Under conditions of a response in yield of lint to potash and nitrogen additions, the percentage and total amount of oil in the seed are influenced.

Erosion, ceaseless, devastating, and ugly, keeps knawing away at this gully in a sloping pasture field near the Hardin farm. This is the kind of gully Hardin, King, and Krelder have healed through good plant food, good grass, and good management.

The Soil Is Our Heritage

By Francis Murray

Assistant Extension Editor, Purdue University, Lafayette, Indiana

THERE is an adage about the soil, "You can't take more out of it than you put back." These ancient words of wisdom were respected but not obeyed during the first century of America's road to agricultural progress. Now there is a rising swell of interest in the comparatively new science of feeding the soil. It comes, in many sections, too late, but in others in time for the individuals tilling the soil to become conservation-minded.

Many farmers have found new hope in the wartime upsurge in prices which has enabled them to furnish nourishment for their thin, mineral-hungry soil. This plant food has helped to hold up production, and production with good prices helps buy more plant food. But much of the cropland has lost more plant food than it gained during the recent war years and can never again produce crops in abundance without fertilizers.

How did our land get this way? There are men everywhere who can tell you the story. The history of nearly every farm has a lot in common with every other farm.

Consider, for example, a 96-acre farm in Huntington County, Indiana. Its history, as far as American farming is concerned, started around the days when the Miami Indians roamed the nearby Mississinewa and Wabash river valleys.

White settlers, who pushed across the Ohio territory to stake out what is now the Hardin farm, found there a great virgin hardwood forest.

The thick undergrowth served as a haven for a multitude of wild fowl and animals. When the foliage tumbled down in autumn it lay where it fell and served as a sponge to retain the water from the melting snow and the spring rains.

It was a hazardous, tedious, and difficult task the pioneer farmer faced. There was more wood than he needed; more than he knew what to do with. The trees that were long and straight and easily split, he converted into a crude dwelling, rail fences, farming implements, and furniture. But there was much too much timber. The quickest way to clear the land was to hack down the trees in the fall and burn them in the spring. Thus there was room to grow corn and wheat and flax between the stumps.

The topsoil was deep and mellow and rich. The rainfall was abundant, the crops grew quickly, and the harvest was bountiful. Growing the crops, once the land was cleared, was less difficult than processing them, a task that was done largely within the home or the frontier neighborhood. Any surplus crops were hauled away and traded for necessary metal products, sugar, and gunpowder. Most of the other essentials of life were gleaned from the harvest.

From the first year the land on the Hardin farm was cleared the soil was tilled relentlessly. Year in and year out the fields were planted to corn or wheat. In spring it was easier to burn off what remained of last year's vegetation than to plow it under.

When more fields were cleared and when the first generation of frontier children grew to manhood it became necessary to stock the farm with more animal power. Then it required some domestic hay in addition to the volunteer hay to feed the horses in winter. That changed the crop rotation a little, but there was no rest for the soil. The tenant of the land noticed the soil was compacting on the high ground. In dry seasons great clouds of dust arose from the open fields, and the heavy rains made the creeks muddy from the silt that was washing from the cornfields. Little gullies began to appear on the slopes.

Each succeeding generation saw the gullies widen and deepen, and the creeks became muddier each year. The

A few years ago this grassy valley was cut up with gullies "you could bury a horse in," says County Agent Walter Rusk, commenting on the farm. Grass waterways, good fertilization and management have resulted in healing over the gullies.

Hardin and King are shown in the heavy stand of bluegrass that supplies more than abundant pasture for their 30-head of Guernseys. There is always more pasture than the herd needs on the 96-acre farm, but the owner and operator are bent on returning organic matter to the depleted topsoil.

wild game and wild fowl diminished in numbers. Birds that came in great multitudes during the summertime were noticeably fewer; and the insects became increasely numerous and troublesome. Some years they damaged the crops.

The struggle to make a living on the Hardin farm became more and more difficult. Sometimes there were almost total crop failures. It seemed the summers got drier each succeeding year. The soil was noticeably less productive. Some of the fields became so gullied they had to be abandoned to pasture.

By the turn of the present century the Hardin farm was scarcely producing a living for a family of average size. It became necessary to obtain some acreage in addition to the original 80. Sixteen adjoining acres were secured and helped to offset the acres that were being taken out of cultivation.

The operator of the farm decided it might well become a dairy farm. There was the city of Huntington less than five miles away, and the low ground still supported a good stand of pasture grass. Some winter feed could be raised on the tillable high ground.

The dairy venture on the Hardin farm was a partial solution to the problem of making the tired, worn-out soil produce a livelihood. More land might have been obtained but money was "hard to get laid up," and so the next best move was to rent some additional land for growing winter feed for the dairy herd. By now, half the Hardin farm was pasture and of that which remained, little was productive. The little creek went dry each summer. The last bit of woodland was cleared for cropland.

Sam Kreider, who owned the farm before Hardin bought it, had struggled to his death trying to make an honest and decent living; and the farm, as a productive unit in a competitive age, was dying with him. Leonard Kreider, the son, had left the home farm to work in the city because there wasn't a living on the farm for both father and son.

When the elder Kreider died, Leonard came home to continue the problem of getting a living from the farm. It was in the late thirties. Times were extremely difficult. Prices were low, and taxes, set for the farm when it was more prosperous, were high.

Almost hopelessly young Leonard Kreider toiled against seemingly insurmountable odds in an effort to keep the home place producing, producing at least a living for himself and his widowed mother.

The county agricultural agent told him that if he could apply some lime to the soil and get sweet clover started it might build up the ground and at the same time the sweet clover would make pretty good dairy roughage. It was worth trying, but the farm income wouldn't stand much of a cash outlay for lime. The young farmer discovered the operator of a limestone crusher nearby who would give away the pulverized portion of the stone for the hauling since it was unfit for road surfacing. Kreider hauled the refuse lime to his farm by team and wagon and shovelled it onto the soil. Every acre, pasture land and cropland, was coated with lime.

The lime made the sweet clover grow. When the sweet clover was turned under, the corn crop that had gotten down in production to less than 25 bushels per acre began to increase accordingly.

The county agent, impressed with the sincere efforts young Kreider made to restore the old farm to productivity, recommended the farm to Purdue University as one of a group throughout the State which were being selected as test demonstration farms, in a project sponsored jointly by The Tennessee Valley Authority and the University.

The University, in an effort to find practical and profitable means for restoring lost fertility to the various types of soil in the State, had a plan whereby the farm operator was offered the technical services of the University in return for his cooperation in carrying out subsequent suggestions which included modern soil conservation and restoration practices. Under the plan, the financial returns of the farm were entirely in the hands of the operator although he was required to keep an account of costs and profits for comparison.

The farm was to remain as a dairy farm, but some of the fields were to be rearranged. The rented acreage in addition to the Kreider farm was not to be affected but was to be used for growing additional corn for winter feed.

Kreider went into the plan with whole-hearted enthusiasm. He filled in gullies and sowed them to grass. Grass

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The house on the Hardin farm is occupied by operator Marvin King. Along with the farm the house, too, is getting its face lifted. New landscaping, a new heating plant, and other modern conveniences are being installed. In an ideal owner-operator relationship, King goes ahead with the improvements. He is shown here preparing to rebuild the front porch.

Corn Production In Mississippi

By J. M. Weeks

Department of Agronomy, Mississippi State College, State College, Miss.

APPROXIMATELY 2⅔ million acres of corn and a half million acres of oats and other small grains are planted in Mississippi each year. The low average yield of 15 bushels of corn and 30 bushels of oats to the acre produce only 65 to 70 per cent of the grain needed for feeding the number of livestock now on farms. The State has always been a deficient feed-producing area, along with other southeastern states, and the number of grain-consuming animals is steadily increasing.

Corn has been a "stepchild" in its treatment compared with the cash crop, cotton. Probably 90 per cent of the cotton acreage receives reasonably high rates of recommended fertilizer, while not more than 10 per cent of the corn receives any fertilizer at all. This difference in treatment cannot be justified on a basis of difference in returns from the dollar spent for fertilizer for the two crops.

Junior Merle Hester, Iuka, Mississippi, grew 130½ bushels of corn per acre in 1945.

Corn experiments in Mississippi for more than 20 years have shown that nitrogen, in all sections of the State, returns four to five dollars worth of corn for each dollar spent for fertilizer used on it. This is about the same rate of returns as received from fertilizer used on cotton.

The yield of corn could be increased from the 15-bushel average to 25 bushels if each acre was fertilized with 24 to 32 pounds of nitrogen. This would mean an increase of 26 million bushels of corn from the 2.6 million acres in prospect for 1946. At present high prices, the increased corn would be worth 39 million dollars. The total corn production would be a record crop of 65 million bushels, worth 97½ million dollars. This quantity of corn and the 15 million bushels of oats should satisfy the grain requirements of the livestock in the State.

While 24 to 32 pounds of nitrogen per acre are generally recommended, there is evidence that many very poor hill soils need phosphorus and potash also for growing high yields of corn. Other states in the Southeast have published record yields of corn produced on poor land from heavy applications of complete fertilizer. These tests and demonstrations are pointing out possibilities of corn production through a balanced fertilizer program which is gaining attention and support of agricultural workers and leading farmers.

Special corn-production demonstrations were started in Mississippi in the late spring of 1945 with 4-H Club boys. The demonstration program was expanded in 1946 to include adult farmers and larger numbers of 4-H Club members. The American Potash Institute sponsored the special 4-H corn-production contest in cooperation with the Mississippi Extension Agronomy Department and participating county and assistant county agents. A total of 109 4-H boys conducted corn demonstrations in 1945. Complete records were obtained on 23 demonstrations which were in competition for awards offered in the contest. Eight widely scattered counties were represented.

Fertilizer requirements in the demonstrations follow:

HILL SECTIONS OF STATE AND FOOTHILLS OF DELTA

Plot	Treatment	Rate per Acre
1	6-8-8 fertilizer	500 lbs. (applied in water furrow before bedding rows for planting)
	Additional nitrogen	32 lbs. nitrogen side-dressed when corn is about knee high
2	Nitrogen only	32 lbs. nitrogen in water furrow
	Additional nitrogen	32 lbs. side-dressed
3	Check—no fertilizer used	

Fertilizer in plots 1 and 2 was applied in the water furrow before the land was bedded for planting. These two plots also received a side-dressing of 32 pounds of additional nitrogen when the corn was about knee high.

Corn yields were estimated in the field according to a standard method and were finally corrected to a basis of dry corn after storage and drying.

The location, soil, fertilizer treatment, and yields per acre on these reported demonstrations are shown on page 45.

The average yield of the check plots, without fertilizer, was 47 bushels per acre. Since the State average yield in 1945 was 20 bushels per acre, the soils on which the demonstrations were conducted were generally better than average.

Average yield on No. 2 plots, receiving 64 pounds of nitrogen per acre, was 61 bushels, or 14 bushels more than the corn which was not fertilized.

Plots No. 1, which received the same amount of nitrogen as plots No. 2 and also phosphorus and potash, averaged 78 bushels. This yield was an increase of 17 bushels per acre which can be credited to the phosphorus and potash, and this corn which received complete fertilizer and high rate of nitrogen averaged 31 bushels more corn to the acre than the 47-bushel yield from the unfertilized corn.

Five of these club boys produced more than 100 bushels to the acre. The highest yield was 130½ bushels per acre, produced by Junior Merle Hester of Iuka, Tishomingo County. He grew 118⅔ bushels per acre on the same land in 1944.

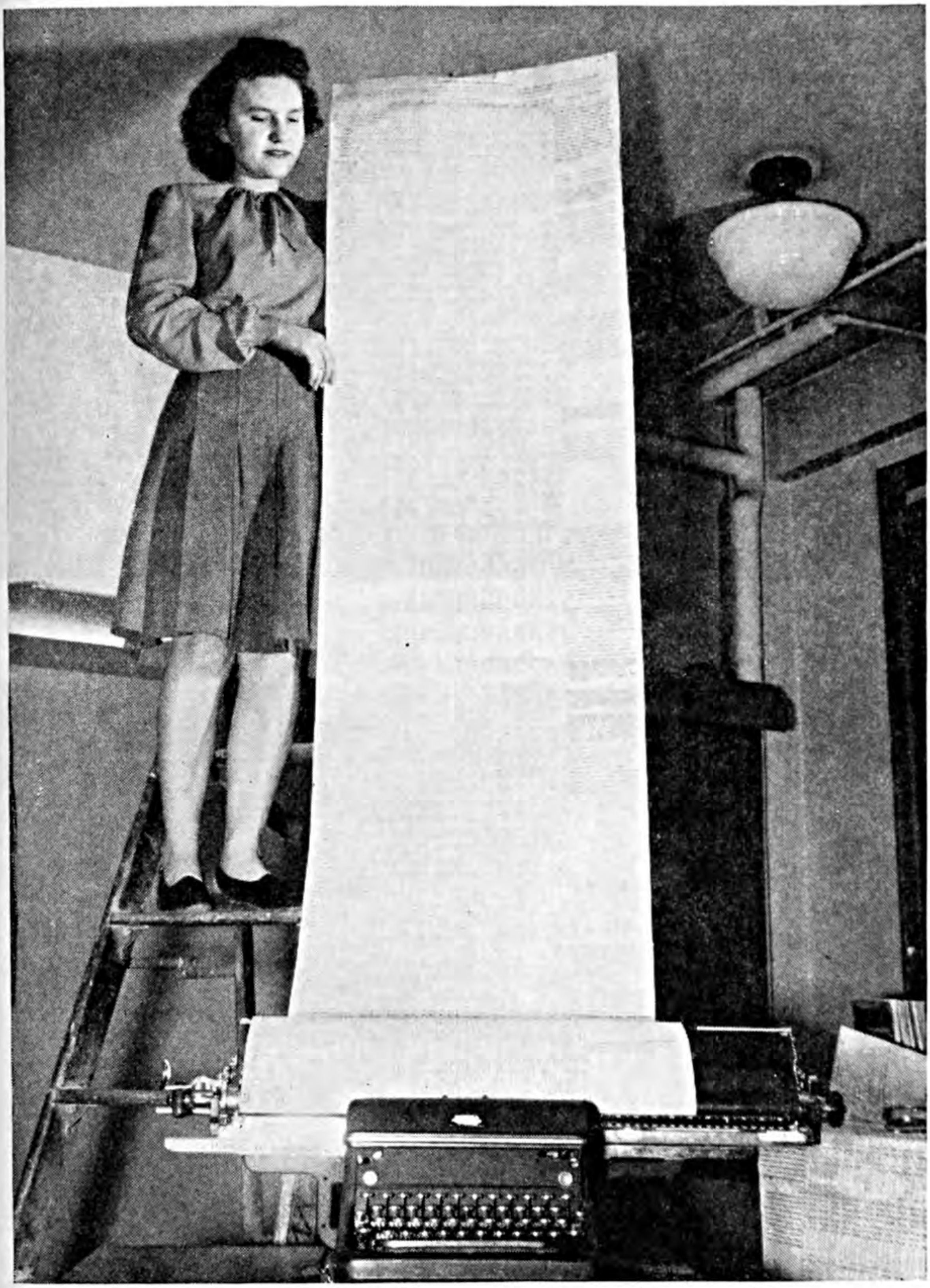
As Junior Merle told it in the newspapers, and in Chicago last December at the National Livestock Show, here's how he produced the bumper corn yield:

"With the help of T. K. Marlin and S. P. Dent, assistant county agents, and other members of the extension staff, I went all out for 4-H Club work. Due to a wet spring, I got off to a late start. I cleared up my ground May 18 and got it disked and ready for planting by June 1.

"I planted my corn June 1, using 200 pounds of soda to the acre on one plot and then I planted five rows without any fertilizer. On the other part of the acre I used 500 pounds of 6-8-8 to the acre. When the corn got about six inches high, it began raining. It was June 22 before I got to work it out. The grass was about three inches high and the ground was muddy, but I muddied through it.

(*Turn to page* 44)

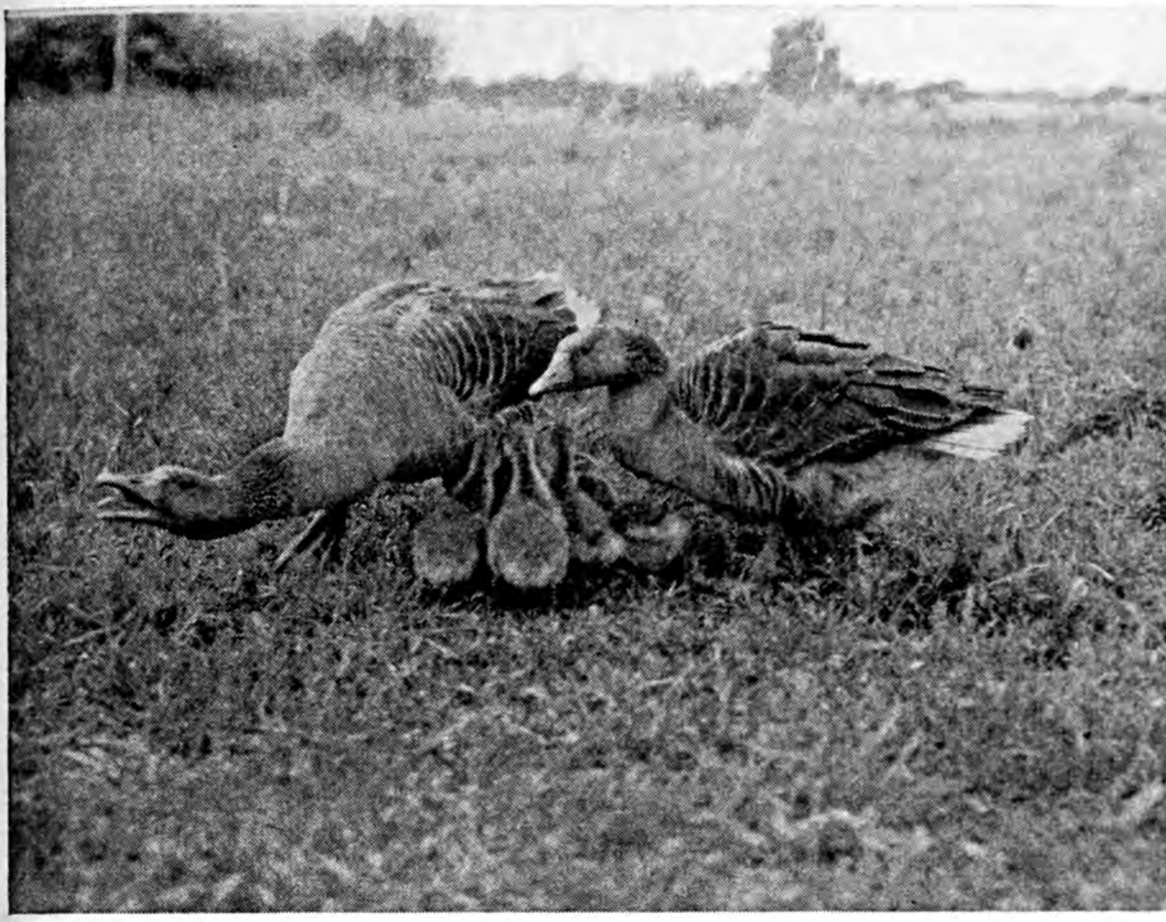
PICTORIAL



Miss Opal Marcus of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Md., exhibits a chart she has just typed showing "Productivity Ratings of the Soils in St. Joseph County, Indiana." The chart shows that a soil survey often covers a lot of ground and many different kinds of it. This one shows the productivity of 113 soil types for 13 crops, but some soil survey reports have covered more than twice as many types. That is one reason why where soil surveys have been made farmers can get accurate information about the land right under their feet.

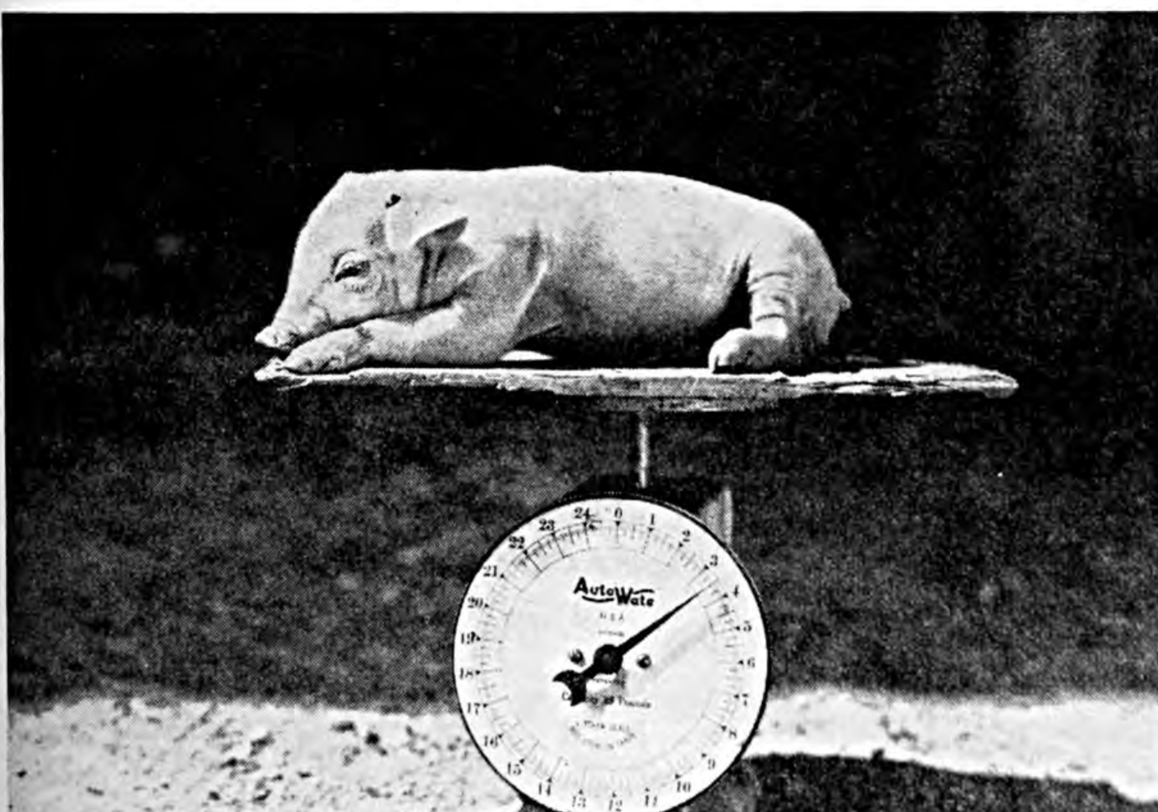
Above: Ice-cream "time" is just around the corner.

Below: Filling the hopper with food for corn.



Above: Well-guarded against any over-all attack.

Below: Will he ever catch up with his litter?



Above: The beginning of some good steaks.

Below: The finishing of some good steaks.

The Editors Talk

Starvation in America

The eyes of the world are turned to America to relieve the starving peoples of the war-devastated countries. Our bounty is well known and from our stocks now, every effort is being put forth to meet the dire needs of these peoples. At the same time, fortunately, our agriculturists are not lessening their concern that our soils be so managed as to meet these additional drains being put upon them and still produce in abundance and variety for the demands of our standard of living.

Dr. George D. Scarseth of the American Farm Research Association is to be credited with some cogent statements in this respect. "If the plants in our fields and pastures could cry out whenever they were starving for elements that nourish them, the noise coming from some fields," he says, "would be enough to give the strongest mind a headache. If the noise were in proportion to the extent of the starvation, there are really only a very few fields throughout the humid agricultural area of America that would be so contented that no sound would be heard."

He goes on to say that plants, of course, cannot express themselves through sound but that they have another means equally eloquent for expressing their needs. When plants starve for a nutrient element some characteristic symptoms usually develop. These symptoms are popularly called "hunger signs." The details of these hunger signs are numerous; however, every grower of crops will benefit by becoming acquainted with them.

Dr. Scarseth points to the startling fact that on about 33,000,000 acres of corn in the U. S. A., which is about 43 per cent of the total acres in corn, the average corn yields are down to only 12 to 20 bushels per acre. When the yield is this low it means that the farmer is going backwards financially and also probably in health. It means that on all these millions of acres of impoverished land millions of bushels of corn are being produced that have come from starved plants. It means that the farmer and his family on millions of acres work for nothing as far as any net cash returns are concerned. From studies of farm records it has been pointed out that it costs from $12 to $18 per acre to produce and harvest a corn crop, thus if the yield is in similar figures the cost per bushel is about $1.00. It is not often that the price of corn has been above $1.00 per bushel.

"It is difficult," Dr. Scarseth says, "to see how there can be great agricultural prosperity even if prices for farm commodities were good, as long as the productivity of the different acres is so low that the cost per bushel or ton or bale is high because of the very fact that the yield is low. It appears that farming methods must become more efficient on the basis of producing our bushels of corn and grain, our bales of cotton, our tons of hay, or our gallons of milk at lower costs per units by producing more per acre and by using fewer acres.

"In the past we have made the error of looking at the gross bulk of crops produced in the Nation and have feared overproduction if any methods for increasing the yield per acre were strongly advocated. We have tended to overlook that too frequently much of this production occurred from plants growing on impoverished soils, showing the hunger signs of various degrees of imperfection from malnutrition, and on top of all this the farmers have been compelled to produce many of the crops uneconomically. If the plants of our fields and pastures could only cry good and loud when they are starving or if they could cry 'we are producing uneconomic crop units' we would sooner recognize some of the real basic problems confronting us.

"The scientific technology exists for making almost any acre produce economic units of crops free from hunger signs and producing food materials that come from healthy plants. This will mean growing our gross total of crops on fewer acres but more economically on the acres used. This would release much land for a better land use with respect to the conservation of the soils on lands that are easily eroded. If we are to utilize these technologies amongst the 6,000,000 farmers of America, a *tremendous problem of widespread education* confronts us. Merely to throw fertilizers on the land is not enough. Crop rotations must be planned in such a manner that vital organic matter is provided as well as the nutrients that grow to make organic matter."

Dr. Scarseth concluded his remarks with: "The problem then that confronts us because of the hunger cries from the fields is vital to all Americans, not just those living on the land. It becomes of indirect concern to all consumers of food materials. The Nation cannot be abundant unless our fields are abundant and our fields cannot be abundant with starvation symptoms in crops more prevalent than non-starved crops."

Rightly stressed is his emphasis on the *tremendous problem of widespread education* which is confronting us. In that connection, we wish to call particular attention to the article by Dr. E. E. DeTurk of the University of Illinois entitled "Learn Hunger Signs in Crops." As Dr. DeTurk points out—The job is not done. In far too many cases our reply has been "We do not know."

Rural Life Conference

"Rural Life in a Changing World" is the fitting theme of the conference of the American Country Life Association to be held at Michigan State College, East Lansing, Michigan, June 11-13. At no time probably, since the formation of the Association in 1919 has its conference had more significance. Not only are there many internal problems such as attracting our farm youth to the farms and rehabilitating men who have been in service, but the world is now counting on American agriculture as a big factor in winning the peace.

Dr. D. E. Lindstrom, Professor of Rural Sociology at the University of Illinois is President of the Association. He has outlined topics covering four phases of rural living as the basis for the three-day conference. These include: Number of people in rural life; religious and moral foundations for rural life; public relations programs for agriculture; and rural community and international relations. Subtopics will be considered under each of these principal items.

The Association encourages many types of rural life programs at state and local levels. It seeks to learn through public forums what rural people are doing and can do through their independent organizations and through their agricultural and educational agencies. The findings of this year's conference will be eagerly awaited.

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
April........	20.20	21.4	174.0	211.0	107.0	149.0	16.90	51.90	....
May........	20.51	42.2	177.0	214.0	108.0	149.0	16.50	52.10	....
June........	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July........	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August......	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November...	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March.......	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April........	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
April........	163	214	250	240	167	169	142	230	259
May........	165	422	254	244	168	169	139	231	193
June........	169	512	258	251	173	170	134	233	269
July........	171	563	263	262	174	165	130	244	244
August......	172	449	240	292	176	164	123	233	240
September...	175	432	198	236	174	164	120	228	159
October	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January.....	180	363	208	237	171	174	132	226	249
February.....	186	339	209	254	173	175	133	223	275
March.......	183	319	225	269	178	179	137	211	283
April........	190	429	232	279	181	179	126	213	282

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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	Fish scrap, wet acidulated 6% ammonia, 3% 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	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944	1.75	1.42	7.68	5.77	3.34	4.86	6.71
1945							
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1946							
January	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	146	129	139
1927	112	79	145	166	143	128	162
1938	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	131
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944	65	50	219	163	110	144	191
1945							
April	65	50	223	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	110	144	191
1946							
January	65	50	223	163	110	144	191
February	65	50	223	163	110	144	191
March	65	50	223	163	110	144	191
April	65	50	223	163	110	144	191

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
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	.524
1927	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
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								
April	.650	2.20	6.20	.535	.797	26.00	.200	....
May	.650	2.20	6.20	.535	.797	26.00	.200	....
June	.650	2.20	6.20	.471	.701	22.88	.176	....
July	.650	2.20	6.20	.503	.749	24.44	.188	....
August	.650	2.20	6.20	.503	.749	24.44	.188	....
September	.650	2.20	6.20	.503	.749	24.44	.188	....
October	.650	2.20	6.28	.535	.797	26.00	.200	....
November	.650	2.20	6.40	.535	.797	26.00	.200	....
December	.650	2.20	6.40	.535	.797	26.00	.200	....
1946								
January	.650	2.20	6.40	.535	.797	26.00	.200	....
February	.650	2.20	6.40	.535	.797	26.00	.200	....
March	.650	2.20	6.40	.535	.797	26.00	.200	....
April	.650	2.20	6.40	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
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								
April	121	61	127	75	84	108	83	....
May	121	61	127	75	84	108	83	....
June	121	61	127	66	74	95	80	....
July	121	61	127	70	79	101	82	....
August	121	61	127	70	79	101	82	....
September	121	61	127	70	79	101	82	....
October	121	61	129	75	84	108	83	....
November	121	61	131	75	84	108	83	....
December	121	61	131	75	84	108	83	....
1946								
January	121	61	131	75	84	108	83	....
February	121	61	131	75	84	108	83	....
March	121	61	131	75	84	108	83	....
April	121	61	131	75	84	108	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 materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
April	203	180	154	97	57	175	121	78
May	200	180	154	97	57	175	121	78
June	206	180	155	95	57	175	121	69
July	206	180	154	96	57	175	121	74
August	204	180	154	96	57	175	121	74
September	197	181	153	96	57	175	121	74
October	199	182	154	97	57	175	121	78
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	156	97	57	175	121	78
February	207	185	156	97	57	175	121	78
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78

* 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 with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

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

"Eighth Annual Report of the Arizona Fertilizer Control Office," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Sp. Bul., Feb. 1946.

"Fertilizers for Sugar Beets on Some California Soils," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 694, Nov. 1945, Ray A. Pendleton and W. W. Robbins.

"Manure Is Worth Money, It Deserves Good Care," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 595, Dec. 1945, C. M. Linsley and F. H. Crane.

"Fertilizer Tonnage Sold in Indiana as Reported by Fertilizer Manufacturers from January 1 to December 31, 1945, Purdue Univ., Lafayette, Ind., F. W. Quackenbush.

"Cooperative Potash Demonstrations for 1945," Ext. Serv., L.S.U., Baton Rouge, La., R. A. Wasson.

"Tonnage of Different Grades of Fertilizer Sold in Michigan in 1945," Soil Science Dept., Mich. State College, Lansing, Mich.

"Fertilizer Trials on Corn and Oats in Mower County, 1945," Agr. Exp. Sta., Hormel Inst., Univ. of Minn., St. Paul, Minn., S.S. 15, March 1946, A. C. Caldwell.

"Fertilizer for Potatoes on the Light-Textured Soils of East-Central and North-Central Minnesota," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., S.S. 16, March 1946, L. E. Dunn and C. O. Rost.

"Fertilizer Sales in Ohio in 1945," Dept. of Agron., Ohio State Univ., Columbus, Ohio.

"Effect of Large Amounts of Phosphates upon Yield and Composition of Grasses," Agr. Exp. Sta., A. & M. College, College Station, Texas, P.R. 983, J. F. Fudge and G. S. Fraps.

"Wisconsin 1945 Commercial Fertilizer Summary," State Dept. of Agr., Madison, Wis.

"Food Crops Need Phosphate," U.S.D.A., Washington, D. C., AIS-46, Jan. 1946.

Soils

"Map of Soil Zones of Alberta," Univ. of Alberta Ext. Dept., Edmonton, Alberta, Can.

"Collecting Soil Samples for Chemical Analysis," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Cir. 148, Dec. 1945, L. C. Olson and R. P. Bledsoe.

"Illinois Soil Experiment Field Data Sheets," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1141, March 15, 1946.

"Soil Conservation Districts in Massachusetts," Ext. Serv., Mass. State College, Amherst, Mass., Sp. Cir. 131, Nov. 1945.

"The Importance of Soil Organic Matter," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., S.S. 14, April 1945, C. O. Rost.

"Soil Testing," Agr. Exp. Sta., Raleigh, N. C.

"Preventing Soil Erosion," Agr. Ext. Serv., Pa. State College, State College, Pa.

"Practical Land Clearing on the Cumberland Plateau," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 198, Nov. 1945, J. J. Bird.

"Report of the Chief of the Soil Conservation Service, 1945," U.S.D.A., Washington, D. C., Sept. 15, 1945.

Crops

"Crimson Clover for Winter Grazing," Ext. Serv., Ala. Polytechnic Inst., Auburn, Ala., Cir. 312, July 1945, J. C. Lowery and D. R. Harbor.

"Outdoor Roses in Canada," Div. of Hort., Dept. of Agr., Ottawa, Can., Publ. 777, F. B. 133, Jan. 1946, R. W. Oliver.

"The Improvement of Naturally Cross-Pollinated Plants by Selection in Self-Fertilized Lines," Agr. Exp. Sta., New Haven, Conn., Bul. 490, Oct. 1945, W. R. Singleton and O. E. Nelson.

"Sweet Corn Trials, Mt. Carmel and Windsor, Connecticut 1945," Agr. Exp. Sta., New Haven 4, Conn., R.P. 45G2.

"Farming for Freedom," Agr. Ext. Serv., Univ. of Del., Newark, Del., Bul. 41, A.R. 1943.

"Cotton Variety Tests in Georgia, 1942-45," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Cir. 149, Feb. 1946, W. W. Ballard, A. L. Smith, and R. P. Bledsoe.

"Peanut Yields Can Be Doubled," Ga. Exp. Sta., Experiment, Ga., Press Bul. 557, Jan. 3, 1946.

"Illinois Hybrid Corn Tests 1945," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 517, Feb. 1946.

"Grass or Gullies," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 593, Oct. 1945, E. D. Walker and R. C. Hay.

"Varieties of Winter Wheat for Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir.

596, Dec. 1945, G. H. Dungan and O. T. Bonnett.

"Why Cultivate Corn?" Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 597, Jan. 1946, D. C. Wimer.

"Sow Adapted Varieties of Spring Oats," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 601, Feb. 1946, G. H. Dungan and O. T. Bonnett.

"Twenty-eighth Annual Report," Ill. State Dept. of Agr., 200 State Capitol, Springfield, Ill.

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The Soil Is Our Heritage

(*From page* 24)

waterways were established everywhere there was a wash. A long-time crop rotation was set up. Permanent pastures were laid out for some areas, legume crops seeded in other areas, and the whole farm was to be given an application of fertilizer as fast as the income would permit, not just any kind of fertilizer but specific types of plant food the soil tests showed were lacking.

The old farm that was once so fertile and then so poor seemed definitely to be on the road back.

Then the youthful farmer was fatally injured in a farm accident. Mrs. Kreider, the widowed mother, was unable to continue operation of the farm, which she later offered to Ivan Hardin for sale.

Hardin, after examination of the experimental demonstration plan outlined for the farm by Purdue University, offered to continue the program as originally set up.

It was about the time World War II started that Hardin purchased the farm. Productivity of the farm in recent years has been little short of phenomenal.

Pasture on the farm adequately supports Hardin's 30-head herd of purebred Guernseys, and the increased productivity of cropland is such that it is no longer necessary to rent additional land.

This past year the Hardin farm produced so much hay that tenant Marvin King couldn't use it all. The first cutting of alfalfa was damaged by rain and so some of it is being used for bedding and the remainder, amounting to many tons, is piled up to decay and be returned to the soil. The second cutting furnished ample hay of excellent quality for winter roughage. The third crop was never cut. Both Hardin and King are extremely "organic matter" conscious and preferred to turn under the crop rather than to harvest it for the market.

Grass in the pasture land was belly-deep to the dairy herd by midsummer. In addition to bluegrass and alfalfa there were many experimental plantings that produced a variety of dairy feed. For example, there was ladino, lespedeza, sudan, brome, red clover, alsike clover, timothy, sweet clover, balbo rye, wheat, and oats. Obviously, all these crops will not be continued. Meanwhile the sleek dairy herd that roams the Hardin farm have about the widest variety of available feed any cows could have. As a result, the milk checks are running well over $200 a month the year round. Hardin and King could easily sell enough surplus legume hay to purchase supplemental dairy food. They keep a small herd of hogs which, too, are offered a wide choice of feed. Part of the corn crop goes into the silo and the balance is turned into ground feed. The farm is once again capable of producing 100 bushels of corn per acre.

This high state of productivity has been developed on the Hardin farm through a rather intensive application of plant food. During the past six years the soil has had the following plant food in addition to tons and tons of manure hauled from the dairy barn; 21,600 pounds of 45 per cent phosphate; 2,700 pounds of 60 per cent muriate of potash; and 1,800 pounds of 33 per cent ammonium nitrate. These applications were in addition to standard fertilizer the equivalent of 2-12-12 at the rate of approximately 300 pounds per acre. This application was given the pasture land as well as crop land.

Hardin and King were asked recently if all this experimentation was not a costly lot of fuss and bother. Both agreed conclusively that on the contrary they have had a lot of fun watching the soil respond to legume and plant-food tests and they brought out figures to show they are making a good net profit on the farm. They are ready to prove the old run-down hill farm that had lost more than six of its original nine inches of topsoil is not washing out from under their feet every time it rains these days. They are convinced their farm is no longer crop bankrupt.

Efficient Fertilizers Needed for Profit in Cotton

(*From page* 20)

phate. In 1945, with severe weevil injury, 50 pounds of P_2O_5 increased the yield 476 pounds per acre. Contrary to the effects of nitrogen and potash, phosphate had no effect on the composition of the seed.

Reasonably heavy applications of P_2O_5 every year are necessary to insure rapid plant development and high yields. About 50 to 100% more phosphate is needed in the cotton fertilizers on Piedmont soils than on Coastal Plain soils.

Lime

Last, but not least, broadcast applications of dolomitic limestone are necessary on some soils to supply adequate calcium and magnesium. Characteristic magnesium-deficiency symptoms, red leaves with green veins, are found on cotton grown on some of the light sandy soils.

In experiments with dolomitic and calcitic limestone in 1945, dolomitic limestone was particularly beneficial. (See Table 1.) There was practically no response to calcitic limestone while dolomitic limestone gave responses of 183 and 175 pounds of seed cotton, respectively, at the first two locations. The response was not related entirely to the exchangeable magnesium in the soil but came at the locations with severe weevil injury. In 1944 on Norfolk loamy sand (pH 5.1, ex. cap. 2.8,

TABLE 1. EFFECT OF PHOSPHATE AND LIME ON COTTON YIELDS
(pounds of seed cotton per acre)

Treatment	Lbs. P_2O_5/A applied	Ruston loamy sand 1945	Norfolk fine sandy loam 1945	Norfolk fine sandy loam 1945	Lbs. P_2O_5/A applied	Cecil gravelly loam 1944	Cecil gravelly loam 1945*	Norfolk fine sandy loam 1944	Norfolk fine sandy loam 1945
		Lbs/A	*Lbs/A*	*Lbs/A*		*Lbs/A*	*Lbs/A*	*Lbs/A*	*Lbs/A*
Dolomitic lime (1T.)	20	1,230	944	1,652	0	1,390	1,349	1,396	1,074
Dolomitic lime (1T.)	60	1,524	1,342	1,606	50	1,695	2,232	1,482	1,550
Calcitic lime (1T.)	60	1,356	1,222	1,469	100	1,988	2,018	1,435	1,685
No lime	60	1,341	1,167	1,508					
L. S. D. (.05)		147	197	219		264	251	232	172
Soil Analysis									
pH		4.7	5.0	5.2		6.4		6.0	
B. Ex. Cap. (m.e.)		1.6	2.9	3.1		3.9		4.1	
Ex. Ca (m.e.)		0.46	1.02	1.36		1.31†		1.04†	
Ex. Mg (m.e.)		0.18	0.30	0.19		0.37†		0.24†	
Ex. K (m.e.)		0.04	0.10	0.11		0.09		0.04	
Soluble P (ppm.)		8.0	43.0	43.0		trace		18.0	
		Severe weevil damage	Severe weevil damage						Severe weevil damage

* 0, 100, and 200 lbs. P_2O_5/A, respectively.
† Before one ton of dolomitic lime was added.

ex. Ca 0.29, ex. Mg 0.13) one ton of lime increased the yield 419 pounds per acre.

Applications of limestone are best made on the basis of soil requirements as determined by soil tests. In North Carolina this soil-testing service is easily available to the growers.

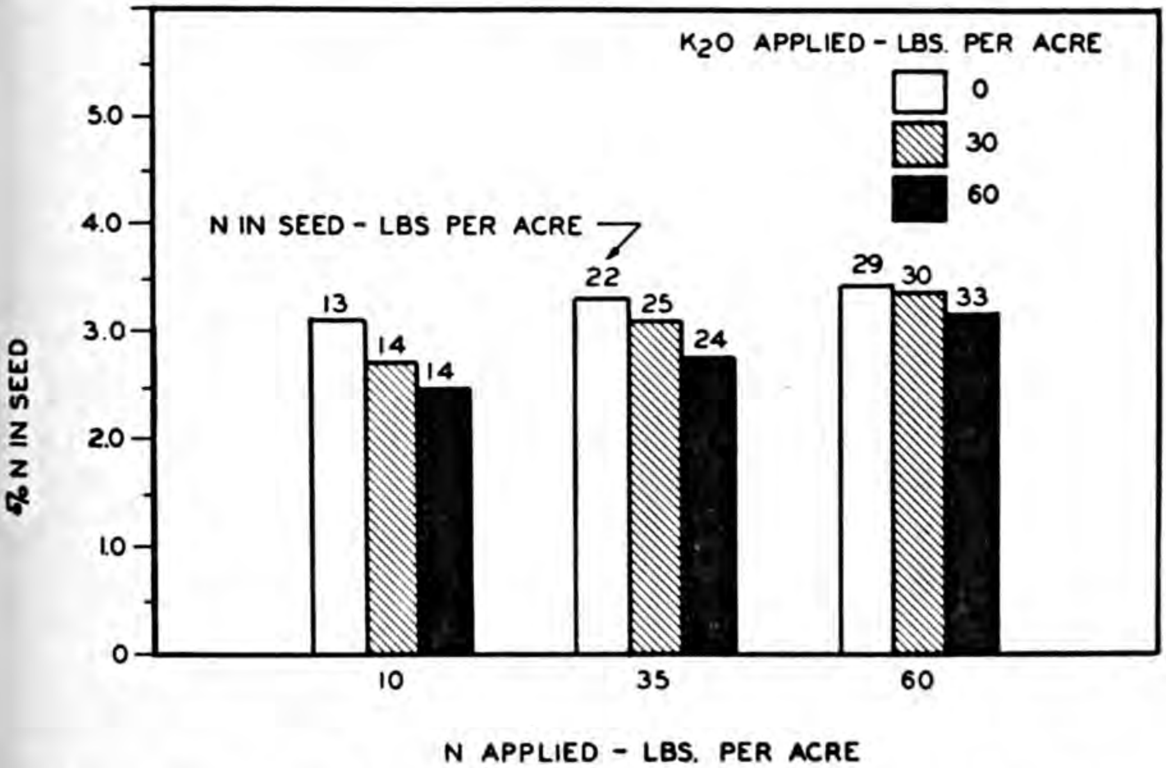

Fig. 5. Under conditions of a response in yield of lint to potash and nitrogen additions, the percentage and the total amount of nitrogen in the seed are affected.

Summary

Adequate quantities of nutrients must be supplied to the cotton crop if high yields are to be produced. If the maximum returns are to be obtained from the nutrients, they should be placed in bands at the side of the seed rather than directly under.

The response to fertilization, particularly to nitrogen, is complicated by boll-weevil injury in some areas in certain years. A good system of boll-weevil control will make possible greater returns from high fertilization.

I Saw It Happen in the Soil Testing Laboratory

(*From page* 14)

the same personnel to do all of the work throughout the year. There is still a peak of work during the spring, but it is not a very severe one.

Summary of Soil Tests

From the 16,000 samples tested last year, some interesting things were observed. In interpreting the data from these tests, the State was divided into five soil areas; namely, the Mountain, the Piedmont, the Sand Hill, Upper Coastal Plain, and Lower Coastal Plain areas. The principal difference between the latter two groups is that the Lower Coastal Plain soils often have a finer texture, are not as well drained, and consequently have considerably more organic matter than the Upper Coastal Plain soils.

Lime Recommendations. Lime recommendations were made on the thesis that a pH of 6.0 would approximate the optimum pH for greatest efficiency of fertilizer utilization. This is not in complete agreement with the work of Volk and Bell, since they found that the retention of ammonia and potash increased very materially up to a pH of 6.8. Many other authorities in other parts of the country would probably place the optimum up to as high as 6.5. On the soils of this State which have a low exchange capacity, such as our sandy soils of the Coastal Plain area, we would often get into complications if we carried our pH much above 6.0. The assimilation of potash seems to be very materially reduced, and in many cases minor plant-food element troubles develop above a pH of 6.0. This is particularly true of soybeans, in which case the plants often develop manganese deficiency with a pH even approaching 6.0 on the sandy soils. Such lime-loving crops as alfalfa and sweet clover grow very satisfactorily at a higher pH, but also usually do well on a pH of 6.0 on most soils utilized for these crops.

Of course, the entire rotation must of necessity be considered in any well-planned lime and fertilizer program. If, included in a rotation where the pH is as high as 6.0, there are crops which would constitute a problem, the liming program should be adjusted accordingly. It is very desirable to lime a soil where the pH is below 5.0 for all general crops; and it is desirable to lime most general crops where the pH is between 5.0 and 5.5. Many crops will respond very nicely to liming where the pH is from 5.5 to 6.0. Thirty per cent of the soils tested from the Piedmont area had a pH of 6.0 or above. In one Piedmont County, 55 per cent of the samples were in this category; whereas, in the Lower Coastal Plain only 11 per cent of the soils tested had a pH of 6.0 or above. The other extreme of this lime status is that 39 per cent of both the Piedmont and Mountain soils had a pH below 5.0.

Phosphorus. Only 3 per cent of the Mountain soils were very high in phosphorus, while 32 per cent of the Upper Coastal Plain soils were very high in this element. One county in the Upper Coastal Plain had 41 per cent of its soil testing very high in phosphorus. On

Fig. 3. This is an over-limed spot on Norfolk fine sandy loam soil. It has a pH of 8.1 and the the calcium and magnesium are very high.

the other extreme, 72 per cent of the Mountain soils and 8 per cent of the Upper Coastal Plain soils were low in phosphorus.

Potash. The tests showed 23 per cent of the Mountain soils and 6 per cent of the Sand Hill soils to be fairly high in potash. The other extreme on potash showed 13 per cent of the Mountain soils and 45 per cent of the Sand Hill soils very definitely low in this element. Even the Upper Coastal Plain area—which is perhaps the most highly fertilized area in the State—showed 35 per cent of the soils to be very definitely low in potash.

This very brief summary of the soil tests in general shows that very many fields have been amply limed and that some have even been over-limed. On the other hand, the lack of lime is a seriously limiting factor on large areas of the State. As an over-all picture, the lack of lime far overshadows the small portion of the State which has been amply limed. Only a fraction of the lime that is needed is actually being used.

Many of the soils of the Upper Coastal Plains are well supplied with phosphorus, while the Mountain and Piedmont areas need all of this surplus and more.

The Mountain soils are fairly well supplied with poash and some of the Piedmont soils are also, but more soils in these two groups are becoming deficient in this element each year. Most of the soils in the Coastal Plain and Sand Hill areas are quite deficient in potash. A generalization like this, however, may be ruinous to any individual farmer or field, since adjoining fields are often very different. Every field, and every crop that is planted on that field, is an individual problem all of its own, and should be so treated.

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Corn Production In Mississippi

(*From page* 26)

"I ran out the middles with a 14-inch sweep and scratched around the row. Then on June 25, I ran around the row with a 14-inch sweep and on the 27th I side-dressed it with nitrate of soda at the rate of 200 pounds per acre except on the five rows which were left for the check.

"On July 10, I went twice to the middle with a scratcher stirring the clods around, because it had not rained during all of these workings.

"When the check on the yield was made, it was found that the plot fertilized with the complete fertilizer, 6-8-8, produced 130½ bushels of corn to the acre. The plot where nitrogen only was used produced 96 bushels per acre. The check plot where no fertilizer was used produced 70 bushels per acre, or 60½ bushels less than the plot where the complete fertilizer was used.

"My advice to anyone who is a member of the 4-H Corn Club or who is carrying any other 4-H project is to check with the 4-H Club agent or any member of the Extension Service if he wants to do an excellent job.

"To grow 100 bushels or more of corn per acre, one must prepare a good seedbed, use the correct fertilizer, space closely in the row, and properly cultivate. With this in mind and using good seed, everyone can be a winner.

From reports and comments received from hill counties and Delta counties, farmers, club boys, county agents, assistant agents, and other agricultural workers are this year outdoing anything previously done about improving corn production in Mississippi. It now appears that 300 to 400 corn demonstrations are being conducted by juniors and adults this season.

Agricultural workers, farmers, and 4-H club boys will make organized tours in August to October to study the results of corn fertilization, close spacing of corn, and several hybrid corns in these demonstrations.

General acceptance of improved prac-

Proper fertilization increases production of forage as well as grain.

SPECIAL 4-H CORN PRODUCTION CONTEST RECORDS

County and Name of Club Boy	Soil (Upland, Terrace, Bottom)	Fertilizer Used and Yield per Acre		
		Plot 1	Plot 2	Plot 3
		500 lbs. 6–8–8 in water furrow before bedding for planting. Side-dressed with 200 lbs. nitrate of soda or 100 lbs. ammonium nitrate per acre	200 lbs. nitrate of soda or 100 lbs. ammonium nitrate per acre in water furrow before bedding for planting. Side-dressed with 200 lbs. nitrate of soda or 100 lbs. ammonium nitrate per acre	Check—No fertilizer
		(Yield per A.) (Bu.)	(Yield per A.) (Bu.)	(Yield per A.) (Bu.)
Alcorn:				
Vester Smith	Bottom	97	81	74
Stanley Fields	Bottom	70	54	46
Leon Sherard	Bottom	62	55	53
Choctaw:				
Price Miller	Bottom	102	63	60
Greene:				
Chas. McLendon	Terrace	45	32	26
Lowndes:				
Walter Rex Rose	Bottom	90	48	30
Walter Rex Rose	Bottom	80	32	25
Madison:				
Eldridge Hoy		60	40	20
Tishomingo:				
J. T. Skinner	Upland	63	48	42
James Lee Coker	Terrace	72	52	36
Bobby Wimbish	Upland	70	50	28
Carroll Hester	Terrace	46	50	28
Charles Skinner	Terrace	58	58	52
Harold Davis	Terrace	72	51	48
Edgar Johnson	Upland	50	30	26
Junior Merle Hester	Bottom	130	96	70
Jimmy Kirk	Upland	81	56	36
Jimmy Enlow	Bottom	102	97	92
Dennis Smith	Bottom	116	113	90
Billy Bridges	Bottom	90	77	60
Wayne:	Bottom	60	38	18
Webster:				
Robt. Crowell	Terrace	106	99	75
Mahlon Taylor	Bottom	81	77	49
Average all reports		78	61	47

tices in corn production would soon result in plenty of grain to meet feed grain needs. With further improvements in hybrid corn prospects in the State, the total acreage now being planted to corn can be reduced considerably, thus providing more land for small grains, hay, or pasture which will need much less labor than for growing corn.

Learn Hunger Signs of Crops

(*From page* 12)

Another group of soils which are usually deficient in potassium for crop production are the alkali soils of central and northern Illinois. They contain from a few tons to a hundred or more tons of calcium carbonate per acre plow depth usually in the form of snail shell fragments. These soils have lost potassium into the drainage water faster than soils which are otherwise similar, but without excess of calcium carbonate. A probable reason is that the constant excess of calcium displaces potassium from the clay into the soil water. Moreover, these soils must contain more available potassium than non-calcareous soils, in order to deliver it into the plants because of the competition of the calcium. For every atom of potassium around the plant roots there are hundreds of calcium atoms.

These, then, are the soils that nature deprived of their available potassium reserves without much help from the farmer. There remains another very large area of Illinois soils which were well endowed with available potassium and potassium reserves when the white man began farming them. Their potassium reserves have been "farmed out" or they are approaching such a state by a system of soil management which 25 years ago was considered sound. We were deceived by 35,000 pounds an acre of total potassium in the plow depth, not knowing that 85 per cent of it is locked up in unweathered coarse particles (sand and silt) that will not furnish appreciable amounts to crops for centuries. As a result of this error, which we may as well admit, the best managed farms have had their yields greatly increased by limestone, legumes, and phosphate, at the expense of the potassium reserves which are approaching, and in many cases have reached, inadequate amounts for average yields.

In contrast to phosphorus the shortage of which is not shown by striking symptoms in any of the common crops after the seedling stage, potassium deficiency waves its flag for all to see in most kinds of crops at all stages of growth. Like phosphorus, potassium is used twice in emergencies, moving out of old leaves into younger ones, so that the symptoms move upward from the base of the plant. Being all soluble, the potassium moves out of the old leaves rapidly, killing the leaf quickly with but little yellowing, which lasts but a day or so. Potassium firing first destroys the edges of the leaves, which in corn become wavy at about the time they turn brown and die, after which the dead edges break up in the wind and become ragged. These symptoms are somewhat similar in corn, soybeans, clover, alfalfa, potatoes, and other crops. There are differences in detail of pattern, which should be seen in order to learn to recognize them.

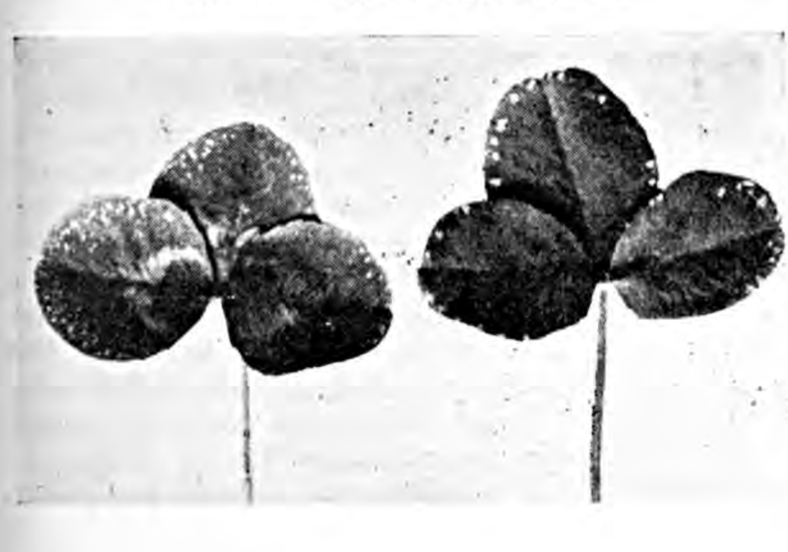
In corn there are other signs of potassium shortage. If it is severe in early stages, the whole plant dies early. If the plant lives, it fails to lengthen the stalk, so that the plant is low, with the leaves close together. It is also weak-stalked and often breaks over. If an ear forms, it may be all pollinated, but the best seeds are at the butt, becoming more and more chaffy toward the tip. The cob is weak and breaks easily.

Nitrogen

Soil nitrogen reserves reside entirely in the soil organic matter, having been added by way of vegetation and having come by more or less roundabout journeys from the atmosphere. There is no nitrogen which originated in the rocks of the earth's crust. The nitrogen reserves vary along with the organic matter from small amounts in light-colored sandy soils to rather large amounts in the dark brown to black silt and clay loams, and to very large amounts in muck and peat soils.

Now, what of the available nitrogen which our growing crops must have? It is an old story that nitrogen is liberated from organic matter as the latter decays, but it may be a new story that plant feeding on this available nitrogen is entirely different from that on the immovable soil phosphorus and potassium. Nitrate nitrogen, the chief available form, is completely soluble in water. It is not absorbed by clay or any other soil material, but moves freely in the soil, going wherever the water goes —down to the root zone as rain water soaks in and up to the surface when the water evaporates. But it cannot follow the water into the air. A field of corn may be badly fired during a drought because of nitrogen starvation when there is enough nitrogen for a 100-bushel crop in the half-inch surface crust where there are no roots.

Above, Alfalfa; below, Red and Alsike clover. Potash deficiency is indicated by white spots on these legumes. Later, edges of leaves become dry and appear scorched.



Another result of the free movement of nitrate in the soil is that with the usual moisture conditions, crop roots have repeated opportunities to take up the nitrate as it passes by going up and down with the water movement so that in a very short time the growing crop may completely exhaust the root zone of this available nitrogen. It is indeed fortunate that weather conditions which favor crop growth also favor the decay of organic matter with continual renewal of the nitrate nitrogen.

A long-time view of the nitrogen problem has convinced me that we have been fooling ourselves in believing that with liming, legumes once in rotation, together with phosphate and potassium where needed, we have maintained our fertility, even though we have a record of many years of high yields as proof. We have frequently called attention to the fact that by our farming methods of the past we have destroyed ⅓ to ½ of our soil organic matter. But have we realized that the nitrogen for these high yields was supplied only in part by the legumes and that the remainder of it was supplied at the expense of permanent destruction of organic nitrogen reserves? The proof of it is in the startling increase in numbers of fields of badly fired corn in good years and bad on what we have considered our better corn-belt soils. These signs do not so often appear on the unimproved soils. Phosphorus and potassium fertility there have gone down with the nitrogen, and declining yields without "hunger signs" are the results we see with such poor, but still balanced, fertility.

It is my belief that the good old days are gone. In the future, if we maintain high yield levels, and even go to super-high yields as many hope to do, there are only two roads open to us. One is to reduce the grain ratio and increase the legumes in the crop rotation above what has been considered standard, good practice and the other choice is to supplement legume nitrogen with nitrogen fertilizers.

Now as to the hunger signs. Back of the symptoms always lies the plant physiology—what is happening inside the plant. Nitrogen within the plant, like phosphorus, is about half free and half fixed in the living tissues as a part of the organic matter of the cell itself. When the soil supply slackens, the free (soluble) half is moved out of the old, lower leaves without immediate harm, but loss of the second half very gradually kills the leaf, first by yellowing, later killing the tissues along the midrib, still later spreading to the edges. The most prevalent time for this firing is when the ear begins to enlarge, or with plants other than corn, when seed production sets in—but it can happen any time.

To review briefly some main points—First, in the soil: The available forms of phosphorus and potassium are fixed, not in the old sense of not being usable, but fixed against movement, so that the advancing roots drill little tunnels through the mass of these available forms, leaving ⅔ to ¾ of it still available at the end of the season. This is true even if the plant is showing starvation symptoms because the potassium in the path of the roots is too thinly distributed, while the meager supply between the root paths is "positionally unavailable," or out of reach, and goes through the season untouched.

Whether the available phosphorus or potassium be much or little, the amount accessible to the crop increases in proportion to the expansion of the root system as the season advances. Nitrate, the principal available nitrogen, on the other hand, moves freely in the soil and can be completely taken out of the root zone by the crop in a fairly short time, except in the early growth stages.

Secondly, in the plant: these elements group themselves differently. Now phosphorus and nitrogen are grouped together. Both are a part of the vital tissues of the plant, to the extent of about half of the total amount present. The organic part moves out of these older tissues slowly, after the soluble portion has gone, of course, resulting in slow death of these leaves, accompanied by the characteristic symptoms. Potassium, in contrast, is all soluble, goes out of the old leaves quickly in time of critical shortage, with more sudden death of the tissues.

All three elements are alike in that they can be used twice, the second time to keep the most important organs functioning at the expense of older leaves that die.

Calcium

We do not know as much about calcium as we should. We are protected in our ignorance by knowing that the good crop rotations require certain legumes which do not thrive on sour soils. So we lime, and our calcium problems are automatically solved. We know that sweet clover, as well as other clovers, alfalfa, and soybeans require large amounts of calcium. Soybeans can take it out of acid soils, but alfalfa and many clovers cannot. We do not know why. Corn uses very little calcium, but we found one inbred by accident that has a very high calcium requirement, and in this discovery we found and recognized calcium "hunger signs." In this discovery we also learned why certain hybrids had failed in early summer (rotted, the growers said) on sour soils. This inbred was one of the parental lines.

Magnesium

Magnesium occurs in common farm crops in about the same amounts as calcium. It is a constituent of chlorophyl, the green pigment in leaves. Mild deficiency is suspected but not proved in the gray prairie in southern Illinois. We forced a magnesium deficiency in corn on that soil by adding eight tons of potash per acre which pushed the magnesium down into the subsoil. The symptoms appeared soon after pollination and consisted of whitish yellow striping along the veins of the leaves with an occasional red stripe.

Iron

Iron shortage in most plants causes chlorosis (loss of green color) in the younger leaves near the top of the plant. The golden yellow color which covers the whole leaf persists for a long time—two to three weeks—before the leaf dies, and if iron is supplied in the meantime, the green color is restored. Iron deficiency is rare in Illinois soils, but may occur on shelly alkali areas.

Boron

Boron, like iron, is a trace element. Its severe deficiency is wide-spread in many truck crop areas of Michigan and Wisconsin as well as some southeastern states. Alfalfa suffers from boron shortage in the soils of the southern third of Illinois and in scattered small areas elsewhere. Like iron, the symptoms are in the upper or youngest part of the plant. The older leaves obtained their supply before the soil supply was exhausted. The symptoms usually appear in the second or later years in alfalfa and in the second or third cutting or both—all after the root system is established. After the boron is deposited in the cells of the plant, it is fixed there and cannot be re-used as is nitrogen, or phosphorus, or potassium. This fact explains the "hunger signs" in the top of the plant. The surest symptom for diagnosis in alfalfa is death of the terminal bud of the main stem and growth of the upper branches until they are higher than the main stem, causing a rosette-like arrangement of the leaves. Less important symptoms are yellow and pink leaves in the upper third of the plant.

Copper-Zinc

Copper and zinc deficiencies have been established in some areas of the United States, but not in Illinois. This does not mean that we should be complacent and wait for actual plant starvation. We hope to make a survey of Illinois soils for these elements as soon as facilities and man-power will permit.

Iodine-Cobalt

Iodine and cobalt are chemical elements essential in trace elements for animals, but not known to be necessary for plants. Since they can be added to animal feeds or salt mixtures, it is not necessary for animals or men to obtain them from the soil through plants. However, on ranges where no feeding is done, soil applications may be desirable.

In parts of Australia and New Zealand in recent years, the range production of sheep and cattle came dangerously near to a disastrous end until it was discovered that application of 4 to 16 ounces of cobalt per acre to the ranges by airplane would solve the problem for two or more years.

Parity and Charity

(*From page* 5)

contest to originate a newer and better and fairer system of formulas on which to erect a lasting agricultural parity platform, one that Congress might adopt if it is wise enough to take a broad attitude rather than a sectional one. For the present moment the backgrounds behind the proposals advanced in that contest of wit and wisdom have little place in discussion, as they relate to a long-time, future policy, with or without prosperity.

AS FAR as our production prospects in America go, they are much brighter and better per farm than they are abroad. That much we know. It's the consuming and the selling side that bothers so many of us in casting up our horoscopes. If that is true, then we must watch and cheer hard for all workable plans advanced in coming months and years to increase the volume of food products moving in the channels of world commerce, to and fro, in and out. Can we do that by setting our own financial sights per bushel or per ton so high that exports are impossible except with a public subsidy? That goes for other countries as well.

Speaking again of production outlooks in the long run, I quote from a letter received lately from a farm paper editor long known to me, who has been interviewing farmers in all corners of the food-deficit areas. In contrast to our own expected powerful food-producing possibilities—even greater than they have been since 1941—here is what this writer says about European agriculture:

"The long-term agricultural problem is the acute shortage of land in a majority of the countries visited. Greece, for instance, has only four or five acres per farm and not very good land at that. Cash income above farm living costs is about $125 per family per year. You might say that increased industrialization will remove some of these people from the land, and that better farming systems and better livestock will help. Yet even then there remains a land shortage which will prevent the average farmer here from ever approaching the high standard of living we have in the United States."

He also reports that few farmers in Italy lift up their hopes high enough to attain land ownership. Here we have plenty of such hopes all right, but hardly enough money and brains and grit to carry through, in far too many cases. Ownership, of course, is not entirely the answer. But the utter absense of ambition, such as he saw abroad, strikes at the root of world welfare and agricultural progress.

Right here there enters the need for active resistance to exploitation. That evil has already robbed Europe of many tons of soil fertility and human ambition. It can happen here if we don't watch out. In the regeneration of Europe with our assistance, we must have a care not to use our forces and facilities for the kings of entrenched privilege instead of the down-trodden hosts on whom the world depends for consumption and mass production. This is not silly, vain preachment, but ordinary common sense. We must get the facts from overseas in return for our relief efforts. If we quit without facing further responsibility than that of putting out a fire, we may not have anything to say about the kind of buildings and institutions erected in their places. And believe "you me," in this shrinking world of ours, what happens over there will affect our lives and fortunes just as much as what we do with parity over here.

Continuing the quote from our editor abroad:

"The battle is over but the problems of war remain. They are magnified by the terrific destruction. The United States can be a great moral and economic force in the regeneration of Europe if it wishes. I believe we are not being realistic unless we see this fact and take positive steps in this direction."

Were we to lay a yardstick of parity alongside our own agricultural and national prosperity and privileges and compare it with most of the other countries, the evidence would be plain. We base our bedrock period from which we reckon farm price parity in the assumed "golden age" of fair exchange value, from 1910 to 1914, when life was simpler, wants were fewer, and our farming systems and individualism were more comparable to European agriculture than they have become since farming became commercialized. We have gone ahead to perfect our power farming, and our multiple organizations, leaving the foreign peasant about where he was at the turn of the century. Now the prime sixty-four dollar question is whether we alone in our own domestic circles can swing this parity club on every occasion with no thought of the results both to ourselves and the world in general.

JUST what the outcome of further internal pressures may be, no man can say. Some recent editorials in high places have accused the American farmer of keen greed, intimating that he is merely imitating the actions of the business groups who have forgotten what the war was for and push mainly for the dollar sign.

I am not so much afraid of the greed of the farmer as I am concerned lest he become giddy, dazed, and cuckoo over so many rapid contradictions and disappointments in return for his national deposit of patience, forbearance, and loyalty.

Largely because the farm folks I know best are outspoken sometimes to their friends, I think I have some insight into the situation. Because the majority of the farmers really do not know exactly what parity stands for but are fully aware of what charity signifies, and because they would rather produce a surplus for charity than to store it away to be haggled over through parity, it means using all-out efforts for a bumper crop in 1946.

I am sure that this is the correct hunch. I am positive that farmers prefer risking one year's surplus for charity or relief to piling up perfectly good victuals until the proper bargain can be struck in exchange.

Perhaps I am too free in using the "charity" term respecting the food relief tonnage expected of our farmers. However, it may be a trifle early to start any squabble between us over the terms on which settlement, if any, will be made. It's true the farmer is not exactly selling wheat on a charity market in terms of his own private income. But maybe America is, and if so, what about it?

Well, I suspect that such a gift for human welfare and maintenance of decent order and a stimulation of renewed hope abroad would be like the proverbial bread on the flowing waters. I would think so but for one recurring thought—that too few of our foreign folks can revive much confidence in the future by reason of so many disasters in the recent past. If we could send them some bond of unity and give them some strength of soul along with the food we dole out, and if we could stick to this new international feeling awhile to see things through, the whole investment would pan out.

Some of my friends are bound for London this month to share in the fresh experience of starting a new international farmers' association. I think they will return home with a broader outlook and a more serious opinion than some of them have had before relative to the interdependence of nations in a world grown smaller.

You and I can recall the days when the local township and its doings and public affairs, its markets and its successes were the sum total of our horizon and all we seemed to require for reasonable prosperity and content.

Gradually through our later lives the county, then the state, then the region, and finally, the commodity bloc, assumed the center of the stage in our thinking and our planning for agriculture. We were not satisfied to send delegates to the Grange state convention or elect men to state assemblies. It became our purpose to set up skillful representatives in every state capital and in the largest industrial market places, as well as at Washington.

Finally after fighting two world wars over narrowness and bigotry, we find our farm leaders—and other ones too—standing down on the shores of the ocean, wondering what lies beyond for future organization and greater power and strength. Agriculture has in fact outgrown its old American birthplace and environment and is about to step across the international barrier—and we hope strip that barrier meanwhile of much cluttering tariffs and misunderstandings.

ALL of this painful growing spasm we have experienced during the past transition period could hardly have been avoided and it did some of us good. Some of us made mean remarks and said unkind things about brother farmers, but most of that is laid aside like old army relics.

Yet we are not quite to the hands-across-the-sea phase until we find out how to cure our own ills and are willing to be charitable among our own home folks. My hunch is that if we put more emphasis on charity and less on parity—the kind we keep on hiking after but never reach—the way will be smoother for our brogan-shod feet as well as for the atomized aircraft of the coming generation.

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)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
E-2-42 Fertilizing for More and Better Vegetables
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II-12-42 Wartime Contribution of the American Potash Industry
A-1-43 The Salt That Nearly Lost a War
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CC-8-44 Soil Fertility's Effect on Asparagus
MM-12-44 Blue Lupine Is a Valuable Legume
QQ-12-44 Leaf Analysis—A Guide to Better Crops
A-1-45 Fertilized Corn Plants Require Well-Ventilated Soils
C-1-45 Fertilizers for Cotton and Corn Following Lespedeza
G-2-45 Some Whys and Wherefores for Air-Conditioning Soils
K-2-45 Plow-Sole Fertilizing on the Average Farm
P-3-45 Balanced Fertility in the Orchard
Q-3-45 Earliness Counts with Austrian Winter Peas
R-3-45 Higher Corn Yields for North Carolina
V-4-45 Yield and Quality of Cotton Can Be Improved by Boron
W-4-45 Fertilizing Golf Greens
Y-5-45 How Long Do the Effects from Fertilizer Last?
Z-5-45 Alfalfa—the Aristocrat
BB-5-45 Applying Experimental Work to Cotton Farming
DD-5-45 A Case of Combined Potassium and Boron Deficiencies in Grapes
EE-6-45 Balanced Sods in Orchards
FF-6-45 Orcharding from the Ground Up
GG-6-45 Know Your Soil
JJ-8-45 Plow-Under Practices
LL-8-45 Fertilizing for Better Soybeans in North Carolina
MM-8-45 Red Clover Suggests Shortage of Potash
NN-8-45 The Effect of Borax and Lime on Quality of Cauliflowers
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
PP-10-45 More Vegetables for Less Money
QQ-10-45 A Little Boron Boosts Sweet Potato Yields
RR-10-45 A Potash-Nitrate Relationship in Corn As Revealed by Tissue Tests
SS-10-45 How to Start White Dutch Clover Pastures in Florida
TT-10-45 Kudzu Responds to Potash
UU-10-45 Soil Conservation—More Plant Food—Better Crops
VV-11-45 Borax on Crimson Clover in Tennessee
WW-11-45 What Is the Best Method of Applying Fertilizer
XX-11-45 Kudzu on Abandoned Land Needs Phosphate and Potash—Maybe Borax
YY-11-45 Potash—In War and Peace
ZZ-11-45 First Things First in Soil Fertility
BBB-12-45 Success with Blueberries
CCC-12-45 Poor Soils—Poor People
DDD-12-45 Efficient Crop Production Means Balancing Supply of Available Plant Nutrients
FFF-12-45 Florida's Legume Pastures Depend on Seed Source
A-1-46 Crop Production Horizons
B-1-46 Potash Increases Tomato Yield and Quality
C-1-46 A New Machine for Deep Fertilization
D-1-46 A New Legume for the South—Wild Winter Peas
E-1-46 The Sources of Potash for Flue-cured Tobacco
F-1-46 The Fertilizer Rate Problem
G-2-46 Profit on Mississippi Soils from One Ton of Potash under Cotton
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
I-2-46 Boron Deficiency of Lettuce
J-2-46 Correcting Potash Deficiency in Growing Corn
K-2-46 Thank You Farm
L-3-46 Tomatoes Are a Field Crop in Western Ohio
M-3-46 Pasture Possibilities on Coastal Plain Hills
N-3-46 Sweet Potatoes Are Proving New Gold for the South
O-3-46 Fertilizer Placement for Corn in Kentucky
P-3-46 The Story of Potash

THE AMERICAN POTASH INSTITUTE

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

One Sunday morning, just before service, a note was handed up to the Rev. Henry Ward Beecher. Opening it the famous clergyman discovered that it contained the single word: "Fool."

Mr. Beecher arose, described the communication to his congregation and added, with becoming seriousness: "I have known many an instance of a man writing a letter and forgetting to sign his name but this is the only instance I have ever known of a man signing his name and forgetting to write the letter."

MISTAKE

He: "There's a certain reason why I love you."

She: "My goodness!"

He: "Don't be ridiculous."

"Madam, what do you mean by letting your child snatch off my wig?"

"Sir, if it is just a wig, think nothing of it. I was afraid that the little devil had scalped you."

TOO MUCH FOR MAGGIE

A canvasser for a magazine house walked to the door of the prospect and knocked. A colored maid answered.

Canvasser: "Is the lady of the house in?"

Maid: "She's takin' a bath, suh!"

Canvasser: "I'd like to see her."

Maid (grinning): "I'se speck you would, white man."

The only way to get along with women is to let them think they're having their own way. The only way to do that is to let them have it.

SHORT-SHORT EPITAPH

The young reporter had been lectured about padding his stories, getting in too much uninteresting details. So when a fatal accident took place in the highest building in town, he reported it this way:

"Bill Walker, the janitor, looked up the elevator shaft in the Jones building this morning to see if the elevator was running. It was. Age 52. Funeral Tuesday morning, 11:30."

Spring fashion note: Young ladies will be wearing the same things in sweaters again this season.

Bachelor: "Sometimes I yearn for the peace and comfort of married life."

Married Friend (wistfully): "So do I."

Boy: "Where did I come from, Daddy?"

Father: "Well, er—you see, son, the bees fly from flower to flower—"

Boy: "Oh, I know all that stuff, but the kid next door is from Nashville. So where am I from?"

Diner: "This steak isn't very tender."

Waitress: "Sorry, sir, but the only affectionate things in this restaurant is us waitresses."

Many a chap with a plump waistline swings himself into the day's activities more deftly than the average lean and lanky type. He has cultivated poise and balance.

A fool and his money are some party.


V
C

Printed in U. S. A.

Better Crops with PLANT FOOD

June-July 1946 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 XXX NO. 6

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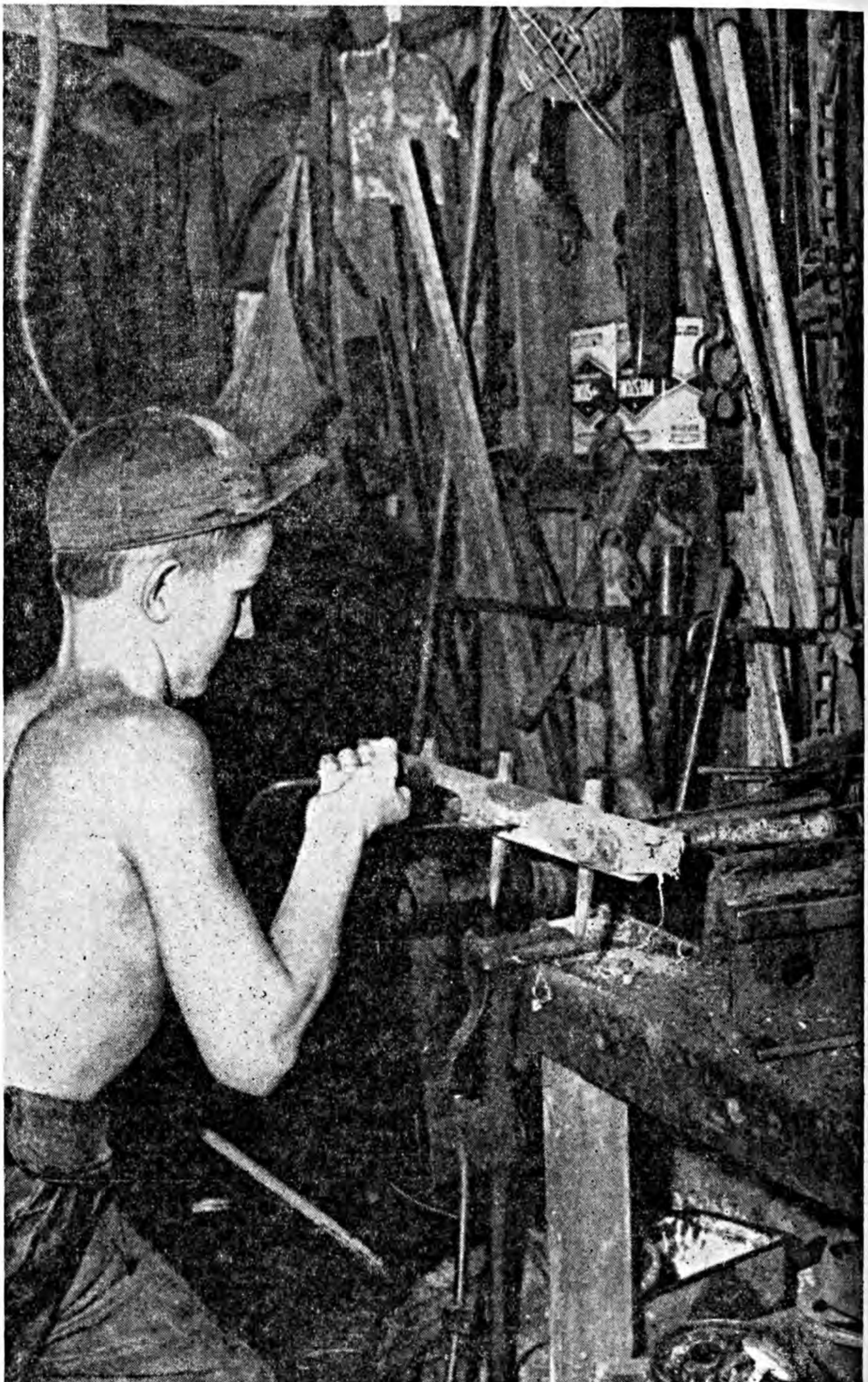

A good workshop with the "know-how" is important to any farm

Better Crops with PLANT FOOD

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In Defense of . . . . .

Land Lore

Jeff McDermid

AS a fence-jumping rural scribe I often marveled and envied the ease and stark simplicity with which some stump speakers tackled the whole complex farm problem, and had it sorted, screened, steamed, and processed for quick consumption inside of half an hour's discourse. Being so long rather close to the wrinkles on the face of nature and the patches on the jeans of farmers had undermined my confidence in my own ability to lift up their hearts and strengthen their hands solely through the medium of platform platitudes. I have lurked modestly in discreet corners of town halls and other rural forums on many a heated occasion and observed clowns thresh out things that wiser men avoided.

Luckily for the county agent and the other program sponsors, there was always a convenient and ready flow of such wit and wisdom on tap, becoming available and particularly cheap for the committee along about election time. In a sort of belated testimonial to the multitude of miscellaneous misinformation uncorked by such volunteer agricultural clairvoyants, I dip a bit into some of the land lore which many of them abused and misjudged while jumping at conclusions and aiming at much applause. At least it provides me with a bow from which to let fly a few arrows.

Incidentally, it must be frankly admitted at the outset that us solemn and serious guys deserved to be relegated to the listening posts, regardless of our criticism of the aforesaid vociferous volunteers. We lacked the talent for wise-cracking without which it was supposed no farm audience could be kept awake for twenty minutes after their nose-bags had been removed. Anecdote and repartee have saved many a farce from failure.

Lambasting the middleman as an arch market malefactor was the top-notch theme of most spellbinders back in the days of the first pioneer co-ops. I do not come here myself to defend all the snide games that "happened in the dark" between the God-fearing producer and the humble consumer; but because those preachments of former times were only half truths, they seemed to me unworthy of such undue emphasis. It would have been far kinder and wiser for the speakers to lay it on the line about the increasingly necessary services which the public would demand, and which merchandising co-ops must eventually supply or else go bankrupt.

IN those same categories were those who aimed at the bull's eye of prejudice through blanket ridicule and condemnation of all products which for the moment offered competition to raw farm materials—the synthetics as well as the substitutes, like margarine. "Dirty old axle grease" in reference to a product high in sanitary excellence, accompanied by certain unchecked homeopathic experiments, in which hogs and chickens ate one fat product avidly and nobly refused the other, was not conducive to a vigorous improvement program for creameries.

Another bungling term often heard in debates and orations is the "family-sized" farm. Because so much depends on the ability of any sized family, as well as its equipment and the productivity of its land, a more sensible term to use is either "family-type" or "family-operated" farm. It all adds up the same way, as long as the object sought is to preserve such farms to stand the stress and strain and make the decisions in a changing world not yet ready to accept large-scale corporation agriculture.

To stand up and yodel about the sacred nature of "family-sized" farms or lump them together in regard to protective laws and current regulations is just like flying in the face of facts without a pilot. I have been checking through some heavy ammunition lately which most fervid orators would discard as too tedious and too factual for safe usage.

Studies of family-operated farms were made in five typical zones of this country. In the cotton belt the 1930-45 average net annual farm income was about $1,150 on $7,500 invested capital, of which $3,500 was free of debt. The other four types showed up thus: Dairy farms, $1,600 net annual income on $12,000 invested capital, with $8,000 debt-free; corn belt farms, $1,800 net income on $20,250 capital, with $9,000 of it debt-free; winter wheat farms, $2,300 net income on $20,500 investment, of which $8,000 was debt-free.

The value of machinery and equipment ranged from about $500 on the cotton farm to about $2,000 on the winter wheat ranch. The value of the production per hour of man labor varied from 52 cents on the cotton farm which was family-operated to about one dollar on the same kind of a winter wheat farm. I presume the net degree of satisfaction and family enjoyment as between these types of agriculture is something that no man can weigh or measure by any financial scales or yardstick. I am sure glad to know this is so, because if it wasn't, comparisons would be far more odious than they often are.

LEADING out of that one is its twin question, often asked by legislators and business salesmen who seek a quick estimate of the buying power of agriculture — How much of the gross farm income represents net, or in-the-pocket spending money? The usual replies I have heard on the circuit are vague and varied, as they might well be. One common rule-of-thumb way is to assume that a certain gross income bears the same relation to net income on all types of specialized farms.

Of course it's silly, but there are folks who claim that the New England dairyman's net income is the same percentage of gross income as either that of the cotton or the wheat farmer, which is worse than misleading doc-

trine. Not only does the relationship between gross and net differ widely as to kinds of activity followed, but it also alters with the passing years. First, one must know what kind of farm—cash grain, hog-beef, hog-dairy, dairy-cash crop, wheat-livestock, southern plains, black prairie or delta—and second, at what level of farm prices and expenses is the income derived.

Maybe we fall so easily into lump sum generalities because our urban business judgment is still hitched to the old walking-plow era of live-at-home, non-commercial agriculture. A farm was just a cozy homestead, then, with maintenance and production costs closely on a par everywhere. What a man ate from his own acreage counted more in net profits than it is ever booked up for now, and cash in hand meant much less in proportion to happiness and contentment.

There has also been a vivid change in the way city folks in the ranks of commerce, labor, and industry keep a watchful eye on farm market opportunities. "Way back when" farmers were not looking so hard for the net dollar, few business organizations ever charted the volume of their sales to rural customers, except to note the purely local effect.

On this great shift of sales and buying emphasis hinges all the equalizing plans and most of the price and parity problems of these complex times. Farmers are never alone in their bookkeeping duties. The business world looks over their shoulders and wafts hopeful breath on the back of their sunburnt necks.

An example of "the why" — In 1932 our farmers spent 328 million dollars for machinery, automobiles, and building materials; but in 1942 they bought two billions' worth, or six times as much of these durable goods out of a cash income only two and a half times greater. Your average farmer is strictly up-to-date and eager to partake of the flesh-pots and helpful gadgets. If the strikers and the strike-resisters ever get this fact into their noodles, maybe we'll begin to sell the farm market as nobody has ever "been sold" before.

As an opposite thought, of course, all must be aware by now of the reliance of farmers for their prosperity upon the non-agricultural earning power and employment level. That, too, has changed, because not over four decades ago the ruralite could "hole in" with his ground-hog neighbor and live off his own fat regardless. One would think that this interdependence among us would tend to curb the too reckless independence of pressure groups, but it seldom seems to do so. When railroaders refuse to haul the food, they, too, go hungry; and when farmers quit growing stuff they will miss some of the tasty variety foods needed to "balance their rations." If railroaders are ready to live off their own backyard gardens or wheat growers and dairymen are willing to forego their citrus fruits, and vice versa, then we can wave the independent banner and

(*Turn to page* 49)

Photograph of a vigorous, healthy, and adequately manured stand of rubber. Note the dense and dark foliage which cuts off nearly all light from the ground. The area supports a luxurious ground cover which checks soil erosion, discourages injurious weed growth, and possibly adds some nitrogen to the soil.

Improved Production on Rubber Plantations

By W. E. Cake

United States Rubber Company, New York, New York

THE natural rubber industry, comprising more than 8,000,000 planted acres, must be regarded as one of the major agricultural projects of the twentieth century.

Rubber-growing is amenable to both small-scale and large-scale operation. On the one hand, there are the many native gardens containing a few trees only; at the other extreme, there are the European and American-owned estates consisting of many thousands of acres in consolidated blocks.

The largest rubber plantations under single ownership are those of the United States Rubber Company, which, before the war, included 28,770 planted acres in British Malaya and 72,871 planted acres in Dutch Sumatra. The total of 101,641 acres was planted with approximately 10,000,000 rubber trees producing at the rate of about 75,000,000 lbs. of rubber per year.

The plantations of the United States Rubber Company pioneered in scientific research as applied to raw rubber production, and many economically important developments have resulted from this work. It is one aspect of this research which is described in the present paper.

Natural rubber production is an industry which requires an abundance of labor. Since each tree has its own distinct and individual characteristics, it has so far been impossible to develop any satisfactory mechanical means to accomplish the tapping operation. Tapping is therefore a manual process, and a well-run estate requires labor to the extent of about 235 men per 1,000 acres in bearing. The importance of labor in plantation rubber production is illustrated by the fact that tapping costs comprise more than 27% of the total f.o.b. expenses in the preparation of smoked sheets for shipment from Malayan ports. As high as it is, this figure is probably lower than usual for the industry in general since it is taken from the 1942 forecast of operations for the Malayan plantations of the United States Rubber Company, where production was at a considerably higher rate than average for plantations in the East.

It is no more difficult and requires no more time to tap a high-yielding tree than a poor-yielding one. Accordingly, an obvious means of reducing the cost of rubber production would consist of increasing the yield of rubber per tree.

Developments toward increasing the yield per tree have been accomplished along two different lines; namely, (1) the application of fertilizer treatment in stands planted to rubber, and (2) improvement of the stock available for planting through genetical selection.

The United States Rubber Company's first sizable plantings were conducted in 1911 in the Asahan district of the East Coast of Sumatra. Two different soil types are encountered in this area: (1) A white loam, frequently containing sand and/or clay, extending along the coast; and (2) a red soil of volcanic origin formed in situ from liparite tuff which occupies the higher ground farther away from the coast.

The rubber was planted at the rate of 121 trees per acre. Tree losses and thinning reduced the density somewhat; accordingly, the stands averaged about 100 trees per acre at the time production started. For most considerations, it is sufficiently accurate to regard the yield per acre as 100 times the average yield per tree in an area of rubber.

The original planting was conducted with ordinary unselected seedlings of the type available in the East at that time.

These early plantings were brought into regular production in the latter part of 1915 and the first complete year's records were therefore obtained in 1916. The early yields were low, particularly in the white soil areas where, even during the third year of tapping, 1918, the harvest amounted to only about 250 lbs. dry rubber per acre. Yields in this range are insufficient to allow adequate returns on investment at the market prices for rubber which have, in general, prevailed.

Manuring Treatment

The question arose as to whether the situation could be improved through the use of artificial fertilizers. There was already plenty of evidence to the effect that growth, foliage, and fruit production can frequently be improved through fertilizer treatment. However, it did not immediately follow that manuring would increase the rate of rubber production since the rubber-containing latex of *Hevea brasiliensis* is neither foliage nor fruit; furthermore, nothing was known of the function of latex in the physiology of the tree nor of its precursors. There perhaps was some logic to the supposition that, if manuring improved growth, the larger trees resulting therefrom might give higher yields.

During the year 1919, the first comprehensive manuring experiment with rubber was laid out in a white soil area of the 1911 plantings. Various quantities, intervals of application, and kinds of artificial fertilizers were tried; all of the manures contained nitrogen. It is sufficient for the present to describe two of the treatment series: Series C involved annual applications of sodium nitrate at the rate of 5 lbs. per tree; Series E involved biennial applications of ammonium sulphate at the rate of 4 lbs. per tree. (Five lbs. sodium nitrate contain approximately the same amount of nitrogen as 4 lbs. ammonium sulphate.) Series A comprised an unmanured control.

The yield response to these fertilizer treatments was rapid and decided. At the same time, there was a marked improvement in the appearance of the manured trees in that the foliage became denser and darker green in color. Also, the trees in the manured plots showed improved growth rates.

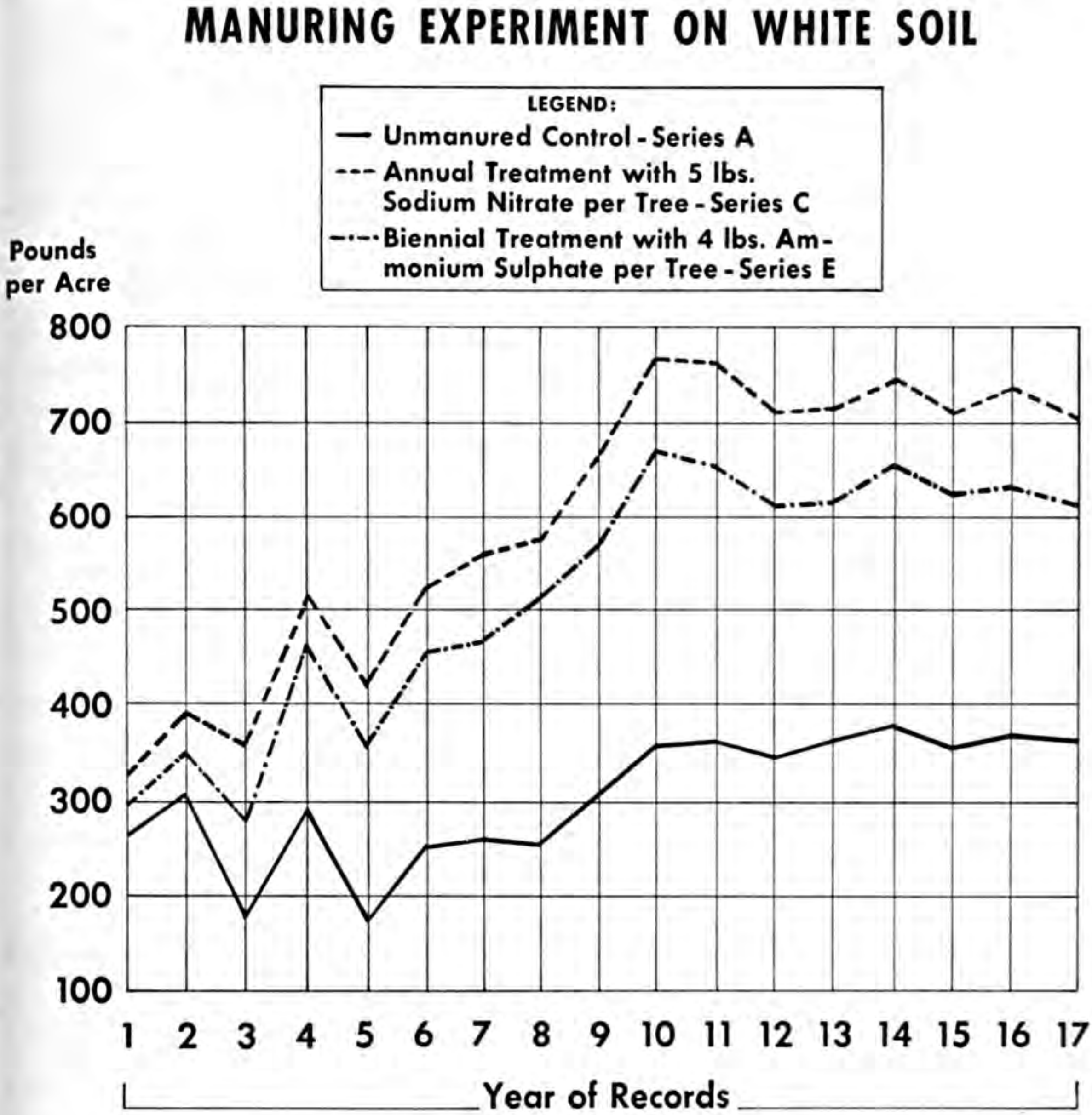
The results of carefully controlled yield measurements in this experiment are shown in Table 1; the same data are presented graphically in the chart which follows the table.

The foregoing data indicate decided yield improvements due to manuring, increasing at first but gradually leveling off to more or less constant values. After becoming constant, annual manuring resulted in a proportionate yield

Table 1

Manuring Experiment on White Soil

Year of Records	TREATMENTS					
	Series A Unmanured Control		Series C Annual Treatment with 5 lbs. Sodium Nitrate per Tree		Series E Biennial Treatment with 4 lbs. Ammonium Sulphate per Tree	
	Yield per Acre	Relationship	Yield per Acre	Relationship	Yield per Acre	Relationship
1st	279 lbs.	100%	321 lbs.	115%	292 lbs.	105%
2nd	311	100	393	127	353	114
3rd	180	100	354	196	283	157
4th	298	100	534	179	465	156
5th	171	100	422	246	353	206
6th	255	100	535	210	467	182
7th	268	100	550	205	473	177
8th	259	100	581	225	505	196
9th	307	100	672	219	575	187
10th	362	100	764	211	671	186
11th	358	100	757	211	656	183
12th	334	100	709	213	608	182
13th	363	100	725	200	611	168
14th	380	100	741	195	658	173
15th	356	100	719	202	623	175
16th	372	100	736	198	633	170
17th	357	100	707	198	615	173



increase of about 100% and an actual yield increase of approximately 370 lbs. rubber per acre per year; the biennial treatment caused a proportionate yield increase of about 75% and an actual yield increase of approximately 270 lbs. rubber per acre per year. The advantage of annual over biennial treatments amounted to about 100 lbs. rubber per acre per year.

In view of these highly satisfactory results on white soil, it was decided to conduct a somewhat similar manuring experiment with rubber situated in a red soil area of the property. In such stands, the early yields were not so low as in the white soil areas and growth was somewhat better; however, it seemed important to determine the manner in which red soil stands of rubber would respond to treatment with nitrogenous fertilizers.

It is perhaps sufficient to describe two of the treatment series in this manuring experiment on red soil. Series B involved annual applications of ammonium sulphate at the rate of 4 lbs. per tree; Series D involved biennial applications of sodium nitrate at a rate of 5 lbs. per tree. In this experiment also, Series A comprised an unmanured control.

Results of the yield measurements in this experiment are shown in Table 2; the same data are presented graphically in the chart which follows the table.

Upon comparison with the white soil experiment, the response to fertilizer treatment in this red soil area was

Table 2

Manuring Experiment on Red Soil

Year of Records	TREATMENTS					
	Series A Unmanured Control		Series B Annual Treatment with 4 lbs. Ammonium Sulphate per Tree		Series D Biennial Treatment with 5 lbs. Sodium Nitrate per Tree	
	Yield per Acre	Relationship	Yield per Acre	Relationship	Yield per Acre	Relationship
1st	414 lbs.	100%	412 lbs.	100%	426 lbs.	103%
2nd	469	100	503	107	509	109
3rd	523	100	598	114	606	116
4th	509	100	601	118	575	113
5th	443	100	534	120	515	116
6th	465	100	621	133	565	121
7th	474	100	618	130	577	122
8th	478	100	674	141	564	118
9th	472	100	693	147	571	121
10th	501	100	704	141	586	117

somewhat sluggish and the proportionate yield improvements were not so large; the latter is undoubtedly due, at least in part, to the fact that the unmanured controls in the red soil experiment have given consistently higher yields than the unmanured fields of the experiment on white soils. Nevertheless, in the red soil experiment also, the improvements in production due to manuring are significant and appreciable. After attaining more or less constant levels, annual manuring resulted in a proportionate yield increase of about 40% and an actual increase of approximately 200 lbs. rubber per acre per year; the biennial treatment caused a proportionate yield increase of about 20% and an actual yield increase of approximately 100 lbs. rubber per acre per year.

As soon as the manuring experiment on white soil began to show definite indications of yield improvement through fertilizer treatment, a general program involving the application of nitrogenous manures was adopted for the white soil areas of the property. The same was done for the red soil stands when the experiment on this soil type started to yield positive results. Approximately 10,000 acres were accorded manuring treatment in 1921; by 1923, the whole "H.A.P.M." complex of about 40,000 acres was included in the program.

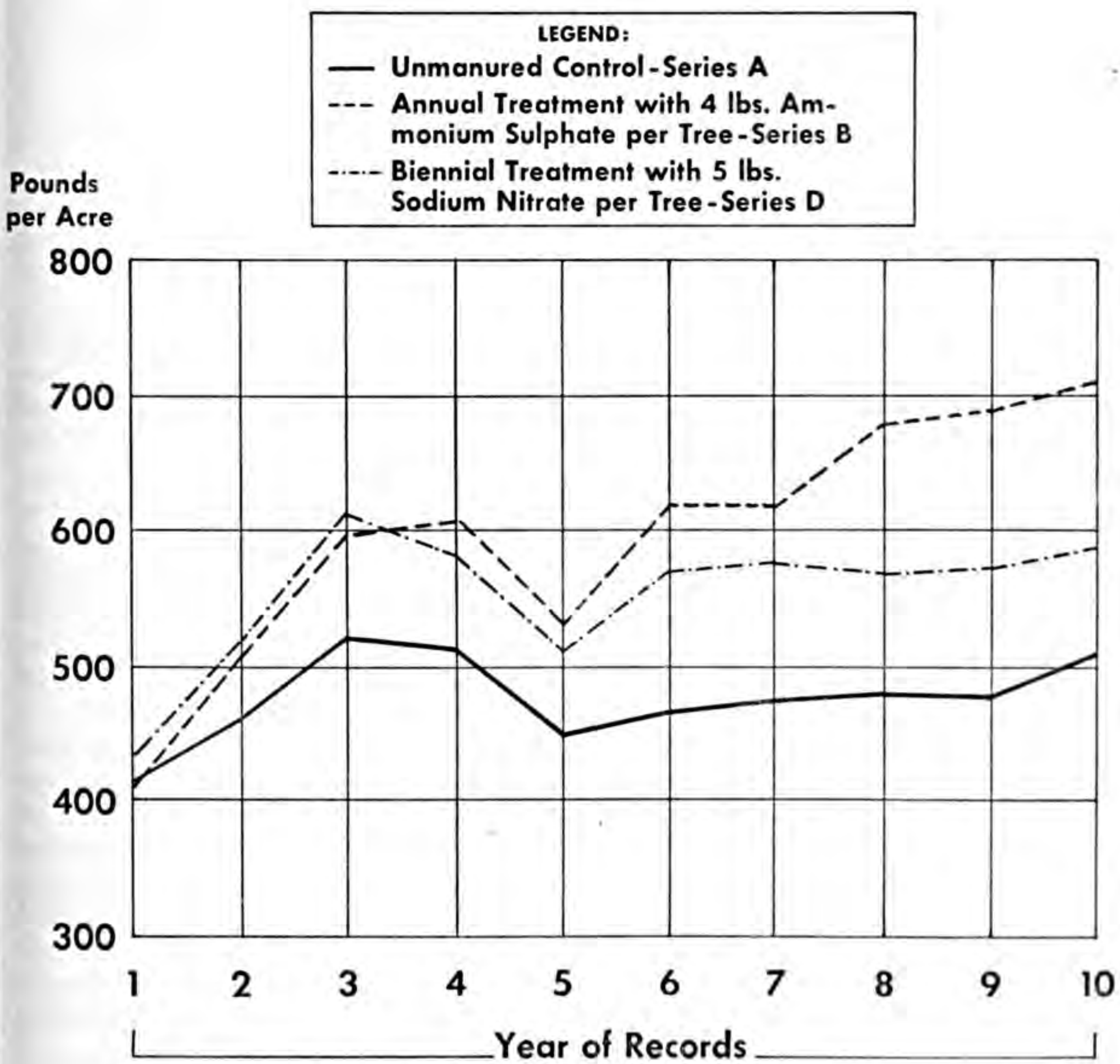
Due to variable economic factors, the periodicity of fertilizer application has not been held constant. In general, the whole property was accorded treatment during years of high rubber prices and about half the area during years of low market price. No stand was omitted from manuring for more than one year and, so far as possible, the poorer areas were given preference in frequency of treatment. As an average from 1923 up until the war with

Japan, the periodicity of application was about equivalent to a point halfway between annual and biennial treatment.

Following the adoption of this manuring policy, the plantations as a whole showed successive improvements in yield during the ensuing years. By 1932, the whole of the 40,000 acres comprising the "H.A.P.M." complex produced rubber at an average rate of 684 lbs. per acre. Yield improvements continued beyond this date but, by this time, appreciable areas planted to genetically improved stock had come into bearing and, as separate records were not kept, it is impossible to designate how much of the further improvement was due to manuring and how much to the tapping of selected planting material.

In any event, the over-all average of 684 lbs. rubber per acre in 1932 demonstrated quite conclusively that the benefits from manuring, as shown by the experiments, were indeed being fully realized in general application. Since the annually manured plots in both experiments attained about the same ultimate yield (approximately 700 lbs. per acre per year) and since the unmanured control fields leveled off around 360 lbs. per acre per year in the white soil experiment and 480 lbs. per acre per year in the red soil experiment, it follows that the general average of 684 lbs. per acre in 1932 reflected a yield improvement due to the fertilizer treatment of about 325 lbs. per acre per year

MANURING EXPERIMENT ON RED SOIL



in the white soil areas of the property and around 200 lbs. per acre per year in the red soil stands.

The general manuring was conducted with either ammonium sulphate or sodium nitrate, depending upon which was cheaper to purchase during any particular year. The cost of fertilizer application varied considerably from year to year; it was highest just before the war when, in 1941, the treatment involved an expenditure of $10.73 per acre manured. During "normal" years, the cost of fertilizer treatment was much lower; for example, in 1936 the expenditure amounted to $4.60 per acre treated. These figures are total costs; i.e., they include not only the price of the fertilizer but also freight, insurance, local transport, and labor for application in the field.

Fertilizer Profitable

For the sake of extreme conservatism in showing the economic returns from manuring, consideration is here given only to the highest treatment cost encountered; namely, the expenditure of $10.73 per acre incurred during 1941. Taking the periodicity of application as half way between annual and biennial treatments, the average annual cost, on the 1941 basis, would amount to three-quarters of the figure noted, or $8.05 per acre. As has already been shown, the general manuring program over the whole property resulted in a yield increase of, say, 325 lbs. per acre per year in the white soil areas and 200 lbs. per acre per year in the red soil stands. Assuming these extra yields have become available for an average manuring expenditure of $8.05 per acre per year, it follows that the extra production has been realized at a manuring cost of 2.5¢ per pound rubber in the white soil areas and 4¢ per pound rubber in the red soil stands.

The extra yields from manuring are harvested at practically no increase in tapping and collecting costs and these items can therefore be ignored in considering the economy of manuring. The same applies to overheads. Taking transport and processing costs in smoked sheet manufacture at 1.36¢ per pound and Netherlands Indies export duty at 2.64¢ per pound, it follows that the extra rubber from manuring treatment can be placed f.o.b. Netherlands Indies port at a total extra cost of about 6.5¢ per pound in the case of production from white soil areas and 8¢ per pound with the harvest from red soil stands. Since the market price for smoked sheets f.o.b. Eastern port has ranged between 13 and 20 cents per pound during recent years, the financial advantage resulting from manuring on these rubber plantations becomes immediately apparent. Actually, the early adoption of a manuring program for the Sumatra plantations of the United States Rubber Company was one of the principal factors in transforming what appeared at first as a mediocre venture into an enterprise which was profitable indeed. From a financial standpoint, the feasibility of manuring as a means to increase yields was particularly fortunate because the higher production becomes available almost at once; the other important method of attaining improved production, i.e., genetical selection of planting material, is a comparatively slow process.

As stated earlier in this paper, the use of nitrogenous fertilizers on these rubber plantations resulted in marked improvement in the growth and appearance of the trees. The contrast between a nitrogen-deficient area and an adequately manured stand is clearly demonstrated by the two photographs.

It is probably of interest to mention a further development which has taken place in the manuring experiment on white soil. The experiment was continued beyond the 17 years of observations reported in the table and graph accompanying this article. During later years, the plots of Series C (manured annually with sodium nitrate) began to show marked diminution in yield while, at the same time, this was accompanied by signs of regression in the crowns of the trees and a decided

(*Turn to page* 47)

Dynamic Sassafras Soils

By George R. Cobb

Salisbury, Maryland

IN 1921 J. M. Snyder and R. L. Gillett, representing the USDA Bureau of Soils, made a soil survey of Wicomico County, Maryland. As I was serving as County Agent at that time my interest in soils was naturally increased and because I was planning to purchase some farm land I awaited the results of the survey with a strong personal interest. Incidentally I secured several glass tubes, 3 feet by 2 inches, in which the "surveyors" placed profiles of the different soils in the county. These tubes were used for display in the office and were visual aids in explaining to farmers and would-be farmers the differences between the soil types of the county.

The survey showed that the Sassafras series of soils was perhaps the best soil for all farming purposes and that there were more acres of this type in the county than any other. Among the soils listed in the survey were Keyport, Elkton, Portsmouth, Norfolk, St. Johns, Tidal Marsh, Swamp, and Sassafras. The total acreage of Sassafras in the county consisted of—

	Acres or	%
Sassafras sand	24,000	9.9
Sassafras loamy sand	22,400	9.3
Sassafras sandy loam	8,704	....
deep phase	6,784	6.4
Sassafras fine sandy loam	6,904	2.5
	68,792	28.1

In discussing the survey with Messrs. Snyder and Gillett it became clear that the Sassafras sandy loam was the best soil in the county for agricultural purposes because of its good drainage, ease of handling, and natural productiveness. The surface soil of the sandy loam consists of a light-brown, mellow light loam with a depth of from 8 to 10 inches. This is underlain by a reddish-yellow or yellowish-brown heavy sand or sandy clay loam extending to 22 to 30 inches where it passes abruptly into a dull red or reddish yellow sand or loamy sand. The good drainage is due perhaps to position and the presence of the porous substratum. The friable, heavy-textured subsoil, however, is retentive of moisture, and crops do not suffer during ordinary droughts. It can also be tilled under a wide range of moisture conditions.

The Sassafras soils are classed under soils of the Coastal Plain and may be found in New Jersey, Delaware, Maryland, and Virginia. On these soils "there exists a very highly improved type of agriculture and the best yields of wheat, clover, and timothy in the South are made on the Sassafras loam and silt loam." In New Jersey the series covers over a million acres (Hester) and the sandy loam embraces about 150,000 acres and is described as "one of the better agricultural soils of the Coastal Plain." The series includes sandy loams, gravelly loams, loamy sands, and fine sandy loams. These soils contain more organic matter than the gray soils of the Coastal Plain, such as the Norfolk series, and they are more retentive of moisture and naturally more productive.

Coastal Plain soils are said to be of the Pleistocene age and of the Columbia group and made up of un-consolidated gravels, sands, and sandy clays. Most of these soils have been derived mainly from the erosion of the Piedmont Plateau and other inland areas, and the materials were transported and deposited beneath the sea to be exposed by the uplift of the ocean floor. In geological sense the soils may be said to be of recent origin, for it has been

Differences in growth of tomatoes growing in sassafras sandy loam are clearly indicated in the following treatments:

51—no fertilizer
53—fertilizer only
55—lime only
57—fertilizer-lime
59—fertilizer, lime, minor elements

but comparatively lately that they have been exposed.

Some authorities rate the Sassafras series of soils as among the "poor" soils as compared with a Hagerstown loam which is rated as a "good" soil. The following table compiled by F. H. King illustrates the difference, chemically, between "good" and "poor" soils.

Pounds of water-soluble plant food in 4 million pounds of soil

	Average of 4 poor soils	*Average of 4 good soils*
Nitrogen	7.5	21.3
Phosphorus	12.1	22.2
Potassium	46.0	69.3
Magnesium	44.9	91.9
Calcium	100.5	264.8
Sulphur	66.9	156.9

In 1941 a study of soils from successful and unsuccessful tomato fields was made by the University of Delaware to determine, if possible, the most satisfactory soil fertility levels for the economic production of tomatoes in Kent County of that State. Three soil samples were taken from each of 23 farms or fields. These samples were taken from poor as well as good producing soils and chemical tests were made of these samples.

Soil analysis	*Average yield ⅝ bkts. per acre*
pH above 5.8	386
pH below 5.8	440
Mg. medium	438
Mg. low	389
Org. M. above 1%	477
Org. M. below 1%	362
N. high	476
N. medium	378
P. low to medium	392
P. low minus to low	440
K. low plus to medium	457
K. low minus to low	341

Of special interest in the above table is the fact that a low pH produced more tomatoes than did a pH above 5.8 which is contrary to many other experiments. Also it may be noted that a low minus to low phosphorus content produced almost a ton more per acre than did a soil where the phosphorus content was low to medium. Otherwise the results of this survey show that what may be considered a "good" soil will produce more tomatoes than a "poor" soil.

Soils not only differ chemically but they also vary in their mechanical make-up as illustrated by the following table:

	Fine gravel Per Cent	*Coarse sand Per Cent*	*Med. sand Per Cent*	*Fine sand Per Cent*	*V. fine sand Per Cent*	*Silt Per Cent*	*Clay Per Cent*
Sassafras fine sandy loam.......	0.6	8.0	14.6	27.0	24.1	19.8	5.9
Sassafras loam.................	2.4	8.1	6.2	13.2	20.1	40.4	9.6

Comparing a Sassafras soil with a Lansdale loam and a Toledo soil we find that:

	Sand	*Silt*	*Clay*
Sassafras contains...........	65%	26%	9%
Lansdale soil contains.......	31	51	17
Toledo soil contains.........	20	52	28

showing that as the soils increase in natural productiveness, the sand and gravel content decreases while silt and clay increase.

The most recent work with a Sassafras sandy loam that has come to my attention is that done by Dr. J. B. Hester in the Campbell Soup Company's laboratories at Riverton, N. J. The results of this work have been published as a monograph entitled "Fundamental Studies on some Tomato Producing Soils" in which are compared 11 different un-cropped soils. As the results of this study agree with results of hundreds of demonstrations conducted by the American Potash Institute on many farms in the northeast and mid-Atlantic section, it seems advisable to review a part of this study.

In this review a Sassafras sandy loam will be compared with a Lansdale loam which is naturally a more productive soil than a Sassafras and a Toledo soil which is more productive than either.

These soils were placed in three gallon pots with 14,000 grams of soil, representing two horizons, and set to tomatoes. Although neither the Lansdale nor the Toledo are found in the Coastal Plain, the Lansdale is found in eastern Pennsylvania, and many acres are devoted to tomato culture, while the Toledo is a popular tomato soil type in Ohio.

The series of pots were treated differently—one series having nothing added as compared with a series having fertilizer (12-24-12) added, another series having lime only applied, a third series had fertilizer and lime applied, and the last series had fertilizer, lime, and minor elements added to the soil.

It has been shown that soils differ mechanically, and the table below illustrates some chemical differences found by Dr. Hester in the three soils mentioned:

	pH	*Ca*	*Mg*	*NH4*	*P*	*K*	*Mn*	*Al*
Sassafras sandy loam........	4.8	VP	P	G	VP	P	VVH	VH
Lansdale loam..............	5.3	F	G	VP	P	P	H	H
Toledo.....................	7.3	VVG	G	F	VG	VG	L	N

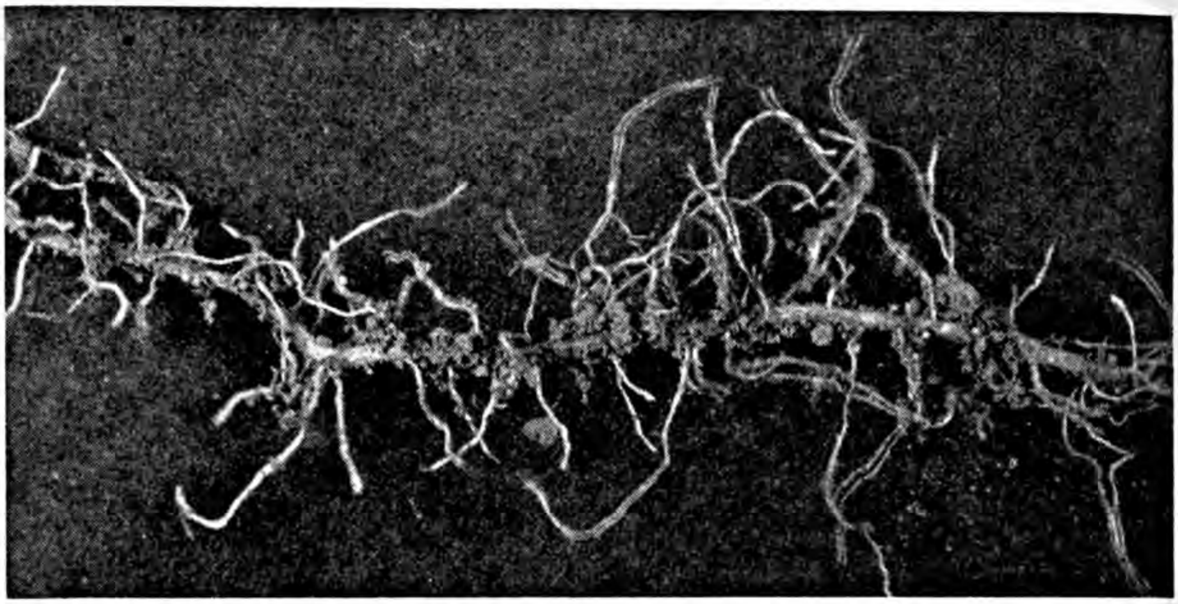
This table is self explanatory and shows that a fertile soil contains more of the plant-food elements than does a non-fertile soil, except perhaps manganese and aluminum which may be classed as plant-food elements.

Of interest is the chemical analysis of the Sassafras soil before and after the soil amendments were added:

	pH	*Ca*	*Mg*	*NH4*	*P*	*K*	*Mn*	*Al*
Un-cropped virgin soil.......	4.8	VP	P	G	VP	P	VVH	VH
Fertilizer added.............	5.0	VP	F	VVG	F	VG	VVH	T
Lime only added.............	6.75	VG	G	F	VP	F	M	T
Fert. and lime added........	6.45	VG	G	VG	VG	VG	M	N
Fert., lime, and minor elements	6.60	G	G	VVG	VG	VG	VVH	N

It will be noted from this table that a Sassafras sandy loam in its virgin state is extremely acid, the replaceable Ca, Mg, and K low. The organic

(*Turn to page* 40)



Potato roots with here and there a globular golden nematode attached.

The Newest Potato Pest— Golden Nematode

By Charles E. Gapen

Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland

THE newest potato pest in America, the golden nematode, gradually comes out in its true colors as Federal and New York State scientists study its oozing spread in Nassau County, Long Island. For generations a drain on the potato growers of Northern Europe and now established on much of the potato land of England and Ireland, it was first found in the United States in a potato field near Hicksville, about 40 miles east of New York City. Since 1934, the farmer-owner of that failing field had been asking for soil tests of several unproductive spots in an effort to locate the cause of his trouble. So it seems to Dr. G. Steiner, head nematologist of the U. S. Department of Agriculture, that, wherever this new crop threat came from, it probably got its start on this continent at least as early as 1930. Its continued presence here for possibly 15 years marks it as a danger to be considered in the future of all American potato areas.

Now the Department, Cornell University, and New York State researchers and inspectors find the golden nematode on approximately 800 acres in the vicinity of the Island potato-belt towns of Hicksville and Bethpage. Dr. Benjamin G. Chitwood, the resident nematologist from the Department's Bureau of Plant Industry, Soils, and Agricultural Engineering, says there are as many as 50 to 75 of the readily visible female nematodes in an ounce of the surface soil. By "surface soil" Dr. Chitwood means down to a depth of 3 or 4 inches. When potatoes are growing in the infested soil these small organisms, called eelworms by the English because of their appearance in one stage, become active when the temperature has reached

59° F. Chitwood digs up handfuls of soil and roots and shows how the females somehow are attached to the fine rootlets. They (the females) hold on and gain their substance from the plant that is all set to produce tubers. When they first begin their active life, that is, after they have hatched from the eggs that were left in the dead body of the mother nematode, they are almost transparent. This is the only stage when they can wiggle and move about; they are then threadlike rather than globular. When they become globular, like many men, they become sedentary. At this stage the laboratory men say they are a "protoplasmic gray" color, a common color of minute cells. Then with the maturing processes these little-more-than-microscopic eelworms become "bubbles" that are visible to the naked eye and gradually change to white, then to ivory, then to the bright golden color which gives them their name, and then to brown. You can see all these colors in a handful—except the protoplasmic gray. Gently free the roots of most of the dirt by letting it sift away between the fingers and many of the nematodes may be seen apparently cupped in slight depressions on the surfaces of the rootlets. As the soil and the rootlets dry, the organisms rub off readily and mix with the soil like bright grains of fine sand.

But when the potato plants push their roots near these hungry nematodes in the soil, the organisms make another tenuous attachment and go ahead with their life work of sucking nourishment and moisture from the crop. They cut the rootlets and interfere with the plant's supply of water and fertilizer, greatly reducing yields. Where infestation is high, the yield of late potatoes may be only one-fourth or less of normal and is unprofitable. (Dr. Chitwood says that if the golden nematode cannot be eradicated or controlled at reasonable cost, the infested lands cannot be used to grow late potatoes.) Early potatoes, such as Cobblers, if planted very early, may yield fairly well as they can do much of their growing in spring when soil temperatures are low. Such varieties can produce a good crop of tubers before the root system has been damaged badly. However, definite conclusions have not as yet been reached as to just what is to be done. Field research men and inspectors have been accumulating facts as a basis for action toward eradication, control, or as a basis on which to get along with this pest without too much of a cut in yield or too much expense. The experiments in the use of the soil fumigrants—DD mixture, Dowfume G., chloropicrin and carbon disulfide—indicate a very considerable control effect which in certain

This photograph of broken soil beside a potato plant shows the stolons and roots of the plant and the nematologists can recognize the female nematodes appearing like small grains of sand.

applications has killed off nearly 100 per cent of the nematode. The expense of applying these chemicals for commercial control, however, is high, and DD mixture, which so far seems best, costs about $60 an acre, says Chitwood. Unless the control effect extends over more than one season, he thinks it might not be commercially feasible.

Other ways out of this nematode pickle that have been suggested include: (1) A change over to other crops since the pest attacks only potatoes; (2) the public purchase of an area containing the infested lands and the disposition of them for other than agricultural uses; and (3) the selection or development of potato varieties that grow early enough to avoid the nematode or that will resist its attack.

DD mixture is a by-product of the petroleum industry that has recently been under test to determine its qualifications as a killer of various nematodes and other soil crop pests. The Division of Nematology, under Dr. Steiner's leadership, has been testing it at the Plant Industry Station at Beltsville, Md., and in field tests of various crops in addition to those tests on potatoes in the Long Island area. It is introduced into the soil to a depth of 4 to 6 inches. This gassing of the soil to get the golden

The relative size of the female golden nematodes is indicated as they show up on a dime as background.

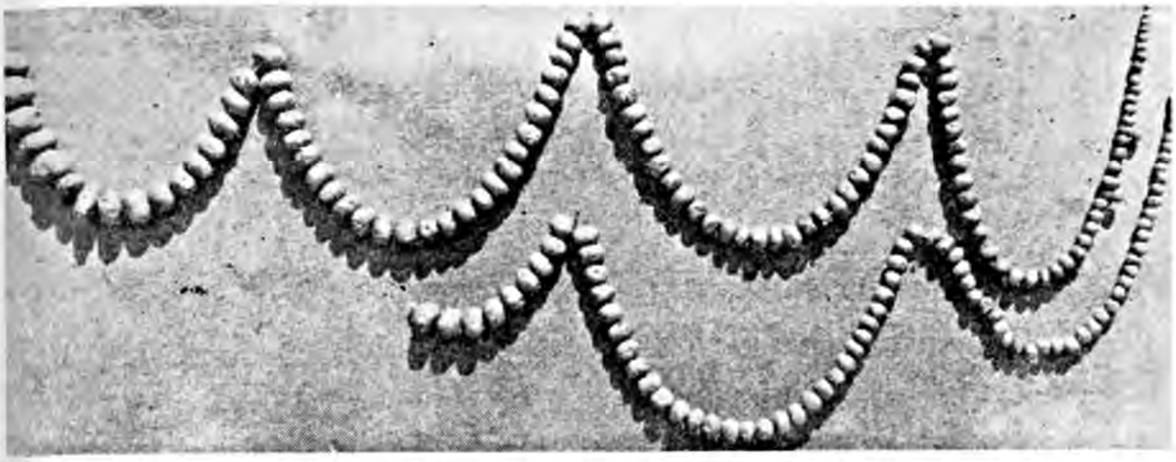
nematode is done in the fall and so far it seems possible to cut down the infestation by 99 per cent at the previously mentioned cost of $60 an acre.

As a result of these fall applications, in the spring when "invasion week" comes around—that is when the soil temperature is 59° or more—there are too few nematodes to make much of a dent in the root system of the potatoes. But those nematodes that are left multiply fairly rapidly, and it is not yet known whether the application of DD mixture will have enough lingering effect to make possible a second good crop on the treated ground.

The life cycle of the golden nematode has a strange twist to it; the female, full of eggs, dies and her body provides a protective egg case. The cyst-like body lies in the soil, eggs hatching over a period of several years and larval nematodes coming out to join the teeming vari-colored millions in the soil of the potato field. This way of living, according to Dr. Chitwood, is a strong link the pest has with the future. He says they have not yet found out just how long the golden nematode will maintain its hold in the soil, whether potatoes are grown on the land or not, but according to European experience it is at least eight years if the pest is not interfered with by the fumes of DD mixture or some other nematicide that the future may turn up.

So far the male g.n. has not been mentioned—not that he is nonessential. The male is invisible to the naked human eye and, furthermore, does not occur in such large numbers as the female. Apparently nobody bothers about his color. Perhaps the assumption is that it is protoplasmic gray.

The effect of nematode attack on the appearance of the potato plant is such as to indicate the seriousness of the malady. Even the above-ground parts of the plants in a badly infested spot look sad, as might be expected with all these hangers-on. This is why the Long Island farmer on whose land the golden nematode first appeared had become alarmed about "bad spots" in his fields. It is the reason some farmers



The increase as a result of treatment against the golden nematode is largely in No. 1 potatoes.

have spoken of the golden nematode damage, before they learned the cause, as "lightning spots." They thought that bolts of lightning had hit their fields. Maybe that explanation was correct in some cases as lightning has been known to blast and kill spots of vegetation.

There is now no more confusion in the Long Island area about the common cause of this destruction of the potato crop. The plants are, of course, suffering from a lack of food and water because the pipe-lines have been cut, not by swift lightning, but by a slow organism. The root system itself, when taken up and examined, shows a characteristic development. Instead of vigorous roots and long stolons with widely spaced strong branches on which No. 1 tubers could grow, there is a mat of fine roots, a sort of horsetail or stringmop effect. There may be as many potatoes as on a healthy plant but they will be very small, what the farmer calls "marbles." If a field is heavily infested the tops of the potato plants will go down rather quickly after the soil temperature gets up to the 59° level.

Dr. Chitwood has listed various ways in which the golden nematode may be spread—by man and by nature. Farmers spread the organisms when they move potatoes from infested land to other places, to storage, to other farms, to consumers; when they take implements or work animals from infested field to uninfested fields; when they go themselves from infested to uninfested land; and when they use infested seed or potato bags containing infested soil.

Nature moves these small organisms wholesale—in rain water flowing from infested to uninfested land even where the slope is very slight; and the wind blows the cyst-like female with her charge of eggs, along with other dust, from field to field.

The golden nematode disease is aggravated by economic conditions. For example, in the Long Island area the good potato land is high priced, so farmers do not waste land in hedge rows; too, there are few fences with the accompanying grassy ridges which might otherwise serve to slow up the drift of nematodes by air or water. Then, again, the economic factor is back of the practice of following potatoes with potatoes year after year on this high-priced land because they are a high-income crop that can be produced with a comparatively low labor supply.

Dr. Chitwood said we can think of Long Island in comparison with England. The golden nematode got to England perhaps shortly after 1900 and it was 1944 before it had infested about half the potato acreage in that compact country. On such a basis, with no very successful method to stop the spread, he says we could reasonably expect it would require 100 years for the pest to bring the potato growing industry of the United States to England's present condition of 50 per cent infes-

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A Machine for Deep Fertilizer Placement[1]

By A. C. Caldwell and C. O. Rost

Division of Soils, University of Minnesota, St. Paul, Minnesota

WHILE working with the fertilizer attachment for the plow, it early became apparent to the authors that this machine for deep placement of fertilizer was not all that could be desired. There are a number of drawbacks which render the implement rather ineffective. For one thing the hopper is too small. The plow attachment is satisfactory for experimental work in which modest amounts of fertilizer are applied, but applying fertilizer on an 80-rod strip at 1,000 pounds per acre involves filling the hopper every half round—and no farmer relishes that prospect. One feature a satisfactory machine for deep fertilizer placement should have is hopper capacity.

Another objection to the present plow attachment is the height at which it rides. It is no mean hoist to lift a 100-pound bag of fertilizer and empty it into a hopper the top of which is about five feet from the ground.

Add to the above major inconveniences such relatively minor objections as loss and scattering of fertilizer at the ends of the field, the lack of flexibility in depositing fertilizer only on the plow sole, and the extra weight of attachment and fertilizer borne by the plow, and quite a case can be built

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[1] Paper No. 547 of the Miscellaneous Journal Series, Minnesota Agricultural Experiment Station. St. Paul 8, Minnesota.

This fertilizer-placement machine was manufactured by the E. S. Gandrud Company, Owatonna, Minnesota.

A string of tempting fish is the reward to an efficient pond owner.

Mistakes Versus Essentials of Pond Management for Fish

By Verne E. Davison

Southeastern Regional Biologist, Department of Agriculture Soil Conservation Service, Spartanburg, South Carolina

POND management is much simpler than most folks imagine. There are a dozen ways to mismanage a fishpond, and some ponds cannot be well managed. In either case the wrong techniques are more complicated and more difficult than the few essential practices which produce good fishing.

Since 1941, soil conservationists in the Southeastern Region of the Soil Conservation Service have encouraged owners in pond management for fish. Most of these ponds are a source of satisfaction, pleasure, and good food. I wish I could say, "Every pond will demonstrate successful fish management;" but unfortunately some of them will not provide good fishing because owners have made mistakes.

We have studied dozens of ponds that were constructed, stocked, fertilized, fished, and otherwise managed as a part of the soil and water conservation activities of farmers who are cooperators of soil conservation districts. Even soil conservationists at first had their doubts relative to these surprising techniques, developed by Swingle and Smith, Alabama Agricultural Experiment Station. The technicians and farmers were entitled to doubts until they had living proof in their own communities; but the time for mistakes and doubt has just about run its course in the Southeast. Almost every technician who began pond work as long as two or three years ago now can point to many successful farm fishponds for each disheartening example.

Introducing a new set of water management techniques certainly has its trials. Our technicians encounter the full barrage of questions and arguments about fish management—for old ponds as well as new. A few folks honestly admit, "I don't know anything about managing fishing waters, but I like to fish." You would think, however, from the freely given advice handed out over the counter and from the barber's chair, that a fishing license is generally regarded as a permit for the professional practice of fish culture.

It has been fun to dip a minnow seine in the shallow edges of hundreds of ponds from Virginia and Kentucky south to Mississippi and Florida and show the surprised owners and our own technicians the simple, easy ways to tell what most ponds need in management. Few people really know what conditions exist within their ponds. Everyone seems concerned to protect the little fish from snakes and birds and turtles and bass and the so-and-so who would take anything less than the "big ones." But if there's pleasure in success, there's balancing heartbreak in the failures. If I have failed to find every way in which a pond can be mismanaged, it's probably because I'm only 42 years old. Nevertheless, I fear I'll see more ways and hear more owners say, "I didn't know. My best friend told me to do it. What can I do now to correct it?"

Offered here is a list of five essential, easy things that must be done to have the best fishing in farm ponds.

1. It is essential to protect each pond from muddiness and too much water. This can be done best by selecting a site on a small drainage area and keeping it well vegetated to prevent erosion. In many situations the pond can be given additional protection with a diversion ditch to carry excess water around. Pond management is chiefly water management where fertilization is a hopeless task if the pond continually refills with fresh water and washes out that which has been fertilized. The construction must be as water-tight as possible, and safe.

2. It is essential to keep a pond free from weeds, grass, brush, trees, and other debris or obstruction. Fishing will be more pleasant and successful. More of the fish will be large enough to use. The pond area, therefore, must

A pond produces fish according to the fertility of the water. Good pastures in the Southeast are made with the help of nitrogen, phosphorus, and potash; so also are good fishponds.

A well-managed pond is a delightful part of a farm.

be cleared completely before water is impounded; and shallow water should be eliminated to avoid troublesome weed growth.

3. It is essential to fertilize pond water. Submerged water weeds and mosquitoes can be kept out in this way. Fertilized waters produce a heavy yield of fish and make fishing more successful. Mineral fertilizers to make up the equivalent of 500 to 1,500 pounds of an 8-8-4 are required per acre annually. Without nitrogen, phosphorus, and potash, a pond will be no better than ordinary. And organic fertilizers like barnyard manure will not do the job as well.

4. It is essential to begin with approximately 100 bass and 1,000 to 1,500 bluegills per acre. More are too many. A few adults won't do, and no other kinds of fish have been managed very successfully in small farm ponds.

5. It is essential that a pond be fished —removing usable fish by hook and line — without regard for spawning season, size, kind, or numbers. The number of pounds removed will govern the number of pounds produced. The food, formerly consumed by those caught, then becomes available to those remaining. The fish themselves will limit the angler's catch, leaving a big margin of safety in breeding stock.

To summarize: These five essentials will produce excellent fishing without any other measures. To make each pond manageable requires a little common sense when selecting sites and constructing the reservoirs. Management requires a reasonable amount of work and expense to apply fertilizer and control vegetation around the pond edges. It is important, therefore, that effort and thought be concentrated on the essential things and not dissipated on the unnecessary or incorrect practices, several of which are listed as follows:

1. Stocking a well-fertilized pond with less than 100 bass per acre is wrong. Any Southern pond without bass is no good. Stocking with adult bluegill in numbers substantially below 1,000 per acre is wrong (if the pond is to be well fertilized).

2. Stocking ponds with crappie, catfish, or any species other than bass and bluegills is not likely to produce continuous fishing. No other combina-

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County Agent O. B. Elliott (left) and D. W. Fortenberry, Soil Conservationist of Walthall County look over the crimson clover of W. I. Conerly which made the Walthall dairyman $17 a day more money. This included the increased production of milk and the decreased use of feed.

Pastures in Mississippi Produce Profits

By Jack Flowers

Mississippi State College, State College, Mississippi

WHEN a dairy farmer increases his income $17 a day from 17 acres of crimson clover, it is no wonder that Walthall County farmers are working out pasture programs second to none in Mississippi or the South.

The success of their pasture programs in one of the most progressive rural counties in Mississippi is due to the fact that a definite plan was made before the projects were started. The Soil Conservation Service, Extension Service, and AAA pooled their planning and assistance and formulated a plan which couldn't miss. From a soil type standpoint, land-use is being carried on more pastures where formerly workers and farmers believed clover and grass would not grow profitably. Dairy and beef cattle interests are increasing because these enterprises now can be and are a profitable enterprise, where formerly without pastures they were not paying off comparable to cotton production.

At this time when the one-crop system is admittedly obsolete, Walthall County farmers are hinging on livestock as the base of their agricultural program. The first essential of the livestock program is ample pasture and feed. Since a good pasture is the most practical and economical source of feed, they are endeavoring to establish a 12-month pasture or grazing program.

A system has been developed by these pasture-minded farmers to the extent that almost year-round grazing can be had and yet the program is economically sound and has proved to be practical.

A car of muriate of potash is being used in Walthall for an intensive pasture demonstration program. This potash program is being supervised by D. W. Fortenberry of the Soil Conservation Service, in cooperation with O. B. Elliott, County Agent.

Potash was used on more than 75 farms and on the various soil types of the County. It was applied on strips across the pastures at the rate of 200 pounds per acre and was plowed in along with the other minerals used. It is believed that this amount of potash will be sufficient to last from two to four years, and during this period the results will be observed.

If such a thing as a permanent pasture exists in Walthall County, it would be a mixture of White Dutch clover and Dallis grass. This mixture of 10 pounds White Dutch seed and 15 pounds imported Dallis grass per acre has proved most satisfactory.

At first lespedeza was recommended as a part of this mixture, but with a good stand and growth of White Dutch, lespedeza cannot survive. However, lespedeza and Dallis grass are used as a summer and fall pasture and afford good grazing. To supplement the summer and fall pasture, Alyce clover, following crimson clover, can be used to great advantage especially during dry summers and falls.

It has been proved that year-round grazing can be had in Walthall County with proper management, fertilization, and seeding. White Dutch clover is usually ready by March 1 and will last through May. The Dallis grass will continue through the summer and fall until frost. Combination of Dallis and lespedeza will supplement the Dallis grown in with the White Dutch. Alyce clover can be grazed beginning August 15 until frost. The earliest for grazing oats has been October 15, but good grazing has been had during November, December, January, and February. Sericea and kudzu are proving to be good summer and fall grazing.

The success of a pasture program depends largely upon the farmers' willingness to establish pastures correctly, according to County Agent O. B. Elliott. All land going into pasture should be thoroughly plowed and disked and allowed to settle well with two or more rains. Fertilizer should be added before disking. During October, planting should be done at the rate of 10 pounds of White Dutch to the acre.

A light harrowing is necessary just ahead of seeding, but one should not attempt to cover seed after broadcasting. Dallis grass should be planted in Walthall during the last two weeks in December or the first two weeks in January at the rate of 15 pounds per acre. The best results obtained with this mixture were where a ton of basic slag and 200 pounds of potash were applied before seeding.

One ton of limestone and 500 pounds of superphosphate (20 per cent) will replace one ton of slag. One thousand pounds of basic slag and 50 pounds of potash are the annual application of fertilizer on established pasture.

Balanced Sod

Fertilization has more to do in keeping a balanced, desired mixture of clovers and grasses than any other one thing. Mowing and proper or controlled grazing are the next most important factors in maintaining a desirable pasture mixture.

Some farmers who do not have improved pastures question the sound economics of such a program. The best proof of its soundness is that the dairymen who have such a program say that they would not continue milking unless they could have this year-round grazing. The beef cattlemen are maintaining their pastures and increasing the acreage as the number of cattle make the demand for more pasture.

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Potash: The Sugar Maker

By George D. Scarseth

Director of Research, American Farm Research Association, Lafayette, Indiana

MEET Old Man Potash! He is not just the last figure in a common mixed fertilizer, as 2-12-6, where he is used in as diluted a quantity as economics and habits tolerate. He is the key tool of the Creator in giving us food for growth and warmth. He is the link that gears carbondioxide to water in plants to make the first organic compound—simple sugars. From these sugars the cell fibers and carbohydrates are built. He is the link that ties our earth to the universe as he packs the energy of the sunbeams into storage materials that make the plant, the wood, and the seed. The atom-smashers even suspect that he also feels the impact of cosmic beams. They even suspect that the calcium of our limestones came from potash before potash was calmed down with age and was charged with the electrons of the stardust. We know that potash is part of life itself, because in the living plant it will not leak out of the cells as long as the cells are alive; but once the cells are dead as when hay is dried, a rain will wash nearly all the potash out.

Nutrient Balance

We know potash is a close kin to calcium and magnesium of dolomitic limestone, and that when too much calcium (overliming effect) is swept into the plant both potash (called potassium as the pure element) and magnesium have a hard time getting in; so much so that the plant may suffer unless more is supplied. Likewise, if a lot too much potash, as in some old greenhouse soils, accumulates to enter the plant in excessive quantities the plants may starve for calcium and magnesium. The balance between calcium, magnesium, and potash is most important.

Grandmother knew potash in soft soap made from potash lye. She knew soda lye made hard soap. The Indians must have noted that a fish buried under a corn hill where a brush pile had burned made a bigger corn plant than where there had been no ashes to furnish potash and other minerals. Today a farmer wants to know that when he hauls off his field one load of legume hay he is removing as much potash (K_2O) as would be contained in about 750 pounds of 2-12-6 (the leading fertilizer grade sold in the U. S. A.) or in 75 pounds of muriate of potash (this is the 60% potash material produced at the mines).

The farmer wants to know that potash is lost in cattle urine. In one year the urine from one cow will contain as much potash as in 1,000 pounds of 2-12-6 or 100 pounds of 60% muriate of potash. Not all of this is returned to the fields and when returned is not spread evenly. Agronomists at the Vermont station have shown that urine spots contained added nutrients that on an equivalent acre basis amounted to about 5,560 pounds of a 10-0.1-11 fertilizer. The vegetation on such a spot is obviously oversupplied with nitrogen and potash and extremely deficient in phosphorus.

The farmer loses potash in erosion, water run-off, and in manures as well as by crop removal. Dr. A. R. Midgley of Vermont has shown that on a 15-cow farm just to make up for these losses from all sources would require an annual purchase of potash in 1,660 pounds of an 0-20-20 or 5,500 pounds

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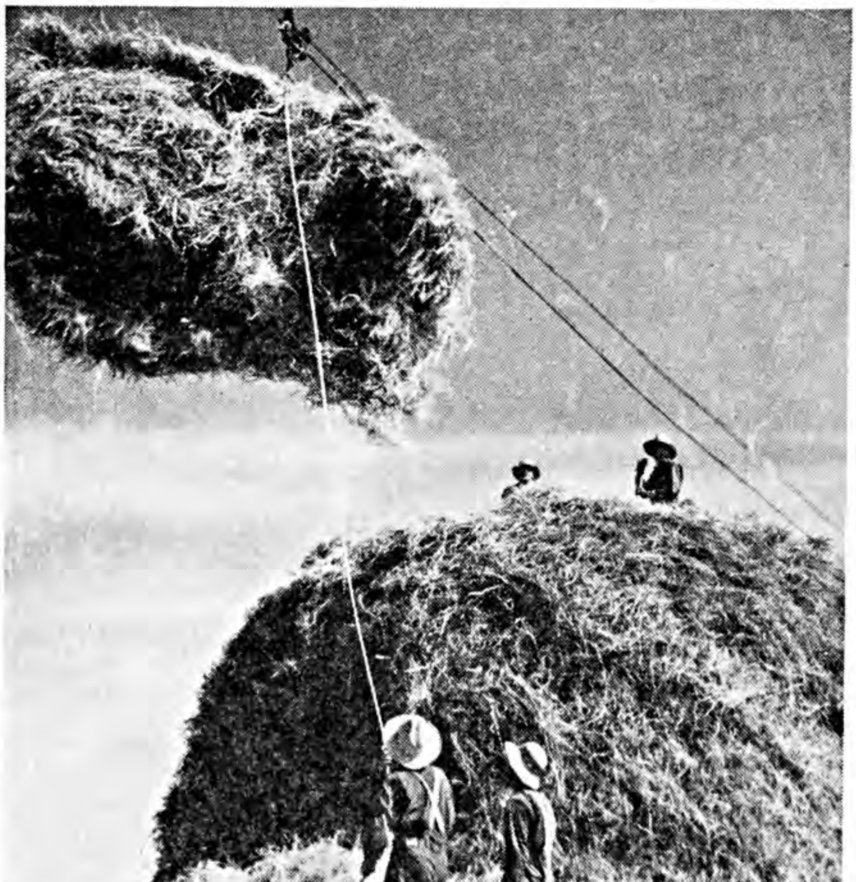
PICTORIAL

Sustenance for a Starving World



Haying

Harvesting

Above: Haying and harvesting usually include "all hands" on the farm.

Below: Modern methods lessen the manpower required.

The Editors Talk

Understanding F. A. O.

To many the FAO may mean just another of the almost countless government organizations known by their initials during and since the war. To the informed the Food and Agricultural Organization of the United Nations is one of the greatest hopes of mankind for peace and plenty in the future.

Secretary of Agriculture Clinton P. Anderson believes that perhaps the most important single task facing FAO is to gain wide understanding of its purposes and its methods among all groups of people in every nation in the world. Speaking before the 37th Annual Convention of Rotary International in Atlantic City, New Jersey, June 5, 1946, the Secretary explained FAO and its importance to all of our citizens in terms understandable and satisfactorily brief enough to be usable in disseminating information.

"FAO is the first tangible, operating agency the nations of the world ever have set up to attack the problem of hunger at its roots," he said. "Its primary objective is to help nations of the world to expand both the supply and the effective demand for food so that the earth's two billion men, women, and children may have a better living. It seeks to bring new standards of nutrition to the world, and the means to meet those standards. It hopes to lift the curse which has kept two-thirds of the world's people perpetually underfed.

"The job of FAO is colossal. Decades and generations must pass before FAO can hope to say that it has achieved material success. But it is a genesis.

"Already, we have seen an important example of what it means to have a permanent international food organization. The Director General of FAO, Sir John Boyd Orr, called a Special Meeting on Urgent Food Problems to convene two weeks ago in Washington. I was happy to serve as chairman of the meeting, and as the United States delegate to point out that the Combined Food Board was a war agency that had outgrown its boots and should be succeeded by an agency organized and directed specifically toward meeting the new situation.

"The conference set something of a speed record for international gatherings. Within a week, it saw the creation of the International Emergency Food Council, which will have its first meeting on June 20th and will begin to function. It will look at food supplies and food needs on a global basis. It will not give orders, but it will seek export commitments from the exporting nations and will put those in the balance against the import requirements. It will provide a common meeting ground where the nations can agree on food conservation measures and production measures. And if the time comes that exports of any commodity could exceed the import requirements, all of the nations will know it and can use that knowledge to plan appropriate action."

Secretary Anderson went on to say that what we want in the world—and what we hope to promote through FAO and other organizations of the United Nations —is an increasingly productive agriculture, balanced by an increasingly productive industry. Only in that way can there be more food and more products to divide among all of us.

"Another major aim is that of developing the less-advanced countries. Fully two-thirds of the earth's population haven't the facilities or the techniques for producing enough to eat or wear, and people with a low standard of living are a serious threat to the living standards and safety of the rest of the world. From a strictly business point of view, production and markets can be expanded only if those who are now inefficient and underfed are enabled to do their full share of producing and consuming. They represent the greatest untapped markets in the world.

"But there is far more to the FAO job than coordination of production and trade. It must also promote research, education, and production techniques to lift the quantity, quality, and efficiency of agricultural production. This is a very definite, well-charted route toward better living. In the United States a close tie-up between our education, research, and agriculture goes back nearly a century in the work of the Department of Agriculture and the establishment of the Land Grant Colleges.

"Now, in about 3,000 counties, county agricultural agents work with farmers on one hand, and keep in touch with agricultural colleges on the other. When a new and better crop variety is developed, it gets into our fields just as fast as possible. Through this extension service system science is translated into everyday farm practice. There is nothing quite like this system in the rest of the world. But we hope there will be. FAO will stimulate and aid the establishment of similar systems in other lands. And it will act as a global clearing house of agricultural knowledge from all parts of the world."

Among other things, therefore, FAO is designed to be a world agricultural extension service. Anyone familiar with what the Extension Service has meant to the agriculture of the United States cannot help but place faith in the Food and Agricultural Organization and trust that it will receive the full cooperation which it deserves.

Controlling Weeds

The weed season is at hand. How much pleasanter would be the summer days of farmer and urbanite with lawn and garden if there were no such pesky thing as a weed. Methods of cultivation have been devised and new chemicals introduced for weed control—many of them successful. Appearing rather radical, perhaps, is the use of fertilizer in weed control, especially to those to whom it seems a weed will grow faster than anything else. Yet, L. B. Miller, Assistant Chief, Soil Experiment Fields, University of Illinois College of Agriculture, is credited with the statement that weed control is easier on soils kept fertile by use of lime, phosphate, and potash where needed, and by crop rotation.

"Although well-treated land holds much more water than poor land, the soil surface dries more quickly, making the land workable sooner. Thus good land can be cultivated to destroy weeds sooner after a rain than can poor land," Mr. Miller maintains.

"Weeds constitute nature's way of trying to prevent soil loss through leaching and erosion, but for all their good intentions they are not desirable compared with crop plants which, if properly used, are more effective and easier to control.

"While weeds, like crop plants, make more vigorous growth on fertile soil, good crop varieties respond more actively to good soil than do weeds, and competition from the weeds is relatively reduced. Most common field crops planted in a fertile, well-prepared seedbed will outstrip the annual weeds and make control of them rather easy."

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
June.........	20.90	51.2	180.0	220.0	111.0	150.0	15.90	52.50	....
July..........	21.25	56.3	183.0	230.0	112.0	146.0	15.40	55.00	....
August......	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October......	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November...	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March.......	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April.........	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
May........	24.00	43.0	157.0	251.0	135.0	170.0	14.80	49.60	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
June.........	169	512	258	251	173	170	134	233	269
July..........	171	563	263	262	174	165	130	244	244
August......	172	449	240	292	176	164	123	233	240
September...	175	432	198	236	174	164	120	228	159
October......	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January.....	180	363	208	237	171	174	132	226	249
February.....	186	339	209	254	[illegible]	175	133	223	275
March.......	183	319	225	269	178	179	137	211	288
April........	190	429	232	279	181	179	126	213	282
May........	194	430	225	286	210	192	125	220	177

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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	Fish scrap, wet acidulated 6% ammonia, 3% 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	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.70	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944	1.75	1.42	7.68	5.77	3.34	4.86	6.71
1945							
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
1946							
January	1.75	1.42	7.81	5.77	3.34	4.86	6.71
February	1.75	1.42	7.81	5.77	3.34	4.86	6.71
March	1.75	1.42	7.81	5.77	3.34	4.86	6.71
April	1.75	1.42	7.81	5.77	3.34	4.86	6.71
May	1.75	1.42	9.07	7.59	3.34	4.86	7.30

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	146	129	139
1927	112	79	145	166	143	128	162
1938	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	131
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944	65	50	219	163	110	144	191
1945							
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	1.0	144	191
1946							
January	65	50	223	163	110	144	191
February	65	50	223	163	110	144	191
March	65	50	223	163	110	144	191
April	65	50	223	163	110	144	191
May	65	50	259	215	110	144	207

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
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	.524
1927	.525	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	15.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
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								
June	.650	2.20	6.20	.471	.701	22.88	.176	....
July	.650	2.20	6.20	.503	.749	24.44	.188	....
August	.650	2.20	6.20	.503	.749	24.44	.188	....
September	.650	2.20	6.20	.503	.749	24.44	.188	....
October	.650	2.20	6.28	.535	.797	26.00	.200	....
November	.650	2.20	6.40	.535	.797	26.00	.200	....
December	.650	2.20	6.40	.535	.797	26.00	.200	....
1946								
January	.650	2.20	6.40	.535	.797	26.00	.200	....
February	.650	2.20	6.40	.535	.797	26.00	.200	....
March	.650	2.20	6.40	.535	.797	26.00	.200	....
April	.650	2.20	6.40	.535	.797	26.00	.200	....
May	.650	2.20	6.40	.535	.797	26.00	.200	....
Index Numbers (1910-14 = 100)								
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
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								
June	121	61	127	66	74	95	80	....
July	121	61	127	70	79	101	82	....
August	121	61	127	70	79	101	82	....
September	121	61	127	70	79	101	82	....
October	121	61	129	75	84	108	83	....
November	121	61	131	75	84	108	83	....
December	121	61	131	75	84	108	83	....
1946								
January	121	61	131	75	84	108	83	....
February	121	61	131	75	84	108	83	....
March	121	61	131	75	84	108	83	....
April	121	61	131	75	84	108	83	....
May	121	61	131	75	84	108	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 materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
June	206	180	155	95	57	175	121	69
July	206	180	154	96	57	175	121	74
August	204	180	154	96	57	175	121	74
September	197	181	153	96	57	175	121	74
October	199	182	154	97	57	175	121	78
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	156	97	57	175	121	78
February	207	185	156	97	57	175	121	78
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78
May	211	192	162	100	57	195	121	76

* 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 with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

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

"The Fertilizer Trade in Canada," Dom. Bur. of Statistics, Dept. of Trade and Com., Ottawa, Can., July 1, 1944-June 30, 1945, W. H. Losee.

"The Effects of Fertilizer Treatments, Curing, Storage, and Cooking on the Carotene and Ascorbic Acid Content of Sweetpotatoes," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., So. Coop. Series, Bul. 3, Dec. 1945, M. Speirs, H. L. Cochran, W. J. Peterson, F. W. Sherwood, and J. G. Weaver.

"Official Inspections 197," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Oct. 1945.

"Fertilizer Recommendations in Mississippi, 1946," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 124, Dec. 1945, Clarence Dorman.

"Analyses of Commercial Fertilizers," N. C. Dept. of Agr., The Bul. 111, March 1946.

"Results of Agronomic Research on the Use of Lime and Fertilizers in Ohio," Dept. of Agron., Ohio Agr. Exp. Sta., Wooster, Ohio, Agron. Mimeo. 96, Revised Dec. 6, 1945, R. E. Yoder.

"Inspection and Analysis of Commercial Fertilizers," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Bul. 363, Dec. 1945, H. J. Webb.

"Fertilizer Recommendations for South Carolina," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 283, April 1946, H. A. Woodle.

"Fertilizer Tonnage Sales Survey Report for Washington for July 1, 1944 to June 30, 1945," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Mimeo. Cir. 34, April 1946, S. C. Vandecaveye.

"Prewar World Production and Consumption of Plant Foods in Fertilizers," U.S.D.A., Washington, D. C., Misc. Publ. 593, April 1946, K. G. Clark and Mildred S. Sherman.

Soils

"Chemical Methods of Soil Analysis," Central Exp. Farm, Div. of Chem., Ottawa, Canada, Feb. 1946.

"Soil and Water Conservation in New Hampshire," Gen. Ext. Serv., Univ. of N. H., Durham, N. H., Ext. Folder 12, Oct. 1945.

"Improving Land the Modern Way," Ext. Serv., R. I. State College, Kingston, R. I., Ext. Bul. 94, June 1945, C. R. Creek and J. F. Hauck.

"Management of Soils in the Lower Rio Grande Valley," Agr. Exp. Sta., A. & M. College, College Station, Texas, Cir. 110, March 1946, B. S. Pickett.

"Soil Erosion in Small Irrigation Furrows," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 320, Jan. 1946, O. W. Israelsen, G. D. Clyde and Cyril W. Lauritzen.

"Sprinkler Irrigation," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 336, March 1946, Gustav H. Bliesner.

"Soil Survey of Lincoln County, Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Ser. 1937, No. 16, Issued Feb. 1946, Foster Rudolph, L. J. Strickland, E. F. Henry, Robert Wildermuth and B. H. Williams.

"Review of Principal Results, 1945," S.C.S., So. Piedmont Conservation Exp. Sta., Watkinsville, Ga., May 1, 1946, B. H. Hendrickson, John R. Carreker and William E. Adams.

"Soil Conservation Service Research Summaries, Part II," U.S.D.A., Washington, D. C., Jan. 1946, J. H. Stallings.

Crops

A new "Handbook for Agricultural Workers 1945-46" has been published by the Agricultural Extension Service, North Carolina State College, Raleigh, North Carolina, covering the important data on agriculture and including recommended practices on agricultural engineering, agronomy, animal husbandry, dairy husbandry, entomology, fruit spray schedules, horticulture, plant pathology, and poultry. The pocket size volume is, as its name implies, a most convenient ready fund of information. The little book sells for 60¢ and the Station prefers some form of money order or check made out to the Extension Emergency Fund. They do not wish to receive stamps.

"Addresses and Proceedings, Potato Section, Ontario Crop Improvement Association," Ont. Dept. of Agr., Crops, Seeds, & Weeds Branch, Toronto, Ont., Can., Feb. 11, 1946.

"Avocado Production in Florida," Agr. Ext. Serv., Gainesville, Fla., Bul. 129 (Rev. Bul. 112 and 272), March 1946, H. S. Wolfe, L. R. Toy, A. L. Stahl, (Rev. by H. S. Wolfe).

"Fifty-seventh Annual Report of the Director," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., July 1, 1944 to June 30, 1945.

"Varieties of Vegetables and Fruits Recommended for Freezing," Ext. Serv., Univ. of Md., College Park, Md., Ext. Mimeo 25, April 1946, Francis C. Stark, Jr.

"Production and Utilization of Silage in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 425, Nov. 1945, H. W. Bennett, R. H. Means, W. C. Cowsert, O. A. Leonard, and Marvin Gieger.

"Soybean Varieties and Dates of Planting in the Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 428, Jan. 1946, Paul R. Henson and Robert S. Carr.

"Dry Land Pasture Experiments at the Central Montana Branch Station, Moccasin, Montana," Agr. Exp. Sta., Montana State College, Bozeman, Mont., Bul. 431 (Rev. B. 388), Oct. 1945, Ralph M. Williams and A. H. Post.

"Measured Crop Performance, 1945," Agr. Exp. Sta., Univ. of N. C., Raleigh, N. C., Bul. 354, Jan. 1946, R. P. Moore and G. K. Middleton.

"1945 Rose Test at the Pennsylvania State College," Agr. Exp. Sta., Pa. State College, State College, Pa., Jn. Ser. Paper 1300, Dec. 13, 1945, E. I. Wilde and R. P. Meahl.

"The Cotton Contest—1945," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 278, March 1946, H. G. Boylston.

"Agricultural Research in South Dakota, Fifty-eighth Annual Report," Agr. Exp. Sta., S. D. State College, Brookings, S. D., July 1, 1944 to June 30, 1945.

"South Dakota Corn Performance Tests, 1945," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Cir. 60, Jan. 1946, Karl F. Manke.

"Boysenberries and Youngberries," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., S. Cir. 213, January 1946.

"Strawberry Growing in Washington," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Bul. 246 (Rev.) March 1946, John C. Snyder.

"Pollination of Tree Fruits and Nuts," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Bul. 342, April 1946, John C. Snyder.

"4-H Garden Club Outline," Agr. Ext. Serv., State College of Wash., Pullman, Wash., 4-H Club Cir. 24 (Rev.), March 1946, J. C. Dodge, D. H. Brannon, and C. T. Meenach.

"Gardening as a 4-H Project," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 4H-51, January 1946, O. B. Combs, T. C. Allen, R. E. Vaughan, and K. C. Berger.

"Descriptions of and Key to American Potato Varieties," U.S.D.A., Washington, D. C., Cir. 741, April 1946, C. F. Clark and P. M. Lombard.

Economics

"Connecticut Vegetable Industry and Its Outlook for 1946," Dept. of Agr., Bur. of Markets, Hartford, Conn., Bul. 93, April 1946.

"1945 Statistics of Diversified Agriculture in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu, T. H., Cir. 199, April 1946.

"Illinois Farm and Home Outlook for 1946," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 600, Jan. 1946.

"Soybean Production Experience in Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AE2345, Oct. 1945.

"Farm Ownership in Louisiana Financed Under the Bankhead-Jones Farm Tenant Act," Dept. of Agr. Econ., La. State Univ., Baton Rouge, La., Bul. 397, Aug. 1945, Willie Mae Alexander.

"Economics of Broomcorn Production in New Mexico," Agr. Exp. Sta., College of A. & M., State College, N. M., Bul. 326, Dec. 1945, Morris Evans.

"The New York Agricultural Outlook 1946," College of Agr., Cornell Univ., Ithaca, N. Y., Bul. 691, Jan. 1946.

"Agricultural Production to Meet 1946 Needs," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Cir. 70, Nov. 1945, G. H. Aull and M. J. Peterson.

"Land Ownership Trends in North Dakota Selected Years, 1929-1944," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 337, Dec. 1945, Lyman W. Wallin and Reuben Engelking.

"Membership Relations in Farmers' Cooperatives," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Cir. 122, April 1946, Adlowe L. Larson.

"Costs Materials and Practices in Growing Irish Potatoes on Cumberland Plateau," Dept. of Agr. Econ. & Rural Soc., Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Rural Res. Ser. Mono. 194, Jan. 15, 1946, F. N. Masters and C. C. Mantle.

"The Vermont Farm Outlook," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., April 1946, Roy S. Beck.

"The Farm Business and Farm Family Living as Related to Land Class in Nine Vermont Towns," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 526, Dec. 1945, Robert M. Carter.

"Meeting Farm Production Needs for 1946," Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., Bul. 167, Jan. 1946.

"More Production Through Better Practices," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 320, Sept. 1945, D. M. Keyes.

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Farm Population Shifts

The farm population comes out of the war not only fewer in numbers, but also with a change in age groupings, Dr. C. C. Taylor of the Bureau of Agricultural Economics points out. Between 1940 and 1945 the number of persons living on farms decreased by 5 millions, or more than 15 per cent. From 1940 to 1944 there was a loss of 40 per cent in the number of males between 14 and 24, and a drop of more than 20 per cent of those between 25 and 44. The number of persons 45 or over remained about the same.

Readjustments are to be expected, says Dr. Taylor. Some demobilized servicemen and industrial workers will return. How many will return depends largely on employment opportunities. Such movements respond sensitively to economic opportunities elsewhere. If widespread unemployment exists, there will probably be a considerable shift of people to farms.

"Shifting to non-farm jobs," says Dr. Taylor, "or combining them with farming has been an important means of raising the level of living of farm families. The amount of non-farm work done by farm operators during 1943 was 36 per cent greater than in 1939, while the wage income from such work increased by a much greater percentage."

The Newest Potato Pest—Golden Nematode

(*From page* 19)

tation. Spread in the intensive potato-growing areas could be slowed, he thinks, by diversified farming and by isolating fields.

So far, the only mandatory control is applied by New York State which has a primary regulation against the use of seed potatoes from infested or exposed fields for planting in other areas. The State also has taken some measures against the re-use of potato containers and requires thorough cleaning of farm implements that are to be moved from infested fields for use in fields outside the golden nematode area. There are, however, no regulations applying to the movement or cleaning of automobiles and trucks.

Checking up on what the pest has been doing geographically, State and Federal inspectors have found little indication of the presence of the pest outside the central area. Surveys covering practically all potato land on the island brought to light three new small infestations, none more than two miles out from the original area. Last year the Department surveyed potato areas in 17 northern and northeastern states but found no indication of the golden nematode in any of them.

Dynamic Sassafras Soils

(*From page* 15)

matter content is good and the soil is well supplied with total N, a condition about average for the virgin soils of the Coastal Plain.

The yield figures, although maximum yields were not obtained because the plants were not allowed to mature, bear out Dr. Hester's conclusion that although the Lansdale and Toledo soils have a greater potential, they have no greater producing power than the Sassafras sandy loam after fertilizer, lime, and minor elements are added. The yields of green and dry fruit on the three soils without added amendments were as follows:

	Grams	*Grams*
Sassafras sandy loam	38.4	5.2
Lansdale loam	160.5	8.8
Toledo	513.5	29.8

With fertilizer added, the yields on the three soils were—343.5 and 5.2, 946.5 and 56.2, and 971.5 and 59.3, showing that fertilizer increased the yield on the Sassafras sandy loam nearly 10 times while fertilizer on the Lansdale and Toledo increased yields about six and two times the yield before the fertilizer was added. When fertilizer, lime, and minor elements were added to the Sassafras sandy loam, the yield was about 24 times the yield of the virgin soil or 906.0 grams as compared with maximum yields of 976.5 and 971.5 grams on the Lansdale and Toledo respectively.

It is evident from the following table that fertilizer, lime, and minor elements are needed on a Sassafras sandy loam for highest yields of tomatoes and that when these are added its producing ability is nearly equal to that of soils which are far more fertile and have a greater potential. When fertilizer alone was added to the Sassafras sandy

Yields in grams	Nothing added Green-Dry wts.		Fertilizer		Lime		Fertilizer and Lime		Fert., Lime, and Mn elements	
Sassafras sandy loam......	38.4	5.2	343.5	5.2	200.5	8.6	817.5	45.8	906.0	55.3
Lansdale loam............	160.5	8.8	946.5	56.2	206.5	9.7	895.5	54.6	976.5	57.6
Toledo..................	513.5	29.8	971.5	59.3	542.5	39.6	635.5	48.2	588.0	34.7

loam, the yield was increased nearly 10 times. With fertilizer, lime, and minor elements, the yield was increased about 24 times so that the maximum yield was nearly as great as the maximum yields on the other two soils. Of interest also is the fact that fertilizer alone gave the highest yield on the Toledo while on the Lansdale and Sassafras all of the plant-food elements were needed for maximum yield.

Summary of the Experiments

Eleven different soil types were brought to the greenhouse and placed in 3-gallon pots. Yield records were kept and analyses were made for sugars, vitamin C, titratable acids, and mineral and nitrogen content of the dried fruit. The amount of plant nutrients present in the soil, that taken from the soil by the fruit, and that removed from the soil by leaching are summarized.

Fertilizer increased the titratable acids in the fruit when used on the soil without lime while lime alone showed a decrease. Fertilizer and lime and fertilizer, lime, and minor elements improved the vitamin C, sugar, and general quality of the fruit. On the acid soils fertilizer increased the yield but did not produce a satisfactory crop. Lime increased the yield but did not give a satisfactory crop. Lime and fertilizer greatly increased the yield and quality of crop. The most satisfactory crop was secured when fertilizer, lime, and minor elements were added to the soil.

Sherman T. Perkins of Wrightstown, N. J., has been a member of the Ten-Ton Tomato Club for eight consecutive years which indicates that his production of tomatoes has been above the average. His soil is a typical Sassafras sandy loam and in 1941, for example, his yield was 19.2 tons per acre on 9.55 acres. He applied 1,500 pounds of hydrated lime, 1,200 pounds of a 4-8-10 fertilizer, and used a starter solution. Contrary to many experiences this large amount of fertilizer applied in the row has had no injurious effects on the plants.

Many other members of the Ten-Ton Club farm sandy loams and apply the fertilizer part before plowing and part in one or two side-dressings. Five of the six winners in 1945 followed this method of applying the fertilizer. It is generally conceded that on light soils the fertilizer should be applied in two or more applications.

Mistakes Versus Essentials of Pond Management

(From page 23)

tion is as simple to manage as bass and bluegills, and experimental results have proved no combination of fish as successful.

3. Brush and trees in a pond neither increase the fish nor make fishing better. Sand, gravel, or rock piles for spawning are entirely unnecessary. Pond fish will spawn adequately without them.

4. Addition of golden shiners, gizzard shad, top minnows, and other "base food" is unnecessary. The small bluegills and bass provide adequate food and will eat all mosquito larva in weedless ponds.

5. Screens across spillways are dangerous and largely unsuccessful. Little fish washed out even in great numbers are of no consequence—there will be that many more produced. Large fish go out only with deep flows through spillways—a condition avoidable by making wide spillways that spread the overflow thin (no more than 3 to 6 inches deep) and by avoiding flood waters, either by diversion ditches, or still better, by selecting sites on small watersheds.

6. Kingfishers, herons, fish ducks, and other birds have no material influence on fish in farm ponds. They eat only little fish of which every pond will have plenty. Only in hatcheries where thousands of fingerlings are kept in relatively little water are such birds undesirable.

7. Planting of water lilies, mosses, or other water weeds is, of course, detrimental. More fish are produced in weedless ponds than in those that are weedy.

8. Running water to "keep it fresh" is unnecessary. The plant and animal life, together with the sunlight, maintain a healthful condition for fish, livestock, and people even in waters remaining without "fresh" water entering.

9. Leaving stumps or putting wire, posts, broken glass, and other impediments in ponds to "keep some so-and-so from seinin' all the fish out" makes wading, swimming, and fishing unpleasant. Very few ponds can be seined heavily enough to reduce the brood stock substantially. Depth is usually sufficient guarantee against harmful seining.

10. Draining a pond to "dry it out for weed control" is not successful. Weeds that live beneath the surface can be killed and kept out with shade resulting from the dark green coloration of fertilized water; the roots of water lilies can be exhausted by cutting the leaves as they reach the surface of the water (several cuttings are necessary as exhaustion proceeds slowly); and cattails and similar "edge-weeds" can be kept under control by pulling them occasionally as they appear. Bluestone (copper sulphate), calcium arsenate, and other chemicals are less desirable for weed control as some weeds are not harmed substantially. Chemical poisons kill fish foods too, and the "successful" results are but temporary.

11. "Feeding" with stale bread, grain, or other foods is less efficient than fertilizer and contributes little to the poundage of fish when fed in the small quantities usually given. Five or ten pounds of such foods will probably produce one pound of fish—to add to the 500 pounds per acre supported in fertilized water.

12. The use of manures, cottonseed meal, hay, or other organic fertilizers is not so successful or productive of fish as inorganic chemical elements. Organic materials support the undesirable pond scums.

13. Closed seasons or "protected areas" are quite unnecessary in conservation of pond fish. In fact, the spawning beds of bluegills should be located and heavily fished if a high yield is to be harvested. It is foolish fear to refrain from catching fish whenever they will bite.

14. It is not necessary to fish the bass and bluegills in proportion to the original stocking for the purpose of keeping a balance. The bass will maintain a correct balance whether the owner takes only bass or only bluegills. To enjoy full use and to harvest the usable surplus, however, both bass and bluegills should be fished; the possible yield is approximately three pounds of blue gills for every pound of bass.

15. A narrow belief has been built up by contests and sports-lore that "catching the big ones" is the foremost (and, to some, the only) objective of fishermen and fish producers. To a

size-hungry fisherman, one should suggest the Gulf of Mexico or either of the two oceans bordering the United States. Now that pond owners know how to produce more fish, it is time to recognize as "master fisher" he who can produce the most pounds of fish per acre and catch delightful strings of fish frequently. Most people like small pan fish, and like to catch them, too, if the braggart and the contest winner does not bully them into embarrassment.

All of the foregoing 15 common, but futile practices, are an unnecessary waste of effort. And the worst of these wrong practices will ruin fishing in any pond. More than that, it is simpler and easier to do the five essential things which make farm pond fishing a pleasure—and put healthful food on the table.

Pastures in Mississippi Produce Profits

(*From page* 25)

White Dutch clover and Dallis will easily carry two head of cattle per acre for a period of four months, then one head per acre after the clover is gone for a period of five months, giving a total of nine months. Oats and crimson clover will provide grazing from October 15, when the oats are ready to graze, and then beginning February 1, the crimson will fill in until May 1.

The farmers in Walthall County have used a number of fertilizers in establishing white clover pastures. Some have used complete fertilizers such as 4-8-8 or 6-8-8; some combinations of lime, superphosphate, and potash. However, the most general practice recommended by county officials is one ton of basic slag and 200 pounds of muriate of potash at the time of establishing

Where the White Dutch runs out is where the fertilizer ran out. The plot to the right was treated with one ton of basic slag and 200 pounds of muriate of potash. The check to the left was plowed and seeded just like the other, but received no fertilizer. W. C. Smith, dairyman, shown at left, has some of the finest pastures in the county.

the pastures. To maintain the pastures, they are now using or recommending 1,000 pounds of basic slag and 50 pounds of potash annually. The heavy applications of fertilizer are applied at the time of establishing or renovating the pastures.

It is believed that reseeding of pastures will not be necessary in Walthall if they are renovated and properly fertilized when the clover begins to weaken, or shows signs of being crowded out by grass or objectionable weeds. This has been demonstrated on a number of farms.

Many thousands of pounds of seed have been wasted by broadcasting on land inadequately prepared and improperly fertilized. Preparing the land has been found to be very important, but under certain conditions white clover may be grown successfully without immediate preparation. For example, land properly prepared and fertilized for lespedeza makes an excellent seedbed for the beginning of a permanent pasture. However, it is important that the hay be cut fairly close to the ground, leaving a clean surface for seeding.

The large amount of nitrogen added to the soil by white clover stimulates the growth of Bermuda and other grasses, and if they are not grazed fairly close or mowed in the fall, the clover probably will not appear the following spring. The seeds germinate and young plants die.

Pasture fertilizer recommendations from the Mississippi Experiment Station of State College are as follows:

New pastures—First, sample the area to be put to pasture as directed by the County Agent and let him send the samples to the Soil Testing Laboratory. Lime to bring the pH of the soil to between 6.5 and 7. This will vary with soil type, topography, degree of erosion, etc.

Apply liberal amounts of some phosphatic material if soil tests low or medium in phosphate. Apply at least 100 pounds of available P_2O_5 to be followed by annual applications of 60 pounds of P_2O_5 per acre.

Soils testing low or medium in potash should get an application of 100 pounds of K_2O per acre. This equals 200 pounds of muriate of potash or its equivalent per acre.

The above amounts, if not supplied with materials, may be supplied by 1,000 pounds of basic slag plus 200 pounds of muriate or 800 pounds of an 0-14-7 per acre.

Top-dressing a newly seeded or sodded pasture after growth begins with 200 pounds of nitrate of soda or its equivalent is recommended.

Old or existing pastures—Top-dress sandy soils with 500 pounds of finely ground liming material and heavy soils with 1,000 pounds every five years.

Apply at least 60 pounds of available P_2O_5 per acre per year. Use 50 pounds of available K_2O per acre every other year. Under management, apply 16 to 32 pounds of nitrogen per acre in July.

Temporary pastures—Fertilize legume crops with 60 pounds of available P_2O_5 and 25 pounds of available K_2O per acre. Four hundred pounds of 0-14-7 may be substituted for above materials. Grass crops such as the small grains should receive 32 pounds of nitrogen per acre two weeks before grazing.

The lowering of the cost of production and the efficiency of production are as important in agriculture as in any other type of industry. In this economic sense, the efficient production of livestock and livestock products is directly related to the production of pastures.

Soil fertility is probably the most important factor to be considered in the selection of land for pasture. Like other crops, pasture plants can produce only in proportion to the productive capacity of the soils upon which they are grown. Land that is too poor

Here are some of W. C. Smith's 40 acres of fine White Dutch clover pasture.

to produce crops will cause disappointment if put to pasture without fertilization.

Should land that is to be put to pasture have slope enough to be subject to erosion, means should be provided for erosion control. When converting previously terraced fields to pasture, the terraces and the row system should be re-worked so that all rows are on a contour and the furrows are shallow enough to allow mowing. Erosion control also prevents the movement of seed and fertilizer by flowing water.

Potash has given profitable results on many soil types. Especially is this true where legumes have been grown for hay for many years. An application of 200 to 300 pounds of muriate of potash or its equivalent made just before disking is recommended.

In the establishment of newly seeded pastures, an application of nitrogen will hasten the establishment of the grasses. A top-dressing of 100 to 200 pounds of nitrate of soda or its equivalent after the grasses are up or starting growth will greatly hasten their establishment.

Potash: The Sugar Maker

(From page 26)

of 2-12-6 if these mixed fertilizers were used.

Our heavy virgin timbered soils contained up to 40,000 pounds of potash per acre at 6-inch depth. Of this only 300 to 600 pounds were available. The unavailable bulk of potash in the soil is like the cash in a bank to the man on the sidewalk. As long as he only had a dime in his pocket, the frozen reserve was hardly of much use or comfort to him. So it is in the soil; this available supply is today dangerously low in nearly all soils not heavily fertilized. The hunger signs of potash starvation are so common that every farmer owes it to himself to learn to recognize them.

We marvel at the performance of such crops as alfalfa. It is common experience that the oftener alfalfa is grown on a field, the fewer seems to be the years that a stand will last. Just figure out how many tons of hay have been removed and calculate how much potash has been removed at the rate of about 45 pounds potash (K_2O) per ton of hay. Then add up how much potash has been returned in fertilizer and in manures (1 ton manure adds about 6 to 10 pounds potash) and you will not be surprised at one trouble causing the poor alfalfa yield.

Remember, the alfalfa root feeds out of the same taproot hole as long as the alfalfa lives and then think how this root and its smaller roots must have just about drained dry the soil next to these roots after 4 or 5 years of heavy production. Also, remember that crops may suck up too much potash if it is all added in large infrequent doses. Annual or semiannual applications have advantages over big ones 3 or 4 years apart.

Fortunately, potash presents no such serious reaction with the soil components that lock it up as does phosphate. So the problem of adding potash is simple as to manner of application. Just get it on, and be sure it is balanced with adequate phosphate, dolomitic limestone, some nitrogen and boron.

A Machine for Deep Fertilizer Placement

(*From page* 20)

up for the development of a machine which does not have these drawbacks. In short, a machine is needed which will place fertilizer at any depth from the surface of the soil to depth of plowing, and will have a hopper of handy height and of sufficient size to minimize the number of refills.

Fertilizer is the more effective the shorter the time between its application and need by the crop. This principle works against the farmer who likes to or must plow in the fall. Therefore there is also need for a machine which will place fertilizer deep in the spring on fall-plowed land.

It was decided rather reluctantly that qualifications as stated could be best obtained only in a machine which was an entity in itself. In the fall of 1944 the principal requirements of such a machine were suggested to the E. S. Gandrud Company, Owatonna, Minnesota, already manufacturer of a broadcast fertilizer spreader. It was hoped that Mr. Gandrud would have an experimental machine ready for trial in the spring of 1945, but labor and materials shortages delayed completion until well after planting season. The general features of the implement put together by Mr. Gandrud can be seen in the accompanying photograph. The hopper capacity is approximately 500 pounds and it is designed to place the fertilizer as deep as the land is plowed, but can be used for shallower placement. The shoes are spaced 15 inches apart and in the present model are not adjustable for various widths of spacing. It should be emphasized, however, that this machine is only in the experimental stage and it is planned to use it this coming season to determine its practicability, flexibility, and general all around usefulness and to determine what modifications are necessary.

One possible objection to this machine is that it represents another implement for the farmer to buy. Furthermore it is proposed that the implement be used on plowed land just prior to seeding and this involves another farm operation when time is at a premium. However, it is believed that in areas where the principles of deep and heavy fertilizer placement are practiced, the advantages of such a machine heavily override the disadvantages and at least promise to overcome some of the defects inherent in the attachment to the plow currently used for placing fertilizer deep.

Improved Production on Rubber Plantations

(*From page* 12)

change in soil structure. Tests showed a marked development of alkalinity in the soil which was, of course, caused by the alkaline residue from the long-repeated applications of sodium nitrate. This unfavorable development is an illustration of the trouble which can arise from the long-continued application of one type of fertilizer. Such difficulties can be avoided by alternating with another fertilizer involving a residue of the opposite reaction, in this case for example, by substituting ammonium sulphate occasionally in place of the sodium nitrate.

It is not impossible, of course, that somewhat similar difficulties will eventually arise in areas accorded long-continued applications of ammonium sulphate alone, due in this case to the development of excess acidity from the acid residue; so far, however, there have been no signs of trouble from this cause.

In addition to the two experiments discussed in this paper, many other manuring experiments have been conducted on the plantations of the United States Rubber Company in Sumatra and Malaya. As a general resume of the results obtained, it is of interest to mention the following:

1. Appreciable yield improvements attend the application of all types of nitrogenous fertilizers examined, regardless of the chemical form of the nitrogen.

2. The use of phosphatic manures by themselves does not result in increased production. Following treatment by a combination of nitrogen plus phosphate, the trees occasionally show greater improvement in appearance than that attending the use of nitrogen alone; the yields, however, are no better than those available from the use of the accompanying nitrogen by itself. Actually, there is some slight evidence to the effect that the application of phosphate tends to repress yields. If true, this can be taken to indicate that maximum rubber production does not necessarily attend optimum growth conditions for the tree.

3. As a general rule, the available potash in the plantation lands under discussion seems to be adequate; it has only been possible to demonstrate an advantage from potash manuring in certain very restricted areas in Malaya consisting, for the most part, of old sandy river beds.

Improved Planting Material

It is not the intention in the present paper to enter into a detailed discussion of genetical selection with rubber leading to the development of better planting stock. It is of interest to touch

Photograph showing the typical appearance of a nitrogen-starved stand of rubber. Note the pale, small-leafed and sparse foliage which permits an abundance of light to reach the ground. Here the soil is too poor to support a ground cover.

upon this subject in passing, however, since the work has resulted in even greater yield improvement than that attending the application of artificial fertilizers to stands of unselected rubber.

In the old unselected seedling stands, there exists very considerable yield variation among the individual trees; although the average production may amount to, say, five lbs. rubber per tree per year, there are always a few individuals yielding in the 20- to 40- lb. per-year range and, very infrequently, trees giving even more than this. As an initial step in the problem of selection, production measurements were taken on all the 4,000,000 trees situated in the 40,000-acre complex of old "H.A.P.M." and the individuals grouped in yield classes. The trees in the higher yielding groups were then used as sources of budwood for the production of vegetative offspring. These vegetative offspring consist of buddings made on seedling stocks; all buddings originating from a single seedling mother tree are said to comprise a clone. In the case of some seedling mother trees, the high-yielding characteristics are to be found in the vegetative offspring while in other cases this does not occur; accordingly, it is necessary to "prove" a clone before it can be adopted for general use. Clone-proving consists in planting out an adequate number of the buddings for testing purposes and, after they have attained maturity, keeping them under yield observation until the production characteristics are definitely determined.

In this way, some very desirable clonal planting material has been developed. It is true that this process of selection is comparatively slow since it is necessary to wait about five years after planting before a budding may be tapped and tapping must be continued for some considerable time (preferably seven years although shorter intervals are frequently used) before yield characteristics are adequately established.

The average yield of the buddings comprising a clone is never as high as the production rate of the corresponding seedling mother tree; nevertheless, the harvest from areas of proved clones shows very decided improvements over the crop available from unselected seedlings.

The first proved clones which became available for use as planting material yielded in the range of 10 to 12 lbs. per tree per year; a subsequent group of clones was developed with production capacity in the range of 15 to 20 lbs. per tree per year; during the period just preceding the war, still further improved material became available with indicated yields in the range of 25 to 30 lbs. per tree per year.

During the last 15 years preceding the war in the Pacific, all extensions on the plantations of the United States Rubber Company, in both Sumatra and Malaya, were made with the best available planting material of the type just described; the same applies to areas which have been cleared of old rubber and replanted. The earlier of these improved plantings were already in production before the war and the yields obtained were about in line with expectations as derived from the clone-testing experiments. The highest yield of rubber so far obtained from a large area in routine commercial production was realized in one of these extensions when the harvest amounted to just over 1,800 lbs. per acre in a single year; at the time in question, the trees had not yet attained full maturity nor maximum production rates. There is every indication that the more recent stands of further improved planting material will yield at maturity in the range of 2,500 lbs. per acre per year or higher.

Concluding Remarks

The adoption of an adequate manuring program for the plantations of the United States Rubber Company has provided a quick means for the realization of improvements in crop to quite satisfactory yield levels in the old original plantings.

More gradual but greater improvement in yield levels has resulted from the development of better planting material through processes of genetical selection.

These two means of attaining increased production are, of course, complementary; actually, the yields mentioned above for the various classes of improved planting material relate to stands receiving adequate manuring treatment.

Accordingly, the combination of manuring treatment together with the use of the improved planting material, already developed, has provided the means of attaining production rates of about ten times those available from the old original plantings at the time when work was started on these problems.

Land Lore

(From page 5)

try the "idle ideology." Ergo, we need more speakers who will omit the prejudice pleas and talk unity for prosperity.

COMING back to the ageless topic of the family-operated farm, the theme and goal of speakers galore have ever been to preach ownership as opposed to tenancy. Since the days of Thomas Jefferson and onward through the western migration, the Ultima Thule of agricultural endeavor has been to get a deed to ancestral acres. Meanwhile many successful men have farmed well under tenancy and townsmen have rented stores and made good money. Yet we have always heard it said by vehement orators that the best plan was to mount the ladder, step by step, from hired hand to renter and thence to ownership. Without doubt we have preserved the family farm ideal pretty well, but owner-operatorship is still a distant goal and landlordism dominates the picture.

It is probably true that landlords would provide much better housing and farm facilities and grant easier terms for tenants if there were fewer families bidding for the land in question. It sums up to the same old thing—that there are too many people crowding on too little land, which commands a sale and rental value regardless of the actual productivity of the unit or its ability to afford a fair American living standard under fair to middling operation systems.

Then there are countless philosophers in the renter class who avow with conviction and experience that they can do better for themselves by renting than if they put their savings or borrowed capital into a deed. To some extent they are living in the more fertile sections and are themselves helping to make the local community all that is most desirable. Such operators would rather put their cash into modern machinery and registered livestock or family welfare conveniences than to pinch along on the last upper rung of the w. k. ladder of tenure.

ANOTHER ill arising from the lack of good land in relation to demand for it shows up in the countless number of families who are obliged to work holdings much too small to support rural employment on a satisfactory basis. This new census seems to show a slight trend toward larger farms in many states, outwardly a strange thing because during the war years the bulk of the operators were middle-aged or older. Maybe this presages a noteworthy shift toward much larger operating units, something that is hastened by the age of power farming. If so, there must be a definite increase soon in the non-farm population, which in turn will thrust off their holdings numerous squatters who run small subsistence acres in suburban zones. What do we want after all — a chance for everybody who was raised on a farm to remain there if he desires, or larger and more economic working units manned by fewer operators? If farming is to copy the pattern set by corporate business enterprise, then farming as a way of life and living must yield to farming as a commercial success. This alternative is upon us and platitudes won't solve the question.

ADVANCE planning in the wake of forward thinking by farm leaders and economists is all the rage. Projecting past production ahead to the year 1950 and beyond and estimating what levels of output should be aimed for usually swing back to the old question of price and fair exchange value between farms and consumers of food.

It is axiomatic in all these schemes that farmers under modern methods and encouraged by recent successes will hardly go backward to a lower rate of voluntary production or be content with subnormal living standards. But recent relentless events in the non-farm sphere almost make me think that future planning for agriculture alone is not safe or sane. Just when the boys had returned and rolled up their sleeves to follow the plow and feed the shoats, we found out that city folks were rebellious and greedy for special privileges in one way or another, which upset both the apple cart and the hopes for reconversion. Most of our advance planners overlooked strikes and stalling methods by consumers when they figured out the balance sheets. Yet no farmer is safe to operate from day to day, because his whole investment is wrapped up in perishable things, and seeding time and livestock management call for some reasonable degree of certainty and confidence for at least a year or more ahead.

Until we set up some common ground for all economic groups to meet upon and pool their plans and set their goals, we are merely groping and gambling in blocs and sectors with the country's welfare and mutual good will at stake. If labor and farmers represent big business along with the capitalists and managers of commerce, why do they all seek separate destinies by divergent paths? All the platitudes and preachments galore won't guess us out of a dilemma created by one-track minds, whose chief interest in the other guy is what his wages will buy of the stuff they have to sell.

BEFORE we hope hard along these theoretical lines, of course, we have to clean our own house of obstacles. By this I refer to the diversity of opinion within the ranks of agriculture and within the processing and farm-serving systems as to the right course to take, if any.

We discuss parity prices and income, price supports, producer subsidies, two-price systems, food allotments, social security, plenty of control or none whatever. We put a man in as avowed leader and pace-maker and give him the good old American "razzberry" at the first slip. Only tough old owls of hard-boiled mien and indifference to opinion can last through such a barrage. Then when they get too tough and indifferent they are also valueless and dictatorial. We ask for free speech and determined personal courage, but we want to use the free language and ask the other fellow to produce the courage to stand for it.

Those entrusted with the burden of agricultural decisions and expected to guide us Moses-like into the promised land face a tremendous task and a set of highly complex and inter-related problems for solution. And the joker in the deck is that after such leaders have made such ponderous decisions for agriculture, it's up to the lone old farm operator to make his own decision after all, as much as he can under current cramping circumstances.

History shows us that positive all-out production programs have been easier to realize and quicker to bear fruit than the kind which come in the opposite direction during depressed consumer situations. The magnificent response of farmers to the need for food and fiber in war-time was possible because of the inner urge which all farmers have to outdo themselves. But two factors were also responsible aside from machinery — favorable weather on the whole for six years straight and the fact that many farmers took increased production right out of their own hides.

Price terms that were attractive may have influenced farm families to nobler efforts under handicaps, but prices surely had nothing to do with weather behavior. Neither did prices directly influence yields per acre derived from the wider use of pedigree seed and hybrid corn or tested dairy cows or better bred hogs. Those things, as well as soil improvement discoveries, occurred as much during the depression as afterwards, although the presence of such means and methods at a crisis enabled the production to reach unheard-of heights.

IN all future calculations on production we can omit the price factor as far as certain basic scientific contributions to agriculture and animal husbandry are concerned. These improvements and new discoveries will proceed just as sure as night and day, and they will happen to us whether farm prices lag or boom. Does this mean that average farm prices must in the long run advance to justify efficiency, or does it signify that competing farmers will use these new discoveries to enable food prices to stay at a medium level for mass consumption?

Finally we come to the sixty-four dollar question relating to a boom or bust in land values. An unhampered, full-fledged upsurge in farm values is the surest road to ruin known to modern agriculture. In a way it is like the weather, because there are many discussing it but very few who are able to stop it.

Given the same stimulating forces which produce an era of crazy land price-kiting as we had after the other world war, then the only variable (?) factor in the whole equation is human behavior. But maybe we better not bank too much on human reactions to these same conditions, even though so many warnings and bulletins have been released to stem the tide of title-taking. The young men especially must learn things all over for themselves, even if it costs them money and comfort.

Supporting the notion that land values should go higher is the prime reason felt by many speculators that farm demand and prices will keep on a firm level for two or three years more. The recent famine jitters have also operated to make investment in land attractive and interesting to thousands who never had such an urge before. The slim margin which exists between a feast and a famine has been publicized widely and I have heard many a city slicker yearn for a small plot on which to grow his own beans and nourish his own cow. All this adds up to a land boom, or I am off the trolley.

What's more, we have high net rental values to count on in relation to land values. Landlords have secured much above normal returns in recent years. More farm boys are returning and, giving one sick look at the city muddle, are flying back to the home roost for one like it.

SO we can prepare for more heated oratory on all farm fronts, giving us again the chance to clap or condemn as the subject warrants. After all, it would be a very tiresome world were there no farm problem to solve or no wrongs to be righted. I almost wish, however, that the campaigners would refrain from hectic debate until after the fairs and the dog days—at which time I will have cooled off enough to listen with my usual erudition.

A Few Whinnies

During a weekly Press Conference with the local Congressman, one of the society reporters asked him:

"Tell me, Senator, do you believe that tight clothes stop circulation?"

"Not with a woman, my dear," replied the Congressman. "The tighter the clothes, the more she's in circulation."

"Pa, my teacher told me that I was illiterate," announced the teen-age Arkansawer.

"The heck he did!" snorted the irate parent. "Well, you just take your birth certificate to school with you tomorrow and show him you ain't."

Some women's slacks look all right at the cuff, but they look kind of funny around the bottom.

"When we want to visit the restricted hot spot areas," a soldier wrote from North Africa, "we dress up like the native women—with veils over our faces. Because they don't dare peek, even if they suspect the truth, the MP's are going nuts!"

A man called a Doctor on the 'phone and said his wife had had a severe attack of appendicitis and he wanted her operated on:

Doctor—"You are mistaken. How could your wife have appendicitis, when I removed her appendix three years ago?"

Man—"Easy enough, I have another wife."

DRAMA.

He had choked her. She was dead; there was no doubt about it. He had listened to her dying gasp. Now she was cold—cold as the hand of death. Yet in his anger he was not convinced. Furiously he kicked her. To his amazement she gasped, sputtered and then began to hum softly.

"Just a little patience is all it takes, John," remarked his wife from the back seat.

Golfer—"Terrible links, caddy, terrible links!"

Caddy—"Beg pardon, sir, but this ain't the links. For the last half hour we've been on the south 40 of Cloverdale Farm."

A Negro pastor in an impoverished area sent frequent appeals to his bishop for aid. Tired of the constant requests, the bishop wrote to the pastor telling him to send no more appeals for aid. In a few weeks the bishop received this note:

"This is no appeal. It is a report. I have no pants!"

An elevator operator, off for the day, was replaced by a girl who on her first trip brought the elevator to an abrupt stop.

"Did I stop too quick?" she asked the passengers.

"Oh, no indeed," coyly replied a little old lady in one corner of the car. "I always wear my bloomers around my ankles."

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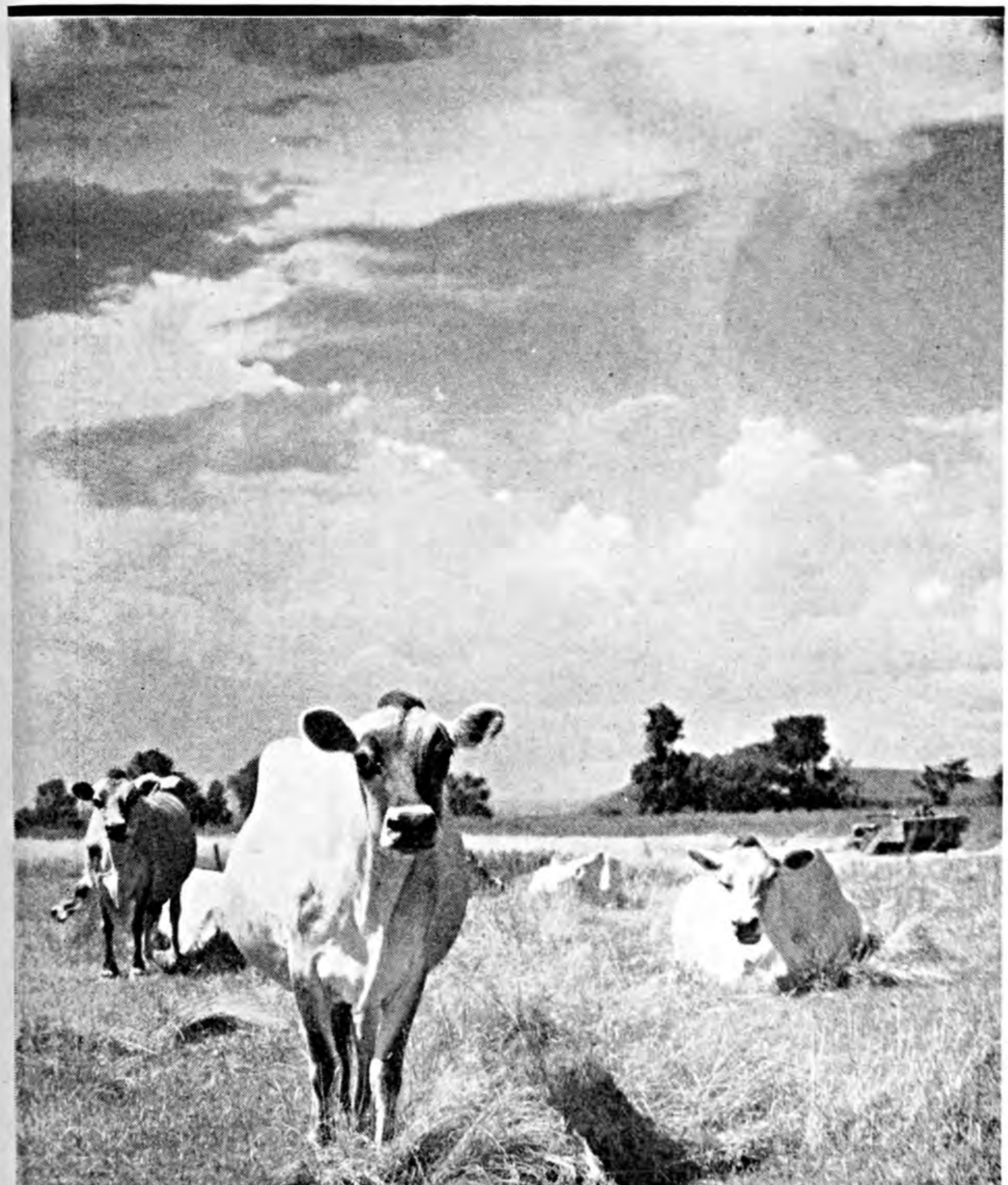

The Pocket Book of Agriculture

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.

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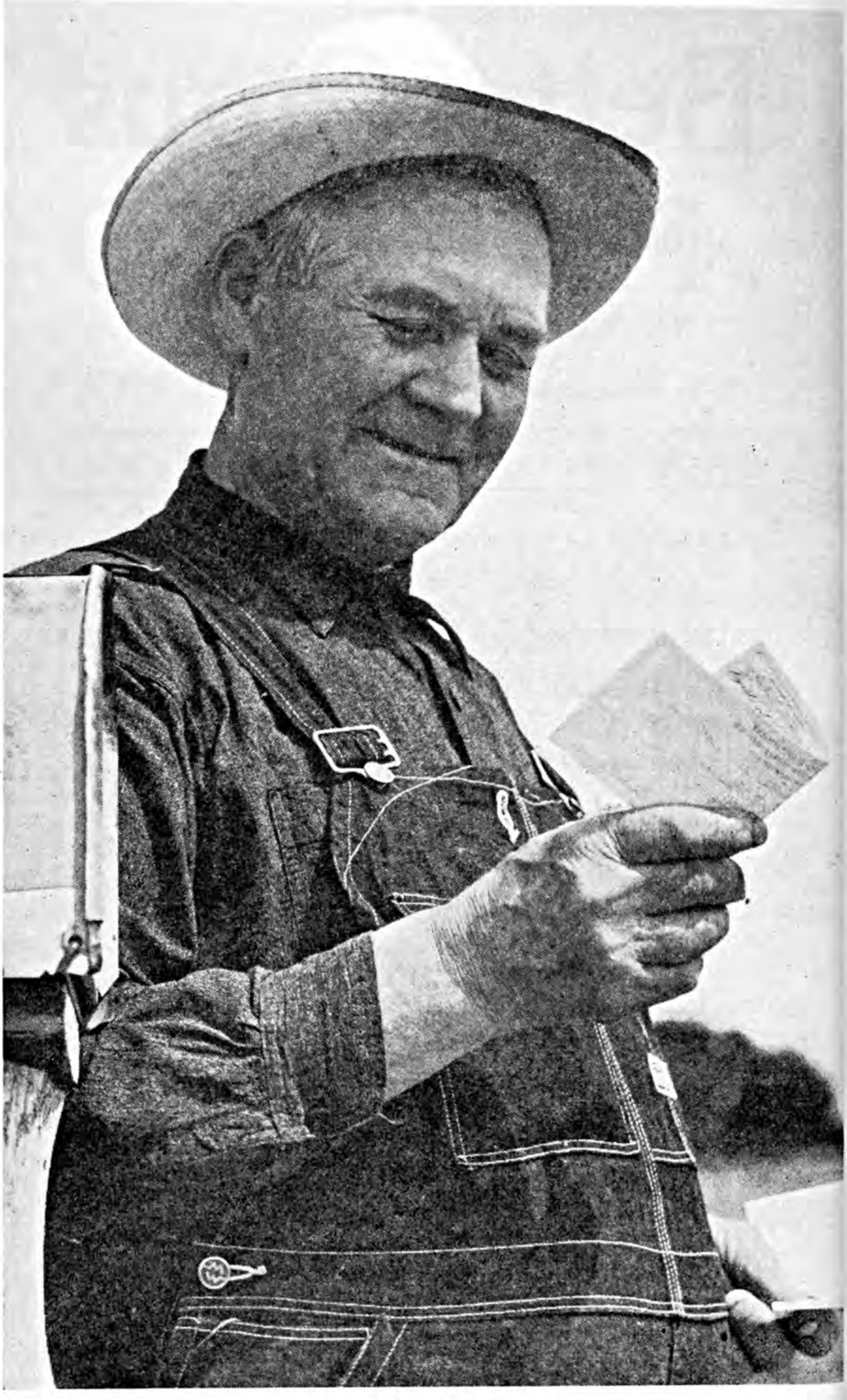

WELCOME MAIL!

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Science Goes Into . . . . .

FERTILE DIRT

Jeff McDermid

MY earliest recollection of fertilizing a farm brings visions of a one-horse, light-draft rickety wagon drawn by a gray gelding named Pike, and driven by a determined but rather inefficient operator, (in the modern version) who called me "Sonny." The accumulated heaps of excreta and straw bedding which required daily removal from the stalls of Pike and his stable-mate, a ring-streaked hybrid cow of the original boarder class, were forked up in fibrous chunks in the early spring and loaded on the gunwales of our galleon with many a grunt and backache.

Of course we had no handy contrivance of wheels, chains, and sprockets to hook into and scatter the refuse to the far winds of the field, so the odorous load was twice handled. The Boss used to say that our "critters" were good consumers of grain and hay and A-1 producers of intestinal residues, but he objected to having the task of lifting so much tonnage in and out for them at so little net profit. With a sense of justice, he thought the old cow should be hitched to the wagon with Pike to help in the hauling.

He had never discussed scientific manurial matters with the leading soil savants of his day, but he was confident that if one just used his nose he could pick a useful commodity for soil enrichment, and the only thing then left to do was to get that strong scent as far away from the house as possible and well plowed under before hot weather.

His era was that of the pioneers. They trusted to their sense of smell to find things most suitable for burying and their sense of sight to detect values gained from such deposits of decayed effluvia. They knew also something of the worth lying in green-manuring of herbage, the virtue of fallowing, and the strength which followed a system of crop rotation. They learned indirectly about the desirability of liming land from occasional green spots of corn and oats growing on the graves of deceased farm animals. But they had no contacts with the few farm colleges then existing, and most agricultural journals relied on practical farm experience for tips and suggestions.

HERE and there nursery and seed catalogs offered sample lots of commercial plant food, but there was no unified effort to banish mystery and penetrate new fields which would multiply the use of and reduce the cost of prepared balanced fertilizers. It seems to me we used a little fertilizer once on some garden vegetables, but the expense and the effort of ordering it offset the apparent advantage. So the folks said it was a fancy fad and stuck to the manure pile. There never was enough of it to go around, however. So they too often depended on luck instead of lime and relied on "fate" instead of fertilizer.

Farmers, however, were not alone in their disregard of mixed goods for soil improvement. I recall hearing agronomists out in the Midwest, full of zeal and short of facts, say repeatedly that the lime-manure-legume-phosphate program was all-sufficient. Some few forward ones wondered if there might not be a different answer for worn-out topsoils and began some local and state cooperative experiments. They located progressive farmers with open minds willing to test the new theories if it didn't cost them anything but the risk of "losing a crop." Plots were staked out and fertilized, signs were put up for the public to heed in passing by, and harvest checks were made for review at sundry winter institutes.

This must have borne fruit, if we go by the statistics on usage of commercial fertilizers. Official dope has it that the tonnage of plant food used on our farms in 1945 was at least 270 per cent of the trickle that reached tired soils in 1915. Men in my bailiwick who scoffed at mineral replenishment of the land have fallen into step long ago and reckon on an annual outlay for fertilizers as normally as they do for seed and binder twine. Instead of being regarded as a nifty new racket, second only to the worthless offerings of the patent medicine sachem and the lightning-rod purveyors of the times, soil-bank builders are accepted today as reliable advisers on procedure for production.

Private estimates based on reports of over 12 million tons of fertilizing materials spread in 1944 indicate that this year optimistic and production-zealous farmers have used close to 15 million tons all told. The thousand or more different grade formulas which were in the picture in 1940 have dwindled to about 260, which is probably a forward step likely to build confidence and avoid confusion and misdirected effort. Along with this there has been a corresponding gain in the plant-food content found in the commercial offerings of mixed goods, from an average of about 14 per cent to nearly 22 per cent, accompanied by a better physical condition when received by the growers.

THIS has been caused by teamwork. Credit for these progressive improvements belongs to the farmers themselves whose kicks and complaints lodged in the right hands; to the county agents and college specialists, as well as the fertilizer agents and field men, who reported results and reviewed opinions; to scientists in states and federal laboratories who took apart the faults when found and made them tick; and to the manufacturers who built better business on the strong foundation of satisfied customers and bumper crops in times of need. I believe the old empirical and speculative period for the industry has vanished with the husking-peg and the ox-yoke. Hereafter judicious attitudes toward a necessity will replace haphazard guessing about a luxury.

IF the farm papers 25 years ago had carried warnings of impending scarcity of commercial plant food, few rural brows would have furrowed in

perplexity and dismay. Today when a world shortage of many vital fertilizing ingredients appears, it is looked upon as a major calamity. This has not been caused simply by skillful advertising or wordy repetition. Its reason lies in personal farm experience.

It is often said that agriculture is usually "in the middle of some muddle." If so, the end of a war era does not bring much relief from that customary quandary. Yet, however, the program runs or whatever the end result may be, either scarcity or surplus, the farmer must rely on soil fertility to pull him through safely.

We all know how that happens and why. If the country should achieve a good long spell of industrial prosperity and sustained wage earnings by the masses who consume the grub, it will spur the food producers to seek greater total production of crops, pasture, and livestock products. To get this goal, there must always be a sound program of fertility—erosion control, irrigation, liming, manuring, plow-down crops, and restoration of mineral plant food. Less land will lie idle, more land will be worked overtime, and good top-soils will be tapped. Perhaps some questionable land and livestock will be used from a net profit angle, but folks lose sight of that in years of fat markets.

If, on the contrary, the cycle of inflation and underconsumption should wreck our immediate hopes for prosperity in peacetime, the farmer begins to ponder on higher production, too, in self defense. No matter if individual projects in that direction cause a combined surplus somewhere and prices are depressed—the urge to make each acre count to accumulate enough tonnage to offset the lower price—it will still be with us. That, too, argues for no great decline in the demand for additional plant food. History rather proves the case. In the depression years of 1932-34 inclusive, our farmers bought an average of 5.2 million tons of commercial fertilizers compared with about 7.5 million tons in the three years both preceding and succeeding that gob of woe. That was no great shakes of a slump after all.

Hence no huge reconversion cut-back is facing fertilizer people now. One thing that will hold it firm is the general hunch so many farmers have that maintenance of the soil is a long-time program, not just a short heat to be run with an acre or two of specialty crops in boom years.

I DO not know of any case where we can demonstrate the united effort of the white-collar and the sweatshirt boys in meeting a crisis like we can with the war food campaign. Managers of implement and fertilizer factories in the winter of 1941-42 found themselves facing a huge wave of keen demand from the dirt farmers. The working force of these firms making tractors, plows, fertilizer distributors, and mixed fertilizer was disrupted by the call for man-power in the armed services and

(*Turn to page* 49)

Fig. 1. Excellent pastures are produced on rolling sandy land when minerals are used.

South Mississippi Soils Produce Fine Pastures and Livestock When Minerals are Applied

By H. B. Vanderford

Department of Agronomy, Mississippi State College, State College, Mississippi

THE farmers of South Mississippi are producing livestock without blemishes or nutritional deficiencies by applying the essential minerals to their soils. Their experience, under the direction and guidance of Soil Conservation Service technicians and other agricultural leaders, has shown definitely that improved pastures can be developed on soils that were once thought poorly adapted for pasture crops.

This belated program has taken root and expanded considerably in Walthall County. The agricultural workers in this County have made use of the recommendations of the Mississippi Experiment Station and the results of the pasture work in the State of Louisiana. The basic principle behind this remarkable and important development in pasture improvement and quality of livestock produced is that adequate minerals have been added to the land. This story strongly re-emphasizes the truth that was brought to our attention often during the war and has been stressed considerably during recent years: "Fertile land produces healthy plants and in turn healthy animals" or conversely "poor land produces sick plants or plants low in nutrients and consequently sick animals."

Extensive livestock production always has been associated with soils containing adequate mineral supplies, and probably always will be. Many disappointments have been experienced in trying to develop improved pastures on soils without natural or applied fertility. Farm operators who desire to develop good pastures on soils deficient in minerals must certainly consider the extra cost of applied fertility necessary for the production of nutritious pasture plants and healthy livestock. Even at the present high price levels, minerals bought in a sack and applied to pasture land are proving to be good investments in many localities. Money invested in minerals that are applied to pastures is returning to many farmers of South Mississippi high interest rates in terms of pastures and livestock that were once thought to be nearly impossible and certainly impracticable in this area. There are many acres in this section of the State now covered with luscious white dutch clover and dallis grass that are carrying healthy livestock the greater part of the year. One pasture, in Walthall County, properly fertilized and seeded, 25 acres in size, furnished plenty of grazing for 50 head of beef cattle for a period of 10 months in 1945. This is quite a contrast to the usual pasture which has been common in this section where several acres have been required to maintain one cow.

History of Program

The pasture program was initiated in Walthall County by D. M. Fortenberry, District Conservationist with the Soil Conservation Service. Mr. Fortenberry as soon as he came to the county converted a few farmers on the idea that pastures could be developed on the soils that comprised their farms, and several operators were willing to try his plan. The first pastures were prepared, fertilized, and seeded in the fall of 1942. In the spring of 1943 these pastures served as demonstrations for several other farmers as well as for visitors from other counties. With the shortage of labor that was encountered about this time, the farmers were ready to turn to other farming practices which required less labor than "king cotton." More pastures and livestock seemed to be the correct solution to the problem.

In the development of improved pasture, Fortenberry stressed two fundamental necessities. First, the land must be well prepared in time to seed clovers and grasses in early October. Good

Fig. 2. Poor pastures on similar soil conditions as shown in Fig. 1. The vegetation is sparse and several acres are necessary to support one cow during the summer. No winter or early spring grazing is obtained.

preparation, although expensive, is absolutely essential. Said Fortenberry, "It is foolish to pay a dollar per pound for seed and then put them on poorly prepared land." High-priced seed of pasture plants should always have the advantage of a well-prepared seedbed. Good land preparation is illustrated in figure 5. Successful farmers never expect row crops to grow off and produce well when planted on rough or poorly prepared land. If this is true for row crops, it is also true with regards to pasture crops.

The second prerequisite was that adequate minerals such as calcium, potassium, and phosphorus must be applied and worked into the soil prior to seeding. These minerals could be added in the form of agricultural limestone, muriate of potash, and superphosphate, or basic slag and muriate of potash. The results of the first demonstrations where adequate minerals were used were outstanding and many visitors were sold on the idea that pastures could be developed when the land is properly prepared and sufficient minerals added. Of course, the management and utilization were to be worked out later, but the ground floor of an important pasture program had been established.

Soils of Walthall County

There is an old adage to the effect that "in order to be successful in life, a person should be very careful in choosing his grandparents." The present farmers and operators of Walthall County are fortunate enough to have had grandparents who settled on land with excellent physical properties, and as a result they inherited good soils. Walthall County lies entirely in the Coastal Plain Province, but a thin mantle of loess has influenced the soils in several places. This thin mantle of loess has been removed from many of the soils on the rolling and steep topography by accelerated erosion. The Coastal Plain material is rather fine-textured and is somewhat unusual for marine material. The material resembles somewhat the deposits found in the Pontotoc Ridge Area. The upper strata are composed of sand and clay with a high percentage of silt. This extends to a depth of several feet, which would seem to preclude the idea that the silt found in the soils is altogether of wind-blown origin. In some places where the topography is level to gently rolling, a definite loess deposit which has had a definite influence on the soils is found. However, where this loess material cannot be detected, the soils possess a fine texture compared with other Coastal Plain soils. This property of the soils enables them to hold moisture and fertilizers for extended periods of time.

Many variations occur among the soils of Walthall County, but in general they are deep, well-drained soils with medium textures. All of these soils characteristics are favorable for the production of most agricultural crops. These soil properties have played a major roll in the development of the highly intensified type of agriculture that has been common in this County for many years. Some of the predominant upland soils of the County are Ruston, Luverne, Shubuta, and Ora which developed from Coastal Plain material, and in areas where loess overlies the Coastal Plain material, the Providence, Lexington, Bude, and Brandon soils which have silty textures are found. Many of the soils contain a considerable quantity of gravel but few are droughty from excessive internal drainage. The physical properties of the soils have in the past been considered highly favorable for row crops and less favorable for livestock production and diversified farming. The soils in general are low in natural minerals, and pasture development on soils deficient in minerals was once considered too expensive to be profitable. The present results, however, indicate that desirable physical properties of these soils may have a decided advantage in the growth of pasture plants as well as cotton or corn.

Fig. 3. Soil fertility is a controlling factor. The portion of this field on the right received basic slag and potash. The part to the left was prepared and seeded but no minerals were added.

Progress of Pasture Program

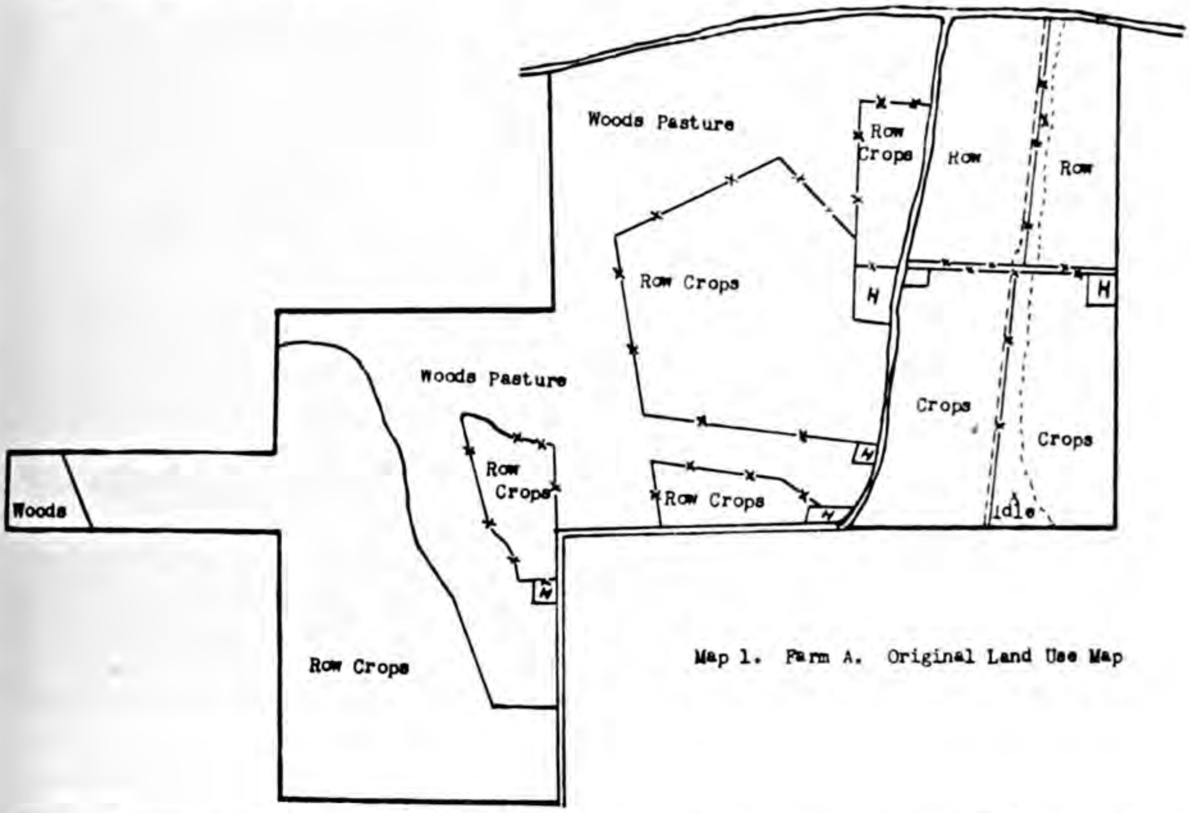
By using the original demonstrations as guides and making some improvements on the original plan, many farmers in Walthall and adjoining counties have elected to devote many acres on their farms to pasture crops. At the present time a panorama of white dutch clover blooming in promiscuous profusion is observed on many farms in Walthall County. Pasture demonstrations were conducted on 70 farms in that County this year in which a complete fertilizer was tested in com-

Fig. 4. Same scene as shown in Fig. 3 after two months of heavy grazing. Cattle grazed the fertilized part and left the unfertilized part. The cattle refused to eat the grass from the unfertilized plot.

Fig. 5. Good preparation is one of the necessary prerequisites for pasture development.

parison with lime and phosphate. In Walthall County alone a carload of potash was used in demonstrations during one year in the development of improved pastures. The program has advanced to the point where all the agricultural leaders and many farmers in that County are stressing the fact that crops which can be harvested by animals instead of hands and machines are what are needed. Good cotton land that once produced a bale of cotton per acre, with high fertilization, is now making more income growing excellent pastures that are being harvested by beef and dairy cattle. This type of farming blends nicely into the Soil Conservation Program, since most of the land is continually in pastures or close-growing crops which reduce the loss of

Fig. 6. Adequate minerals produce a good pasture comprised of a mixture of grasses and clover.

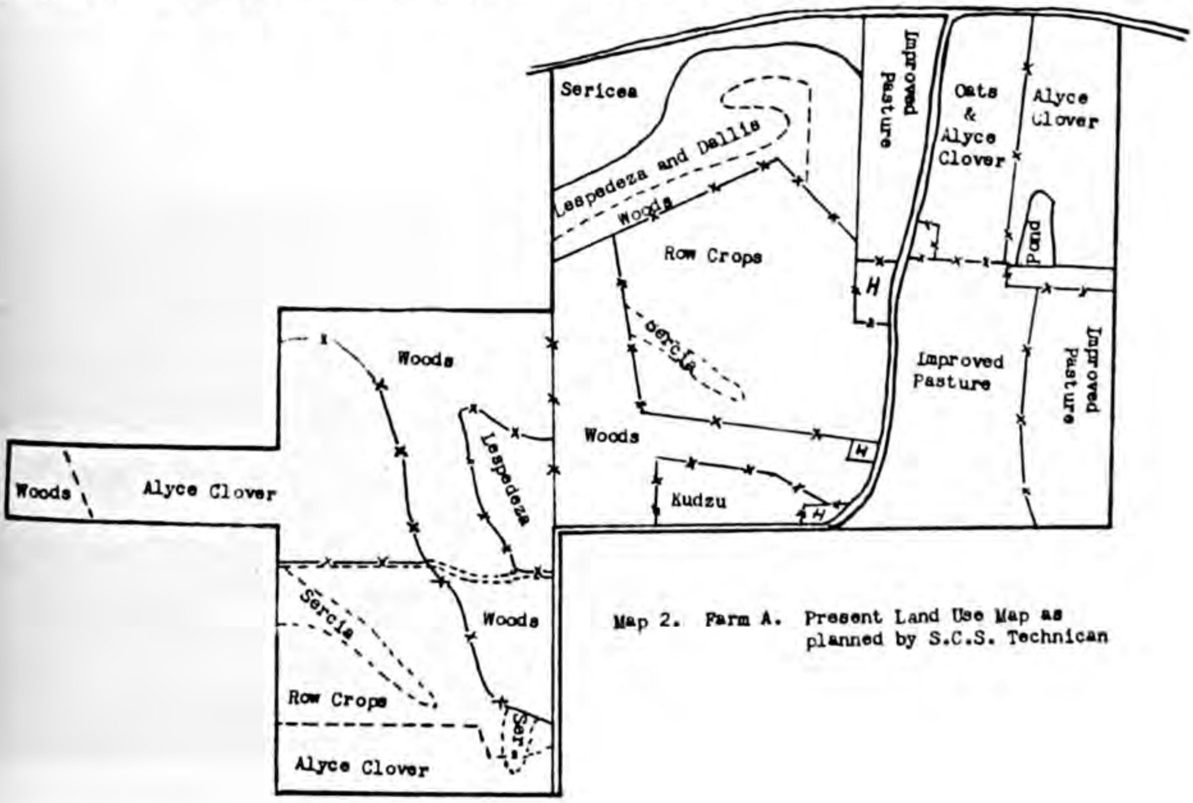


Map 1. Farm A. Original Land Use Map

fertility and soil by accelerated soil erosion.

Some Typical Examples

The following is an example of how one farmer changed his type of farming and how well the new plan is working. In 1943 this particular farmer had five tenants on his 260-acre farm and was growing approximately 60 acres of cotton. There was not an acre of improved pasture on the entire farm. In the fall of 1943, he signed an agreement with the Soil Conservation Service, and Mr. Fortenberry devised a farm plan which indicated more pastures and close-growing crops and less acreage devoted to row crops.



Map 2. Farm A. Present Land Use Map as planned by S.C.S. Technican

Farm plans of farm A are shown in maps 1 and 2. It is well to note that there were only wood pastures and no stock or fish pond on farm A in 1943. In 1946 we found a different picture on this farm as shown in map 2. The farm was being operated with very little labor other than the operator's efforts and only a few acres of cotton were being grown. Only one tenant was retained on the farm, and he, being a negro, was growing the cotton. Most negro farmers would feel that their religion was questionable if they failed to plant at least a few acres of cotton. Twenty-five acres of good cotton land were prepared and seeded to white dutch clover and dallis grass in the fall of 1943. Minerals were supplied in the form of 2,000 pounds of basic slag and 200 pounds of 50% muriate of potash per acre. An excellent pasture was produced in the spring of 1944. Since that time 1,000 pounds of basic slag and 50 pounds of muriate of potash per acre have been applied each fall.

This farmer was so well pleased with the results of his efforts that since 1943 he has changed the farm to the outlay shown in map 2. The crops have been arranged so that a year-round grazing program can be practiced. It can be observed from map 2 that several fields are devoted to oats and alyce clover, and small patches are planted to kudzu and lespedeza sericea. During 1945, 25 acres of improved white dutch clover and dallis grass pasture carried 50 head of beef cattle for 10 months during the year. The farmer estimated that he netted approximately $50 per acre on this pasture during that year. At the present time this is one of the best pastures in the State of Mississippi.

By managing this enterprise according to the present farm plan this operator expects to obtain year-round grazing in the following manner: Oats with the addition of crimson clover will be grazed from November 15 to February 15; then improved pasture (white clover and dallis grass) from February 15 to August 1; then alyce clover from August 1 to November 15. The patches of kudzu and sericea are for hay and emergency grazing in case of adverse weather conditions and if extra grazing is needed. It is fully realized that good pasture management must provide for controlled grazing. This is one of the paramount factors in the establishment

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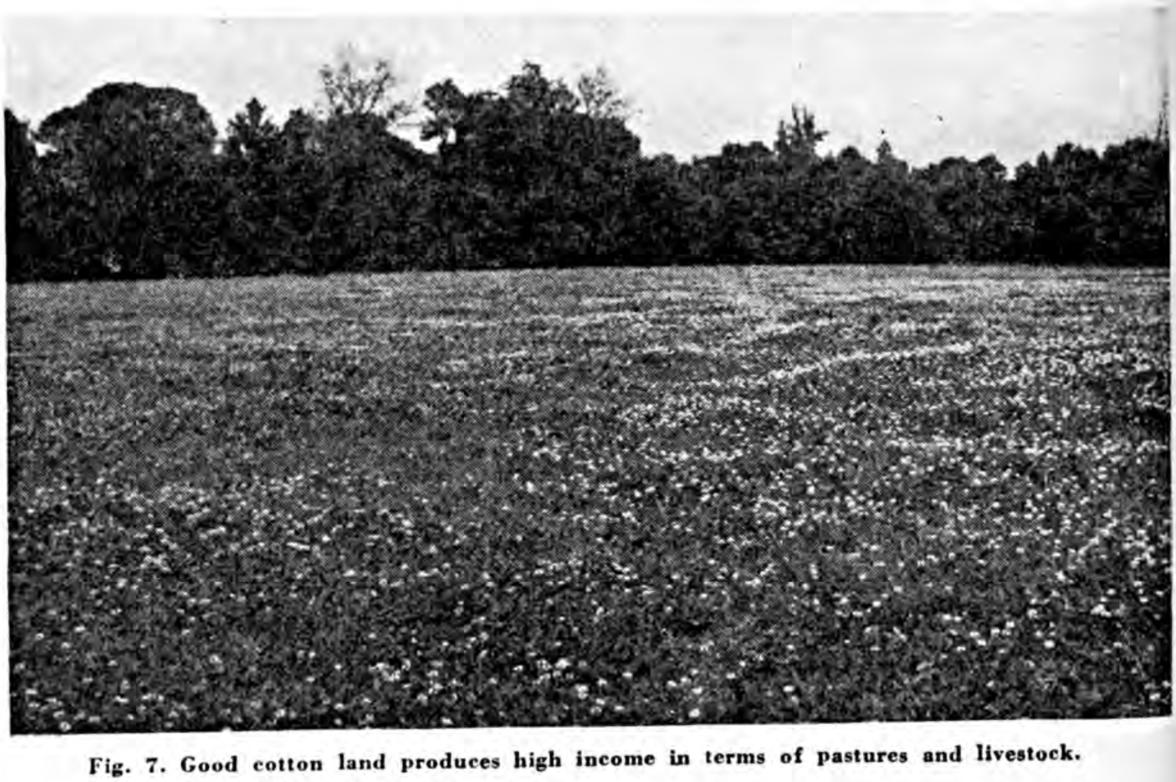

Fig. 7. Good cotton land produces high income in terms of pastures and livestock.

W. E. Harrell standing with $1,200 worth of package bees at the railroad station at Letohatchie, Alabama, awaiting the 4:00 o'clock train. Most of these bees are addressed to honey producers in Saskatchewan and Ontario Province in Canada.

Meet the King of Queens

By L. O. Brackeen

Agricultural Extension Editor, Alabama Polytechnic Institute, Auburn, Alabama

ON small parcels of rented land in seven Alabama and Florida counties, W. E. Harrell, Hayneville, Alabama, operates the largest individually owned package bee and queen empire in the world. His friends call him the "King of Queens".

Each year he ships some 40,000 queens and 150,000,000 honeybees. This is enough queens to lay 6,000,000,000 eggs and enough bees to serve as foundation stock for producing 2,000,000 pounds of honey the same year they are shipped. In addition, they cross-pollinate thousands upon thousands of acres of fruit trees, clover fields, and vegetable patches.

Harrell has perfected his operations to the extent that his bee and queen kingdom is being used as a Laboratory by his Alma Mater, the Alabama Polytechnic Institute. College students, both boys and girls, visit the queen and bee yards at regular intervals and make queen cells, gather royal jelly, catch and plant larvae, place cells in colonies, catch and cage queens, and shake and ship package bees. They report some "unforgettable experiences."

Too, each year he has visitors from all over North America and an occasional visitor from South America and Europe. The government of Norway this year asked that a student be permitted to work two years with Harrell "learning the bee and queen business."

It was 32 years ago that Harrell started on the road to fame in the bee world. As a barefoot lad on his father's farm, he used to stand fascinated for hours watching his neighbor, M. C.

Berry, work with his bees. It was then that he definitely made up his mind to be a package bee and queen producer.

At the age of 16 years his father bought him his first pair of long trousers and sent him to college. He was very studious, but his grades were only fair. This was attributed to the fact that he was more interested in bees and queens than academic learning. His professors and fellow students labeled him "the bee man."

After graduating from Alabama Polytechnic Institute in 1919, he went back home and began working for Berry without pay "just to learn the trade." Seeing his interest, Berry gave him a job. He worked as a hired hand for one year. Berry then moved to Montgomery and placed Harrell in charge, giving him one-half the returns.

Two years later Harrell borrowed $1,000 for down payment and bought all of Berry's bees agreeing to pay the remainder in monthly installments. From that day until this he has been busy buying bees and extending his bee empire until it now includes 73 outyards in Dallas, Wilcox, Lowndes, Covington, Coffee, and Escambia counties in Alabama, and Santa Rosa county in Florida, and two big queen yards at Hayneville in Lowndes County. Today the queen yards are known as Heaven's Hill and Brewer's Cove.

Each bee yard derives its name principally from local people and places. For example, the Smith, Jones, Johnson, and Morgan yards are named for people, the Dairy yard for a nearby dairy, the Birmingham and Auburn yards for a city and town.

Not only do his bees wing over 2,000,000 acres of forest and farm land, but Harrell holds the distinction of having shipped bees and queens to every state in the United States and to all but three provinces in Canada. The bulk of his bees goes to Michigan, Illinois, Indiana, Ohio, North Dakota, South Dakota, Minnesota, Virginia, West Virginia, Kentucky, Tennessee, and Missouri in this country and the provinces of Saskatchewan, Manitoba, Ontario, and Quebec in Canada. Too, he ships them to England, France, Africa, Belgium, Holland, Thailand, Quatemala, Mexico, and Cuba.

For years he has received orders for more bees and queens than he could possibly supply. Although he is a strong believer in advertising, he hasn't

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W. E. Harrell taking a queen bee from the mating colony and placing it in a small cage used in shipping queen bees. After placing the queen in the cage he catches 6 to 12 worker bees and places them with the queen to feed and fan her during trip from the queen yard to destination.

Trends in Use of Major Plant Foods

By M. H. Lockwood

President, National Fertilizer Association, Washington, D. C.

AS agriculture ages and intensifies, the ratio of phosphorus to nitrogen and potash, in applied fertilizers, narrows. For the United States, nitrogen has increased from 20 to 24 per cent of the three major nutrients during the 24 years following 1920. During the same period, phosphoric acid decreased from 58 per cent of the total to 51, and potash has increased from 22 to 25 per cent.

For commercial distribution only, these trends are even more evident, for government distribution has been principally phosphatic. (See Table 1, both sections.)

New areas of extensive agriculture usually begin fertilizer use with phosphates, and progress toward the three-factor ratios. Increasing rates of application as well as narrowing ratios of nitrogen and potash to phosphoric acid occur as (1) time passes and, (2) agriculture grows more intensive and, (3) returns per acre increase. In some instances, areas of heavy repeated fertilizer use accumulate substantial reserves of available phosphoric acid. Decreases in prices of nitrogen and potash have also been important factors in increasing their use. Prices for phosphates have declined little during the past 20 years.

The national trend upward in nitrogen ratio is masked somewhat by the increasing proportion of our national volume used in the grain-growing areas where a low ratio of nitrogen to minerals is customary. Such areas have clung for years to such grades as 2-12-6 commonly applied at low rates per acre. Fortunately, leaders among both agronomists and industry are courageously converting such practices to narrower ratios and heavier rates more easily defended under today's conditions and knowledge.

Improved methods of application have played no small part in greater fertilizer use. With both "starter" or "beside the row" application and the newer "plow down" or "heavy" application methods, nitrogen and potash are wisely placed where they may work more efficiently. Fortunately, too, the salt index of nitrogen and potash carriers used has decreased as higher analysis materials have increased in use. The decreased use of low analysis potash salts is one of the best illustrations of this as well as the effect of lower unit costs for higher analysis ingredients.

Trends in Regions

Because grand averages for the nation may have in them the confusing effect of unlike area practice, let's take a look at a few different sections of the country.

The historically heavy fertilizer-using state of North Carolina is a convenient place in the Southeast for a beginning. In the 10 years since 1935, the popular 3-8-3 has been replaced by 3-8-5 and 3-9-6, as well as 4-10-6, grades. Such a trend seems constructive from the point of view of displacement of grades unduly dilute. While this change was aided in recent years by state and federal regulations, material progress in shrinking the volume of dilute grades was effected earlier by constructive educational effort. North Carolina authorities credit much of that State's progress from a 15-unit 1937 record to 18.8 units in 1944-45 to regulatory control. They also state that heavy accumulations of phosphoric acid in some soils indicate a need for lower applications of that nutrient for more economic fertilization under some conditions in that state. I do not agree that progress by mandatory grade limitations is an acceptable substitute for voluntary educational methods. I do recommend that industry follow such findings as the evidence supporting lower phosphate applications such as the North Carolina Station suggested.

TABLE 1, SECTION 1.—TRENDS IN PLANT NUTRIENT USE, UNITED STATES COMMERCIAL DISTRIBUTION

Factor	1920	1925	1930	1935	1940	1944
Nitrogen	3.12	3.66	4.47	4.77	5.13	5.38
Phosphoric Acid	9.05	9.12	9.41	9.13	9.21	9.84
Potash	3.53	3.79	4.20	4.70	5.33	5.55
Total	15.70	16.57	18.08	18.60	19.86	20.77

INDEX

Factor	1920	1925	1930	1935	1940	1944
Nitrogen	20	22	25	26	26	26
Phosphoric Acid	58	55	52	49	47	47
Potash	22	23	23	25	27	27
Total	100	100	100	100	100	100

TABLE 1, SECTION 2.—ALL DISTRIBUTION, INCLUDING GOVERNMENT

Factor	1920	1925	1930	1935	1940	1944
Nitrogen	3.12	3.66	4.47	4.77	4.85	5.02
Phosphoric Acid	9.05	9.12	9.41	9.13	10.57	10.47
Potash	3.53	3.79	4.20	4.70	5.05	5.15
Total	15.70	16.57	18.08	18.60	20.47	20.64

INDEX

Factor	1920	1925	1930	1935	1940	1944
Nitrogen	20	22	25	26	24	24
Phosphoric Acid	58	55	52	49	52	51
Potash	22	23	23	25	24	25
Total	100	100	100	100	100	100

TABLE 2.—SOUTHEASTERN TREND
(VIRGINIA, NORTH CAROLINA, SOUTH CAROLINA, GEORGIA, AND FLORIDA)

Factor	1920	1930	1940	1943
Nitrogen	18	18	28	24
Phosphoric Acid	61	56	43	45
Potash	21	26	29	31
Total	100	100	100	100

During the past two years, numerous North Carolina demonstrations of corn fertilization have indicated the practicability of doubling the yield of that crop with heavier fertilizer use including all three of the major plant nutrients but with emphasis on nitrogen. Cummings and Collins estimate that 50,000 tons of additional nitrogen will be required to accomplish this doubling feat on corn yields. Pasture improvement now well started in North Carolina will require substantial quantities of phosphates and potash as well as lime.

In Florida, Dr. A. F. Camp and his associates working closely with the fertilizer industry have done a spectacular job in stepping up the citrus yield and quality by proving that minor elements were needed to more than triple the grapefruit and orange volume as has been done during the past decade. Here is a case where nitrogen, phosphorus, and potash were not the first limiting factors, even though important. Magnesium, manganese, copper, zinc, and sometimes boron and iron have their place in the Florida citrus fertilizer program.

The South Atlantic Coastal States (Table 2) Florida to Virginia, inclusive, increased in potash ratio during the 1920 to 1940 period from 21 to 29 per cent, and decreased during the same period in phosphoric acid ratio from 61 to 43 per cent. At the same time, the nitrogen ratio in those five states gained from 18 to 28 per cent of the total for the three major nutrients.

In Alabama, the promotion of the 6-8-4 grade in place of lower nitrogen ratios is well known. The record of this trend appears to have been submerged, however, (when we study Table 3) possibly by government distributed phosphate used on crops other than cotton.

California is notably a heavy user of nitrogen but finds that with two to three times the quantity of nitrogen as is used in Florida, the quality of California citrus is declining. Indica-

TABLE 3.—ALABAMA

Period	Ratio of Major Nutrients			Total Nutrient Quantity Trend
	Nitrogen	Phosphoric Acid	Potash	
1935–1939 Average	31	46	23	100
1940	30	49	21	119
1941	32	48	20	121
1942	25	55	20	126
1943	24	55	21	156
1944	29	52	19	162

TABLE 4.—(NORTHEAST—NEW ENGLAND & MIDDLE ATLANTIC)

Period	Ratio of Major Nutrients			Total Nutrient Quantity Trend
	Nitrogen	Phosphoric Acid	Potash	
1935–1939 Average	17	54	29	100
1940	15	59	26	116
1941	14	60	26	134
1942	13	58	29	140
1943	14	56	30	148
1944	17	55	28	156

tions from field tests in California point toward minerals as being needed with nitrogen. From 1920 to 1943, the nitrogen used in the three west coast states increased from 28 to 50 per cent of the three major nutrients, while phosphoric acid decreased from 53 to 35 per cent, and potash increased from 19 in 1920 to 30 per cent in 1930, dropping back to 15 per cent by 1943.

The Northeast (Table 4) has narrowed its ratio of phosphoric acid to nitrogen and potash during the past quarter century. In that area of three-century farmed land, there is still room, however, for much more phosphate to be used with farm manures before reasonable efficiency in the use of those manures will be attained. Table 4 does not indicate much change in the Northeast, however, during the past 10 years.

In our area survey of the nation, we may well end in the grain belt, livestock-legume states of the Midwest where recent years have witnessed rapid increases in fertilizer use matched by no other section (Table 5).

The ratio of nutrients in the Midwest is so near 1-6-3, except as the shortage of nitrogen depressed that factor in 1942 and 1943, that the pre-

TABLE 5.—EAST AND WEST NORTH CENTRAL STATES

Period	Ratio of Major Nutrients			Total Nutrient Quantity Trend
	Nitrogen	Phosphoric Acid	Potash	
1935–1939 Average	10	62	28	100
1940	9	61	30	130
1941	9	61	30	149
1942	5	63	32	201
1943	7	63	30	213
1944	9	61	30	253

Compare the above with the Continental United States Trends below.

1935–1939 Average	24	50	26	100
1940	23	53	24	120
1941	23	53	24	132
1942	19	55	26	145
1943	20	53	27	168
1944	24	51	25	179

dominance of the 2-12-6 grade is evident. As soon as an improved balance of supply and demand develops, the ratio of nitrogen and potash should increase in that area. Such a development need not depress the volume of phosphates used, for still greater fertilizer use may be expected in the corn belt. In spite of the fact that 1944 fertilizer consumption in the Midwest reached two and one-half times the 1935-1939 average, certainly nitrogen and potash and perhaps even phosphoric acid were insufficient in quantity to satisfy the rapidly growing demand there.

In a legume-livestock section such as the Midwest, the production of legumes lessens the purchased nitrogen needed and tends to increase the potash requirement. Even so, with deep placement of heavier applications of nitrogen, in which some states in the Midwest have already made substantial beginnings, there is the likelihood that the present low ratio of nitrogen to minerals may be narrowed. During the years 1943-1944, there obviously was less potash available for use in commercial fertilizers in the Midwest than would have readily been purchased, even though special allocations were made favoring that area as against other sections of the nation. Increased use of fertilizers in the Midwest will affect the national trend more as the area volume grows (See also Tables 11 and 12). Anyone who likes to play with figures can have a lot of fun as well as dig out much of value using the tables in U. S. D. A. Plant Food Memorandum Report No. 11, and A. L. Mehring's article in the August 1945 issue of the Journal of the American Society of Agronomy, studying the trends in states, regions, and the nation.

Trends in Mixtures and Materials

A. L. Mehring of the U. S. Department of Agriculture, discussing "Fertilizer Nitrogen Consumption" in the March 1945 issue of Industrial and

Table 6, Section 1.—Nitrogen in Mixed Fertilizers

Form	1925	1940
Solid Nitrates	23	10
Solid Ammonium Salts	20	41
Natural Organics	37	15
Synthetic Organics	11	9
Ammonia and its Solutions	0	25
Total	100%	100%

Table 6, Section 2.—Nitrogen Total—Mixtures and Materials

Form	1925	1940
Solid Nitrates	39	32
Solid Ammonium Salts	31	35
Natural Organics	25	12
Synthetic Organics	5	8
Ammonia and its Solution	0	13
Total	100%	100%

Engineering Chemistry, shows that in the period from 1925 to 1940, nitrogen purchased in mixtures increased from 45 to 49 per cent of the total while nitrogen distributed unmixed decreased conversely (See Table 6). Table 6 of Mehring's article indicates that (1) natural organics decreased from 25 to 12 per cent of the fertilizer nitrogen supply, (2) while ammonia and its solutions increased from 0 to 13 per cent during the same 15-year period. In mixtures for the same period, solid nitrates decreased from 10 to 5 per cent of the nitrogen total, while solid ammonium salts increased from 13 to 20 per cent of that total.

Let's see how, for the same 15-year interval, the nitrogen used in fertilizers changed in form (Table 6).

Obviously, the trend is away from natural organics and solid nitrates toward the lower priced solid ammonium salts, synthetic organics, and ammonia and its solutions.

Superphosphate production, as well as capacity, has undergone less change in volume, methods, location, or type than either nitrogen or potash during the past quarter century. Excess capacity exists mainly in the Southeast, while the Midwest and West Coast are deficit areas. Recent construction of processing facilities in deficit areas indicates, however, that as the post-war adjustment progresses, we shall find new capacity locating soundly to serve new demand of permanence. We will also experience some growth of high-analysis phosphate production, with its inherently greater shipping radius tending to locate new facilities near sources of raw materials and low cost power, and with less dependence on nearby consumption than is essential for the ordinary analysis material. Table 7 summarizes the volume of superphosphates we could produce and have produced. In spite of the reverses which the war brought to both types of material with their emphasis on the high-analysis plants, there is a steady although unspectacular growth of the proportion of phosphates both potentially and actually in the high-analysis form.

Trends in Distribution by Government

Phosphates have predominated in government distribution. The Tennessee Valley Authority began distribution in 1935 with approximately 2,000 tons and reached a volume of 42,000 tons in 1944.

The Agricultural Adjustment Agency began distribution in 1937 with 25,000 tons reaching a volume of about 1,200,000 tons in 1942 and receding to 860,000 tons in 1943. In 1943, the AAA-distributed fertilizer is reported to contain 374,000 tons of phosphoric acid and 41,000 tons of K_2O. In 1944, that agency also initiated distribution of a few hundred tons of nitrogen in the State of Maine. And now "grants-in-aid" are paid in several states for all three major nutrients as well as land-liming materials.

TABLE 7, SECTION 1.—SUPERPHOSPHATE PRODUCING CAPACITY (U. S.)

Year	Ordinary Superphosphate		High Analysis Superphosphate		Total Tons of P205
	Tons P205	% of Total	Tons P205	% of Total	
1920	1,440,000	99½%	7,000	½%	1,447,000
1930	1,600,000	97%	44,000	3%	1,644,000
1940	1,528,000	89%	180,000 [1]	11%	1,708,000
1944	1,667,000	85%	287,000 [1]	15%	1,954,000

[1] Includes Tennessee Valley Authority Capacity.

TABLE 7, SECTION 2.—SUPERPHOSPHATE PRODUCTION—UNITED STATES

Year	Ordinary Superphosphate		High Analysis Superphosphate		Total Tons of P205
	Tons P205	% of Total	Tons P205	% of Total	
1929	710,700	95%	34,900	5%	745,600
1934	477,500	94%	31,300	6%	508,800
1939	632,600	83%	125,500	17%	758,100
1944	1,219,500	91%	124,900 [1]	9%	1,344,400

[1] The production of two large plants was largely diverted to war uses in 1944.

TABLE 8.—PLANT FOOD CONTENT OF FERTILIZERS DISTRIBUTED BY COOPERATIVES 1939 THROUGH 1943.

Year	N	P_2O_5	K_2O	Total
1938–1939	3.0	12.0	5.5	20.5
1939–1940	3.2	12.6	5.7	21.5
1940–1941	3.3	13.1	6.3	22.7
1941–1942	2.9	12.8	6.5	22.2
1942–1943	2.7	12.1	7.0	21.8

Distribution by Cooperatives

Doctor J. G. Knapp reports in a Farm Credit Administration bulletin published in May 1945 that farmer cooperatives distributed 9 per cent of the national fertilizer tonnage, varying from 5 per cent in the Southeast to 20 per cent in the Northeast (Table 9). The only significant trend shown in that publication in the cooperatives' ratio of major nutrients is upward in potash ending with approximately a 3-12-7 in 1943 as compared to other distribution averaging close to 4-10-6. You will note that in concentration the cooperatives exceed other channels of distribution by a contrast of 22 units to 20.

Trends by Crops

Cotton which in 1929 received 28 per cent of the fertilizer used in the United States had decreased to 15 per cent by 1942 and yielded first place to corn which increased during the same period from 21 to 22 per cent.

TABLE 9.—PLANT-FOOD CONTENT OF COOPERATIVE AND OTHER FERTILIZER COMPARED—1942-1943.

Nutrients	Per Cent	
	Cooperatives	Others
Nitrogen	2.7	4.22
Phosphoric Acid	12.1	9.96
Potash	7.0	6.06
Total	21.8	20.24

Hay and pasture increased from 6 to 13 per cent of the total from 1938 to 1942, and was only 2 per cent in 1929. The increases in fertilizer use on fruits, vegetables, and small grains are well worth the attention of both agronomists and the industry.

Trends in Secondary and Minor Nutrients

Certainly calcium and magnesium, and occasionally sulphur, become limiting factors in nutrient needs under some conditions, in addition to their roles in affecting the acidity of soils. Increased liming is improving the calcium status of soils. Wider use of dolomite (magnesian limestone) is helping the magnesium needs, together with other more active magnesium carriers in some mixed fertilizers. Most fertilizer mixtures contain enough sulphur to remove that element from the troublesome class.

TABLE 10.—FERTILIZER USED ON PRINCIPAL CROPS 1929, 1938 AND 1942[1]

Crop	Per Cent of Total Consumption		
	1929	1938	1942
Corn	20.7	21.6	22.0
Cotton	28.0	19.3	14.6
Small Grains	13.8	14.3	14.1
Vegetables	5.3	4.3	8.9
Potatoes	8.5	7.4	7.1
Hay	2.1	4.1	7.1
Pasture	(2)	2.1	5.8
Fruits	4.3	4.5	6.7
Tobacco	6.8	6.7	5.3
Sweet Potatoes	1.4	1.8	1.5
Other Crops	9.1	13.9	6.9
Total	100.0	100.0	100.0

[1] From the Fertilizer Review, July-September 1943.
[2] No estimate, very low.

Boron deficiency on some soils and for certain vegetable crops as well as for some legumes is increasingly recognized as a limiting factor by its in-

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More birds and better hunting are the tests of game-food planting. Bicolor has demonstrated its value before the dog and gun.

For Farms and Game Preserves, Bicolor Lespedeza

By Verne E. Davison

Southeastern Regional Biologist, Department of Agriculture Soil Conservation Service, Spartanburg, South Carolina

BICOLOR lespedeza has earned a place in the management of land in the Southeast. The seeds are taken readily by bobwhites, the bark and leaves are eaten extensively by rabbits, and the flowers are attractive to honeybees. Bicolor is a dependable plant which will live many years without replanting. At least one plot in the South is more than 50 years old. It withstands burning, disking, cutting, or rabbit use in winter; and it will control erosion on the sites we recommend. You will like its attractive appearance, too.

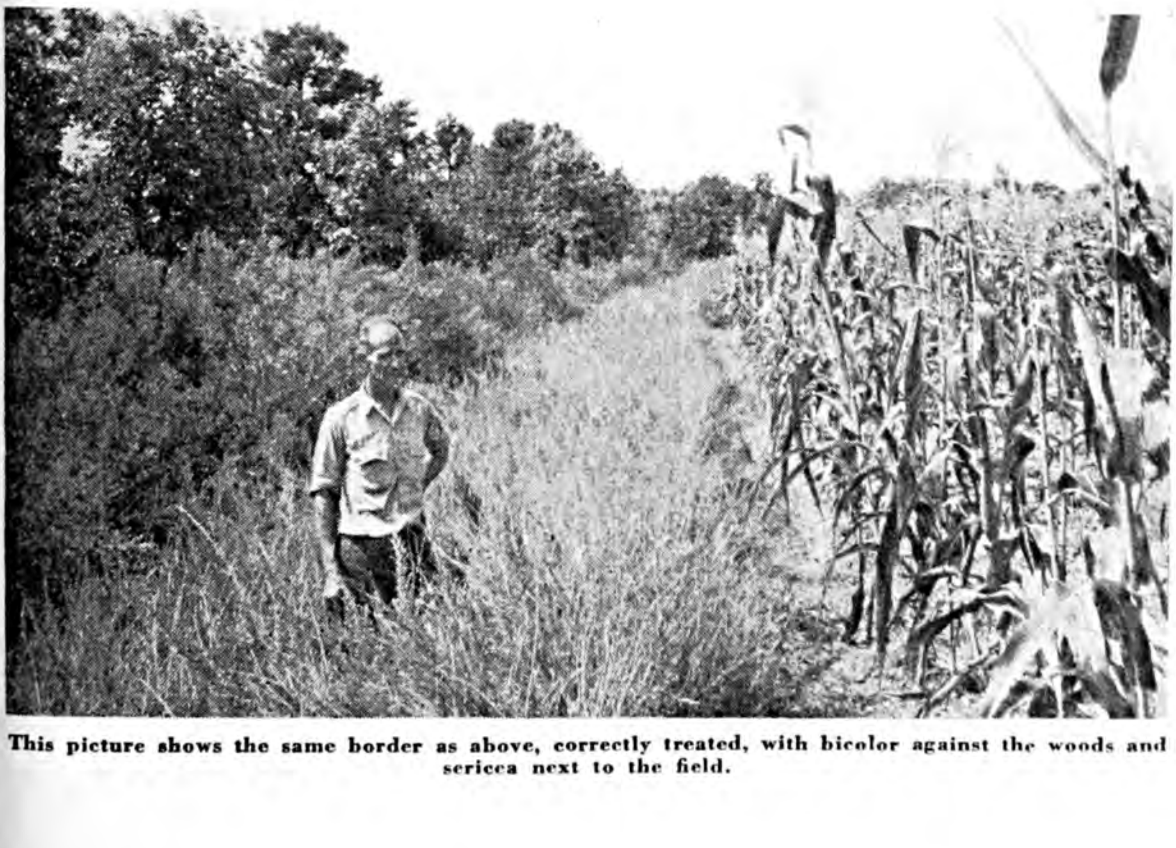
Bicolor is a shrub that grows 5 to 10 feet high. It is a perennial plant which leafs out each spring as do other woody shrubs. Like the other lespedezas it is a legume. Bicolor and other similar shrub lespedezas were introduced from Asia as ornamentals under names such as Oriental lespedeza and flowering desmodium. Several have more showy flowers but grow less seed than bicolor.

The plants of common bicolor are hardy as far north as central New England, but they fail to ripen seed if frost comes before October 15. This happens too often north of Tennessee and central Virginia. Bicolor has been but partially successful in Florida. Strains, however, have been selected to get a plant better adapted to various conditions. The best are being tested throughout the natural range of the bobwhite quail. Thus bicolor may become more successful north of the Ohio River, and in Florida.

The wildlife border is a symbol of better land use. Above, the abandoned border—useless—troublesome—wasted.

By observation and food studies we now know that bicolor is a preferred food of quail. They eat the seeds in preference to their usual favorites—annual lespedezas, cowpeas, partridge peas, and acorns. The bobwhites begin feeding on bicolor in early fall, before the hunting season. They feed every evening and often at other times of day. One will find the birds using this good food until they change to insects and fresh fruits of early summer.

In feeding tests of pen-reared pheasants in Pennsylvania, bicolor proved to be an excellent food. Doves eat the seed in February and March, although



This picture shows the same border as above, correctly treated, with bicolor against the woods and sericea next to the field.

they seem to prefer other foods when they can get them. Few if any other birds eat bicolor seed. This is fortunate for game conservation, as it leaves the seed for the bobwhites.

Bicolor must be put where it won't be grazed. Heavy concentrations of deer destroy it. Cattle, too, will graze the plant to death.

The Soil Conservation Service began to use shrub lespedezas for wildlife and erosion control in 1935. Besides bicolor, we used *Lespedeza cyrtobotrya* and *Lespedeza thumbergii,* but bicolor was most successful. We used it first in gullies, then on borders between woods and cropland. Food strips in woodland and hedges across fields came later.

Sources of Plants and Seeds

Both plants and seed are already available in limited amounts from three principal sources.

The nurseries of the Soil Conservation Service grow and supply plants and seeds for farmers in cooperation with soil conservation districts. Common bicolor makes up most of this supply, but better strains are available for field tests in certain districts.

Some state game departments purchase or grow common bicolor seed which they distribute to farmers in soil conservation districts—or in some cases to 4-H clubs and others. The Fish and Wildlife Service often makes federal-aid funds available to assist these projects.

A few private seed growers and nurserymen are producing seed and plants of common bicolor commercially. This will be the regular source as soon as the Soil Conservation Service and state game departments have plenty of demonstrations where game can be studied carefully. Better strains will be grown commercially as soon as possible.

The following explains how and where bicolor should be used on farms or game preserves.

Patterns and Objectives

Game management requires a dependable supply of the best foods. Enough cover must be nearby. Quail eat many kinds of seeds, so many, in fact, one need not expect to know them all. Fortunately they do not need all the kinds they will eat. An adequate amount of one good food is enough to grow. They will not be denied a variety, for insects, green leaves, and other

Strips of one-eighth-acre in woodland use no more than one per cent of the land.

A bicolor hedge across the open field provides hunting where birds had no food or cover before.

incidental foods will supplement the food strips.

Every acre of land has some kind of plant which can be recognized as quail food. Often, however, it is not in sufficient quantity to be useful. Fifty pounds of seed scattered over 10 acres are useless. An equal amount on one-eighth acre sets a good table for the birds. Bicolor, therefore, can be used in standard patterns of land management without regard for the absence or presence of other foods.

What constitutes enough cover is not definitely known. Briars, plum thickets, and honeysuckle give very good cover. Woodland is good only if it has shrubs and grass in clumps or open areas. Broomsedge and other grasses may be sufficient with bicolor and nothing else. Thus bicolor may be grown in woods, on borders, across broomsedge fields, or near vegetated stream banks without adding extra cover. We are not yet sure what cover, if any, must be added with bicolor hedges across cultivated fields.

The pattern of planting is very important. The best economy is to use land that is not needed for other purposes. Or if it is necessary to use good land for game, grow a lot of food on a little land. This may take 1% of woodland, 2% of the farm as borders, and 3% of cultivated land in hedges. The remaining 99, 98, and 97% of the land should be used for woodland, pasture, and field crops.

When we try to guarantee enough food for our birds by managing only 1% to 3% of our land, we must manage those small bits of land well. As much food as possible should be produced, on the wildlife land. Good care is worthwhile. Prepare the land well, plant carefully, fertilize to promote excellent growth, and cultivate when necessary to keep the bicolor free of weeds, grass, and trees. This will not be every year—only when other plants begin to invade.

A vigorous growth of bicolor, once started, usually will shade out all other vegetation between the rows. The seed falls only among its own leaves where the birds find it quickly by scratching. Seed that falls in heavy grass is largely lost.

Bicolor can be established with one-year nursery grown plants or by planting seed. Plants are more expensive than seed. Yet plants cost less than ordinary food patches of cowpeas, millets, and other annuals. The same strip does not have to be planted again next year. Nor is there the risk next spring of the weather being either too wet or too dry at planting time. So regardless of the way the strips are established, bicolor is economical and dependable as a food for bobwhites, rabbits, and bees.

Each food strip will require about 1,000 plants or one pound of seed. When begun with seed, the strip should not be expected to mature seed the first year. Plants, however, produce a good seed crop the first year. If the seed is planted in rows, cultivated, and fertilized well, there should be a good crop of seed the second year. If the seed is broadcast, cultivation is impossible, and such plantings often take three years to mature.

Research stations have not studied the fertilizer requirements of bicolor. Until studies have been made, we can only recommend what appears to be best. Phosphate and potash are needed, as with other legumes. Many farmers use whatever complete fertilizer they have on hand. Potash appears particularly helpful. We notice wherever brush was burned before planting, bicolor always has done well. This new quail-food plant will not need fertilizer every year—only when growth lacks vigor. Therefore, a good fertilizer applied at a rate of 400 to 800 pounds per acre can be afforded.

Bicolor will not grow well on wet land. A soil conservationist can be of help. He knows soils. He knows how and where to use bicolor. If bobwhite food must be grown on wet land, sesbania is used. Bicolor, however, will pull swamp coveys to upland food strips. In deep sands, plants are more successful than seed.

The width of a good bicolor strip is important. Less than 12 or 15 feet in width is too narrow. More than 20 feet is too wide, as wider plantings make bird-dog work disappointing. A width of 15 to 18 feet is best, hunting is pleasant, dogs work beautifully, and birds have enough food.

Food Strips in Woodland

Food strips in woodland will attract the coveys as soon as the seed is produced. We are not sure yet how many strips to grow on 100 acres of land. One for each 20 or 25 acres is conservative. Perhaps one for each 10-acre tract is none too many. We need not think of more than this until further results are measured in terms of quail per strip.

We do not know, yet, how short or long a strip should be in woodland. A length of 400 feet is good. Perhaps 300 is enough. We have found two and three coveys on longer strips, but there the dogs often range too far ahead of the hunter. Furthermore, long strips either take up too much land or leave too much space between strips. So 15-foot plantings 400 feet long appear, now, to be a safe design. This will be about one-eighth acre and should produce 25 to 50 pounds of seed per strip.

To plant this standard strip 1,000 plants or one pound of seed should be used. Plant or seed in five rows, three feet apart. Space plants two feet apart in the row. This takes 200 plants per row. Seeding will be at the rate of 40 or 50 seeds per foot of row. Cover seed one-half inch. Plant when ground moisture is good, any time after spring frost. Or the seed may be broadcast. If the seed is broadcast, it should be rolled into a firm seedbed. A cultipacker is best.

The outside rows (in 5-row plantings) will be 12 feet apart. Prepare the bed six feet wider and cultivate outside as well as between the rows. Seed may be placed in rows 24 inches apart, if preferred; this will require seven rows instead of five. If rows are more than three feet apart, sunlight will make grass and weeds grow too much.

This same design should be used in old fields of broomsedge or brush. If the woods or broomsedge is burned,

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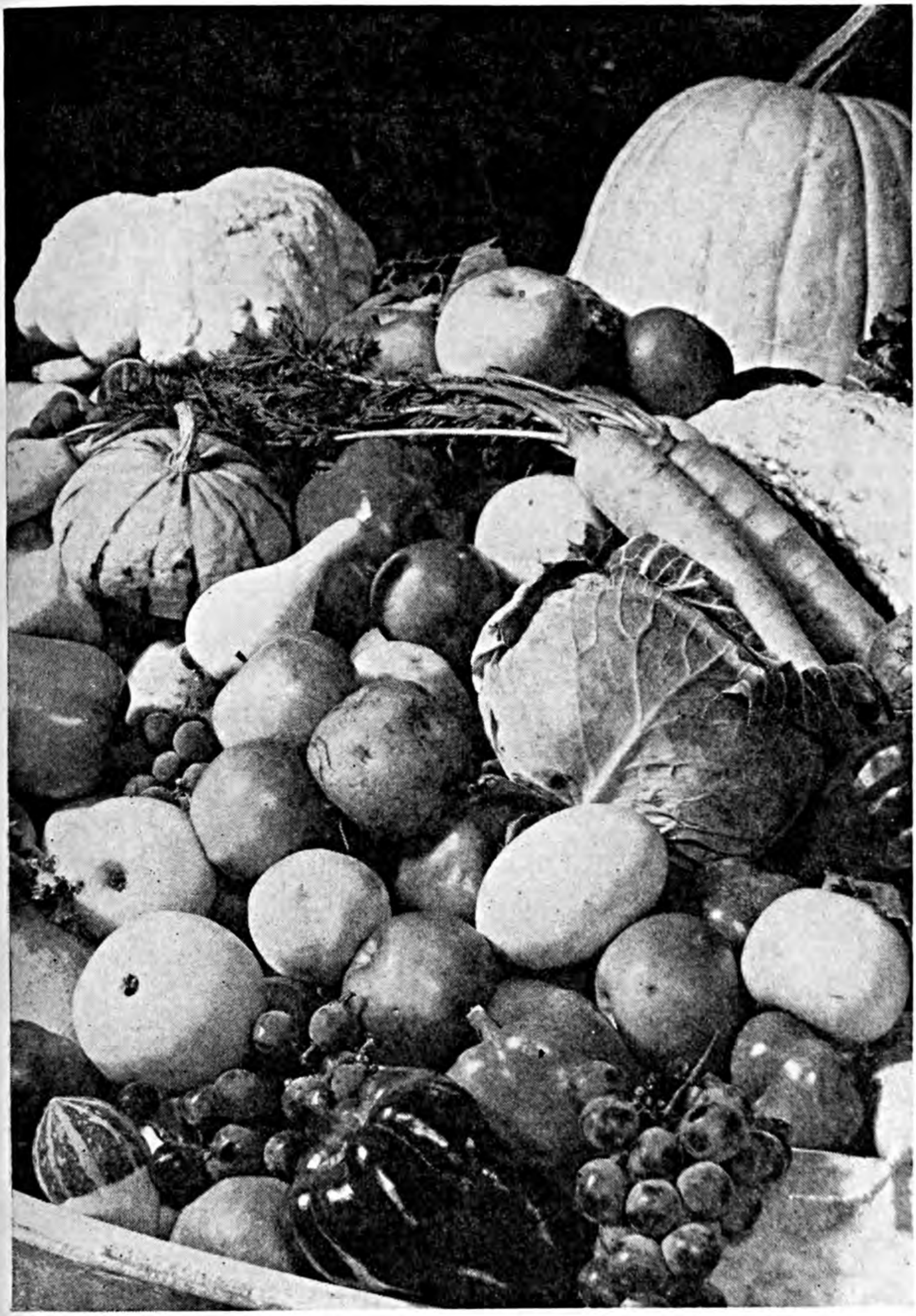
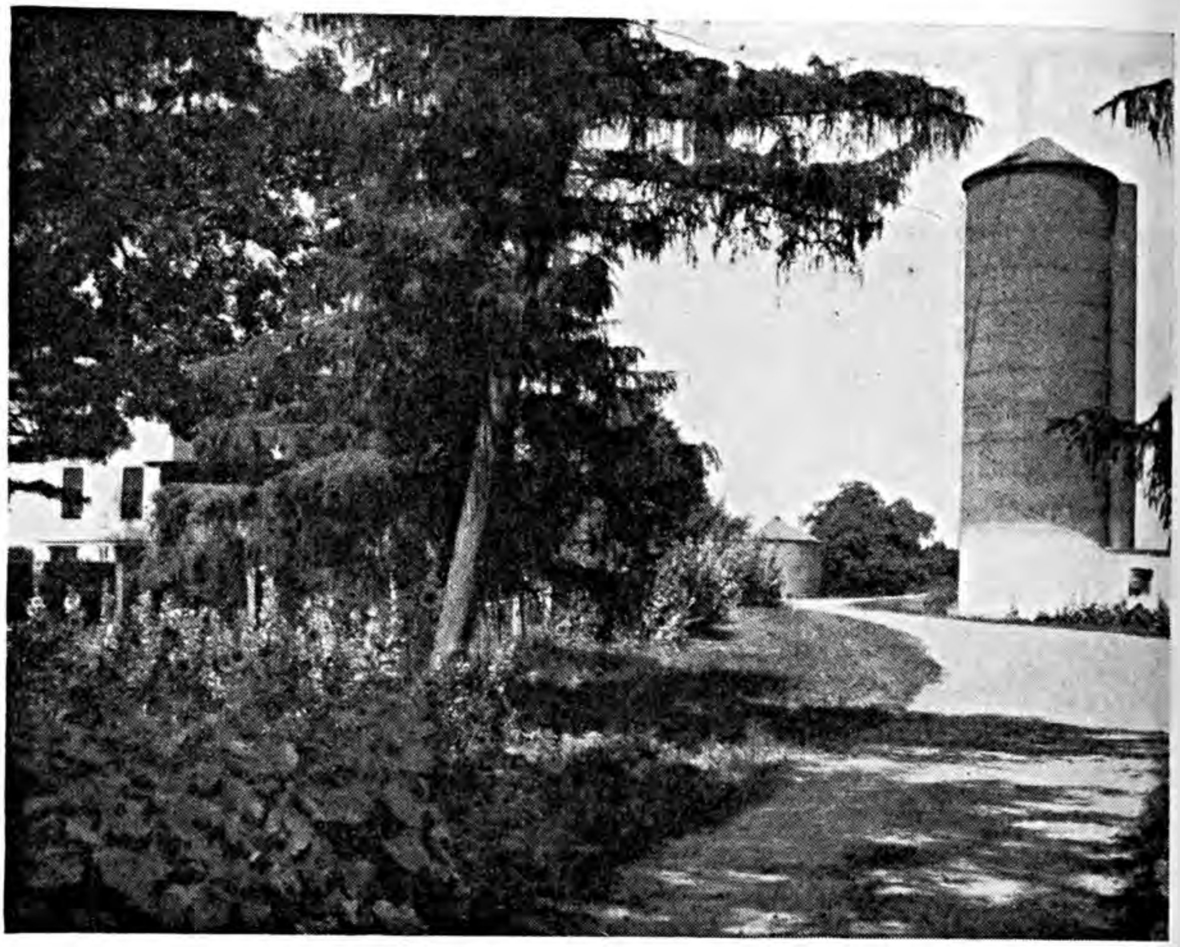
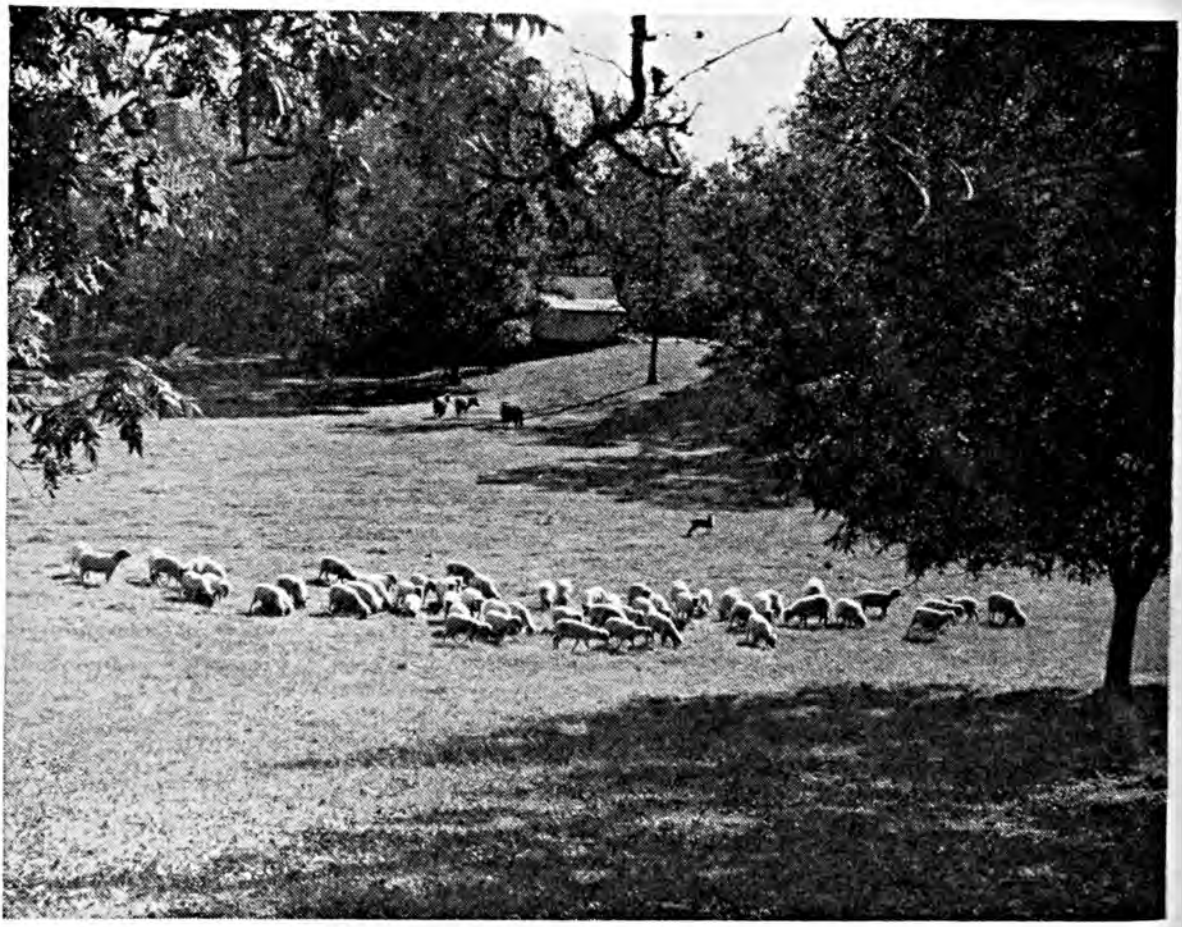
PICTORIAL



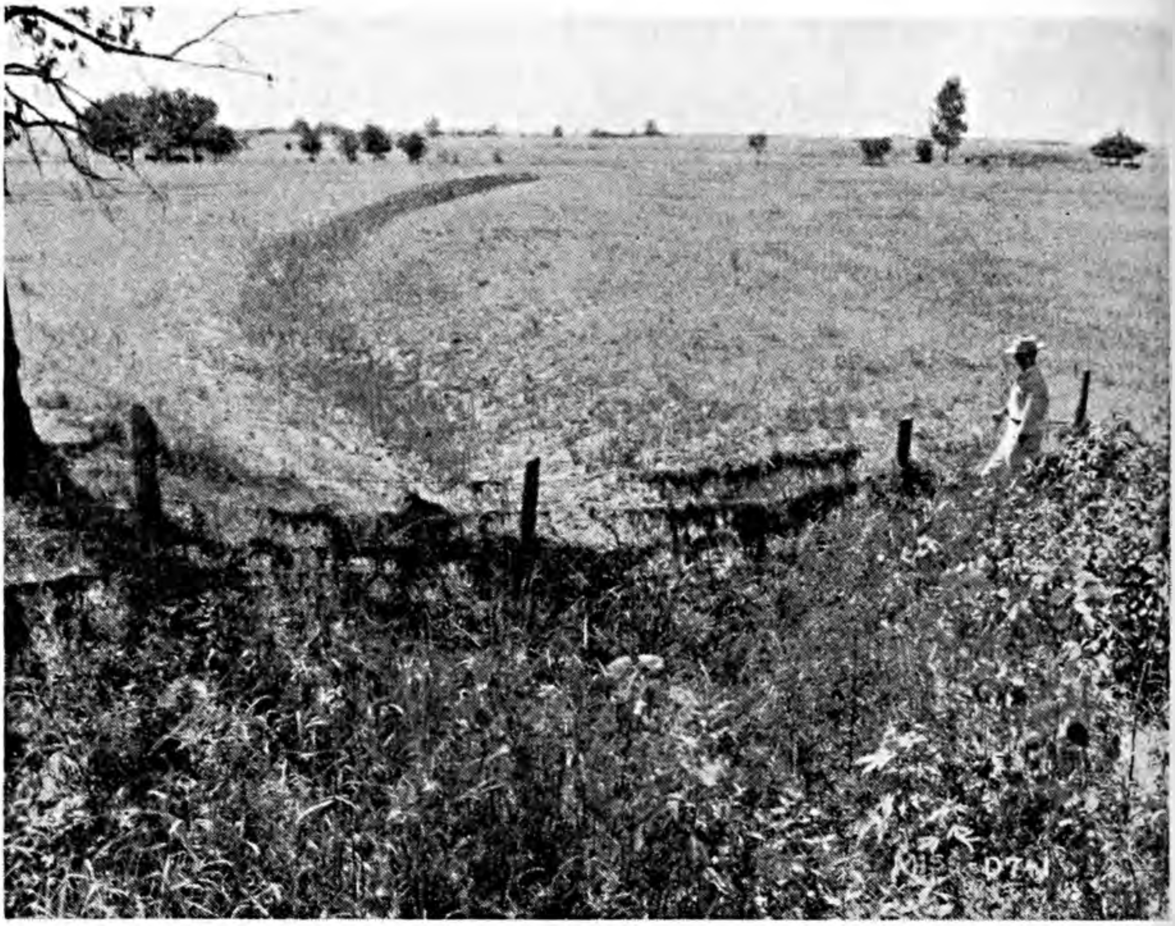
An early autumn "still life."



Summer



Landscapes



Above: This ditch or channel drains approximately 800 acres of pasture and crop land near Canton, Mississippi.

Below: Baling kudzu hay, principal winter feed for dairy cows, on the farm of A. D. Wright, Gainesville, Georgia.

The Editors Talk

Agricultural Conservation 1947

Early announcement of the agricultural Conservation Program for 1947 by the U. S. Department of Agriculture is in line with the efforts being made to put the industry on a peacetime basis as quickly as possible. A greater emphasis on the local approach should help farmers make some needed shifts from practices which were necessary for quick wartime production to those of greater long-term, soil-building value.

For the first time, the program for 1947 allows up to 10 per cent of county conservation funds to carry out a practice not included in the list approved for states. The balance of county funds, as before, will be used to carry out practices selected by farmers and committeemen from a long and flexible list. Such lists are worked out in each state by state farmer-committees and technical experts.

Director Dave Davidson of the Field Service Branch, Production and Marketing Administration, believes that the success of the program depends upon farmers and their committeemen who together work out plans for individual farms. He points out that all County Agricultural Conservation Program (AAA) committeemen are active farmers, elected by farmers in local balloting.

"We had to greatly increase the acreage of some soil-depleting crops during the war," Mr. Davidson states. "We cannot continue to grow them on such a scale indefinitely without permanently damaging our land. Record production one year, or for a few years, doesn't necessarily mean record production over the long haul. Our goal is continuing high production year after year. Conservation farming is the only way to achieve such a goal."

In general, the 1947 program is divided into these major types of practices: (1) Application of lime, fertilizers and other materials; (2) planting of cover crops; (3) harvesting of certain legumes and grass seeds; (4) erosion control and water conservation; (5) range and pasture improvement; (6) forestry; and (7) other practices such as weed control and clearance of land for plowing or pasture.

Special emphasis in 1947 will be placed on measures to prevent soil erosion and to conserve water. Such measures include planting of row crops on the contour, building of terraces, erosion control dams, livestock water ponds and similar practices. Use of lime and fertilizers on legumes and grasses will continue to be a major part of the program.

Director Davidson declares that application of these soil-enriching minerals reveals in a dramatic way the immeasurable value of conservation to both city people and those on farms. "Lime and fertilizers improve the health and vigor of legumes and grasses, greatly increasing production and quality," he says. "This means more and better livestock and gives us what we are finally seeking—more and better food to improve the health of our people and those of other lands who need our food and fiber."

New Problems for the Crop Breeder

With the growing of so-called pure line seeds in widely scattered geographical sites, it is becoming apparent that they are not as pure as at first indicated. For example, corn pure lines developed in the Midwest frequently react quite differently when grown in other sections where climatic and soil fertility conditions are different. There is every reason to believe that similar results would occur with the pure lines of other crops.

This opens up new problems for the crop breeder since inbred lines in a territory apparently will have to be developed for the area if the maximum benefits of hybridization are to be achieved.

The susceptibility of plants to disease, the feeding power of plants, their metabolic efficiency, and their ability to produce high-quality forage or feed are all factors which apparently can be materially influenced by the geneticist. Modern crop breeding thus requires the services of the geneticist, the pathologist, entomologist, plant physiologist, soil scientist, chemist, nutrition expert, and almost every other scientist working on the problems of agriculture and even human nutrition. Since obviously no one scientist can be an expert in all these fields, the problem only can be handled by specialists cooperating in well-rounded and interrelated projects.

New possibilities in the production of food, fiber, and forage not only from the viewpoint of quantity but of quality are opened by this work. More efficient utilization of our soil resources and of fertilizers is made possible. This will coordinate well with the greatly increasing interest in growing more nutrition into foods. It will lead to better living and higher standards of living for all the peoples of the world.

The Fairs Are Back

One of the heartiest expressions of relief from wartime restrictions is the welcome being given to return of our agricultural state fairs. Not all states hold one, and a few struggled along with "sorry" editions even under wartime conditions, but this fall will see many splendid revivals—"the greatest and best" from all angles.

It is a fine and worthwhile return, for the state fair is an old and almost typically American institution. Fairs antedate the Christian era, but these were chiefly commercial gatherings for the exchange of merchandise. American fairs have served primarily the function of agricultural education. They have been the show-cases of and inspiration for greater standards of excellence in crop and livestock production as well as all phases of industry and social activity affecting our agriculture. Millions of dollars have been expended on grounds and buildings and millions each year are distributed in prizes to those who have striven and won in the ability to produce more than the "ordinary." According to Dave Thompson of Grocery Manufacturers of America, who has made a survey of state fairs, the Minnesota fair is a good example of the large investment necessary to make these annual shows of the people a success. The operating society, Minnesota State Agricultural Society, has real estate valued at $4,889,845 and total assets, including accounts receivable, of more than $5,600,000.

The age of some of our state fairs attest their importance to both our agricultural and urban societies. Among those which this year will be more than 90 years old are Michigan, Ohio, Illinois, Iowa, California, North Carolina, and Minnesota. Let us hope they can continue uninterrupted for another ninety.

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	87.8	64.2	88.4	11.87	22.55	....
1920	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
August	21.33	44.9	167.0	256.0	113.0	145.0	14.60	52.50	....
September	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
May	24.09	43.0	157.0	251.0	135.0	170.0	14.80	49.60	....
June	25.98	59.0	147.0	251.0	142.0	174.0	14.70	51.50	....
July	30.83	56.7	148.0	275.0	196.0	187.0	15.00	60.00	....
Index Numbers (Aug. 1909—July 1914=100)									
1920	128	173	180	161	96	207	139	114	....
1921	137	195	163	129	81	117	98	129	....
1922	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
August	172	449	240	292	176	164	123	233	240
September	175	432	198	236	174	164	120	228	159
October	180	459	181	205	176	171	120	226	181
November	182	467	188	212	173	173	126	227	235
December	184	438	197	221	170	174	130	228	223
1946									
January	180	363	208	237	171	174	132	226	249
February	186	339	209	254	173	175	133	223	275
March	183	319	225	269	178	179	137	211	283
April	190	429	232	279	181	179	126	213	282
May	194	430	225	286	210	192	125	220	177
June	210	590	211	286	221	197	124	228	185
July	249	567	212	313	305	212	126	266	163

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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
1922	3.04	2.58	6.07	4.66	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.59	5.16
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						
August	1.75	1.42	7.81	5.77	4.86	6.71
September	1.75	1.42	7.81	5.77	4.86	6.71
October	1.75	1.42	7.81	5.77	4.86	6.71
November	1.75	1.42	7.81	5.77	4.86	6.71
December	1.75	1.42	7.81	5.77	4.86	6.71
1946						
January	1.75	1.42	7.81	5.77	4.86	6.71
February	1.75	1.42	7.81	5.77	4.86	6.71
March	1.75	1.42	7.81	5.77	4.86	6.71
April	1.75	1.42	7.81	5.77	4.86	6.71
May	1.75	1.42	9.08	6.10	4.86	7.30
June	1.88	1.42	10.34	6.42	4.86	7.90
July	1.88	1.42	11.62	8.15	5.34	9.60

Index Numbers (1910-14=100)

1922	113	90	173	132	140	142
1923	112	102	177	137	136	147
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						
August	65	50	223	163	144	191
September	65	50	223	163	144	191
October	65	50	223	163	144	191
November	65	50	223	163	144	191
December	65	50	223	163	144	191
1946						
January	65	50	223	163	144	191
February	65	50	223	163	144	191
March	65	50	223	163	144	191
April	65	50	223	163	144	191
May	65	50	259	173	144	207
June	70	50	295	182	144	224
July	70	50	332	231	158	273

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	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
1922	.566	3.12	6.90	.632	.904	23.87	....
1923	.550	3.08	7.50	.588	.836	23.32	....
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
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	.570
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							
August	.650	2.20	6.20	.503	.749	24.44	.188
September	.650	2.20	6.20	.503	.749	24.44	.188
October	.650	2.20	6.28	.535	.797	26.00	.200
November	.650	2.20	6.40	.535	.797	26.00	.200
December	.650	2.20	6.40	.535	.797	26.00	.200
1946							
January	.650	2.20	6.40	.535	.797	26.00	.200
February	.650	2.20	6.40	.535	.797	26.00	.200
March	.650	2.20	6.40	.535	.797	26.00	.200
April	.650	2.20	6.40	.535	.797	26.00	.200
May	.650	2.20	6.40	.535	.797	26.00	.200
June	.650	2.30	6.45	.471	.729	22.88	.176
July	.650	2.60	6.60	.471	.729	22.88	.176

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
1922	106	87	141	89	95	99	....
1923	103	85	154	82	88	96	....
1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
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							
August	121	61	127	70	79	101	82
September	121	61	127	70	79	101	82
October	121	61	129	75	84	108	83
November	121	61	131	75	84	108	83
December	121	61	131	75	84	108	83
1946							
January	121	61	131	75	84	108	83
February	121	61	131	75	84	108	83
March	121	61	131	75	84	108	83
April	121	61	131	75	84	108	83
May	121	61	131	75	84	108	83
June	121	64	132	66	76	95	80
July	121	72	135	66	76	95	80

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**
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
August	204	180	154	96	57	175	121	74
September	197	181	153	96	57	175	121	74
October	199	182	154	97	57	175	121	78
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	156	97	57	175	121	78
February	207	185	156	97	57	175	121	78
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78
May	211	192	162	99	57	189	121	76
June	218	196	163	100	60	203	121	70
July	244	209	176	103	60	230	121	70

* 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] Since June 1941, manure salts are quoted F.O.B. mines exclusively.

**** The weighted average of prices actually paid for potash are 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.

Fertilizer

"Fertilizer and Fertilizer Material," Ala. Dept. of Agr. & Ind., Montgomery, Ala., Bul. 47, 1944-45.

"Further Studies on the Response of Lettuce to Fertilization," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 199, Oct. 1945, A. E. Griffiths and A. H. Finch.

"Commercial Fertilizers and Agricultural Minerals 1945," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., Sp. Publ. 214.

"Commercial Fertilizer Sales as Reported to Date for Quarter Ended March 31, 1946," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., FM-127, May 24, 1946.

"Recommendations for Soil Management and Use of Fertilizers," Ont. Dept. of Agr., Statistics & Publication Branch, Toronto, Ont., 1946.

"Commercial Fertilizers Report for 1945," Agr. Exp. Sta., New Haven, Conn., Bul. 492, Oct. 1945, E. M. Bailey.

State Laboratory—Fertilizer, Seed, Lime, and Ice Cream Report," Vol . 35, No. 4, State Board of Agr., Dover, Del.

"Commercial Fertilizers," Dept. of Agr., Atlanta, Ga., Bul. 130, Jan. 1946.

"Fertilizer Tonnage by Grades Used in Each County in the State During Calendar Year 1945," Ga. Dept. of Agr., Atlanta, Ga.

"Fertilizers Used in Iowa in 1945," Dept. of Agron., Iowa State College, Ames, Iowa, Agron. 47, 1946.

"Fertilizer Trials on Sandy Soils of Chisago and Isanti Counties in 1945," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., S.S. 17, April 1946, J. M. MacGregor.

"Commercial Fertilizers, 16th Annual Report," N. M. Feed & Fert. Control Office, State College, N. M., March 1, 1946, R. W. Ludwick and L. T. Elliott.

"Corn Fertilization Studies in 1945," Agr. Exp. Sta., State College of A. & E., Raleigh, N. C., Agron. Inf. Cir. 142, March 1946, B. A. Krantz.

"Fertilizer Law," Dept. of Agr. & Immigration, Richmond, Va.

Soils

"Gypsum, A Soil Corrective and Soil Builder," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 200, Dec. 1945, W. T. McGeorge.

"Sulphur, A Soil Corrective and Soil Builder," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 201 Dec. 1945, W. T. McGeorge.

"Shall We Fall-plow or Spring-plow in Northeastern Illinois?" Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 604, June 1946, R. S. Smith.

"Key and Description of Some Major Upland Soil Types of Iowa," Soils Subsection, Iowa Agr. Exp. Sta., Ames, Iowa, Agron. 49, May 1946.

"Ground Treatments as an Aid in Apple Scab Control," N. Y. State Agr. Exp. Sta., Geneva, N. Y., Bul. 714, March 1946, D. H. Palmiter.

"Oklahoma Crops and Soils, 1946," Agr. Exp. Sta., Stillwater, Okla., Bul. B-295, April 1946, Vernon J. Palmer.

"Economic Land Classification of Fluvanna County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 371, July 1945, G. W. Patteson and Farrar V. Shelton.

"Economic Land Classification of Greene County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 372, July 1945, G. W. Patteson and Farrar V. Shelton.

"Soil Survey—The Salt Lake Area Utah," U.S.D.A., Washington, D. C., Series 1936, No. 22, March 1946, D. S. Jennings, J. E. Fletcher, M. H. Wallace, Lemoyne Wilson, I. D. Zobell, F. O. Youngs, and O. F. Bartholomew.

"Soil Survey—Martin County Indiana," U.S.D.A., Washington, D. C., Series 1936, No. 23, March 1946, H. P. Ulrich, T. E. Barnes, Sutton Myers, R. G. Leighty, and A. T. Wiancko.

"Our American Land, The Story of Its Abuse and Its Conservation," U.S.D.A., S.C.S., Washington, D. C., Mis. Publ. 596, 1946, Hugh H. Bennett.

Crops

"Christmas Tree Production," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., Cir. 92, Nov. 1945, J. C. Moore.

"The Climate of Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 197, July 1945, H. V. Smith.

"Walnut Production in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 364, Nov. 1945, L. D. Batchelor, O. L. Braucher, and E. F. Serr.

"Fruit Maturity and Quality," Ont. Dept. of Agr., Statistics & Publications Branch, Toronto, Ont., Can., Bul. 447, March 1946, W. H. Upshall.

"Fifty-eighth Annual Report," Agr. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., 1944-45.

"Tobacco Substation at Windsor," Agr. Exp. Sta., New Haven, Conn., Bul. 493, Feb. 1946, P. J. Anderson and T. R. Swanback.

"Hairy Indigo, A Legume for Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., P. Bul. 624, June 1946, Geo. E. Ritchey.

"1945 Report Florida Agricultural Extension Service," Coop. Ext. Work in Agr., Univ. of Fla., Gainesville, Fla., June, 1945.

"Fruits of Hawaii," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, Bul. 96, Oct. 1945.

"The Lamida, Ebony and Spalding Sweet Cherries," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 109, Feb. 1946, Leif Verner.

"Hybrid Popcorn in Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 510, 1946, Glenn M. Smith and Arthur M. Brunson.

"Alfalfa in Kansas," Agr. Exp. Sta., Kansas State College of Agr., Manhattan, Kansas, Bul. 328, Sept. 1945, C. O. Grandfield and R. I. Throckmorton.

"Louisiana's Program for Peach Production," La. State Univ., Div. of Agr. Ext., Baton Rouge, La., Cir. 259, Jan. 1946.

"Making the Home Lawn," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 130, April 1946.

"Potato Breeding Methods," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., T. Bul. 173, Feb. 1946, F. A. Krantz.

"The 4-H Home Garden," Ext. Serv., Miss. State College, State College, Miss., Bul. 130 (Reprint –30M), June 1945, R. O. Monosmith.

"Fall Gardening," Ext. Serv., Miss. State College, State College, Miss., Cir. 132, Aug. 1945, K. H. Buckley.

"Investigations for the Benefit of the Missouri Farmer," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 491, Aug. 1945, M. F. Miller, S. B. Shirky, and H. J. L'Hote.

"Cherry and Plum Culture in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir 307, Feb. 1946, T. J. Talbert.

"Author and Subject Index of Department of Agriculture Publications," Dept. of Agr., Trenton, N. J., Cir. 359, April 1946.

"Spinach for Marketing and Processing," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 694, March 1946, C. B. Raymond.

"The Vegetable Garden," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 696, March 1946, Arthur J. Pratt, R. W. Leiby, Charles Chupp, and R. D. Sweet.

"Color Standards for McIntosh Apple Leaves," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 824, June 1946, O. C. Compton, W. C. Granville, D. Boynton, and E. S. Phillips.

"Farm Science and Practice," Agr. Exp. Sta., Wooster, Ohio, Bul. 659, June 1945.

"Winter Wheat Varieties for Oklahoma," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. 297, May 1946, A. M. Schlehuber, V. C. Hubbard, W. M. Osborn, C. B. Cross, and R. M. Oswalt.

"Oklahoma Cotton Variety Tests for 1944 and 1945," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-157, March 1946, H. E. Dunlavy, I. M. Parrott, F. W. Self, and Merrill Gover.

"The Oklahoma Farm Wheat Improvement Program: Progress Report, 1938-1945," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mis. Publ. MP-9, May 1946, Roy M. Oswalt.

"Christmas Tree Farming in Pennsylvania," Agr. Ext. Serv., Pa. State College, State College, Pa., Cir. 284, Dec. 1945, F. T. Murphey.

Pa. Sta. Journal Series Papers 1317, "Turnip Variety & Strain Trials—1945"; 1314, "Celery Variety & Strain Trials—1945"; 1311, "Carrot Variety & Strain Trials—1945"; 1310, "Cabbage Variety & Strain Trials—1945"; 1304, "Lima Bean Variety & Strain Trials—1945"; 1309, "Pepper Variety & Strain Trials—1945"; 1305, "Sweet Corn Variety & Strain Trials—1945"; Agr. Exp. Sta., Pa. State College, State College, Pa., M. L. Odland.

"Agricultural Research in Texas," Agr. Exp. Sta., A. & M. College of Texas, State College, Texas, June 1, 1946.

"Suggestions for Growing Cantaloupes in the Texas Winter Garden," Agr. Exp. Sta., A. & M. College of Texas, College Station, Texas, P.R. 988, Feb. 11, 1946, E. Mortensen.

"Vahart Wheat, a New Variety for Virginia," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 386, Jan. 1946, T. M. Starling, S. A. Wingard, and M. H. McVickar.

"Judging Mountain Meadow Range Condition in Eastern Oregon and Eastern Washington," U.S.D.A., Washington, D. C., Cir. 748, April 1946, Elbert H. Reid and G. D. Pickford.

Economics

"Suggested Agricultural Production for Delaware 1946," Agr. Exp. Sta., Univ. of Del., Newark, Del., Pamph. 20, July 1945, R. O. Bausman.

"Cash Farm Income by Counties and by Commodities, Delaware 1941, 1942, 1943, and 1944," Agr. Exp. Sta., Univ. of Del., Newark, Del., Pamph. 22, Dec. 1945, R. O. Bausman.

"Indiana Crops and Livestock, Annual Crop Summary 1945," Dept. of Agr. Statistics, West Lafayette, Ind., Dec. 1945.

"Pre-Harvest Sampling of Soybeans for Yield and Quality," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Res. Bul. 41, Jan. 1946.

"Nebraska Looks Ahead," Agr. Exp. Sta., Univ. of Nebraska College of Agr., Lincoln, Neb., Bul. 380, Dec. 1945.

"The Cultivated Blueberry Industry in New Jersey, 1944," Dept. of Agr., Trenton, N. J., Cir. 356, June 1945, D. T. Pitt.

"Facts and Figures, Annual Potato Summary, Crop of 1945," Dept. of Agr., Trenton, N. J., Cir. 358, March 1946, Alavah W. Severson.

"A Credit Study on 167 Tobacco Farms Puerto Rico, 1939-40," Agr. Exp. Sta., Univ. of P. R., Rio Piedras, P. R., Bul. 69, March 1946, Julio O. Morales and Sol L. Descartes.

"Some Price Factors Affecting Farm Adjustment in Cotton Counties of Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., R. Res. Ser. Mon. 195, Feb. 15, 1946, B. H. Luebke.

"Hay Harvesting," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 531, June 1946, Robert M. Carter.

"Steps Toward Farm Ownership," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 368, March 1946, P. E. McNall.

"Commodity Futures Statistics," U.S.D.A., Washington, D. C., CS-17, April 1946.

"Fruits (13 Noncitrus), Production and Utilization 1934-45," U.S.D.A., Washington, D. C., June 1946.

"The Changing Picture in Agricultural Finance," Farm Credit Adm., U.S.D.A., Washington, D. C., Cir. A-24, March 1946, I. W. Duggan.

"The Status of Cooperatives in Fruit and Vegetable Canning 1943 and 1944," Farm Credit Adm., U.S.D.A., Washington, D. C., Mis. Rept. 97, April 1946, G. M. Weber.

Trends in Use of Major Plant Foods

(*From page* 21)

clusion in mixtures for specific purposes. Two schools of thought seem to have developed in its use. One follows the practice of including borax in small amounts in all mixtures. The other uses borax in larger amounts in mixtures for specific purposes only. I prefer the latter practice both because of the toxic properties of borax if used carelessly and because I am as yet not convinced that we are justified in curing our nutrient ills by a gun-shot prescription, although I prefer a preventive to a post-mortem approach.

Recently cobalt has become important as an element in certain ruminant-feeding areas. At present cobaltous sulphate is being used as a drench applied to feed. How we should or may apply that element in fertilizers is yet to be determined. In any case, the developments concerning cobalt and other rare elements open up new areas of fertilizer use in terms of removing elusive first limiting factors which clear the tracks for more economic use of the major plant nutrients.

Organic Matter

None of us intend to ignore the importance of soil tilth in fertilizer use. Organic matter, aeration, moisture balance are all so important that I shall stress them here by brevity of treatment in our search for major nutrient efficiency. Here is a wide field for the soil physicists to develop with our interested approval and cooperation. Crops, like human beings, must breathe and be refreshed with moisture and sunlight if they are to thrive on the other dynamic factors which feed them and manufacture their chlorophyl and other building blocks.

A Look Ahead

No crystal ball is required to discern some of the major nutrient pattern which lies ahead. The historical pattern will project itself into the future, not statically we may be sure, but dynamically. There will be a further narrowing of the ratio of phosphoric acid to nitrogen and potash. Pioneer areas will, as in the past, begin with phosphates and progress toward the 1-1-1 ratio as the agriculture intensifies, and the minds in them grow. Soil, rainfall, types of farming, returns per acre, costs for nutrients, and the secondary as well as minor elements will all have their effect on major nutrient use. But so also will ideas and the proof of ideas in the

TABLE 11.—MAJOR NUTRIENT RATIOS IN MIXTURES, MATERIALS, AND TOTAL FERTILIZER DISTRIBUTED IN THE UNITED STATES—1934 AND 1939

U. S.	Mixtures			Materials			Total			Total Nutrient Volume Trend
	N.	P_2O_5	K_2O	N.	P_2O_5	K_2O	N.	P_2O_5	K_2O	
1934........	20	51	29	41	46	13	25	50	25	100
1939........	19	49	32	41	45	14	26	47	27	147

Based Upon National Fertilizer Association Surveys by Mehring and Smalley for 1934, and Mehring, Deming, and Willet for 1939.

field. Potash will increase in ratio steadily; nitrogen will climb in some regions and decline in ratio in others. Good management needed on the farm in utilizing the feed crops produced with heavy nitrogen applications makes the job of sound nitrogen promotion a most challenging one. Superphosphate producers will learn to understand that a decreased phosphate ratio need not mean less volume and that if it does the welfare of users ranks ahead of manufacturers' desires. To their credit, more superphosphate producers than we may believe have such an attitude already and are wisely working to develop uses where potential markets are incompletely tapped.

Various estimates have been made of the quantity of commercial fertilizer that farmers will buy. Other estimates have been made of the amount we should use nationally. Some of these estimates indicate a possible need for doubling our present fertilizer use. That would be four times the amount we averaged to use during the five-year period 1935 to 1939. Such goals serve a constructive purpose in stimulating thought. I like them because they do that. But I am sure we should not take such estimates literally. Certainly we can afford to use greater quantities of fertilizer if they are used effectively. As we increase the use of fertilizer further, the need for better management to accompany such use becomes even more important than with our present volume. Thus, we should proceed gradually and I feel sure we will in building still greater fertilizer use.

I suggest that the greatest opportunities ahead are in those fields of ideas and their promotion which those of us in industry and agronomy may both

TABLE 12.—POTASH CONSUMPTION IN THE CONTINENTAL U. S., CALENDAR YEARS 1925, 1940, AND 1945, SHORT TONS OF K_2O

Class of Material	Per Cent of Total		
	1925	1940	1945
60% Muriate of Potash..................	7.4%	69.2%	78.5%
50% Muriate of Potash..................	34.9%	20.5%	8.8%
Sulphate of Potash..................	14.5%	7.0%	5.2%
Sulphate of Potash-Magnesia..................	....	0.3%	2.5%
Manure Salts and Kainite..................	43.2%	3.0%	5.0%
Total K_2O Volume Trend..................	100	152	269

Data for this table furnished by the American Potash Institute.

attack with vigor and imagination. (1) The relation of fertilizers to improved strains of crops, (2) the expansion of feed crop fertilization, (3) the fertilization of rotations in better management of soils, (4) the expansion of soil and plant tissue testing in their sound place toward more economic fertilization, (5) cleaning house of the unnecessarily dilute fertilizer grades still cluttering up the corners of the fertilizer industry's back kitchen, (6) learning a lot more about the secondary and minor elements and their use, (7) the development of new and better fertilizer application machinery to handle tomorrow's fertilizers, and (8) learning how to measure and affect favorably that elusive but important factor of soil tilth, are but a few of the "Ideas Unlimited" which lie ahead. As we tackle these and other problems, we can be sure that not only will others present themselves but that we'll have the stimulating experience of learning that the answers are sometimes simple and sometimes complex, but frequently obvious when we know the why as well as the how.

Regulations

Control laws affecting fertilizers were, I believe, instituted to protect fertilizer consumers from fraud. None of us, I am sure, object to such safeguards. Nor have we objected to most of the wartime restrictions of the type included in food production orders.

Custom built up some ridiculously complex lists of fertilizer grades. Most of us approve reasonably practical limitations of grades. I do not believe we need mandatory restriction to maintain some sense in the ratios and grades of major plant foods to be offered for use. I urge that among the trends in major nutrients we do not twist our control laws into mandatory limitations. Industry will welcome the agronomists' recommendations. Most fertilizers offered will in the future follow such recommendations. Agronomy is not yet an exact science. In our effort to establish reasonable order, let's not trip over the rope of standardization and stifle the progressive minorities. There are an increasing number of top executives and agronomists in the fertilizer industry who have the courage and the sense to limit their fertilizer offerings to a group which their factories can manufacture and distribute with economy. The day is gone when small variations in grade or ratio can or will be produced by most of the industry. But regimenting by regulation is hardly an acceptable substitute for constructive education or good business judgment.

I particularly hope that unlike the custom in recent years in some sections any recommendations made by agronomists will include an emphasis on higher analyses of suggested minimum grades. Only one or two groups of states even mentioned such possible multiples during the war. Let's open the gate for such progressive moves as we settle down to the interesting tasks to come.

Meet the King of Queens

(*From page* 14)

advertised in four years. It has been a problem of rationing bees and queens to customers rather than selling them more, or finding new customers. Usually by October he books all the orders he can fill the following season.

Queens are shipped in small cages with six to 12 worker bees with each queen to look after her. Package bees move in two, three, four, and five-pound packages with a queen caged in the center of each package. Each queen brings about $1.25, while each two-pound package of bees plus a queen

A view of Heaven's Hill queen yard which is owned and operated by W. E. Harrell, Hayneville, Alabama.

sells for about $4.00. In each queen cage goes a small piece of sugar candy and in each package of bees a small can of syrup to feed the bees and queens in transit.

You would think that a man spending his entire time caring for this mass of bees would produce and harvest a lot of honey. All he harvests is enough for home use, plus enough to pay a few landowners who prefer honey instead of cash for rent. The bees produce considerable honey each spring and summer, but are permitted to eat it during the winter months. In this way the amount of sugar needed to carry them through the winter season is reduced greatly.

Harrell is credited with having one of the most modern bee workshops in the country. In it he makes practically everything he needs in producing and marketing bees and queens. He uses white pine, principally from the State of Washington, in building frames and high bodies for the hives. Cypress is used in constructing bottom boards and basswood in building queen cages. When he and his helpers are not busy with the bees they work in the workshop.

After 32 years of training and experiences in the bee and queen world, Harrell is fully convinced that there are many excellent opportunities for G. I. students to study bee culture in college and to enter the bee business following graduation. "I wish you would tell them there is room in the bee, queen, and honey business for many more well-trained men," he said.

Harrell is just one of several hundred beekeepers who have developed a yearly $2,000,000 package bee and queen business in the South and Southwest, principally in Alabama, California, Georgia, Florida, Louisiana, Mississippi, South Carolina, and Texas. He estimates that for each dollar received by beekeepers $15 to $20 worth of pollination services is rendered to agriculture. This is in addition to the 200,000,000 pounds of honey and 4,000,000 pounds of beeswax produced by the country's 800,000 beekeepers each year.

Emphasizing the importance of bees to American agriculture, Harrell expresses belief that honeybees officiate at more successful weddings than all ministers and public officials put together. Officials of the U. S. Department of Agriculture agree and call honeybees "The Priests of the Flowers." They marry pretty flowers to each other instead of beautiful girls and handsome boys and are paid in small bits of nectar instead of money.

Harrell also gives the billions and billions of marriages performed by honeybees credit for much of the happiness of human marriages. "As you know," he says, "it is through flower mating or cross-pollination that we have our delicious apples, berries, peaches, and cantaloupes, and nutritious carrots, cabbage, cauliflower, kale, kohlrabi, onions, turnips, and other vegetables. There is no doubt that honeybees, the only pollinating insects that can be propagated and controlled, work hard for city folks and victory gardeners as well as farmers by pollinating the blossoms of more than 50 crops, including fruits, vegetables, and clovers.

"Our meat supply also is greatly dependent upon the marriage of clovers, alfalfa, and some of the other plants which livestock eat.

"Whether or not we have cotton clothes depends upon whether or not there are honeybees to pollinate or marry cotton flowers to each other."

For Farms and Game Preserves—Bicolor Lespedeza

(*From page* 26)

allow the fire to burn the bicolor, too. It will not hurt.

Borders

Borders, we think, should extend the full length of the woodland-cropland edge. This land has no other use. Hunting at the woodland edge will be rough, compared to open-field and open-woodland shooting.

The border of bicolor should be 15 to 18 feet wide—no more, no less. If crop-rows run into the border, a 12- to 15-foot strip of sericea lespedeza for turning will be needed. Sericea is a poor bird food but a good ground cover for the birds. Bobwhites will be found resting by day and roosting at night in sericea, particularly if they have no grassy cover in the woods. Quail do not rest or roost in bicolor in winter. They go there only to feed. Its cover is sufficient for safe feeding.

Hedges

Hedges of bicolor in crop fields are new. We are not yet sure that they are worth the land they occupy. Strips 15 feet wide (five rows) will take 3% of the land if grown 450 feet apart. They must go all the way across the field to join cover at one end or both. We believe one hedge will support another as added cover. The crops grown between the hedges should be different where the rotation makes such an arrangement possible. Don't try these hedges until use of all borders has been made and strips put inside the woodland.

Bees

Bees use bicolor extensively during August when other foods are scarce. During this time they increase their broods and store small amounts of honey. Bicolor honey is light-colored and good-flavored. The same patterns of woodland strips, borders, and hedges are helpful to bees.

Summary

The objective is to grow a supply of a good food on a small amount of land, to have more game, particularly quail.

Size of strip: Approximately 20 feet wide, 400 feet long.

Preparation of site: Needs to be good. The soil must be firm for seeding.

Fertilization: 400 pounds phosphate and 100 pounds potash per acre, applied before planting. Or use 500 pounds 0-14-10 or a complete fertilizer.

Planting design: Five rows three feet apart. Space plants two feet apart in rows. Broadcast seed or place in seven rows two feet apart.

Cultivation: Two or three times the first year. Succeeding years as needed.

Maintenance: Add fertilizer and cultivate when necessary to maintain vigor. Burn or cut back in winter if desirable.

South Mississippi Soils Produce Fine Pastures

(*From page* 12)

of improved pastures, although one of the most difficult to get farmers to practice.

What does it cost to develop an acre of pasture on this land? This is an important question and the economics of all farm practices must be considered. The farmer operating farm A itemized everything that went into the building of his pastures, and at present prices it was estimated to cost approximately $30 per acre, neglecting AAA benefit payments. This is a considerable amount to spend in developing an acre of pasture, but when we consider that two cows were grazed on each acre of one pasture for the greater part of the year of 1945, it becomes a good investment. After the first year, the cost per acre decreases to the amount necessary to purchase 1,000 pounds of slag and 50 pounds of muriate of potash. The farmer said, "It is much better than growing cotton and I have time to fish in the new pond."

The length of time that this pasture will produce excellent grazing has likewise been considered in the over-all plan of the farm. The Soil Conservation Service technician firmly believes that good preparation of the land is a vital factor in the success of improved pastures, and that after six or eight years in pasture the amount and quality of forage will decrease. Many noxious weeds will also invade the pasture land. When this occurs, the pastures are to be plowed up and planted to oats or row crops in order to take advantage of the nitrogen from the clover and the residual effects of the years in pasture. Some other field that has been in row crops will be mineralized and seeded to pasture and the previous pasture land will produce the row crops. This will give an opportunity to free the old pasture land of weeds and undesirable plants. The permanent pasture idea is becoming less important under this farm plan and more emphasis is placed on permanent or year-round grazing.

Another typical example is the case of farmer B who is engaged in the dairy-cotton type of farming. This farmer signed an agreement with the Soil Conservation Service in 1945 and planted 17 acres of alyce clover in the summer on land that had been in oats. The alyce clover was cut for hay in late September, and the field was then fertilized with a mixture slightly different from the pasture treatment mentioned above. The soil was mineralized with 500 pounds of basic slag, 500 pounds of 20% superphosphate, and 200 pounds of muriate of potash. This mixture was disked into the soil and the field was seeded to crimson clover on October 1, 1945. On February 1, 1946, forty-one dairy cows started grazing this clover field and continued until April 15.

It is estimated that the increased production of milk during this 75-day period and the feed saved amounted to approximately $60 per acre. The clover could have been grazed longer, but the herd was removed in order to obtain a seed crop. The field is shown in figure 11 on April 25 and an abundant seed

Fig. 8. Cattle get their nutrient requirements by 10 o'clock in the morning on a pasture that has been well fertilized.

crop had developed. When the seed crop is harvested, more income will be realized in addition to that obtained from the early spring grazing. Farm plans of this farm are shown in maps 3 and 4. Map 3 presents the farms before farm adjustments were made and map 4 shows the same farm with the changes recommended by the planning technician.

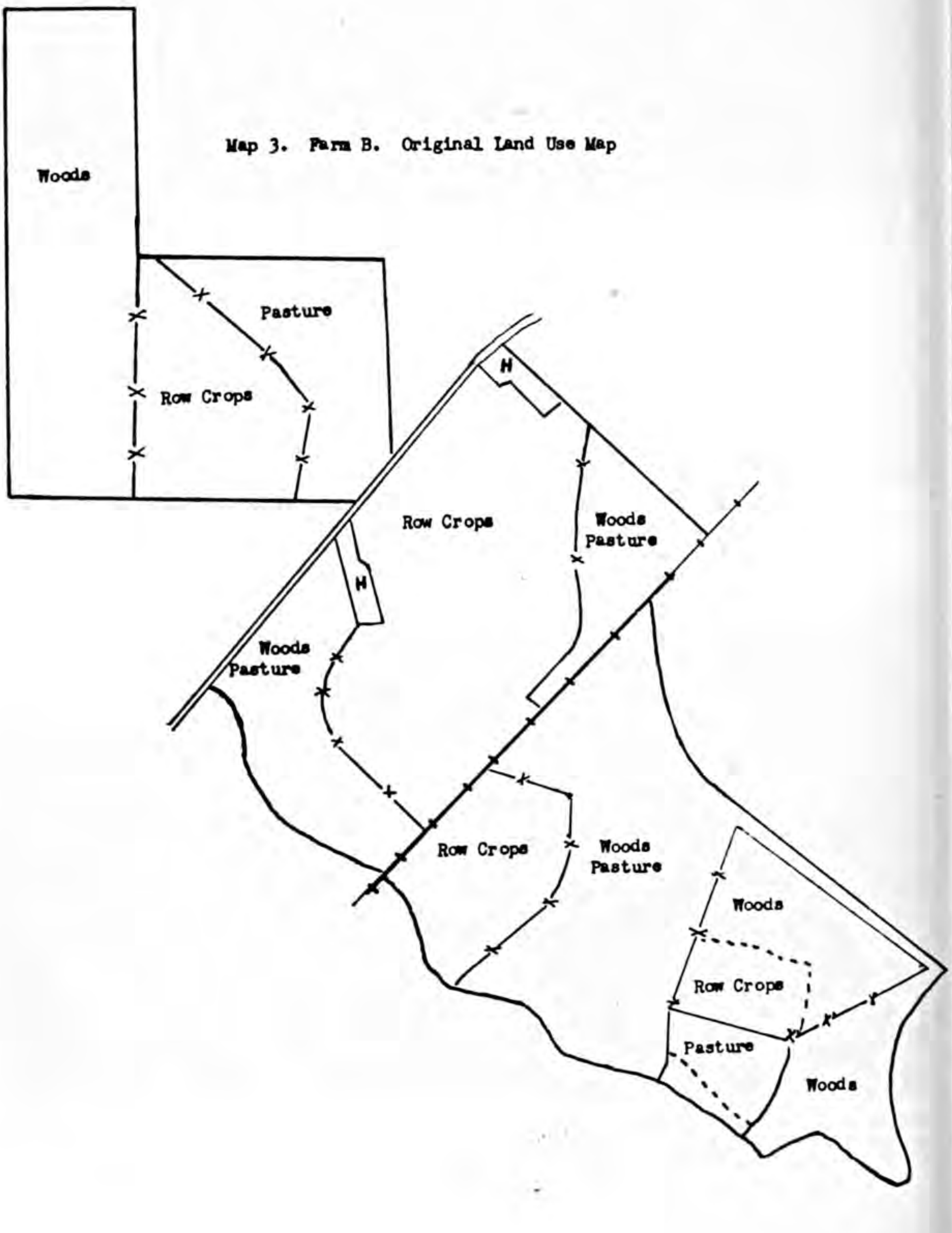
This farmer expects to remain in the dairy business, and, like farmer A, expects to furnish year-round grazing for his cows. He is convinced that it

Fig. 9. A complete mixture of minerals is necessary for maximum production. Basic slag was applied to this entire field. In the foreground potash was applied in addition to the slag. The application of potash stimulated the clover, and the farmer said the cattle grazed the portion more where the potash was applied.

can be done by using minerals on his soils and proper pasture management. Saving feed is generally an expensive operation and using the cow to harvest the crop is much more economical.

Many other farms that have undergone a change from cotton to cows as a result of assistance and recommendations of the agricultural leaders could be mentioned and pictured in Walthall County. One improved pasture that lasted 8 or 10 years and then failed was located. This farmer plowed the pasture land and remineralized it in the fall of 1945 without seed. In the spring of 1946 the rejuvenated, improved pasture was similar to the pasture obtained the first year it was established. This brings to our attention again the importance of minerals in a pasture program.

The effect of minerals on the pasture plants is shown in figure 3. A strip across this field was seeded, but received



Map 3. Farm B. Original Land Use Map

no minerals. The boundary line between minerals and the no-minerals strips is distinct as indicated by growth of the plants. This is a first-year pasture and located on poor sandy soil containing a considerable quantity of gravel. Adequate minerals not only increased the tonnage produced per acre but improved the quality of the forage as well. This is clearly shown in figure 4 which is the same scene as figure 3 after two months of heavy grazing. The unfertilized plot has not been grazed by the cattle and the fertilized plot was grazed closely. The animals grazed only as far as the minerals were applied.

In order to ascertain why the cows preferred to graze the fertilized portion of the pasture instead of the unfertilized part, composite samples of the forage were collected from each part of

Map 4. Present Land Use Map as planned by the S.C.S. Technican

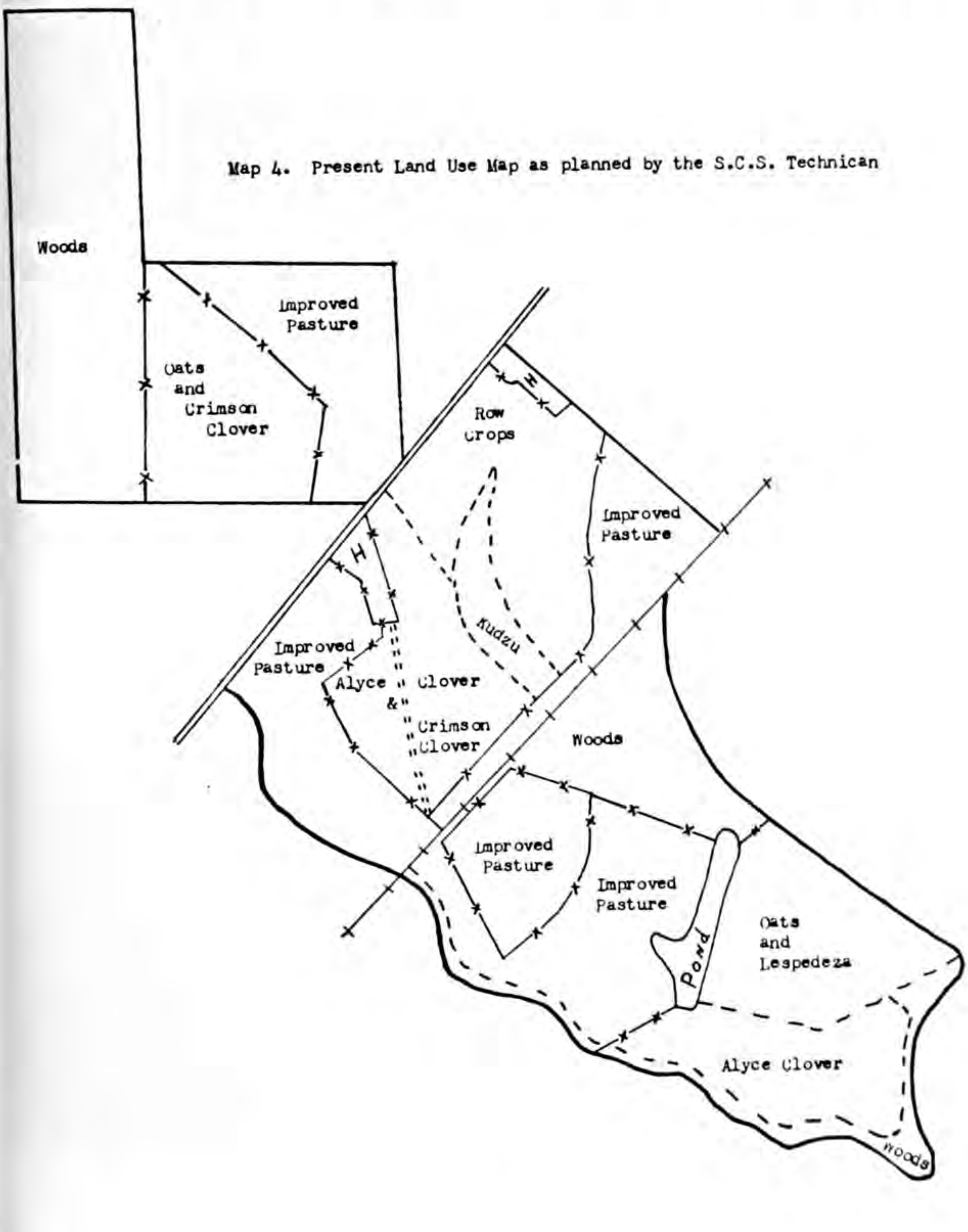


Fig. 10. Soil erosion reduces the growth of pasture plants. In the background the land is steeper and accelerated soil erosion had taken a heavy toll from the soil before the pasture was developed.

the pasture shown in figure 3 and were analyzed in the chemical laboratory. These data are shown in table 1. It is interesting to note that the plants produced on the part of the pasture which was treated with basic slag and potash were considerably higher in calcium, phosphorus, nitrogen, and potassium than the plants produced on the unfertilized plot. The analysis of the plants and the fact that the cattle elected of their own free will to graze the portion of the pasture which was mineralized indicate that the quality of the pasture plants was increased along with the quantity as a result of fertilization.

Fig. 11. A good seed crop of crimson clover. This field had been grazed by dairy cattle for 75 days. This photograph was taken on April 21.

A complete mixture of minerals is also essential. Figure 9 shows a demonstration where potash and basic slag were checked against basic slag alone. Not only is there a difference in growth in favor of the potash, but the operator stated that the cattle grazed the part of the field more where the potash was applied. This indicates that the cows were again able to detect quality in forage stimulated by minerals added to the soil. The animal has often surprised man by his ability to detect soil fertility that has been delivered by the soil into plants. The influence of potash on the composition of the pasture samples collected from the demonstration shown in figure 9 is shown in table 2.

The improved pastures just described

TABLE 1.—EFFECT OF MINERALS ON THE COMPOSITION OF PASTURE PLANTS*

Treatment	% Ca	% P	% N	% K
No treatment.......	.42	.22	1.09	1.94
Basic slag and potash.	.80	.38	2.92	2.43

* Analyzed by Mississippi Experiment Station Chemist.

TABLE 2.—INFLUENCE OF POTASH ON THE COMPOSITION OF PASTURE PLANTS*

Treatment	% Ca	% P	% N	% K
Basic slag...........	.42	.22	1.30	1.19
Basic slag and potash.	.82	.39	2.96	2.59

* Analyzed by Mississippi Experiment Station Chemist.

are quite a contrast to many so-called pastures in the South. Figure 2 shows a typical upland pasture where several acres are required to support one cow. This same scene could be changed into a profitable enterprise as well as one of scenic beauty by the use of minerals and good pasture management. Under a mild climate which prevails in this section, beef cattle can be produced without expensive barns and shelter and with little or no purchased feed. This would enable a farmer to stay in the business if the price of beef should decrease considerably from its present level. With the present shortage of farm labor which demands a decrease in cotton acreage, a golden opportunity is still available for many farmers in the hill section of Mississippi.

Fertile Dirt

(*From page* 5)

weaning away by attractive paying jobs in arms, aircraft, and powder plants.

Some severe shortages of materials, lack of skilled scientists and research men, and a badly overloaded transportation system as well as the warehouse limitations, all combined to make aspirin (or something a trifle stronger) a daily reliance of these industrial leaders.

They heard Claude Wickard and his information boys in USDA shout that food must win the war and dictate the peace. The farmers soon re-echoed this cry and booked startling tonnages for feed and forage crops as well as for cotton, oil seed crops, and cereals. It was 1915 all over again, except that back in those mellow times of conflict we were manure-minded and rolled out our own plant food, such as it was.

THE response to the new appeal was so instant despite all these handicaps that the farmer in need of mixed goods or special plant-food items had only to keep his motor truck running to secure at the supply store in his nearest town something his crops would relish. He could get six and a half hundredweight of nitrogen where only three and a half were on tap before; thirteen bags of phosphate instead of a previous seven; and seven and a half units of potash where only three and a quarter were at his bidding before the war. Sometimes a fertilizer man with biographical talent will fix up a story relating just how the demand was met during that era of urgency and reduced wherewithals.

And yet the well of plenty can stand further priming. After the dust clouds of war begin to settle we can peer through the murk and distinguish how miserable humanity becomes when drunk with destructive debauch. Every speech by Hoover and every riot abroad only renews the pressure for sustenance from the soil—so far mostly our soil. There is no shadow of surplus cast across the rural landscape yet, except for potatoes. The age-old theory of the farm will operate anyhow, to make the land productive and to fill the depleted storages against a time of plagues and locusts, of hail and flood, and other unseen hazards. The reflex action coming to our food providers after those years of "stimulated contraction" is a powerful force that meets the inmost traditions of agriculture. So if you think that the war years brought us terrific fertilizer usage, watch what happens next!

Of course, we of the fertile places untorn by war cannot assume the whole job of keeping folks abroad alive and kicking, especially the latter. In due course there will be a return to domestic normalcy, and our expanded acreage will need to be further adjusted to fit a nation of limited stomach capacity.

Meanwhile, we observe with some dismay reports by our friends who travel into the Southwest that for every twenty-five acres the government withdrew from cultivation in the so-called dust bowl plains, there are over six hundred acres being plowed and planted to fill the present world shortage of victuals. If these operators are well fortified by bank assets and follow better soil-conserving systems than before, perhaps the net result will not be a repetition of old disasters. At any rate, it becomes a duty for the fertilizer leaders to watch those areas and help direct a safer and saner course in their management. At least it is unsound to be a party to exploitation there for the sake of the moment's passing reward.

Moreover, it appears to be the privilege of these leaders of conservation of natural resources to do all they can to ward off a fickle flare-up of speculative land grabbing. One cannot expect a debt-ridden farmer to be a steady and discriminating customer of supply houses, as he may be moving off under sheriff's orders before the spring of 1950. The local fertilizer dealer can help much in checking such tendencies and in a negative way at least he can be of assistance by not encouraging loose talk among his customers about the golden margin to be found at the end of the land boom rainbow. It's better to lose a future dollar than to wager your security on a continued spell of world starvation, anyhow during a time when we insist on getting the world's top prices. Just as soon as the other half over there get the mud out of their hair and patch up their machinery and locate enough land-plaster to coax up some sprouts again, we won't have them on our hands at meal-time.

IT IS better economy and sounder planning to export machinery, fertilizer, and seed to these ravaged countries so they may regain their productivity than it is to drain our soil resources in continued sales or gifts of grains. To defer establishment here of a fertility program to consider more than mere emergency acre-yield boosting is time and money lost.

Does fertility mean only increased crop production? Has it a more balanced and permanent place in agriculture than this temporary one? Do conservation of soil and water resources always fit into a cash-and-crisis food campaign? How much more do we need to know and apply about the science of soil maintenance? May we mine out the cream of our fertility now and neglect the vital portion of the legacy we leave to others? Is this a period of empirical advantage or a time to take stock and renew our obligations to the pioneers?

One unanswered puzzle is the possible connection between the use of plant food on the land and the nutritional value of foods originating in one or another on such land. Folks are working hard at this experiment now and trying to see a clear picture of the whole thing.

OF COURSE, we already recognize that a cow more abundantly fed on high yields of feed per acre will give more milk and butterfat per acre, but what is not always so evident is whether certain states of the soil as to fertility levels and the various plant-food elements it contains will change the quality and nutritional value of the same amount of milk and butterfat.

Some tests have given us a glimmer of insight into this but we will have scores of them to aid us in a few years. How will it affect wool fiber, the vitamins in beef and pork and the food value of eggs built upon grains, hay, and pasture from land differently fertilized and limed? If and when we know it in a fairly definite way, it will challenge us with another kind of commodity pricing system.

If this nutritional scale ever comes into effect so strongly as to convince consumers of its real merit, there must then be a way established to reward producers who take pains and invest time and money sufficient to produce those kinds of foods on land in a higher state of balanced fertility. You can't expect a dairyman to worry much about the vitamin A in his cow's milk tonnage daily as long as the measure of his payment is still upon gross weight and the fat test only. But if slowly and carefully plans are laid and perfected to discriminate somehow between low-nutrition foods and the land that produced them, we'll be facing another revolution in economics for agriculture. All this may be ballyhoo poppycock nonsense, but that's the way the first horseless carriage and the subsidy program looked prior to universal application of them. Anyhow it's high time for a revolt in economics to match the new era in mechanics and electronics. Better get ready to take brain barnacles off and remove the eye-blinders.

After all, the fertilizer game is linked with the whole farm pattern. A guy may have a modern fertilizer formula and the best equipment to apply it, but be minus enough brains and judgment to follow through and round it out. Plain laziness and indifference make a bad combination with fertilizer.

Good fertilizer will raise mighty luxuriant weed crops. It will raise good sturdy soil-depleting crops where soil-binding and nitrogen-fixing ones are required. It will raise timothy and Bermuda grass of great tonnages where a legume mixture would make more milk and beef. It will raise hell with conservation if the operator is a soil spend-thrift.

A STANDPATTER may invest in super-duper brands of plant victuals and throw a lot of it away by insisting upon using open-pollinated corn instead of hybrids, cheap bargain grass seed instead of tested varieties of known good origin, or bonanza wonderberries which look better in litho ink than on the land.

Moreover, the degree of intelligence displayed by a farmer in grasping the modern principles of cooperation in marketing, soil conservation district participation, rural electric facilities within his reach, and educational demonstrations and conferences ties into the net return he gets on his fertilizer. Like any tool used to promote welfare and prosperity, fertilizer is at its best when coupled with similar means and methods contributing to the same end.

Therefore, this means closer working alliances are needed between chemists and economists, physicists and plant breeders, biologists and engineers. As it is we usually go off in separate groups and spiel and splutter about the destiny and the dilemmas of agriculture, as seen from isolated and narrow angles. Maybe we have so many splendid specialists that we lack enough coordination. I know at any rate that the calendar is plenty full of separate conventions that specialize in saving farmers. However, I am happy to note that we are really making vast progress by virtue of so many powerful corporations which use their experience and influence in a broad way, not confining themselves to lectures and literature for the sale of more of their own pet product. This is a good sign that we are entering a better period of commercially financed education.

And we must have both private and public avenues of education. Rightly run, they supplement each other. As a team they can do much good. Your private education program can offer inducements and prizes and such that no public-supported agency is able to undertake. It can often make quicker decisions too. Its research funds are larger and free from constant public scrutiny and criticism.

But no private research and sales program may safely ignore or compete with the experiment station kind of agricultural progress, although it often stimulates it and spurs it on. We have many such programs on tap with soils and fertilizers, including grants to worthy students who may through college training become wonder-workers of the future in plant science.

YES, it's a long, interesting old road that leads back there to the days when I helped Dad unload the odoriferous crop stimulant. I do not suppose that an ounce of any of the plant food we added to that sandy soil remains, and probably it's been a constant battle since to keep it up to snuff. Yet I know the fellows who run that farm now have an advantage over us in knowledge, as well as in fewer aching joints and less need to hold their noses.

A Few Whinnies

Sambo—"I'se jes' been bit by a dog and I'se worried. I hear whenever a dog bites you, whatever the dog has, you get."

Rastus—"Boy, then you has a right to worry."

Sambo—"Why?"

Rastus—"That dog just had eleven pups."

"Who introduced you to your wife?"

"We just met—I don't blame anybody."

A little boy boarded the street car wearing long pants. The conductor charged him full fare. At the next stop a little boy boarded the street car wearing short pants—half fare. Next stop, a young lady entered the street car and the conductor collected no fare.

No! No! She had a transfer.

Minister, at baptism: "What is the baby's name, please?"

Proud father: "Robert William Montgomery Morgan Maxwell."

Minister, to assistant: "More water, please."

"Well, I do say," said the sweet old lady upon tasting her first glass of beer. "It tastes exactly like the medicine my husband has been taking for the last thirty years."

A gal and an automobile are much alike. A good paint job conceals the years, but the lines tell the story.

Marriage is just like sitting in a bath tub. After you get used to it, it ain't so hot.

HOW TO HAVE A FIT

Farmer Squibbs was ploughing the farthest corner of his field when a neighbor came running to call, "Quick, Henry! Your wife's having a fit." Squibbs dropped everything and ran a mile to his house, only to find his wife had recovered fully and was placidly cooking dinner.

A week later he was summoned again. This time, his wife, once more recovered, was darning stockings in the parlor.

A third time the neighbor called for Farmer Squibbs. This time he found his wife out cold on the kitchen floor. He felt her pulse and her heart. Neither stirred. He held a mirror before her mouth. There was no trace of moisture.

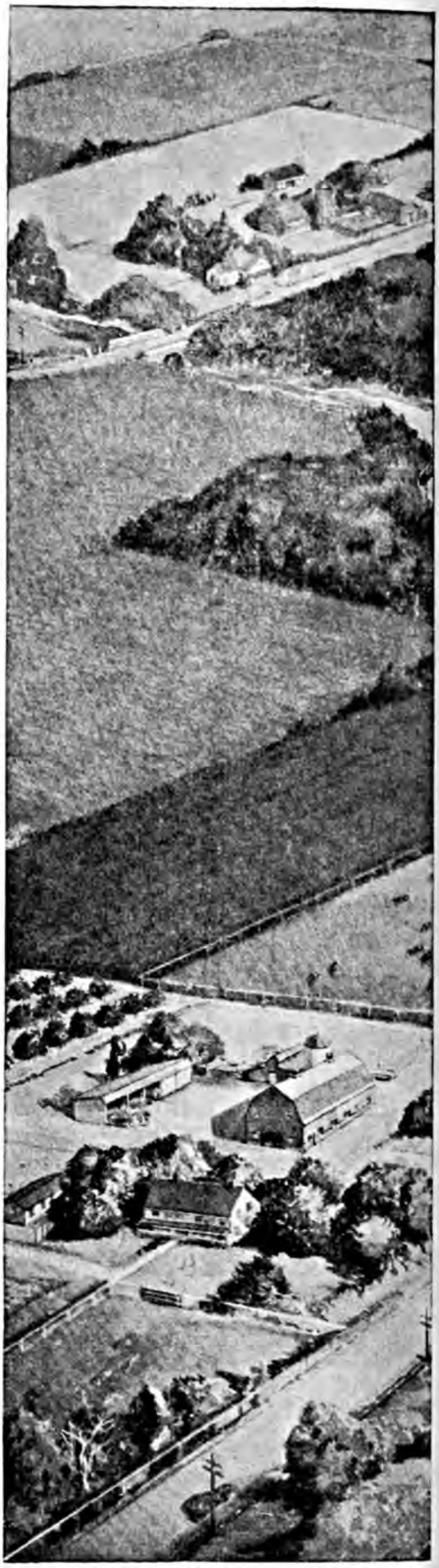
Farmer Squibbs straightened himself and mopped his forehead. "Well," he declared, "this is more like it."

FITTER'S FIT

Lady Customer: "I want my shoes comfortable, but they must look stylish, too."

Clerk: "Yes, ma'am. You want them large inside, and small outside, don't you?"

Ah! Those were the days. When you could kiss a girl and taste nothing but the girl!



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)

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.

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Better Crops with PLANT FOOD

October 1946 | 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 XXX NO. 8

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The American Potash Institute, Inc.

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

Member Companies: American Potash & Chemical Corporation
Potash Company of America
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WHERE RED EARS DON'T COUNT

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. XXX WASHINGTON, D. C., OCTOBER 1946 No. 8

For Better Crops . . . . .

Let Us Boost the Bee

Jeff McDermid

HERDSMEN for the honeybee have seldom if ever received the credit they deserve in the complex process of making eggs, milk, meat, and wool out of feed crops and forages—and none too much thanks for the well-filled apple barrel either.

"How doth the busy honeybee improve each shining hour"—and similar platitudes of ancient vintage come back to us as we scan our own shortcomings respecting the gratitude we owe the bees and our short-sightedness respecting the real importance of a few colonies of them in any good farming community.

In my youth the local "honeyman" was usually a shy, modest, soft-spoken, retiring guy who peddled comb or extracted honey from door to door and then went back to his smoke-pot and supers unsung by the townsfolk. Just one of the profession in my own hamlet was rather simple in the upper story, moreover, which did not count against his product. At any rate, none of these gentle honey purveyors got much praise for his skill and integrity. On the other hand, farmers who fetched in berries, melons, pork, or eggs to sell got a different reception. They were asked about the feeding and breeding of their hogs, the varieties of fruit, and the farm management systems involved.

One reason why the honeyman departed unquestioned was that most folks supposed that his bees lived off the largess of the surrounding country free gratis, and that only a queer sort of genius would get a kick out of a chance to be stung. Some blame for this situation arose from a general lack of knowledge possessed by ordinary customers of the honeyman about the technical methods used and the great, mysterious, unsolved wonders inherent in the life cycle of the queen bee and her drones and workers. Folks raved in copybook style about the ant, and were told to "study her ways and be wise." But the honeyman plodded along in close kinship with nature and the marvels which belong to the bees.

Villagers could understand domestic mammals because they lived, ate, reproduced, and suckled much like themselves. But when it came to the insect world and particularly the "tame" division of it represented by the honeybee, so much of the lore was beyond belief or comprehension that it sounded too much like handling a flea circus—and they gave up and forgot it. In later decades we have fortunately secured for ourselves entomologists with commercial viewpoints and installed courses in beekeeping in colleges. Yet even with this progress toward achieving partnership with the bee most of us are a long way behind and still think the principal value of the honeybee is to manufacture honey—which it isn't. I thought so myself until just a few years ago. When more farmers and county agents and extensionists and their ilk grasp the fact that honey for batter cakes is absolutely not the most vital factor that makes bees so valuable, we will begin to restore the balance in the cycle from soil to sustenance.

BACK when nature was in the raw hereabouts, there was a far better balance established between the wild plant life and the wild insects which pollinated vegetation. For it is true that honeybees are by no means the only insects that favor flowers with their visitations, several species of flies and beetles being gifted with that habit. But the honeybee remains, after all, the steadiest customer of the floral system, inasmuch as substances obtained by them from the blossoms supply all the larder of the Queen's empire, young and old alike depending upon nectar and pollen for their existence.

It has happened in the course of events that the woodlands, marshes, and thickets have been opened up, drained, and hacked away, at least in most areas situated adjacent to the fields when men grew forage for their animals. This drive to settle up and civilize and reclaim the earth has been especially characteristic of America. We have done it all too well and all too dismally in some spots. Great blocks of uniform domestic plants replace the variety of native wild flowers and other herbage, and the nests as well as the ranges of the wild insects have been whittled away. I remember how common it used to be to find big hornets' nests in fence corners and wild bee trees around the farms—but now they are scarce indeed. This means that the domestic honeybee remains almost alone to do the job which in the past was performed by his wild prototypes and by countless wasps and other pollinators.

SCIENTIFIC beemen say that this is just too bad, because many of the wild insects were even more efficient than honeybees in this task. But right here we must stop and admit that absolutely nothing has been done about this, all normal effort being contrariwise. Is it time we set up some kind of method or name some specialists to encourage protective and propagating measures for certain helpful species of insects? Hitherto we have classed everything that belonged to the wild insect world as man's enemies and pests. Last week I saw some children kill a harmless but gawky praying mantis, because it looked so weird and fierce outwardly. We have spent millions in trying to kill harmful insects, sometimes in vain, but little has been done to save the cooperative insects. Most of us wouldn't recognize one from a "tumblebug" or a "vinegarroon" if we saw it.

And still another thing which impresses me is that we have not to my knowledge ever subsidized the honeyman. Not that I crave more subsidies to reduce my grocery bills, but it strikes me as queer that an industry which has been actually plugging hard for agriculture for half a century should take its reward on the chin. This doesn't mean that nightriders or interlopers have injured the beeman or ripped out his apiaries, but that millions of gallons of stuff that is deadly to bees has been squirted around promiscuously in rural fruit-growing zones, so that many colonies have been retarded and their numbers reduced more or less by poison.

Of course, we have heard winter short-course folks address the farmers and remind them not to use arsenicals on trees during full bloom, but this hint has too often been forgotten or perhaps found impractical to thoroughly control. Anyhow, when combined with a modest if not a losing price for honey over the years, plus difficult winter feeding conditions for the colonies, no sugar being on tap during the war, we get some idea of the misery thoughtlessly perpetrated on the beeman. Maybe it's no wonder that the growers of legume seed crops find it hard to produce enough, even with a generous government bonus, to extend the area of high-protein, high-vitamin roughage so badly needed to keep up the country's economic output of health protective foods like milk. If this is really to become a land of milk and honey, some effort must be made to show the close relation between these two products, both in the growing and the eating value thereof.

According to facts found in a Federal survey, there are 22 fruit crops of prominence which depend on honeybees for pollination or else yield more freely when such is the case. Not to list them all, we pick out a few favorites without whose toothsome flavor our meals would often be sadly lacking—even when we are forced to pay 65 cents or more for a No. 2 can. Apples top the list, followed by apricots, cherries, cranberries, grapes, muskmelons, watermelons, peaches, nectarines, pears, plums, the lowly prune, raspberries, and strawberries. The bees must have done a major job last spring for the peach crop hit an all-time high of 83 million bushels with another record for pears at 34 million. Grapes and cranberries also have done a tremendous comeback, in which the bee must share the glory. Now if you carry this surplus bounty back to the food stores, and if OPA lets the much-abused law of supply and demand take effect, we will soon be able to thank the bees for a reduction in the money we must pay for those No. 2 cans aforesaid. But instead of the beeman and his Queen taking the bow, probably some publicized politician will pose for his picture as the responsible party for plenty peaches.

THERE are 30 or more seed crops that rely on the buzzing winged visitors. Alfalfa and asparagus, broccoli and buckwheat, cabbages, carrots, and clovers, King cotton himself, flax, onions, pumpkins, rape and radish, squash and rutabaga, sunflowers and sweetclover, turnips, trefoil, and the vetches are found among these dependents on the apiary.

If one were holding court to try a case relating to the bee and pollination it would be wiser to call as witnesses those folks who specialize in plants and plant breeding rather than to ask for endorsement from the professional

(*Turn to page* 49)

Soil Testing—A Practical Aid to the Grower and Industry

By Jackson B. Hester

Soil Technologist, Campbell Soup Company, Riverton, New Jersey

THE profound influence that the elements, absorbed by plants, have upon man and animals (5, 12) has received considerable attention in recent years. The major nutrient requirements for most crops have been well established (4, 8, 12). However, a review of the literature on the development of the use of various nutrients in crop production shows that one of the most extensive problems has been methods of determining soil nutrient requirements for efficient crop production. Almost every conceivable means of measuring the soil needs, so that general recommendations can be made, has been tried. The fact remains that the available mineral elements in a soil (4, 8, 12) vary tremendously within a given soil type and within a given community, depending to a great extent upon the previous treatment of the land. Available plant nutrients in the soil can be determined by ordinary chemical analyses rather accurately and furthermore, certain of these analyses are adapted to rapid procedures (1, 2, 3, 4, 6, 7, 9, 10, 11, 13).

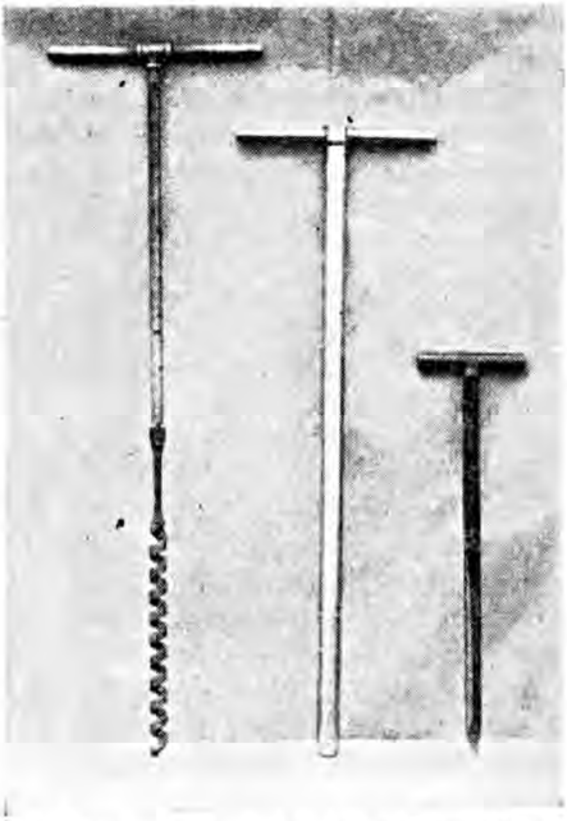


Fig. 1. Soil auger, soil tube, and trowel for soil sampling.

The requirement for production of efficient crop yields on the soil from the standpoint of available nutrients is not merely an analysis of the soil for the availability of certain nutrients. It is also an analysis to see if the environment of the soil is favorable to the crop grown. For example, a soil may have sufficient available potash to grow a number of crops, but if the soil is too acid for the crop concerned, the available potash is unused. From this standpoint a soil-testing system must be of the nature to give not only the available nutrients in the soil, but an indication of the environmental conditions present.

A grower is concerned about the limiting factors in crop production, i. e., the limiting factors over which he has some control. He is willing to take his chances with the weather. He also knows that the weather influences the availability of plant nutrients in the soil, particularly nitrogen. Therefore, he is anxious to know how to cope with the situation when there is a drastic change in climatic conditions. The grower also knows that the plant nutrient requirements for the various soils and cropping practices on his farm vary. He knows that sometimes he has the right combination and produces a bumper crop and other times he produces poor crops. He would like to take as much of the guess out of his practices as possible. From that standpoint, he knows some method of analysis must be available if he is going to get the true answer.

The fact that there are certain nutrient deficiencies in most soils has been well established; and that these deficiencies can be found in most communities, but on various soils in that community, is likewise common knowledge. The conditions in the soil that are favorable for many economical crops have been established (4, 8, 12). The fact that certain laboratories for making soil analyses have proven satisfactory can not be questioned. This discussion will deal with the equipment and procedures for practical work in this field.

The Soil Sample

Suppose a workable system be briefly described from beginning to end. It is without question that the more information one has about the soil and cropping practices, the better equipped he is to make a practical recommendation.

It is obvious that the soil to be analyzed must be representative of the field in which the crop is to be grown. From practical experience it has been proven that an experienced man has better knowledge of how to take a soil sample than one that has little conception of what the chemist does with the soil after he receives it. Furthermore, it is necessary to have the proper tools with which to take a sample. The three most satisfactory tools are (1) a soil auger for deep, stony, and compact soils; (2) a soil-sampling tube for ordinary sampling; and (3) a trowel for sandy soils. (See figure 1.) These tools are satisfactory for drawing samples because uniform cores are drawn from the soil and all of the soil drawn can be brought to the laboratory where proper methods for screening and mixing are available.

Personnel

The person that draws the samples should be trained in the proper method of soil sampling. In most of the processing industries, drawing samples is only a part-time job, and thus he is available for other work during the year. He should be taught to recognize different soil types and how to avoid areas in the field that are not representative of the field as a whole. He should be taught fundamentals of drawing good soil samples and what

Name ....

Address ....

Field ....

Previous crop ....

Present condition ....

Topography: Level Rolling Sloping Steep

Drainage: Good Fair Poor Tiled

Lime .... Manure ....

Form 829 300p 6x3 7-43

Fig. 2. Information obtained from grower at the time the soil sample is taken.

good samples mean to the complete picture. The representative must know what information to get from the grower and to what extent the information obtained is reliable. The information shown in figure 2 is about all that is necessary to be obtained under most conditions.

The soil sample should be taken at such a period as to give adequate time for the analyses and to get the information back into the hands of the grower so that he can have sufficient time to make his purchases and plan his cropping program. It has been found that the fall of the year is a satisfactory season. The weak points of the soil are likely to show up at this time since a crop, more than likely, has been removed from the soil. Therefore, during the early part of the fall of the year the representative calls upon the grower, obtains information about where he plans to plant his next year's cash crop, and draws the soil sample.

The most convenient container for the sample is the round pint oyster cup (Sealright). This cup will hold 10 to 15 borings of soil and is very convenient for drying and holding the screened sample, figure 3. The samples are brought to some convenient place near the laboratory for drying and screening. The 2-millimeter-round-hole screen is very satisfactory for screening soils. It is best to screen them at a state of dryness that permits easy crumbling of the soil. Rubbing the soil through the screen with a rubber pestle is expedient.

Fig. 3. Drying, mixing, and screening soil samples.

Analyses

Once the samples have been air-dried, mixed, and screened, they are ready for chemical analysis. The usual analyses made are for pH value, available calcium, magnesium, ammonia and nitrate nitrogen, phosphorus, potash, manganese, total organic matter, and toxic aluminum. Special samples may require other analyses such as total salt concentration, sulfates, nitrite nitrogen, chlorides, and ferrous and ferric iron. Also special plant tests for boron (4) may be advantageous and, too, a mechanical analysis of the soil by the hydrometer method. See figures 4 and 5. At any rate, the color of the soil should be recorded and the sand, silt, and clay estimated.

The pH value is one of the tests that gives considerable information about the soil. It gives an insight as to the percentage base saturation in the soil and the possibility of toxic amounts of aluminum coming into solution. The glass electrode has become stand-

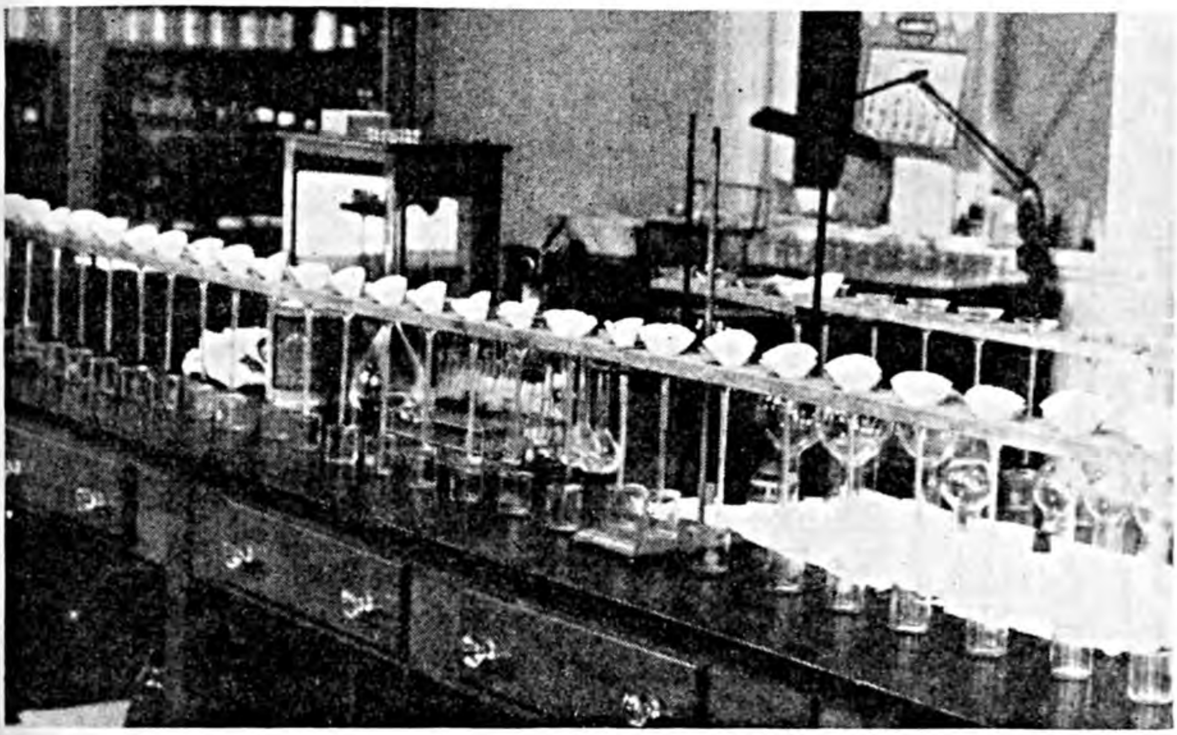


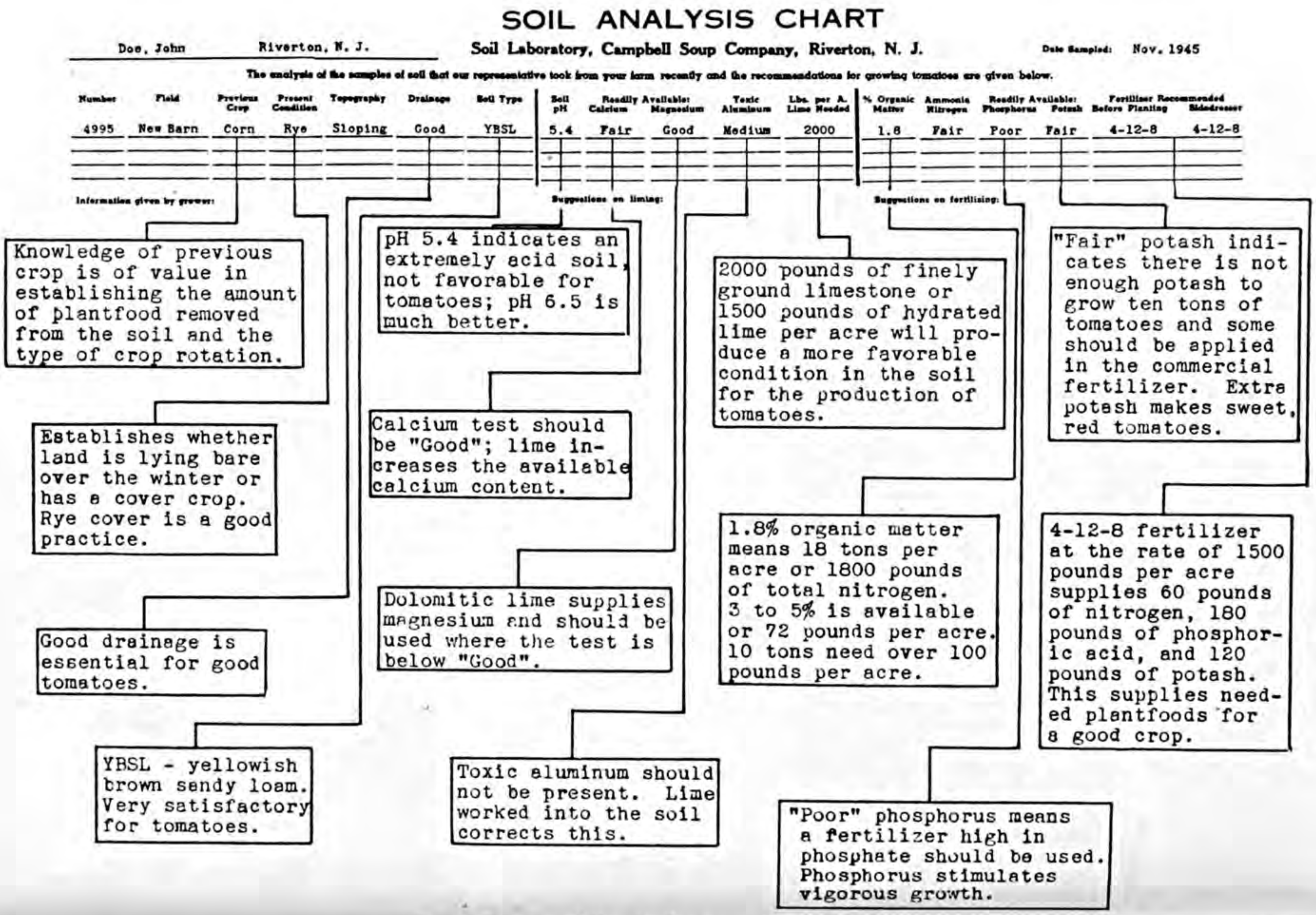
Fig. 4. Equipment used in well-developed laboratory for soil analyses.

ard equipment for this test, although good results can be obtained with the colorimetric procedure.

The soil may be extracted in an extraction flask and filtered for analysis. Most rapid procedures make all the tests for the elements on one extract.

The laboratory must be equipped with good methods of measuring turbidity and colors. A photelometer is a very fine piece of equipment for this purpose. Campbell Soup Company's laboratory handles some 6,000 to 8,000 samples each fall. This can only be done through careful planning and with considerable equipment.

Fig. 5. Weighing samples for soil organic matter analysis.


SOIL ANALYSIS CHART
Doe, John
Riverton, N. J.
Soil Laboratory, Campbell Soup Company, Riverton, N. J.
Date Sampled: Nov. 1945
The analysis of the samples of soil that our representative took from your farm recently and the recommendations for growing tomatoes are given below.
Number | Field | Previous Crop | Present Condition | Topography | Drainage | Soil Type | Soil pH | Readily Available: Calcium | Magnesium | Toxic Aluminum | Lbs. per A. Lime Needed | % Organic Matter | Ammonia Nitrogen | Readily Available: Phosphorus | Potash | Fertilizer Recommended Before Planting | Sidedresser
4995 | New Barn | Corn | Rye | Sloping | Good | YBSL | 5.4 | Fair | Good | Medium | 2000 | 1.8 | Fair | Poor | Fair | 4-12-8 | 4-12-8
Information given by grower:
Suggestions on liming:
Suggestions on fertilizing:
Knowledge of previous crop is of value in establishing the amount of plantfood removed from the soil and the type of crop rotation.
Establishes whether land is lying bare over the winter or has a cover crop. Rye cover is a good practice.
Good drainage is essential for good tomatoes.
YBSL - yellowish brown sandy loam. Very satisfactory for tomatoes.
pH 5.4 indicates an extremely acid soil, not favorable for tomatoes; pH 6.5 is much better.
Calcium test should be "Good"; lime increases the available calcium content.
Dolomitic lime supplies magnesium and should be used where the test is below "Good".
Toxic aluminum should not be present. Lime worked into the soil corrects this.
2000 pounds of finely ground limestone or 1500 pounds of hydrated lime per acre will produce a more favorable condition in the soil for the production of tomatoes.
1.8% organic matter means 18 tons per acre or 1800 pounds of total nitrogen. 3 to 5% is available or 72 pounds per acre. 10 tons need over 100 pounds per acre.
"Poor" phosphorus means a fertilizer high in phosphate should be used. Phosphorus stimulates vigorous growth.
"Fair" potash indicates there is not enough potash to grow ten tons of tomatoes and some should be applied in the commercial fertilizer. Extra potash makes sweet, red tomatoes.
4-12-8 fertilizer at the rate of 1500 pounds per acre supplies 60 pounds of nitrogen, 180 pounds of phosphoric acid, and 120 pounds of potash. This supplies needed plantfoods for a good crop.

Plant Analyses

This laboratory also handles 2,000 or more plant samples each summer. With the use of the Waring Blendor and the photelometer, analyses for the major plant nutrients in the plant can be completed in a few minutes. From the standpoint of diagnosis this is very important. An analysis of a plant for the nutrients being absorbed may lead to a side-dressing procedure that will increase the yield or it may save the grower money and time.

The Recommendation

Once the soil analysis has been made, it is important to get it into the hands of the grower in a form that is understandable. For the most part, growers are practical men and chemical symbols and names do not mean much to them. Therefore, it is desirable to report the results in such a way as to be both understandable and practical to them. The form of the report is important. The tests and recommendations must be logical and workable for the grower. The method of recommendation shown in figure 6 has proven very successful.

The recommendation must be workable and sound. It is impractical to recommend 2,150 pounds of a liming material because the spreading equipment is not accurate to that degree. It is practical to recommend one ton or one and one-half tons of a liming material or to recommend a dolomite or high calcium lime. It is also practical that this be recommended for fall or spring application, and that it be plowed down or disked into the soil.

Soil analyses or variations shown by them do not mean that there must be an outlandish number of grades of fertilizer to meet the needs demanded. A few well-diversified grades will cover most needs. Such analyses as 5-10-10, 4-12-8, 4-8-12, 3-12-15, 0-12-12, 10-0-20, 7-7-7, and the regular materials are usually sufficient for upland soils.

Research Work

Research work on new methods of testing and improvement in technique must continue. Greenhouse pot work, long chemical methods, and finally field experiments (4) must be conducted and correlations made with the short tests if maximum use is to be obtained from the results of the tests. The grower must know of the work done on the soil analyses and the background of the tests if he is to have thorough confidence in them. This is best done through personal contact and published literature.

Follow-Up Work

The soil tests and recommendations must be followed up to see whether the grower followed the recommendations and what yields he obtained. These records are kept from year to year and through that means a complete picture of his entire farm may soon be obtained. It is not uncommon when one attends meetings to find growers there with the soil tests from five to eight years back. They are eager to discuss the results of the analyses and point out how they check with some of the things they have done to the soil.

Soil Testing Pays

Soil testing pays because it calls the attention of the grower to the needs of his soil for specific crop production. For instance, in 1941 a survey of 108 tomato growers revealed that those growers producing more than 10 tons of tomatoes per acre had an average grade of 74% U. S. No. 1 and 25% U. S. No. 2 tomatoes, whereas those growers that produced less than five tons per acre had an average grade of 61% U. S. No. 1, 36% U. S. No. 2, and 3% culls. Consequently, it pays in quality. In 1944, a survey of 40 growers in one county in Pennsylvania revealed that for those having their soil tested, the average yield was 7.46 tons per acre, whereas those without soil

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Plant Breeding in Relation to Soil Fertility and Climate[1]

By Fred H. Hull

Agricultural Experiment Station, University of Florida, Gainesville, Florida

THIS opportunity to discuss plant breeding in relation to soil fertility and climate with a group of soils specialists has been accepted gladly because I think the direction of plant breeding may sometimes depend on progress in soil science.

With continued advances in the science of soil fertility and fertilizer practice, and with the development of better soil-improvement crops such as the lupine, we may expect the level of fertility of crop lands in Florida to be raised appreciably. This may be particularly true of lands growing corn, peanuts, oats, and the grazing crops. Natural fertility is low and a minimum of fertilizer is used.

Poor Breeds Are Poor Feeders

Soil fertility is measured finally by crop production, I suppose, provided that a well-adapted variety of the crop is available. There is a widespread belief that peanuts often fail to make profitable responses to fertilizer. And it is reported that additional responses of corn in Florida to higher rates of fertilizer are sometimes disappointing. Explanations of these failures are not readily apparent nor simple. I am led first to consider that the peanut is not a thoroughly domesticated plant. It will persist for some time in sod land. The peanut is a poor land crop. We may have somewhat of a parallel case in the range cow or the range hog. These animals may survive and reproduce on the range better than improved pure breeds. But in the dairy barn or feed lot, performance of purebreds is far superior to that of range animals. The latter seem unable to respond fully to abundant nutrition.

We may, of course, question whether or not the turning of a heavy leguminous crop and balancing the nitrogen with potash and phosphate will always provide abundant nutrition in the full sense to a following crop. Other elements may be deficient or out of balance initially or may be made so by heavy rainfall. How serious this general problem is and how rapidly the soil chemist may solve it, I do not know. My interest is in the burden of unsolved residue which will presumably fall on the plant breeder. If this problem is of slight importance there is still the question of drouth which may be serious where a high fertility level is built up on light land and a thick planting of the crop is made. Relation of corn production to climatic factors must be quite different when fertilizer rate and thickness of planting are both doubled.

Most of the corn grown in Florida has been here a long time and has perhaps achieved some degree of adaptation to prevailing climate, soil, and soil management. If now we begin looking for a corn which will produce efficiently after lupines with heavy fertilization and thick planting, will we find it among the varieties and hybrids developed in the older practice? Or how fast may we go in developing the desired type? The question of how

[1] Presented before the Florida Society of Soil Science, February 1946.

well corn may respond to high rates of nitrogen, potassium, and phosphorus which is being currently investigated at various points in the South might be varied to ask at what levels of these and other elements might corn-breeding operations best be done? No one, of course, has any definite answers to these questions. I shall devote my remaining discussion to some of the factors which may bear on them.

Stringfield and Salter (6) tested several local corn varieties and some corn hybrids in Ohio on fertility levels ranging from no treatment to 16 tons of stable manure plus 800 pounds of fertilizer per acre. They found differential varietal response to fertility levels in two of five seasons. Differential response of varieties to seasons was highly significant and much greater than that to fertility levels. Some varieties were superior in the dry seasons—not so much so in wet seasons. Other varieties were definitely "good season" performers.

Smith (5) and Lyness (4) separately tested different strains of corn on different levels of phosphorus. Each one found marked differences among lines on low phosphorus. Smith found lesser differences on low nitrogen. Efficient lines on low phosphorus had greater proportions of secondary to primary roots. Harvey (1) found significant differences in responses of corn hybrids and inbred lines to ammonium and nitrate nitrogen in mineral solution cultures. Similar work has shown inherited differences in nutritional requirements among different pure strains of tomatoes, and of other crop plants. "Whitebud" of corn which has been corrected in Florida by application of zinc salts was much more severe in some varieties of corn than in others. The more susceptible varieties were those developed on the more fertile soils.

This brief review supports the general belief that crop plants may be bred for adaptations to variations in available nutrient elements and to variations in climatic factors. A vast amount of data from cooperative tests of experimental hybrids by state and federal agencies shows also a considerable amount of differential response of hybrids to conditions in different states at the same lattitude.

Let us look now at the general picture of corn-breeding experience for indications of how rapidly we may breed corn for adaptation and how far the process may be carried.

Domesticating Corn

Most of the work of developing the highly domesticated corn plant with its unique structure, the ear, was done in past centuries. Controlled breeding experiments were begun 50 years ago when Hopkins at the Illinois Experiment Station introduced his ear-row breeding plan. One novel feature was the planting of a row of corn with seed taken from a single ear. Ear-row selection was the selection of a few of the more productive of 100 such ear rows.

A few years after ear-row breeding began the still further complication of growing ear-rows from self-fertilized plants was started. This new practice eventually led to hybrid corn which now grows on about two-thirds of the corn acreage of the United States. The realized yield improvement from hybrid corn is estimated at about 20 per cent, although considerably higher gains have been obtained in experimental plots. Such gains are obtained with only a few certain combinations of inbred lines. Many combinations are actually less productive than the original varieties from which the inbred lines were derived.

Among some corn breeders there has been the expectation that a considerable further advance in yield of hybrids would appear when a new cycle of inbred lines had been derived from crosses of the best lines of the first cycle. It is now fairly clear that this expectation is not to be realized beyond a very limited extent which is truly disappointing if no alternative can be found.

Various explanations have been suggested for the apparent halt in progress of developing still higher yielding hybrid corn. One is that a close approach to a physiological ceiling has been realized in the better hybrids now in hand. Another is that the later cycles of work have been too limited in extent.

A third possible explanation which has been of great interest to me recently is that our breeding operations have been designed on a misconception of the genetic nature of hybrid vigor in corn.

If we must accept either of the first two explanations, we must be prepared to be content with little more than 20 per cent improvement of corn yield in the South by the use of hybrid seed. The extensive work of the past 20 years on development of hybrid corn in the main corn belt area is not likely to be equalled anywhere in the South for a long time. If we may find the third explanation correct, our expectations for improvement of corn yield may be considerably greater.

Behavior of Cycles

Behavior of corn yield in breeding experiments has been somewhat enigmatic. First of all the extensive and long continued ear-row selection effected hardly any improvement of yield at all. In the two succeeding decades selection within and among self-fertilized lines based both on appearance of the lines and on hybrid performance effected an improvement of 20 per cent in yields. This not inconsiderable result was obtained early with the first cycle of inbred lines. Later work with second and even third cycles of inbred lines has provided little or no further improvement of yield. In contrast, second and third cycle lines are frequently very great improvements over lines of the first cycle in many other desirable characteristics. We recall, too, that the Illinois ear-row selection experiments were very effective in modifying oil and protein content of the seed and morphology of the plant.

In 1935, we began at the Florida Station with a cross of the large late field variety Tuxpan and the small early sweet variety, Golden Cross Bantam. Selection was practiced at approximately the rate of the best plant in 100 for the most leaves or nodes on the stalk. The astounding result after four generations was a new strain with an average of 20½ leaves or nodes above ground. The average for original stock was 13. No plant with 20 leaves was observed among some 1,300 of the original stock. But by measuring the variation statistically of several hundred of the original plants it was estimated that one with 20 nodes might have been expected once among some 10,000,000. Thus, the gain effected by growing about one-fourth acre of corn each year for four years was approximately that of growing 3,000 acres the first year and selecting the best single plant. The principle involved here is roughly analagous to dilution technic. A laboratory utensil is rinsed three times successively with 10 c.c. each time to obtain the same dilution of contamination with 30 c.c. as would be done by 1,000 c.c. in a single rinsing.

This multiplicative principle must have been understood, at least in part, by early operators of ear-row selection. Failure of the ear-row method and subsequent success of hybrid corn for improvement of so important a character as corn yield have probably caused undue emphasis to be given to inbreeding and too little to recurrent selection as plant-breeding tools.

Selection for high oil on the ear-row plan continued for 28 years by the Illinois Experiment Station achieved a result equivalent to improving yield 120 per cent. This comparison is made with due allowance for initial genetic variability of the respective characters.

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Soil Aeration Affects Fertilizer Needs

By Kirk Lawton[1]

Soil Science Department, Michigan State College, East Lansing, Michigan

IN the last few years there has been a growing interest in the subject of soil aeration. Although considerable investigation has been carried out by Cannon (2) and others concerning germination, growth, respiration, and other metabolic activities of plants as influenced by soil aeration, the role of oxygen and carbon dioxide in the absorption of nutrients from field soils by crops has only been partially explored. The need for more study of soil aeration as it affects plant growth has been pointed out in a recent article by Hoffer (5).

In culture solutions plant physiologists have studied rather closely the influence of aeration on nutrient uptake of a number of crop plants such as soybeans, tomatoes, and barley. Different plants have been found to have different aeration requirements. It is generally agreed that oxygen must be supplied to maintain cell activities associated with the accumulation of salts

[1] The author was formerly associated with the Department of Agronomy, Iowa State College. Now with Soil Science Department, Michigan State College.

Fig. 1. The influence of nutrient treatment, moisture content, and compaction of a Clyde silt loam soil on the growth of corn.
Jar 1—NP fertilizer, 25% soil moisture, no compaction.
Jar 2—NPK fertilizer, 25% soil moisture, no compaction.
Jar 3—NP fertilizer, 50% soil moisture, no compaction.
Jar 4—NPK fertilizer, 50% soil moisture, no compaction.
Jar 5—NP fertilizer, 25% soil moisture, compaction.
Jar 6—NPK fertilizer, 25% soil moisture, compaction.

Fig. 2. The effect of compaction and nutrient treatment on corn grown on a Clarion loam soil at 15% moisture.

Jar 1—No compaction, NP fertilizer.
Jar 2—Compaction, NP fertilizer.
Jar 3—No compaction, NPK fertilizer.
Jar 4—Compaction, NPK fertilizer.

by plants. A recent study by Chang and Loomis (3), however, points out that carbon dioxide toxicity must be considered along with oxygen deficiency as a factor affecting plant development under conditions of poor soil aeration.

We would expect to find evidence of poor soil aeration in reduced yields, stunted growth, or nutrient deficiency of crops wherever the amount of functional pore space occupied by air has been reduced below the critical limit either by high moisture content or by the compaction of the soil through tillage operation or lack of it. Everyone has seen corn or beans or some other crop stunted in growth and yellowed when water has stood in the field for a week or more. Likewise it is quite surprising sometimes to see plants in these same waterlogged spots become green and produce good yields if the excess water is drained away fairly quickly. At other times plant functions may be interrupted for so long a time by lack of soil oxygen or the presence of high concentrations of carbon dioxide that the crop never regains full growth or dies.

A good deal of interest in the relation between soil aeration and tillage practice has been evoked in consideration of the relative merits of plowing versus subsurface tillage. Data and observations from several agricultural experiment stations indicate that in certain seasons and on some soils plowing for corn may be definitely superior to discing or subsurface tillage. Bower, Browning, and Norton (1) believe that the method of seedbed preparation for corn has an important effect on yield as the tillage operation affects soil aeration and in turn the absorption of soil nitrogen and potassium. Certainly plowing produces a seedbed which is looser and better aerated than the other practices mentioned.

On the other hand, compaction of the soil and reduction of total pore space by working the soil when too wet, by the continual use of heavy farm implements, or through the action of very heavy or beating rains might critically lower the soil air supply and limit

Fig. 3. The effect of forced aeration and nutrient treatment of corn grown on a Clarion loam soil at 40% moisture.

Jar 1—No aeration, NP fertilizer.
Jar 2—Aeration, NP fertilizer.
Jar 3—No aeration, NPK fertilizer.
Jar 4—Aeration, NPK fertilizer.

root penetration and respiration with resultant lowered crop yields. It has been suggested by Hoffer (5) that on some soils adequate nutrients may be present, but if soil aeration is a critical factor the response of crops to fertilizers may be very small.

The relation between the various forms of nitrogen in the soil and aeration conditions has long been recognized. By means of soil tests it is quite easy to demonstrate in the laboratory or field the conversion of ammonia nitrogen to nitrates when the oxygen supply in the soil is adequate. Recently the absorption of potassium by plants has been found to be directly related to aeration conditions in culture solution. Hoagland and Broyer (4) found that the uptake of potassium by barley plants could be closely correlated with the supply of oxygen. The influence of carbon dioxide toxicity on the reduction of absorption of nutrients, and potassium in particular, has been shown by Chang and Loomis (3) in their studies on maize plants.

To study the effect of soil aeration on the growth and absorption of nutrients by corn, greenhouse experiments were conducted recently at the Iowa Agricultural Experiment Station (6). The soils selected for study were a Clyde silt loam from a poorly drained field in northeastern Iowa and a Clarion loam from the central part of the State. Chemical analyses of the Clyde soils indicate a high content of available potassium, but additional potash in the form of fertilizer is generally needed to produce high yields of corn. This would indicate that although there there is a good supply of potash in the soil, some factor such as high soil moisture is limiting potassium absorption by the plant. Tillage studies on the Clarion soil in 1944 showed that severe potash deficiency occurred in corn plants on plots where subsurface tillage was practiced. On plots where plowing was used as the method of seedbed preparation, the corn was healthy and green.

A comparison of several degrees of soil aeration was obtained in three ways. Two moisture levels were used together with two degrees of soil compaction or tamping and a forced air system. Fertilizers were added to half of the pots to see whether additions of potassium and phosphorus would help alleviate the effects of poor soil aeration. At the end of the experiment the tops and roots of the corn plants were harvested, dried, weighed, and the tops analyzed for total nitrogen, phosphorus, potassium, calcium, and magnesium.

As one might suspect, the size and weight of plant tops and roots were reduced as the soil moisture content was increased. The per cent of potassium in the plant, as indicated, decreased likewise. This was the case also for nitrogen and phosphorus. A small increase for calcium and magnesium was found in plants on the Clarion soil. The corn grown on the Clyde soil without potash fertilizer showed marked potassium starvation signs especially when soil aeration conditions were poorest. Addition of a rather large amount of potash to both soils caused luxury consumption of this element. Calculations showed that the total pore space occupied by air was reduced from about 35% to 0% at the high moisture content for the two soils.

Creating conditions of poor soil aeration by artificial soil compaction gave similar results. Yields were very low and resultant functional pore space was reduced almost completely when the soils were tamped.

Root development was less when the soils were tamped than when high soil moisture treatments were used. Since the pore space was lowered approximately to zero in both cases, it would indicate that root growth was limited in part by difficulties in penetrating the packed soil mass. Tamping the soil reduced the potassium content of the corn plants, but increased the ni-

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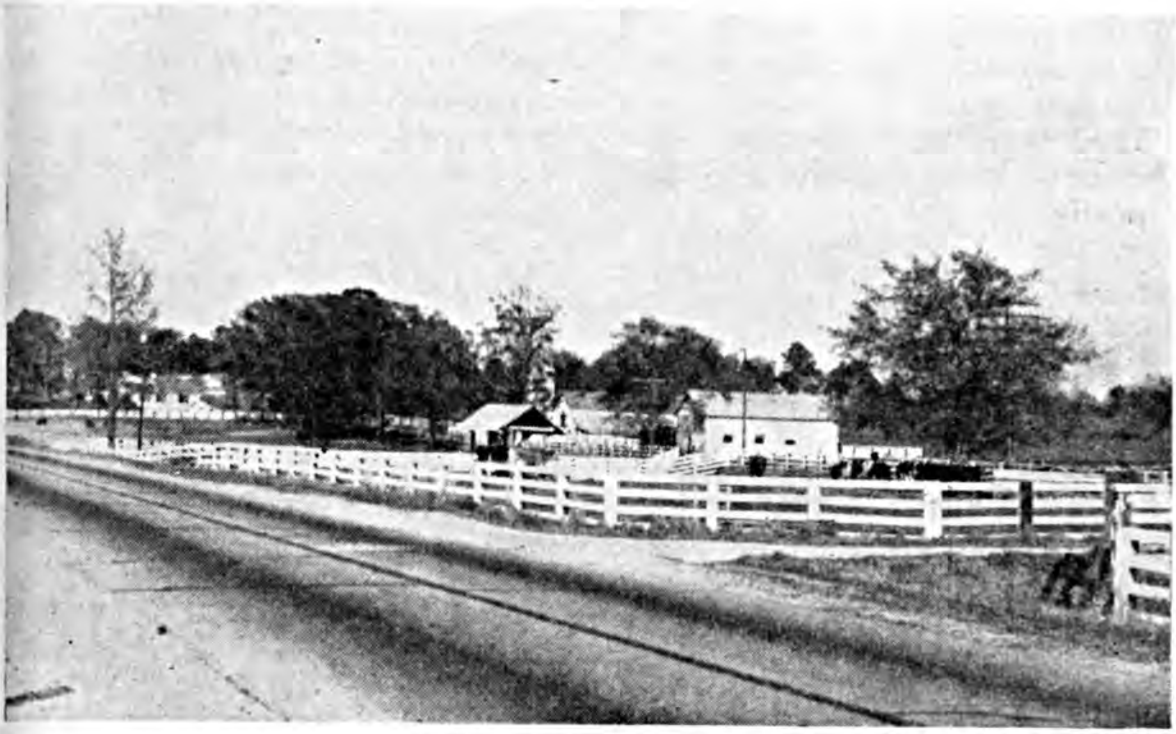
TABLE 1

Fertilizer treatment			NP	NPK	NP	NPK
	% soil moisture	% pore space occupied by air	Yield of tops in grams		% K in plant tops	
Clarion loam	15	37.1	20.8	24.6	2.10	3.15
	40	0.0	13.3	18.1	0.95	2.06
Clyde silt loam	25	30.4	7.4	24.7	0.95	4.68
	50	0.0	4.7	13.3	0.65	2.58

TABLE 2

Fertilizer treatment			NP	NPK	NP	NPK
	Soil treatment*	% pore space occupied by air	Yield of tops in grams		% K in plant tops	
Clarion loam	Normal	37.1	20.8	23.9	2.10	3.14
	Packed	1.0	8.7	10.7	0.81	2.85
Clyde silt loam	Normal	30.4	7.4	24.7	0.93	4.68
	Packed	0.2	2.6	10.8	0.80	2.80

* Clarion and Clyde soils were held at 15 and 25% soil moisture.



A general view of the Burton farmstead. Cattle and feed barns and silo in foreground, residence in background.

The Burtons Farm To Feed People

By Fred J. Hurst

Director of Information, Farm Credit Administration, New Orleans, Louisiana

IT'S a wonderful thing to reclaim, transform, and improve a run-down farm. It's reassuring to see eroded areas terraced, limed, fertilized, and sodded to grasses and clovers. It's an inspiration to see grain grow and cattle graze where weeds flourished. In a world where millions suffer from hunger, it's a good thing to farm more efficiently and produce more abundantly.

That is what W. L. Burton, a Jackson, Mississippi, businessman and his son, Billy, have done. Six years ago the Burtons bought an 800-acre farm near Jackson. This farm had been practically abandoned. It had been poorly farmed. The soil had been depleted. The hill land was eroded. The bottom land needed draining. There were no fences. The buildings were dilapidated. Practically the whole farm had grown up in worthless, limby trees, bushes, and briars.

Probably if Mr. Burton had been a full-fledged farmer he might have hesitated to tackle the job. But he operates a restaurant in Jackson. Having been raised on the farm, he had a yearning to get out in the wide-open spaces and get the smell of fresh air and wild flowers. He wanted to ride horses and see cattle grazing. And Billy had become tremendously interested in raising cattle. He wanted to engage in some challenging occupation and needed a full-time managerial job. So the farm was the answer to the wishes of both father and son.

The Burtons believed they could take over the old farm, rebuild it, and make it productive. And that is what they have done. They have cleared away the briars and bushes. They have built terraces and filled in the gullies. They have stopped erosion and dug miles of ditches. They have put out limestone and added phosphate and applied potash. They have grown and plowed under soil-building legumes. They have built lush pastures. They have developed a magnificent herd of registered Hereford cattle. They have produced big crops of corn and oats and hay.

Drive south from Jackson on Highway 51 for about eight miles and you will see the Burton farm. There is a beautiful country home, big hay and cattle barns, white painted fences, lespedeza meadows, green pastures, grazing cattle.

But it has taken a realistic faith in the principles of agricultural science, a practical knowledge of the best farming practices, the assistance of agricultural agencies, the use of modern machinery, a considerable volume of capital and ready cash money, and a lot of hard work to bring about the transformation.

Sought Help

Realizing the need for the latest information on farming, Mr. Burton from the very beginning sought the help of his county agent, the Soil Conservation Service, the Agricultural Conservation Service, and other agricultural agencies and workers. He visited and studied other successful farms and attended meetings of the Jackson Farm Club.

The first things needed were clearing, terracing, and ditching. For this purpose, Mr. Burton contracted for a bulldozer and put this giant machine to work clearing the land, pushing up stumps, filling gullies, and digging ditches. For weeks the bulldozer was kept busy subduing the wilderness of bushes, blotting out gullies, forming terraces, and making the land ready for the plow. Four stock ponds were built.

Corn and oats for grain, lespedeza and soybeans for hay, and white clover, Dallis grass, and lespedeza for pasture, make up the cropping and pasture program. This system provides a protective covering for nearly every acre of land, produces cheap feed for livestock, permits use of labor-saving machinery, and reduces hand labor to a minimum.

This year there were 120 acres in oats, 80 acres of which were seeded to white clover and lespedeza for pasture, and 40 acres to lespedeza for hay. The land was thoroughly prepared, fertilized with 1,000 pounds of basic slag, 100 pounds of nitrate of soda, and 100 pounds of muriate of potash per acre, and seeded to 2½ bushels of certified oats per acre early in October. White clover was seeded on the oats in October and lespedeza planted in February. The oats were top-dressed with 200 pounds of nitrate of soda in February.

The 120 acres of oats were combined the last two weeks in May and yielded 5,000 bushels. On May 30 when I walked over the farm with Mr. Burton and Billy, the 80 acres of oat land which had been seeded for pasture was half knee-deep in white clover and lespedeza and the 40 acres of Kobe lespedeza, except in spots where the stand was sparse, promised to yield 1½ to 2 tons of hay per acre.

This combination of oats and lespedeza for grain and hay is one of the most economical ways to conserve soil fertility and produce feed cheaply. The oats cover the land during the winter and yield a grain crop in the spring. The lespedeza produces a dense growth that covers the ground, holds the topsoil, adds nitrogen and humus to the land, and produces a good feed crop in the fall.

Farmers who use this combination should remember that the oats need a liberal supply of nitrogen fertilizer.

Part of the Burton Hereford herd on permanent pasture.

The lespedeza responds wonderfully to applications of phosphate and potash, and these two elements should be applied in amounts needed.

We have never seen a more efficient job of oat harvesting than that witnessed on the Burton farm. The oats were combined, the straw was windrowed with a 12-foot, side-delivery rake and then baled with a one-man pickup baler, which turned out 1¼ bales per minute and covered 40 acres in a day. Lespedeza will be cut with a power-mowing machine, raked with a tractor-drawn, side-delivery rake, and baled with the one-man baler, which is a real

Fresh roasting ears and other wholesome vegetables are produced on the farm for direct sale to consumers.

labor-saver and enables the farmer to get his hay in the barn in a hurry and take advantage of favorable weather.

There are 60 acres in corn. Every effort is made to obtain high yields. The land is thoroughly prepared by plowing and harrowing. Hybrid seed are planted; 400 pounds of 6-8-8 fertilizer per acre are applied before planting and the corn is side-dressed with 200 pounds of nitrate of soda unless it follows a winter cover crop that was plowed under.

Soybeans are drilled in rows, fertilized with 200 pounds of 6-8-8 per acre, and cultivated two or three times. Heavy seeding, early planting, balanced fertilization, and clean cultivation are essential to good yields.

One of the most important and efficient jobs done on the Burton farm has been the establishment and improvement of permanent pastures. Neither labor nor money has been spared in building pastures which are now carrying up to one animal unit per acre. Every acre of hill land on the farm not in timber has been put in pasture. Nearly 500 acres of bottom land have been established to pasture.

Control of surplus water by terracing and drainage, addition of nitrogen and humus to the soil by plowing under a crop of vetch in the spring and a crop of crotalaria in the fall, thorough preparation of the seed-bed by plowing and harrowing until the soil was finely pulverized, application of two tons of limestone and fertilization with 400 to 600 pounds of 20 per cent superphosphate and 200 pounds of muriate of potash per acre, and heavy seeding were practices followed in building highly productive permanent pastures.

Mr. Burton found heavy seeding important. He seeded 10 pounds of white clover and 30 pounds of Dallis grass per acre in October and 30 pounds of lespedeza in February. This is about double the usual rate of seeding, but these amounts have proved profitable in getting a thick stand and in establishing a heavy sod of grasses and clovers, which has crowded out other plants and withstood heavy grazing without impairing the stand.

In addition to using plenty of mineral fertilizers, Mr. Burton says, "I have some spots which I have to manure and reseed. This added fertilization and seeding are necessary to build up

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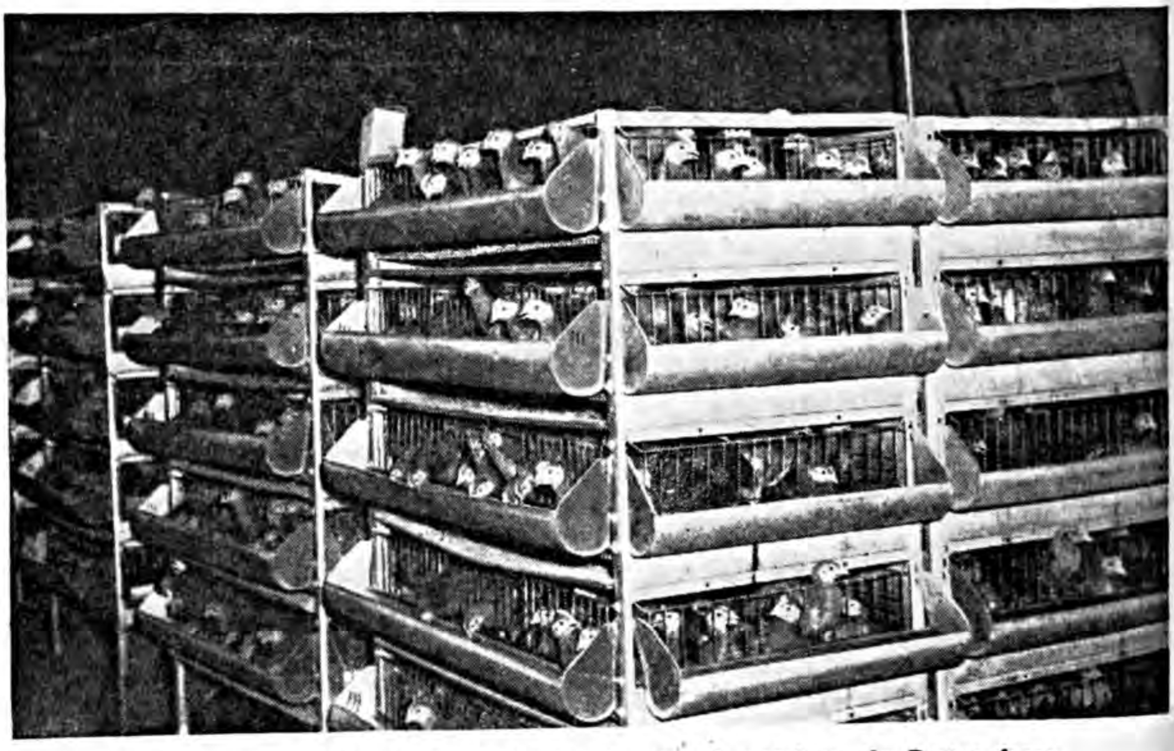

Showing some of the 4,000 broilers produced each month on the Burton farm.

Tip-Burn-Like Condition in Greenhouse Lettuce Corrected By Borax

By E. E. Greer

Williamson County Agent, Marion, Illinois

IN the Spring of 1944 the author was asked to assist two Williamson County greenhouse operators who reported peculiar symptoms in leaf lettuce appearing just at marketing time. This lettuce showed a necrotic tissue near the leaf margin and over the growing point. The plants seemed to have thick, small-cupped, brittle leaves. The leaves then browned and death resulted at the growing point. The lettuce leaves seemed brittle and in handling gave a metallic, rustling, paper-like noise.

The soil samples taken from the greenhouses showed that as far as nitrogen, phosphorus, and potassium were concerned they were sufficient for good growth of the lettuce. The management of the greenhouses was carefully checked and found to be satisfactory.

According to J. S. McHarque and R. K. Calfee in reporting on the effects of boron on the growth of lettuce in Plant Physiology, Volume VII of 1932, a similar condition existed in boron-deficient head lettuce plants. A. D. Moinat, in Plant Physiology, Volume XVIII of 1943, reported the thickening and the cupping-like condition on lettuce grown in nutrient solutions without boron.

Soils in Illinois have shown boron deficiencies in several soil types. Alfalfa was found to be sensitive and has responded to boron in southern Illinois.

The soil in these greenhouses has been used consistently for more than 30 years. It is the highly weathered type common to southern Illinois and is one expected to be low in available boron for alfalfa and other legume crops. Previous to 1935 manure from the livestock yards at East St. Louis had been applied at the rate of 100 tons per acre. For the last 10 years manure produced on their own farms has been used. Since the farm soil is probably low in available boron, the feeds produced and fed to the livestock are likewise low. This soil had been producing three crops of lettuce yielding 50 to 60 tons per acre and tomatoes yielding from 20 to 30 tons which has caused a heavy withdrawal of boron so that a deficiency for lettuce was created.

Followed Recommendations

Mr. Ridgway, owner of one of the greenhouses, followed the author's recommendations and applied 30 pounds of borax per acre in the greenhouse unit in which the tip-burn-like condition appeared to be worse. The borax was applied ahead of the second planting. The results of this simple and single treatment were phenomenal. At harvest time the total yield of the previous crops increased from 10 tons to a yield of 20 tons per acre. The leaves yielded their normal green growth throughout the harvest without even a trace of the tip-burn condition.

Mr. Greer followed the instructions

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The long runners of Tropical kudzu enable it to thrive beneath trees in spite of competition with the trees for water and nutrients. In times of stress evidently the kudzu foliage under trees is supported by distant roots. Photo was taken six months after seeding.

Tropical Kudzu

By Emery A. Telford and Norman F. Childers[1]

Soil Conservation Service, U. S. Department of Agriculture, Mayaguez, Puerto Rico

THE kudzu (*Pueraria thunbergiana*) which is popular in the southern United States does not grow well in Puerto Rico or countries of similar climate. However, tropical kudzu, a close relative, is adapted to the soil and climatic conditions in Puerto Rico and is proving highly satisfactory.[2] It is filling a long-time need for a vigorous perennial legume which covers the ground thoroughly and quickly from seed, thus helping to control hill-side and gully erosion and at the same time adding organic matter and nitrogen to the soil.

The vine-like legume has several other qualities. It is relatively resistant to drought; grows well in full sun and beneath trees of moderate shade; has no serious insects or diseases; makes good pasture for dairy cows in Puerto Rico; and produces abundant seed, from which it is easily established. The legume tends to spread from an original planting when seeding is permitted, but it can be destroyed easily by plowing or cultivating. There is no danger of it becoming a pest on cultivated lands

[1] Mr. Telford is in charge of Observational Studies for the U. S. Soil Conservation Service, Mayaguez, Puerto Rico. Mr. Childers is Assistant Director, Federal Experiment Station, Office of Experiment Stations, U. S. Department of Agriculture, Mayaguez, Puerto Rico.

[2] Tropical kudzu seed was brought to Puerto Rico in 1940 by Dr. W. F. Stewart, Boyce Thompson Institute, Yonkers, New York, from The Rubber Research Institute of Malaya. The seed supply was increased by H. W. Alberts, former agronomist in charge of Soil Conservation Service Research Station, Río Piedras, Puerto Rico. Tropical kudzu was originally thought to be Wild Cowpea *(Vigna vexillata)* but later identified as *Pueraria phaseoloides (javanica)* Benth. by F. J. Herman, Associate Botanist, Division of Plan Exploration and Introduction, U. S. Department of Agriculture.

and it forms a valuable permanent cover on uncultivated lands.

Tropical kudzu is a common crop in Java, Sumatra, Malay, and neighboring countries where it is used as a ground cover while young rubber and cinchona plantations are becoming established. The Firestone Plantations Company in Liberia, West Africa, reports several thousand acres of this cover crop in their young rubber plantations. In the Indio-Rubber Journal of April 6, 1940, Ashplant reports a reduction in root rot of rubber trees where this plant was used as a cover crop in Sumatra.

The crop has been grown only since 1940 in Puerto Rico but has already proven itself superior to other legumes and many grasses at the Federal Experiment Station. Its trailing runners may extend from 20 to 30 feet up and down banks, under trees, and over grasses and weeds until most undergrowth, such as nut-grass, is smothered by the dense mat of runners and dead leaves. When planted among young trees, it has a tendency to climb the trunks, but the runners can be removed at two- or three-month intervals, and the labor is much less than that required to cut with a machete the natural growth of the entire area.

Not Exacting in Soils

Tropical kudzu is not particularly exacting in soil requirements. At the Station it is growing and flowering luxuriantly on heavy excavated clay soil. In a Catalina clay soil (pH 4.5) the roots were found penetrating to at least 4½ feet. No doubt this accounts for its ability to continue growing slowly during extended dry periods when other legumes, such as Trailing Indigo, show considerable distress. It has grown on poorly drained, compact clay loam and also on porous soils of a calcareous nature.

Fertilizer experiments on eroded or excavated soils revealed that young seedlings were stimulated by an appli-

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Left—A fertilizer experiment on excavated Catalina clay soil revealed that lime alone (poor growth this side of hat) and muriate of potash (plot beyond hat) had little effect on growth of kudzu seedlings, whereas complete fertilizer (background and immediate foreground) gave the seedlings a good start, as did the finely ground superphosphate (right). A complete fertilizer is recommended for seedlings and a month after planting, if the soil pH is below 6.0, lime also should be applied.

The Use of Caley Peas in Alabama's Black Belt

By Kenneth B. Roy

Editor, Agricultural Experiment Station, Auburn, Alabama

WHEN A. F. Caley walked through an old cotton field on his dairy farm near Marion Junction, Alabama, one late spring morning in 1935, little did he realize that he was to find a legume that was later to become a favored forage crop with stockmen in the Alabama Black Belt.

It was *Lathyrus hirsutus,* commonly known as rough peavine, wild winter pea, or Singletary pea. Years before it had been discarded as a soil-builder because it produced green matter too late in the season to be followed in a rotation by most row crops. In the Southeast it now bears the name of Caley because of Mr. Caley's interest in its potentialities as a forage plant.

Experiments to determine how to grow and manage Caley peas as a forge plant since 1937 at the Alabama Agricultural Experimental Station's 1,100-acre Black Belt Substation adjoining Mr. Caley's farm have revealed that the crop is particularly suited in that section to forage-growing systems supporting livestock production.

Experimental Results

In early trials, begun the fall of 1937, Caley peas were placed in plots on lime soils of the Substation to determine best production methods. The crop was treated similarly to vetch, being planted on a good seedbed at the rate of 20 pounds per acre about the middle of September. It became apparent, after obtaining poor results from this treatment, that reasonably good stands might be expected from planting on a firm seedbed at about double the original rate of seeding.

With the discovery of the best cultural methods, Caley peas were planted on a 15-acre field in 1939. This field is still in production and continues to have good stands of peas without any additional seeding or cultivation. Later other areas were seeded for further experiments to determine the best uses, methods of handling, and combinations with other crops.

Out of this work has come a system of grazing that combines Johnson grass and Caley peas. Previously, the Substation had developed a method for using Johnson grass as a supplement to permanent pastures in times of drought and as a hay and grazing crop. In combining the two, it was discovered that the peas greatly increased Johnson grass yields, even more so than the spring clovers. Also, the combination extended the grazing of the areas.

Limited tests show that, if they are harvested before blooming and seeding stage, Caley peas may become an important source of legume hay in the region. Results from experiments at the Substation also indicate the possibility of Caley peas being grown in rotation with grain sorghum, and in combination with Dallis grass or fall oats. However, farmers are cautioned against this latter combination, unless they are willing to go to the expense of separating the oats and pea seed. If the combination is to be used as a hay crop, the Caley peas and oats are harvested before the Caley peas bloom.

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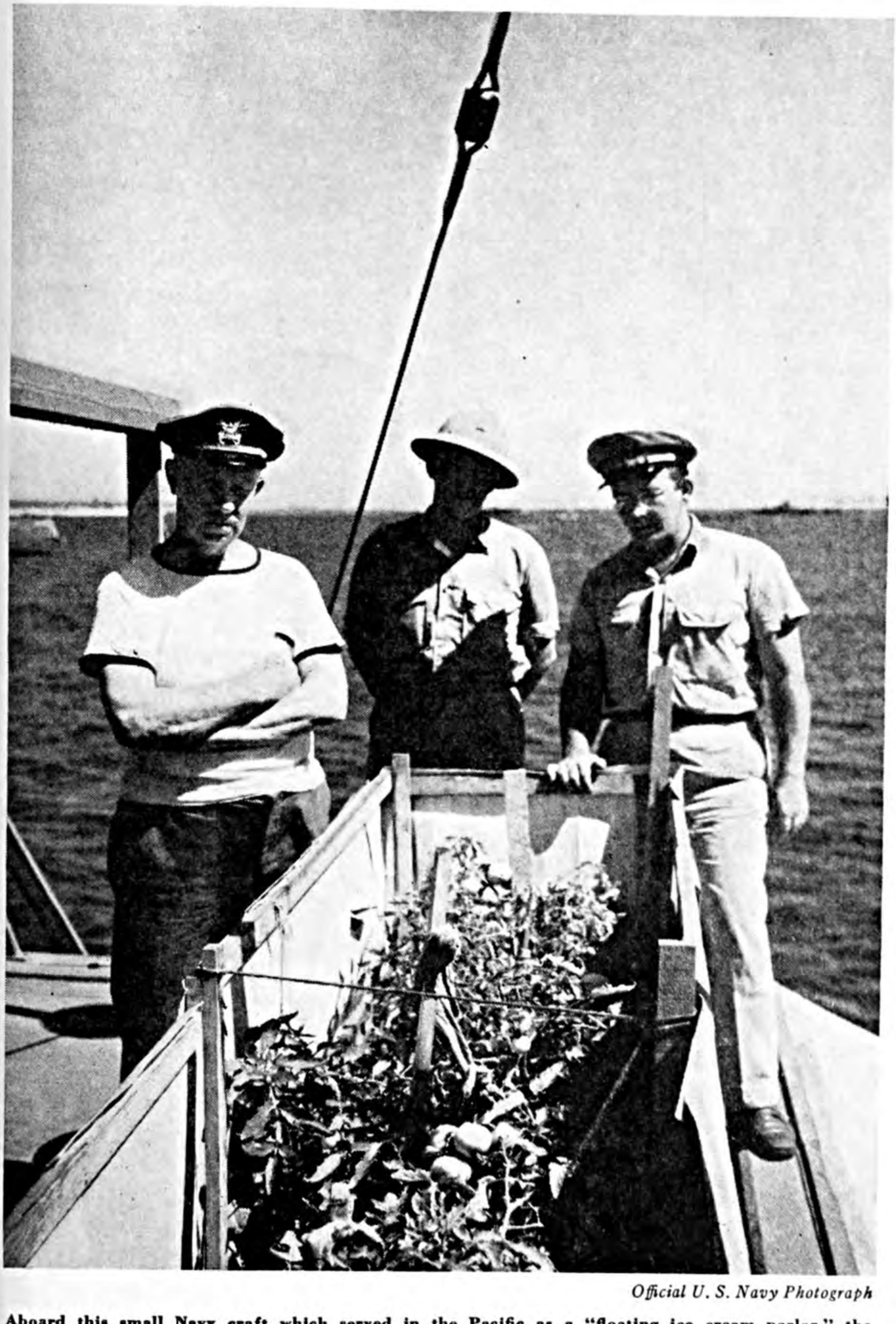
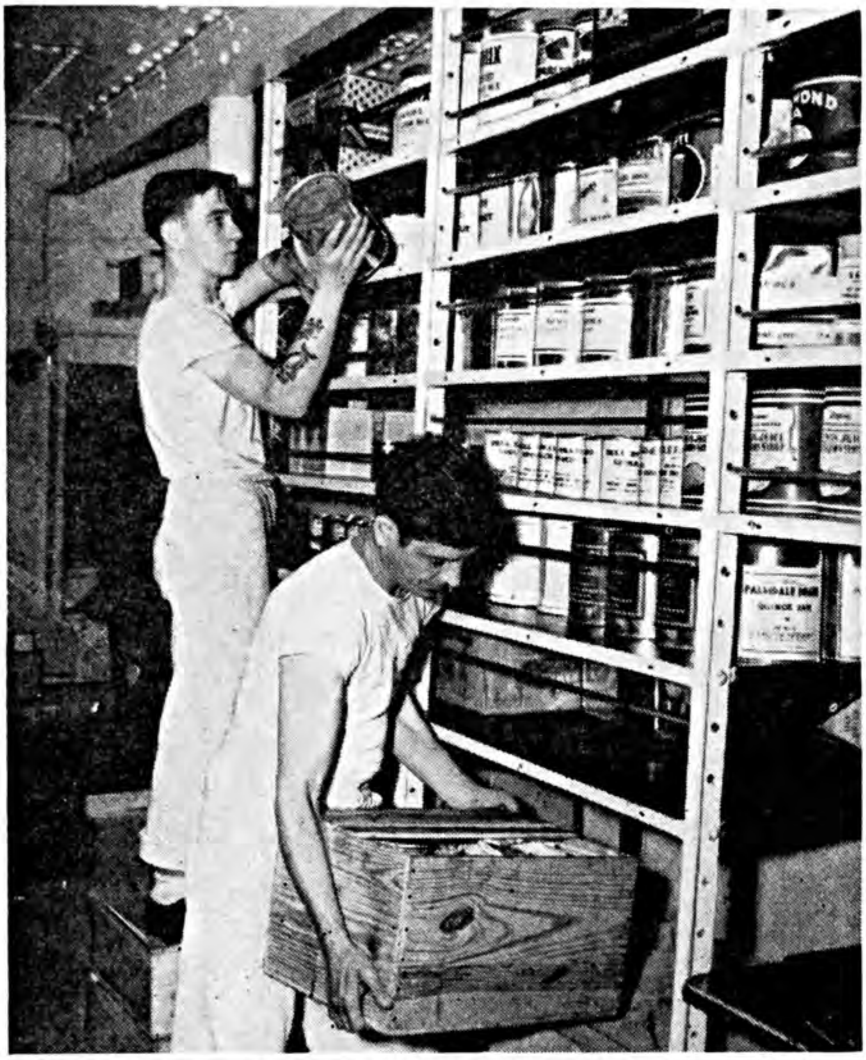
PICTORIAL



Official U. S. Navy Photograph

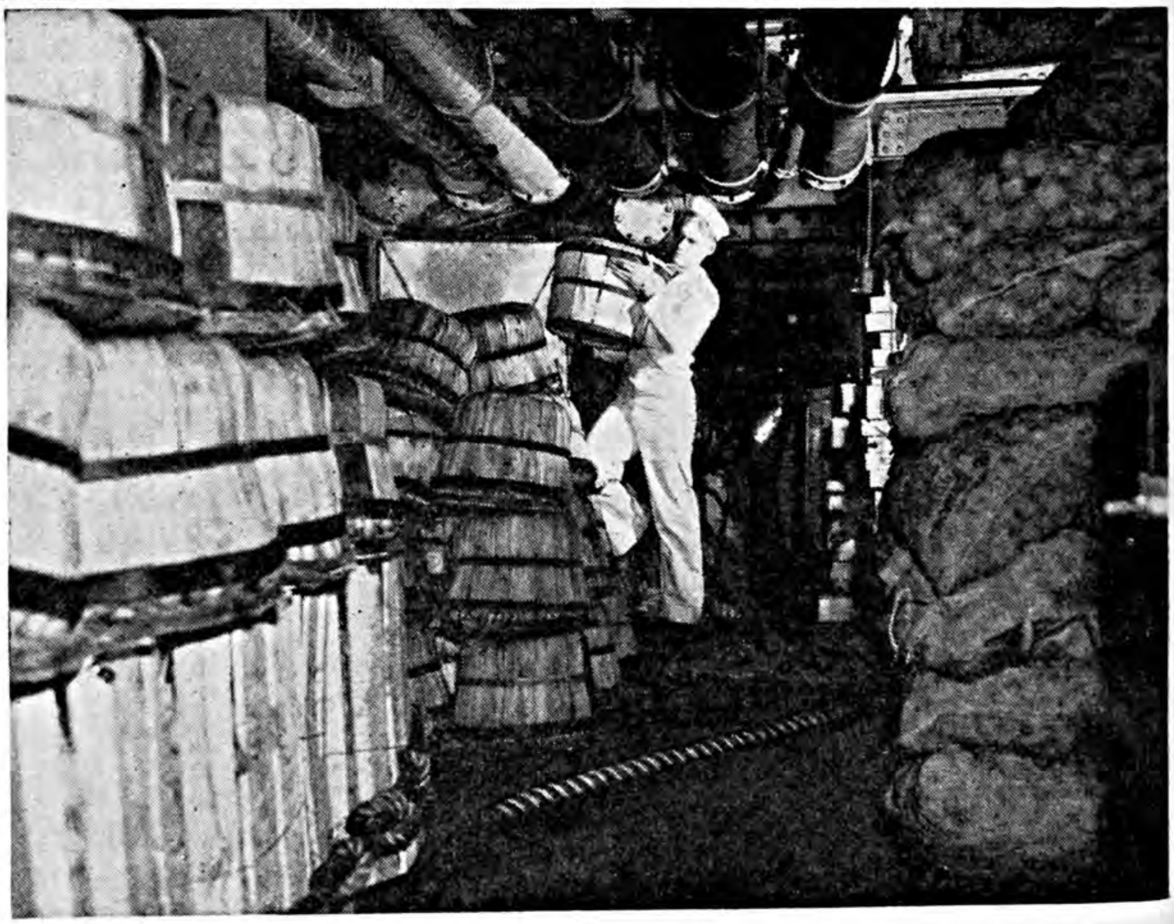
Aboard this small Navy craft which served in the Pacific as a "floating ice cream parlor," the skipper had a victory garden which gave him a personal supply of fresh tomatoes, radishes, and lettuce.

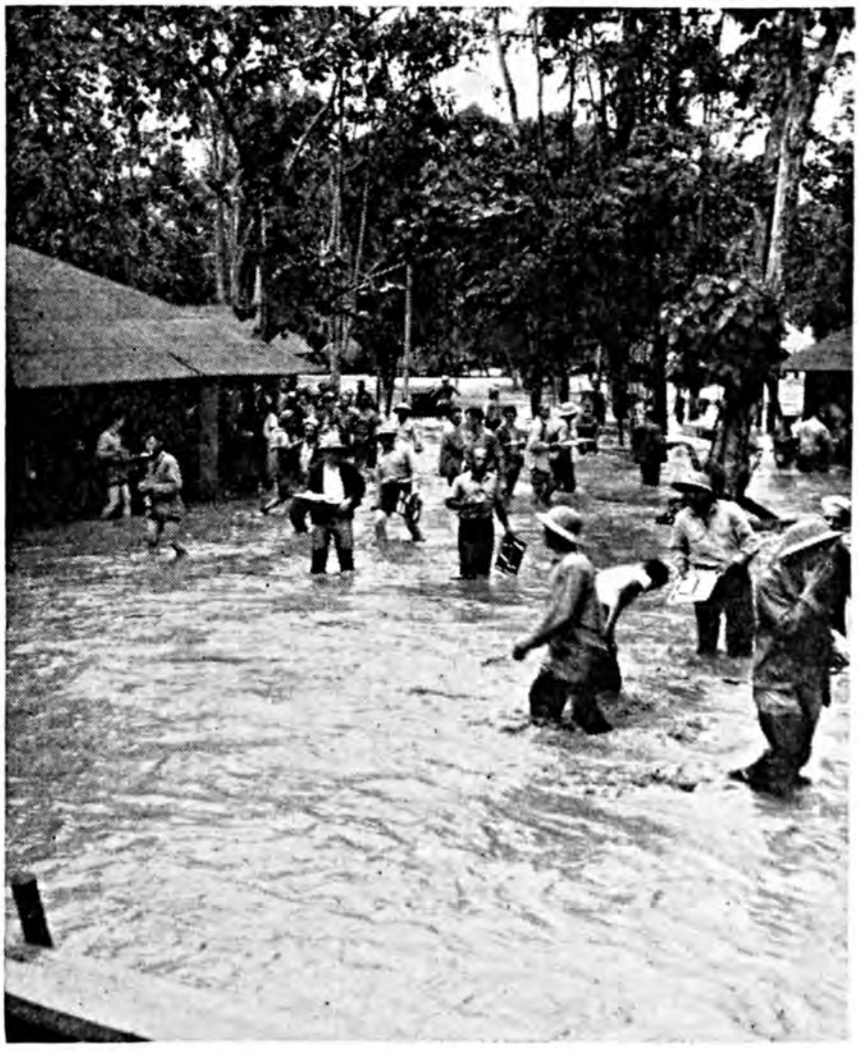


Left: Cleanliness and neatness are "musts" in the Navy. Here men are stacking canned goods in orderly rows on shelves.

Below: Perishable supplies are stacked under cover on ship for rigid Navy inspection before being sent below.

Official U. S. Navy Photographs





Above: This turkey made a long trip across the Pacific in order that these Navy men could have a real American Thanksgiving dinner.

Below: Chow line and water line, as Seabees attend to the "inner man" while getting the "outer man" good and wet on Guadalcanal.

Official U. S. Navy Photographs

Above: American agriculture went to the conquered soils of the Mariannas to furnish fresh vegetables to men on the fronts and in hospitals.

Below: Purebred cattle, 85 of them, were among the early arrivals for the Navy-Foreign Economic Administration farm on Guam.
Official U. S. Navy Photographs

The Editors Talk

A Self-sustaining Agriculture

In an address before the U. S. Chamber of Commerce at Atlantic City in April, Secretary of Agriculture Clinton P. Anderson defined a self-sustaining agriculture as an agriculture in which farmers will be on a level with all other American groups and be able to work with business and labor on equal terms for the benefit of all. He elaborated with six points:

1. It would stand on its own feet, operating at a fair level of profit without benefit of consumer subsidies, price controls, or continuous price supports or income payments.

2. It would operate on a basis of sustained yield, not obtaining current production and income through drains on future productivity. Under a self-sustaining agriculture, farmers will put back into the soil each year at least as much fertility as they take out.

3. It would operate on the basis of a price level that is at least reasonably stable. Farmers need assurance that the bottom is not going to drop out suddenly from under their prices and income.

4. It would offer reasonable assurance of an adequate living to the families who depend wholly on farming for their incomes.

5. It would operate with as little interference to the actions of individuals as is consistent with the welfare of farmers and the rest of the Nation. There will be times, of course, when common action clearly is in the general interest.

6. A self-sustaining agriculture must not only meet the needs of farm people, but also the needs of the rest of the Nation by supplying adequate supplies of foods and fibers and good markets for the products of industry.

Secretary Anderson then summarized briefly just what our agriculture is today: We no longer are the Nation of farmers we used to be. Just 18% of the total population—less than one person out of five—is on the land today. Yet that makes a total of more than 25 million men, women, and children who make their direct living from the soil. These families operate more than 6 million farms, ranging from vast ranches of thousands of acres down to intensively farmed vegetable enterprises of an acre or so—but also including farms that are too small and too poor to yield even the hardest working family a decent living. These farm people are the custodians of a total of 1,943,000,000 acres of our land—the greatest, richest agricultural empire in the world. Last year they harvested more than a billion bushels of wheat, 3 billion bushels of corn, 1½ billion bushels of oats, and 190 million bushels of soybeans. They milked nearly 26 million cows; they gathered eggs from 469 million hens; they had 40 million beef cattle on the range and in feed lots. Today's agriculture is a 90 billion dollar industry—that is how much its assets are estimated to be worth. In 1945 it produced more than 20 billion dollars of cash receipts for farmers.

Inspiring figures in which every American can feel pride! But the Secretary did not let it go at that. Touching on what happened to agriculture after the last war and during the depression, he outlined some of the problems ahead. He believes that the first prerequisite of a self-sustaining agriculture is Nation-wide full employment, but that even full employment in itself will not be enough to guarantee a strong and prosperous agriculture. Agriculture's capacity to produce may still run ahead of amounts people can buy. People in this country and abroad undoubtedly could use all that U. S. farmers will produce in the foreseeable future; but even in this country many families with the lower-paying jobs would not be able to purchase all the food and clothing they ought to have. The fact that there is a potential market for total farm production does not mean automatically there will be a market for as much of each separate commodity as farmers could turn out. To a certain extent, the pattern of farm production needs to be shaped to the pattern of potential demand.

He thinks that some parts of the job of maintaining the Nation's soil resources will still be too much for farmers acting as individuals. Also, that the constant research into better production and marketing methods, which all large industries must carry out, undoubtedly will be too much for individual farmers or even groups of farmers. Agriculture still will need special machinery for carrying adequate reserves of storable foods, feeds, and fibers from bumper years to years of lean production.

In concluding his address, Secretary Anderson told his audience that he hoped he had given them something of the picture he had of the possibilities for a self-sustaining agriculture. "We can achieve it only by give-and-take cooperation by labor, industry, farmers, and government. . . . You may be sure that farmers are ready and eager to do their part."

We believe his picture is well-drawn and offers enlightenment, not only to farmers but to all Americans, on the benefits to be derived from a self-sustaining agriculture.

TO THE FARMERS OF AMERICA:

In September, 1945, the Japanese surrendered. I regard it as significant that they surrendered during the harvest month, for, no less than the guns and the spirit of our men and women, it was the food which came from the great farming areas of this country that brought us to victory.

The Navy still remembers the heroic work of the farmers, who, although it is more than a year since the fighting ended, have not lessened their efforts to feed the nation and the starving peoples of the world. On Navy Day, October 27, 1946, I wish to thank the farmers of America.

JAMES FORRESTAL

Thus has the Secretary of the Navy acknowledged his gratitude and debt to his country's food producers. It is a nice tribute, and fitting, for it is generally known that food is one of the strongest weapons and that American service men were the best fed of any in the war. For some pictures showing the Navy's utilization of the food provided them, see the pictorial section of this issue.

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
September...	21.72	43.2	138.0	207.0	112.0	145.0	14.30	51.40	....
October......	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November....	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March........	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April........	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
May.........	24.09	43.0	157.0	251.0	135.0	170.0	14.80	49.60	....
June.........	25.98	59.0	147.0	251.0	142.0	174.0	14.70	51.50	....
July.........	30.83	56.7	148.0	275.0	196.0	187.0	15.00	60.00	....
August......	33.55	48.6	143.0	280.0	180.0	170.0	15.10	59.10	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
September...	175	432	198	236	174	164	120	228	159
October......	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January......	180	363	208	237	171	174	132	226	249
February....	186	339	209	254	173	175	133	223	275
March.......	183	319	225	269	178	179	137	211	283
April........	190	429	232	279	181	179	126	213	282
May.........	194	430	225	286	210	192	125	220	177
June.........	210	590	211	286	221	197	124	228	185
July.........	249	567	212	313	305	212	126	266	163
August......	287	486	205	319	280	192	127	262	162

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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
1922	3.04	2.58	6.07	4.66	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.59	5.16
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						
September	1.75	1.42	7.81	5.77	4.86	6.71
October	1.75	1.42	7.81	5.77	4.86	6.71
November	1.75	1.42	7.81	5.77	4.86	6.71
December	1.75	1.42	7.81	5.77	4.86	6.71
1946						
January	1.75	1.42	7.81	5.77	4.86	6.71
February	1.75	1.42	7.81	5.77	4.86	6.71
March	1.75	1.42	7.81	5.77	4.86	6.71
April	1.75	1.42	7.81	5.77	4.86	6.71
May	1.75	1.42	9.08	6.10	4.86	7.30
June	1.88	1.42	10.34	6.42	4.86	7.90
July	1.88	1.42	11.62	8.15	5.34	9.60
August	2.22	1.46	17.15	8.14	6.07	12.14

Index Numbers (1910-14=100)

1922	113	90	173	132	140	142
1923	112	102	177	137	136	147
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						
September	65	50	223	163	144	191
October	65	50	223	163	144	191
November	65	50	223	163	144	191
December	65	50	223	163	144	191
1946						
January	65	50	223	163	144	191
February	65	50	223	163	144	191
March	65	50	223	163	144	191
April	65	50	223	163	144	191
May	65	50	259	173	144	207
June	70	50	295	182	144	224
July	70	50	332	231	158	273
August	83	51	490	231	180	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. At-lantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. At-lantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. At-lantic and Gulf ports	Manure salts bulk, per unit, c.i.f. At-lantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1922	.566	3.12	6.90	.632	.904	23.87	....
1923	.550	3.08	7.50	.588	.836	23.32	....
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
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	.570
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							
September	.650	2.20	6.20	.503	.749	24.44	.188
October	.650	2.20	6.28	.535	.797	26.00	.200
November	.650	2.20	6.40	.535	.797	26.00	.200
December	.650	2.20	6.40	.535	.797	26.00	.200
1946							
January	.650	2.20	6.40	.535	.797	26.00	.200
February	.650	2.20	6.40	.535	.797	26.00	.200
March	.650	2.20	6.40	.535	.797	26.00	.200
April	.650	2.20	6.40	.535	.797	26.00	.200
May	.650	2.20	6.40	.535	.797	26.00	.200
June	.650	2.30	6.45	.471	.729	22.88	.176
July	.650	2.60	6.60	.471	.729	22.88	.176
August	.700	2.60	6.60	.471	.729	22.88	.176

Index Numbers (1910-14=100)

	Super-phosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash in bags	Sulphate of potash magnesia	Manure salts
1922	106	87	141	89	95	99	....
1923	103	85	154	82	88	96	....
1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
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							
September	121	61	127	70	79	101	82
October	121	61	129	75	84	108	83
November	121	61	131	75	84	108	83
December	121	61	131	75	84	108	83
1946							
January	121	61	131	75	84	108	83
February	121	61	131	75	84	108	83
March	121	61	131	75	84	108	83
April	121	61	131	75	84	108	83
May	121	61	131	75	84	108	83
June	121	64	132	66	76	95	80
July	121	72	135	66	76	95	80
August	131	72	135	66	76	95	80

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**
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
September	197	181	153	96	57	175	121	74
October	199	182	154	97	57	175	121	78
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	156	97	57	175	121	78
February	207	185	156	97	57	175	121	78
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78
May	211	192	162	99	57	189	121	76
June	218	196	163	100	60	203	121	70
July	244	209	181	103	60	230	121	70
August	249	214	187	116	67	296	131	70

* 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] Since June 1941, manure salts are quoted F.O.B. mines exclusively.

**** The weighted average of prices actually paid for potash are 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

"Two-Row Distributor for Commercial Fertilizer," Ext. Serv., Texas A. & M. College, College Station, Texas, L-45, R. R. Hickerson.

"Smith County Homemade Lime and Phosphate Distributor," Ext. Serv., Texas A. & M. College, College Station, Texas, L-47, M. R. Bentley.

"Fertilizers for White Potatoes in the High Plains of Texas," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 989, Feb. 27, 1946, D. L. Jones.

"The Effects of Boron on Yield and Quality of Bright Tobacco," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 395, May 1946, E. M. Matthews and M. N. McVickar.

"Fertilizers and Lime in the United States, Resources, Production, Marketing, and Use," U.S.D.A., Washington, D. C., Misc. Publ. 586, May 1946.

"Preparation of Ammonium Nitrate for Use as a Fertilizer," U.S.D.A., Washington, D. C., T. Bul. 912, June 1946, W. H. Ross, J. R. Adams, J. Y. Yee, C. W. Whittaker, and Katharine S. Love.

Soils

"Land Clearing," Dom. of Canada, Dept. of Agr., Ottawa, Can., Publ. 739, F. B. 111, March 1946 (Rev.), P. O. Ripley, J. M. Armstrong, and W. Kalbfleisch.

"Effects of Soil Treatment on Soil Productivity," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 516, Dec. 1945, F. C. Bauer, A. L. Lang, C. J. Badger, L. B. Miller, C. H. Farnham, P. E. Johnson, L. F. Marriott, and M. H. Nelson.

"Soil Studies for 1945," Agr. Exp. Sta., Univ. of Nebraska, Lincoln, Neb., Bul. 382, May 1946, J. W. Fitts, J. R. McHenry, and W. H. Allaway.

"Grass Down Field Waterways," Ext. Serv., Univ. of Neb., Lincoln, Neb., E. C. 165, May 1946, D. E. Hutchinson.

"The Soil, Virginia's Basic Resource," State Soil Conserv. Committee, Blacksburg, Va., Rept. No. 3, Oct. 1945.

"Economic Land Classification of Southampton County," Agr. Exp. Sta., Va. Polytechnic Institute, Blacksburg, Va., Bul. 373, Aug. 1945, G. W. Patteson and S. C. Shull.

"Economic Land Classification of Shenandoah County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 376, Sept. 1945, G. W. Patteson and S. C. Shull.

"Economic Land Classification of Augusta County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 377, Sept. 1945, G. W. Patteson and J. A. McCartney.

"Economic Land Classification of Culpeper County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 379, Oct. 1945, G. W. Patteson and A. J. Harris.

"Economic Land Classification of New Kent County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 380, Nov. 1945, G. W. Patteson and J. A. McCartney.

"Economic Land Classification of Charles City County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 381, Nov. 1945, G. W. Patteson and J. A. McCartney.

"Economic Land Classification of Botetourt County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 385, Dec. 1945, G. W. Patteson and J. A. McCartney.

"Economic Land Classification of Loudoun County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 387, Jan. 1946, G. W. Patteson and S. C. Shull.

"Economic Land Classification of Hanover County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 391, March 1946, G. W. Patteson and A. J. Harris.

"Relation of Soil Reaction to Toxicity and Persistence of Some Herbicides in Greenhouse Plots," U.S.D.A., Washington, D. C., T. Bul. 911, Aug. 1945, Annie M. Hurd-Karrer.

"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," U.S.D.A., Washington, D. C., T. Bul. 916, June 1946, J. B. Pope, J. C. Archer, P. R. Johnson, A. G. McCall, and F. G. Bell.

"Physical Land Condition in Anderson County, South Carolina," U.S.D.A., Washington, D. C., Phys. Land Survey No. 38.

Crops

"Practices Used in the Production, Canning, and Marketing of Northwestern Arkansas To-

matoes in 1940-41," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 460, Oct. 1945, Otis T. Osgood and T. R. Hedges.

"Second Annual Irrigated Pasture Study Colusa County 1945," Ext. Serv., Univ. of Calif., Berkeley, Calif., B. B. Burlingame and G. E. Frevert.

"Establishment and Maintenance of Turf on Putting and Bowling Greens," Div. of Forage Crops, Dom. Exp. Farms Serv., Central Exp. Farm, Ottawa, Can., J. H. Boyce.

"The Care of Lawns," Div. of Forage Crops, Dom. Exp. Farms Serv., Central Exp. Farm, Ottawa, Can., J. H. Boyce.

"The Construction of New Lawns," Div. of Forage Crops, Dom. Exp. Farms Serv., Central Exp. Farm, Ottawa, Can., J. H. Boyce.

"Orchard Irrigation in British Columbia," Dom. of Can. Dept. of Agr., Ottawa, Can., Publ. 779, F. B. 134, June 1946, J. C. Wilcox.

"Tree Fruits Grown in Prairie Orchards," Dom. of Can. Dept. of Agr., Ottawa, Can., Publ. 780, F. B. 135, March 1946, W. R. Leslie.

"High Altitude Forage Investigations in Southwestern Colorado," Agr. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., Bul. 490, Jan. 1946, Dwight Koonce.

"Thirty-seven Years of Windbreak Planting at Akron, Colorado," Agr. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., Bul. 492, March 1946, R. J. Preston, Jr. and J. F. Brandon.

"Annual Report of the Director, 1945," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 259, Nov. 1945.

"Annual Report, 1945," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla.

"Chemical Composition of Hay and Forage Crops As Affected by Various Soil Treatments," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 518, H. J. Snider.

"Report on Agricultural Research, Part I: Project Reports, Publications, Staff Financial Statement; Part II: Iowa Corn Research Institute Tenth Annual Report," Agr. Exp. Sta., Iowa State College, Ames, Iowa.

"Size of Whole and Cut Seed and Spacing in Relation to Potato Yields," Agr. Exp. Sta., Univ. of Me., Orono, Me., Bul. 439, Dec. 1945, J. A. Chucka, Arthur Hawkins, Bailey E. Brown, and F. H. Steinmetz.

"Gardening for 12 Months," Ext. Serv., Miss. State College, State College, Miss., Cir. 134(30M), Feb. 1946, K. H. Buckley.

"The Agricultural Experiment Station Serves the Farmer," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 490, July 1945, M. F. Miller, S. B. Shirky, and H. J. L'Hote.

"59th Annual Report," Agr. Exp. Sta., Univ. of Nebraska, Lincoln, Neb., June 1946.

"What is Certified Seed?" Ext. Serv., Univ. of Neb., Lincoln, Neb., E. C. 167, D. L. Gross.

"Science for the Farmer," Sup. to 58th A. R., Agr. Exp. Sta., Pa. State College, State College, Pa., May 1946, B. L. Seem and A. C. Richer.

"Report of the Federal Experiment Station in Puerto Rico 1945," Federal Exp. Sta in P. R., Mayaguez, P. R.

"Swords into Plowshares," Ext. Serv., R. I. State College, Kingston, R. I., Bul. 103, March 1946.

"More Money From Cotton," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 280, March 1946.

"Northern Plant Novelties for 1946," Agr. Exp. Sta., S. Dak. State College, Brookings, S. Dak., H. Pamph. 34, March 1, 1946.

"Abstracts of Bulletins Nos. 663-677, Circulars Nos. 106-108, And Other Publications During 1945," Agr. Exp. Sta., A. & M. College, College Station, Texas, Cir. 109, Feb. 1946, Tad Moses.

"Forage and Seed Yields of Sorghum Varieties," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 991, March 6, 1946, J. R. Quinby.

"Main Station Farm Cotton Variety Test for 1945," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 992, March 8, 1946, J. E. Roberts and D. T. Killough.

"More Wheat," Ext. Serv., State College of Washington, Pullman, Wn., Cir. 101, June 1946.

White Burley Tobacco Production," Ext. Serv., W. Va., Univ., Morgantown, W. Va., Cir. 346A, Feb. 1946, Charles E. Campbell.

"White Burley Tobacco Production," Ext. Serv., W. Va. Univ., Morgantown, W. Va., Cir. 346B, Feb. 1946, Charles E. Campbell.

"Savory Herbs, Culture and Use," U.S.D.A., Washington, D. C., F. B. 1977, May 1946, M. S. Lowman and Miriam Birdseye.

"Production and Preparation of Horseradish," U.S.D.A., Washington, D. C., Leaf. 129, (Rev. Feb. 1946), W. R. Beattie.

"Report on the Agricultural Experiment Stations, 1945," U.S.D.A., Washington, D. C., Jan. 1946, J. T. Jardine, G. Adams, F. Andre, H. P. Barss, E. C. Elting, F. W. Fromme, F. G. Harden, H. C. Knoblauch, F. V. Rand, H. M. Steece, R. W. Trullinger, J. W. Wellington, and B. Youngblood.

Economics

"Father and Son Farm Agreements," Agr. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., Bul. 491, March 1946, R. T. Burdick.

"The Operations and Management of 13 Farmers' Cooperatives in North Georgia, 1944," Ga. Exp. Sta., Experiment, Ga., Bul. 246, May 1946, N. M. Penny.

"Farming Opportunities in the Midwest," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Bul. 325, 1946.

"The Kansas Agricultural Outlook for 1946," Ext. Serv., Kansas State College, Manhattan, Kansas, Cir. 190, Dec. 1945.

"Cooperative Association Law of Maryland," Ext. Serv., Univ. of Md., College Park, Md., Bul. 110, Feb. 1946, R. P. Callaway and S. H. DeVault.

"Postwar Readjustments in Massachusetts Agriculture," Agr. Exp. Sta., Mass. State Col-

lege, Amherst, Mass., Bul. 430, March 1946, David Rozman.
"Michigan Farm Organization and Practices Type-of-Farming Area 9," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Sp. Bul. 336, Feb. 1946, Lauren H. Brown.
"Facts About Flathead County's Agriculture and Suggestions to Prospective Farmers," Mont. Ext. Serv., Bozeman, Mont., Cir. 163, Dec. 1945.
"Relationships Between Cooperative Organizations Serving Farmers in Five Ohio Counties," Agr. Exp. Sta., Wooster, Ohio, Bul. 660, March 1946, G. F. Henning and L. B. Mann.
"Looking Forward in Oklahoma Agriculture," Div. of Agr., Okla. A. & M. College, Stillwater, Okla., Bul. B-299, June 1946.
"Looking Forward in Oklahoma Agriculture," Div. of Agr., Okla. A. & M. College, Stillwater, Okla., Cir. C-123, June 1946.
"Farming in West Virginia," Agr. Ext. Serv., Univ. of W. Va., Morgantown, W. Va., Cir. 345, Feb. 1946, Robert S. Boal.
"The Land Market," U.S.D.A., Washington, D. C., May 1946.
"Farm Population Estimates United States and Major Geographic Divisions 1910-1946," U.S.D.A., Washington, D. C., June 1946.
"Fruits (13 Noncitrus) Production and Utilization 1934-45," U.S.D.A., Washington, D. C., June 1946.
"Foreign Agricultural Trade," U.S.D.A., Washington, D. C., June 14, 1946.
"Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1945-46," Misc. Publ. No. 603, Agr. Research Adm., U.S.D.A., Washington, D. C., June 1946, B. T. Richardson.
"Changes in Farming in War and Peace," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., FM-58, June 1946, Sherman E. Johnson.
"World Food Prospects for 1946-47," Office of Foreign Agr. Relations, U.S.D.A., Washington, D. C., WFPI-46, July 29, 1946.
"National Survey of Liquid Asset Holdings, Spending, and Saving Conducted for the Board of Governors of the Federal Reserve System; Part III, Prospective Spending and Saving," Bu. of Agr. Econ., U.S.D.A., Washingon, D. C., Aug. 1946.

The Use of Caley Peas in Alabama's Black Belt

(*From page* 26)

While it was first believed that the crop required lime soil, the Substation is now growing excellent crops of Caley peas on moderately acid land without lime. However, on very acid soils, a lime application previous to planting is essential, the rate varying from one to three tons per acre depending upon the degree of soil acidity. It was also found that Caley peas grow well on bottom lands that are not too swampy but are too wet for clovers and small grains.

Use in Grazing System

Experiments at the Black Belt Substation have furnished evidence that Caley peas can be produced, managed, and used advantageously in forage systems. In utilizing the Johnson grass-Caley pea combination, cattle are grazed in the late fall on frosted Johnson grass, under which are the young volunteer pea plants. Later in the winter and early spring, the Caley peas are grazed. With good fall rains, the peas make enough growth to carry one mature animal on two acres of this combination through the winter without supplementary feed. When germination is delayed by dry weather, it is necessary to supplement the grazing with one to three pounds per head per day for at least a part of the wintering period.

In the 1945-46 wintering experiment, only the sucking cows were fed concentrate for the last 58 days of the 91-day period (December 1 to March 1) in addition to the grazing and stacked Johnson grass hay. Results from this wintering study are:

(1) Dry cows were fed no concentrate during the entire period, and lost an average of 79 pounds. Since they entered the winter carrying excess fat, this loss was of little importance.

(2) Calves entering the wintering period and those dropped during the period made an average gain of 128 pounds per head, or a daily gain of 1.41 pounds per calf. On March 1, the average weight per head, including

birth weight, was 207 pounds. All calves in this study were dropped after October 9.

(3) A total of 4.87 tons of cottonseed meal pellets was fed the sucking cows the last 58 days of the period. This concentrate cost $263.95 delivered. The gain of 6,550 pounds in weight by the calves during the 91-day wintering period at four cents a pound would pay the cost of the bought concentrate.

Advantages of Crop in the Black Belt

In favor of the Caley peas, the Substation has found these advantages if properly managed: (1) It produces considerable quantities of seed, which germinate the following fall; (2) it supplies grazing in late winter and early spring when feed supplies are usually short; (3) it stimulates growth of non-legume crops grown in combination with it; (4) it does not require land-breaking for planting; (5) it will grow on both lime and slightly acid soils; and (6) it will grow well on bottom land that is not too swampy but too wet for clover and small grains.

Toxicity to Livestock

Under certain conditions Caley peas may be poisonous to livestock. The toxic effect of the crop is associated very definitely with the stage of maturity. As the Caley peas reach blooming and seed-forming stage, animals grazing the crop are variously affected.

At the Black Belt Substation, cattle have been grazed on Caley peas during the seeding stage for three successive years. In one of those years the animals became stiff, but all recovered within 30 days and appeared to be normal even though they were left on the peas. In the other two years no toxic effects in the animals were observed. Observations indicate that, as the plant approaches maturity, it becomes less palatable to livestock, and if other vegetation is present they will graze it by preference. The most exaggerated effects of poisoning result when animals are suddenly switched from a dry, short pasture to a Caley pea field in the late blooming or seeding stage.

As far as is known, there is no record of cattle losses directly attributed to Caley peas.

History of Plant in State

The Caley pea (*Lathyrus hirsutus*) is a member of the peavine genus, which includes some 60 species. Actually, it is an old resident of Alabama. The first plant specimen taken in this country was at Mobile in 1880, but it was more than a half century before its forage possibilities became evident.

The recent work is not the Alabama Agricultural Experiment Station's first experience. In 1930, R. J. Goode, farmer and former Alabama commissioner of agriculture, found *Lathyrus hirsutus* growing wild on his farm near Gastonburg, and called it to the attention of the Station. At that time it was included in the experiment with winter legumes. However, it was discarded as a green-manure crop, because it made its growth too late for turning previous to planting most spring crops.

Adaptability of Crop

Because it is better suited for forage in the Black Belt than most other winter legumes, the Caley pea has won a definite place with many of the region's livestock men. Acreage has increased about as fast as seed supplies have permitted. In some localities, demands for Caley pea seed have exceeded available supplies.

Outside of that region, there is some question as to its place and adaptability in forage-cropping systems for other areas. While the Agricultural Experiment Station has established stands of Caley peas successfully on other soil types, further experimental evidence is needed in respect to its productiveness and use as compared with other crops. In experiments at the Main Station, Auburn, for example, earlier and longer grazing have been obtained from manganese bur clover and hard-seeded crimson clover, neither of which is toxic to livestock.

(*Editor's Note:* The Alabama Station has issued Mimeograph Series No. 17, "Caley Pea Production and Uses in Alabama," by K. G. Baker, Superintendent of the Black Belt Substation. A free copy may be obtained by writing M. J. Funchess, Director, Agricultural Experiment Station, Auburn, Alabama.)

Soil Testing—A Practical Aid to the Grower and Industry

(*From page* 11)

tests produced only 4.26 tons per acre. Those growers mindful of their soil produced more than three tons of tomatoes per acre more than the growers less concerned.

It is believed that soil testing and recommendations made upon sound principles are true aids to both the grower and industry. For that reason to assist the grower in his nutritional problem and to help relieve the world food crisis, more soil testing should be done throughout the country.

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Plant Breeding in Relation to Soil Fertility and Climate

(*From page* 14)

Slightly less striking results were obtained in separate operations for low oil, and for high and low protein. Our result with high number of nodes on the stalk is equivalent to about a 50 per cent improvement of yield. Amazingly, there was no apparent loss of genetic variability during any of these selection operations. Selection could have been continued further with no lessening of effect.

I must emphasize, too, that if we

should go into a field of corn of the original stock of any of these selection operations to look for a single plant equal to the final product, we might not find such a plant in thousands or even many millions of acres. It is hardly too much to say that something really new was produced. But if we should look in a field of one of the well-adapted, old-type varieties for a single plant equal in yield to the best hybrid so far developed, we would probably find it among the first 1,000 plants; certainly in the first acre. This is true in spite of the much greater effort expended on yield of corn. Of course, yield is more dependent on environmental variations and more difficult to measure, but I think we are still forced to conclude that its response to breeding effort is unique and slow. I think that we must learn how to make recurrent selection work with yield of corn if we are to go far in developing efficient nutritional complexes for the higher levels of fertility which good soil management must provide.

In the latter part of the 19th century, there developed among biologists a great interest in continuous or recurrent selection as a possible explanation of the remarkable variations and adaptations of plants and animals. Failure of ear-row selection with corn yield may have dampened enthusiasm for that explanation. Success of hybrid corn possibly gave emphasis to the theory that isolation and inbreeding are necessary for effective selection, as they very probably are. More recently Gossett in Ireland and Fisher in England, the two statisticians who developed the "Analysis of Variance," have re-examined the Illinois ear-row data with oil and protein. They pointed out the remarkable nature of results obtained that I have already noted. Fisher says with respect to the multiplicative aspect of continuous selection, ". . . is a mechanism for generating improbability of very high order."

Still more recently I have undertaken an analysis of some of the data on yield of inbred lines and hybrids of corn as published by various workers or as accumulated from cooperative tests of State Experiment Stations and the U.S.D.A. Here another seemingly enigmatic feature of corn yield has appeared. If we study the several crosses of a weak inbred line with a number of other lines, we find on the average that where the other line is weak the hybrid is weak. Where the other line is strong the hybrid is strong. Among the crosses of a line of medium vigor the same tendency is clear but not so strong. Among the crosses of one of the strongest lines the tendency is hardly evident at all or in extreme cases may appear slightly reversed. The enigmatic feature of these results is not that the tendency decreases as we improve the common parent of a group of hybrids, but that the tendency disappears when the common parent is still a weak inbred line with yield hardly one-half that of an average hybrid.

Prepotency

In analogy, consider a variable herd of cows. If the herd sire is weak and nondescript the calves are variable with merit dependent largely on that of the dams. The sire is not prepotent. If the herd sire is very good, the calves are much more uniform. Those from the poorer cows are not much poorer than those from the better cows. The sire is prepotent. A completely prepotent bull with offspring from poor cows just as good as offspring from good cows would be a very excellent individual. No one has seen an animal so good.

In corn we have apparently a number of inbred lines completely prepotent for high yield. These prepotent lines, while the best we have, are quite weak and unproductive in comparison with ordinary corn.

On the current theory of the genetics of hybrid vigor in corn the most prepotent inbred line should be the equal of the best hybrid in vigor and yield. This line would not be easily obtained because of genetic linkage of favorable with unfavorable factors, but steady progress toward it by current breeding methods should be possible. A close approach to the goal of a pure line in which all of the more favorable factors are fixed would probably make hybrid seed corn with its renewal each year unnecessary. On this theory hybridity is not truly fundamental for high vigor and yield.

If now we adopt the alternative theory that hybridity is fundamental to high vigor and yield, all of the enigma of corn-breeding experience with yield seems to disappear. Ear-row selection failed primarily because after each ear-row test the best individual ears were taken from the selected ear-rows. The best individual ears were from the most hybrid plants. In them excellence was due not to higher-than-average concentration of favorable factors but to a greater-than-average concentration of hybridity—matching of each more favorable factor with a less favorable mate. Such selection favors the less favorable almost as much as the more favorable factor.

Similarly, second cycles of inbred lines from the parents of the best hybrids in the first cycle failed because the best hybrids of the first cycle were not those with higher concentrations of favorable factors. They were the most hybrid ones, with no greater proportions of more favorable factors than found in original stock. Hybrid corn has succeeded up to a point with certain rare combinations having more than average hybridity. Such rare combinations when once found are repeatable by recrossing the pure parent lines.

The fact that a strong inbred line is likely to combine equally as well with a weak line as with another strong line may be explained on present theory by the greater expectation of hybridity in the cross of strong x weak. Other hitherto unexplained details which now become clear hardly need be enumerated here.

I must emphasize that available evidence is not sufficient for definite proof that hybridity is fundamental for high yield of corn. It is simply that this theory appears more plausible than any other. It leaves no unexplained residue so far as present evidence goes. On this basis we must for the present consider revision of corn-breeding technic towards the goal of the greatest degree of hybridity and abandon the goal of the greatest concentration of favorable factors. How this may be done has been fully described (2), for those regions where hybrid seed corn is commercially feasible.

Ear-row Selection

Where hybrid seed corn is not feasible it would seem well to try ear-row selection again or some modification as the one proposed by Jenkins (3). In such operations secondary selection based on individual appearance must be avoided as strictly as possible.

The newly proposed breeding plan (2) to develop a superior hybrid allows maximum utilization of the multiplicative principle in recurrent selection. There is now no apparent evidence to indicate that it should fail to isolate combinations many times more rare than any we have seen. If this breeding plan should prove to be so powerful, and we have no alternative to trying it out, it must be carefully directed. If we operate this breeding plan with thickly planted test plots of corn following the turning of a heavy crop of legumes with potash and phosphate to balance the nitrogen, the selection may be largely for drouth resistance. This would be particularly likely on lighter soils. If the removal of heavier and more frequent crops of corn should cause a deficiency of, for example, magnesium which was sufficient in the older less intensive system, this deficiency might be hard to detect. For if the breeding system is powerful it will isolate the combinations which are more efficient and "normal" on the deficient soil. Progress will then deviate somewhat from the best course. I think it may be desirable for the soil chemist and plant physiologist to try to steer the plant breeder on the main course. For this reason I have been willing to try to outline the indefinite but promising state of our knowledge of the genetics of corn yield, and how we may use that knowledge in breeding corn for adaptation to soil and climate.

Of the genetics of yield in peanuts and oats we know even less than for corn. Each one of these crops is naturally closely inbred. There is little prospect of ever using hybrid seed commercially with either one. Oat breeding has so far been largely a matter of isolating disease resistance in pure strains.

Just how the principle of recurrent selection may be most efficiently employed in breeding such crops as peanuts and oats in relation to soil fertility and climate can only be determined by actual investigation of the problem with breeding experiments.

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Tropical Kudzu

(*From page* 25)

cation of complete fertilizer or finely ground superphosphate a month after planting. On acid soils where the pH is below 6.0, an application of finely ground limestone has increased the production of seed and forage. Many kinds of nitrogen-fixing bacteria form nodules on the roots of this legume, especially when grown on an area where the previous legume crop produced root nodules. However, inoculation of the seed before planting appears to be a valuable practice.[3] When an abundance of nodules are present on the roots, applications of commercial nitrogen are not necessary.

Cultivation Is Easy

In Puerto Rico the crop produces seed in the dry season averaging about 150 pounds per acre on soils of average productivity. Seed yields exceeded 300 pounds per acre on clay soils (pH 5.0) treated with limestone screenings, four tons per acre, and chemical fertilizer 6-9-7 at 750 pounds per acre. High production cannot be obtained unless the chemicals necessary for good growth are available to the plants.

Beginning in late December this plant flowers and seeds over a period of 6 to 10 weeks depending upon soil and moisture conditions. As the pods ripen they are harvested by hand and placed on canvas in the sun where they break open upon drying. The seed are about one-sixteenth inch in diameter, and each pound contains a minimum of 35,000. It is advisable to treat the seed for 30 minutes in a 1:1 water-commercial sulphuric acid solution to obtain 90 per cent or better germination in 10 days. The seed seem to germinate better if they are held for six months after harvest at room tempera-

[3] A special inoculant is available for Tropical kudzu through The Nitragin Company, Milwaukee, Wisconsin.

ture and humidity. In Puerto Rico, the unprotected seed have suffered practically no insect damage and have shown satisfactory germination after a three-year storage period under room conditions.

Seed are planted at the beginning of or during the rainy season at a rate of three to five pounds per acre, depending upon the purpose of the crop. If it is desirable to control erosion on steep, more-or-less barren slopes, the seed are sown in contour rows three or four feet apart around the slope. About 10 seed are sown per linear foot in two- to three-inch plow furrows and they are not covered with soil, as sufficient silt will wash into the furrows to cover the seed during the rainy season. The ground should be prepared to a depth of 8 to 10 inches in the neighborhood of the seed. If the ground has little or no slope and the crop is to be used as a ground cover among trees such as rubber, circular patches of ground three feet in diameter and 10 inches deep can be prepared about 15 to 20 feet apart on the square and the seed broadcast on the prepared areas. If rains are irregular, the seed should be scratched in with a rake and covered with about an eighth of an inch of soil.

A quick ground coverage for pastures can be secured by preparing small patches of ground about three feet apart and dropping a pinch of seed on each "hill." Heavier forage and seed production per acre can be obtained if tripods of bamboo poles or living tree posts are arranged at intervals of 10 to 15 feet for the vines to eventually cover. With regular rains, Tropical kudzu under these conditions should thoroughly cover the ground in five to six months and become deeply rooted by the beginning of the dry season.

Tropical kudzu has made luxuriant growth in the higher rainfall belts where the annual precipitation is over 75 inches, but good cover has been produced on areas receiving about 40 inches. More time is required for coverage in areas of lower rainfall. In Puerto Rico it seems to grow faster and make a heavier cover from sea level to about 2,000 feet, than at 3,100 feet. This may be a temperature effect since rainfall is about the same in the test areas.

Tropical kudzu has failed to survive the winters in the Southeastern States. It was killed by frost as far south as Brooksville, Florida, and is truly a tropical plant.

Serves Many Purposes in Puerto Rico

Because it forms a dense mat of runners and dead leaves over the ground, Tropical kudzu climbs over and kills out many undesirable plants. However, the better pasture grasses, such as "malojillo," molasses, and guinea have made good progress growing together with kudzu. Preliminary trials at the Insular Agricultural Experiment Station at Río Piedras indicate that these combinations appear to be desirable for grazing from the standpoint of palatability and nutrient value. On the basis of chemical analyses, Tropical kudzu compares favorably with other legumes and has about three times as much crude protein (15.7 per cent dry basis) as Guatemala and guinea grass. Tropical kudzu produces from 15 to 20 tons of green forage per acre annually under favorable conditions.

During the rainy season cows readily graze the tender foliage of Tropical kudzu, but during the dry season, when growth is slow and the foliage may be somewhat dusty and tough, a day or two is required before the cows become accustomed to it. One acre will graze two cows during the rainy season and about one cow during the dry season.

No Known Commercial Source of Seed

There is no known commercial source of Tropical kudzu seed in the Western Hemisphere at this time. Over 500 pounds of seed were collected this year from the experimental plantings in Puerto Rico. However, inasmuch as

This plot of Tropical kudzu was the best source of green forage for the Station cows during the extended dry season of early 1945. Ten cows pastured the one-third-acre plot for two weeks. Plots of this crop have produced between 12 and 20 tons of forage per acre per year (when cut two or three times) on Catalina clay at Mayaguez, Puerto Rico.

the plant grows rapidly and seeds heavily, it should not take long to extend a planting originating from a small packet of seed. This Station is in a position to supply small packet samples of seed for trials in areas having a tropical climate.

Conclusion

In conclusion it might be stated that Tropical kudzu appears to be the most promising pasture legume available in Puerto Rico. The inclusion of such a legume in cattle forage should reduce the need for imported concentrates, which are the most expensive part of the dairy cattle ration in Puerto Rico. The erosion-resistant qualities of Tropical kudzu on steep hill-sides are also of considerable merit.

Soil Aeration Affects Fertilizer Needs

(*From page* 18)

trogen per cent in plants from both Clarion and Clyde soils. Phosphorus on a percentage basis, increased in the corn with compaction on the Clyde silt loam, but fell slightly in the case of the Clarion loam.

Another way of studying the influence of soil aeration on plant growth was undertaken by forcing air through pots of soil held at high moisture content. The data in the following table indicate that forced aeration increased the growth as well as the per cent of potassium in the corn plants. Distinct potassium deficiency symptoms were eliminated from the plants on both the soils when the aeration treatment was used. In contrast, however, the per cent of nitrogen, phosphorus, calcium, and magnesium was reduced when greater corn growth was made.

It is apparent from this work that when soil aeration conditions are varied the metabolic and physiological processes of growth, root respiration, and salt accumulation are markedly affected. No attempt was made to determine critical limits of oxygen or carbon diox-

TABLE 3

Fertilizer treatment			NP	NPK	NP	NPK
	Soil treatment*	% pore space occupied by air	Yield of tops in grams		% K in plant tops	
Clarion loam...........	Normal	0.0	13.3	17.3	0.95	2.60
	Aerated	3.2	17.3	27.7	1.28	3.30
Clyde silt loam.........	Normal	0.0	4.7	13.3	0.65	2.58
	Aerated	0.0	8.1	27.1	1.50	3.80

* Clarion and Clyde soils were held at 40 and 50% soil moisture respectively.

ide supply for corn, but rather the general differences in growth and nutrient absorption were studied at widely varying degrees of soil aeration. Whether these differences were due to an oxygen deficiency, a carbon dioxide toxicity, or a combination of these two factors is not known. The presence of reducing conditions when aeration conditions were considered poor as evidenced by ferrous-ferric iron tests of the soils suggests that some toxic substance may have caused injury to the corn plants.

Summary

A reduction of the total pore space occupied by air by any of the three methods studied resulted in stunted growth and nutrient deficiency of corn plants in most all cases. The absorption of potassium by plants was found to be more dependent on soil aeration than the uptake of nitrogen, phosphorus, calcium, or magnesium. Although the addition of a large amount of potash fertilizer was shown to partly overcome the detrimental effects of poor soil aeration, the maximum benefits of such fertilizer can only be obtained when soil air relations are not limiting factors in plant growth.

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TABLE 4

	Soil moisture	Soil treatment	Relative content	
			Ferrous iron	Ferric iron
Clarion loam....................	15	Normal	0	+++
	15	Packed	+++	+
	40	No aeration	+++	+
	40	Aeration	+	+++
Clyde silt loam..................	25	Normal	0	+++
	25	Packed	++	+
	50	No aeration	++	+
	50	Aeration	0	++

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Tip-Burn-Like Condition in Greenhouse Lettuce

(*From page* 23)

of Dr. Steinson, Head of the Agronomy Department of S.I.N.U., and of Dr. Bray, Agronomy Department, University of Illinois, by planting some check plots where borax was applied and similar plots which received no borax. Again the results were phenomenal. The check plots which received borax did not suffer from the tip-burn condition and were about 50 per cent larger in size than the plants that did not receive borax. In the boron-deficient plot this brown tissue-dying condition appeared on practically all of the plants and the yield was twice as small as that of the plot which received borax.

Mr. Ridgway, in 1946, had one of the finest crops of lettuce and tomatoes on this treated soil that he has grown in the last 30 years. He reports that there have been savings or a net increase in earnings of about $10,000 which he feels can be attributed to the improved value of the crops from the borax treatment.

Other greenhouse men in the county have turned to the use of borax on their greenhouse soils and have reported similar results in the increase of yield and the quality of their products.

The Burtons Farm to Feed People

(*From page* 22)

depleted areas and give uniformly good grazing on all of the pasture."

Mowing is regarded as "one of the most important pasture maintenance and improvement practices." Two tractor-drawn mowing machines are used to mow the pastures at the right time to give the most effective control of weeds.

The productivity and quality of the pastures on this farm were evident when as early as May the 250 head of Hereford cattle being grazed were fat enough to go into the show ring.

Pride of the Burton farm is the excellent herd of Hereford cattle. Carefully planned breeding with a relentless search for still better purebred sires, constant culling of all animals that fail to measure up to the high standard set for quality and type, and good feeding to develop fully the potentialities of every individual, have been the formulae followed in improving the herd. Every precaution is taken against the introduction of disease into the herd. Plenty of salt and clean, fresh water are provided. A trained herdsman is employed to look after the breeding, feeding, and management; and Billy looks after the herd with an "eagle eye."

But rating first place as a source of net cash income on the Burton farm and a top favorite on the Burton restaurant menu are the 4,000 high quality broilers produced every month. Cross-bred baby chicks are purchased and raised in batteries in a modern concrete house that is kept scrupulously clean.

There is a baby chick room, a growing room, and a finishing room, where the right temperature and proper feed are provided until the broilers are ready for the table. The latest type electrically operated machinery is used in picking and dressing the birds, which are immediately placed on ice and sent to the Burton restaurant where they are served to individual customers.

Another important enterprise on the farm is the production of fresh vegetables, such as pole beans, butter beans, roasting ears, tomatoes, peas, and squash, which also are harvested fresh and marketed directly to the consumer through the restaurant.

Likewise, all of the sausage and some of the meat served at the Burton restaurant come from the farm. Both hogs, grade cattle, and cull purebred beef cattle are marketed in this manner, giving the largest possible return for each pound of pork and beef produced on the farm.

While some might question the economy of the large investment and the extensive improvements made on this farm, Mr. Burton last year had to pay income tax on it, despite the fact that he is saving all of his best young cattle and is increasing the size and value of his herd. He can prove that his investment in soil-building, in liming, in liberal use of fertilizers, and in improved machinery and good cattle is paying off.

Mr. Burton has taken full advantage of the AAA farm program. He has carried out twelve different practices including terracing, ditching, growing and plowing under winter legumes, clearing and establishing pasture, applying limestone and phosphate, harvesting legume seed, and building stock ponds.

Let Us Boost the Bee

(*From page* 5)

honey producers. Your entomologist might serve readily, however, as a sound testifier, as he regards the topic objectively. Summaries of such statements I have seen to date usually support the positive belief in the efficacy of the bee and his vital part in the picture of productiveness.

AWAY back in 1859 Charles Darwin through exhaustive experiments showed that continued self-pollination is apt to result in somewhat inferior plants. It has been proved also that hardly any of the pollen of the plum and many other stone-fruits is wind-borne to other trees, as it is so moist and sticky. Pears are like that too, while the apple being drier in its flower parts is probably wind-blown to some degree. Over in England it was observed that 80 per cent of all the cross-fertilization in orchards is done by the hive bee, not quite 20 per cent by the wild bee, including the bumbling bumblebee, and the remaining bit by the other wild insects.

Our own entomologists remark here that England in many respects is different from our country. Over there, large areas grow thick hedges, and wild spots abound along the roads lined by small farms. In this country, the agricultural zones usually have much larger cleared spaces and open cultivated fields, and thickets and woodlands are dwindling. There is probably greater reliance on poison sprays—so that the proportion of our fruit requiring the service of the honeybee must be higher than in England.

Repeatedly in New York State it has been said that more hives should be kept near orchards. While no study I can cite has clearly laid down the principles by which one must be guided as to bee population and range compared with the size of orchards, it is evident that in some seasons and on some days there are much shorter periods in which the bees will be apt to fly abroad. When the sources of pollen are abundant near at hand the chances are better regardless of sunshine or temperature. To this extent at least it can be pointed out that domestic bees are the only pollen-carrying insects that lend themselves to actual management and direction by the orchardist. Commercial planters probably realize this much more than amateur farm growers.

Of late some interesting work has been going on to see how much actual direction and training a smart honeyman can give to his colonies. It consists of seeing to what extent it is possible to coax bees to gather nectar from certain desired honey plants, both for the type of honey wanted as well as for the partnership in crop culture.

IF fresh ripe clover blossoms, for instance, are collected and placed in dishes mixed with syrup it seems to flavor the concoction enough to induce many of the bees to scout abroad in search of that same nectar—and if within flying range, they will find it. To carry this plan to perfection some folks are extracting the pure nectar from specific plant bloom, and then using this perfume to whet the appetite of their colonies for more of the same brand. Whether this is accomplished through automatic instinct or whether the bees actually whisper or communicate tips on the places to go in search of their favorite "booze" is still within the realm of research. However, I believe this is not going to be sufficient in itself until we get more bees in relation to food plants, or more actual study to link the favorite species from the bee's standpoint with the location of our apiaries. This whole topic is so new and strange, despite the presence of the bee in sacred and profane literature since ancient times, that it should challenge the attention of men as much as all this atomic destruction technique has intrigued science. How long are we going to neglect to cultivate and perfect the arts of peace and spend billions without a quiver for the conduct of war?

MICHIGAN observers tell us that bumblebees were once the main pollinizers of the clover blossom. But their numbers are down these days, as anybody with childhood memories can testify. Even in the country, you do not see those awkward, fat, and fumbling fellows any more to the extent we saw them 40 years ago. There also are some ground-nesting solitary bees which were effective pollinizers in times past, but their homes have been torn up by cultivation, and they do not multiply nearly so fast as domestic bees either. Moreover, it is quite evident that land-clearing campaigns have eliminated many of the natural species of plants with blossoms that attracted wild bees and other insects, and this has choked them off and finally caused wild pollinizers to disappear altogether in farming areas.

It is folly to expect the agricultural regions to return to old primitive wilderness conditions, of course, but intelligent local shrub management might sometimes save clusters of such favorite food sources here and there to enlist some aid from the "tramps" among the insect world. I understand, too, from going afield with a bug specialist, that there are numbers of parasites of the cornborer in the same species that do some pollinizing. Maybe the two services could be jointly promoted. But in this I shall not extend my neck too far outwardly without benefit of qualified wiseacres.

Unpopular as they are, it must be admitted that ants and some blow-flies are listed among the insects that pollinize fruits in rainy times when honeybees do not go abroad. But they cannot compete with the bee in the long run. There is at least one popular fruit meanwhile that thrives in marshes surrounded by overgrown lands highly favorable for wild insect pollinating, and this is the cranberry. The blueberry likewise does well in such locations. I have never heard any honeyman advertise cranberry honey, however.

IT is a paradox that with the clearing, settling, and open cultivation of land it attains a greatly increased cash sales value over more remote and wilder zones; yet the chances for abundant fruiting and reproduction of food vegetation and the production of field seeds are considerably reduced in those highly cultivated places.

In Nova Scotia's famous Annapolis Valley, studies made about 10 years ago proved that just a few solitary colonies of bees placed in a spot surrounded by large areas devoid of bees has limited value. In places where beekeeping is understood and successfully practiced, one colony to the acre or possibly one to three or four acres may be enough to do the trick. But the chief obstacle to achieving such a balance always turns out to be the lack of expert honeymen and bee-tenders. It's too exacting and "piddling" work for some men, and their chief idea in fruit growing is to find an adaptable variety and then shoot the orchard with poisonous dust or liquid spray.

I guess there is not much which can be done about it, but the shepherd and the bee-herdsman are not any too chummy. Domestic and wild bees both starve and languish on lands heavily populated with grazing flocks of sheep. Close-cropping by the scissor lips of the herbaceous ovine render the vegetation unfit for visitation and sustenance for the bees. The worst offense in this connection is to pasture sheep in woods, because the open meadows may already be robbed of suitable floral baits for bees while some tempting specimens are often left in the timberlands.

Another beautiful way to banish the bees, both wild and home-loving ones, is to start out on a burning campaign. Forest, brush, and grass fires, stubble-burning forays, fence-row firing, and reducing the edges of roads and railways to ashes may have some incidental value against pests, but it cannot be said to aid vegetation or furnish more ranges for the bee population. This may be taken as a hint to let bad weeds flourish and scatter, for which no sane farm-minded guy can argue—but it puts up a poser in perplexities anyhow. It shows that what is meat for some is poison to others, and that what is regarded as good practice may at times be injurious in other ways.

One point, however, where we all agree and can find no ground for abusing each other is in preventing wild forest fires. Campers, careless smokers, and like offenders, as well as heavy timber cutting that exposes forest areas to fire hazards, all combine to put the skids under our hopes for encouragement of wild insect life, especially that of the pollinizers.

DOMESTIC honeybees commonly have an advantage over their wild relatives in their greater brood-rearing capacity. One single queen bee may have 12 to 15 brood cycles in a year, it is said, making in all perhaps 100,000 individuals. In the wild species five brood cycles with a few hundred survivals are closer to average. Winter resistance is much stronger in domestic bees, it is obvious, and it is likely that if winter food is provided some early new brood cycles may appear in the spring before the plants reach full bloom. The custom of the bee to confine most of its activity on a given excursion afield to certain single kinds of plant blooms enhances its value in agriculture and horticulture.

How many pollen grains does a bee transport at a time? Well, in digging into it I find an authority in New York who claims that it takes about 400 single pollen grains of an apple flower to cover a bee from nose to toes. If it makes hundreds of trips in a season the amount of reproductive aid which one busy bee provides runs into astronomical digits.

Combine this with the knowledge that red clover is self-sterile. The pollen of a flower will not fertilize any flower borne on the same plant. The bee may find other flowers than that of clover which tempt him more, which argues for (1) timing the second or seed-harvest growth to bring it in full bloom when competing adjacent flowers are scarce, or (2) introduction of more bees in the region as a precaution. There are many sides to this relationship, some of them very complex and worthy of further intensive cooperative study.

WE have always held to the belief in our rural philosophy that the farmer is the natural partner with nature and the wild. I begin to suspect that this was probably truer in pioneer times and in wilderness regions which still exist than it is with our deft and accomplished mechanical, commercial farmers of today.

It is always so easy to draw sweeping conclusions and to cling fast to traditional opinions. On close examination we often bob up against such things as these existing in modern times, whereby the original balance of nature has been broken, and yet means exist to restore some of it if we direct ourselves properly. Like thousands of other laymen I could never write a treatise on what I know about the bee, but the fact stares me in the mug that I know so little about the question that it bothers me. Maybe we all require more of the same lessons—for the good of husbandry and the supply of honey.

PROPOSAL

"Jim proposed to me last night and I'm sore at him."

"What makes you so mad?"

"You ought to have heard what he proposed."

"Rastus, do the people who live down the road from you keep chickens?"

"Dey keeps some of 'em, sah."

Curious Friend: "Why in the world did that saleslady slap you?"

Purchasing Agent: "Darned if I know. All I did was ask her how much she would take off for cash."

A doctor asked his woman patient her age. "I never tell anyone my age," she answered coyly. "But, as a matter of fact, I've just reached twenty-one."

"Indeed," said the doctor. "What detained you?"

PROOF POSITIVE

A seasick sailor was leaning over the rail. The captain, standing nearby, said sternly, "You can't be sick here."

The sailor regarded the captain a minute, then said, sadly, "Watch."

A convincing talker is one who can persuade Willy that algebra is good for his mind.

IT DEPENDS

"How big is your car, Joe?"

"Well, it'll hold four, usually. But you can get six in if they're well-acquainted."

She: "Kiss me once more like that, and I'm yours for life!"

He: "Gosh, thanks for the warning."

The bachelor's a cagey guy,
And has a lot of fun;
He sizes all the cuties up
And never Mrs. one.

Little Woman: "Dear, why can't we live peacefully like the dog and cat lying there by the hearth? They never fight."

"No, they don't but tie them together, and then see what they do."

Father—"I see by the gasoline tank that you did not get very far last night."

Son—"Well, Dad, I'm not complaining."

"I always judge a girl by her figure."

"And I always judge a girl by her brains."

"My system is better. It's a lot easier to tell if she's got a figure."

"Brother Jones," said the deacon, "can't you-all donate some small contribution to de fund for fencing in the cullud cemetery?"

"I dunno as I can," replied Brother Jones. "I don't see no use in a fence around a cemetery. You see, dem what's in there can't get out, and dem what's out sho' doan wanta get in."

Better Crops with PLANT FOOD

November 1946 10 Cents

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Better Crops with PLANT FOOD

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R. H. STINCHFIELD, *Editor*

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

VOLUME XXX NO. 9

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READY TO "STRIKE" AGAINST AMERICAN HOLIDAYS

Better Crops with PLANT FOOD

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VOL. XXX WASHINGTON, D. C., November 1946 No. 9

Cataloging Our . . . . .

Cluttered Calendars

Jeff McDermid

AN authority on dates and celebrations informs me that we now possess at least sixty special weeks named for certain observances and campaigns, some of which bear startling and unique titles. This vast schedule surely gives us something extra to do every week in the whole year, plus eight more weeks for good measure—all of which helps to find an excuse not to pay grocery and rent bills on the first of each month, being so busy observing this and that. Moreover it appears that we also have nearly an equal number of red-letter days on which to work and ponder for profound, patriotic, or puerile purposes.

When I was a supposed innocent youngster, indifferent to all other needs than bare necessities, the old calendar near the clockshelf had only five official dates for us to remember and give pause to in our round of labor and refreshment. They were New Years, Washington's Birthday, Fourth of July, Thanksgiving, and Christmas.

I do not recall that we were ambitious enough in those primitive times to stretch our imaginations over entire weeks of dedication and inspiration. I will, of course, make due exception here to revival meetings, teachers' institutes, terms of court, mercantile bargain days, the county fair, hog-killing week, corn-planting week, and maybe a spell of farmers' institutes. We were too stultified and prosaic perhaps to envision the dire need we should have for felt hat day in October, straw hat day in June, gum-for-digestion week, prunes-for-slow-bowels week, dress-up day, know-your-neighbor month, international good-will week, theft-prevention day, discourage-borrowing week, bank-your-bonds day, donut-dunking week, and so on through the list.

Nowadays nobody can come out with celebration and observance statistics as I have been without sticking his neck out, because of a good chance that a dozen or more brand new ones have been adopted by state legislatures, congress, or the amalgamated workers organizations, or even some of the farmer co-operatives, who have been bitten hard by the publicity and proclamation bug with almost as violent a reaction as the urban campaign hounds.

I know positively that my treasured list of freak anniversaries and stimulation-begetting events, put into dynamic form by means of days and weeks of specialization is completely archaic and outmoded. Every 24 hours some bright group of energetic people with budgets to speed them forward are closeted in some office or hall hatching up another significant commodity or project to decorate the billboards with and use for national promotion.

SOME of us on the sidelines regard this with shades of tolerance or disdain, while no small segment of our citizens pack everything they have into fleeting and temporary support of, or acquiescence in, many of these motley observances.

It fits very well on sundry occasions into the programs of radio stations or the copy-shops of newspapers. When there are no handy murders, society scandals, political campaigns, or atom-bomb tests to feature, the calendar of odd observances is a neat adjunct to a lean and tiresome interval. Moreover as most of them have some commercial appeal or advertising significance, there is that extra fillip to spur publicity efforts in their behalf.

Meanwhile where does this leave us old codgers who have made up our minds not to chase fads and scramble on ballyhoo bandwagons? Speaking frankly for that moss-grown generation, our reaction sums up about thus: Why not have fewer and better things to celebrate, use some definite date to launch them, and then keep at it indefinitely? I grant you that such a method would rub out the observance of straw-hat day, furnace-cleaning week, or plant-a-garden week because obviously you couldn't possibly go on indefinitely with these seasonal pepper-uppers. But you can pick out any of the holidays and observances, except the birthdays and historical anniversaries, and triple the value of the thought behind it by continuous, patient, and conscious efforts to conform to its symbolism.

I know, for instance, that most always I am never very thankful or appreciative of having more calories than the underprivileged except at the advent of the last Thursday in November. At that time I gorge myself full of fine foods with six times the calorie intake of European eaters and sleep it off pronto. On the next day I find myself grumbling at the wife because she hasn't got the right knack with her kitchen range or the beef bootlegger; and I howl hard because there is no butter at my plate in the Rush & Roach restaurant—not only the next day, but right on almost up to Christmas, which shames me a bit and sobers down my fretfulness for awhile.

Somewhat chastened and solemn, I do my Christmas shopping early (in the morning) and sneak the bundles home with a weather eye on Dec. 25. On Dec. 24 I break out in feeble smiles, read old Scrooge again, or listen to Lionel Barrymore's perennial presentation of the Christmas Carol. Then maybe I give the kids fifty cents for their Sunday school poor basket and then wonder what I'm going to get for what I gave. I forget to growl much about the menu during these holidays because there's no reason to, for Ma has laid up enough goose grease and confectionery to last for a considerable stomach siege.

Yet this spell of good humor doesn't last any longer than it takes to rip off

December from the calendar, disclosing frigid January and February, bereft of any hints of brotherly love and thankfulness. All that cold weather makes folks huddle selfishly.

Obviously, I am in no shape at New Years to adopt the Chinese custom of paying all my debts and getting square, after expending so much in solicitude for others at Christmas. Neither am I in a mood to retain any high percentage of my New Year resolutions, so blandly assumed that day in deference to the calendar.

PROCEEDING further as the months roll by, we find many other dates on which to embark on some great and noble enterprise within the limits of some specified interval, duly publicized lest we overlook the obligation or the opportunity.

January begins with four special observances to get me into good training for stiffer assignments just beyond. Potato and Onion Week comes between the 17th and 26th. It was thought up by the Idaho Chamber of Commerce, regardless of the benefit it might give to Maine as well. This is surely one year when we ought to bake, fry, boil and casserole every spud in sight, because otherwise the Government will be obliged to dispose of them for potable alcohol again. If somebody would only step forward now with the glorious meat gravy bowl plumb-filled to the brim, I could double my intake of tubers without halting for breath on the 26th.

I am somewhat stumped by the sight of Large Size Promotion Week, beginning on January 18. I am finding it hard to observe that one as I boast only a size 14½ collar and potatoes without the above-named gravy are not going to increase my bulk fast enough. I must write to New York for more details on how to promote larger sizes, especially in winter when everything contracts so much in zero weather.

Next on the January docket is Peanut Week, from the 23rd to 27th. Somebody in Atlanta was not satisfied with the goober consumption rate, although in picking my purchases of fancy mixed nuts I find fully 80 per cent of them to be peanuts of the long brown or redskin kind. But I reckon that my new artificial ivories set in rubberoid will see me through the week's crunching. One more week only remains in January—Youth Week, starting on the 27th. If I thought the kids wouldn't resent my intrusion, I'd go with them to a few dances or juke-box huddles, or offer to help them with their algebra. As far as trying to regain a fling of my own youth, I desist from experience. It's too far gone for that.

For a short month, February offers me more than its share of periods of note. Aside from the two memorable birthdays commonly observed within this last winter month, we have three "Days" and three "Weeks" to study up on. Ground Hog Day on the 2nd instant passes more uneventfully for city exiles than it once did when we lived in the country close to the lairs of the hibernators. St. Valentine brings me less thrill and heart throb than it did in far-off school days when I sent comic slams to the meanies and cupid cards to the lassies. However,

(*Turn to page* 50)

Fig. 1. Delta Experiment Station and Cotton Ginning Laboratory in background.

Mechanical Production of Cotton in the Yazoo-Mississippi Delta

By J. E. Adams and P. W. Gull

Delta Branch Experiment Station, Stoneville, Mississippi

THE use of power equipment for production of cotton in the Mississippi section of the Delta has been both widespread and increasing over a period of years. Loss of labor to the war industries greatly stimulated interest in the problem at a time that availability of equipment diminished. Realization that the spindle-type cotton harvester is a reliable farm implement came during that period; that, coupled with the fact that labor is not returning to the cotton fields, has thrown the problem of elimination of hand labor in cotton production into bold relief.

Even under the system of one man, one mule, and half-row equipment, any labor unit is able to produce more cotton than it can pick, and power equipment increases this unbalance. A plentiful supply of mechanical pickers will, of course, materially alter the situation. With a total of 130 to 140[1] man hours per acre formerly required to produce an acre of cotton, the 80 to 85 hours consumed in picking are reduced to approximately 5 per acre. Unless production technique is improved, the

Acknowledgment is made to J. W. Neely, Sidney G. Brain, and Wm. E. Meek, members of the Delta Station staff, and T. L. Baggette, former member, for the agronomic and engineering phases of the program.

[1] Welch, Frank J., and Miley, D. Gray. Mechanization of the Cotton Harvest. Miss. Expt. Sta. Bull. 420, p. 9. June 1945.

producer will have to carry extra labor for production, where in the past it was carried for picking of the crop.

The thinning of cotton to a stand and control of grass and weeds in the growing crop must be as completely mechanized as possible in order to offset the change in labor balance induced by mechanical picking. Where topography allows, cross-plowing of cotton, either planted or plowed out to a checked stand, materially reduces the hoe labor required for weed and grass control. Hill dropping to a stand eliminates the thinning operation, as does checking or cross-plowing, with an added advantage of a substantial saving of seed, but requiring more hoe labor for weed and grass control. There remains, however, a residuum of hand labor required for grass and weed control, even where cross-plowing can be practiced, that should be eliminated by mechanical means in so far as possible.

Mechanization undoubtedly will aid the producer to stay in business, but profits will also depend upon high yields of a uniform product in sufficient volume and quality to allow efficient manufacture. Adequate use of fertilizer, based on soil and plant needs, and judicious use of cover crops and good seed of an adapted variety of cotton, must be combined with efficient production methods. The most economical use of the mechanical harvester depends on large yields, as cost of operation is based on acreage covered. Only large yields allow a low cost per bale for picking.

Research Facilities at Stoneville

Any production program is not complete unless the effects on processing and marketing are studied simultaneously. An unusual combination of facilities for coordinated research is available at Stoneville, Mississippi, and advantage of these has been taken. The only experimental ginning laboratory in the United States, a unit of the Bureau of Plant Industry, Soils, and Agricultural Engineering, is located at Stoneville. (See figure 1 for view of Delta Station and Ginning Laboratory in background.) The engineering phases of the work are under Charles A. Bennett. F. L. Gerdes is in charge of the fiber and cottonseed testing laboratories of the Cotton Branch of Production and Marketing Administration. When a special appropriation was made in 1944 by the Mississippi Legislature, as a result of the farsighted program of Dr. Clarence Dorman, Director of the Mississippi stations, responsibility for the mechanization of cotton and other crops studies was assigned to Delta Branch Station. Delta Station has all facilities needed for the agronomic and breeding phases of the problem. Cost studies in cooperation with plantations having mechanical pickers have been carried on by Frank J. Welch and Gray D. Miley of the agricultural economics section of the main station.

Mechanization Technique

Mechanization of cotton production must be planned for when the stalks are broken and the winter cover crop is turned if it is to make complete use of all implements now available. Flatbreaking has several advantages, such as good coverage of cover crop and trash and ease of drainage. Middlebreaking is, however, as cheap a plowing operation as can be had. There is an added advantage in that a firm seedbed aids in getting a stand, particularly in fields having both light and heavy soils.

Successful planting and cultivation depend on beds both evenly spaced and of even height. This condition cannot be attained with a two-row middlebreaker. The three-row breaker, using a marker, prepares beds suitable for subsequent use of two- or four-row planting equipment. If power is limited, the rear plow is dropped and the machine operated as a "skip-row" type breaker.

Beds are worked down at planting so

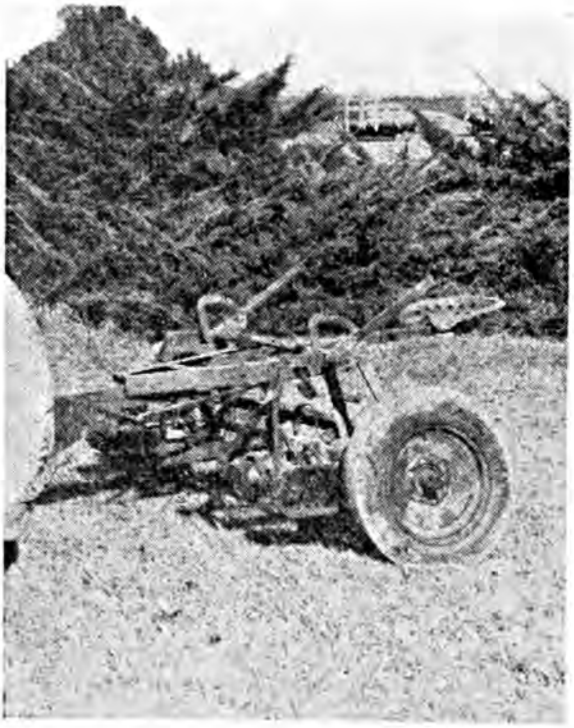

Fig. 2. Two-row "Dixie" cotton chopper.

that the cotton if not planted on the level is on an extremely low bed. This is essential if either the area is to be cross-plowed to a check stand or if the flame is to be used later for weed and grass control, or both.

If for any reason cross-plowing or hill-dropping is not desirable and it is necesary to drill and thin to a stand, mechanical chopping will have to replace hand labor. Four choppers have been compared at the Delta Station: The one- and two-row, tractor-drawn Dixie (figure 2); a one-row machine developed by the Finklea Implement Company, Leland, Mississippi (figure 3); and the flame chopper (figure 4). The Dixie chopper does very well for small cotton when soil conditions are ideal; this is true also for flame chopping, with an added advantage in that some control of small grass and weeds around stalks left in the "hill" or "block" is obtained. This control has been pronounced in some tests. Flame chopping is accomplished by mounting open-end metal boxes, spaced on 20-inch centers, on a wheel; the boxes are about 5 inches wide, 8 inches long, and 10 inches high. Burners are directed toward the row from each side, and the wheel is rolled down the row, the boxes protecting the plants as the wheel rotates. The flame destroys small plants of all kinds not protected by the boxes, spacing the hills at 20 inches. Four-row flame choppers have been used in 1946.

The Finklea chopper consists of a rotating shaft paralleling the row, powered by a wheel driven by traction with the ground; thus the rotation of the shaft is synchronized with ground speed. A bar is mounted perpendicular to the shaft with a hoe attached to each end of the cross-bar. The machine operates best when drawn by the tractor operating at highest speed. This machine shows greatest adaptability of any of the three tested in that it will not only thin or "chop" cotton of the size-range handled by the flame and Dixie choppers, but is the only one tested that will satisfactorily chop cotton larger than four to six inches in height.

The ease and efficiency of mechanical thinning, regardless of the machine, are dependent to a great extent upon planting operations. A good stand is necessary, of course, as a machine is not selective as is hand hoeing. Beds, if used, must be uniformly spaced and

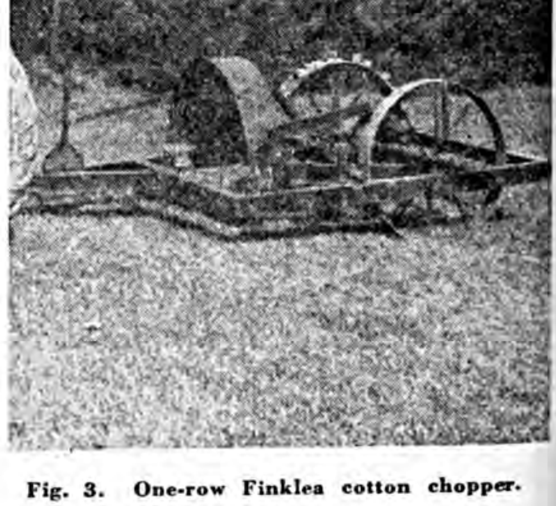

Fig. 3. One-row Finklea cotton chopper.

uniform in height. Flame chopping, like cross-plowing, to a checked stand is best accomplished when cotton is planted flat. It would seem that with these points in mind practically as much attention should be given to leveling of land for mechanical farming in the Delta as is given to the irrigated and mechanized sections of the Southwest.

Evenly spaced rows, combined with proper planting, greatly aid early cultivation. The use of a gang of four "rotary hoes" (figure 5), otherwise known as "picker wheels" mounted on an axle attached to the front tool-bar so that each gang operates independently and is "floating" on the bed, speeds up early cultivation. Developed at Hopson Planting Company, the unit is mounted between the inside sweeps and operates on and to about four inches on either side of the row of young plants. Acting to break up any crust and as a rotating fender, two-leaved cotton can be cultivated at the maximum speed of the tractor. Although cultivation at five miles per hour gives satisfactory results, it is thought that six to seven miles per hour would be somewhat better. Efficient use of the principle of the rotary hoe depends on speed attained only with the rubber-mounted tractor. Cotton as tall as six inches has been successfully cultivated with this attachment; the two inside wheels can be removed and the two outside wheels used as a fender for larger cotton, if desired. Throwing the clods back to the "middle," allowing only pulverized soil to filter in around the plant, helps to keep the bed flat and even, so necessary for subsequent flaming. High-speed sweeps, set flat, with all cultivation done at the front of the tractor, are used. All flaming is done behind the tractor. Four-row equipment to allow simultaneous cultivation of middles and flaming of rows has been in operation since early 1945.

Fig. 4. Two-row flame chopper using oil-air type burners.

Flaming of cotton for weed and grass control has been practiced since 1943[2] at Delta Station. Cotton must be about 3/16 inch in diameter at the crown before it will stand the temperature

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[2] Neely, J. Winston, and Brain, Sidney G. Control of weeds and Grasses in Cotton by Flaming. Miss. Agr. Expt. Sta. Circular 118. March 1944.

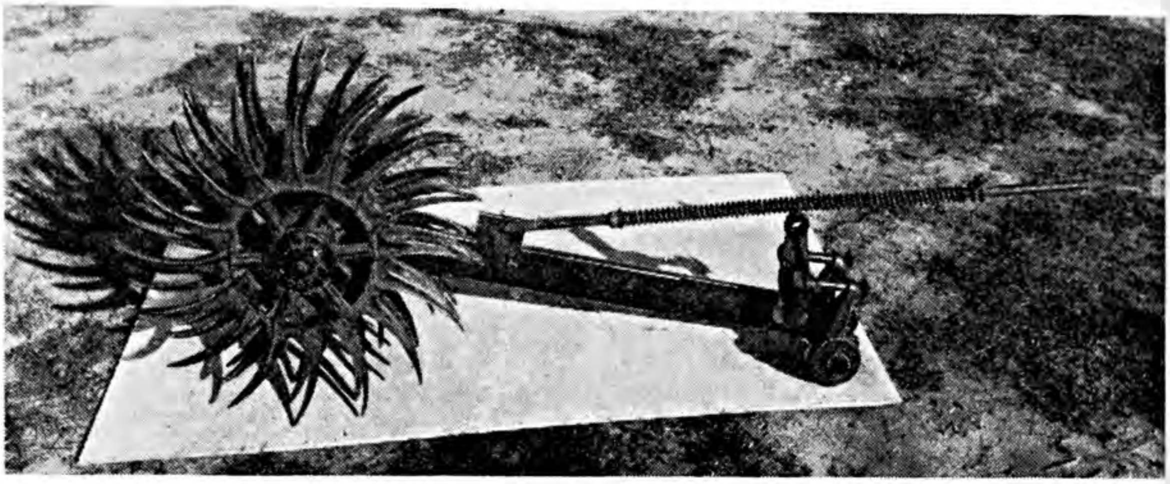

Fig. 5. Rotary hoe shield unit, or rotary tiller.

of 1800 to 2000° F. of the flame passing the plant at 2½ to 2¾ miles per hour. Burners are set 4 to 6 inches from the row at an angle of about 15 degrees with respect to the ground level so that the flame passes the stem of the plant, skimming the bed and spreading into the middle beyond the row. With two burners to the row, one from either side, they are set so that the flames do not oppose each other, as this would cause them to flare up into the plant and scorch the leaves. More recently, use of four burners to the row has allowed use of third gear, or approximately 4¼ miles per hour.

Machines manufactured in 1946 use either propane or butane as fuel and do not require a compressor. A two-row experimental machine (figure 6) developed during the latter part of the 1945 season used propane, drawing vapor from the top of the tank. Successful use of butane requires either a vaporizer or the self-energizing type of burner. The self-energizing burner in which fuel is vaporized by circulating within a shell forming an integral part of the burner lends itself to use of more than two burners per row with increased speed for flaming.

(*Turn to page* 44)

Fig. 6. An experimental two-row flame cultivator for use of compressed gas.

Fertilizer Inequalities . . . Can They Be Corrected?[1]

By T. B. Hutcheson, M. H. McVickar and S. S. Obenshain

Virginia Agricultural Experiment Station, Blacksburg, Virginia

ONE of the first studies undertaken by a great many of the agricultural experiment stations was that centered around the establishment of rotation-fertility plots. The data collected from these experiments have furnished much of the information on which our fertilizer and rotation recommendations are based. These same experiments have provided the material on which much of our basic knowledge in soil chemistry, soil physics, soil microbiology, and related fields has been secured.

There are many agricultural workers who feel that the long-time rotation fertility plots have furnished the information for which they were designed and therefore should be discontinued. On the other hand, there are investigators who maintain that there still remain unsolved problems which can be answered best by these old long-time experiments. Those who belong to the latter school maintain that with modification of the experimental procedure a new set of values can be established for the experiments.

One has only to review the fertilizer usage trends to see that for years phosphate, in addition to lime where needed, was thought to be the principle nutrient necessary for maintaining or increasing crop yields. Long-time experiments have shown the fallacy of this assumption, and results reported by farmers support the most recent research findings. In the Old Rotation Fertility Plots, located at Blacksburg, Virginia, and established in 1914, no response was received from potash for years after the study was started. However, in recent years the yields from the plots receiving no potash or an insufficient quantity of potash have declined rapidly. More recent experiments with alfalfa show very similar results.

As agricultural science advances and more information is gained concerning plant nutrition, the function of these nutrients in plants, and the behavior of the so-called fertilizer constituents in the soil, the question that naturally arises is—how should soils be treated where an unbalanced nutrient condition exists? It has been assumed that the deficient nutrients should be added in liberal amounts, but experimental data to support this hypothesis are lacking. The Old Rotation Fertility Experiment afforded an excellent opportunity to secure information bearing on this assumption.

From 1914 to 1941, inclusive, many of the plots had received heavy annual applications of fertilizer ingredients in unbalanced proportions. Starting in the spring of 1942 the Agronomy Staff altered the experimental layout so that data could be obtained on the effectiveness of different methods and on the time required to correct the unbalanced conditions. Figures 1 and 2 show the layout of the experiment as it formerly was and as it now exists.

The data reported have been collected from some of the plots of the Old Rotation Fertility Experiment, located on a

[1] Published with approval of the Director of Virginia Agricultural Experiment Station.

Fig. 1:- Plan of Experiment 1914 to 1941 inclusive

0-70-0 (2)	Check
40-70-100 (1),(2),(3)	Check
40-70-0 (4),(5)	Check
0-70-100 (2),(3)	Check
0-0-100 (3)	Check
40-0-100 (1),(3)	Check
40-70-0 (1),(2)	Check
40-0-0 (1)	Check
16 Tons Manure *	Check
16 Tons Manure * 0-70-0 (5)	Check
4 Tons Manure †	Check
16 Tons Manure * 0-70-0 (2)	Check
0-70-0 (5)	Check

Fig. 2:- Plan of Experiment since 1941

0-70-0 (2)	Residual	40-0-100 (1),(3)	Fertilizer Ratio Δ	Check	Fertilizer Ratio Δ
40-70-100 (1),(2),(3)	Resid	0-36-18 (2),(3)	F-R	Check	F-R
40-70-0 (4),(5)	Resid	0-0-100 (3)	F-R	Check	F-R
0-70-100 (2),(3)	Resid	6-36-18 (1),(2),(3)	F-R	Check	F-R
0-0-100 (3)	Resid	40-70-0 (1),(2)	F-R	Check	F-R
40-0-100 (1)(3)	Resid	0-70-0 (2)	F-R	Check	F-R
40-70-0 (1),(2)	Resid	0-0-100 (3)	F-R	Check	F-R
40-0-0 (1)	Resid	0-70-100 (2)(3)	F-R	Check	F-R
16 Tons * Manure	Resid	0-70-0 (2)	F-R	Check	F-R
16 Tons M * 0-70-0 (2)	Resid	8 Tons * Manure	F-R	Check	F-R
4 Tons † Manure	Resid	2 Tons M † 0-70-0 (2)	F-R	Check	F-R
16 Tons M * 0-70-0 (2)	Resid	8 Tons * Manure	F-R	Check	F-R
0-70-0 (5)	Resid	40-0-100 (1),(3)	F-R	Check	F-R

(1) N from Uramon : (2) P_2O_5 from Superphosphate : (3) K_2O from 50% Muriate :
(4) N from Ammonium Sulfate : (5) P_2O_5 from Raw Rock Phosphate :
* Manure applied once every 4 years before corn:
† Manure applied annually.
Δ Fertilizer Ratio experiment superimposed on Check – not discussed in this paper.

Dunmore silt loam soil. This soil was developed from the weathering of limestone and is one of the more productive upland soils in Virginia. It has a grayish-brown topsoil with yellowish-brown or slightly yellowish-red subsoil, and usually has a depth of from four to ten feet above bed-rock. The plots were located at Blacksburg, Virginia, at an elevation of about 2,100 feet above sea level.

In 1914* a four-year rotation of corn, wheat, and two years of hay was established. Fertilizer treatments employed are given in table 1. Plots were not duplicated but adjacent to each treated plot was an unfertilized check plot. Yields, as reported, have been adjusted on the basis of the yields from the uniform check. Both the fertilized and the check plots have received finely ground raw dolomitic limestone at the rate of one ton per acre every fourth year. This amount of lime has maintained a soil reaction of about pH 6.7. Each crop in the rotation appears each year.

In the spring of 1942 each fertilized plot of the Old Rotation Fertility Ex-

*This experiment was in progress from 1909-1913 inclusive. The plots received identical treatments listed in table 1 but only one-half the amounts.

This picture shows vegetation on a plot receiving an annual application of 40-0-0.

periment was divided into three 1/50 acre sections. (See figure 2.) Section 1 remains unchanged and continues to receive the same annual fertilizer treatment that has been applied since 1914. Section 2 was designed for a "Residual-Effect Study" and has not received any fertilizer since 1942. Of course, from 1914 to 1942 this section received the identical treatment of Section 1. Section 3, the "Revised Treatment Section," received fertilizers in the same amounts and kinds as Section 1 until 1942, but since this date has been fertilized according to treatments under "Revised Treatment Section" in table 1.

Picture of a plot which received from 1914-42 identical treatments as the one shown above. Since 1942, it has received an annual application of 0-70-100.

Four years' data have been collected and furnish a basis for the study undertaken; namely, Fertilizer Inequalities . . . Can They Be Corrected?

The variation in yields obtained from the original fertilization plots show, beyond a doubt, that inequalities exist among the plots used in this study. Since the only variable from 1914 to 1942 was that of fertilization, it can be assumed that these inequalities are due, eithed directly or indirectly, to the difference in fertilizer application. The variation between the highest and lowest yielding plot is given in table 1 for each crop in all three sections. These data serve as a good measure of the degree of inequality that exists.

In the section still receiving the treatments started in 1914, the differences between the highest and lowest yielding plots are large. On an acre basis, yields vary in this section as follows: Corn, 73.3 to 41.3 bushels; wheat, 23.7 to 5.8 bushels; clover-timothy hay, 4,096 to 1,941 pounds; and mixed hay 4,288 to 2,598 pounds. These data would indicate that of the crops studied wheat is one of the most sensitive to soil inequalities. The effect of soil inequalities is not uniform or identical for the different crops studied, although the use of nitrogen alone for a long period has resulted in the lowest yields of the crops grown. Likewise with the exception of corn, the plot with complete fertilization has yielded higher than any other plot.

The yield of corn was 13.4 bushels greater in the "Residual Section" than the same plot in the "Original Treatment Section" where the annual application was 40-70-0. Likewise, the plot which received 0-70-100 yearly yielded 6.0 bushels less than the same plot receiving no fertilizer since 1941. These two cases were the only exceptions where yields were significantly greater in the "Residual Section" than in the "Original Treatment Section." Time alone apparently does very little to even out inequalities resulting from past unbalanced fertilization. This is reflected by the variation in the yield which still exists between the plots in the "Residual Section." Some progress seems to have been made as far as corn yields are concerned.

In all but two cases (and here the

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TABLE 1.—AVERAGE ANNUAL YIELD OF CORN, WHEAT, FIRST YEAR HAY, AND SECOND YEAR HAY—OLD ROTATION FERTILITY EXPERIMENT, 1942-45, INCLUSIVE.[1]

Original Treatment Section					Residual Section					Revised Treatment Section				
Fertilizer treatment Acre basis	Yield				Fertilizer treatment	Yield				Fertilizer treatment[2] Acre basis	Yield			
	Corn	Wheat	1st year hay	2nd year hay		Corn	Wheat	1st year hay	2nd year hay		Corn	Wheat	1st year hay	2nd year hay
	Bu/A	Bu/A	Lb/A	Lb/A		Bu/A	Bu/A	Lb/A	Lb/A		Bu/A	Bu/A	Lb/A	Lb/A
40–70–100	62.4	23.7	3562	4288	Plots received original fertilizer treatments from 1914–1941 inc. Since 1941 no additional fertilizer treatments have been made.	52.5	21.7	3053	4123	0–36–18	62.7	19.9	3166	4460
0–70–0	57.7	22.0	2448	3143		60.3	20.2	2445	2961	40–0–100	70.2	27.2	3507	3797
40–70–0	47.5	14.3	4096	2627		60.9	12.8	2874	2181	0–0–100	71.6	21.2	5052	2772
0–70–100	68.7	18.5	7213	3925		73.7	24.5	7131	4445	6–36–18	70.7	21.6	7821	5025
40–0–100	50.6	12.1	3583	3691		54.3	12.6	3043	2757	0–70–0	70.1	18.2	5856	4885
40–0–0	41.7	5.8	1941	2598		44.5	5.5	1468	2272	0–70–100	88.7	12.8	3699	4225
0–0–100	73.3	7.9	3480	2829		63.1	6.4	3508	2148	40–70–0	88.2	15.2	7317	3333
Maximum yield	73.3	23.7	4096	4288		73.7	24.5	7131	4445		88.7	27.2	7317	4885
Minimum yield	41.7	5.8	1941	2598		52.5	5.5	1468	2148		62.7	12.8	3166	2772
Mean yield	57.3	14.9	3760	3300		58.5	14.8	3360	2984		74.6	19.4	5203	4071

[1] Yields reported to have been adjusted on basis of uniform check.

[2] From 1914 to 1941, inclusive, same as original treatments; starting in 1942, plots have received treatment listed.

Soil Conservation Service Photo

John M. Brown, Piedmont, South Carolina, harvesting lespedeza seed from a neighbor's field. The early application of potash makes possible a hay crop in July and a crop of seed from the same land in October. This fits into the small grain-hay-seed lespedeza program discussed in this article. Some farmers prefer to apply a strong potash fertilizer to small grain at seeding time. They claim this gives lespedeza an earlier start.

Using Potash in Soil Conservation

By W. G. Lowry

Agricultural Adjustment Administration, Charlotte, North Carolina

THE Government's 1946 Agricultural Conservation Program for North Carolina includes among others a practice for applying potash materials to perennial or biennial legumes, perennial grasses, annual lespedeza, and crotalaria. Mecklenburg County chose to keep this practice along with eight others in our County Program. We regard the application of potash to lespedeza as a more important practice from a standpoint of soil improvement and volume of productivity than the practice allowed for lespedeza seeding. Our experience shows that many acres of lespedeza and other legumes will be seeded but that a comparatively small percentage will have potash applied. It is necessary that our farmers be educated to the value of this fertilizer in a legume and grass program.

Most farmers are not interested in the chemical make-up of potash materials, but are very interested in the results that may be obtained through their use. We have learned that potash may be expected to give certain results in plant growth. They may be briefly listed in the following manner:

1. Increases vigor.
2. Helps plants resist disease.
3. Gives strong stalks.
4. Increases plumpness of grains and seed.

5. Helps production of sugars, starches, and oils.
6. Gives better quality of product.

Methods for applying potash are the same as for applying any other fertilizer. As a goal, however, the more evenly the material is spread over the soil, the better the results obtained.

This spring many farmers saw the results of using a strong potash fertilizer on their grain carried over to their lespedeza crop. There have been instances reported to me in which this was demonstrated beyond a doubt. One case was in a field where 2-12-12 fertilizer was used until it gave out; then 3-12-6 was used to fertilize the rest of the field. The farmer reported that there was a clearly evident line showing in that field exactly where the 2-12-12 fertilizer ended and the other was substituted. He told me that where the potash was used the lespedeza was every bit of twice as tall, more vigorous and showed no signs of the drought. The other was dwarfed and turned brown in spots.

We have learned in this county that the continued cutting of lespedeza for hay takes potash out of the ground. This shows that it takes potash to make good lespedeza—that it is one of the plant foods necessary to produce this legume. Therefore this material should be added to lespedeza fields each year. Do not neglect the use of lime about every five years, and do not leave off the phosphate any year, but be sure to put some potash on the lespedeza fields every year. This should be done whether the crop is cut for hay, turned under for green manure, or left on the land as a temporary mulch and cover crop. Several of our most progressive farmers say that they have been cutting their lespedeza for hay at an early stage—say the last of July or the first of August—and then having a bumper crop for seed in late September or early October. It is generally known that the smaller lespedeza and the later crops of this legume produce more seed in proportion to the foliage than the earlier and more lush growths. Potash helps make such a profitable lespedeza program possible.

Very often the addition of 100 pounds of muriate of potash, or its

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Soil Conservation Service Photo

Richard Puckett, Route 9, Charlotte, North Carolina, harvesting a meadow hay mixture. Lime, phospate, and potash were applied to this land and a good yield was obtained from land rather steep to row crop.

Soil Requirements For Red Clover

By H. J. Snider

Department of Agronomy, University of Illinois, Urbana, Illinois

SOIL requirements for red clover are not so high as for alfalfa and sweet clover, although red clover is sensitive to soil deficiencies and responds accordingly as these deficiencies are corrected. Shortages of certain fertility elements in soils are the cause of most red clover failures in areas where this crop flourishes. These failures may consist of either an insufficient stand, lack of a satisfactory yield when a desirable stand is secured, or failure to produce hay and forage with desirable feeding quality.

Red clover is one of the most important hay, forage, and soil improvement crops over a large part of this continent. Regarding this legume Dr. A. J. Pieters says, "Red clover is one of the most important and most widely known of all cultivated legumes. Either alone or in mixtures with other plants, chiefly timothy, it is the most used forage and soil-improving crop throughout northern and central North America and Europe and its culture as a rotation crop extends beyond these boundaries."

Red clover has long been used as a farm crop throughout the eastern and midwestern sections of this country. Dr. Pieters says that it is not known definitely when it was brought to America, but there are records of it being grown in this country as early as 1747. E. N. Fergus is authority for the statement that red clover was brought from Pennsylvania to central Kentucky in 1803. This was probably its first appearance west of the Allegheny mountains.

Red clover is especially adapted for various crop rotations and flourishes in a variety of mixtures of other legumes and grasses. The red clover-timothy mixture is an old standard and this combination has been responsible for the production of many tons of beef, pork, dairy products, and horse power on farms throughout the land. Aside from its productive possibilities as a feed, it has enriched many acres of land and consequently increased the yield of many acres of crops. It has also saved many tons of valuable top soil from being transported to the low lands and also retarded the building up of deltas of various streams of the nation.

Red Clover Needs Phosphorus and Potassium

A great deal has been written about the effects of acid soils on the red clover crop and a less amount has been said about the effect of phosphorus and potassium deficiencies on this crop. There has been a tendency among practical men in the Midwest to assume that when the acidity of soils was corrected by liming the principal soil deficiency was cared for and red clover should flourish on all limed land. It becomes increasingly evident that available phosphorus and potassium must also be supplied when these elements are deficient in soils if red clover is to make the most in yield and give the highest feeding quality in hay and forage.

Red clover in Illinois responds rather remarkably to potash treatment on land deficient in available potassium. It has frequently given substantial increase in yields on soils not considered especially deficient in this element.

TABLE 1. YIELD AND COMPOSITION OF CLOVER HAY ON SOILS OF HIGH AND LOW AVAILABLE POTASSIUM CONTENT.

Soil Treatment	Hay lbs/A	Per cent		
		Protein	P	K
	Easton 90 pounds*			
SP	790	16.1	.17	1.47
SPK	2210	15.9	.15	1.92
	Toledo 80 pounds*			
LrP	3500	19.1	.24	1.01
LrPK	4180	18.2	.23	2.61
	Elizabethtown 180 pounds*			
LrP	2540	16.8	.19	1.92
LrPK	3180	18.0	.20	2.51
	Joliet 200 pounds*			
LrP	3940	16.8	.24	1.34
LrPK	4040	16.9	.21	2.18

* Amounts available potassium in untreated soil. Red clover except Toledo field was alsike. Muriate of potash applied: Easton, 400 pounds on wheat, clover seeded in wheat. Toledo, 200 pounds on wheat, 100 pounds on corn, 100 pounds on clover. Elizabethtown, 200 pounds on wheat, 200 pounds on corn, 100 pounds on clover. Joliet, 200 pounds on wheat, 100 pounds on corn, 100 pounds on clover.

This is apparent from the results in table 1, where on soils containing only 80 to 90 pounds available potassium an acre there were 680 and 1,420-pound increases respectively in hay yield where muriate of potash was applied to the land. There was an increase of 640 pounds hay an acre on the Elizabethtown field where muriate of potash was applied. The available potassium content of this soil was as high as 180 pounds an acre. Potash treatment had been followed for a number of years on this field and evidently had been helpful also in building up the much needed organic matter supply in this eroded hill land.

Potash treatment on the Dixon experiment field gave increased red clover hay yields each of the three successive years indicated in table 2. This field is on Muscatine silt loam which contains

TABLE 2. RED CLOVER HAY YIELD AND COMPOSITION THREE DIFFERENT YEARS ON THE DIXON FIELD.

Soil Treatment	Hay lbs/A	Per cent		
		Protein	P	K
	1943			
LP	2020	16.2	.21	1.14
LPK	2720	16.4	.20	1.96
	1944			
LP	2880	19.0	.19	1.30
LPK	3400	17.0	.18	1.90
	1945			
LP	2820	21.0	.24	1.70
LPK	3080	21.0	.20	2.31

Muriate of potash applied 100 pounds for corn, 200 for wheat, and 100 on oat stubble for clover.

Red clover grown on Illinois Corn Belt soils has been found to contain potassium equivalent to 100 lbs. of 50% muriate of potash in a ton of dry hay. This important soil improvement crop may rob the land of a very essential element.

about 170 pounds an acre of available potassium and as a rule is not considered in need of potash fertilizers. The gain in hay yield on this field which may be attributed to the 100 pounds of muriate of potash varied from 260 pounds up to 700 pounds an acre or an average of 510 pounds for the three years. In addition there is to be considered the second crop and the additional organic matter added by the larger clover growth.

It is of interest and of considerable value to note the distribution of the amounts of dry matter and percentages of various elements in the stems, leaves, and bloom of the red clover plant at hay stage. Stems make up the largest proportion of the hay, 56%, compared to 39% leaves and 5% bloom (table 3). The clover blossoms are relatively rich in nitrogen, phosphorus, and potassium, but make up such a small percentage of the total bulk as to be rather insignificant in the feeding value of the hay. Leaves are relatively high in nitrogen, phosphorus, and calcium, while the stems are relatively low in these important elements. It may be readily seen that red clover could be converted from a high protein to a relatively low protein hay through the loss of a large part of the leaves during hay-making operations.

On the basis of the percentages presented in table 3 approximately 60% of the potassium in the red clover hay

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TABLE 3. COMPOSITION OF RED CLOVER LEAVES, STEMS, AND BLOOM, AVERAGE OF FIVE SAMPLINGS, JUNE 15-19, 1945.

Part of Plant	Per cent of total	Percentage					
		N	P	K	Ca	Mg	Fe
Leaves	39	3.50	.17	1.87	2.17	.42	.004
Stems	56	1.48	.11	2.14	.89	.32	.004
Bloom	5	2.83	.23	2.32	.92	.28	.002

Crop Requirements For Available Potash

By Eric Winters

Agronomy Department, University of Tennessee, Knoxville, Tennessee

"WHAT kind of fertilizer should I use—and how much?" farmers often ask.

For a satisfactory answer, the fertility of the soil and the fertility requirements of the crop to be grown are important things to know. Then if the soil fertility is deficient in any respect for that crop, the kind and amount of fertilizer necessary to overcome the deficiency can be recommended.

In recent years chemical methods have been proposed for evaluating the fertility, or "available" nutrient content, of soil samples. When the results of such chemical tests can be correlated with crop yields on the fields from which the soil samples were taken, a sound basis for predicting fertilizer needs of this crop on similar soils is provided.

Several years ago field experiments with corn, cotton, dark-fired tobacco, alfalfa, and Irish potatoes were started in Tennessee to determine their response to potash fertilization at different levels of "available" potash in the soil. Three treatments were given each field experiment—no potash, a medium potash application, and a heavy application. All plots, except in the case of alfalfa, were given uniform applications of nitrogen and phosphate to eliminate any serious deficiency of these two critical materials.

Soil samples were collected from each plot area before any fertilizer was applied. "Available" potash was determined on the samples by a modification of the chemical analysis method suggested by R. H. Bray of Illinois. The method chosen measures the exchangeable soil potassium which is presumed to represent the "available" potassium in the soil.

During a four-year period beginning in 1940, 60 field experiments were completed. The data obtained are summarized in Table 1. The levels of exchangeable soil potassium used in grouping the data for Table 1 were selected tentatively after preliminary inspection of the results. Thus, 150 lbs. per acre (75 ppm) are designated as a medium level and 200 lbs. per acre as a high level of exchangeable potassium. Only in the case of corn were there sufficient data to justify three groups in the summary.

Results

The average yields of the no-potassium plots are given in column 4 of Table 1. Except in the case of corn, the soils with the higher exchangeable potassium gave the higher yield. In the case of corn, 11 of the 16 experiments where the exchangeable soil potassium is below 150 lbs. were located in Carter County. Carter County lies in the extreme northeast section of Tennessee where soil and climatic conditions differ from those in other parts of the State. Therefore, the average yields for the Carter County experiments and those outside Carter County were computed separately for these soils low in potassium, and the former are shown in parentheses in Table 1. Only two of the remaining 14 corn experiments were located in Carter County, and their effect on the average yields for the soils containing more than 150 lbs. of available potassium can safely be neglected. If only the corn data outside Carter County for the soils low in potassium are considered, then the correlation between yield of corn and exchangeable potassium is comparable to that observed with other crops.

Average Yield Response to Fertilization

The average yield increases from potash fertilization are given in column 6 of Table 1. They are greater in every case on the soils with the lower exchangeable potassium. The appreciable average yield responses for those corn experiments where the exchangeable soil potassium exceeded 200 lbs. were due in each case to one exceptional experiment. The averages omitting these single experiments are given in parentheses. It will be noted that the yield on the check plots of the soils low in exchangeable potassium, plus the increase in yield with the larger increment of potash, approximately equals the yield on the check plot of the soils high in exchangeable potassium. Since very little increase resulted from potash fertilization on these high potash soils, it can be safely assumed that sufficient potash was supplied by the higher rates of application so that it was not an important factor limiting yield under the conditions of these experiments. Another point worth noting is the operation of a law of diminishing returns with the larger increment of potash. This also suggests that the larger amount of potash added is approaching the maximum

TABLE 1.—AVERAGES OF CHECK PLOT YIELDS AT DIFFERENT LEVELS OF EXCHANGEABLE POTASSIUM AND AVERAGE YIELD INCREASES FROM POTASSIUM FERTILIZATION

Crop	Exchangeable K in soil Lbs. per acre	No. of field trials	Average yield of check plots	Increment of K_2O Lbs. per acre	Average yield increase per acre
Corn	Under 150	16	53.6 bu. (58.3)[1] (33.8)[2]	25 75	8.5 bu. 11.2 bu.
	150 to 200	10	41.9 bu.	25 75	3.5 bu. 7.0 bu.
	Over 200	4	52.8 bu.	25 75	3.1 bu (1.3)[3] 4.9 bu (−0.5)[3]
Irish potatoes	Under 200	4	80.0 bu.	50 150	37.5 bu. 49.5 bu.
	Over 200	3	136.0 bu.	50 150	5.6 bu. −2.3 bu.
Alfalfa	Under 150	5	1.89 tons	50 150	.53 ton 1.02 tons
	Over 150	3	3.20 tons	50 150	None None
Cotton	Under 200	6	977 lbs. (seed cotton)	25 75	177 lbs. seed cotton 272 lbs. seed cotton
	Over 200	3	1266 lbs. (Seed cotton)	25 75	23 lbs. seed cotton 120 lbs. seed cotton
Dark-fired tobacco	Under 200	3	221 dollars	50 150	31 dollars 49 dollars
	Over 200	7	242 dollars	50 150	−3 dollars 10 dollars

[1] Average for Carter Co. [2] Average excluding Carter Co. [3] Average for three trials.

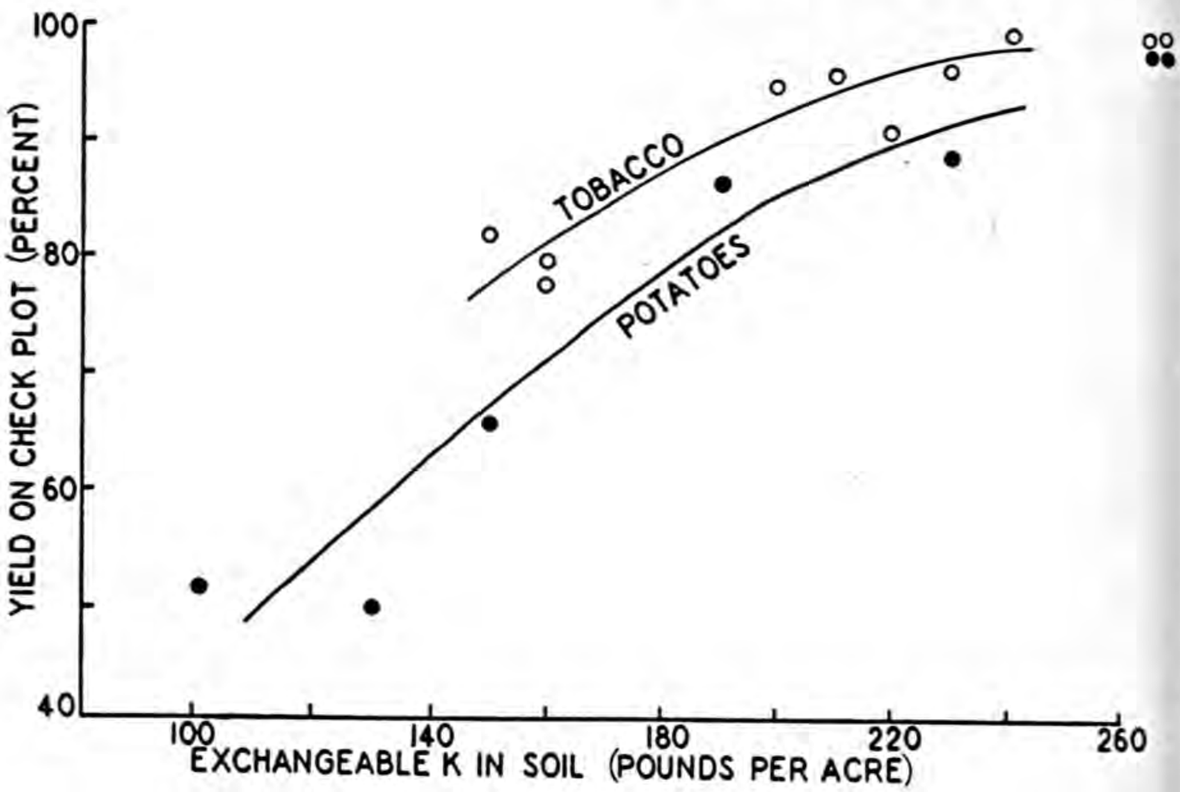

Fig. 1. Relationship between exchangeable potassium and yields of tobacco and Irish potatoes on check plots receiving no potash.

that could be used by the crops under the conditions of these experiments.

Yield Response Graphs for Each Crop

Another way of presenting data of this type graphically in order to bring out other significant relationships has been suggested by Bray. The yield on the plot receiving the high potash increment is taken as 100%, and the yield on the check plot is computed as a percentage of this yield. Then the response of a given crop to potash fertilization from a number of experiments may be plotted on the same graph where the percentage yield of the check plot is represented in the vertical direction, and the exchangeable soil potassium is represented in the horizontal direction.

Figure 1 presents the data for dark-fired tobacco and Irish potatoes graphed in this fashion. A smooth curve has been fitted approximately to the points for each crop to show the trends. It is at once clear that the potash requirement for potatoes is greater than that for tobacco, since for any given level of exchangeable potassium, the percentage yield for tobacco is higher than for potatoes.

The data for the 30 corn experiments have been graphed in a similar fashion in Figure 2. The points for the Carter County experiments have been differentiated from the others. The upper broken curve shows the trend for the Carter County data. The lower broken curve shows the trend for the other data. The solid curve shows the general trend of all corn data.

The yield response curves for all crops studied have been assembled in Figure 3. The curves for alfalfa and cotton are less reliable than the others because they are based on fewer and less consistent data.

Relative Potassium "Requirements" of Crops

Except for alfalfa, the curves in Figure 3 are all similar in general shape but they differ in respect to their positions on the graph. The relative potassium "requirement" of each crop may be inferred from this positional

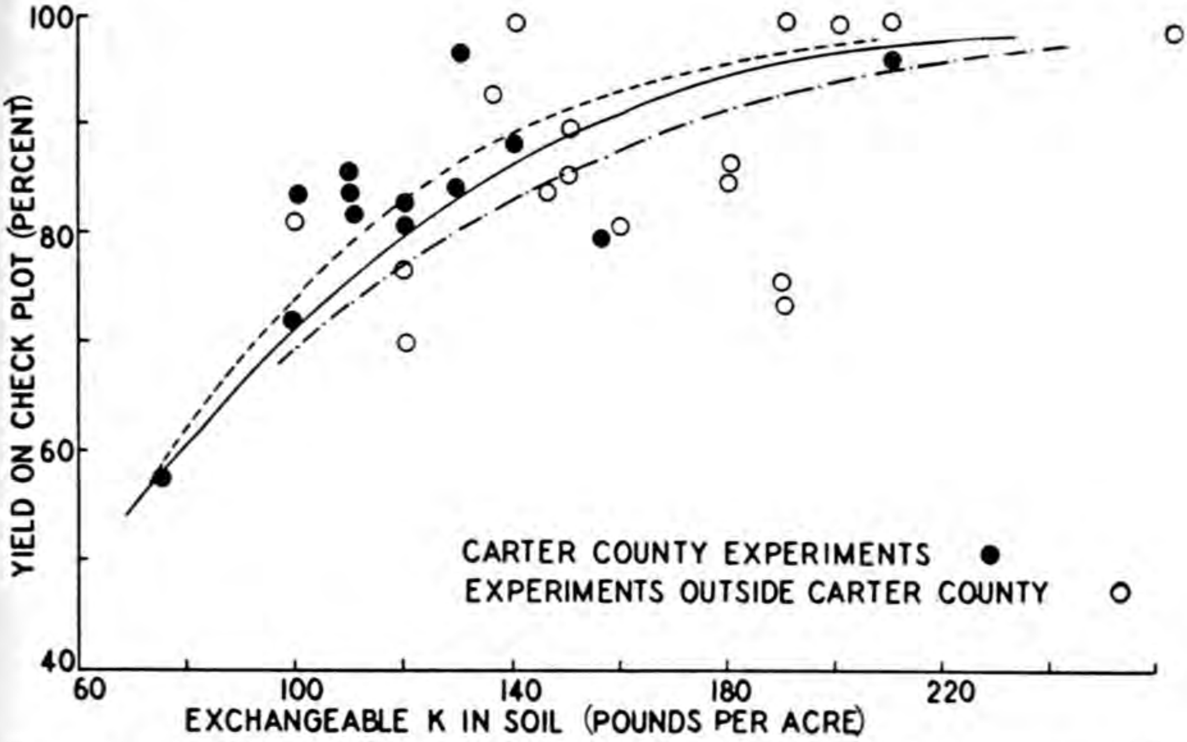

Fig. 2. Relationship between exchangeable potassium and corn yields on plots receiving no potash.

difference by comparison of the soil content of available potassium at some suitable yield level, say 90%. In this region the curves, except for alfalfa, are tending to level out. The approximate potassium requirements in pounds per acre for a 90% yield are as follows: corn, 155; alfalfa, 160; cotton, 185; dark-fired tobacco, 190; Irish potatoes, 220.

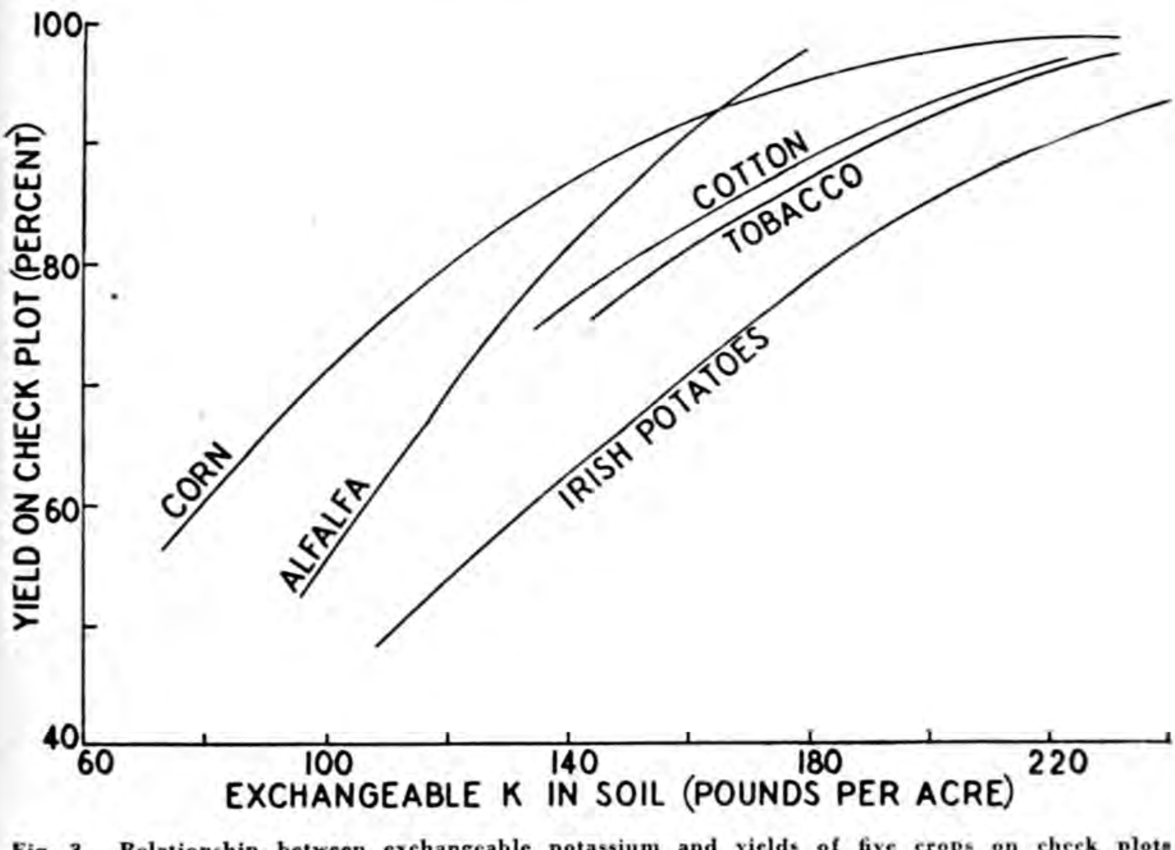

Fig. 3. Relationship between exchangeable potassium and yields of five crops on check plots receiving no potash.

Other Data on Yield Responses of Crops to Potash Fertilization

Bray has recently published a yield response curve for corn. Comparison of this curve with Figure 2 shows the two curves to be very similar. The scatter of points in Figure 2, however, is somewhat greater than in Bray's graph, and the potassium requirement at the 90% yield level is smaller, being 155 lbs. as compared to 180 lbs. These differences are not surprising in view of the variations of soil and climatic conditions between Tennessee and Illinois.

Three other recent studies which contained all the soil and crop data necessary for the preparation of yield response curves have been published. The resultant graphs are not reproduced here, but the points of major interest brought out by comparison of these graphs with those in Figure 3 will be presented.

The data on cotton obtained by C. D. Hoover in Mississippi gave a curve very similar to the one for cotton in Figure 3. The potassium requirement at the 90% yield level is 180 lbs., which is in close agreement with 185 lbs. in this study. The soil and climatic conditions under which Hoover's data were collected are fairly comparable to those of the cotton belt of Tennessee, so the close agreement in response is not surprising.

L. C. Olson's data on cotton were obtained in Georgia. Most of the soils had low exchange capacities of about three milli-equivalents with only a few as high as five or six milli-equivalents. This is in contrast to capacities of five to 12 milli-equivalents or more for most of the soils in the Mississippi and Tennessee studies on cotton. The curve for cotton obtained from Olson's data is comparable to the others above 160 lbs. of exchangeable soil potassium, but at lower values it is more nearly horizontal. Thus at 90 lbs. of available soil potassium the graph of Olson's data indicates a yield level of 70%, while in the case of the graph of Hoover's data the yield level is only 50%. This indicates a higher availability of potassium to cotton in soils of lower exchange capacity.

The data on soybeans obtained by W. L. Nelson and W. E. Colwell in

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Fig. 4. Corn at right received no potash; the row of taller corn received 25 lbs. of potash (K_2O). Fullerton soil very low in exchangeable potassium (50 lbs. per acre).

Three Thousand Miles to Market

By E. R. Jackman

Extension Specialist in Farm Crops, Oregon State College, Corvallis, Oregon

SOMEONE defined a seed as "a small plant, packaged for shipping." Each year millions and hundreds of millions of these tiny plants move from the state of Oregon by all possible routes to the 13 southern states. The South rather strangely gets its cover crop seeds from Oregon, which is about as far away as one can get and still stay in the United States. If 1,650 freight cars were loaded to 80,000 pounds, they would just about hold the annual southern movement of these seeds from Oregon. The money value of this transcontinental diagonal movement is about $8,000,000.

The crops involved are Austrian Winter peas, Willamette vetch (pronounced to rhyme with dammit, not silhouette), common vetch, Hungarian vetch, and common ryegrass. Oregon grows many other seed crops also, but these make up the bulk of this unique cross-country business.

They are used in the South mainly for cover crops—to nail down the soil during the winter and to impart to it the life-giving nitrogen. It is not always understood that most of the southern problems are born of the soil.

The main trouble comes from the same source as the energy of the atomic bomb—the sun. We are inclined to look at all tropical lands and the near tropics as places of marvelous fertility where one plants a seed and jumps back; where the jungle covers by night as much land as a man can clear by day. But, as many of our soldiers found when detailed to raise gardens in the South Pacific, a hot sun on bare ground does things that are all bad. The sun burns out the organic matter and the organic matter is the only source of nitrogen.

So the lands of the South are the same as the coral islands of New Guinea—dreadfully shy of nitrogen. Most of the southern states raise more acres of corn than cotton, but take a look at a meager set of statistics below, deliberately shortened and simplified to avoid dullness:

Area	Average Corn Yield 1932–41	Total Corn Acreage Harvested
7 states farthest south (Alabama, Mississippi, Louisiana, Texas, Florida, Georgia, South Carolina)	13.2 bushels per acre	19,629,000
7 northern corn belt states (Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa)	38.1 bushels per acre	35,032,000

And yet, with the long growing season, plenty of summer moisture, and farmers trained to row-crop farming, the South succeeds time after time in capturing personal and individual acre national yield laurels. One can raise more corn per acre in the South than elsewhere, but in order to do so, the commercial fertilizer must be piled on. The South incidentally uses more commercial fertilizer per acre than the Midwest by several times over. In 1943, the last year for which I have seen the figures, the southern states above (minus Texas) averaged 330 lbs. of commercial fertilizer per harvested acre, while the corn belt states used an average of 28 pounds.

So we come back to the southern soil and the sad lack of nitrogen. That nitrogen must be supplied either by commercial fertilizer or by cover crops or both. The use of one does not erase the need for the other. As the nitrogen need became apparent to thoughtful southerners about 50 years ago, they experimented with every known legume and soon found that legumes would not do well in most places without phosphate, lime, and often potash. In order to correct the glaring nitrogen defect, it was often necessary to invest heavily in other elements.

At first the vetches and peas were bought in Europe, but the supplies were uncertain, of poor quality, and difficult to get when needed. Oregon jumped into the picture about 20 years ago and started to ship south in quantity. Why Oregon? Because this state has that most rare of climatic combinations, cool summers without rain, cool to promote slow ripening and plump seeds, and dry for uninterrupted harvests.

Expanded Rapidly

Acreage expansion, at first slow and spasmodic, received a boost from the AAA soil improvement program. The groundwork had been laid by years of careful experimental work in all of the southern states. County agents were prepared to tell people exactly where they could seed each kind of cover crop, how much to seed, when to seed, how to fertilize, and when to turn it down.

It had been demonstrated that continuous cover cropping tended to build up yields, or give a cumulative effect. Thus the second five years of a cover crop program usually produced more corn or cotton per acre than the first five years, whereas with commercial nitrogen, or "sto' bought nitrogen" there was no such bonus yield.

The cover crops had other advantages: prevention of erosion, of course, and use for pasture and hay. The "sto' bought nitrogen" could hardly compete in these uses.

At any rate, the cover crop acreage in Oregon responded generously to the stimulus of the AAA program and later to the still greater needs fostered by the war-time nitrogen shortage. Here is the over-all acreage of all of these crops grown in Oregon for seed:

Year	*Acreage all Cover Crops in Oregon*
1930	30,100
1935	71,900
1940	251,200 (AAA boost)
1942	387,000 (War-time needs)

Since then acreage has slumped due to removal of support prices on peas and because of insect troubles with hairy vetch. In many western Oregon counties one acre out of every four is still in these cover crop seeds, and in the 150-mile length of the Willamette Valley, no matter what road one travels, he is never out of sight of a seed field.

Of all the cover crops used in the South, hairy vetch gets the nod over competitors. On southern farms it will grow on dry soils where peas fear to tread; it will thrive on soils so acid that other vetches and peas never even start; it will survive sudden blasts from cruel north winds that send other shivering crops below ground; and it is the all around foolproof crop. Its cold resistance can be gauged by the fact that the only state outside of Oregon that historically has been a consistent seed producer is Michigan.

Unfortunately, from a seed producer's standpoint the hairy vetch is the bad boy of the group. Seed shatters with eager haste to do its own harvesting, drastically limiting the acreage on any one farm; a sudden hot spell of 90° or more may blast the blooms and reduce

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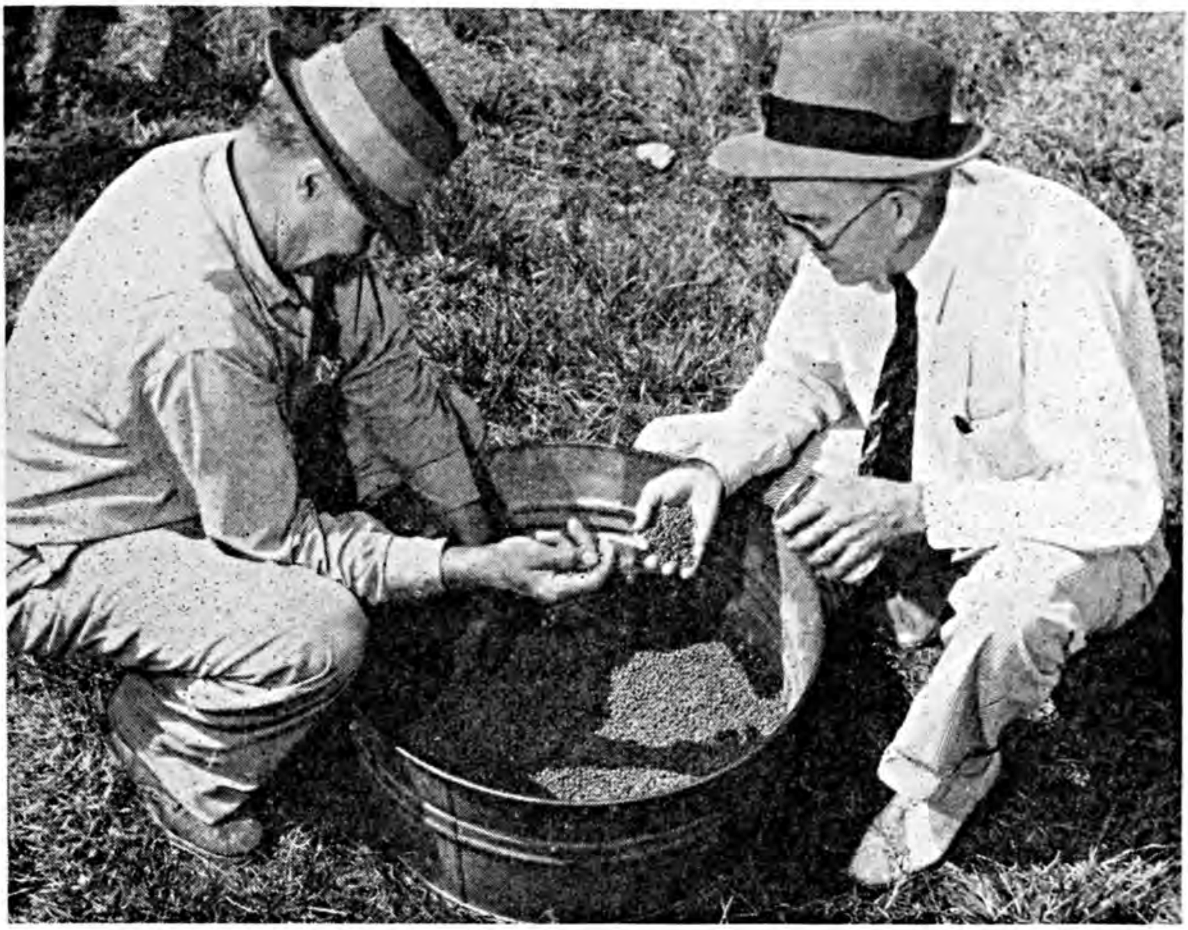
The rich purple blooms of hairy vetch make a colorful countryside in Oregon in June.

Above: A Willamette Valley seed farm with hairy vetch in the foreground nearly ready for harvest.

Below: The Federal-State Laboratory at Corvallis tests more seed samples than any other laboratory in the U. S.

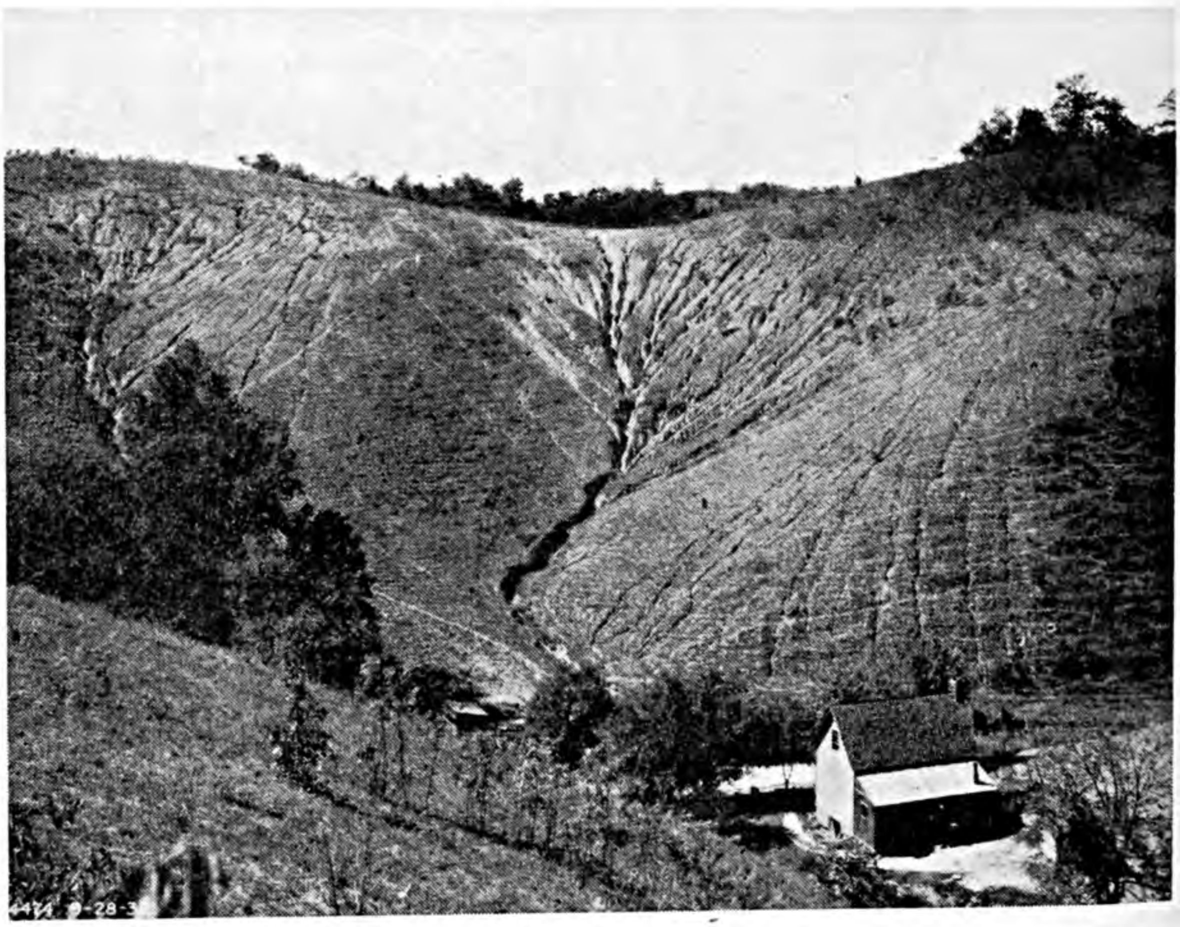


Above: In Lincoln County, Mississippi, a farmer inoculates his seed of winter peas from Oregon.

Below: Cotton in the famous Delta country of Mississippi following soil-enriching crop of winter legumes.

Above: Dusting hairy vetch for weevil control. Nearly the entire Oregon acreage was dusted in the spring of 1946.

Below: This barren hillside clearly shows the deep erosion which inevitably results from row cropping on steep land.



The Editors Talk

A New National Soil Association

A little vague, perhaps, to most people only a few years ago, the words "soil conservation" have now come to mean one of the greatest national projects for maintaining this country's wealth and power and recognized as the concern of everyone. Announcement of the formation of a National Association of Soil Conservation District Governing Officials in August of this year is therefore to be welcomed as another means not only of awakening public consciousness but of greater efficiency within the project.

The new association explains its background as stemming from the dust storms of the mid-thirties and the increasing soil erosion which aroused the Nation to the need for combatting this menace. Conservation research was strengthened and watershed demonstration projects and CCC camps were established throughout the country to show farmers how to control soil erosion with crops best adapted to good land use. Out of these experiences grew the knowledge that responsibility for conservation work must rest with local farmers and ranchers.

To accomplish this, state legislatures in 1937 began to pass soil conservation district laws, patterned after a national model, authorizing the establishment of soil conservation districts under time-honored democratic processes of petition, referendum, and election. A soil conservation district is an organization of farmers, by farmers, for farmers, and is a local subdivision of a state, set up under the laws of the state in which it lies. It is organized and run by farmers and ranchers to protect farm and ranch land from erosion, conserve rainfall, and improve productivity. It is authorized to ask and receive help from state, federal, and local governments and from private sources. The Soil Conservation Service and other federal and state units and private sources furnish technical and other aid to districts.

Between 1937 and mid-June 1946, farmers and ranchers had formed over 1,600 soil conservation districts in 48 states. These districts included more than 3,800,000 farms—over two-thirds of the farms and ranches in the country—containing over 800,000,000 acres. Additional districts are being formed at a rapid rate. District governing officials have organized state associations in two-thirds of the states of the Union. These officials found that state associations of members of district governing bodies enabled them to develop better methods for managing the districts. They then felt the need for a national association to do a similar job on a national scale.

Representatives of soil conservation districts from 32 states met in Washington in January 1946 and instructed E. C. McArthur of Gaffney, S. C., President of the South Carolina Association, to form a committee to organize a national association. This committee of 18 met in Chicago in July, adopted a constitution, and elected a temporary board of directors—one from each of the seven geographical divisions of the country. The temporary Board then elected Mr. McArthur President and R. L. Rutter, Jr., of the Kittitas Soil Conservation District of Washington, Vice-president. Other states represented on the Board of Directors include Texas, Colorado, Kansas, Ohio, and Maine. Other states represented on the Committee were Alabama, Louisiana, Kentucky, Michigan, Indiana, Maryland, Nebraska, West Virginia, Minnesota, and Arizona.

The National Association is to be a non-profit, non-partisan organization formed to accelerate the effective functioning of soil conservation districts as democratically organized and operated public instrumentalities, through which landowners and operators may work cooperatively in effectuating the conservation and wise use of the Nation's soil and water resources. Its more specific purposes are:

a. To facilitate the exchange of information, knowledge, and experience among soil conservation district governing bodies.

b. To collect, compile, and disseminate information relating to the organization and effective functioning of soil conservation districts.

c. To further the functioning of State Associations, or other organized groups of members of soil conservation district governing bodies.

d. To advance generally the organization and functioning of soil conservation districts, including matters relating to applied sciences, processes of administration, and management arts used by them.

An organization actively carrying out the four purposes listed above should be able to perform a substantial service in strengthening soil conservation work throughout the country. It is to be hoped that this new Association will succeed in developing a well-rounded program based on these purposes, and its activities will be watched with interest.

Thanksgiving

Our All-American holiday has a deeper meaning in store for it this year. Events of the past few years have made individuals more keenly aware of their everyday blessings. Things like freedom and peace and health are more than words in songs, more than words of grace spoken over the roast turkey. They have come to life with a personal and present feeling.

This Thanksgiving will be more than a recounting of our personal benefits. A keener edge has been put upon our sympathy for the less fortunate, and our prayers are including them. We are more interested in the brotherhood of man and hopeful for its greater recognition. But recognition will not come with the wishing for it; recognition comes with a day-in and day-out living of ideals—an earnest pursuit of the principles we deem worthwhile.

Let us appreciate the abundance that is ours, but let us also find the time and the occasion to manifest in actual deeds the thoughts that come to mind as we say our Thanksgiving prayer.

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
October......	22.30	45.9	126.0	180.0	113.0	151.0	14.30	51.00	....
November....	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January.....	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March.......	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April........	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
May.........	24.09	43.0	157.0	251.0	135.0	170.0	14.80	49.60	....
June.........	25.98	59.0	147.0	251.0	142.0	174.0	14.70	51.50	....
July.........	30.83	56.7	148.0	275.0	196.0	187.0	15.00	60.00	....
August......	33.55	48.6	143.0	280.0	180.0	178.0	15.10	59.10	....
September...	35.30	48.8	128.0	224.0	173.0	179.0	15.40	57.80	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
October......	180	459	181	205	176	171	120	226	181
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January......	180	363	208	237	171	174	132	226	249
February....	186	339	209	254	173	175	133	223	275
March.......	183	319	225	269	178	179	137	211	283
April........	190	429	232	279	181	179	126	213	282
May........	194	430	225	286	210	192	125	220	177
June.........	210	590	211	286	221	197	124	228	185
July.........	249	567	212	313	305	212	126	266	163
August......	287	486	205	319	280	201	127	262	162
September...	285	488	184	255	269	202	130	256	154

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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
1922	3.04	2.58	6.07	4.66	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.59	5.16
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						
October	1.75	1.42	7.81	5.77	4.86	6.71
November	1.75	1.42	7.81	5.77	4.86	6.71
December	1.75	1.42	7.81	5.77	4.86	6.71
1946						
January	1.75	1.42	7.81	5.77	4.86	6.71
February	1.75	1.42	7.81	5.77	4.86	6.71
March	1.75	1.42	7.81	5.77	4.86	6.71
April	1.75	1.42	7.81	5.77	4.86	6.71
May	1.75	1.42	9.08	6.10	4.86	7.30
June	1.88	1.42	10.34	6.42	4.86	7.90
July	1.88	1.42	11.62	8.15	5.34	9.60
August	2.22	1.46	17.15	8.14	6.07	12.14
September	2.22	1.46	10.60	6.95	6.07	12.14

Index Numbers (1910-14=100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1922	113	90	173	132	140	142
1923	112	102	177	137	136	147
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						
October	65	50	223	163	144	191
November	65	50	223	163	144	191
December	65	50	223	163	144	191
1946						
January	65	50	223	163	144	191
February	65	50	223	163	144	191
March	65	50	223	163	144	191
April	65	50	223	163	144	191
May	65	50	259	173	144	207
June	70	50	295	182	144	224
July	70	50	332	231	158	273
August	83	51	490	231	180	345
September	83	51	303	197	180	345

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	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
1922	.566	3.12	6.90	.632	.904	23.87	....
1923	.550	3.08	7.50	.588	.836	23.32	....
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
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	.570
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							
October	.650	2.20	6.28	.535	.797	26.00	.200
November	.650	2.20	6.40	.535	.797	26.00	.200
December	.650	2.20	6.40	.535	.797	26.00	.200
1946							
January	.650	2.20	6.40	.535	.797	26.00	.200
February	.650	2.20	6.40	.535	.797	26.00	.200
March	.650	2.20	6.40	.535	.797	26.00	.200
April	.650	2.20	6.40	.535	.797	26.00	.200
May	.650	2.20	6.40	.535	.797	26.00	.200
June	.650	2.30	6.45	.471	.729	22.88	.176
July	.650	2.60	6.60	.471	.729	22.88	.176
August	.700	2.60	6.60	.471	.729	22.88	.176
September	.700	2.60	6.60	.471	.729	22.88	.176

Index Numbers (1910-14=100)

1922	106	87	141	89	95	99	....
1923	103	85	154	82	88	96	....
1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
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							
October	121	61	129	75	84	108	83
November	121	61	131	75	84	108	83
December	121	61	131	75	84	108	83
1946							
January	121	61	131	75	84	108	83
February	121	61	131	75	84	108	83
March	121	61	131	75	84	108	83
April	121	61	131	75	84	108	83
May	121	61	131	75	84	108	83
June	121	64	132	66	76	95	80
July	121	72	135	66	76	95	80
August	131	72	135	66	76	95	80
September	131	72	135	66	76	95	80

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**
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
October	199	182	154	97	57	175	121	78
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	156	97	57	175	121	78
February	207	185	156	97	57	175	121	78
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78
May	211	192	162	99	57	189	121	76
June	218	196	163	100	60	203	121	70
July	244	209	181	103	60	230	121	70
August	249	214	187	116	67	296	131	70
September	243	210	181	108	67	226	131	70

* 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] Since June 1941, manure salts are quoted F.O.B. mines exclusively.

**** The weighted average of prices actually paid for potash are 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.

Fertilizer

"Annual Report for the Calendar Year 1945," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., Oct. 1945.

"Spinach Fertilizer Experiments," Div. of Truck Crops, Univ. Farm, Davis, Calif., T. C. Mimeo. No. 37, 1946.

"Fertilizers for 1947," The Maritime Fertilizer Council, Moncton, N. S., Canada.

"Annual Report, State Chemist of Florida, Yr. end. Dec. 1945, Pt. I: Fertilizers," Chem. Div., Agr. Dept., Tallahassee, Fla.

"Fertilizer Materials Used in Florida for Fiscal Year July 1, 1945, thru June 30, 1946," Fertilizer Stat. Div., Bu. of Insp., Tallahassee, Fla.

"Liming the Soil to Increase the Yield of Cotton," Agr. Exp. Sta., Experiment, Ga., Pr. Bul. 572, Aug. 16, 1946, L. C. Olson and R. P. Bledsoe.

"County Fertilizer Data: Mixed Goods and Materials, July 1, 1945 through June 30, 1946," St. Dept. of Agr., Jackson, Miss.

"Poultry Manure and How to Use It," Ext. Service, N. J. State College of Agr., Rutgers Univ., New Brunswick, N. J., Ext. Bul. 241, April 1946, H. R. Cox.

"Ohio Law Relating to Sale of Agricultural Liming Material," Div. of Plant Ind., Dept. of Agr., Columbus, Ohio.

"Summary of Fertilizers and Fertilizer Materials Sold in South Carolina," Clemson Agr. College, Clemson, S. C., Aug. 30, 1946, B. D. Cloaninger.

"Fertilizer Tests with Cotton and Corn at the El Paso Valley Substation, 1943-45," Substation No. 17, Ysleta, Texas, P. R. 993, Mar. 11, 1946, P. J. Lyerly.

"Effect of Phosphates upon the Percentage of Phosphoric Acid in Pasture Grasses," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 996, Mar. 23, 1946, J. F. Fudge and R. R. Lancaster.

"Distribution of Fertilizer Sales in Texas, July 1-Dec. 31, 1945," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 998, Apr. 9, 1946, J. F. Fudge.

Soils

"General Summary of Soil Experiment Field Results—Joliet, AG 834; Dixon, AG 835; Clayton, AG 836; Aledo, AG 837; Carthage, AG 838; Carlinville, AG 839a; Kewanee, AG 840; Oquawka, AG 841; McNabb, AG 842; Mt. Morris, AG 843; Minonk, AG 844; Hartsburg, AG 845; Brownstown, AG 953; Toledo, AG 1023; Newton, AG 1096a; Enfield, AG 1096b; West Salem, AG 1096c; Ewing, AG 1096d; Dixon Springs, AG 1096e; Raleigh, AG 1096f; Lebanon, AG 1096g; Oblong, AG 1096h; Sparta, AG 1096i; Elizabethtown, AG 1096j; Bloomington, AG 1145; Antioch, AG 1146; Urbana, AG 1150 Rev.;" Agr. Exp. Sta., Univ. of Illinois, Urbana, Ill., May 1946, F. C. Bauer, A. L. Lang, M. H. Nelson, L. B. Miller, P. E. Johnson, C. J. Badger, and C. H. Farnham.

"Directions for Collecting Soil Samples from a 40-Acre Field," Dept. of Agron., Univ. of Illinois, Urbana, Ill., M-397, Feb. 1946.

"Soil Conservation Districts in Indiana," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., Leaf. 233 (2nd Rev.), 1946.

"Experiments in the Control of Soil Erosion in Central New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 831, Apr. 1946, G. R. Free, E. A. Carleton, John Lamb, Jr., and A. F. Gustafson.

"Orchard-Site Selection," N. Y. State College of Agr., Cornell Univ., Ithaca, N. Y., E. Bul. 697, June 1946, Damon Boynton.

"Publications of G. S. Fraps and Work of Division of Chemistry Texas Agricultural Experiment Station 1903-1945," Agr. Exp. Sta., Texas A & M. College Station, Tex., P. R. 958, Sept. 10, 1945, A. D. Jackson, Editor.

"Economic Land Classification of Grayson County," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 392, Mar. 1946, G. W. Patteson and Z. M. K. Fulton, Jr.

"Some Soil Properties Which Influence the Use of Land in West Virginia," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 321, Sept. 1945, R. M. Smith, G. G. Pohlman, and D. R. Browning.

Crops

"Growing Alfalfa on Sand Mountain," Agr. Exp. Sta., Alabama Polytechnic Inst., Auburn, Ala., P. R. 3 (Rev. July 1946), R. C. Christopher.

"Forty-seven Years of Experimental Work with Grasses and Legumes in Alaska," Agr.

Exp. Sta., Univ. of Alaska, College, Alaska, Bul. 12, Nov. 1945, Don L. Irwin.

"Blackeye Beans in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 696, Feb. 1946, W. W. Mackie.

"Citrus Culture in California," Agr. Ext. Ser., Univ. of Calif., Berkeley, Calif., Cir. 114, Jan. 1940 (Rev. Feb. 1946), R. E. Caryl (Rev. by J. C. Johnston).

"Hays and Hay Making in the Prairie Provinces," Dominion Exp. Farm, Brandon, Manitoba, Can., Publ. 722, Aug. 1946 (Rev.), M. J. Tinline.

"Horticultural Experiment Station, Report for 1943-1944," Ontario Hort. Exp. Sta., Vineland Sta., Ont., Can., 1945.

"Azalea Culture for Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., P. Bul. 621, April 1946, R. J. Wilmot and R. D. Dickey.

"Winter Pasturing and Feeding of Cattle," Ga. Exp. Sta., Experiment, Ga., P. Bul. 570, July 24, 1946, O. E. Sell and Z. A. Massey.

"Growing Small Grains," Ga. Exp. Sta., Experiment, Ga., P. Bul. 573, Aug. 19, 1946, U. R. Gore and J. G. Futral.

"Four Field Crop Rotations," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG 1288, Dec. 1945, F. C. Bauer.

"Helps for the Home Garden," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., E. Bul. 238 (4th Rev.), 1946, W. B. Ward.

"Indiana Peach Production," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., E. Bul. 322, 1946, C. L. Burkholder and Clarence E. Baker.

"Ornamental Shrubs, Their Planting and Care," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., E. Bul. 324, R. B. Hull.

"The Retting of Hemp: I. Field Retting of Hemp in Iowa," Agron. Sect., Iowa State College, Ames, Iowa, Res. Bul. 342, May 1946, W. H. Fuller, A. G. Norman, and C. P. Wilsie.

"The Retting of Hemp: II. Controlled Retting of Hemp," Agron. Sect., Iowa State College, Ames, Iowa, Res. Bul. 343, May 1946, W. H. Fuller and A. G. Norman.

"The Retting of Hemp III. Biochemical Changes Accompanying Retting of Hemp," Agron. Sect., Iowa State College, Ames, Iowa, Res. Bul. 344, May 1946, W. H. Fuller and A. G. Norman.

"The Home Lawn," Agr. Exp. Sta., Iowa State College, Ames, Iowa, E. Bul. P80, April 1946, H. L. Lantz, L. C. Grove, and E. P. Sylwester.

"Fifty-eighth Annual Report, Agricultural Experiment Station of University of Kentucky," Lexington, Ky., 1945.

"Burley Tobacco Project for 4-H Clubs," Agr. Ext. Div., Univ. of Ky., Lexington, Ky., Cir. 412, Jan. 1946, E. J. Kinney.

"Guide to Planting Forest Trees," Agr. Ext. Div., Univ. of Ky. Lexington, Ky., Leaf. 101, Jan. 1946, W. E. Jackson.

"Identification of Blueberry Varieties by Plant Characters," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 431, May 1946, John S. Bailey and Arthur P. French.

"Fifty-second Annual Report, Agricultural Experiment Station, University of Minnesota, July 1, 1944-June 30, 1945," University Farm, St. Paul, Minn.

"Flower Gardening," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 306, March 1946, J. E. Smith, Jr.

"Production of Vegetable Plants," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 308, March 1946, Aubrey D. Hibbard.

"Alfalfa Seed Production," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., Cir. 168, June 1946.

"Common Red Clover in Nebraska," Ext. Serv., Univ. of Nebr., Lincoln, Nebr., Cir. 169, June 1946.

"Planting and Caring for the Lawn," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 724, March 1946, Gilbert H. Ahlgren.

"Fifty-sixth Annual Report, Agricultural Experiment Station, New Mexico College of Agriculture and Mechanic Arts," State College, N. M., 1944-1945.

"Apple-Tree Pruning Wounds Treatment and Healing in Sound and Winter-Injured Trees," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 821, Oct. 1945, D. S. Welch and L. H. MacDaniels.

"Better Wheat for New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 828, Jan. 1946, H. H. Love and W. T. Craig.

"A Year to Remember," N. C. Agr. Ext. Serv., State College Sta., Raleigh, N. C., 1945.

"Record of a 50-year-old Apple Orchard," Agr. Exp. Sta., Wooster, Ohio, Bul. 661, April 1946, C. W. Ellenwood and T. E. Fowler.

"Dairy Farming Based on the Liberal Use of Meadow Crops," Agr. Exp. Sta., Wooster, Ohio, Bul. 662, Aug. 1946, M. A. Bachtell, C. J. Willard, W. Livezey, and C. F. Monroe.

"Your Lawn," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, No. 271, May 1946, C. J. Willard and Victor H. Ries.

"Trials of Sweet Corn Hybrids at Columbus, Ohio, 1945," Dept. of Agron., Agr. Exp. Sta., Wooster, Ohio, Agron. Mimeo. 100, March 1946, J. B. Park and P. P. Preston.

"Wide Row Planting of Small Grains to Establish Sweet Clover and Lespedeza," Agr. Exp. Sta., Stillwater, Okla., Bul. B-298, June 1946, Horace J. Harper.

"Chemical Defoliation of Cotton," Agr. Exp. Sta., Stillwater, Okla., Bul. B-302, Aug. 1946, H. E. Dunlavy, I. M. Parrott, M. Gober, and C. H. Brett.

"Cowpeas in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Mimeo. Cir. M-160, May 1946, L. L. Ligon.

"Forage Production of Winter Small Grain Varieties and Annual Rye Grass and Effect of Clipping Upon Grain Yields," Agr. Exp. Sta., Stillwater, Okla., Mimeo. Cir. M-161, May 1946, Hi W. Staten and W. C. Elder.

"Ladino Clover, A Perennial Pasture and Hay Legume," Agr. Ext. Serv., Pa. State College, State College, Pa., Cir. 296, April 1946, J. B. R. Dickey.

"Fifty-eighth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College," Clemson, S. C., Feb. 1946.

"Tobacco Production," Clemson Agr. College, Clemson, S. C., Cir. 287, July 1946, H. A. McGee and J. M. Lewis.

"Alfalfa Production in South Carolina," Clemson Agr. College, Clemson, S. C., Cir. 290, July 1946, H. A. Woodle and W. H. Craven.

"Fifty-seventh Annual Report, 1944," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn.

"Oat Variety Studies in Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 199, April 1946, N. I. Hancock and O. H. Long.

"Growing Berries and Grapes," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 297, March 1946, W. C. Pelton.

"Report of Cotton Variety Test, 1945," Agr. Exp. Sta., Texas A & M, College Sta., Tex., P. R. 979, J. W. Collier.

"Grain Sorghum Yields," Substation No. 12, Texas A & M, Chillicothe, Tex., P. R. 990, March 6, 1946, J. R. Quinby.

"Barley Experiments," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1004, May 6, 1946, I. M. Atkins, and P. B. Dunkle.

"Oat Experiments," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1005, May 6, 1946, I. M. Atkins and P. B. Dunkle.

"Wheat Investigations," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1006, May 6, 1946, I. M. Atkins and P. B. Dunkle.

"Date Palm Culture in the Texas Winter Garden," Substation No. 19, Texas A & M, Winter Haven, Tex., P. R. 1007, May 8, 1946, E. Mortensen.

"Annual Soil Building Crops for the Blacklands of Northcentral Texas," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1009, May 10, 1946, P. B. Dunkle.

"Madrid Sweetclover," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1010, May 10, 1946, P. B. Dunkle.

"Cotton Variety Tests at Denton," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1011, May 10, 1946, P. B. Dunkle.

"Grasses for the Black and Clay Loam Lands of Northcentral Texas," Substation No. 6, Texas A & M, Denton, Tex., P. R. 1013, May 13, 1946, P. B. Dunkle.

"Gains of Heifers on Native and Improved Pastures in the Gulf Coast Prairie of Texas," Substation No. 3, Texas A & M, Angleton, Tex., P. R. 1018, June 24, 1946, W. F. Turner, N. F. Willey, and J. H. Jones.

"Alfalfa Production in Virginia," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 393, April 1946, T. B. Hutcheson, M. H. McVickar, and T. J. Smith.

"Mineral Constituents and Protein Content of Certain Grasses and Legumes Grown in Pure Stands on Three Soil Types," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., T. Bul. 102, Aug. 1946, N. O. Price, W. N. Linkous, and H. H. Hill.

"Pasture Guide Posts," Va. Polytechnic Inst., Blacksburg, Va., Cir. 375, Rev. July 1946.

"What's New in Farm Science," Pt. II of Annual Report, Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 469, May 1946.

"Bromegrass & Alfalfa for Hay, Pasture, or Silage," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 344, May 1944 (Rev. Jan. 1946), H. L. Ahlgren and F. V. Burcalow.

"Tobacco Growing in Wisconsin," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Sten. Cir., Jan. 1946, James Johnson.

"Fifty-third Annual Report of University of Wyoming Agricultural Experiment Station, 1942-1943," Univ. of Wyo., Laramie, Wyo.

"Carrot Production in the West and Southwest," U.S.D.A., Washington, D. C., Cir. 750, July 1946, T. W. Whitaker, J. H. MacGillivray, J. T. Middleton, and W. H. Lange.

"The Cultivation of Hevea Rubber on Small Plantations," Bu. of Plant Ind., U.S.D.A., Washington, D. C., March 15, 1946, W. E. Klippert.

Economics

"Avacado Production Cost and Efficiency Analysis, Tenth Annual Summary with Ten Year Average, San Diego County," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., 1945.

"Irrigated Pasture Management Study, Imperial County," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., 1945.

"Adjustments in Farm Organization Needed to Conserve Soil Resources in South-Central Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 515, 1946, F. V. Smith.

"Efficiency Dairy Program," Agr. Ext. Dept., Purdue Univ., Lafayette, Ind., Leaf. 268, 1946.

"Working Capital Needed to Farm in Central Indiana," Agr. Ext. Dept., Purdue Univ., Lafayette, Ind., Leaf. 275, 1946.

"Marketing of Cottonseed in Louisiana," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 400, Jan. 1946, James F. Hudson.

"Changes in the Apple Industry in Maine," Agr. Exp. Sta., Univ. of Maine, Orono, Me., Bul. 440, Dec. 1945, C. H. Merchant.

"Postwar Purchase and Improvement Plans of Farmers," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. A40, Sept. 1945, A. M. Ahalt, S. H. DeVault, and L. E. Flesch.

"Apple Quality and Its Effect on Price and Rate of Sale," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 826, May 1946, G. E. Blanch.

"Farm Management in Oneida County, 1942-1943," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 830, March 1946, L. C. Cunningham and S. W. Warren.

"Farm Real Estate Activity in Oklahoma, 1945," Agr. Exp. Sta., Okla. A & M, Still-

water, Okla., Bul. B-301, Sept. 1946, R. T. Klemme, L. A. Parcher, and E. C. Ford.
"An Appraisal of South Dakota Production Adjustments in Agriculture, 1946 and Post-War," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Agr. Econ. Pamp. 18, July 1945.
"Washington Farm Security Administration Borrowers Weigh the Future," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Bul. 472, Jan. 1946, P. H. Landis.
"Charting a Route for Agriculture in West Virginia," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Spec. Cir. 2, June 1946.
"Economic Aspects of Canning Peas in Wisconsin," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Res. Bul. 158, Sept. 1945, W. W. Wilcox and J. B. Bowditch.

Seven Fat Years Followed Lean

Experience in the United States has run just contrary to the Egyptian chronicle of the seven lean years following the seven fat years of the Pharaoh's dream which Joseph interpreted. Here the seven "fat" years of high production have followed instead of coming before the seven "lean" years preceding (1933-39). However, as a result of the change in demand—both national and world-wide—the farm situation in the "lean" years was characterized by a threatening and persistent "surplus" problem. In the "fat" years, the parade of record-breaking crops has not been able to match the war-created requirements, and "shortages" have accompanied bumper crops.

These contrasts appear in U. S. Department of Agriculture tabulations of crop production. By using the August Crop Report figures for the seventh fat year, and official estimates for previous years, simple addition shows a production of more than 21 billion bushels of corn for the seven years of 1940 to 1946. For the seven previous years the "lean" production was 15.4 billion bushels. For wheat, the figures show almost 7 billion bushels in the seven fat years and 4.8 billions in the lean period. For oats, the record stands at more than 9 billion bushels compared with 6.5 billion.

The record reveals that for these crops, production in two "fat" years has been nearly equal to three of the "lean" years. And the United States has experienced seven successive fat years of good crops! Crop experts agree that the weather is a principal item. They mention as other elements in the picture: hard work and planning by farmers, improved machinery, and better cultural practices that include such items as use of fertilizer, hybrid corn and improved varieties of other crops, and control of erosion. From the standpoint of human nutrition, substitution of machines for horses as farm power has released much acreage for food growing.

Mechanizing Peanuts

Peanut growers have opportunities to increase production efficiency through increased mechanization, Secretary Anderson suggested at the recent meeting of the National Peanut Council. He said: "A sheller has been perfected by our agricultural engineers which will shell as many peanuts in one hour as 300 men can shell in that time. Our engineers have also developed a tractor-mounted, two-row harvester which digs, lifts, shakes, and windrows peanuts, all in a single operation. By hand methods it takes one man 32 hours to carry out these operations on an acre. The machine will harvest two acres an hour—the equivalent to a crew of 64 men. Peanut growers also have much to gain from greater use of cover crops, better crop rotations, and greater knowledge of plant-food requirements."

Soil Requirements for Red Clover

(*From page* 19)

was in the stems. When hay is harvested and field cured there is considerable likelihood that a portion of the leaves may remain on the land, but the stems are usually very thoroughly removed. This entails a relatively large removal of potassium from the land.

The data in table 3 indicate that there are approximately 41 pounds of potássium in a ton of red clover hay composed of the percentages of leaves, stems, and bloom given (table 3). None of the five samples included in this average came from potash-treated fields or plots, although two samples came from manured land. These 41 pounds of potassium are equal to about the amount in a 100-pound bag of 50% muriate of potash (41.5 lbs. K). For each ton of clover hay removed from the land there is approximately the equivalent of 100 pounds of muriate of potash in the hay. It is not unusual to remove three tons of clover hay from an acre in the first and second cuttings of red clover in a single season. This means that it would require about 300 pounds of muriate of potash per acre so that there would be no loss of potassium from the removal of this crop.

Most practical men in the Midwest and other sections of the country consider red clover as a soil improvement crop and have not yet been brought to realize that this crop may also rob the soil of some of its very important fertility elements.

Fertilizer Inequalities . . . Can They Be Corrected?

(*From page* 14)

differences are not large enough to be considered significant) yields were higher in the "Revised Treatment Section" than on the same plot still receiving the original fertilizer application. Generally speaking, the yields were considerably greater for all crops in the "Revised Treatment Section."

An application of 100 pounds K_2O per acre to the plot originally receiving 40-70-0 has resulted in the greatest increase in the yields of both corn and wheat. The use of this quantity of potash resulted in an increase of 24.0 bushels corn and 6.9 bushels wheat. This response to potash was the most noticeable of any single nutrient addition. However, the addition of potassium and phosphorus to the plot which had received only 40 pounds nitrogen yearly from 1914-42 gave still greater increases. When 70 pounds P_2O_5 and 100 pounds K_2O were added to this plot, yields increased as follows—corn

TABLE 2.—POPULATION COUNTS EXPRESSED AS PER CENT GRASS, CLOVER, AND WEEDS FOR THE ORIGINAL FERTILIZER TREATMENT SECTION, RESIDUAL SECTION, AND REVISED TREATMENT SECTION OF THE OLD ROTATION EXPERIMENT FOR 1946. FIRST YEAR HAY.

Original Treatment Section				Residual Section				Revised Treatment Section			
Fertilizer treatment acre basis	Clover	Grasses	Weeds	Fertilizer treatment	Clover	Grasses	Weeds	Fertilizer treatment acre basis	Clover	Grasses	Weeds
	Per cent	Per cent	Per cent		Per cent	Per cent	Per cent		Per cent	Per cent	Per cent
40-70-100	30	65	5	Plots received original fertilizer treatments from 1914-41 inc. Since 1941 no additional fertilizer treatments have been made.	30	69	1	0-36-18	30	68	2
0-70-0	60	38	2		24	74	2	40-0-100	21	78	1
40-70-0	16	82	2		20	78	2	0-0-100	43	56	1
0-70-100	43	56	1		40	55	5	6-36-18	37	60	3
40-0-100	90	1	9		78	4	18	0-70-0	80	16	4
40-0-0	2	38	60		25	20	55	0-70-100	50	47	3
0-0-100	38	39	23		76	14	10	40-70-0	42	54	4

from 41.7 to 88.7 bushels; wheat from 5.8 to 12.8 bushels; first year hay from 1,941 to 3,599 pounds; and second year hay from 2,598 to 4,225 pounds.

The effect of the Revised Treatments on the change in plant population—grasses and legumes—has been most marked. Clover had just about disappeared on plots where the minerals had been depleted. It reappeared, however, after the limiting nutrients had been added. Stand counts made in the spring of 1946 are shown in table 2.

Valuable as have been the results of the original rotation fertility experiment at Blacksburg, as a basis for fertilizer recommendations, we are convinced that without the data on the residual and build-back phases herein reported, our job truly would be only one-half completed. In reporting the results of these studies for one full rotation, we do so knowing full well that the final story on fertilizer inequalities and the time required for their correction cannot be written until data from several rotations are available. However, the present rate of recovery of the Virginia rotation experiment under the revised treatment plan promises to add a new and interesting chapter to the final story of the true values of long-time fertility experiments.

Crop Requirements for Available Potash

(*From page* 24)

North Carolina gave points on the graph which formed two distinct groups, one for the soils of medium to high exchange capacity (above six milli-equivalents) and one for those of low capacity (below four milli-equivalents). The curve for the high capacity soils is fairly comparable to the one for corn in Figure 1 and its indicated potassium requirement for 90% yield of soybeans is about 155 lbs., whereas the indicated potassium requirement for 90% yield of soybeans on the soils of low capacity was only 50 lbs. Again, as in the case of Olson's data, the results suggest a higher availability of exchangeable potassium in soils of low exchange capacity.

Practical Application

Results from this and similar studies can be of great value in helping farmers with their fertilizer problems. Many States now have soil-testing laboratories where farmers can send samples. Most of these laboratories include suggestions for crop fertilization when the results of the soil tests are sent to the farmers. Information on the fertilizer requirements of crops in any State, therefore, is invaluable to the man who must make suggestions for crop fertilization from the interpretation of soil-test results.

The graphs showing the yield responses of crops to potash in Tennessee are used as a guide in making suggestions for fertilization at the soil-testing laboratory in this State. For example, potash is normally included in the fertilizer recommendations for corn on those Tennessee soils testing below 150 lbs. of exchangeable potassium, whereas it is ordinarily included in the recommendations for Irish potatoes on Tennessee soils testing below 220 lbs. Similar data on the other fertilizer constituents are equally useful in the interpretation of soil analyses at the service laboratory.

Crop response to fertilization may, and often does, vary from State to State because of differences in soil or climatic conditions. On this account, studies of the response of crops to fertilization are being made in most States. As the results accumulate from these studies, farmers can expect more and more satisfactory answers when they ask "What kind of fertilizer shall I use—and how much?"

Summary

To correlate the levels of available soil potassium and crop response to potassium fertilization, field experiments were conducted with five crops in several sections of Tennessee over a period of four years. Potassium was used at two rates; nitrogen and phosphorus were applied uniformly to all plots, including the no-potassium check. All treatments were in triplicate. Soil samples for determination of available potassium were collected from all plot areas before fertilizer was applied.

Data for each crop were plotted on a graph, and smooth curves fitted to them. These curves indicate the following approximate levels of exchangeable

Fig. 5. Effect of potash on dark-fired tobacco. Left—no potash; right—150 lbs. of potash per acre. Dickson soil medium in exchangeable potassium (160 lbs. per acre).

Fig. 6. Cotton at the left received 75 lbs. of potash; that at the right only 25 lbs. of potash. Greendale soil very low in exchangeable potassium (100 lbs. per acre).

soil potassium above which potassium fertilization ceased to give significant increases in yield; corn 155 lbs. per acre; alfalfa, 160; cotton, 185; dark-fired tobacco, 190; Irish potatoes, 220. Data available from studies by several other investigators were graphed for comparison. The results are similar in those cases where soil and climatic conditions were comparable. The application of the results to fertilization practice are discussed.

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Mechanical Production of Cotton in the Yazoo-Mississippi Delta

(*From page* 10)

Flaming usually is done when cultivation of middles for weed or grass control is necessary, but may be done when the soil is too wet to be cultivated. Cotton was cultivated 11 times and flamed 8 in 1945. Bringing the cotton to the size requisite for flaming, i.e., 3/16 inch diameter, at which time it will be 6 to 8 inches tall—provided it was thinned early—is the critical period. If the tops of weeds or Johnson grass are above the flame zone, they eventually will have to be removed with the hoe. Crab, coco, and other grasses are susceptible to repeated flaming. Flaming is most successful if done when vegetation is dry and the sun is shining.

Flame cultivation is not a "cure-all" but rather an aid to mechanization. It has its limitations and requires planning for its use but will go far in reducing labor costs when intelligently used. More research under varied cultural conditions is necessary before both its limitations and potentialities are fully understood.

Results of Flaming

Those seeing flame cultivation for the first time are inclined to be disappointed. Flaming is a "flash" process in that the plants are exposed to the flame but momentarily. The young morning glory plant wilts immediately after exposure to the flame; in contrast, some plants do not show any change until 30 to 60 minutes have passed. The only change apparent in coco, or "nut" grass, is a darkening of color, and it may take two to three days for the ends of the blades to wither and die. This pest is, however, easily controlled with the flame. While short grass and small weeds are completely wiped out with one flaming, heavy grass requires three to four flamings for elimination. Best practice seems to be the complete cleaning of the drill before soil is thrown to the cotton, and it is doubtful that any "dirting" is necessary. Again it is emphasized that beds should be kept as flat as possible at all times. Clods thrown around the plant cause the flame to be deflected up into the plants, and leaves are scorched, which is to be avoided.

Flaming late in the season is very effective for vine control inasmuch as many seed germinate when early fall rains come. This is very necessary for mechanical picking, as vines interfere with the picking operation and also add trash and stain to the cotton.

Mechanical harvesting increases the amount of trash in the cotton. Defoliation with calcium cyanamid, if accomplished under proper conditions, helps in this respect. The need for more efficient cleaning, to be discussed by Mr. Gerdes in a companion paper, also the need for factual information concerning the effects of all phases of mechanization on fiber and spinning qualities led in 1944 to a series of studies cooperatively planned and executed by the various agencies at Stoneville. The investigations were as follows: (1) Cotton thinned mechanically, with weeds and grass controlled by the flame, was compared with cotton produced by regular plantation practice. Both drilled and cross-plowed cotton were used. Half of the area was defoliated with calcium cyanamid, while half was undefoliated. Further, half of each plot was picked by hand and half with the International cotton harvester, a machine having been purchased by the Delta Station for its experimental program; (2) the relation of variety, exposure, and time and method of picking to lint quality; (3) a comparison of several combinations of commercially available cleaning equipment used with five varieties of cotton grown commercially in the Delta. All samples were ginned at the U. S. Cotton Ginning Laboratory, and the seed and lint were tested in the Cotton Branch's fiber and seed laboratories. The field plots were adequately randomized, and where sampling allowed, the various data were analyzed by variance methods. Many samples were spun to obtain data on the spun yarns. These spinning tests were made in the Cotton Testing Laboratories at Clemson College and Texas A. & M. College; (4) a study of costs of mechanical picking, in cooperation with the owners of the 14 International cotton harvesters in use in the Delta.[3]

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[3] See footnote 1.

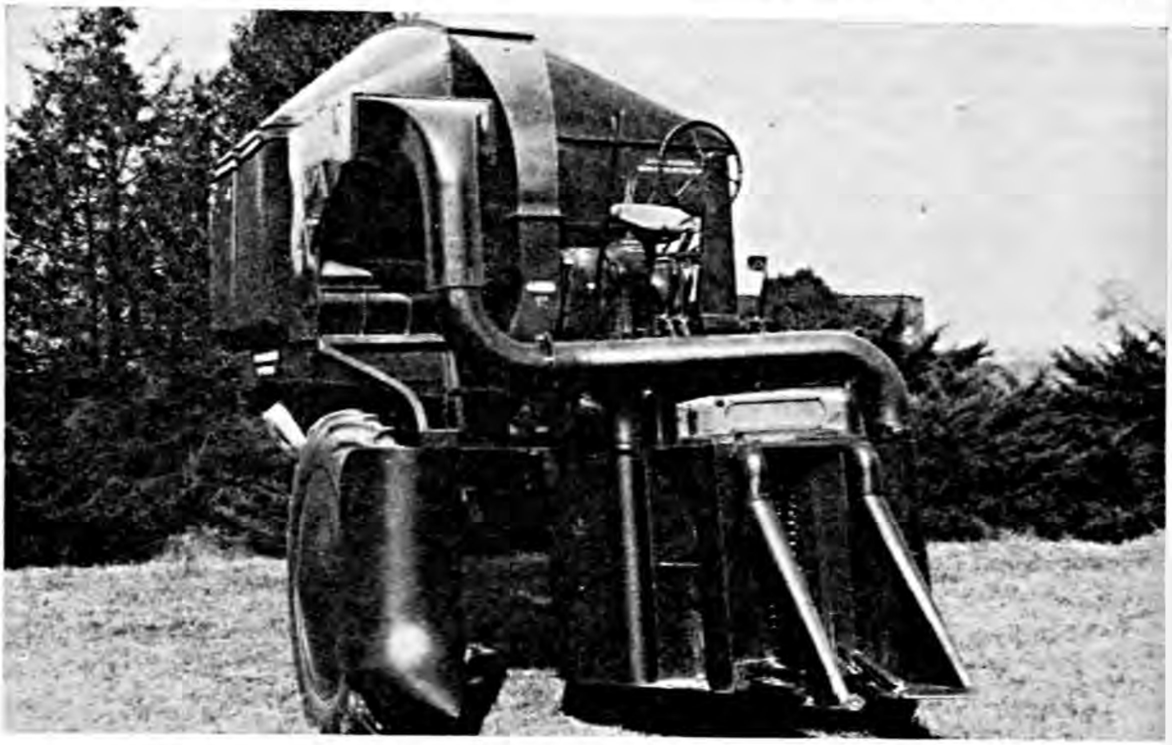

Fig. 7. International spindle-type cotton harvester.

The results of some of these studies are to be published in detail in "Mississippi Farm Research," official organ of the Mississippi stations, and only highlights of the mechanization work are given in this paper.

Mr. Gerdes will discuss the results of the tests involving exposure, methods of picking, et cetera; also the studies on cleaning five varieties of cotton picked mechanically. The results of the first test are given here. Provision was made for determining comparative effects on yield, classification, fiber and spinning quality of lint, and milling quality of the seed for drilled and checked plantings; hoeing and flame control of grass and weeds; defoliation with calcium cyanamid versus no defoliation; and picking by hand as compared with picking with the spindle-type picker. While yield was not affected materially by many factors, the increase due to cross-plowing was statistically significant. As has been pointed out, average yields of cross-plowed and drilled cotton grown on fertile soil producing approximately a bale per acre may be expected to be about the same. The 1944 season was unusually dry. The cross-plowed cotton continued to grow and fruit, while the thicker planted, drilled cotton showed distinct effects of the drought. Cross-plowed cotton also produced a longer staple, stronger yarn of equal appearance, and higher grade seed of lower free fatty acid content than drilled cotton. Defoliation with calcium cyanamid improved the grade of the lint slightly and caused material reduction in picker and card waste. Defoliation also reduced the moisture content of seed cotton, seed, and lint, as well as the free fatty acid content of the seed.

Mechanical picking, as compared with hand picking, caused significant increases in moisture content of seed cotton, lint, and seed. This was undoubtedly due to the necessity of adding water to the spindles to obtain doffing of the cotton and to prevent accumulation of plant gums on the spindles. It increased foreign matter content of seed cotton, lint, and seed, with corresponding increases in picker and card waste. The yarn strength, however, was somewhat higher than for hand-picked cotton, and the appearance was equally as good.

The report has dealt entirely with

the use of the spindle-type picker (figure 7). This type is designed to pick cotton more than one time. This is important under Delta conditions if high spinning quality cotton is to be obtained, as it allows mechanical picking to be started practically as early as by hand. A stripper used commercially in the Plains section of Texas was tried at the Delta Station in 1944. It was necessary to wait, of course, until all of the cotton was open. Fall rains came before that time, and it was not until a freeze occurred that operation was possible. By that time considerable deterioration of the plants had taken place, and under these conditions the performance was not satisfactory. It might be of interest to know that it was tried later on an area of Macha cotton, a cotton developed in Texas for the Plains section, at another location in the Delta with somewhat better results. It would seem, however, that if the stripper principle is to be used under Delta conditions, one of different design and perhaps more gentle stripping action will have to be found. Several strippers of more or less promise are in various stages of development. If adequate machinery for cleaning cotton harvested by such means can be developed for the longer staple cottons, the stripper type machine may have a real part to play, especially when weather conditions are such as to cause rapid deterioration of fiber quality, with an urgent need to get the crop harvested.

Any machine or procedure that will enable cotton to be harvested early will materially increase the value of the crop. This must be kept in mind when the relative merits of hand picking are compared with machine picking, as machines eventually will be available while hand labor may not, with the result that the average value of the crop in terms of spinning value will be materially enhanced.

Three Thousand Miles to Market

(*From page* 26)

a potentially fine crop to near zero; a wind or hail at harvest will leave the grower with nothing but straw; and most important of all—the European vetch weevil has moved in. He leaves the grower only the worthless outside shells of the seeds. This year (1946) virtually all Oregon growers airplane-dusted their fields with DDT. Results are not perfect, but it is likely that hairy vetch is on its way back.

Next in importance in Oregon is Willamette vetch. It is a more winter-hardy strain of the old common or so-called spring vetch, not adapted to so wide a region in the South as hairy. It has of necessity been used in recent years because there was not enough of the preferred hairy vetch to go around. It has virtually replaced common vetch in Oregon because sometimes winter weather that removes the old type common will leave Willamette untouched.

Austrian peas have had acreage spurts and secessions up to 80,000 acres in Oregon at one time. The palouse country of Washington and Idaho heard of the peas, and as a result, production zoomed to 150,000,000 pounds with an annual use of not over half of that. In 1942 and '43 much of the crop was held over, the hold-over being in the hands of the Commodity Credit Corporation. Increased southern use, sales by CCC to Russia and other countries, and reduced acreages in the Pacific Northwest have combined to eliminate the carry-over, and the fall of '46 is showing a strong market.

Ryegrass is in a different category. It not only is used in the South, but nearly everywhere else. Many commercial lawn mixtures carry it, because it springs up fresh and green in a few days whereas the more permanent grasses grow very slowly. It not only is used as an erosion preventer, but as winter pasture and for hay. For these purposes it comes clear up to New York. Also many commercial pasture mixtures carry it because it makes a vigorous spring growth and provides feed while the slower starters are just getting up steam. Although the South is the largest user, every state in the union uses some, and the use is expanding tremendously.

Hungarian vetch, crimson clover, and purple vetch complete the list of Oregon-grown cover crops. All are grown on small acreages. The Hungarian variety has no particular advantage over Willamette except that it is almost aphid proof, will grow on wetter land, and sometimes it is cheaper. It usually yields less than Willamette on soils adapted to the latter, but often yields more on heavy clays or wet locations. Purple vetch is seldom used in the South. It lacks winter hardiness. California is the main user. Crimson clover is increasing in use, but it ripens too early in Oregon, often while spring rains are still frequent. The acreage of these three tends to remain low and constant.

Why Western Seed?

If the South sends six or eight million dollars diagonally across the country each year, why not grow the seed at home and save the money? Actually, that is happening to some extent. Arkansas is in the hairy vetch business to the extent of 14,000 acres this year. Oklahoma is producing 4 or 5 million pounds of ryegrass, and crimson clover production in the South is up to 15,000,000 pounds. But it is doubtful if the South will ever raise its entire needs unless new seeds come into the picture. So far, the more a state produces, the more people use it and the more they import. There are several reasons for importations: 1. The climate. Legumes dislike hot weather and the grower dislikes rain at harvest time. One reduces the crop, the other its quality. 2. Disease. Many root rots, mildews, and other fungi interfere very little with the legumes for cover crop purposes, but interfere drastically with seed production. Some follow the seed and interfere with a crop resulting from it. 3. Machinery and cleaning equipment. It costs at least $30 per acre in equipment to grow hairy vetch.

The South, however, is growing an increasing amount of a long list of competing legumes. These are summarized briefly:

1. Blue lupine. From 5,000,000 pounds in '43 the crop is up to 37,300,000 pounds in '46. Suitable only for the extreme South close to the gulf.

2. Caley peas (also called Singletary, a rough pea, and wild pea). More suitable for pasture and hay than for green manure.

3. Manganese bur clover. Very sensitive to lack of fertility. Used more for pasture.

4. Big flowered vetch. A wild vetch beginning to volunteer over parts of the South. Not very productive for cover crop purposes.

5. Bur clover. There are various forms. These are used now mostly in Mississippi where the state grew 2,000,000 pounds in 1945. However, the clovers planted 126,000 acres as compared to 700,000 acres of peas and vetches.

There are other local crops, Monantha vetch, Le Conte vetch, yellow trefoil, and a few others, all used only on small acreages.

The West is countering with a new legume of its own, Dixie Wonder, a strain of Austrian winter pea that can be planted in late fall and can still be turned under ahead of the regular crops. The biggest single headache with the legumes is that in many seasons they can't be turned down in time.

They are either plowed when there isn't much to turn down or else they are plowed so late that the following crop is injured. The Dixie Wonder threatens to overcome that.

All in all, it looks as though the cover crops are here to stay. They will shift in acreage from time to time and it is likely that new ones will appear, but it seems that the long haul from Oregon to the South will be with us for many years. With all of the huge developments, only a small portion of the soils that should have winter cover crops actually has them. At present they are seeded on less than 5% of the crop land in the South and the economy of the entire nation would be helped if that figure could be stepped up to 25% or more. So the use could be increased to at least five times the present amount if the proper seeds were available.

Using Potash in Soil Conservation

(*From page* 16)

equivalent, will double the tonnage of hay produced by an acre of lespedeza. Weighing the cost of this against the results, it is clearly *necessary* to apply potash to lespedeza. But do not make the mistake of applying it too late.

Potash has almost the same effect on other legumes and grasses. Dairymen insist that cows prefer to graze on pastures that have been limed and had phosphate and potash applied. They say that the increase is evident in the volume and richness of the milk produced, that the animals stay healthier, and that the cost of production is cut. Add to this the labor saved by letting the cows harvest the crop and spread the manure for you and you have a program that just cannot be overlooked.

Owing to supply and shipping problems you should accept delivery of muriate of potash whenever your dealer is able to supply you. Your needs

Ladino clover is an improved variety of white clover. Mecklenburg County farmers have experienced such yields as this when they applied a complete fertilizer strong in potash.

should be on hand as early as possible before you plan to apply it to the fields. This is true whether you plan to use the mixed phosphate and potash such as 0-10-10 or 0-12-12 fertilizers or whether you use muriate of potash. The demand is far in excess of the supply. Better get ready for fall seedings as soon as you can.

In a soil-building program lime, phosphate, and potash are essential to the success of the legume or other cover crop grown to turn as green manure. These minerals not only produce a more lush growth in the legume but they add the other necessary plant foods so necessary to a well-balanced soil. Many would be surprised to see how rapidly legumes can restore fertility and productivity to worn-out or eroded soils when the "Three Musketeers" of Lime, Phosphate, and Potash are added in proper amounts. These three plant foods are the "Pep-up Boys" for legumes and grasses.

Under the Government's Agricultural Conservation Program farmers in North Carolina may receive credit for the use of potash on the crops discussed in this article at a rate of three and one-half cents per pound of potash in the material used. This is equivalent to $1.75 per hundred pounds of 50% muriate of potash. This material is not being furnished by the Government under the purchase order plan because of short supplies. Farmers will report the use of this material when they report on their other soil-building practices at the end of the year.

Cluttered Calendars

(*From page* 5)

I try to revive some of that essence by sending the Wife a valentine—often easier to remember then than on the anniversaries of our wedding, which usually catch me cold and consign me to the doghouse. February 6 is labeled Social Hygiene Day, whereat my confusion is rampant, not knowing if it refers to living a cleaner life or bending my efforts to reform the customs and social negligence of my neighbors. Hence I drop it and spend my energy on Cherry Week and Sew and Save Week. The cherry harvesters and packers were cute enough to get dated up for the week which includes Washington's birthday, although he probably had less personal interest in cherries than he did in tobacco. As I finish up the last crumbs of my cherry pie on February 23, the calendar says it is time to ply the needle and push the bank account. My wife is able to observe her end of the sewing and saving deal much better than I am. I help her, however, by fetching more socks and torn shirts and pants to exert her thrift upon. There's nothing like family cooperation in all these eventful observances!

SAVE Your Vision Week hits me between the eyes March 3-9. The optometrists are pushing it. We used to call them eye-doctors and then buy our specs at the dime store. I believe the electric light arrangers are also allied in this drive—and my opinion is the motor clubs should be also. March 8 is fixed up as Farm Day, with no sponsor listed. Most city slickers will observe it by grim expressions about the high cost of living and the snap enjoyed by the hay shakers. One calm voice like mine raised in protest is drowned out by the commies and the agitators. The green ribbons and snakes of Old Saint Pat soon give way to the fervid demonstrations of Hobby Week, beginning March 18. I boast few successful hobbies and can therefore partake in no local shows, except as an envious observer. Most hobbies spell too much hard work and concentration for me, but I do not object to a neighbor lad having one if he keeps his litter off my lawn. Lastly, March ends with Wildlife Week and Donut Week. I am a bit advanced in years and repleted to enjoy much of a fling during Wildlife Week, and I do not belong to the country club. My digestion on the fair circuit already has been injured beyond repair by sinkers and thick coffee, so dunking the grease balls is taboo.

QUICKLY passing over All Fools Day which applies to most of us, we find the April calendar heaped with variety. Army Day is on the 6th, time of delight for small boys watching parades and theme for rousing debates on "preparedness vs. imperialism." Between the 7th and 13th we face Want-ad Week, Be Kind to Animals Week, and Know Your Public Health Nurse Week. Not wishing to fritter my energies too widely, I choose the last-named suggestion, having a warm regard both for the profession and the sex. Honey for Breakfast Week follows from the 21st to 27th. I'll enjoy that one fully, if I can get the honey, but I maybe can't make it last for a whole week. Fisherman's Week handily comes as the honey disappears, but for one with drainage ditches the only waterways adjacent, this one must be observed by proxy. I glory in the final event of the April series, Noise Abatement Week, which puzzles me, however, because of the numerous airplanes and tom cats in my bailiwick; and likewise because my "noiseless" typewriter does not seem that way to neighbors after midnight. At least five Days and as many Weeks mark May's calendar. Hospital Day on the 12th brings to mind overcrowding of wards and pleas for more of the wartime zeal for volunteer bed-making, cleaning, and enema-giving by our women folks, while Maritime Day this year will find the ports open for business again—we hope. It seems queer why the eating-house props chose May 6-12, ending on Mother's Day, for their observance of Restaurant Week, because if there is anything with more contrast than the meals that Ma used to serve and the dishes thrown at you in the hasheries, I fail to find it. May 20-25 keeps us busy with Citizenship Week and Cotton Week. Sheets and diapers being so scarce, we suggest surprising the citizens this time with a comfortable stock of such native American goods as being the best way to celebrate it. Again my "aching back" interferes with proper attention to Tennis Week, starting May 25. Leaving that for you to handle, let's note the scheduled dates for Posture Week, from 6th to 11th, plugged by the Institute for Better Postures. If that were "Pastures" instead I could swing into it with bucolic enthusiasm. Let's change the "o" to an "a" and get the jump on them anyhow. As for the final event of the month, Memorial Day, my only gripe lies in the way so many observe it, since heroism and sacrifice for national service mean less to many folks than a fast car and faster company.

JUNE is an abused month indeed, for there occur but two Days and one Week in its 30-day period. Flag Day and Fathers' Day are all right, long may they wave but never waver, but Swim for Health Week still finds me snug in my bath tub. Strange that we have no Last Apple for Teacher Week, which should be referred at once to the commission merchants.

Amid the heat of July our publicity ardor diminished, apparently, for aside from the U. S. Birthday all we can dig up to talk about is Farm Safety Week. As usual we try to crowd every warning and precept on accident-prevention with bulls and bees and tractors into seven days, and then urge speed and super-production per man regardless for all the rest of the crop season.

In similar manner, August is vacation time and nobody wants to spoil their fun with much ado about nothing, hence Aviation Day on the 19th is seemingly the only break in the routine—unless you want to celebrate Napoleon's natal day and mine on the 14th, or maybe combine those with V-J Day and quit work altogether.

Slowly getting up steam again, September deigns to include three noteworthy dates—Lessons in Truth Week, 9th to 15th, followed quickly by Felt Hat Day on the 15th and Constitution Day on the 17th. My old felt hat has weathered so many Septembers and other months that it can hardly get itself in real presentable trim for public observances; and likewise the constitution itself has withstood so many attacks and slanders and violations that one day more in the limelight won't disturb its serenity. I am not qualified by experience to dilate much about the aforesaid truthful week and so hasten to October—replete with special assignments.

IN this autumn tang interval we swim in celebrations, 13 in all. Newspaper Week begins Oct. 1, which means I must buy more Sunday comics and be more thorough in perusing the want ads and the editorials, and be more charitable toward the competing clamor of columnists. Knowing the bibulous nature of the profession, some smart guy trotted out Wine Week to run right afterwards. Business Women's Week and Fire Prevention Week bid for favor consecutively from the 6th to 13th. Between the 13th and 19th it's your duty to write to somebody, even the arrogant creditors, for that's dubbed Letter Writing Week, when ink bottles and stamp books must be well reinforced. If you think Honey Week confusing, give the dear lady the benefit of the doubt and you'll be safe, because honey in jars is mighty hard to get or pay for. The flow of weekly events ends with Apple Week and Better Hearing Week, both crowded into the last seven days. I must not overlook the Days either. On the 10th I hasten to get better acquainted with my stoical yellow laundryman, it being China Friendship Day, while Columbus Day and Navy Day spell duty as against the deviltry of Halloween.

NOVEMBER'S list is rather slim. Besides Thanksgiving and Armistice Day, the only things I can detect on the calendar are Author's Day on the 1st, Education Week, 10th to 16th, and Prosperity Week from the 25th to the end. My hunch is that if more authors were better educated our literature would improve. Now all that an author needs to get in good shape to be glad during Prosperity Week is a few smutty anecdotes and a good press agent. I also believe we could observe armistice memories much better if we muzzled a lot of loose-lipped war-mongers on press and radio. If we could reform our authors and shut up our agitators, I could be thankful even if I had to eat sardines on the last Thursday of November.

Of course every day in December is "One-More-Shopping Day" and not much can logically interfere with the push toward Christmas. We do pause, however, for Pearl Harbor Day on the 7th, give a fleeting nod to Forefathers' Day on the 21st, and gaze in dubious dismay at what is left of our "rights" on Bill of Rights Day on the 15th. And so we have gone sketchily through the entire gamut of observances, with pardon asked if we have inadvertently omitted your favorite one.

I presume we would sorely miss the foam and tang of life were we to enact laws forbidding any further set-asides on which to pay our devotions to something tangible or intangible. Nobody cares to become known as a blue-nose reformer, a nonconformist, and a bellyacher. You therefore have the privilege of being tolerant and indulgent, taking just what you want from the menu of festive occasions and tossing the rest to the dogs.

But on the other hand, American life is becoming very complex. As the variety and complexity increases, the rate of sickness from heart failure and fatigue and sloppy nerves goes up. Sometimes this makes us old-timers bred in the days of serenity and provincialism feel out of gear and rebellious.

Added to the routine of general public observances thus accounted for in everyday life, we who belong to certain lodges, unions, federations, and churches likewise owe allegiance to specific days and seasons, interlarded sometimes incongruously with the public pronouncements aforesaid. Endless committee meetings, society obligations, and kindred conclaves fritter away much of the so-called leisure time which they advance in argument for shorter hours of labor.

I AM not in favor of being a hermit or a recluse, because one will eventually spend a long time alone when life is over. However, it is self-evident that some reverie and soul-searching pauses often benefit all of us. Possibly a Retreat or Be Yourself Day, when one could shun the pressures and perplexities, the bitterness and inconsistencies and pettiness, would refresh and restore us for another long whirl with the world as it is.

I am a trifle "afeared" that unless we watch our steps with care, we too, like the w. k. calendar, will become cluttered with nonessentials and dated too far ahead with other people's problems to enjoy our families and do our home work.

ONE ON THE HOUSE

A group of men in a Western barroom were exchanging wild stories about their feats of courage and bravery. When the tall tales were almost at the breaking point, a quiet old Swede who had been silently drinking and listening, spoke up. "I myself, never do anything so very brave," he said. "But my brudder, he call Yesse Yames a big s.o.b."

The others were appalled. This was the wildest story yet. "What," they cried, "he called Jessie James a big s-o-b? Tell us about it."

"My brudder, he was drinking, and he get pretty drunk. Yessie Yames in same barroom. My brudder, he go over to Yessie Yames and say, 'Yessie Yames, you are one big s-o-b.'"

"What did Jessie James do?" demanded his listeners.

"He shoot my brudder!"

She: "My lawyer told me to say 'No' to everything."

He: "Do you mind if I hold your hand?"

She: "No."

He: "Do you mind if I put my arm around you?"

She: "N-n-no."

He: "We're going to have a lot of fun if you're on the level about this."

Many a man thinks he has an open mind when it is merely vacant.

Little Mike didn't like kindergarten and refused to go any more. His mother reasoned with him, scolded him, and insisted on his returning.

"Okay, Mom," he said. "If you want me to grow up to be a bead-stringer, I'll go."

A man rushed up to the new colored orderly at the hospital, excitedly asking: "Where is the maternity ward?" "Which one is yo' lookin' fo' boss," queried the new orderly, "de ladies, er de gentmun's?"

An old Dutch farmer, seeing an electric fan for the first time, exclaimed, "Py golly dot's a dam' lifely sqvirrel you got in dar, ain'd it?"

In the primary election the girl from the mountains asked for a ballot.

"What party do you affiliate with?"

"Do I have to answer that?"

"You do if you want a ballot."

"Then I don't want no ballot because the party I affiliates with ain't divorced yet."

She: "Men are contemptible creatures."

He: "Yeah, I know, thats why I run around with women."

Mrs. Smith: "My son's at medical school doing research on obstetrics."

Mrs. Jones: "Goodness, haven't they found a cure for that yet?"

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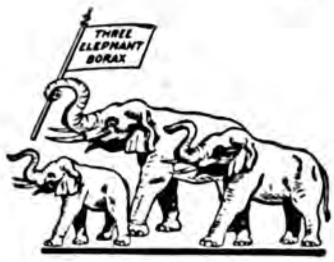

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R. H. STINCHFIELD, *Editor*

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

VOLUME XXX NO. 10

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

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A DESIGN FOR WINTER

Better Crops
PLANT FOOD

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VOL. XXX WASHINGTON, D. C., DECEMBER 1946 No. 10

Remembering . . . . .

Sundry Other Sundays

Jeff McDermid

LAST SUNDAY when the elders passed us the collection plate it occurred to me suddenly how much more I was able to contribute in cash than I had left in youth and years compared to those other Sundays long ago. This reverie, I am afraid, intruded itself too fully between me and the text and sermon—but maybe it did me almost as much good as to have heard the pastor and been heedless of the present stark reality.

I cannot approach this topic with the saintly self-conscious aspect of the w. k. Pharisee, for my life has been a very open book for all my kith and kindred and my long-suffering neighbors—a book not embellished with "pretense and long prayers" or much decorated with heroism, piety, or charity. I have been humble enough to a fault, but humility and want of aggressiveness alone cannot be relied upon for a ticket to immortality.

Negative virtues are somewhat comfortless when seen from life's hilltop along toward sunset. If I had it to do over again, I'd pray for a little militancy to mix with mercy and forbearance, provided it was not expended in bigger business boosting or pressure group publicity.

At any rate, I tried to see myself and young companions of my generation as we were on sundry other Sundays—Sundays when the days seemed longer, the nights shorter, and the ways of life and living easier, simpler, and (seemingly) more stabilized and secure.

First remembrance of Sunday concerns a basement classroom used for the juvenile and infant Christians—a place I was sent to at the earnest solicitation of my parents bv a buxom, capable church woman of talents, wife of the Sabbath school superintendent. She played the organ for all services and devoted her energy to the selection and distribution of colored golden text cards and little leaflets for the inspiration and guidance of our new and toddling minds.

Her husband was a bank-teller on weekdays and a sacred tenor soloist on Sundays. (I recall seeing my first picture of Caruso then and wondering if he could sing Onward Christian Soldiers as sweetly as "Chan," our S. S. man.) Chan was lithe, spry and kindly, verv human and none too godly out of Sabbatical assignments. He would have made a bang-up Rotarian, but he arrived too soon for membership. Awhile ago I saw Chan after an interval of much too many years—and that's when I really began to count the wrinkles in my own face and future. For Chan sang no more and his once erect and dashing figure had gone forever to the same unknown bourne with his wavy brown hair and stylish suits.

THUS do the darling idols of our infancy recede and leave us stranded against the shoals of time. All of which by way of saying that songs well sung, bright pictures, and lilting music and marching seem to linger longer as Sunday memories than any of the precepts and preachments they were designed to foster. I shall expect to shake hands with Chan and his Missus just outside the Heavenly choir loft and find out if he has any nicer chores on weekdays than counting other men's cash. (I might modify that with certain reservations relative to my own presence there.)

Taken in toto, that's just about the case with most of the recollected incidents of all those years spent in Sunday services from six to sixteen. To us who were really heathens amid the elder converts, Sunday partook of its prehistoric origin—that is, Sun-day was to us like the sun worship of the ancients—a time of basking in our vivid growing vigor and animal expansion, a good time to eat well, play hard, and take short rests from schoolday routine, with little thought of the morrow or the days of the turbulent years too soon to come.

OUR leading hardware dealer's lady taught the older boys' Bible class, as much as she was able to, limited by her own shortcomings and our eagerness to chatter about athletics, pets, and bicycles. The only things that happened on regular schedule were the penny collections and the closing signal. Just a bit beyond us across the aisle were the high-school girls in Sunday raiments—whom we watched covertly or openly with many a sigh and snicker. I confess that my chief consolation for two hours in a pew at Sunday services was the chance to scan rows of bright eyes just visible above the outer rail of the choir, peering out at us provocatively below their pompadours. Ah me, oh my, "them was the happy days." But only a few scant texts from sacred tomes are left to keep these memories company.

Texts, hymns, prayers, and penances were but of fleeting and feeble moment when one was young and ardently hopeful of a future which bore no hint of weakness or failure or of becoming forgetful or forgotten. Certainly the church had its charms and Sunday its solace, but they partook of the mystery and the challenge and the dreams ahead, rather than of the miseries, the mistakes, and the burdens of something past and gone.

Verily, you lay something heavier

and harder in the elder's plate each Sunday at middle years and over than you ever did on those Sabbaths of your springtime. Yet in all this there lies some hopeful compensations, perhaps a wider knowledge of the values and

balances of life and maybe less perplexity about the real personal goal that should be sought. But as to its real meaning and its potential power no doubt we are no better off now than we were as young communicants.

We grope in that way still, despite all the material progress we have made during the intervening years of full achievement and sorry abomination. In those years we have as a people soared in the stratosphere without cutting one iota the awful distance between the plow and the stars, or pulling our feet from the mud upward toward the saints and angels. I rather doubt, however, if I ought to blame the old preachers and teachers of my Sabbath memory for this, our gross inadequacy. They just went down in temporary defeat before too much hot competition, that's all.

Time marches on, as they say, and so in due season my folks suggested to me that a boy approaching twenty-one should make his peace with eternity by public confession of faith and acceptance of church vows. I had not taken this thing very seriously as the teen-age interval rushed by me. In some ways I was still a pagan, only lacking the flute and the flowers to resemble a rollicking and carefree Pan.

Yet I succumbed to custom and the standards set by my family and made known my desire to begin paying tithes to the struggling parish. I only faintly recall the brief ceremony as Elder Lawson stood by my side while the preacher gave me the right hand of fellowship. I was, I remember, very weak in the joints and red of face before all the kids I had played hookey with and whom I had joined in lurid forays in apple orchards or tipping over backhouses on All Saints Eve. I believe that John Jones took the oath with me that Sunday morning, and six years later he was buried with military honors in Flanders Fields.

Joining lodges proved much more exciting to me in later years, but there is something to be said after all for the quiet simplicity of a church affiliation, where no horrid and meaningless penalties are invoked and where are handed to you the compass and rudder with which to guide and steer your untried craft through rapid floods and silent waters. Maybe they thought I was a better sailor than I really was, because they told me I was master of my fate and captain of my soul and then called upon the audience to sing, "Throw Out the Lifeline, Somebody's Sinking Today."

COURTSHIP Sundays and Newlywed Sabbaths are almost too divine to be dragged bodily into the public gaze. I'm not sure which phase of adoration and dual communion brings me happier memories—the unbelievable companionship in the pew before or after the nuptials. Being then in a romantic trance, neither of us can clearly testify. Neither can we recall the sermons. But we took heed when he read from Corinthians that "love beareth all things and endureth all things."

(*Turn to page* 50)

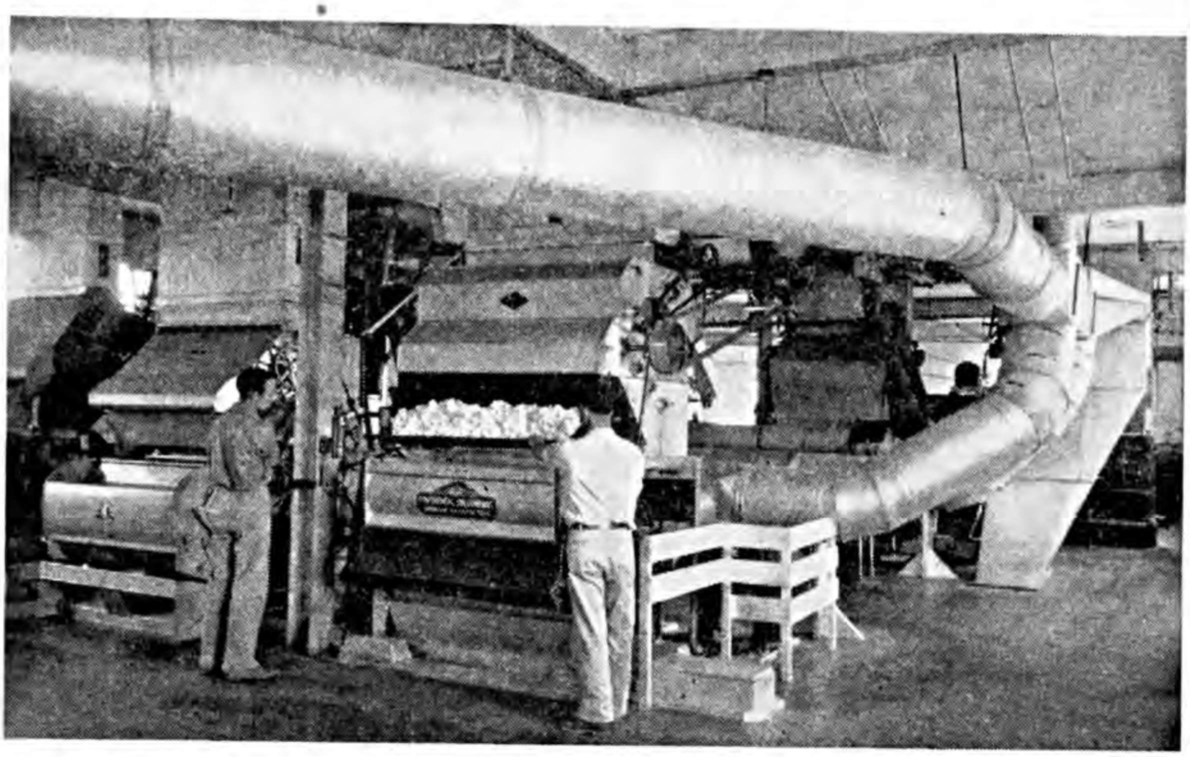

Fig. 1. Interior of experimental set-up in the U. S. Cotton Ginning Laboratory where all types of cleaning and extracting machines are tested. In recent years, emphasis has been placed on adapting and developing processes for cleaning mechanically picked cotton.

Farm Mechanization in Relation To Cotton Quality and Marketing

By Francis L. Gerdes

In Charge, Stoneville Laboratory, Research & Testing Division, Stoneville, Mississippi

MECHANIZATION of cotton production, involving the use of mechanical equipment for the control of grass and weeds, the mechanical cotton picker, and other mechanical devices, has proved to be economically and technically feasible during the past two years at the Delta Branch Experiment Station and has been applied on several plantations in the Yazoo-Mississippi Delta. Plans for mechanization over wide areas, particularly on the larger farms, are now in advanced stages of development in the Delta. Labor shortage and high costs of labor in recent years have been important factors in bringing about expansion in mechanized farming. Moreover, a realization on the part of Southern agricultural leaders that economies need to be sought in the production, marketing, and manufacturing of cotton in order to maintain a stable and profitable industry is another important factor responsible for the achievements made so far in the mechanization of cotton production.

Research, developmental, and testing work in the fields of agronomy, agricultural engineering, technology, and marketing is providing information basic to complete mechanization of cotton production. At Stoneville, Mississippi, a program has been developed for coordinating the efforts of workers in these fields. The Delta Experiment Station operates a large experimental farm devoted to all phases of cotton production research—breeding, agronomy, agricultural engineering, and insect control—with emphasis on the development of mechanical methods for the production of cotton.[1] At the Station, the U. S. Department of Agriculture operates the U. S. Cotton Ginning Laboratory, known throughout the Cotton Belt for its research and developmental work in cotton ginning and packaging and related processes. The third unit devoted to cotton research and testing is the U. S. Cotton Fiber and Cottonseed Laboratory, which is charged with the responsibility of testing for quality the samples involved in the production and ginning research work at Stoneville, as well as samples for public and private cotton breeders, shippers, manufacturers, and others interested in improving the quality of cotton and efficiency of marketing.

[1] See "Mechanical Production of Cotton in the Yazoo-Mississippi Delta," by J. E. Adams and P. W. Gull, BETTER CROPS WITH PLANT FOOD, November 1946.

The Stoneville groups and the Agricultural Economics Department of Mississippi State College are working closely together on the cotton production mechanization research and developmental program, which through the support of all branches of the industry is already beginning to pay dividends. Attention is being focused on the development and testing of production practices, varieties, plant-defoliation procedures, mechanical picking practices, and cleaning, drying, and ginning methods that will aid in maintaining the standard of cotton quality. Also, mechanization of cotton production has now reached such a stage of development that problems incident to marketing and manufacturing the mechanically-produced cotton must be dealt with in order to assure complete success in this enterprise. The research studies, completed this year in connection with mechanization, have brought out from the standpoint of lint quality effects the following facts:

(1) The characteristics of the variety of cotton planted on mechanized farms definitely influence the grade of ma-

Fig. 2. Laboratory workers determine strength, length, and other properties of cotton produced in the mechanization studies at Stoneville, Mississippi.

chine-picked cotton. It was evident that in the process of machine picking, the varieties of cotton characterized by smooth leaves gave higher quality lint by one full grade than varieties having an abundance of hairs on the cotton leaf, the differences in grade being reflected in differences in mill waste.

(2) Flame cultivation appeared to give higher grade machine-picked cotton than ordinary plantation methods for controlling grass and weeds. This process eliminated the grass and weeds that are normally gathered with the picker, thus reducing the foreign matter content of machine-picked cotton.

(3) Dusting of cotton plants with calcium cyanamid during the harvesting season to cause leaf shedding again proved to be helpful in facilitating mechanical picking and in reducing the amount of extraneous material in seed cotton. This practice was especially effective where the physiological condition of the plant was favorable and moisture on the plant foliage was sufficient to create the chemical reaction needed for causing the leaves to shed properly from the plant, and where fair weather conditions prevailed long enough for the cotton to be machine-picked before a second growth developed from subsequent rains. It was again verified that the application of the defoliant can be made as early as three weeks after the last bolls are set and still have no adverse effects on the quality of the cotton fiber.

(4) Improvements made in the spindles of the mechanical picker in 1945 made it possible to harvest a high percentage of the cotton with the use of much less water in doffing and resulted in substantial improvements in the grade of the lint and cottonseed over 1944. The difference in grade between hand- and machine-picked cotton in 1945 ranged from one to two grades as compared with the difference of two to three grades in 1944.

(5) In most comparative spinning tests in 1945, the results of tests of previous years with respect to yarn strength were confirmed, in that they showed that machine-picking produced cotton of higher yarn strength than hand-picking, presumably because it passes up immature locks to a greater extent.

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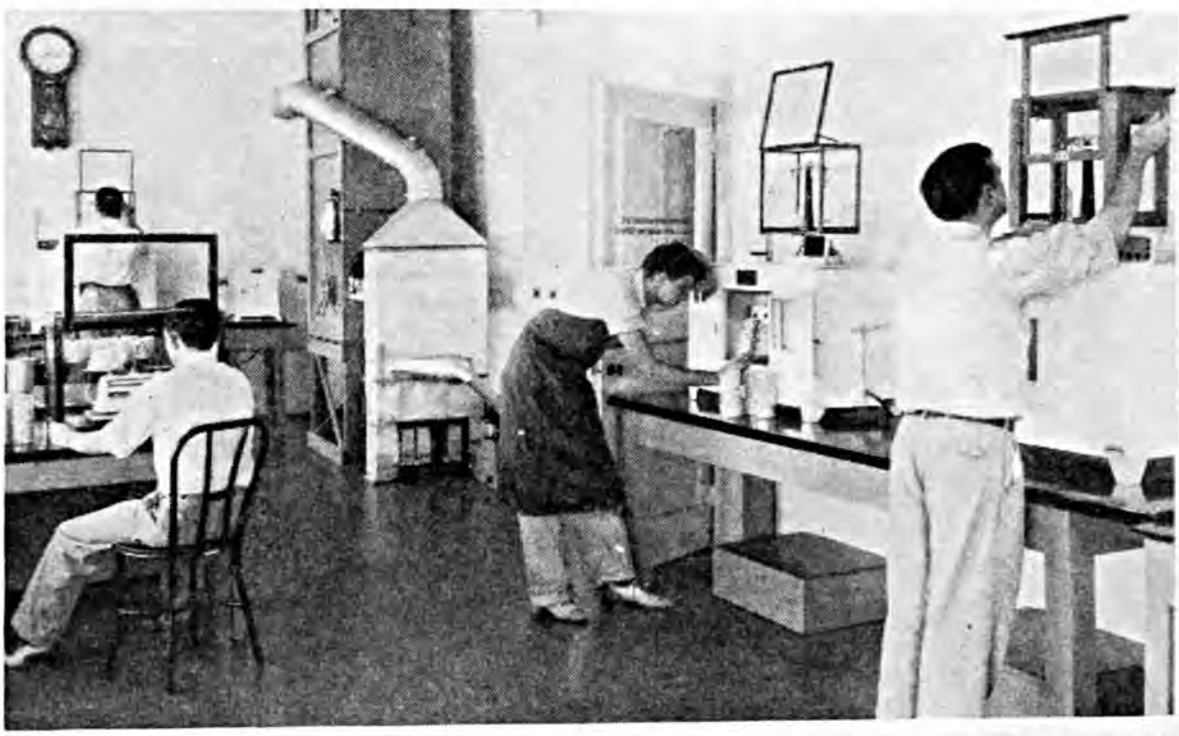

Fig. 3. Testing machine-picked cotton for moisture content to determine how it compares with hand-picked cotton. The picker generally adds 2% moisture to the cotton during the picker spindle doffing operations, and driers are used at gins to remove this excess moisture.

How Guernsey Calves Helped Solve A Feed and Crop Fertilization Problem

By E. R. Kuck

Brookside Farms, New Knoxville, Ohio

THIS STORY has its setting in the combination calf and maternity barn, built in 1945 to better control the hazards involved in the birthing of calves and bringing them through the critical first 60 days of life. Great care was exercised in the planning of this building, particularly with regard for ample space, provision for proper lighting and ventilation, and a type of construction which would lend itself best to thorough sterilization and fumigation. The reason for this enterprise was to substantially eliminate the high mortality rate (23% to 41% annually) among our new-born calves.

Title to Brookside Farms, New Knoxville, Ohio, was acquired in 1933 and a general farming program featuring a pure-bred Guernsey dairy herd, pure-bred Poland China hogs, and a 500-layer flock of White Leghorn chickens was inaugurated. The farm originally consisted of 180 acres in two units. Subsequently three additional farm units were leased, involving an additional 240 acres. Much of this land has been in cultivation for 100 years and the soils are principally Miami silt loam, Crosby clay loam, and some rich Brookston loam.

Having had the advantage of an agricultural college training (Purdue 1920-Ohio State 1922) and having a natural inclination to scientific study, I introduced all the latest ideas and procedures in soil and animal husbandry that came to my attention. Careful records concerning each enterprise have been kept since 1933.

However, the employment of all the latest scientific principles involving poultry, swine, and dairy cows did not permit me to fare any better than most of my neighbors. A high mortality rate with young chickens caused me to drop the poultry program in 1939. A high mortality rate with pigs caused me to abandon the swine-breeding program in 1940. Today the entire farm program at Brookside Farms is devoted to dairying, and in this we have had no small amount of discouraging experiences, especially with a high mortality in young calves, with mammary disturbances in the milk cows—both milk fever and mastitis—and, of course, the ever-present problem of shy breeders.

The foregoing background brings us to the present status of Brookside Farms with a normal milking herd of about 100 head of milk cows, 50 bred heifers, 70 open heifers, and about 40 head of bull calves. All of these animals, excepting the bull calves, are grown to maturity and given an official production test during their first lactation period, after which they are sold on the basis of an automatically applied price formula based on the pounds of butter fat produced.

Under the above program there are

Calves ate the finishing plaster from the walls in an effort to supplement their magnesium-deficient feed.

approximately 120 calves born each year. When 49 of these calves died in one year it was not only a disappointing experience but it also represented a real economic loss. It was because of this heavy mortality rate that the modern calf and maternity barn was planned and built.

This barn 28′ x 72′ was constructed of clay tile building-blocks with all the inside walls plastered with a two-coat plaster application. Ample window lighting and ceiling ventilation were installed. The barn was started in November 1944 and was put in use about April 15, 1945. All the walls in the 16 individual calf stalls were given a rough coat plaster application and six of these stalls were given a finish coat plaster application. The other 10 stalls were not completed with the finish coat until the latter part of October 1945. All of the stalls were promptly put in use, but our experience with the calves remained the same. They kept right on turning up their heels with the same symptoms as before.

Symptoms

The following symptons prevailed: Calves were born weak with slow reflexes and no appetite; dietary scours developed in 100% of the cases, 50% of the cases were accompanied by low type of pneumonia with much coughing; calves that died invariably went down with convulsions and no calf ever to go into the convulsion stage lived beyond six hours.Strong, disagreeable odors always were present in the stalls. Calves that lived through the first 90 days showed remarkable recuperative ability and matured to good size without any signs of these calfhood disorders.

Attempted Treatment

Thousands of dollars were spent to find a practical cure. Every type of treatment involving the entire list of sulfa drugs, vitamin tablets and vitamin preparations of every description, blood transfusions from the mother, calf scours serums and vaccines, modification of the milk formula graded down to pure skim milk, special pre-natal feedings to the mothers—all of these were tried with no change in the general results.

Discovery

As previously explained, six of the calf stalls had been completely finished with the finish plaster coat and the other 10 had only the rough coat application. The observation that, for some reason the calves were severely mutilating the finished walls in each of the six finished stalls was almost immediately made. No particular thought was given to this at first except as to whether it would pay to have the other stalls finished if the calves would mutilate the walls any way. Then one day the belated thought came to me: Why are those calves trying to eat the finish coat from the wall? Close inspection revealed that the rough-coated walls had not been touched.

A partially filled bag of the material used for the finish plaster coat was at hand and I requested the manufacturer to send me a detailed chemical analysis of the materials used in this finish lime material. Considerable correspondence followed and it was learned that this material was prepared from a heavy dolomite lime analyzing:

Calcium Carbonate $CaCO_3$	53.94%
Magnesium Carbonate $MgCO_3$	45.47%
Other elements	.59%
	100.00%

This company also sent their chemist to our farm where for several days we made exhaustive soil tests from all of our fields and found the following:

Element	No. of samples	Lowest reading	Highest reading	Average for farm
pH	17	5.4	7.2	6.36
Nitrogen (Parts per M)	17	25.0	60.0	35.0
Phosphorus (# per acre)	17	50.0	100.0	70.0
Potassium (# per acre)	17	120.0	220.0	180.0
Magnesium (# per acre)	12	very low	low	very low plus

Deduction

The natural deduction, based on the foregoing information, led me to assume but one answer—the element magnesium. A carload of this material was immediately ordered with 4 tons of the material ground to a fineness to go through a 200-mesh screen for mineral supplement feeding and 40 tons to go through a 100-mesh screen for pasture and field application. The car was unloaded August 25 and our extensive experiments started from this date.

Feeding Practice

Regardless of season, it has been our custom to feed a grain ration supplemented to provide a 16% protein ration. The supplement used was manufactured by a nationally prominent feed manufacturing concern and was guaranteed to contain the mineral elements necessary to heavy milk production. Nevertheless, we always added to this ration an additional 40 lbs. per ton of a mineral mixture made up as follows: 40 lbs. of 98.4% pure calcium carbonate, 40 lbs. steamed bonemeal (or 40 lbs. defluorinated di-calcium phosphate if bonemeal was not available), and 20 lbs. of salt. This formula has not been varied since 1938.

On August 25 I ordered a change in this home-mixed mineral as follows: Substitute dolomite lime (54% $CaCO_3 \cdot 45\%$ $MgCO_3$) for the pure 98.4% calcium carbonate used previously and add 40 lbs. additional dolomite lime to each ton of feed mixed.

This order was predicated on the assumption that the calcium carbonate content would remain about the same as with the 98.4% pure calcium carbonate used before, but the additional amount of magnesium carbonate would be fairly high.

Results

All of the calves in the calf barn were fed milk from the cows receiving this new mineral mixture. After about two weeks it was noticeable that the odor previously present in the stables was becoming less, and we noticed a considerable change in the droppings of the calves. We also noted a gradual increase in the thirst for water on the part of the calves between feedings. The calves became more alert and, as if by magic, the scours condition cleared from the older calves. The calves just born, however, still proceeded through the scours stage but soon recovered when put on milk. During the latter part of October the remaining 10 stalls were treated with the finish lime coat, using the same material as was used for the first six stalls, and not a single tooth-mark is to be seen on any of these walls to this date.

At this point we were satisfied that we had made a very important discovery. Then followed a long list of experiments that are still in progress, some with very illuminating and striking evidence of the importance of the proper balance and the inter-relationship of certain major and trace elements.

Other Observations

1. On August 25, there were 16 cows in the milking herd quarantined for mastitis. On September 15, 13 of these animals were entirely cleared without any other treatment. On October 6, a herd test was made involving 79 animals, only 2 reactors were found and they showed slight traces in one quarter. Today there is not a single animal in quarantine for mastitis on the farm. Previously the incidence of mastitis would affect better than 50% of the herd at one time or another during a lactation.

2. On August 25, we were carrying on our No. 2 farm 23 head of dry cows that had completed good production records but which we had not been able to breed. The pasture on this farm was treated with a 700-lb. application of the dolomite lime on August 27. Excellent fall rains produced a good pasture during the latter part of Septem-

Right: Healthy, vigorous alfalfa, produced on a field treated with dolomite; left: poor growth of alfalfa from an adjacent, untreated field.

Mr. Kuck shows the difference in corn yield. Left string, untreated; right string, dolomite treated.

ber and these cows ranged this pasture until in December. In addition, they had free access to the mineral in special boxes in the barn. On January 8, 1946, when these animals were bled for our periodical Bangs and TB test, 18 of them were pronounced safely with calf by the veterinarian and 20 have subsequently calved on dates showing they were bred about October 1 or after. The same bull accompanied these cows throughout the year.

3. Milk cows that had been on the dairy mineral feed for at least two months before they were turned dry produced strong, normal calves that did not go through the scours stage. Check cows and heifers that did not have the advantage of the mineral mixture dropped weak calves and gave the same symptoms and results as before.

Field Crop Observations

The most striking evidence of the effect of this magnesium element remained to be found in the crops from the dolomite-treated fields. In an abnormally wet spring season, followed by one of the most severe droughts in late summer ever experienced in my immediate community, the results could be read without effort. The outstanding observations were briefly, as follows:

1. Because of an abnormal rate of rainfall following corn-planting season, the corn fields generally presented a mottled array of colors—a patchwork ranging from yellow to dark green. This phenomenon was attributed to drowning and excessive rainfall. However, these yellow areas were evident on high ground as well as in depressions. On the dolomite-treated fields, the corn retained a uniformly green color and the yellow spots were not evident except in a few isolated places where plants were in water for three or four days. However, it was noticed that these plants had a remarkable recuperative ability.

2. Where nearly all of the untreated corn fields in the immediate community were severely fired, the dolomite-treated 120 acres of corn on this farm remained green throughout and made a highly increased yield over the average of the community.

3. Following the third cutting of alfalfa hay the stand, generally, turned yellow and brown, giving the appearance of being dried up. The dolomite-treated fields are going into the winter with a healthy, dark-green color.

Indiscriminate use of magnesium salt may result in detrimental effects

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Alfalfa—A Crop to Utilize the South's Resources

By J. A. Naftel

President, Plainsman Farms, Auburn, Alabama

A LONG growing season and ample rainfall have been referred to as great assets to the South, but in the past farmers have never completely utilized these possible natural resources in producing crops. On the other hand, long periods of high temperature and heavy rainfall have through oxidation of organic matter, erosion, and leaching actually depleted our lands of their native fertility. This, if allowed to continue, will remove more and more land from economical production.

Row crops such as corn and cotton occupy a majority of the cropped acreage. These crops are clean-cultivated and have a growing period of about five months, or a productive period of only 40 to 50 per cent of the annual period. During the other half of the year, high losses of soil and natural resources occur. An ideal crop would be a perennial that could be quickly established, would grow throughout the year, conserve the soil, require little cultivation and hand labor, fit into a desirable rotation, and yield economical returns of a useful product.

Alfalfa meets most of these requirements in that it is a perennial readily established, with returns the first year. It grows about 10 months out of the year and not only conserves the soil but through nitrogen fixation and deep root penetration increases the fertility of the surface soil. Moreover, alfalfa requires practically no cultivation or hand labor and, finally, it produces relatively higher returns than most other crops.

The question as to why alfalfa has not been grown in the Southeast to any great extent in the past naturally arises. The answer now appears simple. It was discovered only recently that two essential plant foods were deficient in the soils and fertilizers when earlier attempts were made to grow alfalfa on many of our soils. The two elements were potash and boron. Earlier trials had generally supplied ample phosphorus and lime but insufficient potash and no boron. Since the recent discovery that alfalfa could be grown successfully on soils that were formerly considered unsatisfactory for the crop, the growth of alfalfa has been confirmed throughout the State on types representing most all of the well-drained soils (table 1).

Borax and Potash Needed

A brief historical background of the recent discovery of the treatment required for successful alfalfa is of interest and demonstrates the value of agricultural research. Formerly, large acreages of alfalfa were grown in the Black Belt on the calcareous soils, but stands could not be maintained and Johnson grass usually took over these fields. Consequently, interest in alfalfa in this area was largely lost. The fertile red lands of the Tennessee Valley have been planted to limited acreages of alfalfa for many years, but stands deteriorate and the acreage of this crop has not been extensive. Small acreages of alfalfa have been successfully grown in the Piedmont for several years, but the crop has not been commercially established. Alfalfa on Sand Mountain was not successful until a few years ago when adequate amounts of potash and borax were supplied in addition to the usual lime and phosphate treatments.

Perhaps the greatest impetus and stimulation of interest in alfalfa stemmed from the results obtained with potash and borax in 1942 from a small 8 x 16-ft. plot in the Crops Garden at Auburn. This is located on a Norfolk sandy soil. Since this investigation is considered the origin of the revival of interest in alfalfa in the State, it will be discussed in detail.

In the Crops Course of the Alabama Polytechnic Institute, an introductory crops garden is maintained in part for the benefit of student classes. Many students, especially those of middle and south Alabama, had never seen alfalfa except in baled hay which generally was shipped into the State from the Midwest. Consequently, a small plot was seeded in the fall of 1941 to alfalfa with the usual lime, phosphate, and potash treatments. An excellent stand of alfalfa was obtained but the crop lost its vigor, turned yellow, and appeared doomed as most alfalfa trials had been in the past on similar soils outside of the "Alfalfa Belt."

This plot, however, was divided into four sub-plots and borax and additional potash treatments were applied to certain of these sub-plots following the first cutting. Satisfactory growth resulted (table 2). The alfalfa on the sub-plot without additional potash and borax did not survive on this soil. Thus

TABLE 1.—YIELDS OF ALFALFA IN THE OLDER ALFALFA SECTION AND IN ALABAMA

Yields in tons per acre of hay

State	Old Alfalfa Section[1]	Alabama results[2]	
	With fertilizer	Location	Yield
New York	1.8	Tennessee Valley	2.4
New Jersey	2.8	Sand Mountain	3.4
West Virginia	3.3	Alexandria	3.8
Tennessee	2.5	Lafayette	4.2
AVERAGE	2.6	Auburn	4.0
		Black Belt	2.3
Ohio	3.6	Atmore	5.0
Michigan	2.4		
Indiana	2.6	State Average	3.58
Illinois	3.5		
Wisconsin	2.7	North Alabama Average	3.20
Iowa	3.0		
AVERAGE	2.96	Central and South Alabama, exclusive of Black Belt	
Missouri	3.9	AVERAGE	4.40
Kansas	2.0		
Oklahoma	4.6		
AVERAGE	3.5		
Montana	3.0		
Idaho	4.6		
Utah	4.0		
Oregon	4.6		
AVERAGE	4.0		
California	6.6		
New Mexico	6.7		
AVERAGE	6.65		

[1] From The Fertilizer Review XXI (1946).
[2] From "This Month in Rural Alabama." June 1946, Ala. Extension Service.

TABLE 2.—THE YIELD OF ALFALFA ON NORFOLK SAND WITH DIFFERENT POTASH AND BORAX TREATMENTS[1]

Fertilizer treatment—pounds per acre		Yield of hay per acre in pounds			
		Cutting—1942			
Fall of 1941	After first cutting—1942	1	2	3	Total
200# muriate of potash 1,000# superphosphate 3,000# dolomite	None	1,564	1,430	367	3,361
Same as above	340# muriate 30# borax	1,564	2,497	1,414	5,474

[1] Sturkie, Rogers, and Naftel: Unpublished data Alabama Agricultural Experiment Station.

was seen the possibility of growing alfalfa on the light sandy soils of the Southeast through the use of borax and adequate potash in addition to the usual lime and phosphate applications. The significant finding in this exploratory test was that borax and more potash than was formerly believed necessary made the difference between success or failure with alfalfa.

Discussion

Alfalfa yields in southern Alabama are higher than in the northern part of the State. This is in contrast to yields of most other crops. Moreover, alfalfa yields are higher in central and southern Alabama than in the corn belt or midwestern states of the alfalfa region (table 1). The probable reasons for the higher yields in the Southeast are a longer growing period, the use of larger amounts of fertilizer, and high temperature and high rainfall. All of these produce more cuttings annually than in some other sections.

Present general recommendations for establishing alfalfa are two tons agricultural limestone, 500 pounds superphosphate (20%), 300 pounds muriate of potash (60%), 20 pounds borax, and 25 pounds seed per acre, representing an outlay at present of approximately $35 to $40 per acre for the first year. Annual fertilizer maintenance cost of 400 pounds of superphosphate, 300 pounds of muriate of potash, and 15 pounds of borax approximates $12 per acre. Over a five-year period, the annual cost per acre would be approximately $17.60 for seed and fertilizer. With an average annual yield of three tons of alfalfa hay per acre at $40 per ton, the gross income would be $120 per acre. For a five-year period, the fertilizer and seed cost would amount to approximately $88 and gross income approximately $600 per acre. The difference between these two amounts represents other costs and profit and it appears promising that there would be a good chance for profit. By grazing alfalfa with hogs or other livestock, even greater returns might be possible. The above does not consider the erosion control and the gain in nitrogen and organic matter content of soils which preliminary results show to be highly valuable where corn followed the alfalfa.

Alfalfa is a deep-rooted plant that penetrates the subsoil to several feet and quite commonly to five-ft. depths or greater in some soils. This means that alfalfa feeds on perhaps 10 times the volume of soil that is used by many ordinary row crops. When it is considered that a stand of alfalfa gives complete coverage on the surface of the soil, it is readily understood that row

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Agricultural Experiment Station in the Brazoria-Galveston, Texas, Soil Conservation District on the Coast Prairie. Area shown has been plowed, disked, leveled, drained, seeded to white clover, lespedeza, Bermuda and dallis grass, and mowed. The pasture where the men are standing had 100 lbs. of available phosphoric acid mixed with the soil; the pasture across the fence had none. Maximum recommendations for this area for pasture development are: 120 lbs. P_2O_5; 70 lbs. K_2O; 16 lbs. N; and 3 tons of limestone.

A Discussion of Soil Analyses on the Forested Coastal Plain, Bottomland Coast Prairie, and Cross Timbers of Texas

By M. F. Wichman

Soil Conservation Service, Temple, Texas

THE Soil Conservation Service Operations Laboratory at Temple, Texas, has made more than 500 soil analyses for soil conservation district cooperators during the past year. These farmers, seeking to establish coordinated soil conservation measures on their farms, have realized that plant succession, longer grazing seasons, quantity and quality of forage, and freedom from certain diseases in animals are due largely to the balanced fertility and fertility management of their pasture and meadow soils.

That statement can be made about cultivated soil and its fertility relationship to the human.

In a good soil management or fertility management system, various and important factors must be considered; some of these are: Cultural practices and tilth, noxious plant control, plant disease and insect control, vegetative and mechanical erosion measures, crop rotation and proper land use, and application of needed plant nutrients. Here we are primarily interested in the last factor—the application of needed plant nutrients. At the present time 14 nutrients are thought to be necessary for normal plant development; of these, we are interested in those most important—phosphate, potash, nitrogen, and lime.

Soil fertility might be defined as the ability of a soil to produce adequately those crops which are permitted by climate. The most frequent cause of infertility is the deficiency or excess of moisture. Fertility depends upon a balance of all factors. Where fertility is out of balance the limiting factor must be found and corrected. Fertility can be determined only in terms of specific crops. When applying fertilizers to soils we are adding them to balance the elements present, feed the micro-organisms, and supply available plant nutrients.

On the various samples, recommendations have been made for either soil-conserving crops, soil-improving crops, pastures (grass and legume), or for meadow development.

These analyses reveal some definite trends in Texas soils. In general, the base content, or base saturation,* increases from east to west (as does the soil reaction); that is, the more western soils have more base materials such as calcium, sodium, potassium, and magnesium available and are less acid. Forested Coastal Plain soils in east Texas are different in reaction (pH) from other Coastal Plain soils in that they are generally more acid in the subsoil than they are in the surface soil. Occasionally Cross Timber soils will have a high base saturation but will be low in available calcium. The potash content of soils increases from east to west.

Deep, medium-textured, slowly permeable soils in east Texas have an average of 50 p.p.m.** or less of available potassium, while soils of the same na-

* Base saturation of a soil is the proportion of base elements—calcium, magnesium, sodium, and potassium—that tend to saturate the small organic and inorganic soil particles or those colloidal in size. Under favorable conditions the hydrogen ion (acid) will displace the bases, causing the base saturation to vary.

** All references to available plant nutrients in parts per million are determined by using LaMotte procedures. Some of the plant-food nutrient levels are still questionable and will vary greatly with increased exchange capacity and other factors.

Adding 5-10-5 fertilizer at 100 lbs. per acre helped the corn at the left make its good growth. The corn at the right of Collin Johnson, cooperator with the Kiamichi Soil Conservation District near Hugo, Oklahoma, has not been fertilized. This farm is on the Forested Coastal Plain. Johnson says that his fertilized cotton produced 100% more than his unfertilized cotton.

The Cross Timber soils of Texas often show a need for phosphate to get maximum production, controlled erosion, and sustained fertility. Here brabham peas, on the left, have been fertilized with 100 lbs. of 20% superphosphate. The other peas on this fine sand have not been phosphated. Both areas have been in a crop rotation, but the value of the phosphate is evident. J. B. Inabnet, cooperator with the Brown-Mills Soil Conservation District and owner of the site shown, calls this area part of his best land. In this area there is often need for complete fertilizers on most crops though in smaller amounts than in east Texas.

ture and basic land resource area in the vicinity of Yoakum will have 70 to 80 p.p.m. of available potassium. On these soils, in the vicinity of Yoakum, it is indicated that small applications of potash will pay. As a whole the soils of all four of the basic land resource areas, Forested Coastal Plain, Coast Prairie, Bottomland, and Cross Timber, are low in available phosphorus. Low plant-food nutrient levels or lack of plant-food nutrient balance are two of the chief reasons for low productivity. For the eastern part of Texas (east of the Blacklands) phosphorus is the nutrient most commonly needed, then potassium, and finally calcium or lime. All of these soils are deficient in nitrogen; it can be used to advantage.

Forested Coastal Plain soils having 30 to 40 p.p.m. of available phosphorus do not respond to applications of phosphate. Phosphorus is essential for plant growth since it hastens maturity, encourages symbiotic bacteria, increases root development, aids in starch digestion, stimulates drought resistance, helps seed formation, and is necessary for cell division and formation of fats and albumen. A lack of phosphorus, indicated by a purpling of the leaves, results in a restricted root system.

Forested Coastal Plain soils having 80 to 90 p.p.m. of available potassium have an adequate supply of this nutrient and applications of potash are not profitable. The influences of potash upon plant growth are many; it gives tone and vigor to plants, increases resistance to certain diseases, encourages an adequate root system, acts to balance nitrogen and phosphorus, and is essential for starch formation, translocation of sugar, and development of the green coloring matter. Potassium or potash helps grain formation and is necessary for legumes. In general, root crops will respond to its application. Sodium and potassium are similar in plant nutrition but sodium can not completely take the place of potassium. Plants that have dry and scorched leaf edges, with the surface somewhat spotted, reveal potassium deficiencies.

Five hundred to 750 p.p.m. of available calcium are adequate for good plant nutrition if the soil is from 70 to 80 per cent saturated with bases. This will hold true for Forested Coastal Plain soils with low exchange capacities. As the exchange capacity * increases, the available calcium should increase. For different plants the available calcium required will vary. Blackberries and watermelons need very little, most legumes do best with small amounts, clovers like more than vetch, while alfalfa and okra do best where there is plenty of available calcium. When calcium is applied to the soil, generally in the form of limestone, care must be taken not to overlime as this practice is harmful. Calcium is an essential material for plant growth, since it effects translocation of plant foods, acts as an agent to speed up or retard chemical reactions, and helps regulate internal plant reactions. The formation of chlorophyll is poor when calcium is low. Calcium also seems to make membranes more permeable. Plants that are deficient in it have poor color. Lime is applied as a nutrient and to change base saturation; it is not applied primarily to correct soil reaction.

All soils in the eastern part of Texas are deficient in nitrogen. The nitrogen content of soils will vary day to day and from season to season and it is for this reason that tests for available nitrogen are not made by the laboratory. Nitrogen can be used to advantage on grass pasture, cultivated land that is to be retired and put in pasture, kudzu, oats, and other small grains. Nitrogen is an essential material of protein and protoplasm, since it is used primarily to produce vegetative growth. It is also necessary for reproduction and stalk development. Plants lacking nitrogen are stunted and have a yellow appearance.

The level of available plant-food nutrients within the various basic land resource areas will vary with the amount of organic matter present and the exchange capacity. Soils with low exchange capacities can use less fertilizing materials than those with high exchange capacities.

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* Exchange capacity—The ability of a soil, due to the small organic or inorganic particles (colloids), to hold fertilizing materials whereby the plants may take them up.

Spreading lime near Mt. Pleasant, Texas, in the Sulphur-Cypress Soil Conservation District. Lime is a definite asset in pasture improvement work at this location on the Forested Coastal Plain. The farm is owned by John B. Stephens, a district cooperator.

Fertilizing & Cropping Systems for Flue-cured Tobacco

By J. A. Stinson

Officer-in-Charge, Delhi Experiment Station, Delhi, Ontario

FLUE-CURED tobacco farmers in Ontario point with pride to crops on their new land and take for granted lower returns from those on fields that may have grown only two or three crops of tobacco alternated with rye. Indeed, there is striking evidence that already, productivity has fallen off seriously on many areas where tobacco has not been grown for longer than 15 years. Along with soil depletion owing to crop removal, soil erosion, and leaching, a gradual but somewhat alarming increase in tobacco root rot has taken place. Results of experimental work indicate that such conditions may be avoided by practical and economical means and that general improvement in cropping practices is needed to insure economic use of this land for growing tobacco in the future.

When tobacco was first planted on these soils, they usually contained a reserve of organic matter, stored up over a number of years in grass or other soil-building crops. Decomposition of organic matter went on at a rapid pace under the influence of cultivation required in growing tobacco. In the meantime, while the reserve of organic matter lasted, alternating tobacco with rye was apparently an ideal system, and it accordingly became the established practice. As organic matter dwindled, tobacco crops responded remarkably to barnyard manure which could be bought at low cost on general farms in surrounding districts. Although the selling and hauling of manure rapidly became a business of considerable proportions, subsequent developments have shown that there are definite limits to the extent that barnyard manure can be used in solving the problem of declining soil productivity. Not only are available supplies inadequate for the ever-increasing acreage, but its frequent use for tobacco in such an intensive cropping system makes conditions more favorable to the incidence of black root rot. Accompanying the increased use of barnyard manure for this crop, black root rot has become the most costly disease with which tobacco farmers have to contend. To avoid possibility of serious loss from this disease requires planting flue-cured tobacco not oftener than once in three years, under present conditions.

Rotation studies at Delhi indicate that the length of rotation has a decided influence on the returns per acre of tobacco. This is illustrated by records of yields and gross returns per acre that are tabulated in table 1. The

TABLE 1.—AVERAGE YIELD AND GROSS RETURNS PER ACRE WITH FLUE-CURED TOBACCO IN TWO- AND FOUR-YEAR ROTATIONS. (1944-1945)

Length of Rotation	Yield per Acre Lbs.	Returns per Acre $
Two-year	1,262	295
Four-year	1,483	357

returns per acre from tobacco in the four-year rotation were more than 20 per cent higher than from those in the usual two-year rotation. Although results over a sufficient number of years

Table 2.—Average Grade Value, Yield per Acre and Gross Returns per Acre with Flue-cured Tobacco Grown in Two-year Rotations During Six Years.

Rotation Flue-cured Tobacco Following:	Grade Index ¢	Yield per Acre Lbs.	Returns per Acre $
Rye disked when mature	25.3	1,339	338
Rye harvested	25.2	1,244	313
Oats	25.7	1,183	304
Weed fallow	25.2	1,157	292
Soybeans harvested at maturity	24.0	1,028	246
Bare fallow and five tons per acre barnyard manure	23.8	1,192	283
Buckwheat	23.6	1,175	278
Field corn	23.3	991	231
Soybeans ploughed under green	22.0	1,406x	209
Sweet clover	19.1	1,148xx	229

x—100 pounds green leaf of no commercial value.
xx—183 pounds green leaf of no commercial value.

to warrant definite conclusions are not available, those presented serve to indicate that the increased returns from the tobacco in the longer rotation are likely to be more than sufficient to cover the investment in extra land. Besides the larger average cash return from tobacco grown in rotations capable of maintaining soil productivity at a high level, it has been noted that there is less variation between the crops in good and poor tobacco seasons. This fact should prove of interest not only to farmers but to all of those concerned with stability of tobacco production. In a good three- or four-year rotation there is also an opportunity to secure revenue from one or more crops in addition to tobacco.

There are a number of crops that may be used to advantage in the flue-cured tobacco rotation, provided they are properly arranged and grown. An indication as to the relative effect of several different crops when grown immediately preceding flue-cured tobacco can be gathered from table 2 which contains data on tobacco in two-year rotations with various cropping systems. In each instance a winter cover crop

Table 3.—Average Grade Index, Yield per Acre and Returns per Acre with Flue-cured Tobacco in Two-year Rotations During Succeeding Five-year Periods, 1935-1939 and 1940-1944, Respectively.

Rotation	Average for Five Years (1935–1939)			Average for Five Years (1940–1944)		
Flue-cured Tobacco Following:	Grade Index ¢	Yield per Acre lbs.	Returns per Acre $	Grade Index ¢	Yield per Acre lbs.	Returns per Acre $
Rye disked when mature	28.0	1,415	396	26.2	1,256	329
Rye harvested	27.4	1,384	379	25.9	1,174	304
Soybeans harvested at maturity	27.5	1,336	368	24.4	951	232
Soybeans ploughed under, green	24.7	1,407x	247	22.8	1,403	319
Field corn	27.6	1,288	355	24.2	926	224

x—100 pounds green leaf of no commercial value.

A field of flue-cured tobacco. Experimental plots at Delhi.

of rye followed the tobacco but the tobacco crop was preceded only by the incorporation of whatever crop residue remained. Tobacco planted the year after a seed crop of soybeans or corn was light in yield and suffered from a crop effect known as "brown root rot." A heavy growth of tobacco that failed to mature properly and was of low grade followed soybeans ploughed under when green, as well as sweet clover, indicating that these crops stored up too much available nitrogen for tobacco. It may be observed that average returns from the tobacco that followed rye disked into the soil at maturity were considerably higher than those following any other

Early in May next year winter rye cover crop in the foreground will be turned under for tobacco in soil-building studies at Delhi.

TABLE 4.—AVERAGE YIELD AND GROSS RETURNS PER ACRE WITH FLUE-CURED TOBACCO FOLLOWING DIFFERENT METHODS OF UTILIZING THE REST CROP OF RYE. (1940-1945)

Table Following	Yield per Acre Lbs.	Returns per Acre $
Rye disked when mature and ploughed the following spring	1,247	323
Rye disked when mature and fall ploughed	1,225	306
Rye ploughed before maturity and winter cover crop of rye seeded	1,188	299

treatment. Whereas, harvesting the rye gave poorer results than disking the entire crop, numerous observations indicate that combining and reseeding is a highly satisfactory practice.

An idea as to the relative value of different practices for maintaining soil productivity may be derived from data presented in table 3. This table contains a comparison of the tobacco grown in different two-year rotations during the first and second half of a 10-year period.* The rotations were continued on the same plots throughout the entire period.

Part of the reductions in grade and yield of leaf from the first to second five-year period were undoubtedly owing to variations in weather conditions, but it is clear that such reductions were greater in some rotations

TABLE 5.—AVERAGE YIELD AND GROSS RETURNS PER ACRE FOR FLUE-CURED TOBACCO WITH AND WITHOUT WINTER COVER CROPS OF RYE. (1935-1941)

Treatment	Yield per Acre Lbs.	Returns per Acre $
Winter cover crops of rye	1,191	306
No winter cover crops	1,043	266

than in others. Disking of rye at maturity offered the most promise of any practice compared, as a means of maintaining production of flue-cured tobacco in the two-year rotation.

The growing of crops that are capable of returning a large amount of suitable organic material is essential in rebuilding the productivity of these soils. Maintenance alone is not enough as productive capacity is reduced by the growing of each tobacco crop and this must be rebuilt to prevent reduction in crop growth. Losses in humus, or organic matter of the soil, take place during the growing of any hoed crop such as tobacco, corn, or potatoes. Net losses are reduced, of course, by turning under stubble and by disking or ploughing under plant refuse such as rye straw and corn stalks.

As flue-cured tobacco is sensitive to the effect of a preceding crop, the arrangement of crops in the rotation is extremely important. Late maturity and low quality leaf usually result where flue-cured tobacco follows alfalfa or the ploughing under of other legumes. Tobacco planted the year after corn, soybeans, or timothy sod is frequently light in yield owing to brown root rot. A crop of rye before planting with tobacco does a great deal to remove the undesirable effects where these crops have been grown.

Fall rye is a very useful crop to precede tobacco in the rotation, particularly when the mature rye straw is disked into the soil. Besides having ability to grow during late fall and early spring and to furnish a sole covering during winter, rye produces a large amount of suitable plant material to form humus. Different methods of handling rye were compared in the two-year rotation at Delhi, and data on average yield and returns from six tobacco crops following each method are given in table 4.

Throughout this six-year period fall ploughing was followed each year by a poorer tobacco crop than that where

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When Hugh Bennett went home last September to receive all the honors his home town people could give him, the Soil Conservation Service chief found the streets flag-lined and this huge "Welcome Hugh" sign above the courthouse steps.

Hugh Bennett's Homecoming

By Gordon Webb

Head, Regional Division of Information, Soil Conservation Service, Spartanburg, South Carolina

YEARS AGO when he was virtually a lone crusader against soil erosion Hugh Bennett said, in effect, that you can't go home again.

"There is really no such thing," he declared in talking about his native Piedmont North Carolina, "as returning to the places and people you remember from your youth. Even in my time, my part of the country has changed. The old swimming holes I remember have fallen away to little shallow, red mud puddles. Many a field I remember in virgin woods or thick grass has been cottoned out and gutted."

Hugh Bennett, Chief of the U. S. Soil Conservation Service, did go home in September to Wadesboro, North Carolina, for honors few men are privileged to receive from their friends and neighbors. It was Hugh Bennett Soil Conservation Day not only in Wadesboro but, by proclamation of Governor R. Gregg Cherry, in the whole Tar Heel State.

And the landscape Dr. Bennett saw in September was neither the one he remembered from his youth on a Gould's Fork plantation nor the one he described when he said you can't go home again. Many of the gullies had been healed by rank-growing, forage-producing kudzu. Green blankets of annual lespedeza or the perennial sericea lespedeza had been spread over the red, galled spots. Modern swimming holes—farm fish ponds—had replaced the creek pools for boating, fishing, and swimming.

These were the landscape changes being wrought by the Brown-Creek Soil Conservation District, the first of more than 1,650 such farmer-organized districts in the nation and the sponsor of Hugh Bennett Soil Conservation Day.

Joe M. Liles, farmer, merchant, and chairman of the farmer supervisors of the Brown Creek District, is credited with the celebration idea. Reared on a plantation adjoining the Bennett farm and a boyhood friend and schoolmate of the soil conservationist, Liles had three goals in mind. He wanted to honor the man who has become the world's No. 1 authority on erosion control, to have special events that would remind Bennett of his boyhood days, and to underscore the need for and benefits of soil conservation farming.

"Welcome Hugh"

On the Anson County courthouse steps, beneath a huge, red-lettered "Welcome Hugh" sign, Dr. Bennett received from Mayor G. E. Andes the key to the city. H. P. Taylor, who guided the soil conservation district act through the North Carolina legislature in 1937 and who was master of ceremonies for the day's events, read resolutions passed by the County Commissioners, the City Commissioners, and the Anson County Bar Association in praise of Dr. Bennett's work.

Next was the Rotary-Civitan luncheon where Jonathan Daniels of Raleigh, Tar Heel journalist, author, and former presidential secretary, recalled a visit he'd had with Dr. Bennett early in the war. The chief soil conservationist was just back from a 35,000-mile trip by Army bomber to help South Africa in its fight against erosion.

"I was interested," said Daniels, "in Hugh Bennett's report then not merely as one of his neighbors and chief admirers but because my boss then, Franklin D. Roosevelt, even in the midst of war was already thinking about Hugh Bennett's teachings as a part of a plan for peace for the world which he believed must contain plenty if it could ever hope for security. You remember that the acceptance of Hugh Bennett's discoveries (which for 20 years had been scoffed at) was one of the items in Roosevelt's program for America. The extension of that work was a part of Roosevelt's purposes for the world."

Of Dr. Bennett's work and discoveries, Daniels said:

"Any people who think that Hugh Bennett's science is a mere matter of water and wind, soil and plows have only the slightest understanding of the meaning of Hugh Bennett the man. What he discovered was the carelessness and blindness of man. Men had seen gullies before him. Children can see them. . . . What Hugh Bennett taught us was that in our ignorance and blindness and almost in secrecy, the treasure of our land and our lives can slip from beneath us and suddenly be gone forever. In the science of soils, you know, you call that sheet erosion.

"Perhaps the destructiveness as Hugh Bennett showed it to us . . . may seem now very tame stuff beside the powers to destroy we have deliberately and scientifically developed in our times. I am not sure. But I am sure that not even the atomic bomb is more terrifying than Hugh Bennett's discovery that under our ignorance and complacency the substance of our land could disappear without our awareness."

There were other honors for Dr. Bennett.

With help from 15 banks in the Brown Creek District, the supervisors published and dedicated to Dr. Bennett a 24-page bulletin dealing with their local soil conservation work. Each person attending the celebration received a copy.

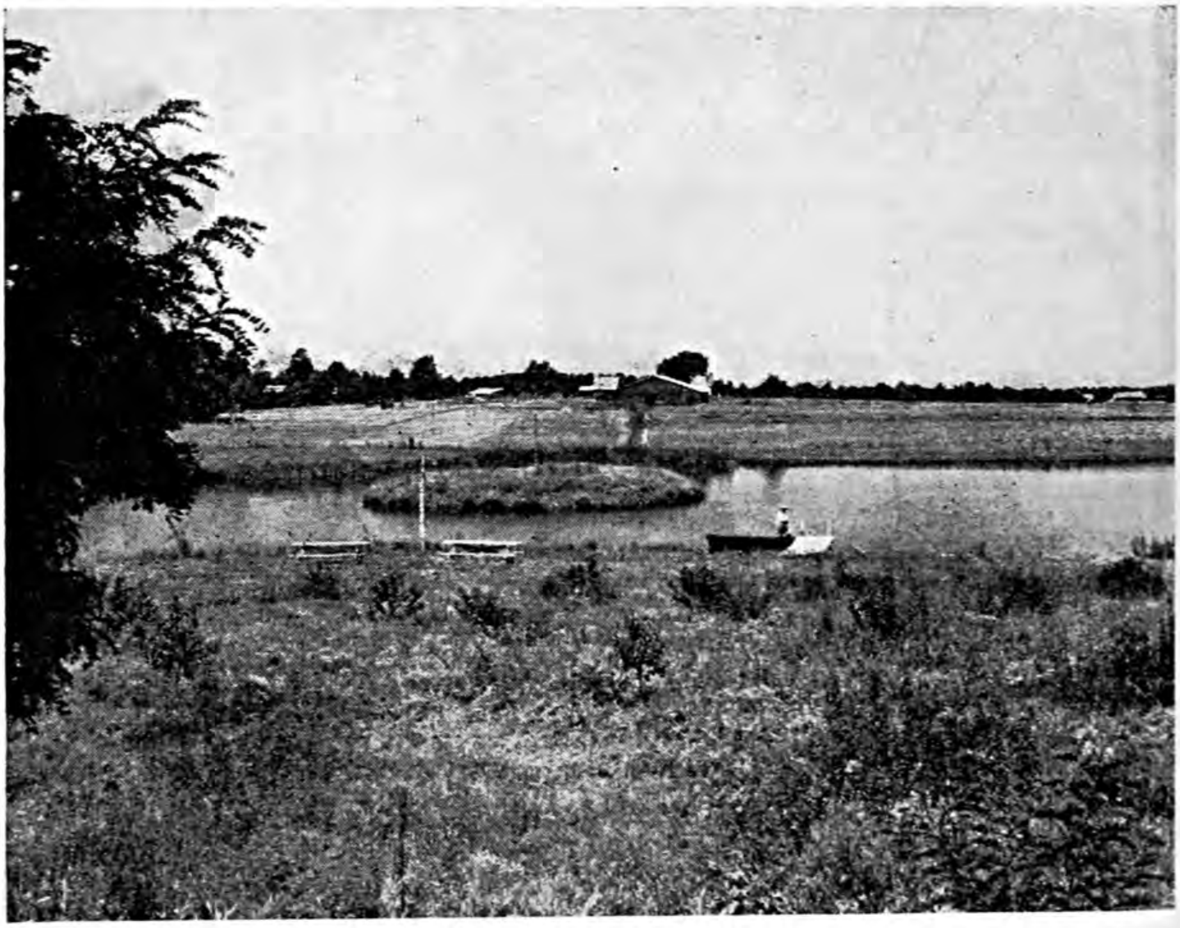
Proudly the supervisors said in the dedication note: "Hugh Bennett is known wherever hoe scratches earth. His fame as a land doctor extends to all the continents and to many of the islands of the sea. . . . We are proud that Hugh Bennett is one of us."

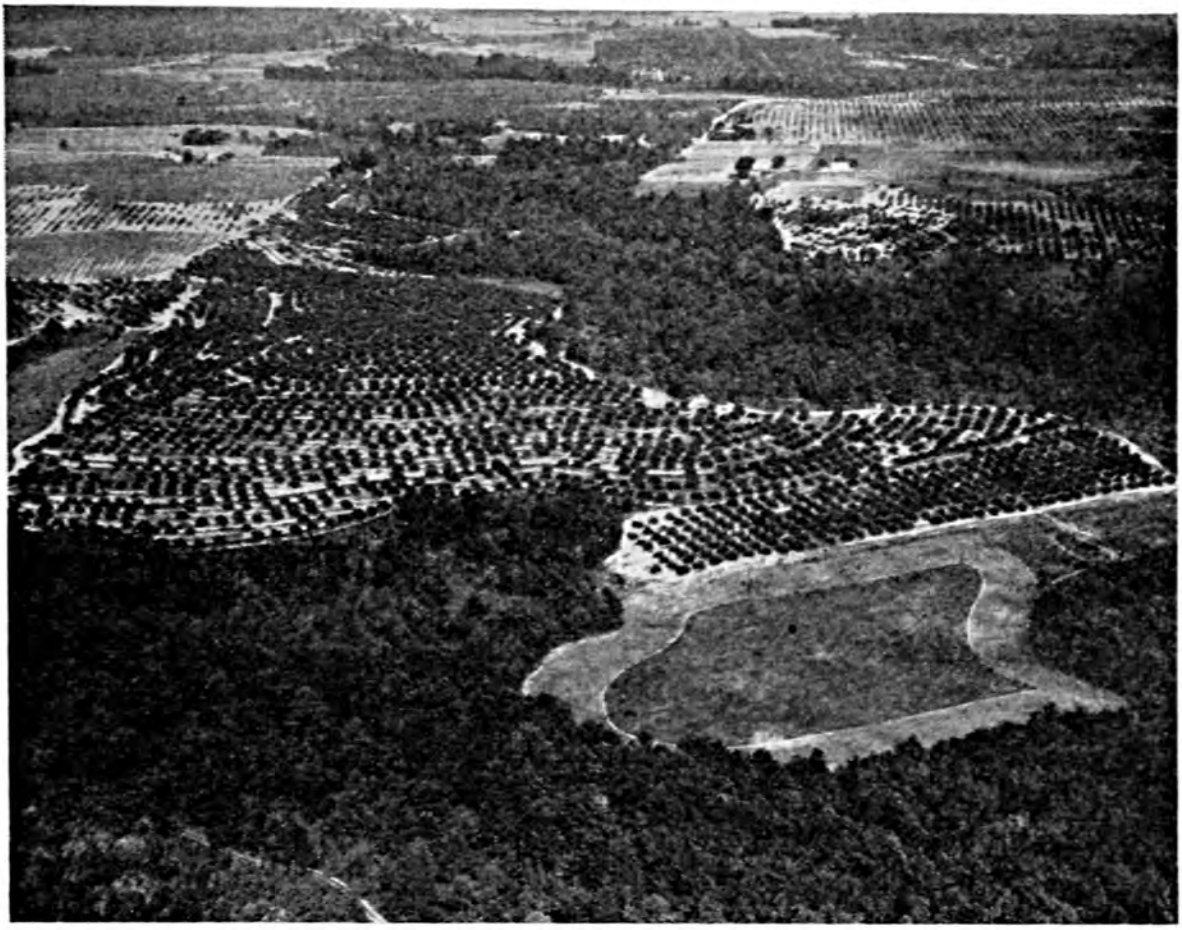
(*Turn to page* 47)

Memories of boyhood days on an Anson County plantation were revived by many special events, including a welcome from "Uncle" Sim Bennett, 80-year-old former field hand on the Bennett farm. Here the chief soil conservationist replies to "Uncle Sim's" words.

Above: **Part of a new land pattern designed by Hugh Bennett.**

Below: **Farm fish ponds replace the silted-up creek swimming holes.**





Above: New orchards covering many acres are going in on the contour.

Below: Erosion-choked stream bottoms have been cleared and put to grass.

Above: **Fields gutted from one-cash-crop farming are back in production under a cover of kudzu grazed by cattle.**

Below: **Young pine and sericea heal the galled spots, breathe life back into the land. A scene on Bennett's farm.**

The Editors Talk

Agriculture 1946

Another year is drawing to a close and American farmers can look back over it with a keen sense of satisfaction. Again they have hung up another crop-production record—three per cent more than in 1942, their previous all-time record.

According to details given by the Bureau of Agricultural Economics, U. S. Department of Agriculture, the largest wheat crop in history has been harvested. From statistics available, the largest corn crop on record is assured. The same holds for tobacco, pears, peaches, plums, and truck crops as a group. Near-record crops were made by oats, rice, potatoes, peanuts, grapes, cherries, and sugarcane; average or better crops include hay, soybeans, dry peas, prunes, apricots, and sugar beets. Only cotton, rye, sorghum for grain, flaxseed, buckwheat, dry beans, sweet potatoes, and pecans were below average.

In general summary, the aggregate production of food and feed grains is the largest in history, tobacco the largest, fruits and vegetables as a group a near-record, oil crops above average, with only cotton well below average.

One of the amazing things about all of this is that American farmers are today producing a third more products for market than they did before the war. And they have been doing it with 10 per cent fewer workers and very little increase in the land used. One can better realize this achievement when remembering that although there were larger increases in industrial production, manufacturing plant capacity is now much larger than before the war and the number of workers in industry is about a fifth more.

Sherman E. Johnson, Ass't. Chief of the Bureau, says that it is true farmers have been generally blessed with favorable weather during the past half-dozen years, but that only a fraction of the increased production can be attributed to the favorable weather. Witness for example, he says, that farmers set a new production record in 1942 when the growing season was one of the best in history; but in 1945 when the weather was not nearly so good they excelled the 1942 record. Most of the increase is credited to the quick adoption by farmers of new and better ways of doing the job, combined with long hours of hard work.

Probably the most important force bringing about this revolution in agriculture is the tremendous advance in the mechanization of so many farms. Today, at least a third of the farmers have tractors compared with only 14 per cent in 1930. Widespread adoption of the general-purpose tractor, adapted for use on smaller farms and a variety of farm jobs, together with the greatly increased use of rubber tires on tractors and other machines, have stimulated the mechanization of many farm operations.

"Along with increased mechanization in bringing on the revolution in agriculture is the greatly increased use of fertilizer and lime," Mr. Johnson says. "Farmers are now using about twice the amount of fertilizer and three times the amount of lime they used a decade ago. And it certainly is not out of the question that the quantities used now might be doubled in the next 10 years. Greater use of fertilizer and lime, together with the cumulative benefits of better soil management of the past dozen years, has contributed much in the procession of one yield after another of practically all major crops during the war."

Third place in importance is accorded the unprecedented adoption by farmers generally of improved crop varieties. Hybrid corn is probably the most outstanding example. In the past decade the acreage planted with hybrid seed has jumped from a negligible five per cent of the total corn acreage to over two-thirds of it. Because yields from hybrid corn are about one-fifth more than from open-pollinated, 3-billion bushel corn crops now seem to be the rule rather than the exception. Farmers also have been making more use of higher-yielding, more disease- and weather-resisting varieties of oats, wheat, potatoes, tobacco, cotton, legume hays, soybeans, peanuts, flaxseed, many fruits and truck crops, to name some of the more important.

These far-reaching changes would have been less effective if the extensive soil conservation and improvement practices of the thirties had not helped the soil to stand up under the heavy strain during the war. The technological advances in mechanization, use of fertilizer and lime, improved crop varieties, and soil conservation did not come full blown, almost overnight as it were, at the outbreak of the war. However, it was the war and the incessant demand for farm products at good prices that speeded up the process, that increased the production per acre by a fifth in the past decade and the output per worker a third more.

Today the productivity of American farms is the greatest it has ever been. It is likely to increase, Mr. Johnson believes, as long as farmers are reasonably prosperous and continue the technological advance, even though it may be at a slower pace than during the war.

In the Spirit
of the Season
We Extend
to
All of Our
Readers
Heartiest
Greetings

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	87.8	64.2	88.4	11.87	22.55	....
1920...........	15.9	17.3	125.3	141.7	61.8	182.6	16.46	25.65	....
1921...........	17.0	19.5	113.3	113.1	52.3	103.0	11.63	29.14	....
1922...........	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
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	94.5	9.67	47.65	....
1942...........	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943...........	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	40.8	149.0	192.0	109.0	141.0	16.40	52.70	....
1945									
November....	22.52	46.7	131.0	186.0	111.0	153.0	14.90	51.30	....
December....	22.84	43.8	137.0	194.0	109.0	154.0	15.40	51.40	....
1946									
January......	22.36	36.3	145.0	208.0	110.0	154.0	15.70	50.90	....
February.....	23.01	33.9	146.0	223.0	111.0	155.0	15.80	50.30	....
March........	22.70	31.9	157.0	236.0	114.0	158.0	16.30	47.50	....
April.........	23.59	42.9	162.0	245.0	116.0	158.0	15.00	48.00	....
May..........	24.09	43.0	157.0	251.0	135.0	170.0	14.80	49.60	....
June..........	25.98	59.0	147.0	251.0	142.0	174.0	14.70	51.50	....
July..........	30.83	56.7	148.0	275.0	196.0	187.0	15.00	60.00	....
August.......	33.55	48.6	143.0	280.0	180.0	178.0	15.10	59.10	....
September....	35.30	48.8	128.0	224.0	173.0	179.0	15.40	57.80	....
October.......	37.69	53.0	122.0	209.0	171.0	188.0	16.10	66.00	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1920...........	128	173	180	161	96	207	139	114	....
1921...........	137	195	163	129	81	117	98	129	....
1922...........	185	228	95	114	116	109	98	135	....
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	408	214	219	170	160	138	234	212
1945									
November....	182	467	188	212	173	173	126	227	235
December....	184	438	197	221	170	174	130	228	223
1946									
January......	180	363	208	237	171	174	132	226	249
February.....	186	339	209	254	173	175	133	223	275
March........	183	319	225	269	178	179	137	211	283
April.........	190	429	232	279	181	179	126	213	282
May..........	194	430	225	286	210	192	125	220	177
June..........	210	590	211	286	221	197	124	228	185
July..........	249	567	212	313	305	212	126	266	163
August.......	287	486	205	319	280	201	127	262	162
September....	285	488	184	255	269	202	130	256	154
October.......	304	530	175	238	266	213	136	293	151

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	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
1922	3.04	2.58	6.07	4.66	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.59	5.16
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						
November	1.75	1.42	7.81	5.77	4.86	6.71
December	1.75	1.42	7.81	5.77	4.86	6.71
1946						
January	1.75	1.42	7.81	5.77	4.86	6.71
February	1.75	1.42	7.81	5.77	4.86	6.71
March	1.75	1.42	7.81	5.77	4.86	6.71
April	1.75	1.42	7.81	5.77	4.86	6.71
May	1.75	1.42	9.08	6.10	4.86	7.30
June	1.88	1.42	10.34	6.42	4.86	7.90
July	1.88	1.42	11.62	8.15	5.34	9.60
August	2.22	1.46	17.15	8.14	6.07	12.14
September	2.22	1.46	10.60	6.95	6.07	12.14
October	2.22	1.46	10.60	6.95	6.07	12.14

Index Numbers (1910-14 = 100)

1922	113	90	173	132	140	142
1923	112	102	177	137	136	147
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						
November	65	50	223	163	144	191
December	65	50	223	163	144	191
1946						
January	65	50	223	163	144	191
February	65	50	223	163	144	191
March	65	50	223	163	144	191
April	65	50	223	163	144	191
May	65	50	259	173	144	207
June	70	50	295	182	144	224
July	70	50	332	231	158	273
August	83	51	490	231	180	345
September	83	51	303	197	180	345
October	83	51	303	197	180	345

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	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	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
1922	.566	3.12	6.90	.632	.904	23.87	....
1923	.550	3.08	7.50	.588	.836	23.32	....
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
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	.570
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							
November	.650	2.20	6.40	.535	.797	26.00	.200
December	.650	2.20	6.40	.535	.797	26.00	.200
1946							
January	.650	2.20	6.40	.535	.797	26.00	.200
February	.650	2.20	6.40	.535	.797	26.00	.200
March	.650	2.20	6.40	.535	.797	26.00	.200
April	.650	2.20	6.40	.535	.797	26.00	.200
May	.650	2.20	6.40	.535	.797	26.00	.200
June	.650	2.30	6.45	.471	.729	22.88	.176
July	.650	2.60	6.60	.471	.729	22.88	.176
August	.700	2.60	6.60	.471	.729	22.88	.176
September	.700	2.60	6.60	.471	.729	22.88	.176
October	.700	2.60	6.60	.471	.729	22.88	.176

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1922	106	87	141	89	95	99	....
1923	103	85	154	82	88	96	....
1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
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							
November	121	61	131	75	84	108	83
December	121	61	131	75	84	108	83
1946							
January	121	61	131	75	84	108	83
February	121	61	131	75	84	108	83
March	121	61	131	75	84	108	83
April	121	61	131	75	84	108	83
May	121	61	131	75	84	108	83
June	121	64	132	66	76	95	80
July	121	72	135	66	76	95	80
August	131	72	135	66	76	95	80
September	131	72	135	66	76	95	80
October	131	72	135	66	76	95	80

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**
1922	132	149	141	116	101	145	106	85
1923	143	152	147	114	107	144	103	79
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	150	94	57	160	117	77
1944	195	176	151	96	57	174	120	76
1945								
November	205	182	156	97	57	175	121	78
December	207	183	156	97	57	175	121	78
1946								
January	206	184	156	97	57	175	121	78
February	207	185	156	97	57	175	121	78
March	209	187	158	97	57	175	121	78
April	212	188	160	97	57	175	121	78
May	211	192	162	99	57	189	121	76
June	218	196	163	100	60	203	121	70
July	244	209	181	103	60	230	121	70
August	249	214	187	116	67	296	131	70
September	243	210	181	108	67	226	131	70
October	273	218	197	108	67	226	131	70

* 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] Since June 1941, manure salts are quoted F.O.B. mines exclusively.

**** The weighted average of prices actually paid for potash are 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 comolete index covering all publications from these sources on the particular subjects named.

Fertilizer

"Agricultural Minerals Registrants to Date for the Fiscal Year Ending June 30, 1947," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., FM-130, Sept. 24, 1946.

"Commercial Fertilizers Registrants to Date for the Fiscal Year Ending June 30, 1947," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., FM-131, Sept. 24, 1946.

"Agricultural Mineral Sales as Reported to Date for Quarter Ended June 30, 1946," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., FM-132, Oct. 11, 1946.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended June 30, 1947," Bu. of Chem., Dept. of Agr., Sacramento 14, Calif., FM-133, Oct. 11, 1946.

"The Effect of Various Fertilizer and Manure Treatments on the Yield, Size, Stand, and Disease Resistance of Cantaloupes," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 256, Aug. 1945, E. M. Rahn and W. H. Phillips.

"Tonnage of Different Grades of Fertilizer Sold in Michigan January 1 to June 30, 1946," Soil Sci. Dept., Mich. State College, East Lansing, Mich., Oct. 2, 1946.

"Fertilizers for General Farm Crops," College of Agr., Univ. of Mo., Columbia, Mo., Cir. 526, June 1946, A. W. Klemme.

"Fertilizer Inspection, Analysis and Use: 1945," College of Agr., Univ. of Mo., Columbia, Mo., Bul. 500, Aug. 1946.

"Fertilizing Peanuts," Agr. Exp. Sta., State College Sta., Raleigh, N. C., Bul. 356, June 1946, W. E. Colwell, N. C. Brady, and J. F. Reed.

"Recommendations with Reference to the Fertilization of Flue-cured Tobacco Grown on Average Soils in Virginia, North Carolina, South Carolina, Georgia, and Florida for the Year 1947," Agr. Exp. Sta., State College Station, Raleigh, N. C., Cir. 143, Aug. 1946, Agron. Tobacco Work Conference.

"Fertilizer Sales by Grades in Order of Tonnage, January 1, 1946—June 30, 1946," Dept. of Agr., Raleigh, N. C., Oct. 3, 1946.

"1946 Fertilizer Recommendations for Field Crops, Permanent Pastures and Hay Fields," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Ext. Bul. 266, Jan. 1946, Earl Jones and R. E. Yoder.

"Fertilizer in Relation to Oklahoma Agriculture," Agr. Exp. Sta., Stillwater, Okla., Cir. C-124, Oct. 1946, H. F. Murphy.

"Fertilizer Recommendations for Washington," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 338, Aug. 1946.

"Buy and Apply Fertilizer Now," Ext. Serv., College of Agr., Univ. of Wis., Madison, Wis., Spec. Cir., Sept. 1946, C. J. Chapman.

"Fertilizer Use and Crop Yields, A List of References," U.S.D.A., Washington, D. C., Libr. List No. 27, July 1946, John M. McNeill.

Soils

"Irrigation for Home Gardens," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, Hawaii, Agr. Ext. Cir. 208, Sept. 1946, Joseph H. Boyd.

"Disinfecting Seedbed Soils," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, Hawaii, Agr. Ext. Cir. 209, Sept. 1946, Joseph H. Boyd.

"Physical and Chemical Studies of Soils in North Central Ohio Vineyards," Agr. Exp. Sta., Wooster, Ohio, Bul. 663, Aug. 1946, I. W. Wander.

"Humus for the Garden Soil," Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., Cir. 395, April 1946, A. G. Smith, Jr.

"Physical Land Conditions in Fenton Soil Conservation District Genesee and Livingston Counties, Michigan," U.S.D.A., Washington, D. C., Phys. Land Survey No. 39, 1946.

Crops

"Fifty-sixth Annual Report for the Year Ending June 30, 1945," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Jan. 1, 1946.

"The Farmer's Part in Victory," College of Agr., Univ. of Ark., Fayetteville, Ark., Cir. 441, March 1946.

"Handbook of Canadian Spring Wheat Varieties," Dept. of Agr., Ottawa, Canada, Publ. 538, March 1946 (Rev.), L. H. Newman, J. G. C. Fraser, and A. G. O. Whiteside.

"The Production of Flaxseed in Canada," Dept. of Agr., Ottawa, Canada, Publ. 545, March 1946 (Rev.), W. G. McGregor.

"Fruitfulness in Peaches and Its Relationship to Morphology and Physiology of Pollen Grains," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 257, Aug. 1945, L. R. Detjen.

"Silver Anniversary Annual Report, 1944-1945," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 42, July 1945.

"Factors Affecting the Palatability of Sericea Lespedeza to Livestock," Ga. Exp. Sta., Experiment, Ga., P. Bul. 568, July 2, 1946, J. P. Manley, Jr. and L. C. Olson.

"Grafting the Mango in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, Hawaii, Agr. Ext. Cir. 59, Rev. Oct. 1946, William Bembower.

"Grasses and Cultural Methods for Reseeding Abandoned Farm Lands in Southern Idaho," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 267, March 1946, R. H. Stark, J. L. Toevs, and A. L. Hafenrichter.

"Performance of Corn Hybrids in Indiana, 1937-1944," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 511, May 1946, S. R. Miles.

"Improved Golden Cross Bantam and Purgold Sweet Corn," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 513, 1946, Glenn M. Smith.

"Benton and Clinton New Disease Resistant Oats," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 514, May 1946, R. M. Caldwell, R. R. Mulvey, and L. E. Compton.

"The Chemical Composition of Some Sorghum Grains and the Properties of Their Starches," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., T. Bul. 61, March 1946, H. N. Barham, J. A. Wagoner, C. L. Campbell, and E. H. Harclerode.

"Corn Project for 4-H Clubs," Agr. Ext. Div., Univ. of Ky., Lexington 29, Ky., Cir. 414, March 1946, E. J. Kinney and E. E. Fish.

"Garden Project for 4-H Clubs," Agr. Ext. Div., Univ of Ky., Lexington 29, Ky., Cir. 415, March 1946, John S. Gardner.

"Annual Report of the Director of Agricultural Extension, Kentucky, 1945," Agr. Ext. Div., Univ. of Ky., Lexington 29, Ky., Cir. 419, June 1946, T. R. Bryant.

"Eighty-fourth Annual Report, Michigan State Board of Agriculture, 1945," Lansing, Mich., April 1946.

"The Extension Service Reports Progress," College of Agr., Univ. of Mo., Columbia, Mo., Cir. 529, June 1946.

"Science and the Land," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., 58th A. R., 1945.

"Birdsfoot Trefoil (Lotus corniculatur L.) Its Characteristics and Potentialities as a Forage Legume," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Memoir 261, May 1946, H. A. MacDonald.

"Carolina Lawns," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 292, Aug. 1946, J. H. Harris and R. L. Lovvorn.

"Don't Plow Corn," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Folder 65, May 1946.

"Graze Hogs for 12 Months," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Folder 67, June 1946.

"Better Tobacco Plants," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Folder 70, Sept. 1946.

"Bixby, Progress Report, 1946," Agr. Exp. Sta., Bixby, Okla., Mimeo. Cir. M-162, June 1946.

"Meadow Foxtail," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 433, Oct. 1945, H. A. Schoth.

"Pruning of Anjou Pear in Relation to Irrigation Practice in a Clay Adobe Soil," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 436, Nov. 1945, W. W. Aldrich, E. S. Degman, R. A. Work and L. R. Swarner

"Science for the Farmer," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 480, Sept. 1946.

"Annual Report for the Fiscal Year, 1943-44," Agr. Exp. Sta., Univ. of Puerto Rico, Rio Piedras, P. R., 1946.

"Fifty-eighth Annual Report," Agr. Exp. Sta., Kingston, R. I., Cont. 683, May 1946.

"Grow More Winter Cover Crops to Produce More Food and Feed to Conserve Soil Fertility—Save Labor," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Leaf. 6, Aug. 1946.

"Some Physical and Chemical Responses of Agropyron Spicatum to Herbage Removal at Various Seasons," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Bul. 324, June 1946, L. A. Stoddart.

"Seeding Arid Ranges to Grass," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Cir. 122, April 1946, L. A. Stoddart.

"Weather Injuries to Fruits and Fruit Trees," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., Bul. 390, March 1946, A. B. Groves.

"Edgegrowth as Related to Crop Yield and Insect Damage," Agr. Exp. Sta., Va. Polytechnic Inst., Blacksburg, Va., T. Bul. 97, March 1946, G. W. Underhill and O. F. Bodenstein.

"Distinguishing Characteristics of Some Forage-Grass Diseases Prevalent in the North Central States," U.S.D.A., Washington, D. C., Cir. 747, July 1946.

"Classification of Barley Varieties Grown in the United States and Canada in 1945," U.S. D.A., Washington, D. C., T. Bul. 907, May 1946, Ewert Aberg and G. A. Wiebe.

"Contribution to the Morphology and Anatomy of Cryptostegia (Cryptostegia grandiflora)," U.S.D.A., Washington, D. C., T. Bul. 915, July 1946, Ernst Artschwager.

"Research Achievement Sheet," U.S.D.A., Washington, D. C., R.A.S. 62(P), July 10, 1946.

Economics

"Statistical Information Pertaining to the Marketing of Agricultural Products in Connecticut, 1945," State Dept. of Agr., Hartford, Conn., Sept. 1946.

"Causes of Changes in the Price of Potatoes," Agr. Exp. Sta., Pa. State College, State College, Pa., Paper No. 1331, June 1946, G. E. Brandow.

"A Credit Study on 347 Sugar Cane Farms, Puerto Rico, 1939-40," Agr. Exp. Sta., Univ. of Puerto Rico, Rio Piedras, P. R., Bul. 70, March 1946, J. O. Morales and Daniel Haddock.

How Guernsey Calves Helped Solve a Feed & Crop Fertilization Problem

(*From page* 13)

both to animal and plant health. Magnesium absorption beyond the optimum point in animals may produce a disease known as magnesium tetany, while overuse of it in the soil shows evidence of lowering the potassium intake of plants and will cause potash starvation. Much is still to be learned about this element but all indications point to a triumvirate relationship existing between calcium, magnesium, and phosphorus in such balance as these elements are found in nature, as, for example, in the egg shells of wild birds.

Corroboration

If this narrative has given you the impression of being a fairy tale, I do not blame you. I have merely set forth the facts as they have appeared at Brookside Farms. More than 30 eminent agronomists and scientists have visited the farm to see and study this peculiar problem. Hundreds of photographs have been taken and loads of soil and plant tissue have been carted away for further research.

I wish particularly to thank Dr. Fred Boyd, Agronomist and Midwest Representative of the American Cyanimid Company and Dr. G. N. Hoffer, Agronomist and Midwest Representative of the American Potash Institute, for their keen interest and active cooperation in this problem. Their on-the-spot analyses of soil and tissue samples have thrown much light on this subject. Their findings will be published after further experimentation is completed. However, it may be safely stated that from the evidence at hand magnesium plays an important role in plant, animal, and human life as do the other better known elements—nitrogen, phosphorus, and potash.

Farm Mechanization in Relation to Cotton Quality & Marketing

(*From page* 8)

(6) Machine-picking has been found to be a more timely method of harvesting than hand-picking when fair weather prevails, since it enables the producer to hold weather damage to open cotton to a minimum. Indications are that this method of harvesting, on a crop basis, will compare very favorably with hand-picking from a grade standpoint and give better fiber quality and significantly higher spinning value.

(7) Progress has been made by gin machinery manufacturers in the development of cleaning, extracting, and drying equipment and in determining combinations of these units most suitable for cleaning machine-picked cotton.

(8) Lint-cleaning developmental work at the U. S. Cotton Ginning Laboratory has indicated promising possibilities for cleaning the lint ginned from machine-picked cotton as the lint is

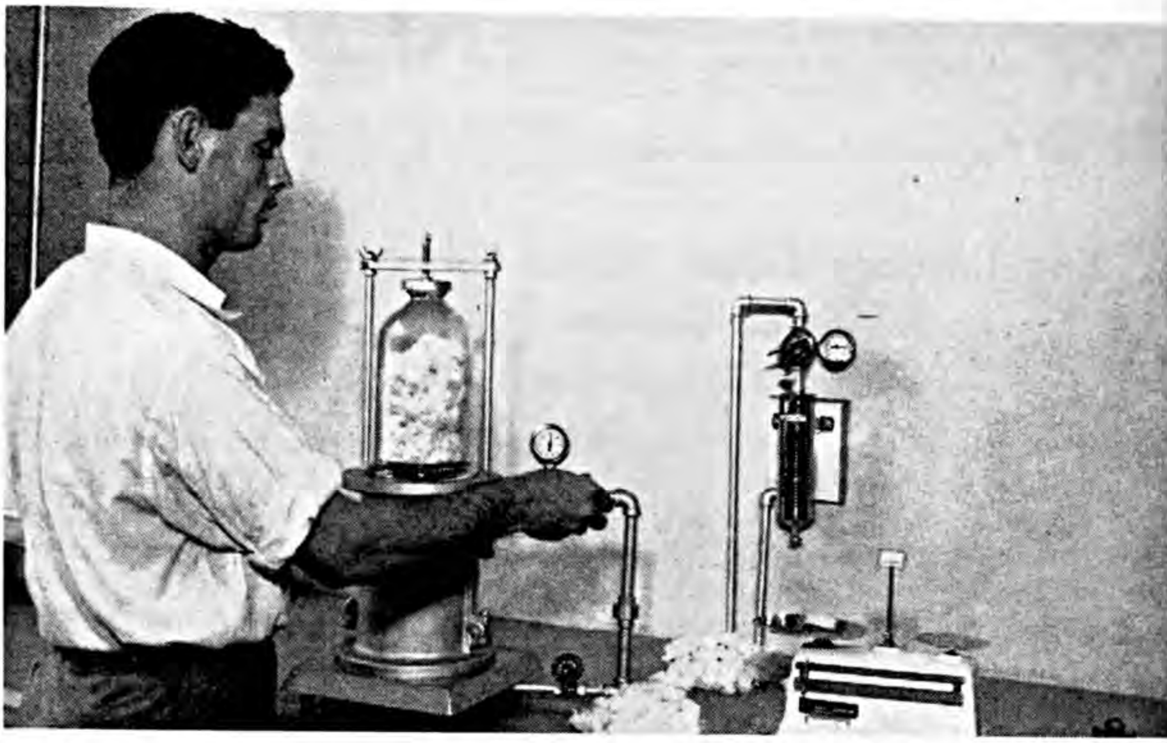


Fig. 4. Determining the quantity and quality of foreign matter present in machine-picked cotton versus that occurring in hand-picked cotton when reaching the Stoneville Laboratory.

blown from the gin saws to the lint flue.

Largely as the result of the Stoneville studies, cotton producers are finding that the first step to take to bring the grade of machine-picked cotton closer to that of hand-picked is to choose a variety of cotton more nearly adapted to mechanical harvesting. Already cotton breeders are taking into consideration these needs in their breeding efforts and are attempting to develop and furnish productive cottons of acceptable fiber quality that will be especially adapted to mechanical harvesting.

Dusting of cotton plants with calcium cyanamid during the harvesting season to cause leaf shedding has been found under experimental as well as practical conditions to facilitate mechanical picking and, at the same time, to reduce the amount of extraneous material in seed cotton. In most tests, defoliation improved the quality of machine-picked cotton from one-third to one-half grade and resulted in corresponding reductions in mill waste during manufacturing. The strength and appearance of yarns manufactured from cotton properly defoliated and mechanically picked have been found to be equally as good as those of yarns made of cotton hand-picked from undefoliated fields.

The development of efficient cleaning machinery for use at gins is considered to be absolutely essential if full economic benefit of mechanical production is to be realized. Several newly developed devices were tried out experimentally in 1944 by gin machinery manufacturers on late-harvested, weather-damaged cotton. The results were encouraging enough to justify the manufacture of a large number of these units for installation and use in gins where machine-picked or roughly harvested cotton was ginned in 1945. All the units are used in combination with drying, cleaning, and extracting machinery customarily used in conditioning and cleaning hand-picked cotton. The new systems this year embrace principally a unit known as the "impact cleaner," a unit designated as the "multi-unit reciprocating cleaner-drier," and some modified or improved designs of overhead extracting machines.

In the light of the developments

here reported, it is evident that mechanization in connection with cotton production in the adaptable areas of this country has great possibilities. In addition to the fact that mechanization offers a means of reducing production costs and of aiding in the maintenance of an adequate return to cotton producers, its widespread adoption as an aid in producing cotton is likely to bring about, or at least to expedite, changes in the handling of cotton from the producer to the consumer. The quality of a cotton crop produced and harvested mechanically will show much less variation than a crop picked by hand. It is conceivable that if adequate machinery is available for economical use over the shortest period during which it is practical to harvest a crop, the bulk of a crop will fall within a very narrow range of grades. This condition would facilitate the assembly of cotton into uniform lots for shipment to consuming establishments and would give spinners a dependable source of supply of uniform quality cotton. It would make it more feasible to maintain the identity of varieties of cotton of high-spinning value. Mechanization will be a factor in reducing the number of varieties of cotton planted in a given area. Thus, sufficient cotton of uniform quality will be available to attract the attenion of agents of textile mills, many of whom now recognize the advantage that pure-variety lots of desired spinning quality have over mixed-variety lots that show abnormal variations in spinning value. Large volume, well-equipped gins will likely be installed at an increased rate as mechanization becomes more generally adopted.

With the trend toward larger-capacity and better-equipped gins, important economies in handling cotton from the farms to the consuming centers are in sight. Economic gains are evident through the adoption of means for improving the appearance of cotton bales and of providing better methods of sampling bales and protecting their contents. Gin compression, especially in the large-volume, centralized gins, is mechanically feasible and affords opportunities for savings in packaging and for improving bale appearance.

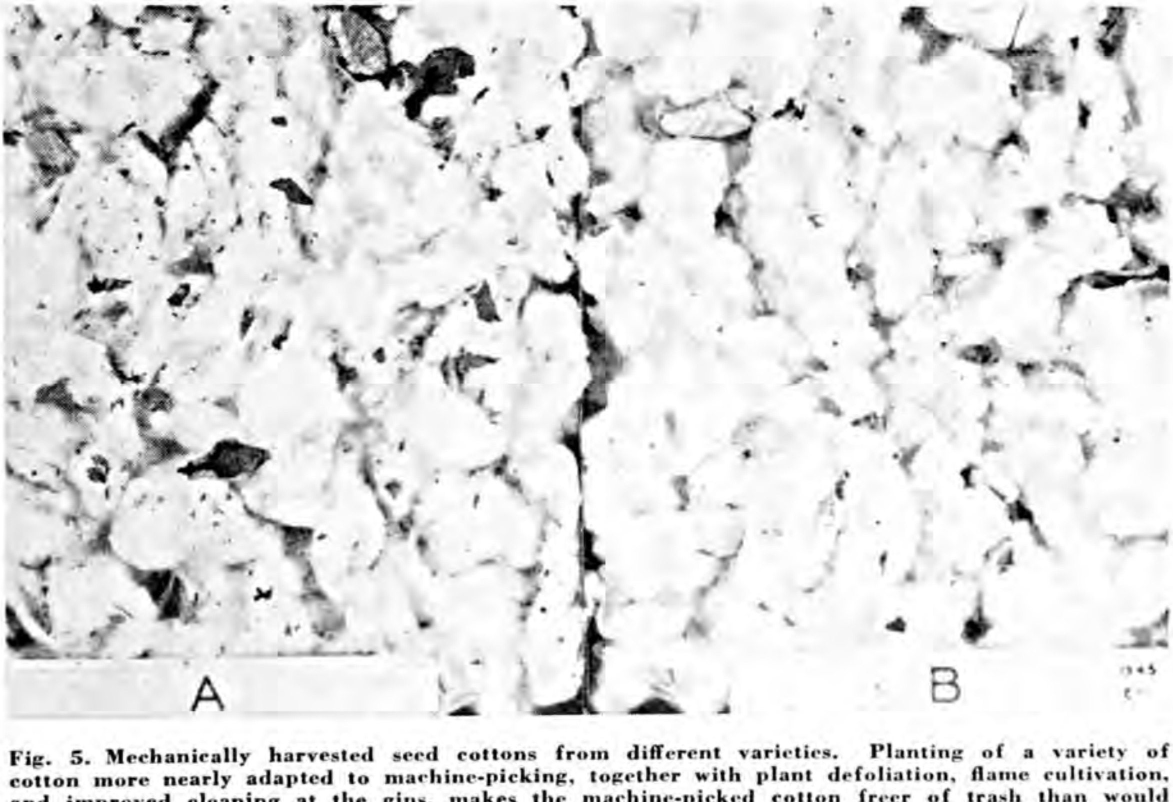


Fig. 5. Mechanically harvested seed cottons from different varieties. Planting of a variety of cotton more nearly adapted to machine-picking, together with plant defoliation, flame cultivation, and improved cleaning at the gins, makes the machine-picked cotton freer of trash than would otherwise be the case.

Alfalfa—A Crop to Utilize the South's Resources

(*From page* 16)

crops do not compare with alfalfa in root absorption area.

High yields of alfalfa result from the extensive root system, the volume of soil in which the alfalfa feeds, and the long growing period. These are some of the reasons why other hay crops yield much less than alfalfa. Kudzu, for instance, grows vigorously during summer months but is killed by frost. With proper fertilization, lime, and borax, stands of alfalfa are maintained and with proper cutting the stand may actually increase annually for a period of years. Therefore, one seeding will last for several years, perhaps as long as desired in order to rotate with other crops.

Consideration should be given to the productive capacity of alfalfa in units of food per acre annually as compared to the removal of raw materials from the soil. For after all, production of crops is simply the manufacture of food by the plant from the raw materials of the soil and the atmosphere. In the manufacturing process, the greater the ratio of raw materials utilized from the air to that taken from the soil, the greater the gain or chance for permanent fertility and profit in the operation. Thus, a crop that utilizes to the fullest extent the N of the air along with the CO_2, water, and energy that are available without cost of depreciation to the farm should yield the greatest returns to the farmer.

The fertility problem is one of resupply of mineral nutrients removed from the soil by crops and crop management in adapting crops whereby the raw materials of nature are manufactured by plants into farm products. The over-all problem is that of efficiency —the utilization of the energy and nutrients provided by nature and available in the soil and air. Alfalfa, perhaps, more nearly utilizes these advantages in the Southeast than any other crop and these facts should be considered by agricultural leaders in planning the farm program.

Fertilizing & Cropping Systems for Flue-cured Tobacco

(*From page* 24)

spring ploughing was done. Results from ploughing the rye crop under when green, followed by reseeding with rye to provide a winter cover, were not as satisfactory as those from disking the crop down when mature. Soil erosion during the winter was not a factor in these plots because they were level and well protected. There can be little doubt, however, that, on many areas in the flue-cured tobacco districts of Ontario where fall ploughing is practiced, or where the winter covering of rye is inadequate for one reason or another, losses in the form of fertility and topsoil owing to soil drifting and washing away are such that it is virtually impossible to restore the land to its previous productivity. The value of a winter covercrop of rye is clearly shown in the results compared in table 5 where tobacco was grown for seven consecutive years with and without cover crops.

Under these conditions winter cover crops were evidently responsible for a substantial increase in yield and returns from the tobacco crop. Retention of available nutrients and addition of organic material undoubtedly were factors contributing to this improvement.

In studying the use of commercial fertilizers in increasing the effectiveness of rye for use in the tobacco rotation, some worthwhile possibilities have appeared. As nitrogen is exceptionally

TABLE 6.—AVERAGE YIELD AND GROSS RETURNS PER ACRE WITH FLUE-CURED TOBACCO IN ROTATION WITH RYE FERTILIZED AND UNFERTILIZED WITH COMMERCIAL NITROGEN.

Fertilizer Treatment per Acre on Rye	Yield per Acre Lbs.	Returns per Acre $
No fertilizer.........	1,212	306
16 pounds N per acre at time of disking mature rye........	1,261	321
32 pounds N per acre at time of disking mature rye........	1,294	319
Five tons barnyard manure at time of disking mature rye..	1,322	333

low in these soils most of the early tests dealt with the effect of applying this nutrient on the rye crop. Some interesting effects on tobacco grown in two-year rotations with rye fertilized and unfertilized over a six-year period are presented in table 6.

The tobacco crop showed a distinct response to nitrogen applications made on the rye in this test, indicating the beneficial effect of increased growth of rye returned to the land. This response was in accordance with data previously published here which showed that the addition of organic materials either in the form of cover or rest crops turned under, or manure applied, was reflected in increased yields of leaf. Lower grades following the higher rate of nitrogen fertilization on the rye suggested an unsatisfactory balance between this nutrient and others, notably potash. As barnyard manure normally contains considerable available potash in addition to nitrogen and phosphoric acid, it is not surprising that the response in growth and quality of tobacco was greater following the applications made in this test. Increased growth of rye following applications of nitrogen was striking, the response to the higher rate being noticeably larger. There was, however, little evidence of improvement in growth of rye where barnyard manure was applied.

Results obtained in this preliminary study paved the way for considerable investigation on the whole subject of fertilizing cover and rest crops of rye in the flue-cured tobacco rotation. Although this work is still in progress, it has advanced sufficiently to show certain definite indications. Notable among these is the additional response in growth of rye that may be obtained by supplying muriate of potash along with a source of commercial nitrogen. Under average local soil conditions a response in growth of rye is not noticeable when muriate of potash is applied alone. When the rye on areas that receive 50 pounds per acre of nitrogen is compared with that on which 50 pounds of potash per acre are supplied in addition to the nitrogen, the increase owing to added potash appears equal to that from the nitrogen alone. As might be expected, the tobacco crop responds in the form of heavier yields of higher grade leaf from the improved balance of potash to nitrogen. Responses to phosphoric acid have not been clearly indicated. There are indications, however, that the application of 10-3-10 commercial fertilizer at the rate of 500 pounds per acre when disking under mature rye straw about August 1 may prove as effective in improving the tobacco crop that follows as five tons of barnyard manure per acre, which contains about an equivalent amount of plant food.

The effectiveness of growing and fertilizing rye as a soil-building practice depends on how good the rye crop is and how it is managed. A reasonably good seedbed is worthwhile for rye. Disking after cutting the stalks is useful in getting a good stand when rye follows tobacco, but the importance of seeding as soon as possible should not be overlooked. Varieties of rye vary in their suitability and Horton is an outstanding variety for use on these soils. This variety makes more rapid growth in both spring and fall and is among the heaviest yielders of straw and seed. Drilling the seed at a fairly heavy rate is worthwhile. Where the soil is in a very low state of fertility, a light application of fertilizer, high in nitrogen, will improve the growth; otherwise fertilizer is more efficiently used at time of disking in the mature straw. Combine-harvesting is advisable when the price of rye warrants, provided sufficient seed is either left or reseeded to ensure a good cover crop. Commercial fertilizer, high in nitrogen and potash, should be broadcast before disking the straw. Under average soil conditions it is advantageous to use an application containing 50 pounds of nitrogen per acre and an equivalent amount of potash. Delay in disking or reseeding after the rye is mature should be avoided, in order to allow as much time as possible for the rye to grow before winter. Fall ploughing is a wasteful practice on flue-cured tobacco land. Much of the advantage of seeding and fertilizing rye is lost if the soil is left bare during the winter and early spring. Furthermore, tobacco crops benefit from a few inches of new rye growth turned under in the spring.

It is apparent, both from the standpoint of organic matter upkeep and root rot control, that the maintenance of productivity in these soils is going to require adopting a longer rotation than is presently practiced. The fact that most flue-cured tobacco farms are equipped and capitalized on the basis of a crop of tobacco on each acre of crop land every second year will retard such a change. Scarcity of suitable land for growing this crop is frequently advanced as an excuse for such intensive cropping. It may be safely stated, however, that land of suitable type in satisfactory climatic zones of Ontario is not sufficiently limited to warrant destructive soil management. To assume the contrary would be one of the most serious errors that could be made.

Simply lengthening the rotation is, in itself, not an effective means of improving the situation. A suitable rotation should provide for methods of fertilizing and growing crops that ensure good stands and yields so that large amounts of stubble and other crop remains may be returned to the land. The return of all crop refuse either directly or in the form of barnyard manure is of the utmost importance to the continued economic use of flue-cured tobacco soils

Fertilizer high in nitrogen and potash disked with the rye straw promotes its decomposition and benefits the following rye cover crop.

The absence of a cover crop on this field is poor farming practice.

in Ontario. When mature crop residues, such as straw or corn stalks, are incorporated it is advisable to apply commercial nitrogen to aid in their change to humus and thus stimulate growth of the crop that follows. Where the nitrogen content has been increased by the growing of legumes or the addition of commercial materials, the potash supply is likely to be too limited for normal growth of flue-cured tobacco and other crops, unless provision is made to furnish additional potash as well.

The very characteristics that make these lighter soils suitable for the growing of flue-cured tobacco render them vulnerable to destruction by many of the practices that are presently followed in its culture. Only by adequately protecting them against the weather, replenishing their organic matter, and keeping them free from plant diseases, can their usefulness be insured.

A Discussion of Soil Analyses . . . . of Texas

(*From page* 20)

Heavy soils of the Gray Prairies, Coast Prairies, Red Lands of east Texas, and soils of the large river bottoms will need a higher level of available plant nutrients. These soils have high exchange capacities and are inherently more fertile. Heavy soils of the Trinity River should have 80 to 100 p.p.m. available phosphorus and around 200 p.p.m. available potassium, while sandy bottom land soils should have 50 to 60 p.p.m. of available phosphorus and 100 to 130 p.p.m. available potassium.

Applications of plant nutrients for production of crops to be used in feeding beef animals and dairy animals should be different. Dairy cattle, because of their heavy use of costly concentrates to produce milk, can offset the higher cost of fertilization when forage of a higher quality is obtained. The applications of these plant nutrients can be brought about in two ways—heavier application or more frequent application. Meadows, where all forage is removed, should be fertilized more often than pasture land. In the vicinity of Madisonville, Texas, virgin grassland or meadow which has been mowed at least twice a year for 15 years on a deep, fine-textured, very slowly permeable soil of the Gray Prairies has less available plant nutrients than cultivated land adjacent where the fertility has been maintained by good soil management.

Lime was required by 61.6 per cent of the Forested Coastal Plain soils, or 205 of the 333 samples. Limestone was applied to raise the base saturation of pasture lands to 75 per cent, or to raise the exchangeable calcium. Where base saturation was high and replaceable calcium was low (less than 500 p.p.m.) on Forested Coastal Plain soils 1,000 pounds of limestone were applied. On deep sands the maximum lime recommendation is 1,000 pounds limestone. This has proven to be most economical due to the low exchange capacities of sands. The maximum application of plant nutrients on Forested Coastal Plain pasture soils is 100 pounds (phosphorus), P_2O_5; 50 pounds (potassium), K_2O; and 16 pounds (nitrogen), N. This has been proven by practical field tests.

Many samples of the Coastal Prairie soils have been analyzed, but only 24 have been used as representative, because many of the analyses were made for other purposes. Forty-six per cent

Three basic land resource areas. Shown are the Coastal Prairie, the Forested Coastal Plain, and the Cross Timbers. In these locations the 500 soil analyses of the Soil Conservation Service Operations Laboratory at Temple were made.

or 11 of these soils require lime. Many of the sandy and gray heavy soils east of Fort Bend County require calcium, while those soils west of Fort Bend County, particularly the heavy soils, do not. The soils in the eastern portion of this area are deficient in phosphorus, potassium, nitrogen, and calcium. Applications of 120 pounds P_2O_5, 70 pounds K_2O, and 16 pounds N, and three tons of limestone have been recommended for pasture development. The soils in the western portion of this area are, as a whole, deficient in phosphorus; some need both phosphorus and potassium. Potassium content increases from east to west, as does the base saturation and soil reaction.

The plant-food nutrient level of soils in the Cross Timber area is higher than that of Forested Coastal Plain soils. These soils are deficient in phosphorus and nitrogen. Applications of potash are also needed, but less is required than in the Forested Coastal Plain. The base saturation is often high, though replaceable calcium may be low. This may be caused by a high sodium saturation. Occasionally small applications of lime are needed; the maximum application recommended is 1,000 pounds limestone.

None of the soils analyzed from the large river bottoms needed lime. This is due to the origin of the soil material. These soils are quite variable, especially in available phosphorus content. They are consistently low in available potassium. Some require heavy applications of phosphorus.

The farmer-cooperators of the soil conservation districts who know the analyses of their soils are in position to proceed with necessary fertilization. That step, and every other one aimed at completing installation of dovetailing soil conservation measures to control erosion and improve soil productivity, is a carefully planned one for the conservation farmer. It should be. The farmer's entire basic capital—his topsoil's ability to yield profitably—is at stake.

Hugh Bennett's Homecoming

(From page 26)

To freshen Dr. Bennett's memory of his farm youth, they took him to the two-story plantation home where he was reared and to the two-room building that once housed Gould's Fork Academy where he first attended classes. At the Bennett farm, "Uncle" Sim Bennett, 80-year-old former farm hand on the plantation, revived more memories. So did a mule race, a visit to a farm fish pond where boys were swimming and boating, and a steaming bowl of turtle stew made from Brown Creek snapping turtle.

Not until that night did they give Dr. Bennett a chance to speak, and that was after a Southern barbecue at the Wadesboro Country Club. Then he said:

"I am accepting in the fullest personal sense this interest of yours and your kindness and hospitality, even though actually, and properly, you are paying tribute to a movement: Conservation of soil and water, a movement the objective of which is the welfare of the community and each individual in the community.

"I don't know," he continued, "anything about how people who are honored as you have honored me today are normally affected by this sort of thing; but, as for me, this kind of expression of one's life-long friends is deeply touching . . . Perhaps the best thing is to change the subject."

From there on out, his talk to his homefolks was the kind of fighting soil conservation speech he has been making all over the United States and in many foreign countries for nearly three decades.

Dr. Bennett told them that "we have moved ahead in the United States from the unenviable position of wasting our basic resource of productive land at a faster pace than any nation or race that we know about, civilized or barbaric, up to the position of world leadership in the field of soil and water conservation."

His next word was one of warning: "Don't misunderstand me. We are not at all satisfied with present progress; we are still losing every year something like 500,000 acres of cropland by unnecessary soil erosion.

"But, and this is important, we do have a going program and we have learned a great deal about how to get the job done. The trail has been blazed; we are on the way. Last year, for example, we did more conservation work than in any previous year, even with shortages of technicians, machinery, and so on. This year our goal is to double last year's output; the prospect for that looks good. And then, next year, we are going to do our best to double that accomplishment again. If we can do that, and I think we can, we really will be getting along with the prodigious job of safeguarding more than 700 million acres of crop, grazing, and other kinds of land needing protection."

Dr. Bennett told his audience that the best farmer device yet invented for dealing "first-hand, effectively, and democratically with the matter of taking care of our agricultural land" is the soil conservation district, the first of which was the Brown Creek District, organized in 1937.

"These districts are subdivisions of state government for soil conservation and good land use," the chief soil conservationist explained. "They are brought into existence through the vote of the farmers themselves and are operated within their locally-established boundaries by the farmers through their elected officers."

Today, he said, all 48 states and Puerto Rico have soil conservation district laws, or similar legislation, that permit landowners to create districts. There are now 1,650 districts covering

900 million acres and 4 million farms—two-thirds, Dr. Bennett said, of all the farms in the nation. His Soil Conservation Service assigns technicians to the districts, at the request of the farmer supervisors, to aid individual landowners to plan, apply, and maintain complete farm soil conservation systems. Last year, he reported, "We planned, in soil conservation districts, 20½ million acres and finished the job of putting conservation practices onto 13½ million acres of land in 1945."

Appropriately, the assignment made to Dr. Bennett for his talk was to discuss "Soil Conservation—A Dream Coming True." To him his work is exactly that—a dream coming true.

Born on his father's plantation near Wadesboro in 1881, Bennett studied geology at the University of North Carolina and received a Bachelor of Science degree in 1903. Almost immediately thereafter he went to work for the Bureau of Soils of the U. S. Department of Agriculture. His first assignment was temporary, to field survey duty. But young Bennett liked it so well that he asked to be kept in this job.

In 1905, as a member of a soil survey party in Louisa County, Virginia, Bennett first discovered the cause and true significance of soil erosion.

From that point on, his life became a veritable crusade for conservation, although often it was uphill going. Wherever his soil survey work took him he bolstered his discovery that good land—and the people on it—were being made poor by erosion. For example, in 1910-11, his survey of Fairfield County, South Carolina, showed that 28 per cent of the county's land had been so damaged by erosion that it had no further practical value for any immediate cultivation, that another 16 per cent had lost most of its topsoil.

When the Fairfield County report came off the press, Bennett expected the public to begin clamoring for action to save the land.

But nothing happened. In Bennett's own words, the report, one of the first quantitative measurements of the effects of soil erosion, "didn't even ripple the placid surface of national complacency with respect to the welfare of the land."

It taught the young soil conservationist that people still weren't interested, but it didn't discourage him. He kept on fighting for erosion control, soil improvement, and good land use. But Bennett was faced with such contemporary, published statements as this:

"The soil is the one indestructible, immutable asset that the nation possesses. It is the one resource that cannot be exhausted; that cannot be used up."

"When I read this," Dr. Bennett once said, "I learned that it was possible to pack a lot of misinformation in two short sentences, even when the statements carry the full resounding ring of what is sometimes referred to as eloquence."

As Bennett continued his evangelistic crusading for soil conservation, a few other people began writing a little and talking a lot about the subject of soil erosion.

Gullies like this . . .

. . . have been healed by rank-growing, forage-producing kudzu.

"Finally, after a long time, there was begun in the U. S. Department of Agriculture an educational campaign on the subject," Dr. Bennett recalled. "Among other things, we published a bulletin called 'Soil Erosion, A National Menace.' Some of the newspapers and an occasional agricultural journal printed extracts from our educational material. Later, some of the magazines began asking for articles on the erosion problem and what to do about it."

In 1928. Bennett presented to a congressional committee handling Department of Agriculture appropriations the whole national problem of land damage by erosion and his recommendations for getting a nation-wide soil conservation program started. The resulting Buchanan Amendment provided federal funds for regional erosion stations to measure the rates of soil and water losses, to make surveys to determine the extent of damage by erosion and locate the principal affected areas, and to work out methods of control.

"It was not long before overwhelmingly convincing information was acquired in quantity at these stations," Bennett said. "For example, at the 10 stations established on 10 very important types of farm land scattered throughout the country more than 200,000 quantitative measurements were quickly made of soil and water losses under different conditions of land use. In rapid order, estimates were thus replaced with measured facts."

And the "measured facts" showed that some of Bennett's earlier estimates of land damage, which had been criticized by a few papers, actually were underestimates.

"With the new information," the chief soil conservationist continued, "it was possible to say, for example, that every year enough soil was being washed out of our fields and pastures to load a train of freight cars that would encircle the earth 18 times at the equator. Nobody challenged that statement, even though it was much larger than any preceding estimates."

The next action, resulting from Bennett's campaigning and that of the other people then aroused, was the Soil Erosion Service created in 1933 in the U. S. Department of the Interior. Quite logically, Bennett was made chief of this first organization to attack soil erosion on a nation-wide basis. But the Soil Erosion Service was a temporary outfit, designed to help relieve unemployment as well as to demonstrate erosion control and good land-use methods in cooperation with landowners.

With the findings of the erosion experiment stations and the results of the Erosion Service before it, the Congress in 1935 created the Soil Conservation Service as a permanent agency in the U. S. Department of Agriculture. This new agency, with Bennett as its chief, replaced the Erosion Service.

Under Bennett's guidance, the Soil Conservation Service expanded and speeded the erosion control demonstrational work.

"Back during the demonstrational period," Dr. Bennett recalled, "some of us came to feel that soil conservation work could be speeded up by giving greater responsibility to farmers. It was further felt that inasmuch as farmers own and control the land needing conservation and must therefore have the final decision as to any work carried out on their own lands, they should direct the program. That is why—at least some of the reasons—the soil conservation district plan was conceived and developed."

Dr. Bennett's soil conservation work has carried him to nearly every county in the United States, to Alaska, Cuba, the Canal Zone, Venezuela, to South Africa. Today many lands, at least 30 of them, are taking up the national pattern of soil conservation he helped to cut. And a steady stream of agricultural leaders from other countries flows through his Washington office and into soil conservation districts throughout the nation seeking information that will help them conserve their own land resources. In recent months they have come from India, South Africa, Australia, Dutch East Indies, Belgian Congo, Brazil, Mexico—just to mention a few.

Bennett the man is colorful, untiring, ever-enthusiastic about soil conservation and good food. Around his home town his liking, and great capacity, for turtle stew, catfish stew, collards and fatback, sorghum molasses, and fried chicken—foods he ate as a boy—are legendary.

As was said of him at the Wadesboro homecoming, Dr. Bennett has never shaken "from his shoes the mud of Brown Creek. He is one with the Land of the Tar Heel. A club woman, confused as to names, once referred to him as 'that interesting speaker, Mr. Clay.' Congressional committees know him as a unique Washington administrator who talks farmer-language while explaining soil conservation in terms of specialized machinery or lespedeza bicolor honey which he lugs to the hearings."

Although his friends have seen him get his fill of good Southern cooking, they never expect to see him satisfied about soil conservation, at least as long as any soil is being wasted needlessly.

And Dr. Bennett himself said as much at Wadesboro in September:

"Experience during the nine years' time since soil conservation districts came onto the American agricultural scene shows that almost every farmer who adopts the planned, acre-by-acre soil conservation way of farming becomes himself a missionary for soil and water conservation. What a gratifying thing this democratic, 'grass roots' leadership in soil conservation has become! What a tremendous force it is for the future prosperity of our American agriculture!

"I hardly need tell you that, personally, I'll not be content until that farm leadership, and the applied soil conservation it represents, have reached into every county in the United States and to every acre of cropland, pasture land, farm woodland, and idle land. I pledge my continued, undivided efforts, and those of the Soil Conservation Service which I represent in helping to bring this about."

Sundry Other Sundays

(*From page* 5)

As the raw years of reality went by us, however, some of that gloss and glamour left us, yielding to a glowing solace we shared in church with our children—whom the minister put to sleep much faster than could we. The washing of smudgy faces, the putting on of pretty ironed frocks that Mother made, the blacking of scuff-toed shoes, the passing out of pennies for clutching stubby hands to hold, the last rehearsal of the lesson text, the loading of chattering youngsters in the ancient family ambulator, and a last look at the basting of the roast—all this meant just another Sunday.

That one and many others like it have been, are now, and will continue to be one day of the week which is anything but an "idle" one. To this credo all the lucky pairs who are burdened and privileged with parenthood can say "amen."

Christenings were "high water" marks in our Sabbatical calendar in family rearing times. I had seen numerous infant initiation ceremonies from the sidelines before the auspicious hour arrived when the Missus and me had to prance forward ourselves—she holding the shawls and blankets and I clutching the baby, to face the font in that ageless ceremonial.

Some pastors do this job as a perfunctory routine, showing no gleam of interest in the prodigy held up for sanctification and holy blessing. If the infant is restless and fretful the dominie hurries to get the irksome task performed, solemn and bored with it all. Some other more sympathetic preachers add a touch of poetic dash to the baptism. One minister I knew used a rose dipped in the font to sprinkle dewy petal drops on the upturned fuzzy head; and another had the audience stand to welcome one more citizen of the Kingdom. I was not worried much on such occasions about our baby not being jovial and smiling, because whenever it looked at me it couldn't help laughing out loud.

FROM the baptism font it is but a short step to the bier and the funeral sermon. In the course of life's channel some well-loved ships eventually sail beyond your visual horizon to rest at last in that "much-desired haven." It is not at the funeral service in my experience that the real sense of vacancy and loss most painfully intrudes. I have on two occasions sensed the sharpest reactions upon attending service at the familiar place of family worship, to feel that all these brave words of faith and courage voiced in earthly prayer and song were now a great mystery no longer to some of those we "have loved long since, but lost awhile."

They are living henceforth in a far country while we abide in the waiting-room checking over timetables and spending our money on trifles to amuse or sustain us until the outbound Skymaster lands to take us aboard. And when the preacher reads the favorite psalm of one whose pew is vacant at the church and whose chair is unused at the table, I am as the Roman centurion said, "almost persuaded to be a Christian."

STRAINS of Jingle Bells amid holly wreaths and colored paper garlands arouse memories of a more cheerful, robust, and warming kind—those week-day and Sunday programs to celebrate another happy Christmas. Here we lead double lives—that of the child in its thrills over a poorly disguised plumber acting Santa Claus and that of the parents and grandparents bemused and restored by the same jolly old traditions which have hallowed our churches and homes at each and every year's conclusion.

It's a strange glowing mixture of caroling voices, lighted candles, tinsel, rustling paper, kitchen spice aromas, crunching snow, frosted fingers, and warm hearts. In that mood I have written Christmas greetings through these kindly pages for over twenty years, and that too is a treasured gift to me. In sooth we've been together now for a long series of Sundays.

Another momentous event was when the church held its district convention of elders, deacons, and ministers of grace in our own home town. Bear in mind that although every hotel in town sent busses to meet every one of our four trains daily, they never carried back any of the church dignitaries to register and regale themselves with two-dollar-a-day board and room. Every home which belonged to our church and some of other creeds opened their doors more or less heartily to the handshaking host of earnest believers. Women took down their best family plate and killed countless backyard poultry for the sacrificial spreads. They lasted for a week, including one big Sunday mass meeting with the Bishop Himself in the "big bear's chair" flanked by presiding elders in the little and middle-sized ones on the rostrum behind the carved oak pulpit.

AT one such conclave of the godly I recall that our house sheltered and sustained five good-sized preachers at one lick. Father had a vacation from saying grace all week but it cost him something for the respite. It was like a perpetual communion of the saints, and me an unworthy but always hungry participant.

I also recall that I was disappointed over the sermon by the bishop, expecting to hear a combination of John the Baptist, Henry Ward Beecher, and Bill Sunday. Instead he spent most of the long discourse on ways and means of financial, rather than spiritual, salvation. He had to. It was his job. But I never realized before that it took more than Sunday-school nickels to enable our church to maintain itself as "a rock in a barren land" in competition with a whole lot of other rocks.

Although these sacred seances seemed long to the householders who provided the provender, there were other events like protracted meetings and revivals which took a month or six weeks to run their course, depending on the rapidity with which sinners thawed out. For them, however, no army of talent was required. Our elders merely hired some professional evangelist and a song-leader to serve nightly as spearheads for a general and continual awakening, which would give the old devil no chance to ply this trade on the vulnerable six days of the week among our witless flock.

Unfortunately, I came along on the church roster after the white heat of the jumping and heel-cracking power wave had subsided. That was part of the ferment and the release of those who braved the wilderness and who attended crude camp meetings to sit on hard log benches through four hours of sin-chasing rhetoric. My folks lived in that raucous era and saw many converts writhing and foaming at the mouth. By my time the church had decided to eschew all circus maneuvers and stick to a more decorous and becoming kind of conversion. I really presume it stuck just as long anyhow. I am sure my parents lived the sort of lives that needed no acrobatics and dementia praecox attacks to nail it down for keeps. Aside from watching Baptist immersions and wondering if maybe the minister might lose his grip or hold them under too long, I got few thrills out of the revivals—compared to what went on before.

For a time at different periods it was my privilege to take charge of the Sunday-school tutelage of young boys. Naturally these assignments came because there were no talented scriptural scholars available, so I was drafted. I managed to hang onto the job by promising to accompany the boys on cross-country jaunts on Saturdays, in which I confess we all showed more enthusiasm than for the sessions on Sundays.

IN winter it was not so hard to pin them down to business, but after the sap began to run and the songbirds returned and the "voice of the turtle was heard in the land" the pupils and their pennies alike dwindled. I suspect that a careful count of the congregation would have disclosed a similar falling away on the part of the parents, whose holiday motor-outings had as much to do with the sudden drop in class attraction as I did myself.

Finally as a burst of genius I decided to take the urchins out on the church lawn for their Sunday instruction—if you flatter me by so calling it. The biggest boy, who always collected the offering, made his usual rounds without delay, handed me the small envelope, and seemingly at a signal, the whole outfit jumped around like rabbits, bounded over the hedge in a jiffy, and disappeared around the corner. I took it with stoical fortitude, comforted by certain frequent references anyone may read in the Songs of Solomon and the Psalms of David praising the beauty of nature and the charms of fair meadows.

FOR to me it is quite evident that one lone man and some stuffy books and maps, however vital such documents may be for good deportment, have little to offer those who are blessed for the time with vibrant youth, impatient minds, and restless feet. I also hold that there is a cathedral-like quality to dense woods and filtering sunshine, and that many species of birds are capable of outdoing our Sunday-school organist. I could never have filled the stern role of a dour Scotch "kirk man" whose scowls and admonitions were benumbing and chastening reproof to all kinds of fractious Sabbath levity.

As one stands reverently in old historic churches which have at various times been distinguished as the meeting places of the Good and the Great, it is not so hard to recapture some of the moods and manners of those bygone times. I have on sundry such occasions been prone to conjecture what our country would have been or would be now were there no churches, leaving us only a town meeting, a political rally, or a picture show to inspire courage and confidence in our present and our future destiny.

Regardless of what creeds we prefer or to what preacher we can listen the longest without nodding, we must admit that were it not for these customary Sunday institutions to break our weary routine, it would not be possible at all for me to say to you right heartily, as I do say now: "Merry Christmas"—and to have you recognize it as the password of sincerity, decency, and good will.

ENCOURAGING

He: "I suppose I'm only a little pebble on the beach of your life."

She: "You might stand a chance if you were a little boulder."

Sambo—"Boy, whut does you all think about dis heah sex business dey's argufyin' 'bout?"

Mose—"Son, ah thinks a man has got a puffick right to belong to any sex he wish."

CHANGED

A minister congratulated a lady on her silver wedding anniversary for living twenty-five years with the same man.

"But he is not the same man he was when I first got hold of him," she replied.

Mother: "I hope that your roommate at the training school is a nice boy, Robert."

Robert: "Judge for yourself, Mom. The other night he barked his shins on a chair in the dark, and I heard him say, 'Oh, the perversity of inanimate objects!' "

He: "Do you object to petting, Mehitabel?"

She: "That's something I've never done, Joshua."

He: "Petted, Mehitabel?"

She: "Objected, Joshua."

"Look here, waiter! This is supposed to be oyster stew, and I haven't found a single oyster yet!"

"Sir, if you had Irish stew, would you expect to find an Irishman in it?"

"Who was that lady I saw you outwit last night?"

Sailor: "Drinking makes you look beautiful."

She: "But I haven't been drinking."

Sailor: "I have."

PRELUDE

Wife: "Darling, aren't those chimes beautiful? Such harmony! Such a lovely tone!"

Husband: "You'll have to talk louder, honey. Those damn bells are making such a racket I can't hear a word."

First Boiled Citizen: "Do you know the time?"

Second Boiled Citizen: "Sure."

First Boiled Citizen: "Gee, thanks."

A Negro spinster of uncertain years decided at long last to join the Baptist Church. As the deacons plunged her into the river the first time she gasped "I believe." The second time she chattered, "I believe." A third time, gulping for air, she sputtered, "I believe." One of the elders interposed: "You believe what, sister?" She eyed him savagely: "I believe you stinkers are trying to drown me."—Ex.

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- 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)

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

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