BETTER CROPS W

The Pocket Bo

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AMERICAN POTASH INSTITUTE, INC.

INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

J. D. Romaine, *Chief Agronomist*

Editorial Office: Investment Bldg., Washington, D. C.

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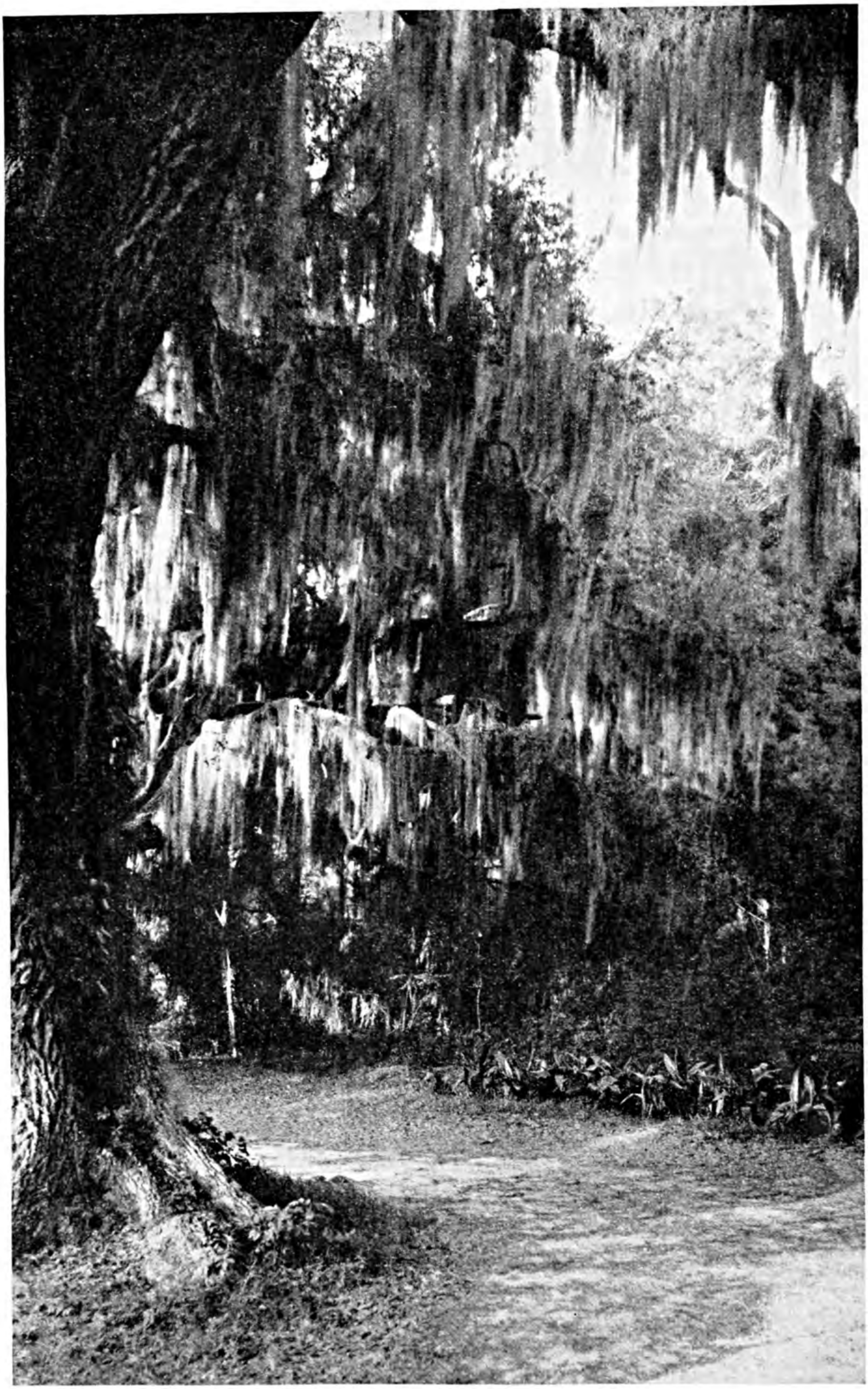

SOUTHERN "ICICLES"—AN ATTRACTION FOR NORTHERN VISITORS

Better Crops with PLANT FOOD

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With the New Year Comes Faith in—

Starting Something

Jeff McDermid

JANUARY is the month arbitrarily marked down by humanity as a time to take a deep breath, spit on your hands, and get a "fresh holt" on life to start something; while if one has made a blotchy mess of the 1940 accounting, they give out a fresh page in January and expect a bum bookkeeper like me to balance the budget pronto.

There's no rhyme or reason why July or October wouldn't be just as suitable a time in which to reform, but it's customary to put it off until winter, mostly because a chap then has a better excuse for slipping. Oh, of course, January has been the month for shooting the starting gun ever since the ancients cooked up the story about Janus.

Janus was a mythical god who was presumed to face both ways like a successful modern candidate. He looked forward and backward hunting for an honest man (or was that the guy with a lantern?). Janus was credited with being a gatekeeper, before they gave Saint Peter the job. He is also listed as being the patron mogul of agriculture and commerce, although nowadays no one deity would hanker to tackle both those jobs at once any more than he would nominate himself to arbitrate between the CIO and AFL.

Hence there is some confusion existing yet about this Janus hombre, but I guess it's all right to pay him homage in a month so full of awkward confusion as January usually is in my township at tax-paying time. I am willing to grant this honor, such as it is, to old man Janus, although I realize he is hopelessly behind the times with his limited two-way vision. In order to keep complete tab on things in our complex era, a god should have a revolving neckpiece geared to several thousand RPM.

IN January the first thing you are admonished about is to get rid of Status Quo. I don't know enough Latin to explain to you why Janus and Status Quo never seem to get along, but seems like we can't have 'em both and celebrate at New Years—and for a day or so thereafter. Status Quo must leave, no matter how plentiful your stock of good cheer may be.

I confess that Status Quo and I are buddies, and we have slept late together for quite a spell, so it will take more than Janus to part us. It's strange but true that many of my most radical friends seem just as attached to S. Q. as I am, despite the thought often expressed that only the conservative party is endeared to the stand-pat policy. They warn you against trailing around with Status and claim he is almost a corrupting influence. Yet just try to separate some of them from their private ideas, predilections, and propensities, and you'll find them sitting tighter than Hoover on the gold standard.

I have solved this puzzle to perfection. The radical extremists stick secretly to Status Quo in private diversions, but kick him all over the carpet for public amusement. So don't any of you write me asking how to slip away from Status Quo, because only one man in ten can do it, and the other nine wouldn't if they could.

Thus handicapped with the weight of habit and precedent, they admonish us next to start something. Anything will do, either a positive thing such as beginning a diary, or a negative thing like not keeping quite so many brands of liquid energizer on hand. Your experience and mine are probably identical here, so why take time showing how easy it is to propose and how hard to perform.

Old Status sneaks up ferninst me on the blind side and whispers that the pages of current history indicate that sometimes he who starts something is worse off than the indolent postponer. If I argue with him trying to keep square with Janus, he reminds me of such recent cases of misplaced ambition as shown by Mussolini & Graziani, Incorp., John L. Lewis, the New York Yankees, Tony Galento, and Al McCoy. They each and all claimed they were fully prepared for any emergency, had been in training for a long spell, and seemed fit, but yet they got behind ahead of time trying to start something.

I have to admit that no high-sounding maxims may be brought up which will soothe wounded vanity like theirs, although one might salve them a bit by the phrase, "It is better to have bragged and lost than never to have bragged at all." I suppose we have to admit that our chances of finishing something we start are as good as the average, yet what holds us back seems to be a combination of laziness, timidity, fear of ridicule, and maybe lack of preparation. So I expect it would be good practice for us to barge along on some new scheme, just for personal training.

BUT New Years is not always the best time to launch it, because there are so many other new intentions under way that the competition is too keen for an amateur. The best time to reform is when reformations are scarcer. It'll be lots easier for the audience too. A first class, high geared, iron-clad, guaranteed original reform can easily be mired when there are too many others trying to use the same road in January. I can't possibly think of worse traveling conditions than to meet a lot of reckless reforms pushing for the right of way on icy highways.

But the lamest excuse for not starting something is the fear of not finishing it. I have a few neurotic acquaintances who find the world conflict a handy excuse for not attempting anything new or needful around their domiciles. About the closest they come to it is buying a new model radio with an alleged "foreign band" on it, and when the screens should be painted or the front steps knocked together, they tune in on Europe to prove that money and time spent on anything short of "all out defense" is futile extravagance. These folks have what is known as "invasion inhibition."

Yet Americans of Napoleon's conquest era spent less time fretting about

the mess abroad, because they were not so well misinformed about the struggle every morning, and because they were too busy fighting Injuns and fever 'n ague to read calamity columns. Unfinished business overseas didn't bother the backwoodsmen, owing to a surplus of the same stuff right on the frontiers. It's when folks don't have any unfinished business of their own that they start to horn in on somebody else's.

Unfinished business holds no terror for me. I have more unfinished business and half-baked projects cluttering up the premises than the seventy-seventh congress. My precious litter of accumulated ambitions is a real museum. I expect my heirs to catalog them just to prove my versatility.

Here are four or five landscape paintings all blocked out, waiting for the sunrise. Had I flung on a daub or two more and hung them in one of our modern arty salons, my name might have become famous as a "subnormal primitive." Over yonder is a sheaf of poems which were turned down regretfully by Scientific American and the Butchers' Guide, but never got any further editorial consideration. Here is a fiddle whose strings have not been tortured since our suburb went under a restrictive zoning ordinance.

And note the little French primer I tried to master when my eldest girl began her high school language lessons, but the only word I could ever comprehend was "ennui." Finally, the lodge pins and regalia which repose in an old wardrobe of mine would almost serve for the Grand Triumphal Entry of Ringling Brothers and Barnum & Bailey. Why, when I look ahead and think of all the projects and programs I haven't even begun on, it is mighty fascinating. I'm not quite sure which it will be in 1941—golf, fly-casting, or knitting. Never put off until tomorrow what you can dabble with today.

THEN let us all not be afraid to tackle something new and fresh, provided it is a sane and stimulating idea. Something New—not merely something freshly varnished, brightly tinseled, temporarily ravishing; not a shibboleth to become shabby, a code to become corroded, or a racking headache due to vintage visions. Not holiday decorations soon to be put away against another revel; not the smears of a bold signature soon to be defaulted; nor toys of which we soon shall tire. Not the animation of the hour, soon to become jaded; nor the unbalanced hopes of the chronic optimist. No, let our type of Something New be a calmer, sounder, more universal, and homely spirit, which will be strong enough to make the ensuing months fruitful of courage and hope.

After all the greatest upheavals and revolutions in social life have come gradually through stern resolves which did not originate on New Years. There never has been any sharp line of demarcation between the period when old evils ceased and right triumphed. This is because folks may rashly lay plans and make promises, and yet the whole scene shifts slowly and magnificently by the weight of mass opinion.

Right now we lay our ears groundward and hear vibrations of some por-

(*Turn to page* 47)

Farmers inspecting a 10-year-old pasture at the Tennessee Valley Experiment Station, Belle Mina, Alabama.

Better Pastures in North Alabama

By R. M. Reaves

Alabama Extension Service, Athens, Alabama

THE permanent pasture program in north Alabama was inaugurated in the spring of 1936. Methods used in establishing two successful pastures, one on Dr. Young's farm in Lauderdale County and one on the Sub-station at Belle Mina in Limestone County, were followed in initiating the program. Pastures have been started on better than 3,000 farms since January 1, 1936, involving practically every soil type in the area.

Studies of these pastures from year to year, as well as records submitted by pasture demonstrators, have enabled extension agents and farm leaders to draw rather definite conclusions regarding the securing and maintaining of satisfactory permanent pastures. Five factors have been found necessary, namely, (1) selection of pasture area, (2) preparation of seed bed, (3) liming and fertilization, (4) seeding, and (5) management. Surveys indicate that 90 per cent of all permanent pastures have been successful, in the opinion of farmers and extension agents, where the demonstrator followed recommendations relative to these five factors.

1. *Selection of the Area*

Crop land that has grown one or two crops of winter legumes has given the most satisfactory results. Old pasture areas that have become sodded with undesirable weeds and grasses have given the most unsatisfactory results. Good land is as essential to good pasture production as it is to good yields of other crops. Lowland areas adjacent to streams have afforded perfect pasture areas, from the standpoint of both production and nearness to water for the livestock. Eroded hills have not afforded satisfactory pasture areas.

2. *Preparation of the Seed Bed*

Failure to thoroughly prepare the pasture area prior to seeding has been the cause of a great many failures. A survey of a large number of pastures reveals the fact that 90 per cent of those seeded on properly prepared areas were satisfactory, while only 30 per cent of those seeded on unprepared areas were satisfactory. Turning a crop of winter legumes in the spring and fallowing the land during the summer have given best results. Where this is impossible, the land should be turned 2 to 3 months prior to seeding, the lime disked into the soil immediately after turning, and the fertilizer applied and disked or harrowed in 2 or 3 weeks before seeding.

3. *Liming and Fertilization*

Mineral fertilizers and lime are as essential for good pasture production as is nitrogen for good grain production. Areas properly fertilized and limed have produced not only twice the green weight, but plants that contained twice as much nitrogen, phosphorus, and calcium as untreated areas. Phosphate and lime alone have given good results on some soils. Potash has been found to be very essential on some soils and should be included in the fertilization program on all soils as an additional insurance.

Lime should be applied in accordance with the soil type. One ton on sandy soil, two tons on red soils, and three tons on gray or white soils have given desired results, provided finely ground material was used. All the lime should pass through a 10-mesh screen and 50 per cent should pass through a 60-mesh screen. The lime should be applied 2 to 3 months prior to seeding and worked into the soil.

Phosphate and potash may be applied either in heavy applications for a number of years or lighter applications annually. The equivalents of 1,000 pounds of 16 per cent superphosphate and 200 pounds of potash per acre have given excellent results for several years. Lighter applications of 300 pounds of 16 per cent superphosphate and 25 pounds of potash per acre annually have given very satisfactory results.

Basic slag may be substituted for lime and phosphate by using one ton of basic slag per acre prior to planting, if the heavy application method is to be followed, or an application of 1,000 pounds of basic slag per acre prior to planting and 500 pounds per acre annually will give excellent results. Under no condition should the annual application method be used unless it is to be adhered to each year.

4. *Seeding*

Seeding the pasture area to desirable grasses and legumes is absolutely necessary. Demonstrators have failed to get desirable pastures regardless of treatment, when the area was not seeded. Legumes should consist of White Dutch clover seeded at the rate of 2 to 4 pounds of inoculated seed per acre and common lespedeza seeded at the rate of 10 pounds per acre. (Two to four pounds of alsike clover per acre in addition to White Dutch and lespedeza have given good results the first year and appear to afford an excellent means of adding nitrogen to the soil.)

Grasses should consist of 5 to 10 pounds of Kentucky blue grass, 5 to 10 pounds of orchard grass, and 3 to 10 pounds of Dallis grass per acre. Seedings may be made partly in the fall and partly in the spring or all in the spring. If fall seedings are made, White Dutch clover, blue grass, and orchard grass should be seeded in September on a well-prepared seed bed. The Dallis grass and lespedeza should be added during the latter part of February or early March. Spring seeding should include all five kinds of seed and should be made during the latter part of February or first part of March. Late seeding either in the fall or spring has not been satisfactory.

The seed should be divided into two equal parts and cross seeded to insure an even stand. (One-half seeded east and west and one-half seeded north and south.) The seed should be covered very lightly. A cultipacker, roller, or brush drag has proved most satisfactory. Many of our demonstrators have failed to get a stand, due to the fact that seed were covered too deep.

5. *Management*

Pastures, like cotton or corn, cannot be expected to give desired results unless given proper attention after seeding. Many demonstrators have expected the pasture to do the impossible and have overgrazed, allowed undesirable weeds to sap the fertilizer and moisture from the legumes and grasses, and have failed to run a harrow or drag over the pasture occasionally to scatter the droppings. Pastures should not be grazed for the first 3 or 4 months after seeding, and only lightly for the first year.

Governing the carrying capacity of the pasture by the height of the legume and grass growth has given best results.

The author examining growth of pasture mixture on the farm of C. C. Loyd, Jackson County, Alabama.

Four inches of growth should be maintained during the growing season. Overgrazing of pastures prevents sufficient legume growth to supply nitrogen for the grasses and has been the cause of a number of very poor pastures. Keeping the pasture free from undesirable weeds is as necessary as keeping the cotton field free from grass. Mowing, digging out, and hand pulling are necessary practices the first few years. If no weeds are allowed to grow until the sod is firmly established, they will give very little trouble thereafter. Failure to scatter droppings causes near them excessive growth that cattle will not eat. Scattering with a section harrow or drag equalizes the fertility from the manure and permits even grazing.

Temporary Pastures Necessary

Temporary pastures or grazing crops must be provided to supplement permanent pastures, if animals are to harvest the maximum amount of their feed. Crops that will afford grazing during late summer and early fall and crops that will afford grazing during winter and early spring should be used.

Kudzu affords the best late summer and early fall temporary pasture. Once established and properly managed, a field of kudzu will afford grazing for a number of years. Kudzu should be fertilized with superphosphate and potash at planting and cultivated and refertilized every 2 or 3 years. Overgrazing will kill kudzu.

Annual lespedeza or annual lespedeza and Dallis grass afford excellent summer and early fall grazing. The crop should be fertilized with superphosphate at planting. Satisfactory grazing may be expected for three years, including the year the crop is planted.

Sudan grass has given very satisfactory summer grazing in sections of the valley. This crop has three disadvantages, namely, (1) it must be planted every year, (2) it must be fertilized with nitrogen for satisfactory growth, and (3) it should be 10 to 12 inches high before grazing is started.

(*Turn to page* 46)

More than 4,000,000 tons of liming materials have been applied to Wisconsin farm lands in the past 7 years. The acreage of alfalfa has more than doubled during this period, and the yields and acreage of clover and other legumes have increased.

Our Defense Against Soil Fertility Losses

By C. J. Chapman

Wisconsin College of Agriculture, Madison, Wisconsin

NO matter what the outcome of this present world war and preparation for war may be, when the gigantic conflict has come to an end, there will still be millions of people on this earth whose chief concern is food, clothing, shelter, and a desire for some comforts and luxuries in a modern mode of living. Looking into the future economic and social status of the people of our own United States, we may well ask the question, "What does this future hold in store for our children, our grandchildren, our future generations?"

Fortunate it is, indeed, that before we launched this great national defense and military program, for several years this nation has been engaged in a peacetime program of national defense, a program concerned with the conservation of our great natural resources. Far and wide over this nation men have 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 the well-being of generations to come.

For 25 years the writer has been called an alarmist. He was the "Wolf! Wolf!" story teller in extension activities in his efforts to arouse farmers in Wisconsin to an appreciation of the seriousness of soil fertility waste. And many older men who may read this article have likewise been members of this great band of missionaries preaching the gospel of soil conservation.

When the writer 25 years ago was hired to become the representative of the Service and Educational Bureau of a great eastern fertilizer company and undertake a program of educational work on soils and fertilizers in Wisconsin and Minnesota, he was looked upon with pity and disdain by many of his fellow colleagues. In his early work he was the object of many a skeptical criticism. But the combined results of the findings of experiment stations, extension workers, and teachers, through demonstrations and experiments, along with the results of work by the educational agencies of the fertilizer industry have long since built up a vast fund of information that has put aside any doubt as to the need for a program of soil conservation and the value and economy of using commercial fertilizers in such a program.

Big Strides Being Made

Tonnage reports for Wisconsin in 1940 indicate the largest use of commercial fertilizers in all its history. It is estimated that better than 55,000 tons of commercial plant foods were purchased and applied to Wisconsin soils.

Great strides in the program for liming the soils of the State have been made. In the past seven years a total of more than 4,000,000 tons of liming materials have been used. Crop reports for the past year show that Wisconsin produced the largest tonnage of tame hay in all its history; according to the Wisconsin State Crop and Livestock Reporter, "Exceeding 7¼ million tons, which is three-fourths of a million tons above the record crop grown in 1938, and more than a million tons above the production of any other State in 1940."

The Federal-State lime production program, W.P.A. soil-testing project, the help from the Federal A.A.A., the S.C.S., and F.S.A. agencies have all contributed to the growing interest in our soil fertility problems. The establishment of more than 50 county soil-testing laboratories equipped and manned with trained W.P.A. chemists, the testing of thousands and thousands of soil samples, with reports to farmers giving recommendations as to the need for lime and fertilizers, have had their effect. In many other States great progress has been made in arousing farmers to an appreciation of the importance of liming and fertilizing their soils. Many States can proudly point to as great or even greater accomplishments than have been witnessed here in Wisconsin. But even though the job in Wisconsin is far from finished, the interest which has been aroused and the support that has been gained through the help of thousands of men in associated educational agencies will push this program forward with increased momentum.

This past year in Wisconsin a total of more than 500 fertilizer demonstrations were conducted. These demonstrations were supervised by some 48 county agricultural agents in cooperation with A.A.A. county and community committeemen, assisted also by Smith-Hughes teachers of agriculture. The fertilizer industry through the Middle West Soil Improvement Association and the American Potash Institute furnished nearly 50 tons of commercial fertilizer for these demonstrations on small grain and legume seedings. The contribution of the Tennessee Valley Authority in supplying free phosphate for demonstrations in several counties, the assistance rendered by the manufacturers of farm implements (who furnished 23 demonstrator drills), the cooperation of all combined agencies resulted in a record year for demonstrations which show more convincingly than ever that Wisconsin soils are responding profitably to fertilizer.

In 86 per cent of all these 500 demonstrations, the increase in the yield of grain alone paid the entire cost of the fertilizer and left a profit. The residual benefit of this fertilizer to succeeding crops of hay will add further to the profit. In a high percentage of those

This picture of one of 500 fertilizer demonstrations conducted on Wisconsin farms in 1940, taken at an early stage of growth, shows the difference in the growth of barley on the various plots. The fertilizers were applied at the rate of 200 pounds per acre with a combination fertilizer drill.

	Yield		*Value of*	*Cost of*	*Net*
Treatment	***Grain***	***Straw***	***Increases***	***Fertilizer***	***Profit***
0-20-0	**55.7 bu.**	**2455 lb.**	**$ 6.63**	**$2.56**	**$4.07**
0-20-10	**62.4 bu.**	**2775 lb.**	**10.46**	**3.67**	**6.79**
Check	**42.9 bu.**	**2302 lb.**	.....	.....	.....

(This field was seeded to clover and alfalfa and there should be increases in the yield of hay in 1941.)

cases where the value of the increase in grain yields was not sufficient to pay for the fertilizer, the increases in yields of hay in 1941 will offset losses incurred and will actually show a profit when the total value of increases in yields of grain and hay are totalled.

Summarized in Table 1 are the results of all 1940 demonstrations, where a direct comparison was made between superphosphates and phosphate-potash mixtures. The evidence revealed in the laboratory soil tests and actual field demonstrations point to the need for

TABLE 1—AVERAGE OF 141 DEMONSTRATIONS, OATS AND BARLEY (1940), WHERE A COMPARISON WAS MADE OF 0-20-0 AND 0-20-10

Soil Type	Treatment	Rate per acre	Average yield	Increase yield	Average yield straw	Increase straw	*Value of increases grain + straw	Cost of fertilizer	Net profit per acre
Mostly silt and clay loams	0-20-0	200*	60.6	11.8	2,792	447	$5.98	$2.56	$3.42
	0-20-10	200	63.9	15.1	2,959	614	7.72	3.67	4.05
	Check		48.8		2,345				

* Oats and barley figured at average value of 45c per bushel—straw at $3.00 per ton.

TABLE 2—AVERAGE OF 294 DEMONSTRATIONS (8 YEARS, INCLUDING 1940), WHERE A COMPARISON WAS MADE OF 0-20-0 AND 0-20-10

Mostly silt and clay loams	0-20-0	200	53.1	10.7	2,575	441	$5.47	$2.50	$2.97
	0-20-10	200	56.5	14.1	2,754	620	7.28	3.60	3.68
	Check		42.4		2,134				

potash in addition to phosphate on a high percentage of Wisconsin soils. For many years the need for potash on sandy and low black bottom soils has been recognized. But it was a revelation to find that a vast area (some 5,000 square miles) of heavy silt loam soil in north central Wisconsin is showing a marked response to potash. Even the silt and clay loam soils of southern, western, and eastern Wisconsin have shown a profitable response to potash in better than 50 per cent of the demonstrations conducted this past year.

The average of 294 demonstrations (shown in Table 2) conducted during the past eight years in Wisconsin shows the same general response to fertilizer treatment as shown in the 1940 results. 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 fertilizer has had, not only on "catches," but on the increases in yields of hay the following year.

The average of 65 demonstrations where residual benefits to the hay crop have been measured is recorded in the summary shown in Table 3.

Yields of hay have been greatly increased. It should be noted that the relative response of the hay crop to potash is as great as the increase of grain from the phosphate-potash mixture the first year. True, the amount of actual potash carried over and available to the hay crop the second year is small, but the effect of potash in the mixture is very helpful in the establishment of the clover and alfalfa seedings the first year. It also gives the new seedings greater vigor and ability to withstand severe winters.

The indirect effect of potash in the mixture resulting in the establishment of deep-rooted, healthy plants is as much responsible for increases in hay yields the following year as is the actual amount of plant food supplied. Where only 200 pounds per acre of 0-20-10 fertilizer is used at the time of seeding, there is only about 10 pounds of actual potash carried over and available to the legume crop the following year. However, this 10 pounds of potash is sufficient to account for increases of 450 pounds of alfalfa or about 550 pounds of clover hay, and that is actually the average increase from the potash as shown in Table 3.

TABLE 3—RESIDUAL CARRY-OVER BENEFIT TO HAY CROP. AVERAGE OF 65 DEMONSTRATIONS

Soil Type	Treatment	Rate per acre	Average hay yields	Increase hay	**Value of increase	Average increase grain yield	Value of increase grain, hay & straw	Cost of fertilizer	Total profit per acre
Mostly silt and clay loams	0–20–0	200#	3,933	743	$3.71	10.7	$8.63	$2.50	$6.13
	0–20–10	200	4,325	1135	5.68	15.2	12.52	3.60	8.92
	Check		3,190						

** Hay figured at average value of $10.00 per ton.

We are now pouring billions of dollars into a national defense program to protect ourselves against the aggression of any power which threatens our way of life, but let us bear in mind that our future and ultimate security are of greater importance than any threat to our present political and social security. We cannot continue to live up to our national wealth in our present system of reckless spending, and that is what we have been doing for a period of over 100 years of farming in the Midwest.

Let us continue the fight we have so well started against 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.

EDITOR'S NOTE: The following is a reprint of an old pamphlet published in 1846 and found in the Congressional Library in Washington, D. C. It is of particular interest because of its approach to our present-day "quick test" methods of diagnosing soil fertility and top-dressing with potash to control cotton rust. The name of J. Lawrence Smith is better known today for his work on methods of chemical analysis rather than his agronomic and soil investigations.

REPORT TO THE BLACK OAK AGRICULTURAL SOCIETY

on the

Ashes of the Cotton Stalk, the composition of Cotton Soils, and the nature of Rust in Cotton

By James Lawrence Smith

Assayer of the State of South Carolina; Member of the Annual Association of American Geologists and Naturalists; Cor. Member of the American National Institute of Natural History, &c.

Charleston: Printed by Miller & Browne, 1846

THE ashes left after the combustion of plants have, until a very late period, been considered merely as accidental ingredients, that varied in quality and quantity even in the same plant growing in the same region; this incombustible part was therefore looked upon as exerting no influence on the health and vigor of the plant.

The researches of modern chemists have proved the error of this supposition, by directing their time and labor and in applying knowledge acquired in the laboratory, to agriculture and rural economy in general; and although among the many views promulgated by them there is some error, the facts that have been brought to light will always make the agriculturist the chemist's debtor, and should teach him to regard with proper respect what may in his eye appear to be hasty generalization.

The chemist has pointed out by analysis that the ashes of plants of the same description, though growing in different climes, contain the same or similar ingredients. Thus, the pines of Norway and Italy when burnt, left earthy portions that are strikingly similar; these also being true of the oaks of the same countries, although these latter differed materially from the pines in the character of their ashes.

Let it not be understood that the amount of the different substances present in the ashes of the same plant is so identical as only to vary by the fraction of a grain; it is sufficient to bear in mind that the leading ingredients are the same, and the whole character of the ashes such as to enable us to infer that they belong to similar plants; the same is true for different parts of the same plants. Were it deemed necessary, numerous instances might be cited to prove the point in question, but any recent work on agriculture will convince the inquirer of this.

As the character of the ashes of plants is so invariable, it must occur to the minds of all that they play an important part in the economy of plants, and without them plants could not grow; such a supposition the most rigid and careful experiments have proved to be correct. It being also shown that the source from whence the ashes come is the soil, for plants create nothing, but only appropriate to themselves elements already existing, simply arranging them so as to give rise to certain compounds—forming their woody portions from elements existing in the atmosphere and water, and their earthy parts from the soil, which must contain all the elements necessary, as the absence of even one will be the cause of a sickly and imperfect growth.

Without dwelling further on this subject, everyone must see the necessity of having all of the required ingredients present in the soil or of supplying them if deficient; therefore the importance of a knowledge of what is the composition of soils upon which we wish to grow certain plants. I do not pretend to say that with a thorough knowledge of the mere chemical composition of the soil all the planter's ends are to be answered, or that he will obtain the directions necessary for the improvement of his soils, as there are other properties of the soil besides its composition that influence the growth of the plant; as for instance its texture, which may be open or compact. If a soil contains all the substances a plant requires, and be compact and moist, when an open and dry soil alone is congenial to the plant, it will decay or arrive at imperfect maturity. It is for this reason that the chemist in analyzing soils has done so little for practical agriculture, he has allowed his views to become too narrowed and not examined sufficiently into other qualities of the soil. In fact the only way that practical benefit is to be derived is by careful investigation on their part, and patience on the part of farmers (who must have, in other ways, seen undeniable benefits arising to them from the chemist's labors). If this be attended to, in a few years incalculable will be their results to rural economy, and a method of analysis will be brought to bear upon soils that will answer all the required ends.

The subdivision of the parts of plants into earthy and combustible portions belongs also to animals—in the higher orders of which they appear in some degree separated from each other, the earthy parts constituting the mass of the bones. In others, however, as the worm, insects, etc., they are intimately blended as in the plant. The prominent ingredients also of the earthy parts of the vegetable and animal kingdoms are the same, which is a natural result, as all animals either directly or indirectly obtain their nourishment from plants. These ingredients are lime, phosphoric acid and potash, the two first more especially, and they may be considered par excellence the earthy ingredients of the animal and vegetable kingdoms, without a sufficiency of which neither one nor the other may expect a healthy growth. So then in studying soils these ingredients should particularly engross our attention as the subject of this report will show.

The ashes of a healthy cotton stalk six feet high and an inch in diameter at the largest part, with some leaves and empty pods, consists of—in 1000 parts:

Lime	303.
Potash	243.
Phosphoric acid	91.
Magnesia	58.
Oxide of iron	4.
Sulphuric acid	13.
Chlorine	8.
Carbonic acid	270.
Sand	5.

The half per cent of sand arose from what was on external portions of the stalk and could not be readily dusted off. The carbonic acid arises from the combustion of the plant and does not previously exist in it. The chlorine that is but a little over a half per cent, the sulphuric acid which is but a little over one per cent, and the oxide of iron which is not one half per cent, may be considered as ingredients of but little if of any importance to the plant. Thereby reducing the really important ingredients to phosphoric acid, potash, lime and magnesia; this last, however, is always to be looked upon in plants in the light of lime, and it can be replaced by lime entirely without prejudice to the plant. The analysis which I have made of the cotton wool and seed (but which do not form a part of the report), as well as the analysis made by others of the same, show that in these also, phosphoric acid, potash and lime are the important constituents. In the analysis of your soils, then, these have been particularly looked to, and with satisfactory results, except in the case of potash, which exists in such small quantities in all soils as renders it exceedingly difficult to collect and estimate; but I had hoped to overcome this difficulty if my duties did not now call me away from home.

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A two-row planter-distributor combination, which applies fertilizer in bands on each side of and slightly below seed band or drill.

How, Where, When Apply Fertilizers?

By F. J. Hurst

Agricultural Extension Service, State College, Mississippi

AGRICULTURAL science marches on. Farm research advances. And the Nation's agriculture is made more productive and farming more efficient. The scientist in the laboratory, the investigator in the field, and the inventor in the factory, working on a common problem, have again contributed to the progress of agriculture. They have developed a new and better method of applying fertilizer that promises to benefit every farmer who uses it.

The new and more efficient way of applying fertilizer in large measure is the result of the investigations conducted cooperatively by the Bureaus of Agricultural Engineering, Chemistry and Soil, and Plant Industry of the U. S. Department of Agriculture and the experiment stations of more than 20 fertilizer-using States. The program was also actively sponsored by the National Joint Committee on Fertilizer Application, an organization set up in 1925 and composed of official representatives of the American Society of Agricultural Engineers, the American Society of Agronomy, the American Society for Horticultural Science, the Farm Equipment Institute, and the National Fertilizer Association. Progressive manufacturers of farm equipment have kept pace with the progress made by the research worker in the field in adapting the discoveries to the improvement of fertilizer distributors and distributing attachments.

The efficient use of fertilizer is of the greatest importance to the farmers of this country, because they use around

7,500,000 tons annually at a cost of over $200,000,000. For a long time, farmers have known that they needed to use the right kinds and the necessary amounts of fertilizers to restore plant-food elements removed from the soil by the harvesting and sale of crops, by the grazing and marketing of livestock, and by leaching and erosion, and to produce profitable yields of quality crops.

Placement Important

But in the light of recent research, farmers now need to learn that it is not enough to use the right amounts of the right kinds of fertilizers, they must also apply fertilizers in the right place. This is the new and highly important fact which the scientists have developed.

The trend of fertilizer practice in the South the past few years has been towards the use of high analysis fertilizers, since the value of a fertilizer is measured by the plant food it contains and its producing power in the field. Reliable experimental information has justified this trend, in that the high analysis mixtures mean a saving of from 10 to 20 per cent in fertilizer bills and greater producing power in the field.

For example, the high analysis mixtures, 4-8-8 and 6-8-8, recommended by the Mississippi Experiment Station, have been more profitable because they contain sufficient plant food in well-balanced proportions. The 4-8-8 contains 25 per cent more plant food than 4-8-4, and the 6-8-8 contains 37 per cent more plant food. This difference in plant food not only means a saving to the farmer in purchase price of the fertilizer, but increased profits in the field. The low analysis mixtures, 3-8-5 and 4-8-4, are not proving the most profitable mixtures to the farmer, and are becoming less popular from year to year. There has also been an increase in rate of application. This has called attention to the importance of proper placement of fertilizers in order to get the highest returns.

The results of many experiments show that it is usually much better to apply mixed fertilizer in bands at the sides of the row than to apply it under the seed. By using this method, the fertilizer is placed near enough to the seed or plants to be readily accessible and quickly available, and yet far enough from the seed or plants not to

A two-row cultivator and fertilizer distributor, which cultivates the crop and places the fertilizer in bands on the sides of the rows at the desired depth.

This distributor attachment for cultivators is commonly used in the Mississippi delta for side-dressing.

damage them. All of the fertilizer is applied more nearly within the main feeding area of the root system. So, the side placement in bands helps to assure better stands, increases early growth, hastens maturity of the plants, and apparently results in more complete utilization of all the fertilizer placed in the soil.

Placements Compared

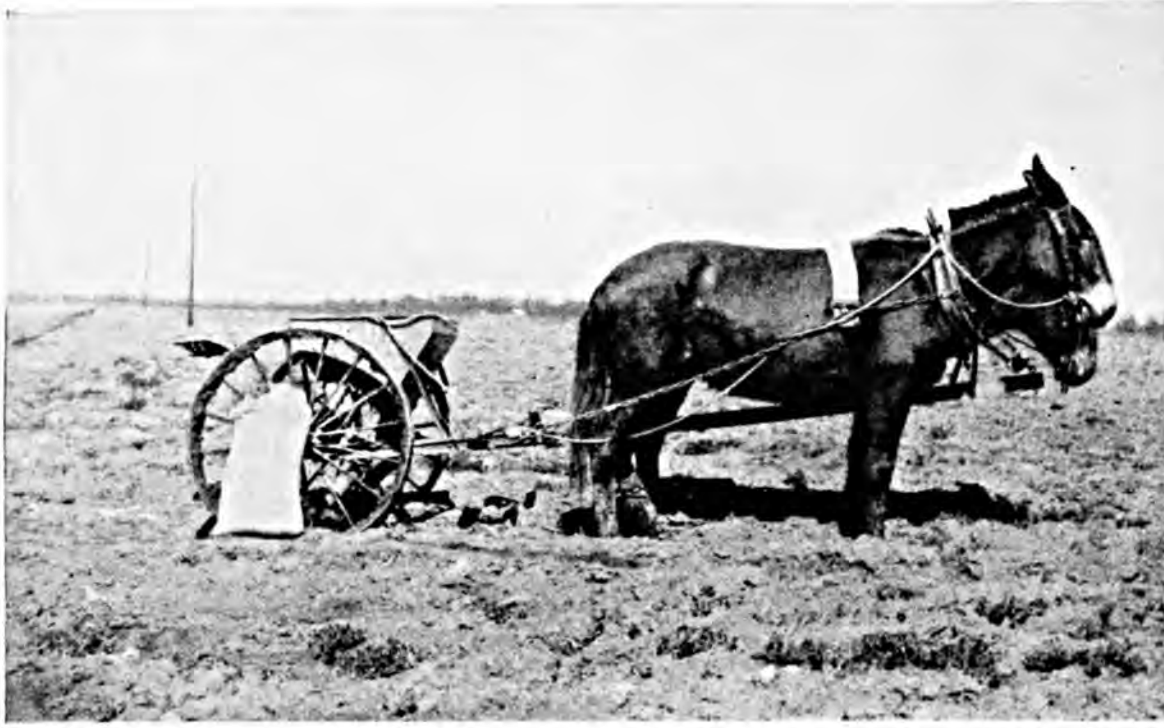
The Mississippi Experiment Station compared the two most common practices followed by hill farmers in fertilizing cotton with other methods. The common farm practices are: (1) Place the fertilizer in a furrow made by a bull-tongue or straight shovel, or in the old middle and bed on it; (2) Bed the land and later open the beds and apply the fertilizer, drag or harrow level, and then plant. Both of these practices place the fertilizer at varying depths more or less below the seed.

The Mississippi tests included the following: Fertilizer placed directly below the seed at different depths of 1, 2, 3, and 4 inches; to one side of the seed at different widths and depths, such as 2½ inches to one side and 2 inches deeper than the seed; to both sides of the seed at different distances and depths, such as 2½ inches to each side and 2 inches deeper than the seed. Placing small amounts of fertilizer in contact with the seed and the remainder at different distances, both to the side and below the seed, were also tried.

The results showed differences in yields as great as 389 pounds of seed cotton per acre with the same rate of fertilizer but with different methods of placement. The lowest yield was obtained where the fertilizer was placed 1 inch below the seed, and the highest yield where the fertilizer was applied 2½ inches to each side and 2 inches deeper than the seed.

The application of large amounts of fertilizer near the seed injured the stand. The placement of the fertilizer 2½ inches to the side and 2 inches deeper than the seed produced a 3-year average of 60 pounds of seed cotton per acre more than the practice of placing the fertilizer in the furrow and bedding on several days before planting.

In tests at the Edgecombe test farm, Rocky Mount, North Carolina, in 1933, 1934, and 1935, the side placement outyielded under-the-seed method by from 341 to as much as 1,115 pounds of seed



This two-row distributor in common use in Mississippi, more especially in the delta, is adapted for applying fertilizer in drill before bedding land. Applications should be made 10 days to 2 weeks before planting.

cotton per acre. The average, annual increased yield in favor of side placement for the 5-year period has been 474 pounds of seed cotton per acre.

Experiments were conducted in 1936 at four locations in three States (North Carolina, South Carolina, and Georgia) comparing three common methods of application employed by farmers with two side-placement methods. The average yields obtained for the methods compared were reported as follows:

Method of application	Average yield per acre	Increase due to fertilizer
No fertilizer	638	......
Band 2" wide under seed at planting*	787	149
Band 3" under seed 10 days before planting*	971	333
Mixed with soil under seed before planting*	1,073	435
Bands 3" each side, 3" below seed level at planting	1,191	553
Bands 2.5" to each side, 3" under, 10 days before planting	1,275	637

* Common farm practices.

From these figures it is evident that all three of the farm methods employed were inferior to side placement. The average of the three farm methods was 306 pounds to the acre, while the average of the two side-placement methods was 595 pounds.

In experiments in the Southeastern States in which fertilizer was placed in bands on each side of the row, average yields of cotton were 253 pounds per acre more than when fertilizers were placed in a band 2 inches directly under the seed, and 104 pounds more than when fertilizers were mixed with the soil under the seed in a zone about 3½ inches wide. However, results obtained from placing the fertilizer to one or both sides of the seed do not vary widely.

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Further Shifts in Grassland Farming?

By Ford S. Prince

Agronomist, Agricultural Experiment Station, Durham, New Hampshire

ONE always sticks his neck out when he assumes the role of a prophet. Yet if a person tries to look ahead to see what changes are likely to occur in agriculture in the next 10 or twenty years, he cannot very well help prophesying a little, so my neck is out. And I think I can see a further trend to grassland farming in the northeast region, even though more than 80 per cent of the tillage land is already in grass.

For the past 20 years, many of us have been preaching shorter rotations and more cultivated crops. With the exception of potato growers, who have in reality shortened their rotations to avoid wireworm troubles as well as to increase the acreage of the crop on their own farms, there has been very little response to the rotation curbing advice. Dairymen, particularly, have been more or less adamant in this respect, and now it may be well to inquire why this has been the case.

In the first place, hay pays more per hour of labor spent on it than any other dairy farm crop. Secondly, the specter of a shortage of this roughage is always in the background, and should a new seeding fail, it might create a serious, although perhaps not an insurmountable situation. Third, most dairymen have been in the habit of using their mowing lands for fall pasture, and the fewer acres of hay lands they have, the less fall feed is available. Fourth, for some years, fertilizers have been tending to a lower price level, due to synthetic processes of nitrogen production and to the discovery and development of huge potash reserves in our own country. Cheaper fertilizers make it easier to maintain yields of hay over a long period.

Of course, there is always the problem of soil erosion on the hill farms. Probably few farmers would tell you

General view of the grass-legume fertility plots at Claremont, New Hampshire.

that they kept their fields in hay as long as possible to control erosion and stabilize the soil. Yet, in the background, there has doubtless been for years the knowledge that erosion, if allowed to proceed unhampered on the hill farms, cuts yields tremendously in a short time. Publicity about serious erosion is but a recent development. Still it seems probable that a certain knowledge of this menace has been handed down from father to son in many cases and amounts almost to an instinct in the minds of numerous farmers. Witness the plowing, throughout New England, of narrow strips of land in several large fields of the farm each year, instead of turning one whole field over. While these narrow strips have rarely been on the contour, they are always bordered by sod land, so that any soil which is removed will not be lost from the fields.

A Natural Trend

When I say there has been a trend toward grassland farming in the past, that is merely a matter of history. In our own State of New Hampshire, almost 90 per cent of the tillage land is in grass, and the other New England States are not far behind this figure. This is but a natural trend, for New England is a grass country. The soils, climate, and rainfall are all favorable to grass crops. (I use the term grass in its broad sense to include clovers and other biennial and perennial legumes.) Cool spring weather with ample rainfall is favorable to the grasses. Short, hot summers favor the clovers, not only yields but seed production, whereby the crop reseeds itself in old mowings under proper fertility conditions. From the standpoint of adaptation, therefore, the trend to grass has been and will continue to be sound.

Shift to Silage

The use of grass silage is now acting as a further spur to keeping more of the tillage land in grass. It is a matter of but a few years that farmers have known how to ensile the grasses and clovers and make good ensilage from them. This development alone justifies the prophecy that a further trend to grass is imminent and may, in the future, eliminate corn as a crop for the silo on many farms. It has already done this in a few instances, and since there are many very good reasons back of a change such as this, it seems likely the trend will continue.

Phosphorus alone does not appear to have much effect in improving hay yield, but when used with lime, nitrogen, and potash, increases may be expected.

What changes in farming practice will such a shift involve? Obviously, any shift toward a more intensive system of grassland management will require different methods of tillage and a much keener knowledge and appreciation of the part that fertilizers play in maintaining hay yields. Farm-produced manures will also have to be used differently in the farming scheme than they are at present, if the fullest benefit is to be derived from them. Farm practice changes slowly, and for that reason alone farmers are very likely to feel their way along in the new program, arriving at the goal of intensive grassland management after some years of trial and error, rather than all at once.

If it were possible to sow a field to grass and maintain the yield for a period of years at the same level that is reached the first year or two after it is seeded down, the inclination toward a grassland farming system would be very much keener. At the moment, however, few farmers have the foresight to maintain the fertility of their soils at the proper point to achieve this goal. Still it can be done on the heavier soils, and there is ample evidence to prove it. At the Rothamsted Station in England, yields of hay have been maintained for over 80 years at the rate of more than 2½ tons per acre with suitable fertilizers. The Rhode Island Station reports an 8-year test where hay yields were maintained at 3½ tons per acre, whereas on land not adequately fertilized, yields fell from 2½ tons the first year to little better than one ton the eighth year.

High Yields Maintained

Here in New Hampshire, we have maintained alfalfa yields very close to a 4-ton average on land adequately fertilized with ample phosphoric acid and potash and a minimum of nitrogen, while on plots without any attention to chemicals, but with farm manure, yields averaged only a little over 2 tons per acre each year. The alfalfa killed out on the unfertilized plots, but a good stand was maintained on the heavily fertilized ones. In a number of tests with grasses in New Hampshire, yields have been maintained around a 2-ton level with chemical fertilizers alone, whereas plots not fertilized yielded only about one ton per acre.

Perhaps the most striking test we have conducted in this connection in New Hampshire is on the Livingston farm, Claremont, New Hampshire. On a field which produced corn that had been manured uniformly in 1936, we have maintained hay yields since 1937 at better than a 3-ton rate per acre, while plots not fertilized or plots from which potash was omitted have yielded at less than half this rate. Moreover, on all the plots treated with potash, clovers have persisted through the fourth season of hay, and last fall we took a second cutting from the plots treated with potash, while on the other plots, there wasn't enough hay to harvest.

Fertilizer Not So Costly

Results such as these indicate that hay yields can be held at high levels, and that plowing need not be so frequent, if farmers are willing to study their soils and the fertilizer requirements of their fields to find out how they can be adequately fertilized to maintain good hay yields.

"But," you say, "this is going to be more costly for fertilizers." And so it is. However, not so costly as it might seem at first glance, for in a grassland management system, farm manures will be used differently than at present. If the fields are not plowed so frequently, there will be more manure available for top-dressing. Since 8 or 10 tons of manure are ample for an acre in a top-dressing program, whereas farmers now use from 20 to 40 loads an acre for corn, these farm manures will go much further and cover a greater acreage than they do under the present system. This will cut down the need for chemical fertilizers, certainly to the extent that no farmer need be frightened over the proposition.

However, no one need think they can proceed successfully with the grassland management idea with what we now know as normal fertilizer practice. Each acre of land will need to be fertilized annually, except perhaps for the year after seeding, to maintain yields and to hold in the stand the most desirable and high-yielding hay plants.

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Hunger Signs in Crops

(*A Valuable Book for Every Agriculturist*)

A NEW book which promises to be a valuable addition to agricultural literature is soon to be published by the American Society of Agronomy and the National Fertilizer Association. Agricultural science is keeping pace with medical science in studying nutritional diseases. Humans, animals, and plants have long been known to suffer some diseases caused by bacteria, but it is only recently, by comparison, that certain diseases and symptoms of disorder were found to result from improper feeding. "Hunger Signs in Crops," as its title implies, gives authoritative treatment to this "newer knowledge of nutrition."

For five years a group of interested scientists have worked on the idea of presenting this information to the public in a practical yet effective form, and a preview of their efforts indicates a thorough job, well done. They took an inventory of available facts and scheduled nine chapters to be written by competent scientists, each one a specialist on the crop about which he writes.

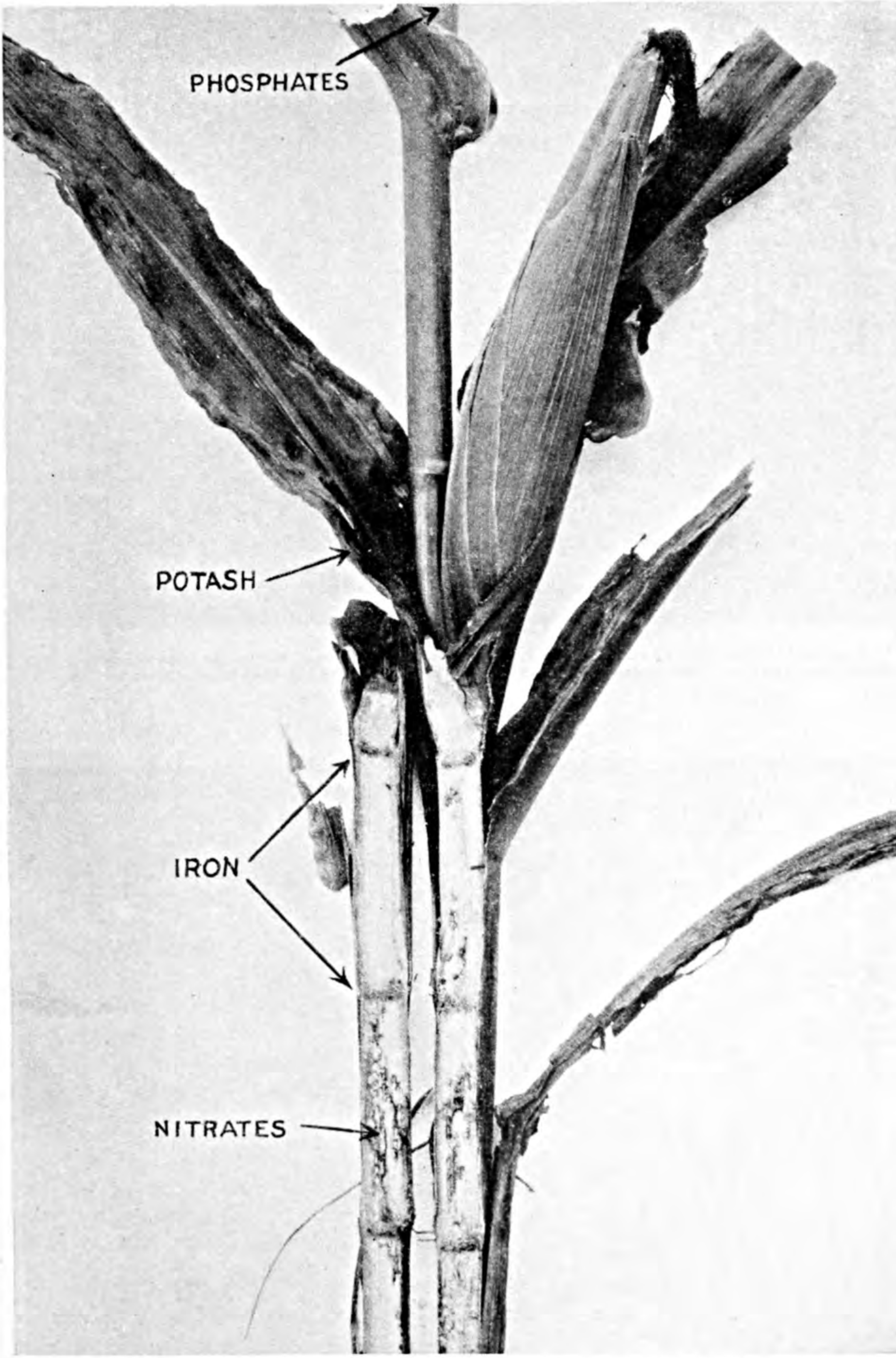
Chapter Authors Well Known

Dr. G. D. Scarseth and Professor R. M. Salter introduce the background of the problem with a discussion of hunger signs, how they are studied, and what they mean. The tobacco plant, which is shown to be especially well adapted to nutrition studies, is dealt with by Dr. J. E. McMurtrey, Jr.; Dr. H. P. Cooper summarizes the results of many experiments dealing with nutritional needs and hunger symptoms in the cotton plant. Using corn as an example for nutritional deficiencies in grain crops, Dr. G. N. Hoffer tells what is known about symptoms in the grains. Dr. H. A. Jones in collaboration with B. E. Brown shows what happens to potato plants that lack various nutritive elements, in the field and in experimental cultures.

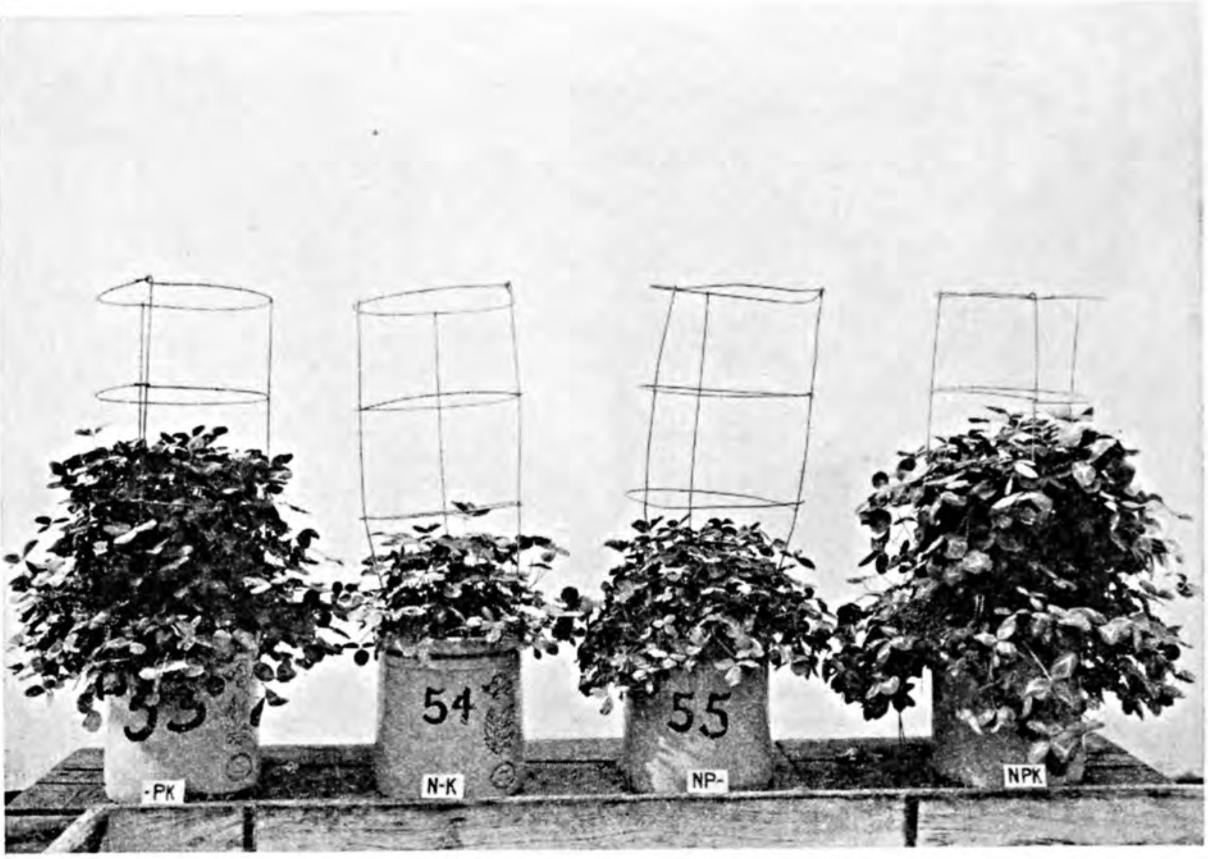
A wide range of crops important to truck growers, with major emphasis on deficiency symptoms in tomatoes, are reviewed by J. J. Skinner. Dr. E. E. DeTurk describes the hunger signs in legume crops that can get their nitrogen from the air but draw heavily on the soil for other plant foods. Dr. O. W. Davidson ranges over the orchards and tells what has been discovered about "hidden hunger" in these crops. Drs. A. F. Camp, H. D. Chapman, E. R. Parker, and G. M. Bahrt give a detailed and practical discussion of nutritional deficiencies in citrus fruits.

Such terms as "fired" corn, "sand drown" in tobacco, "dieback" in citrus, "drought spot" in apples, "heart rot" in beets, "rust" in cotton are now more than worries to the farmer, they are specific symptoms with cause and effect, as well as remedies to prevent or treat the ailing plant. Eighty true-to-life color plates and as many black-and-white illustrations give convincing support to the reading matter and greatly enhance the value of the book. Its low price of $2.00 before publication and $2.50 thereafter is made possible only by the sale of a large number of copies in advance of publication.

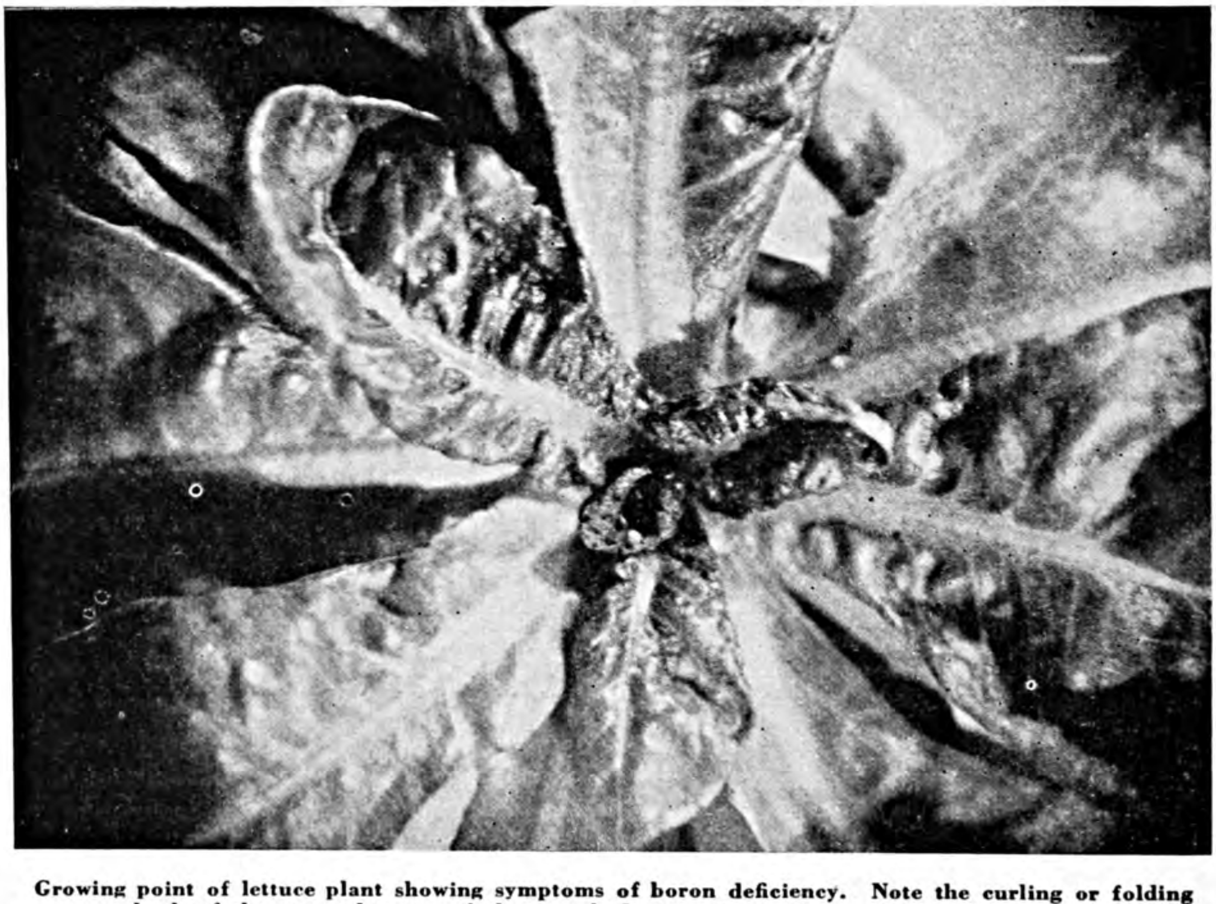
"Hunger Signs in Crops" will be an exceedingly useful book to county agents, teachers of vocational agriculture, extension specialists, libraries, progressive farmers who want to learn more about fertilizing their crops, scientists whose work touches this important field of nutrition, and members of the fertilizer trade. Gove Hambidge, its Editor, is to be commended on his easy flowing style which gives cold scientific facts life and readability. A few illustrations taken from the book are shown on the following pages.



When chemical tests are used to confirm nutrient deficiency symptoms in the field, they are made on the corn plant tissues as indicated. Tests for potash are made in the tissues in the base of the leaves. Iron accumulations in the joint tissues also indicate potash starvation. Tests for nitrates are made on the inter-nodal tissues throughout the plant, and for phosphates on stalk tissues just below the tassels.



The red clover above shows the importance of phosphate and potash in making a good crop. The omission of either of these nutrients greatly reduces the growth. (Treatments are shown by labels.)



Growing point of lettuce plant showing symptoms of boron deficiency. Note the curling or folding back of the young leaves and the scorched appearance of the disfigured leaf tips.

The potato plants on the left, receiving no potash in the fertilizer, collapsed before making full growth. Those on the right, receiving potash, continued growing throughout the season.

Phosphate-deficient Navel orange (left) compared with tree of comparable age receiving phosphate (right). Note the restricted growth and fruiting on the phosphate-deficient tree.

The comparison plots above show the effect of phosphate deficiency on the growth and maturity of cotton. The plot on the left received no phosphate in the fertilizer; that on the right 8% phosphate.

This tobacco plant from a seedbed shows that even seedlings may be affected by potash hunger. Note mottling of leaf and scorching of the tips and edges.

The Editors Talk

Looking Ahead

The United States is beginning a new year which promises the highest level of business activity that this country has ever experienced. Undoubtedly the defense program is the most important issue in the outlook, but from all appearances the United States was scheduled to enjoy an expanding volume of business and a good business year in 1941 without the defense program. A great business backlog has been accumulating for some time coincident with vast supplies of idle funds crying for investment outlet.

One of the most backward of our business indices was that representing construction, but the time was surely coming when this country must enter an era of vast private construction programs. Such programs would include not only homes, but factories, office buildings, and various other types of construction. The automobile manufacturers are building more, and the sales of cars are much greater now than during World War No. 1. In addition, there are many consumer products sold in large volume today that were practically unheard of twenty-five years ago. Examples of these are modern refrigerators, radios, and air-conditioners.

During the present emergency, demands for goods of nearly all kinds will be greater than during the first World War, and American industrial volume has increased so that our industries are better able to handle the additional load that is being placed upon them by the defense program. There is a possibility, of course, that during the early stages of the program and until production bottlenecks have been ironed out, consumer goods will be required to give precedence to war materials. This may result in a decline in production of those commodities normally required to support our advancing level of living. In the end, however, there is no reason to believe that the United States with its vast resources and trained manpower cannot superimpose a vast defense program on its existing industries without disrupting our standard of living.

In 1939 the national income was approximately 70 billion dollars. In 1940 it is estimated to be between 74 and 75 billion dollars, and for 1941 the experts agree that it will exceed 80 billion dollars. The encouraging fact in connection with this increase in income is that it is not expected to be brought about so much by an increase in prices and a depreciation of the value of the American dollar, but through increased production for war and civil purposes. The greatest national income that this country has ever enjoyed was in the boom year of 1929 when it approximated 83 billion dollars. In that year our general price level was much higher than it is at the present time, therefore our 1941 income should represent a larger volume of production than that in 1929. All of this increase in national income and in physical output of industry must surely result in a continuation of our downward trend in unemployment, an increase in retail trade, and an expanding domestic demand for farm products.

During the World War No. 1 the cost of living increased tremendously, but there is nothing in the present situation to indicate a material increase in retail prices. This means that the physical volume of consumption of nearly all of our agricultural and manufactured products may be expected to increase more in proportion to the increase in wages and income payments than was the case in the first World War. It is true that farm prices apparently have fallen out of proportion to other prices since the depression and have been unable to regain their parity, but the favorable aspect of this situation is that present prices will foster an increased volume of consumption, and that is the one thing that American agriculture needs most at the present time.

During the first World War the United States was called upon to supply food products to nearly all of the European countries on the side of the allies. These included Great Britain, France, Italy, Russia, Japan, and many other neutral nations. At the present time, however, England is the only important foreign consumer of our agricultural products. For the time being the American farmer has lost the export market, and exports of farm products during the coming year are expected to continue at low levels, with England as the only important buyer.

Fortunately the importance of the export market to the American farmer has declined considerably since the beginning of the first World War. In the last few years we have learned much about protecting ourselves against price declines in emergencies such as the one we are now facing. The American farmer can, therefore, look forward to the new year with the prospect of a cash income which will have a purchasing power higher than that received in 1940.

Country Editor and County Agent

There is nothing closer to one's interest than his immediate surroundings, the people he knows, and the happenings in his local community. This is the basis of a teamwork between the country editor and the county agricultural agent, teacher of vocational agriculture, and member of other local advisory groups, which has played such an important role in the betterment of American agriculture. Unfortunately the true nature of this teamwork has not always been fully recognized or appreciated to an extent where the greatest use might be made of it. It was gratifying, therefore, to see publicity given the recent tribute to country editor and county agent by M. L. Wilson, Director of Extension, U. S. Department of Agriculture.

"It is no exaggeration to say that the partnership of the county agent and the country newspaper editor has within the past 30 years brought about a revolution in farming methods," Mr. Wilson said. "The results are universally acclaimed. The implications for the future stir the imagination. While other continents are witnessing the growing depletion of the soil, America is actually reversing the process and is on the way to systematic rebuilding of this magnificent resource."

Mr. Wilson then went on to point out the alliance between country editor and county agent since the earliest days of extension work. The former was a means of widening the influence of the improved practices which the latter was attempting to inaugurate in the community, a service which the latter repaid by bringing in news of local interest to increase the standing of the publication. And both were performing services of untold value to the community as a whole.

Such a set-up deserves tribute. It offers the highest type of cooperative service, benefiting not only the participants, but the public. Effort should be made to take advantage of every opportunity to make further use of it.

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

¶ Maine Experiment Station Bulletin 402, "Boron Deficiency Symptoms in Some Plants of the Cabbage Family," by Frederick B. Chandler, gives a comprehensive description of boron deficiency symptoms shown by eleven economic members of the cabbage family. Work reported was begun at the Maine Station in the fall of 1933, a year when many of the rutabagas grown in the State were affected with water heart. This condition, however, was observed in Maine as early as 1914, but the cause was not known until 1933 when it was observed that applications of borax to the soil controlled water heart in rutabagas. In 1936 the investigations were enlarged to include ten other members of the genus *Brassica,* namely: broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, kale, kohlrabi, white mustard, rape, and turnip. All plants have been studied in the greenhouse under controlled conditions and some plants have been studied in the field.

In general the entire cultivated area in the southern part of the State shows boron deficiency. The largest number of reports of this deficiency is from Scarboro and Cape Elizabeth. These towns were among the earliest to be settled in Maine, 1630. From the limited amount of information available, there seems to be a high association between boron deficiency and the date of settlement of the town, and little or no association between the deficiency and the parent soil material or the natural boron content of the soils type.

Accompanying the text are many excellent photographs depicting boron deficiency of the various plants, some portraying the contrast between plants so affected and those that are healthy and normal where a sufficiency of boron was supplied.

The deficiency may be corrected by the use of ten pounds of borax per acre applied in the row for row crops. Borax may be applied with the fertilizer, as a side-dressing, or it may be applied in solution as a spray. The author says that in setting out plants, boric acid solutions may be used, the solution being poured into the holes prepared to receive the plants.

"Relative Effect Upon Peach Production of Nitrogen Derived from Certain Fertilizer Sources," Agr. Exp. Sta., Newark, Del., Bul. 222, Jan. 1940, C. A. McCue.

"Fertilizers for New Jersey, 1941," Agr. Exp. Sta., New Brunswick, N. J., Cir. 406, Nov. 1940.

"Commercial Fertilizers, Pastures and Plant Food," Agr. Exp. Sta., Burlington, Vt., Bul. 464, Sept. 1940, L. S. Walker, E. F. Boyce, and H. J. Cannon.

Soils

¶ The production of vegetable crops has greatly increased in Connecticut during recent years and has come to be one of the important uses of Connecticut soils. According to M. F. Morgan and H. G. M. Jacobson, in Station Bulletin 439, entitled, "Soil Management for Intensive Vegetable Production on Sandy Connecticut Valley Lands," it is a well-known fact that the greater portion of the desired yield of vegetable crops must be obtained as a result of soil treatment. Land receiving no fertilizer, lime, or manure cannot be expected to produce satisfactory yields of any of the common vegetable crops. With a view of solving many of the soil management problems of vegetable growers, the bulletin presents conclusions of much importance as a result of ten years trials of various soil treatments.

A combination of moderate manuring and medium applications of complete fertilizer is most effective in producing high yields of miscellaneous vegetable crops without depletion of the soil. Liming acid soils sufficient to keep the reaction from 6.2 to 6.6 pH is necessary to produce favorable yields of spinach, lettuce, radishes, etc. A pH range between 5.2 and 5.6, with low amounts of active aluminum present, is not unfavorable to sweet corn, sweet potatoes, and tomatoes.

For most vegetable crops, fertilizers supplying 90 to 135 pounds of nitrogen, from 90 to 135 pounds of phosphoric acid, and from 120 to 180 pounds of potash per acre are desirable on unmanured land under intensive vegetable culture. Proportionally less than these amounts of nutrients may be used in connection with manure. It was found that manure gave best response when used at the moderately heavy rate of 20 tons per acre, in combination with a fertilizer treatment equivalent to 750 pounds of a 6-6-8. Smaller amounts of nitrogen are preferable in the growing of peppers and sweet potatoes in rotation with other vegetables. Increasing the potash treatment from 120 to 180 pounds per acre in the fertilizer trials produced larger yields of lettuce, squash, spinach, sweet potatoes, tomatoes, and sweet corn. The root crops were no more responsive to extra potash than other types of vegetables on this soil when well supplied with potash.

The soil management suggestions given in this bulletin are especially applicable to the light, sandy soils of the Connecticut Valley, but many of the fundamental principles revealed in these studies apply elsewhere.

"Dewitt County Soils," Agr. Exp. Sta., Urbana, Ill., Soil Report 67, June 1940, Guy D. Smith & L. H. Smith.

"Jasper County Soils," Agr. Exp. Sta., Urbana, Ill., Soil Report 68, June 1940, R. S. Smith & L. H. Smith.

"Cumberland County Soils," Agr. Exp. Sta., Urbana, Ill., Soil Report 69, R. S. Smith & L. H. Smith.

"Soil Survey, Audubon County, Iowa," U. S. D. A., Washington, D. C., Series 1933, No. 34, Aug. 1940, T. H. Benton & W. J. Geib.

"Soil Survey of Iowa, Franklin County," Agr. Exp. Sta., Ames, Iowa, Soil Survey Report 79, Mar. 1940, Roy W. Simonson, T. H. Benton, & H. R. Meldrum.

"Save Your Soil," Maryland State Soil Conservation Committee, College Park, Md., Bul. 1, July 1940.

"The Control of Soil Erosion in New York," Agr. Ext. Serv., Ithaca, N. Y., Bul. 438, June 1940, A. F. Gustafson.

"Soil Erosion, Farmers and Government Together Can Whip It," Agr. Ext. Serv., Madison, Wis., Cir. 311, June 1940, Noble Clark.

"Soil Survey, Zavala County, Texas," U. S. D. A., Washington, D. C., Series 1934, No. 21, June 1940, Howard M. Smith, M. H. Layton, J. T. Miller, T. W. Glassey, R. M. Marshall.

"Use the Land and Save the Soil," U. S. D. A., Washington, D. C., 213934-40, June 1940.

Crops

¶ All dairymen recognize the fact that total digestible nutrients in the feed ration are usually most expensive in purchased grain. Professor R. W. Donaldson, in Massachusetts Extension Leaflet 150, "Pasture Management," gives a convincing comparison of costs for feeding dairy cows the different types of feed and shows that farm-grown roughage and pasture, even when fertilized and fenced, offer the cheapest source of total digestible nutrients.

Fertilized pasture feed is by far the least expensive, costing but $1.00 per 100 pounds of T.D.N., followed next by hay amounting to $1.50 per 100 pounds T.D.N. Comparative costs for concentrate (20%) and silage feeds are $2.63 and $1.87 respectively, per 100 pounds T.D.N. Thus, it is clearly seen that a farm producing ample roughage and having excellent pasture, with a sufficient number of good cows, should produce milk at the lowest price. With liberal roughage or good pasture, cows require only about half as much grain as is required when hay is fed scantily or when pasture is poor. Even a fair pasture calls for heavy grain feeding. This costly feeding can be reduced by about four-fifths on excellent pasture compared with a poor one or when roughage feeding is light.

The author briefly outlines the sources of pasture feed and suggests the fertilizer applications which may be used. A plan for a full season of grazing from May 1 to October 15 is graphically presented to illustrate how various crops may fit into a complete pasture program to supply excellent grazing. Covering nearly the entire span of the season and providing excellent grazing is Ladino clover. Ladino supports more animals to the acre, recovers from grazing more quickly, and suffers no more from mid-season heat than other pasture sod crops. Annual top-dressing with 300 pounds per acre of a fertilizer equivalent to 0-14-42, or 400 pounds of 0-10-30, is recommended to keep Ladino productive.

Rye furnishes late fall and early spring grazing, natural grasses intermediate, millet and Sudan grass late summer grazing during the period of greatest feed shortage, and rowen may furnish limited grazing in early fall, particularly for young stock and dry cows. Ladino, more often, is the main crop for grazing, to which may be added old pasture at its best and other supplementary grazing as required. All three may be required in dry seasons; in wet seasons any surplus may be ensiled or cut for hay.

Top-dressing for the permanent pasture on heavy soils moist enough to grow clover may consist of complete fertilizers of either 1-2-2 or 1-4-5 ratio for the initial treatment. Examples given are 8-16-16 or 4-16-20 at 300 pounds per acre. The 5-10-10 or 3-12-15 grades may be used at 500-pound rates. In subsequent years when clover develops, 240 pounds of 0-25-25, 300 pounds of 0-20-20, 400 pounds of 0-15-15, or 500 pounds of 0-12-12 may be applied. One ton of lime per acre once in 8 years may be used. For top-dressing the lighter, drier soils where grass is likely to predominate, fertilizer analyses as 11-11-11, 9-8-9, or 7-7-7 may be selected for the initial treatment. Respective rates suggested are 300 pounds, 375 pounds, and 475 pounds per acre. A good application of some nitrogen material would serve in alternate years. One ton of lime in 10 years is advised on strongly acid soils.

"Bur Clover," Agr. Ext. Serv., Fayetteville, Ark., Ext. Cir. 423, June 1940, Charles F. Simmons.

"Annual Report for the Year Ending October 31, 1939," Agr. Exp. Sta., New Haven, Conn., Bul. 438, Sept. 1940.

"Annual Report, State Board of Agriculture, 1939-1940" (Quarterly Bulletin), St. Bd. of Agr., Dover, Del., Vol. 30, No. 3, Sept. 30, 1940.

"Report of Progress in Solving Idaho's Farm Problems, Forty-seventh Annual Report for the Year Ending December 31, 1939," Agr. Exp. Sta., Moscow, Idaho, June 1940.

"House Plants," Agr. Ext. Serv., Ames, Iowa, Bul. P14 (New Series), July 1940, J. B. Wingert.

"Sweet Corn Hybrids," Agr. Ext. Serv., Ames, Iowa, Bul. P15 (New Series), Aug. 1940, E. S. Haber.

"Fortieth Annual Iowa Year Book of Agriculture," St. Dept. of Agr., Des Moines, Iowa, 1939.

"The Culture and Forcing of Easter Lilies," Agr. Exp. Sta., Amherst, Mass., Bul. 376, Aug. 1940, Harold E. White.

"Reed Canary Grass," Agr. Ext. Serv., East Lansing, Mich., Ext. Bul. 220, Oct. 1940, C. M. Harrison.

"The Judging of Livestock, Dairy, Poultry, and Crops," Agr. Exp. Sta., State College, Miss., Bul. 344, June 1940, H. O. West.

"Possibilities and Limitations in the Use of Irrigated Land for Forage Production in Northeastern Nevada," Agr. Exp. Sta., Reno, Nev., Bul. 154, Aug. 1940, C. E. Fleming & C. A. Brennen.

"Lawn Maintenance," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 430, Mar. 1940, Donald J. Bushey.

"Science for the Farmer," Agr. Exp. Sta., State College, Pa., Bul. 399, Sept. 1940.

"Questions and Answers Concerning the Use of Sericea in Tennessee, Prepared Especially for AAA Committeemen," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 133, Nov. 11, 1940, H. E. Hendricks.

"Truck Crop Investigations, the Control of Truck Crop Diseases in Tidewater, Virginia," Va. Truck Exp. Sta., Norfolk, Va., Bul. 104, July 1, 1940, Harold T. Cook & T. J. Nugent.

"Woodland Improvement, A Handbook for Farmers & Others Interested in Trees," Agr. Ext. Serv., Madison, Wis., Cir. 305, June 1940, Roy M. Carter.

"Chinese Cabbage Varieties, Their Classification, Description, and Culture in the Central Great Plains," U. S. D. A., Washington, D. C., Cir. 571, Sept. 1940, James E. Kraus.

"Useful and Ornamental Gourds," U. S. D. A., Washington, D. C., Farmers' Bul. 1849, Oct. 1940, W. R. Beattie.

"Gardenia Culture," U. S. D. A., Washing-

ton, D. C., Leaf. 199, 1940, Guy E. Yerkes, Furman Lloyd Mulford, Lucia McCulloch, and Floyd F. Smith.

Economics

¶ In Extension Bulletin No. 219 of Michigan State College Louis A. Wolfanger has presented in a most interesting manner the general aspects of conservation as it pertains to Michigan. The characters in the Bulletin include John Pioneer who settled about 1825 in an area rich in game and became a trapper and later a logger. Silas Pioneer was a farmer who settled in southern Michigan and cleared a farm in the smooth, gently undulating hardwood sections. Silas sold what logs he could and burned what he did not need for building, gradually pushing back the forest until he was finally surrounded by fields of grain.

Jack Pioneer was a miner. He settled in the copper country and the iron ranges. In those days miners were in demand and the wages were good. Steadily growing industries in the East provided a ready market for the products of the mines.

Peter Pioneer was a shopkeeper who settled in a port on Lake Michigan. He enjoyed and prospered because of the bustle of the village store and the hearty sociability of the lumberjacks and the lake crews.

Sam Pioneer came late in the century and was a lover of freedom. He settled in the northern part of the State and became a trapper, and later a lumberjack. Still later he worked at a job in a sawmill, and from time to time at odd jobs, finally mixed farming activities with trapping. He inherited a homestead in the south central part of the State where oil was discovered, bringing him such wealth as he had never dreamed.

The last of the Pioneer characters, Tom, took up farming in the stump lands of the north country. Markets for oats, hay, and potatoes looked promising, while the lumber towns were booming and busy. He liked the agricultural frontier, but he looked forward to the day when most of the land would be settled and his sons would occupy farms on either side of the old farmstead.

More than a century has passed since these persons began migrating westward and settling in Michigan. Their total number finally reached into the millions. Virtually all of the land worthy of private ownership had been settled, and good lakes, stream sites, and lake fronts had been taken up. Most of the choice forests and mineral and urban lands had been occupied and exploited. Within recent years new currents have set in; much land located in the northern part of the State and also scattered here and there in the southern part is being given up or abandoned. Approximately 6,000,000 acres at the present time have reverted to public ownership through tax delinquency or sale. A few years ago the State Homestead Act was repealed, marking the end of the free land and free resource era, and closing the door on the Pioneer period.

Today John Citizen and his relatives are taking the place of John Pioneer and his kinsmen. The Pioneers were primarily individualists, men who struggled and dreamed and worked alone, earnestly and with high courage. In those days the frontier demanded such men. The judicious use of resources in which the needs of tomorrow as well as those of today are taken into consideration was still strange and unknown, except to a few of unusually farsighted vision.

Citizens, according to the Bulletin, must be conservation minded, community builders—people who work and plan together for the community as well as for themselves. The maturing State depends upon them. Today it must be every man's concern if the lands, minerals, and waters are used to the best interests of all. The easy-to-take and easy-to-use resources have now been largely depleted. In the future the firm basis of life must be rooted in the more fundamental and enduring resources of the community, and these resources must be conserved, neither wasted nor hoarded. but used with intelligence if the community is to continue its life on a wholesome basis.

Resources differ widely from the conservation point of view and because of this the conservation formula is not simple. Each resource must ultimately have its own conservation formula, but we can nevertheless recognize broad groups or types of resources whose problems are more or less similar and whose conservation will be sought in somewhat similar measures. For instance, there are exhaustible but renewable resources, and as good examples of this there are the forests and wildlife resources of the State. Next are exhaustible and irreplaceable resources, iron and copper furnishing good examples. There are inexhaustible but limited resources. As examples the author suggests recreational lakes, sites of scenic beauty and historic importance. Waterfronts constitute one of the most outstanding examples. These resources are not exhausted by use but are limited in amount and quantity. Next are inexhaustible and superabundant resources. Every community has these resources. Wind power, sun energy, gravitational force, tidal energy, etc., come under this category. There are indestructible but impairable resources. Land comes under this specification. Complete and absolute destruction of land is rare. In general its use for certain purposes is affected or destroyed but it still continues to exist as land. In the case of Silas Pioneer's farm, the land merely declined in agricultural productivity. This is serious, of course. The content of the all-important organic matter was reduced, and the smooth surface became broken by gullies.

The challenge to Silas Citizen lies in the task of discovering and learning the types of land in his community in the manner and detail which correspond to his understanding of his plant and animal resources and then in adapting his agriculture, forest and other uses of land to the qualities of the land. Such an understanding of land capabilities would gradually bring about a constructive revolution in land use. Crops, livestocks, rotations, fertilizers, pastures, recreational activities, forests, and other land uses would then be shaped to fit the land. Most efforts until now have been directed toward whipping the land into submission, whereas the fundamental qualities of most lands are more or less fixed—not unalterably so, of course, but such changes can generally be made only at considerable cost and effort. According to the author, the crux or pivotal point of soil erosion lies in the adjustment of land use to land quality.

Michigan has an area of nearly 60,000 square miles. About a century and a quarter ago there were 12 square miles of virgin forests for every man, woman, and child, if they had divided the State equally. The present population exceeds 5,000,000. If the State were equally divided today, each 90 Citizens would have to share one square mile between them, and there would be only scraps of virgin forests—about one-half acre for each. There is good reason, therefore, why the Citizens must insist that the days of needlessly exploiting resources must be numbered. They pay tribute to the courageous work of the Pioneers, but they believe that the time has passed when men should enjoy complete and unlimited freedom to utilize resources when and where they choose and without regard to the welfare of the community. Natural resources will continue to be the foundation stones of the twentieth century community, but their future use should be tempered by the peculiar nature of each resource, by sound conservation principles, and by effectiveness in rendering human services tomorrow as well as today.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended September 30, 1940," St. Dept. of Agr., Sacramento, Calif., Bu. of Chem. Announcement No. FM-13, Nov. 23, 1940, Dr. Alvin J. Cox, Chief.

"Annual Report of Commercial Fertilizers, Agricultural Minerals, July 1, 1939 to June 30, 1940," Division of Agr., 20 State Museum, Denver, Colo., Mimeo., Nov. 1940.

"Farm Outlook, Illinois, 1941," Agr. Ext. Serv., Urbana, Ill., Cir. 511, Dec. 1, 1940.

"An Experiment in Pre-Harvest Sampling of Wheat Fields," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 273, Aug. 1940, Arnold J. King and Emil H. Jebe.

"Dairy and Hog Farming in Northeastern Iowa," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 275, Sept. 1940, R. K. Buck, J. A. Hopkins, and C. C. Malone.

"Cooperation in Grain Marketing in Iowa," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 276, Sept. 1940, Frank Robotka and R. C. Bentley.

"Seasonal Movements in Prices and Sales of Burley Tobacco," Agr. Exp. Sta., Lexington, Ky., Bul. 409, Sept. 1940, Dana G. Card and Carl M. Clark.

"Economic Utilization of Rural Land Resources in Beauregard Parish, Louisiana," Agr. Exp. Sta., University, La., La. Bul. 322, June 1940, Bueford M. Gile.

"Prices and Production of Louisiana Farm Products, 1910-1939," Agr. Exp. Sta., University, La., La. Bul. 324, June 1940, J. Norman Efferson.

"An Economic Study of Dairy Farms in the Kentwood Area of Southeastern Louisiana, 1937-38," Agr. Exp. Sta., University, La., La. Bul. 325, June 1940, J. Norman Efferson and Frank Merrick.

"Types of Farming in Maryland," Agr. Exp. Sta., College Park, Md., Bul. 432, Feb. 1940, A. B. Hamilton and T. D. Johnson.

"Marketing Farm Products Through Community Auctions," Agr. Exp. Sta., College Park, Md., Bul. 434, June 1940, P. R. Poffenberger and S. H. DeVault.

"Fertilizer Grades and Fertilizer Materials to Be Registered and Sold in the State of Mississippi for the Year 1941," St. Dept. of Agr. & Com., Jackson, Miss., Mimeo., Oct. 25, 1940.

"Montana Farm Real Estate Mortgage Indebtedness," Agr. Exp. Sta., Bozeman, Mont., Bul. 383, Oct. 1940, R. R. Renne.

"Farm Organization and Management in the Colebrook Area," Agr. Exp. Sta., Durham, N. H., Bul. 322, June 1940, Harry C. Woodworth and Arno Hangas.

"New Jersey Prices of Hired Farm Labor, Feedstuffs and Fertilizer Materials, and Their Index Numbers 1910-1939," St. Dept. of Agr., Trenton, N. J., Cir. 314, June 1940, D. T. Pitt.

"Standard Fertilizer Grades for Texas, September 1, 1940 to August 31, 1941," State Chemist, College Station, Texas, July 18, 1940.

"The Possibilities of Producing Grain on Vermont Farms as a Cash Crop or for Livestock Feed," Agr. Ext. Serv., Burlington, Vt., Cir. 106, Sept. 1940, Hermon I. Miller.

"The Possibilities of Raising Small Fruits and Vegetables as a Source of Vermont Farm Income," Agr. Ext. Serv., Burlington, Vt., Cir. 107, Sept. 1940, Hermon I. Miller.

"An Analysis of Peanut-Cotton-Hog Farm Businesses in a Depression Year," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 67, July 1940, F. L. Underwood.

"The AAA—What It Is," U. S. D. A., AAA, Washington, D. C., G-102, Aug. 1940.

"Cotton, Land, and People," U. S. D. A., AAA, Washington, D. C., SRM-428, July 1940.

"Cotton Marketing Quotas in 1941," U. S. D. A., AAA, Washington, D. C., 41-Cotton-1, Oct. 1940.

"Income Parity for Agriculture, Part I—Farm Income. Section 13—Income from Sweetpotatoes, Calendar Years 1910-39," U. S. D. A., Washington, D. C., Oct. 1940.

"Income Parity for Agriculture. Part II—Expenses of Agricultural Production. Section 2—Farmers' Expenditures for Fertilizer and Agricultural Lime, Calendar Years 1909-39," U. S. D. A., Washington, D. C., Oct. 1940.

"Income Parity for Agriculture, Part II—Expenses of Agricultural Production. Section 3—Purchases, Depreciation, and Value of Farm Automobiles, Motortrucks, Tractors, and Other Farm Machinery, Calendar Years 1910-39," U. S. D. A., AAA, Washington, D. C., Aug. 1940.

"1941 Agricultural Outlook Charts; Cotton and Tobacco; Dairy and Poultry; Demand, Credit, and Prices; Farm Family Living; Feed Grains, Fats and Oils; Livestock, Hogs, Beef Cattle, Sheep; Wheat, Rye, Rice, and Dry Beans;" U. S. D. A., Washington, D. C., Oct. 1940.

"Economic Analysis of the Food Stamp Plan," U. S. D. A., Washington, D. C., Oct. 1940, Norman Leon Gold, A. C. Hoffman, and Frederick V. Waugh.

"Make Surplus Cotton Work," U. S. D. A., Washington, D. C., 16-18143.

"Corn in the Development of the Civilization of the Americas, A Selected and Annotated Bibliography," U. S. D. A., Washington, D. C., Agr. Ec. Bib. 87, Sept. 1940, Louise O. Bercaw, Annie M. Hannay, Nellie G. Larson, and Mary G. Lacy.

"Directory of the State Land-use Planning Committees, as of June 30, 1940," U. S. D. A., Washington, D. C., Mimeo.

"Planning Committees Cooperate with Local Governments," U. S. D. A., Washington, D. C., County Planning Series No. 8.

"Farm Production, Farm Disposition, and Value of Soybeans and Cowpeas, 1924-1936," U. S. D. A., Washington, D. C., June 1940.

"Disposition of Potatoes, Crop Years 1909-1937," U. S. D. A., Washington, D. C., Sept. 1939.

"Achieving a Balanced Agriculture," U. S. D. A., Washington, D. C., Revised April 1940.

After looking at a moose, it seems that a man shot by mistake for one of them might as well be dead anyhow.

Then there was the husband who asked "By whom?" when told that his wife was outspoken.

Foreign and International Agriculture

To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

Die Ernährung der Pflanze, Vol. 36, No. 7, July 1940

THE INFLUENCE OF INCREASING POTASH APPLICATIONS ON THE YIELD AND COMPOSITION OF SOYBEANS. *By F. Giesecke and L. Yi-Lung, University of Berlin, Berlin, Germany.*

Somewhat conflicting results have been reported by investigators on the influence of potash applications on the production of protein in soybeans. In several cases it was reported that potash reduced protein production, although most work agrees that the potash will increase yield and oil content of seed. In order to obtain further information on the relationships existing, pot experiments were inaugurated in which a subsoil rather high in available phosphoric acid, moderately low in potash, and about neutral in reaction was used. Uniform amounts of calcium, phosphorus, magnesium, nitrogen (as ammonium nitrate), sodium, chlorine and manganese were added to all pots, while varying amounts of potassium sulphate were applied in different pots. Pure chemicals were used in all cases, and the soybeans were inoculated before planting.

During the first month there were no signs of potash starvation on the plants, even where no potash fertilizer was applied. As the plants became larger, distinct signs of potash deficiency became evident on the plants not provided with this nutrient, and on those given the lowest amount. Plants with the other four increments of potash fertilization all presented the same appearance so far as color was concerned. It was very noticeable that the potash-starved plants retain their leaves, although they were dead and dry, instead of shedding them normally. The plants with the highest potash application had thicker and shorter stems than the other plants.

Regardless of treatment, the number of pods per pot was not greatly different, but those from the plants lacking potash were small and many of them had set no seeds. The pods on these plants also were distinctly limited to the upper parts of the stems, in contrast to the rather uniform distribution of the pods along the stems of the potash-fed plants. The number of bean seeds per pot was much lower where potash was lacking, and over half of them were not mature. With increasing potash, there was a tendency for the number of seeds per pot to increase, and the percentage of mature seeds increased even more markedly. Accompanying an increase in seed production was a decrease in straw, which included stems, leaves, and pods.

The potash content of the seeds increased with the potash application. The per cent oil content of the seeds also increased but the per cent total nitrogen and also pure protein tended to decrease with increasing potash applications. The ratio of pure protein to total nitrogen was somewhat higher with increased potash additions, showing that the potash permitted a better utilization of the nitrogen in the plant. The production of oil per pot, of course, increased with potash applications, and the increased seed yield with such additions slightly more than balanced the decreased protein content, so the protein yield per pot was increased slightly by the potash treatment, except for the pot lacking potash, which was much lower than the others in protein yield.

Considering the yield and composition of seed, the authors concluded that the most favorable P_2O_5:K_2O ratio in the fertilization was between 1:1.5 and 1:2, under the conditions of the experiment.

THE ACTION OF VARIOUS POTASH SALTS ON MEADOWS. *By L. Schmitt, Agricultural Experiment Station, Darmstadt, Germany.*

The author calls attention to the low yields too frequently obtained from meadows and points out that experiments have shown that by proper phosphate and potash fertilization yields of hay can be increased a ton per acre, with total yields of five tons and more per acre possible.

In an experiment conducted for 27 years on a good meadow soil, an application of about 100 pounds of actual potash per acre increased hay and rowen yield on the average a little over a ton per acre over plots where no potash was applied. In another experiment on poorer sandy soil, conducted for 22 years, the same amount of potash increased the yield about 1.5 tons per acre.

Attention is called to the fact that when potash is applied to the soil, other ions always are applied along with the potassium, these amounting to relatively large amounts in the case of the less concentrated potash carriers. Among the ions applied, chlorine, sulphate, sodium, magnesium, and calcium would be added in largest quantities. Little data will be found in the literature on the influence of the various potash carriers on the yield of hay and raw protein. This led to the establishment of experiments reported here covering the use of various potash salts applied to meadows on five different soils, and conducted over a period of years so as to give greater significance to the results obtained.

In an experiment conducted for 28 years on a moderately good soil, 110 and 145 pounds of K_2O per acre were applied in the form of muriate of potash and kainite and compared to a plot receiving no potash. Phosphate was applied uniformly over all the plots. The results showed that kainite at both rates increased hay yields about 1 ton per acre, while muriate of potash increased the yield about 1.25 tons. The higher kainite application tended to decrease the yield a little under the lower rate, while the higher muriate rate tended to increase the yield over the lower rate. The raw protein production was increased about 200 pounds per acre by the lower potash application, the higher rate not giving as good results as the lower rate, indicating that on this soil, 110 pounds of K_2O were sufficient. The muriate of potash tended to produce a little more raw protein than the kainite.

In another experiment conducted for 23 years on a sandy soil, kainite, 40% and 50% muriate of potash, sulphate of potash, sulphate of potash-magnesia and a combination of muriate of potash and magnesium sulphate were applied at 110 and 160 pounds K_2O per acre. Hay yields were increased on the average about 1.5 tons per acre by the more concentrated potash carriers; the less concentrated, such as kainite, yielding about a quarter of a ton less. Other than this, there was little difference among the concentrated carriers in their effectiveness. At the higher rate of application, the kainite produced a little less hay, but the concentrated carriers produced slightly higher yields than at the lower rate of application. Even greater differences between kainite and the concentrated carriers were shown in the results of raw protein produced. Magnesium was without appreciable effect on this soil.

On an experiment conducted on a peaty, sandy soil, large increases in hay and protein yields were obtained by potash applications, but only concentrated salts were used, and the results were about the same for all of them. On two fields where the soil was a sandy loam, naturally low in potash, the different potash fertilizers were compared with and without manure applications. The manure increased the yields in all cases, but potash in addition to the manure increased yields even more. Here again, the kainite was not so good as the more concentrated carriers.

To see whether alternating the use of kainite and concentrated fertilizers would overcome the lower effectiveness of the kainite, the plots on the field that has been going on for 23 years were divided three years ago. On half the plots, the former treatments were continued while on the other half, a different potash fertilizer was applied during the last three years. When kainite was used on plots formerly receiving concentrated potash fertilizers, the yield was reduced, compared to the part of the plot which continued to receive the concentrated carrier. When concentrated carriers were used on the plot formerly receiving kainite, the yield was increased. In no case was the effect as good as the continuous use of the concentrated potash fertilizers. Interchanging the concentrated carriers had little effect on yield.

From this work the conclusion is drawn that on the soils studied, for each pound of potash used, about 21 pounds of hay and 2.7 pounds of raw protein were produced. (At even low hay prices, this would give more than 100% profit on the investment in potash fertilizer.) On meadows fertilized each year over a period of years, muriate of potash and the other concentrated potash carriers will produce better yields than kainite. Magnesium did not appear to be beneficial on meadows on any of the soils investigated.

Nutrient Removal and the Course of Nutrient Absorption by Cauliflower. *By A. Wetzel, Berlin, Germany.*

Reviewing the data of several investigators, the author finds that with a yield of 22.5 tons of heads per acre, the average removal of nutrients is about 200 pounds of nitrogen, 70 pounds of phosphoric acid, 190 pounds of potash, and 80 pounds of lime per acre. The figures for potash and lime varied considerably with source of the data. Part of this may be due to the inclusion of several types of cauliflower.

Much of the article is devoted to a review of the work of Vanstone and Knapman of England, published in the June 1939 issue of the Journal of Pomology and Horticultural Science. The authors analyzed 50 representative plants at 6-week intervals from seeding to maturity. A crop of about 14 tons per acre was grown, the type grown being known as Roscoff broccoli, or winter cauliflower. Total dry matter produced by the whole plants amounted to 4,145 pounds per acre, nitrogen amounted to 137 pounds, phosphoric acid was 42 pounds, potash 166 pounds, and lime 119 pounds. It is pointed out that the crop was only moderately well fertilized and manured, and with larger yields, removals of plant food would be greater. It was found that plants producing good hard curds removed slightly less nitrogen, slightly more phosphoric acid and lime, and considerably more potash than plants producing soft curds. In this work there was comparatively little variation in composition of plants regardless of location. The absorption of all nutrients continued rather steadily until maturity.

The author of this article quotes other data showing that when the crop is grown under conditions of higher fertility, much higher amounts of the nutrients are removed, with nitrogen running over 200 pounds per acre, phosphoric acid over 80 pounds, potash 250 pounds and lime over 115 pounds. The high fertility requirements of cauliflower are shown in an experiment in which the crop was grown on a soil containing 29 mg P_2O_5 and 61.4 mg K_2O per 100 g by the Neubauer method. On this highly fertile soil in addition to nitrogen and phosphoric acid, three rates of potash were applied, zero, 270, and 360 pounds per acre. The average number of heads per plot was 374.5, 529.5, and 568.5 respectively, showing that large increases in yield were obtained with potash fertilization in spite of the original high fertility of the soil.

The number of good quality heads was also very favorably affected by the potash applications. Without potash, only 3 first quality heads were produced; with the first potash increment, 160 heads; and with the highest potash treatment 161 heads. The number of second quality heads was 210, 269, and 302 for the three treatments; and for the third quality heads produced, 287, 226, and 230 respectively.

THE SOIL OF THE ISLAND OF CRETE.

A map of the soils of Crete, accompanying an article on the soils of the Island written by K. Nervos and J. Zvorykin, is included as an insert with this issue of the magazine. The classification is based on the system of Gedroiz. Most of the soils are in the high lime group, particularly rendzina and red soils.

THE DISTRIBUTION OF THE SOILS OF JAVA.

Also reproduced in this issue is a soil map of Java prepared by C. I. Mohr, based on a system of classification worked out by him as adapted to the volcanic soils of the island.

How, Where, When Apply Fertilizers?

(*From page* 18)

Probably the most authoritative information on methods of fertilizing various crops is the recommendations of the National Joint Committee on Fertilizer Application. Here are some of the recommendations.

Cotton: Fertilizers, when applied simultaneously with planting of the seed, should be placed in narrow bands approximately 2½ inches to one or both sides of the seed row and 1½ to 2 inches below the level of the seed.

The Mississippi Experiment Station recommends that with the equipment used at present in the hill section of the State, the best practice would be to apply the fertilizer and bed the land 10 days to 2 weeks, or possibly longer, before planting. Care should be taken to see that the fertilizer is deep enough to be 2 to 3 inches below the seed.

Corn: When corn is hilled or check-planted, fertilizer should be dropped at the hill and not drilled. Hill applications are best placed in bands 6 to 8 inches long, ½ to 1 inch to each side of, and from 1 inch below to slightly above the seed level. For drilled corn, fertilizer should be drilled uniformly in continuous bands in the same relative position as suggested for hill applications.

Fertilizer for potatoes should be applied in bands at the sides of the row. It should be about 2 inches to each side of the seed and from 2 inches below the seed to the seed level. On sloping land, in order to avoid fertilizer shifting too close to the seed, it is recommended that the fertilizer be placed about an inch below the seed level.

For sweetpotatoes, place fertilizer in wide bands on each side of the plants 10 days after setting, then cultivate fairly deep to assure mixing the fertilizer with the soil.

For small grains, applying the fertilizers at time of planting through the fertilizer attachment of the grain drill, which places the fertilizer close to and in partial contact with the seed, has been found superior to separate application, either broadcast or drill.

Information on application of fertilizers to other crops including important vegetables can be obtained upon request to county agents, the State Extension Service, or the National Fertilizer Association.

Obsolete Equipment

Many farms are not now equipped to take full advantage of new developments in fertilizer application. Much of the equipment on farms is obsolete in design and could be profitably replaced with modern and more efficient

The broadcasting type of fertilizer distributor in common use in Mississippi, especially the delta, is well adapted for pastures, hay crops, and small grains.

machines. According to the Bureau of Agricultural Engineering of the U. S. Department of Agriculture, there are in use on American farms 5,000,000 machines that apply fertilizer at the time of planting or as a separate operation before or after planting. Many of these are 10 to 20 years old and more or less obsolete in so far as fertilizer application is concerned. The Bureau says that many machines otherwise good could be modernized by new parts or attachments, and that the replacement of the others with modern machines, properly designed to place the fertilizer as herein outlined, should bring substantial returns on the investment required. Although manufacturers have made rapid improvements in commercial distributors, there are still many inefficient machines on the market.

According to a study of fertilizer-distributing machinery made by the National Joint Committee on Fertilizer Application, there are many different classes of fertilizer distributors. However, with regard to placement, all machines place the fertilizer (1) broadcast, (2) in spots or broken bands, or (3) in continuous rows. The Committee also classified fertilizer-distributing machinery into (1) machines used only for applying fertilizer, (2) combination machines for applying fertilizer and planting the crop in one operation, (3) combination machines for applying fertilizer and tilling the soil in one operation, and (4) machines for applying fertilizer in solution with irrigation water.

With so many different types of machines on the market, the farmer faces a problem in selecting the particular type of machine that will best meet his needs. Capacity for accuracy in applying fertilizers according to the latest recommendations should be given first consideration in choosing a distributor. Agricultural engineers say that a satisfactory machine should be capable of applying the fertilizer uniformly, with either broadcast or spot placement and with both light and heavy applications, should be easily adjusted for controlling the rate of application, should be adapted to the use of different types of fertilizers, and should be capable of applying both the lightest and heaviest rate likely to be required. The hopper should be large enough to avoid frequent refilling. Visible feeders, hopper agitators, and easy emptying and cleaning are also listed as requirements of a satisfactory machine.

Report to the Black Oak Agricultural Society

(*From page* 14)

The soils sent were marked by letters, the surface and the sub-soil from the same spot being designated by the same letter marked 1 and 2, respectively.

A.—Somerton near Somerset Creek, in 1000 parts.

	1	2
Sand	760	800
Clay	140	155
Moisture	30	25
Vegetable matter	70	20

The portion of 1000 grains of the soil soluble in warm muriatic acid furnished:

	1	2
Alumina	3.400	3.000
Oxide of iron	2.700	2.500
Lime	1.200	1.300
Phosphoric acid	2.000	2.300
Chlorine	trace	trace
Potash and soda	trace	trace
Magnesia	0.300	0.200

The following is a tabular view of the composition of the soils:

The following is a tabular view of the composition of the soils

In 1000 parts					Portion of 1000 parts soluble in warm muriatic acid							
Soil	Sand	Clay	Moisture	Vegetable Matter	Alumina	Oxide of Iron	Lime	Phosphoric acid	Chlorine	Potash and soda	Sulphuric acid	Magnesia
A 1	760	140	30	70	3.40	2.70	1.20	2.00	trace	trace	....	0.30
A 2	800	155	25	20	3.00	2.50	1.30	2.30	trace	trace	....	0.20
B 1	800	170	10	20	1.20	1.10	1.00	0.16	0.06	0.08	....	....
B 2	850	132	10	8	1.15	1.20	0.60	0.17	0.04	0.06	....	....
C 1	680	270	20	30	1.30	1.50	0.41	....	0.36	0.52	....	....
C 2	700	252	18	30	1.32	1.40	0.51	....	0.25	0.42	....	....
D 1	800	166	12	22	1.20	1.54	1.52	0.29	0.12	0.03	....	....
D 2	850	122	13	15	2.80	1.60	3.32	0.36	0.57	0.45	....	....
E	900	62	8	30	0.63	0.36	0.12	....	trace	trace	....	....
F 1	860	55	25	60	2.60	0.35	1.20	0.05	0.29	0.20	0.56	0.10
F 2	905	50	25	20	2.80	0.36	1.40	0.06	0.28	0.15	0.57	0.05
G	700	253	22	25	0.63	0.90	1.10	0.02	0.32	0.40	....	....
H 1	810	102	28	60	6.20	2.30	0.71	1.15	0.23	0.52	0.51	0.25
H 2	870	95	20	15	5.50	2.10	0.85	1.21	0.12	0.60	0.30	0.10
I	760	200	10	30	2.25	3.00	10.40	0.22	0.15	0.08	....	0.38
J 1	730	150	40	80	5.20	8.53	1.60	0.08	0.04	0.02	....	....
J 2	775	140	45	40	4.80	8.20	0.85	0.08	0.02	0.01	....	....
K 1	760	130	40	70	5.40	4.50	4.62	0.26	....	....	....	....
K 2	783	125	42	50	4.50	4.02	3.21	0.28	....	....	....	....
L 1	825	140	10	25	2.30	1.50	0.45	0.12	....	trace	....	0.13
L 2	862	120	8	10	1.80	1.65	0.62	0.20	....	trace	....	0.15
M 1	820	100	30	50	1.10	0.95	0.42	0.06	....	trace	....	....
M 2	875	90	20	15	1.50	0.65	0.61	0.08	....	....	....	....
N 1	800	110	32	58	2.40	1.68	3.20	0.20	....	trace	....	....
O	850	100	25	25	1.80	1.42	0.55	0.05	trace	trace	trace	....
P	720	180	40	60	3.20	0.90	0.35	0.07	....	trace	....	....
R	705	250	20	25	3.30	2.50	1.26	0.03	trace	trace	....	....

From these analyses I should certainly conclude that A and H were the best soils, on account of the larger proportion of phosphoric acid contained in them. Of these two, I am disposed to think that H will be found the better, from it containing more potash, chlorine, and sulphuric acid than A, although it has not quite as much phosphoric acid; a little dressing of leeched ashes placed immediately around the plant will very probably improve the growth of the cotton. The next best, according to these analyses, would appear to be B, D, I, K, L, N. But B, D, and K are said to rust cotton, the cause of which I will allude to in another part of this report, at least so far as I have been able to make it out. All the others I should consider as being able to grow cotton fairly, except E, which would appear to be unfitted for almost any plant.

It is not the province of this report to enter upon the various methods of improving these cotton soils, but it may not be out of place to state one thing that occurs to my mind, bearing upon the wants of the plant and character of the soils. It is, to let the laborer when he thins out for the last time carry with him a bag containing a mixture of ground bones (about as fine as river sand) mixed with an equal quantity of leeched ashes, and at the root of every stalk he leaves standing, throw a good handful immediately around it. In fact there is little doubt but that it will be found far more beneficial as a manure than cotton seed, and requiring a much less quantity.

The Ashley river marls and all such marls as contain from 4 to 10 per cent of phosphate of lime will answer well to put on the top of the ridges after the planting of the seed.

In a letter received from Mr. F. A. Porcher, accompanying the soils, he stated that F and G are representations of soils not very rich, but very safe, and reference to my analysis will bear this out. I should have stated, although I have no mention made of what sort of soil C is found to be, that I consider it a very inferior one. If any general conclusion can be arrived at from the analysis, it is that cotton soils—everything else being alike—is valuable according to the amount of phosphoric acid present.

The last point to be considered in this report is that of rust in cotton, and here everything is to be learnt. Rust, as a term in agriculture, is in about the same position as that of dispepsia in medicine. It is a name given to a variety of diseases which have some resemblance to each other, but are widely different as to their causes. The rust properly speaking, and which so commonly attacks wheat, is certainly a kind of parasitic plant of the class of fungi, that grows on the stalk, leaves, etc., of the wheat and other grain, under certain disadvantageous circumstances of weather and season. The seeds of this parasite are wafted by the breeze to the spot where it germinates; it takes root into the body of the stalk and interrupts the maturation of the seed. This rust is somewhat the color of iron rust, from which it derives its name; it readily detaches itself, and when burnt, leaves a little ashes. Now I am not aware that rust of this description has ever been known to infect cotton; that which attacks cotton shows no fungus growth, but under the effects of it the plant becomes blighted, changes in color, and dies.

To arrive at the true cause of the rust of cotton, the planter will have, by very close examination, to distinguish between the different kinds (if there be any difference) and mark well the influences that are operating upon the plant at the time they occur. When he goes as far as he can in this, let him call to his aid the chemist, give him the rusted cotton stalk and a healthy cotton stalk of precisely the same size and growth, as well as a portion of the soil taken up at the time the effects are noted. In acting in this way, the planter may hope to find out the causes of this blight, and they will of course point out the remedy which, if practicable, will meet all the wishes and repay the labor of the planter. It is not a rigorous method of comparison to examine the ashes of healthy and diseased plants unless they are of the same stage of growth, for ashes of plants differ with their age. Wheat-straw, just before the grain begins to form, contain some of those ingredients that afterwards abandon to a great degree the straw and pass into the grain, making a decided difference between the ashes of young and matured wheat straw.

My examination into the cause of the rust is very imperfect, not having been furnished, as you must now see, with the proper data to go upon in my investigation; but what has been done shall be made known to your body. I have no doubt that the peculiarity of seasons may produce these diseases as well as animalculae developed in the soil; but my firm belief is that noxious substances in the soil are frequently the causes, and they are more commonly some of the preparations of iron—the protoxide of iron especially. This protoxide was found by me in much larger quantities in D and K, particularly in K, than any of the other soils; in fact some of them contained none of it.

I can pronounce with but little confidence upon anything brought to light by the analysis of the cotton stalks, for the healthy and rusted stalks placed in my hands differed too much in size and age to furnish much information from the comparative composition of their ashes. But I did all that it was possible to do under the circumstances. There was decided difference in the amount of oxide of iron in the two ashes; in the ashes of the full-grown healthy plant it was only one half per cent, while in the ashes of the one diseased it was two and a quarter per cent. The phosphoric acid of the two did not differ materially, the healthy having nine and the diseased eight per cent. The proportion of lime was different, the diseased forty, and the healthy thirty per cent. The proportion of potash in the diseased was fifteen per cent, while that of the healthy stalk was twenty-four.

The protoxide of iron alluded to above is by exposure to the atmosphere, converted into the peroxide, a form from which no injurious effect may be expected, except when in very great excess; so I would suggest that in planting these lands, which rust cotton, as D and K, to disturb the surface as little as possible. This I know to answer in the case of certain soils that were examined for Dr. Townsend, of John's Island.

I am sorry that my unavoidable absence from America will render it impossible to prosecute these labors, commenced under the auspices of your Society, and I regret it the more since much time has been consumed in fixing upon methods best suited for carrying on these investigations. I hope, however, that the active part taken by you in inquiring into the true nature of the circumstances governing the growth of cotton will be crowned with the success it deserves, and that the report may aid in pointing out the right course to be pursued.

The wife awakened her husband.

"Good Lord, man," she squawked, "can't you quiet down a bit? You're snoring away at a mile-a-minute clip."

The husband pulled the blanket around his ears.

"Can't help it," he yawned. "I'm getting up very early in the morning and I've got to sleep fast!" . . .

"Daddy," said a six-year-old lad watching a farm auction, "what's that man doing to the cow?"

"Well son," said his dad, "he's examining her carefully. He wants to see if she's sound; he's probably going to buy her."

"Gee, Dad, we'd better get home before that brush feller who was at the house yesterday buys Maw."

General Horticulture

A Book Review

General information covering the entire broad field of horticulture has been collected into the book Textbook of General Horticulture by J. C. Schilletter and H. W. Richey of the Iowa State College. (McGraw-Hill Book Company, Inc., New York, 1940. $3.00.) As the name implies, the book was written primarily as a textbook, and the authors state in their preface: "The object of the present book is to set forth the essential principles of horticulture in a manner suitable for a general introductory college course."

The opening introductory chapter defines the field covered by horticulture, and gives its subdivisions into fruit growing, vegetable production, ornamental plants, and nursery stock and seed production. Horticulture production over the world as a whole and in the United States is discussed in the following chapters, showing by means of maps where the principal producing regions are located, and giving reasons for the developments in the particular areas. The following chapter becomes even more localized, and considers horticulture around the home. The layout of farmsteads with ornamental, small orchard, and garden plantings is given emphasis.

The next six chapters are devoted to horticultural plants as growing organisms, with brief discussion of how a plant is made up, its parts, how it functions, how it grows, how it feeds, and how it reacts to different temperatures, different moisture conditions, to light, and to soil conditions. Subject matter more strictly confined to the field of horticulture comprises the remainder of the book. There is a chapter on the propagation of horticultural plants, and another dealing with soil management from the viewpoint of the horticulturist. In the latter, sod mulching and clean culture in orchards are taken up, the plant-food elements and commercial fertilizers are briefly discussed, and information on irrigation is given. The next two chapters take up the principles of training and pruning, and following these are two chapters devoted to the important subjects of pests of horticultural plants and their control. Harvesting and storing what has been grown is the subject of the final chapter.

A Book of Principles

The book would appear to be well adapted to the purpose for which it was written. It is general and broad, with little attention given to details but with stress on principles. The authors state, "The approach to the subject-matter is from the viewpoint of fundamentals rather than from the culture of individual crops. Although the methods of performing certain practices are described in many instances, the emphasis has been placed on the reasons for the practices rather than on how they are performed."

It is difficult to take up in a single volume of ordinary size the broad field covered by the subject of horticulture, and when to this is added the great diversity of conditions under which the plants are grown in North America alone it is possible to deal only in principles unless an encyclopedic handbook is to be prepared. The authors intend that their book should be supplemented with material applicable to local conditions, but feel, and undoubtedly correctly so, that a knowledge of the principles will permit a more intelligent and efficient application of the detailed knowledge necessary in the successful production of plants and their products.

While the book is written for college students it can be recommended to all who wish to obtain a good background of horticultural knowledge.

Further Shifts in Grassland Farming?

(*From page* 21)

That this is not done under present farming conditions is indicated by the rapid decline of yields, as soon as the clovers disappear.

Even if a grassland system is more costly for fertilizers, it is considerably easier on the labor bills. Plowing will not need to be so frequent, and heavy hay crops that are difficult to cure will be put into the silo. This will ease up on hay-making charges. Moreover, the labor of filling the silo will be lowered, since hay crops are easier to handle than corn. The machinery costs of the farm will also be reduced, since no corn harvester, cultivator, or planter will be necessary, if corn is eliminated entirely. In short, the whole grassland management operation can be done with ordinary haying equipment. But the greatest saving of labor appears to be in hay making, especially during adverse hay weather, when silo filling can proceed, regardless of weather conditions.

Quite aside from costs is the advantage of being able to harvest hay when this should be done. Here in New Hampshire we have definitely established the fact that early cut grass carries more protein and has greater digestibility than that harvested later, and that second crops are likewise heavier when first crops are harvested early.

In a grassland system, all the hay can be cut at the stage at which it will be most valuable for feeding. Grass crops should be cut early, before the period of bloom, clovers and alfalfa can likewise be cut at the stage when feeding value is at its height. First cuttings of necessity will often be put into the silo, not only because of the need for silage, but also for the reason that the weather in mid-June is often adverse. Hay made during this period often loses a great deal of its nutrients and vitamins as well. These can be preserved without undue loss in the silo. Under such a system, all the roughage will be of high quality, and good roughage is one of the most potent factors for success in northeastern dairy farming.

Besides these shifts in fertility maintenance and in disposing of some of the hay crops in the silo, there is one other important change in farming practice that will have to be made. This refers to the seeding of hay crops, which will often be necessary to maintain yields and to keep legumes in the hay mixtures to as great an extent as possible. Under a grassland management system, plowing may be done after the first crop of hay is cut and the seeding made in July, August, or early September as conditions warrant. The idea of a quick summer seeding is to expose the soil to erosion as little as possible, never for a whole year, which is the case when corn is used as a rotation crop. July and August seedings are to be preferred to later ones, so that the new seedings will become well-enough established to control fall and spring erosion. Farm experience indicates that summer and early fall seedings of grasses and clovers are very successful, especially so on the heavier, well-watered soils that are most susceptible to and need protection from erosion.

This erosion menace has caught up with us, as it did the farmers of Europe centuries ago. Farmers there have already learned how to combat and control it. Grass crops are their chief asset in this respect. We, too, can utilize grass to further preserve our soils. But we cannot do it without changing our methods and making some shifts that are more or less revolutionary, and that will take a little time. Time to learn how these shifts may be made to advantage. Time even to adjust our mental attitudes so that these shifts will seem not only advisable but possible as well.

Small "Dose" of Boron Makes More Daffodils

A "spring tonic" for narcissus bulbs which makes them produce more stems, and consequently more daffodil blooms, has been discovered by Federal Department of Agriculture and North Carolina State College scientists.

In experiments at Castle Hayne, N. C., one of three narcissus bulb producing centers of the country, these workers found that 3 pounds of boron —common borax—mixed with commercial fertilizer applied at the rate of 1,000 pounds per acre, so stimulated the bulbs that flower yields were 10 to 25 percent more than when no boron was used.

Dr. S. L. Emsweller, in charge of floricultural investigations in the Department, reports that 20 different kinds of fertilizer were tested. The results for 2 years show that 6 treatments, including boron, topped the list in blooms produced—averaging in 1938 about 65,000 per acre with an average of 56,000 per acre without boron. The same bulbs replanted again gave in 1939, 70,000 blossoms per acre on boron plots and 54,000 on plots without boron. Roughly, 3 pounds of boron produced 9,000 more flowers in 1938 and 16,000 more in 1939 than without boron. It must be remembered, however, that the 1939 bulbs had received 3 pounds of boron per year for 3 years. The boron causes more "noses" to form on the bulbs.

The effects of the boron are delayed 1 year, because current season flowers form as "noses" the year before. For this reason home gardeners planting bulbs would not benefit from using boron. Too, since boron has a definite toxic effect on many plants, even in quantities as small as 10 to 15 pounds per acre the gardener should rely on the more experienced nurseryman to supply bulbs that already have their "dose" of the minor element. It is also possible that boron might not give the same results in localities other than North Carolina.

Trace amounts of minor elements often stimulate plants, says Dr. Emsweller. Trace amounts of magnesium, manganese, and copper were tried in the narcissus experiment, but only boron proved beneficial.

Corn Cost Goes Down As Acre Yields Go Up

Yield per acre is obviously the most important single element in determining the net cost of producing a bushel of corn, according to analysis by the Department of Agriculture, published in Crops and Markets. Tabulated costs for 1938 by groups of States in which conditions are generally similar, show that in Illinois and Iowa with yields averaging 45 bushels to the acre, the cost averaged 47 cents a bushel in 1938. Ohio, Indiana, Michigan, Wisconsin, and Minnesota corn with a 40-bushel average cost 59 cents. With a yield of less than 15 bushels to the acre, the southeast was the high cost producing area, averaging $1.08 a bushel.

Seed cost averaged 82 cents an acre in Iowa and Illinois, just about double the cost—38 to 43 cents—outside the Corn Belt. This reflects the widespread use of the more expensive but more productive hybrid seed now available for the high yield areas. In the other Corn Belt States, seed cost averaged 68 cents an acre.

Net acre costs, including rent, fell into three distinct groups: $21.15 an acre for Iowa and Illinois, $22.31 for the Northeastern States, and $23.69 for the Corn Belt outside Illinois and Iowa. In other areas costs ranged between $12 and $16 an acre.

Land rent averaged $6.05 an acre in Iowa and Illinois, $4.83 in the rest of the Corn Belt, $4.67 in the Northeast, and from $2.37 to $3.57 elsewhere.

Better Pastures in North Alabama

(*From page* 8)

The three crops mentioned have an added advantage, in that they may be harvested for hay in years when weather conditions make supplementary grazing crops unnecessary.

Small grain, preferably barley, and crimson clover seeded on fallowed land in August have afforded most satisfactory winter and early spring pasture. Combinations of barley and crimson clover are recommended since the crop may be grazed until the middle of March, the livestock removed, and the seed harvested at one operation in June. As a general rule the seed crop will afford sufficient returns to pay the cost of fertilizer, seeding, and harvesting. The one disadvantage is the fact that fallowed land must be used. This crop should be fertilized with superphosphate and potash at planting.

Small grain alone or crimson clover alone, seeded on fallowed land in August, will afford excellent winter and early spring grazing. Livestock may be removed in March and fair yields of grain or clover seed harvested. Superphosphate and potash should be applied

This is 4-year-old kudzu on the farm of C. C. Loyd. Kudzu affords the best late summer and early fall temporary pastures.

to these crops at planting, and the small grain should be top-dressed with nitrogen soon after it is up to a stand. Lespedeza may be seeded on the small grain in late February or early March for summer grazing or for hay.

Crimson clover and rye grass seeded on pastures or lespedeza hay fields are being tried and may prove satisfactory. Two disadvantages have been found to date, (1) stands for early grazing are hard to secure and (2) an excess growth of either crop will crowd out pasture plants in the spring.

Starting Something

(*From page* 5)

tentous kind, presaging some great alteration in the rules of the world. Nerve-racking as it is to others exposed to the beat of these bitter forces, perhaps in the long run we shall be stronger for having lived in an age of tension and unrest. At least it is Something New, and even that is better than stagnation.

From long custom it has been common to chant the chorus of the bells at this interval—ring out the old, ring in the new. To be sure the cash registers have done most of the ringing, so much at times as to mask the holy music of the bells. Certain classes of society and certain types of minds have refused stubbornly to reject the old, however indecent, outworn, and moldy it may be. Others in the minority have yearned to usher in the new, but lacked the power or the concrete plan to carry out the change successfully.

BUT just the same we owe a debt of gratitude to the past. It brings out our errors, and what is more, it gives us a heritage of tradition. This tradition may be family pride, ancestral glory, clan fealty, or national loyalty—each and all resting on the bowed backs of the humble rather than upon the shields of swashbuckling fakirs.

By this I mean that the tradition for truth and justice and progress inherent in our national fiber gets its origin from the common run of folks like yours and mine. Such discerning citizens as they, pursuing the ordinary roles of life, are the ones who detect the false from the true in statecraft and public leadership. But yet more vital than this, they afford living examples to their associates, which in the end determines the final destiny of any country through its fixed mass opinions.

EVERY reader will treasure memories of those who walked the common road and made life brighter by their presence—not just for Christmas and New Years, but forever and always. That is where our citizenship is proud and strong.

No essay at New Years is complete without dragging in a reference to Tolerance and Charity. That is, such might be the case in normal seasons, but this time I intend to devote this one paragraph to the worn-out topic and quit. I am afraid that humanity is too far gone on the dual road of aggression and defense right now for any humble opinion of mine to matter much. Better give the aforesaid virtues a vacation, unless perchance they are so sick of the scenery around here that they've moved out for good.

But when it comes to Faith, luckily, we still have the farmers to rely upon as a sure source of that medicine. Yesterday I met a rural friend over at the machine shop, where he was buying a new three-bottom disk plow for the spring turn-over. He didn't realize that his simple chore was a supreme evidence of faith, just the same kind we define as "the evidence of things not seen." It was almost criminal to ask him if he thought farmers had as much faith as big business or the industrialists.

EVERY year the farmer deals with hazards that are not human and are largely uncontrolled in the business of production. He is the greatest of gamblers, but not in the sporting sense of reaping huge profits or taking big stakes. He faces climatic uncertainty, and being ready for either a feast or a famine, he comes into the seed-time prepared to do his bit. The elements are at his elbow, and he meets the freaks of fortune, while the game of chance intrigues him from the clouds. He follows the round of seasons with calm precision, doing his customary duties and making his appropriate arrangements.

In abiding with faith like he does so regularly, the farmer doesn't have all smooth sailing. He also has his bogies and his ogres that gibber and jibe at him from dark spots along the way. Exposed as he is by dint of isolated residence and separate fields, even the modern farmer gets backed into bad corners sometimes by ghoulish ideas and cross currents of opinion. I think it is a great credit to his stability and his faith in average results, when we see him repeat new ventures on the scene of past failures. How many are there in other callings who can say as much?

I believe the farmer might well be taken as a text by New Years reformers who wish to convince narrow-gaged elements of society that this is a bad time to balk. Of course, the soil tillers have their moments of rebellion and frustration—times when they holler pretty loud and get red in the face; but somehow when spring comes along you'll find them all jogging into the fields to start something all over again.

Indeed I have often surmised what would happen if farmers stayed mad from mid-winter convention time to seeding season; if they decided to quit playing around in the back yards of America and took what they had left for a spree on main street. It would leave banks and government agencies with more land than they could handle and spoil the trading for countless emporiums. Economists would have to dust off that old word, "repercussion," again and watch it spiral across the continent kicking up a dust storm of troublesome events. If farmers decided not to start something in 1941, no amount of munition making or war propaganda would make up the difference to us in domestic security.

I guess we are all somewhat unmindful of the importance of a few simple realities right at home and get so chock-full of international bee-buzzing that we overlook the only things that really mean very much. Why, one good man-sized strike by all the capable farmers hereabouts would do more billy hell to America than all the airships from abroad.

I THINK this is the nugget for all of us to hang onto—namely, that we need to keep on starting something the best we know how, with a sort of inner fire and automatic stoking system like the farmers possess. Otherwise we just simmer along and cower around waiting for something to happen somewhere else. We become expert dodgers instead of competent doers. This practice hardly measures up to American history—at least "not the way I heeard it."

Well, this is about the end of my rope. Maybe I haven't said much or started anything wonderful; but as I said before, nothing in the way of unfinished business bothers me, and what I cannot complete now will wait very patiently, I am sure, for the moment when we meet again. Happy New Year!

No Hurry

The fellow stepped up to the door. He knocked and the door was opened by a beautiful blonde.

"May I speak to your husband for a moment?" asked the fellow.

"I'm sorry!" she said, "but my husband is away on business. He won't be back for at least two weeks."

The fellow pondered. "That's all right," he murmured, "I'll wait."

Man: Watcha cryin' for?
Boy: I lost my nickel.
Man: Where?
Boy: In Virginia.
Man: How come?
Boy: She swallowed it.

Early one morning, on the second day out, a terribly seasick passenger, pale and hollow-eyed, came out of his stateroom and ran into a lady, who was coming along the passageway, clad in the scantiest raiment. She screamed and started to run, "Don't be alarmed," groaned the man. "Don't be alarmed, madam; I shall never live to tell it."

"Pard'n me, shtranzher—wherzh other side uva shtreet?"

"Why, right over there."

"Thash what I thought, but I wuz zhust over there and they shed it wuz over here."

Wife: "Tomorrow is the tenth anniversary of our wedding. Shall I kill the turkey?"

Husband: "Why, what did he have to do with it?"

One trouble with many of us white folks is that we haven't developed a working philosophy like that of the fat negro cook down in Houston, Texas.

She was asked what was the secret of her calmness and freedom from care. Her reply was thorough and complete:

"Well, h'its disaway. When I sits I sits loose. An' when Ah stah'ts to worry, I falls asleep."

Old-fashioned

Sweet Young Thing—My boy friend has cold feet.

Fond Auntie—Shame on you, young lady. In my day we didn't find out those things until we were married.

Tourist (in mountains): This is a wonderful place. I'm sure I can get plenty of ozone here!

Native: Yes, stranger, all you have to do is to leave a jug and a half dollar at the side of the road; go away for five minutes and when you come back the money will be gone and the jug will be full.

Printed in U. S. A.

Better Crops with PLANT FOOD

February 1941 10 Cents

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Better Crops with PLANT FOOD

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R. H. STINCHFIELD, *Editor*

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Editorial Office: Investment Bldg., Washington, D. C.

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American Potash Institute, Inc.

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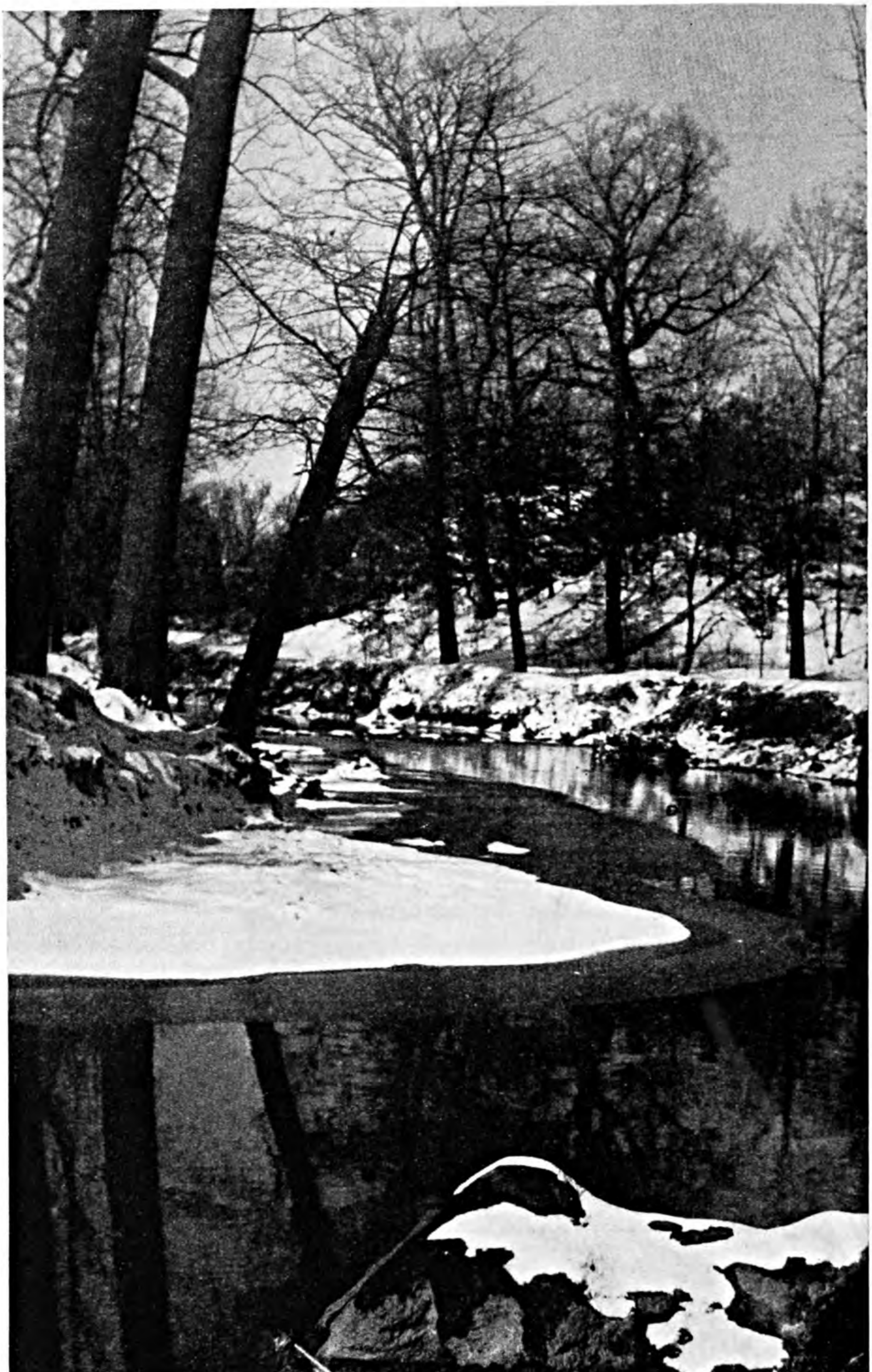

"HALF AND HALF," AS WINTER GIVES WAY TO SPRING

Better Crops with PLANT FOOD

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Let's enlarge the scope for—

Valentines

Jeff McDermid

EXPLANATIONS are perhaps obligatory from a husband who has enjoyed twenty-five years of wedlock in good standing without sending his wife a valentine—or buying a ticket to Reno either. But on the other hand, the woman who wears my ceremonial ring does not have to yank the fluttering petals off a daisy, one by one, to determine the reason why I persistently hang around the kitchen when she is presiding there.

Not that this is going to be a lurid confession story sent to the wrong magazine—far from it. We have never kept a maid and we do not flavor our viands with alcoholic tonics, so neither scandalous triangles nor dizzy circles explain my preference for the sanctum of domestic economy—and she knows it.

What she also knows is that I am uncommonly unhandy with carving and casserole cooking; that I am not to be trusted over much with can-openers or egg-beaters; and that I wipe dishes with the same ferocious zeal which I put into shaking the furnace.

She often remarks that it is amazing that we still possess all our wedding set of spode and limoges, after a quarter century of this dinner-hour diligence of mine. For, she says, I have worn out three or four grates, stripped the gears on at least one auto and a couple of sewing machines, and burned holes in rugs faster than she can hook 'em.

Nevertheless, she is never heard lamenting about my lapse of memory or my sagging sentiment anent the subject of Valentines. Scraping dishes, sopping up sinks, and planning meals for a family diverts the mind from lovers' knots and forget-me-nots. Unless perchance, like many other bygone brides, this duty-laden helpmeet of mine occasionally finds Cupid in the cupboard and bliss in beaten biscuits.

Whether she does or not, I do at any rate. To me, who seldom sends Valentines, a spell spent in the wifely workshop is worth hours hunting up lyrics in a library. The brown hair of thirty years ago is more charming than ever, tinged slightly with strands of silver. If worry or bother took the pigment from her brow, so much the more is that a mark of noble resignation. The brown hair I used to see was a promise, the gray hair of today is fulfillment.

Hands that remain dainty and flexible and capable after being denied so much of the help they could have hoped to receive; shapely feet that have clambered along a rougher road than the bridegroom ever intended; and eyes which stay serene despite this present world of dreadfulness—what kind of gaudy mercantile Valentine could be trusted to say it properly anyhow?

Neither can you march right out into the kitchen and tell her that pointblank. It would be harder than doing the original asking. She would sniff and toss her head at first—disdain amid the doughnuts—but if persisted in for very long, I am sure there would be a quick call put in for the village doctor. It won't do to unload a batch of delayed sentiment all in one delivery, either written or verbal. Minds have cracked for less cause than that. Or she would think it a reflection on her cookery and blame it at once on something I had "et."

VALENTINES are usually regarded as being anonymous tokens of regard, which partly absolves me from sending any. If I remain sort of anonymous under my present authorship it seems sufficient without cluttering up the mails with lackadaisical correspondence.

Yet nothing prevents me from looking backward toward the times when Valentines meant something in my charmed scholastic circle; and then perhaps to give you an inkling of some anonymous tokens of regard which I might send if I had enough jack left on February 14 after Christmas bills and tax receipts come in.

Back in the "golden rule days" the missives we sent by way of the handy class-room post-office were of two kinds —the heart-throbs and the slanderous comics. I suppose these are still in circulation the same old way by the same old route, but only those with grade school youngsters are privileged to see much of them. I used to go by myself and distinctly on the sly select my heart-throb specimens, but I was glad enough to go along with the fifth ward gang when the choice of comics was in order.

WHEN driven by silent adoration to express myself in somebody else's melting meter, I sidled into the long aisles of the dingy store on Main street, and by slow degrees nonchalantly strolled over to the Valentine counter. If there were no girls of my own age hanging around, I sampled the saccharine specimens carefully, in an effort to obtain as much red-hot blandishment as possible for a small outlay of cash. If two or three giggling and cold-snuffling females were poking at the piles of lacey gems, I hastened to transfer my attention to the Nick Carter dime novel rack until they had gone. Some of the girls bought Valentine materials and toted them home for sticking and trimming. Not me—I had too many teasingly inquisitive members in the family. I chose to buy my sizzling sentiment right off the griddle and put it in secret cold storage so it would keep sweet until the day of dispensation.

But it was the zero hour of juvenile justice indeed when we smeary-faced urchins met at the store after school to pick over the flimsy lithograph monstrosities done in sickly and poisonous hues on longish strips of cheap print paper. We had no secrets then. We pooled our power-house of mean ideas and helped each other paw over the fearful litter in search of the most lurid, damnable, and ire-provoking insults possible to find on short notice.

Sometimes we were needlessly unkind and brutally thoughtless, such as when we conspired to send a Valentine about Dowdy Dora to a spinster teaching our class in mathematics, who had to scrimp and save and make over her clothes so as to keep a brother in college; or that Foolish Phiz cartoon sent to a lad with rather vacant mentality.

Yet looking at it as a whole, I verily believe some of those sallies on Valentine day were laudable correctives to smart alecs and bullies. The thing which gave them a special bang was the fact that they came from unknown sources, having something of the stern disciplinary influence of fate or the natural elements. One who received a critical analysis of his mood, manner, or character in this frank and vigorous fashion took it to heart perhaps more effectively than if his Sunday school teacher had tried to point a moral with it; and certainly it got by better than a curtain lecture at home. In fact, I knew a few incorrigible nuisances who were much improved and toned up after getting a barrage of caricatures in the w. k. schoolroom mail box.

ON the Fourteenth of the month everybody was on the *qui vive* for the closing hour of school, when teacher declared the "ballot box" closed and time to "count returns." Among the girls the sport was to see who got away with the most Valentines. The boys, with those comics impending, vied to see who got away with the most mischief.

There was for one short season, I recall, a certain blonde young miss sitting ahead of me whose long braids were forever slapping about among my pencils on the knife-scarred desk. Some girls less amiable and comely might have tempted me into tying erasers and paper strips to those golden locks just a foot or so before my eyes; but I held her in constant calflike reverence and awe. If she dropped a slate or a tablet I was the first to see and retrieve it. On a few rare occasions at recitation I was able to give her the right answer in a hoarse whisper.

I never went to any parties with her; never wrote her any notes; and never walked with her along quiet streets, carrying her books while she carried my heart. But her back hair got into my lessons and her soft accents got into my life for awhile, both of which were equally disturbing for at least one term in the sixth grade. Then she up and moved to Kansas.

BEFORE that Valentine day forty years ago when she was foremost on my horizon, every time I looked up for eight hours a day (and a good share of the other hours), I wrestled over the deep mystery why a member of our gang could so easily become a backslider and a renegade. I did not choose to bear the stigma of a sissy chaser when there was so much more invigorating sport to be found at the ball ground or the boat house. Yet I watched the advent of February 14 with mingled shame and daring. That date would tell my fate.

And lo and behold, it did. I have never been the same man since. Not that the mawkish little fluttery card I sent her counted up much in her collection, but it separated me from a hoydenish time of boyhood wherein manly ideals of pirates and robber caves and buried treasure crowded out all taints of softer things. Not that I once and for all divorced my lovelorn soul from the community of comrades known as "Chuck" and "Barrel Head"

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Right: cotton without potash in the top-dresser showed rust, potash hunger, and yielded only 740 lb. seed cotton per acre. Left: where 100 lb. muriate of potash was added to the side-dresser the cotton showed no rust and yielded 1,260 lb. seed cotton per acre.

The Cotton Program in Bertie County, N. C.

By B. E. Grant

County Agricultural Agent, Windsor, North Carolina.

INDICATIONS are that Bertie County averaged a bale of cotton per acre in 1940 for the first time in its history. When the beautiful fields of stalks of medium height laden with fluffy white bolls were contrasted to the 1939 cotton fields of excessive stalk growth but few bolls, courage and determination that cotton can still be produced in North Carolina were renewed.

In 1939 Bertie County planted the smallest cotton acreage and made the smallest average yield of any year recorded. With an allotment of approximately 10,000 acres, less than 6,000 acres were planted and only 1,862 bales produced, an average of 164 pounds lint per acre. After making two very short crops of cotton in succession, many Bertie farmers said they did not intend to plant any in 1940 since they had lost money on both the 1938 and 1939 crops. During the past 17 years cotton production has been a major extension project in the County, but we had begun to wonder if we were justified in continuing to make it a major project.

In 1939 Bertie County farmers planted 10,000 acres of tobacco, whereas the tobacco allotment for 1940 was 5,802 acres. The difference in acreage planted in tobacco for the two years was about the same as the difference in the allotment and planted acreage in cotton for 1939. With tobacco exports sharply curtailed, little hope could be held out for much increase in the price for tobacco even with the reduced production. We realized that our farmers would need an additional income to take the place of the tobacco taken out of production.

Based on the results of demonstrations conducted on Bertie farms and in other counties, along with experimental evidence, an educational program was put on which included: The Agricultural Conservation Program and the benefits from it; production of ample food and feed supplies on the farm; use of good cotton land for cotton; use of certified Coker-100 seed; moderate fertilization; pre-square poisoning; and organization of one-variety communities.

In the educational work with the Agricultural Conservation Program, we explained the cotton payment, which includes the parity payment and the conservation payment, and that the combined payment amounts to approximately 3c per pound which producers who comply with the program are sure of getting, regardless of the crop actually produced as a result of weather, insects, and other hazards. The regulations that any farm having a cotton allotment will lose its allotment if no cotton is planted for three consecutive years were explained.

Farmers were urged to produce all the food and feed crops needed and that could be produced economically, including ample corn and hay, a year around garden, plenty of pork for home use and some for sale, and more milk cows to supply the farm families with milk and butter.

As a part of the cotton project we have conducted cotton variety tests on Bertie farms during most of the past 17 years. When these variety tests were started, most of the cotton planted was inferior gin-mixed varieties with a staple of ⅞-inch and less. We were advised that most of the mills in North Carolina used cotton of $^{15}/_{16}$ to $1^{1}/_{16}$-inch staple. The Experiment Station and plant breeders furnished us seed of improved varieties to use in comparison with each other and with local varieties. These variety tests showed that we could produce as good yields of lint of the staple length desired by North Carolina mills as from the inferior and gin-mixed seed.

Cotton-mopping demonstration on J. B. Wadsworth's farm at Woodville, N. C.

During the early years of this work, it was evident to us that under weevil conditions we needed earlier maturing and dwarfer growing varieties than those in use at that time, so we have constantly been on the lookout for such varieties. When the Coker-100 variety was first used in these variety tests, it appeared to come nearer reaching this ideal than any other variety we had used. Accordingly, we began to advocate the use of this variety, and in 1937 we assisted farmers in getting 163 bushels of pedigreed Coker-100 direct from the breeder, with the request that seed stocks be saved to furnish other farmers.

In 1939 two such variety tests were conducted on Bertie farms. These were conducted on C. B. Griffin's farm at Woodville and Dr. Wayland Mitchell's farm near Powellsville. In each of these tests Coker-100 Strain 2 was the leading variety, and so in 1940 we concentrated our efforts in getting the maximum acreage planted in certified seed of this variety. Accordingly, Bertie farmers, ginners, supply merchants, and fertilizer dealers were assisted in getting 2,500 bushels of certified Coker-100 Strain 2 from Union County. In addition to this, 500 bushels of certified Coker-100 Strain 1 and about 200 bushels of pedigreed Coker-200 Strain 1 were secured. With the Coker-100 seed already on Bertie farms, practically all the cotton grown in the County in 1940 was of the Coker-100 type. Results from the three variety tests and the yields on Bertie farms indicate that no mistake was made in making this selection.

Seed Treatments Beneficial

Many times we have seen farmers plant their cotton and get such a poor stand that the crop had to be planted over or else cultivated with such a poor stand that maximum yield could not be secured. Sometimes this would be from failure to get a sufficient stand of plants to emerge and other times from the plants dying after coming up during cold weather. For a number of years we had treated the seed with Ceresan and observed that a better stand of stronger plants was obtained from the treated seed. In late winter of 1936, we decided that enough preliminary work had been done to justify an educational campaign on seed treatment. For conducting this campaign, we had a barrel seed treater made and

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Using surplus cotton to make mattresses for low-income farm families.

A 25-lb. rate of borax applied to the plot on the right eliminated "alfalfa yellows" and produced a more vigorous, healthy growth.

Use Boron and Potash For Better Alfalfa

By R. W. Donaldson

Agricultural Extension Service, Amherst, Massachusetts.

BORON as well as potash appears to merit attention in fertilizer practice for alfalfa on some Massachusetts soils. A definite response secured this past season from applications of borax in control of "alfalfa yellows" substantiates for this area similar findings reported previously in other regions. Moreover, local trials showed that where a deficiency of boron is manifest in an alfalfa stand, ordinary applications of muriate of potash do not replace a need for extra borax applications.

The field trials which I mention now were simple pilot plots applied November 1939, the Massachusetts Agricultural Experiment Station and several county agents cooperating. Sixteen fields of alfalfa were selected at random, but representing several soil types ranging from coarse sandy to those of heavier loams. Each trial consisted of a strip on which borax was applied at a 25-pound rate, crossed by a similar strip on which muriate of potash (60%) was applied at a 300-pound rate to the acre. No attempt was made to restrict the owners from superimposing their own top-dressing treatments.

The spring crop which followed showed no visible effect from either the borax or potash applications. This first cutting grown under favorable moisture conditions developed normal healthy growth in all cases with no sign of yellowing.

It was a little surprising, though, not to find some response from our potash applications. However, upon questioning the owners, we learned that all these fields had been top-dressed by them in the spring. Their treatment, for the most part, had been fairly liberal in minerals. It included muriate of potash, 200 to 300 pounds to the acre, which in some cases had been an annual practice of the past several years. This may explain in part our failure to obtain response to the extra potash.

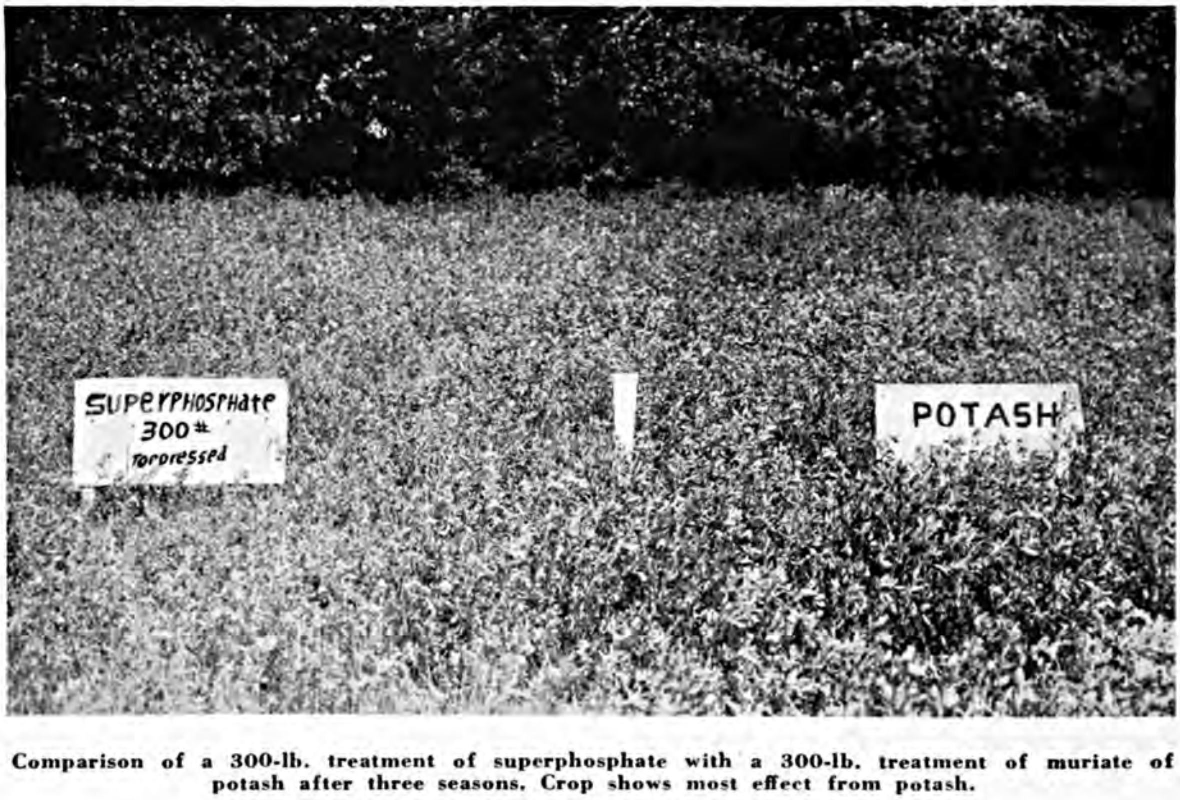
Yellowing Appeared

"Alfalfa yellows" appeared in the second crop and again in subsequent growth on about half the fields. The symptoms observed were a yellowing or occasionally a reddening of the terminal leaflets, accompanied by more or less stunting of plants and shrivelling of the terminal buds. These symptoms were more evident at maturing stages of the crop.

In contrast with unhealthy appearance of these stands, the borax-treated plots stood out in marked relief, having healthy, dark green color and taller growth. This contrast reappeared on the third crop and in late November, long after killing frosts, the taller stems still marked the plots of borax applications.

Only one field showing "yellows" failed to give response to the 25-pound rate of borax applied. Leafhoppers, or an insufficient rate of borax in this particular case perhaps due to heavier liming, or some other factor, may have been the cause.

The fields which developed trouble and gave response to borax were all located on the lighter soils. Moreover, the appearance of the symptoms of deficiency coincided with periods of drought. There was little rainfall for the latter half of June, and the period from late July until autumn frosts was abnormally dry. The remainder of the fields included in these pilot tests showed no evidence of alfalfa yellowing, nor were borax applications on these soils of noticeable value in this one season's tests. Since a majority of these unaffected fields were located on somewhat heavier soils and may have suffered less from lack of rainfall, one infers that lack of moisture is a predisposing factor of boron deficiency.



Comparison of a 300-lb. treatment of superphosphate with a 300-lb. treatment of muriate of potash after three seasons. Crop shows most effect from potash.

A 300-lb. rate of muriate of potash top-dressed annually on half of this area at the right produced the above results in four years on the College farm—a gain of 3½ tons more hay per acre and a productive stand for further yields.

A somewhat better comparison was available in another trial to indicate a need for borax on plots of alfalfa which had shown marked response to moderately heavy rates of potash fertilization. In this case, the alfalfa plots had been top-dressed annually for three successive years with muriate of potash (60%) at 300-pound rates and with triple superphosphate (47%) at 130-pound rates, each applied alone and in combination. Across these plots and to include the check, a treatment of borax was superimposed for observation in the third year of trial.

In this set-up, a very marked response in alfalfa growth had been obtained from potash compared with other treatments. However, alfalfa yellowing was evident here. It appeared more or less uniformly on all the plots after the early cutting except where the borax had been applied. This experience tends at least to strengthen an opinion gained from observations of our pilot plots, namely, the characteristic symptoms of yellowing may occur despite ordinary practices of mineral fertilization, but may be controlled through use of borax.

Many workers have shown that only very small amounts of borax are required to correct soil deficiencies of boron. On soils which require boron, as little as 5 pounds or less up to amounts of 50 pounds to the acre, as a rule, supply the need, depending upon the tolerance of the particular crop and upon the time and the method of application. Injury to plants may occur from an overdose, and this seems especially true of applications made at time of seeding.

How Much to Apply

For example, two years ago one trial was conducted in which borax was broadcast at the time of seeding in varying rates up to 50 pounds to the acre. The period was July and included a seeding for each of alfalfa and Ladino clover, located on a heavy limestone soil with the pH around the neutral point. Observations made during the remainder of that season showed retarded growth and white marginal scorching of the leaves on both of these seedling legumes as well as on seedling weeds where the amounts of borax applied exceeded a 30-pound rate to the

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Good pastures mean cheap feed for dairy cows and beef cattle. Thanks to research, cattle are going to better and better pastures.

Florida's Search For Better Grasses

By J. Francis Cooper

Agricultural Experiment Station, Gainesville, Florida.

IT took American farmers 150 years to learn that grass, which the forefathers found growing abundantly in this country, is still the best thing to grow on many thousands of acres. Generation after generation of cotton farmers, particularly, have fought grass with untiring energy, plowing and hoeing row crops to get cash with which to purchase meat and other needed supplies.

Former Secretary Wallace has compared grass to the locks which gave Samson his strength, and said that farmers have been lured by the Delilah of profits to shear these locks and thus have lost strength as a result. "A countryside shorn and stripped of this thick green grass, it seems to me, is weakened just as Samson was," he says. "An agriculture without grass loses a primary source of strength. Like Samson, it is in danger of falling a prey to destructive forces."

Farmers are learning the value of grass, are counting it now as one of their important crops. And grassland conferences held during July and August at the behest of the Department of Agriculture have called additional attention to this new, yet centuries old, crop and have reviewed research with it to date and laid plans for expanded investigations.

The Florida Experiment Station has made prolonged studies of grasses and their management and has secured much worth-while information about them, as have many other research institutions throughout the country. The Florida workers have tested many kinds of grasses to find those best adapted to different uses and have studied various fertilizers and management practices.

Following the political injunction to "get down to grass roots," Dr. W. A. Leukel several years ago built what he called a "showcase" for studying the growth of grass roots without having to pull up the grass. This apparatus for spying on the roots consisted of compartments about five feet deep and two feet square, with one side of each compartment glassed in. Removable panels were placed over the glass, the compartments were filled with soil, and the grass was started in them. The panels could be removed. and the grass roots observed through the glass.

Dr. Leukel noted effect on root growth of different fertilization practices and methods of handling the grass—frequent mowing, less frequent mowing, and no mowing. He found that sometimes in the spring the roots of Bahia grass grow as much as five feet in five weeks, and that the roots often grow to depths of eight feet. This is one of the reasons why Bahia has proven so desirable for high, dry lands—if there is any moisture to be found, the Bahia roots will find it.

Cows grazing Napier grass at the Florida Experiment Station.

Native Grasses Not Best

Grasses have abounded in Florida, as elsewhere, since before the white man came to its shores. The Florida cattle industry, founded largely on native grasses, has been an important one for 150 years. But wiregrass, which covers the great majority of the State's native range lands, is not the most desirable type for grazing purposes. It provides succulent grazing for a few weeks in the spring and early summer and then becomes tough and unpalatable. From 10 to 20 acres of native range, except in prairies and other favorable locations, are required to supply grazing for one cow during the year.

Progressive cattlemen have long desired more nutritious grasses which would provide grazing over a longer period. And research workers have sought them incessantly for several decades.

The Florida Experiment Station has maintained a grass garden for more than 30 years, where it has tested hundreds of different kinds of grasses. Many of them have been introduced by the U. S. Department of Agriculture from other countries throughout the world, as a part of its plant exploration and introduction work that has established dozens of new crops in this country. When new grasses have shown promise in the grass garden, they have been given wider trials on farms before being finally accepted in the State's agriculture.

W. E. Stokes, head of the Station's agronomy department, says that Bahia grass was first tested in 1914 and Napier in 1915. Both have since come to occupy important places in the pasture and forage program of Florida cattlemen, Napier becoming fairly widespread by 1920.

Napier is a native of Tropical Africa. Mr. Stokes says it is the heaviest yielding grass yet tested at the Florida Station. It is a tall, rank grower somewhat resembling small canes and is satisfactory for soiling (cutting and feeding green), silage, and supplementary pasture purposes. It is killed by continuous close grazing, but thrives under rotational grazing. It can be propagated by seed, divided root clumps, or by planting partially mature canes. It is usually planted 3 to 4 feet apart in rows 7 to 8 feet wide. Being a perennial, one planting will last indefinitely if not overgrazed.

All told, the Florida Station has tested several thousand strains of Napier supplied by the U. S. Department of Agriculture. Some of the strains have been subject to a leaf spot disease. Disease resistant strains with good forage characteristics have been selected, multiplied, and distributed to farmers.

Bahia, also a perennial, is a native of South America. Tested under Florida pasture conditions for the past 26 years, it has shown up exceptionally well, being second-best producer of beef. Its deep root system makes it desirable for higher and drier soils. In establishing it, best results have been obtained by broadcasting 15 to 20 pounds of seed per acre and covering very lightly, but solid plantings can be made.

In 1929 Dr. Leukel noted the growth behavior of Bahia grass plants which were cut frequently and those cut less frequently or only at maturity. The frequently cut plants maintained a more vegetative condition, were generally of a darker green color, and were vigorous in the production of new leafage and other vegetative parts. However, under adverse growth conditions at certain periods during the season, these plants sometimes showed a less vegetative condition than plants cut less frequently.

Plants cut in the seed stage were vigorously vegetative during the early part of the growing season and produced abundant leafage during this period. With the advance of the growing season, they became decidedly reproductive and ceased vegetative

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The best method of seeding Para grass is to scatter cuttings on the ground and disc them in. This grass is excellent feed. It is grown on fertile, moist soils of southern Florida.

Some Requirements of Fiber Flax

By W. L. Powers

Oregon Agricultural Experiment Station, Corvallis, Oregon

SUITABLE soil maintained in a good state of fertility and tilth is of primary importance in the successful production of fiber flax in the North Pacific Coast region. Progress has been made in recent years toward successful mechanization of harvesting operations, and modern scientific and mechanical skill should help to firmly establish processing and milling operations to provide local markets and manufacturing plants for flax produced. Flax-growing promises to provide an additional cash crop to the farmer, for which there should be a protected market in this country.

According to chief council for the U. S. Government at Belfast, the linen goods imported into this country annually have had a retail value of \$25,000,000 to \$50,000,000. The linen textile industry of Belfast alone is reported to employ 85,000 workers. The possibilities in flax and linen under western Oregon climate cause much interest, particularly since the European war has interfered with production and importation.

The general soil conditions suitable for fiber flax include good drainage, a good supply of nitrogen and organic matter, and slightly heavy textured soil such as silt loam, having good tilth, usable water capacity, and fertility. Early plantings on clean, well-prepared land seeded around March 15 to April 10 have been most successful. Supplemental irrigation has been very helpful, especially when there was dry weather in June. Early planting permits taking advantage of the spring moisture and moist atmospheric conditions in early season and brings on the "grand period of growth" during the longest days of the year, which was proved by Redington and Priestley (1925) to be important in fiber flax production.

The recently completed soil survey of the Willamette Valley and a study of the flax crops in recent years show there is an abundance of land suitable for fiber flax production in this region. Soils on the old valley filling or main valley floor well suited for fiber flax production include those of the Willamette series, and also the soils of the Amity series where needed drainage has been provided. The Willamette series includes 351,680 acres and the Amity series 277,568 acres, so that there are over half a million acres in the main valley floor capable of producing flax. Some of this land is now devoted to permanent crops These soils are suitable for flax growing about once in four years in a crop rotation that will include grain, clover, and a cultivated crop. The clover sod will supply nitrogen, and the cultivated crop helps to eliminate weeds.

Flax Soils Tested

It should not be difficult to find 50,000 acres a year of old valley filling soils that could be devoted to fiber flax, if market and economic conditions come to warrant it. The soils from flax contract fields were tested and found to be slightly to moderately acid, with 1 to 2½ tons lime requirement, and the available phosphate was moderate in amount, ranging from 25 (low) to 125 (good) pounds per acre to plow depth. The nearly available potassium (Neubauer tests by V. C. Bushnell) ranges from 390 pounds in the surface 8 inches of Newberg fine sandy loam to 918 pounds in Chehalis loam studied. It appears 500 pounds or more are desirable for flax or potatoes.

The recent stream bottom soils include some good flax land, principally the soils of the second bottom of Chehalis series, with a total area of 218,715 acres. Flax has also been successfully grown on heavier textured soils of the Newberg series. There are approximately a quarter of a million acres of bottom land that would grow flax as cleared, of which perhaps 25,000 acres should be available for flax production annually in a 4-year rotation. It should not be difficult, therefore, to grow as much as 50,000 acres of flax on the main valley floor, or 25,000 acres on suitable bottom land, if market and economic conditions should come to warrant it. Robinson (1932) reported most of the fiber flax grown in Oregon was planted in three soil series with the following production: Chehalis—3,514 lb. per acre; Willamette—3,099 lb. per acre; and Amity—2,633 lb. per acre.

The Soils Department of the Oregon Agricultural Experiment Station has conducted field and plant house studies of the nutrient requirements of fiber flax during a period of 12 years. Review of the literature and early results obtained with several soils have been reported previously by Powers (1928 and 1936). Flax was grown in water cultures, soil plats, and field fertilizer trials with a view to obtaining information about nutritive requirements of this plant for maximum fiber production.

Potassium and nitrate were found to be especially needed, and potash was found important in the early growth period. Potash seemed to increase the yield and also length and strength of straw or fibers. The effect of nitrate on vegetative growth has been marked in some experiments. Nitrate appeared to increase fiber yield less than it did straw yield, while potassium seemed to affect fiber production more. There is also an indication that superphosphate is effective in increasing the seed yield, while potassium sulfate increases the ratio of fiber to that of seed.

Microscopic examination of many stained cross sections of fertilized and unfertilized flax stems and fibers shows that potassium increases the plumpness and causes wedging or crowding. X-Ray photographs, secured through the cooperation of Professor Dore of the University of California, show that no difference in individual cellulose units resulted from fertilization.

Field fertilizer and irrigation trials with fiber flax have been conducted for the past decade on Willamette silty clay loam in the irrigation field of the college farm, and results are summarized in Table I. Treatments were applied ahead of the flax crop in a 5-year rotation that included grain, clover, flax, potatoes, and corn. Including some

TABLE I.—AN EIGHT-YEAR AVERAGE YIELD PER ACRE

Willamette Silt Loam—Irrigation Field, Corvallis, Oregon, Agricultural Experiment Station, Soils Dept.

Treatment	Average Yield	Average Net Gain by Irrigation	Average Gain by Fertilization	Average Gain Irrigation & Fertilization	Six-year Average Fiber Yield
	Tons	*Tons*	*Tons*	*Tons*	*Lb.*
Unfertilized	2.17	.90	....	....	613
Potassium Sulfate	2.31	.87	.14	1.03	624
Potassium and Nitrate	2.44	.81	.27	1.14	652
Potassium, Nitrate, and Phosphate	2.50	.74	.33	1.18	680
Average	....	.83	....	1.12	....

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Just a little congestion at a State line, caused by variance in regulations regarding motortrucks.

Letting Down Barriers To Selling Good Crops

By C. B. Sherman

United States Department of Agriculture, Washington, D. C.

AFTER the farmers have raised their better crops, they sometimes come up against barriers to selling them in the very next State. If farmers live so near the boundary that their nearest natural market is in the adjacent State, this may be a serious matter. These barriers take different forms. In some instances the farmers just over the line may be blocked or penalized all along the way when they try to take or send produce to this market.

Regulations by States regarding motortrucks that come from beyond their borders are one of the forms of interstate trade barriers that affect perishable crops the most. Fruits and vegetables lend themselves readily to motortruck marketing. Increases in the quantities so marketed have been phenomenal during the decade. Many farmers depend entirely upon that means, and the distance that these perishables can be trucked in short time is noteworthy. It is a great and growing business, aided by the huge crops that have been grown in answer to the shift in diet toward fresh foods and by the widespread work to improve the quality of crops and shipment.

Yet this business is hampered just as soon as the motortruck must pass a State line, in many instances. A complicated maze of regulations and restrictions, differing in nearly every State, has been thrown up around many of the boundaries.

Several States make all motortrucks

that cross their borders register and pay a fee no matter how good or how needed the food they carry. Others make out-of-State trucks pay higher ton-mile taxes than trucks that use only State licenses. It may be argued, of course, that out-of-State trucks should contribute as much as home-State trucks towards maintaining the roads, and that they do not unless they pay the State registration fee, or a high-ton-mile tax. This argument may have some merit, but the special burden on truckers who cross the State line and who have already paid a registration fee in their own State remains. In some instances, farmers of good crops who depend on truckers from other States to come in and take their produce have protested against their own State laws that hinder interstate commerce by motortruck.

Equipment Regulations

Then there are a multitude of troubling regulations about lights, windshield wipers, defrosters, mufflers, locks and keys, bumpers, fuel tanks, steering gear, tool kits, and fire extinguishers. They may be so hard to keep up with and so hard to meet that a shipper gives up a market across a State line that may want the goods, and sends to another market in his own State that may be further away and perhaps oversupplied. This means waste in time and probably lower prices.

Under port-of-entry legislation several States have placed checking stations at points where main highways enter the State. Here officials stop incoming trucks and make detailed inspections, check for insurance coverage, and collect taxes that vary with weight of the vehicle and the distance it is to travel in the State. In some of these States, anyone driving a truck that does not have a State registration must fill out an elaborate form describing the truck and its load, the route to be taken, etc. One State has 66 ports of entry and there are 58 in another State. In a certain State two sheriffs ran for re-election on a platform that pledged non-enforcement of the motor-vehicle laws.

Next on the way to this market over the boundary comes the question of non-uniformity in State grade specifications, grade names, and grading legislation. This lack of uniformity confounds many growers and shippers, hinders trade in perishables, and causes endless annoyance. Any State grade definitions or packing or marking requirements that differ in any way from those required in other States lead in some degree to interference with the flow of goods into that State. This is the conclusion of investigators, yet there are comparatively few adjoining States that have exactly the same regulations in regard to grading, shipping, and marking perishables. State market officials are fully alive to this situation. They would like to work toward uniformity as rapidly as an informed public opinion in their States will allow.

Then when and if the produce actually reaches this near market across the line, it often faces further discrimination. A license fee to sell may be levied in excess of that charged to other sellers. Particularly is this true if the driver is selling produce beside his own, causing him to be known as a merchant trucker. Levying this larger fee may give most of the near producers a temporary advantage but it is likely to be a disadvantage to the distant growers in the State as well as those across the line, for most grower-truckers do not make long trips. They can't spare the time and they usually have small trucks not built for long hauls. An individual farmer in many instances does not have enough produce of his own to fill a truck at any one time.

Local-preference rules prevail in many markets. Space will allow only a few examples to be given. The trucker-dealer may use the Syracuse farmers' section of the regional market only if he sells produce grown in New York State. In the Farmers' Market at Hartford, Connecticut, only Connecticut-grown produce may be sold, although

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Meeting Fertility Needs in Wood County, Wis.

By H. R. Lathrope

County Agricultural Agent, Wisconsin Rapids, Wisconsin.

SOIL is Wood County's most valuable asset. The prosperity of the citizens of the County depends on the fertility of the soil. The wealth created in the County comes from the soil.

Soils in Wood County are of three major types. A large part of the heavy soil is known as Colby Silt. A belt running through the central part is known as Vesper Silt loam. Soils in the southern part of the County are composed of sand, peat, and muck. Most of the soils lack lime, phosphorus, potash, and nitrogen.

The problem of supplying these plant-food elements is an important one. Many farmers had hoped that if they continued in dairying, purchased some mill feeds, and took ordinary care of their barnyard manure, their soils would never become depleted. They are finding out that their soils are rapidly becoming depleted, in spite of good care of their manure and heavy purchases of mill feeds. Crop yields in many cases are too low for economical production of crops. Farms in Wood County have been operated only about 50 years. Soil tests show that already soils on many farms are hungry for potash, phosphate, lime, and nitrogen. It will cost money to supply these, but there is still time, and the returns at present prices of farm products will pay for the fertilizers and leave a handsome profit on most soils.

Fertilizer tests conducted during the past few years have demonstrated be-

Barley plot on Fred Hoefner's farm, Marshfield. Two hundred pounds of 0-20-20 increased grain yield 21.7 bu. and straw yield 860 lb. per acre.

La Verne Neve, 4-H Club member, in his hybrid corn plot. Two center rows fertilized with 3-12-12.

yond all doubt that there is a fertility problem in Wood County and that the increases in yields due to fertilizer applications will pay good dividends. Fertilizer demonstrations have been conducted at the Branch Experiment Stations at Marshfield and Hancock, Wisconsin. Valuable results have been obtained at these station farms. Many farmers from Wood County have attended "Station Days" at these Experiment Stations during the past 25 years. Many farmers have been wondering if the results obtained at the station farms could be secured on their own farms. Some have believed that their soils would not respond. Some did not have the ready cash to try out some fertilizer recommendations. During the past few years hundreds of Wood County farmers have become curious about their soil fertility problems and have brought samples of soils to the county agent's office for test. Several thousands of samples have been tested for phosphate, for potash, and for lime. As county agent, I have learned the areas where the poor soils as well as the better soils are to be found.

In 1940, 200 farmers and older farm boys cooperated with the county agent's office in conducting fertilizer trials on as many farms as there were cooperators. Soil tests were made on each of these 200 farms. Farmer cooperators were selected from among the AAA committeemen, older 4-H club boys, and young farmers who were interested in conducting a demonstrational enterprise in an effort to find out what is wrong with the soils and how they might be improved.

Fifty-seven older farm boys cooperated with the county agent's office in fertilizing 57 acres of 95-day hybrid corn. Fertilizer was supplied these farm boys, and for the most part it was applied with a hand planter and, in some instances, with a large spoon or trowel. Enough fertilizer was supplied each boy for 160 hills of corn in his acre hybrid corn plot. Outstanding results were obtained in practically every trial. A 3-12-12 fertilizer was applied at the rate of 175 pounds per acre. The fertilized row was selected in the middle of the field. An increased height of corn was apparent after the first two weeks. On August 3 some tall corn was brought in and judged by Professor Al. Cramer of the Wisconsin College of Agriculture. The tallest corn measured 9 feet and 10 inches. The yields on these corn plots averaged 78 bushels per acre. Several plots, which were harvested, ran over 100 baskets per acre. One plot which was husked and weighed yielded 77 bushels per acre where the fertilizer was applied as compared to 41 bushels where no fertilizer was applied. The cost of the fertilizer was just $2.34. The owner secured corn at 6¢ per bushel charging the fertilizer to the increased yield.

Cooperative Demonstrations

One hundred older farm boys cooperated with the county agent on a demonstrational enterprise "Bringing Back Clover on Wood County Farms." For many years farmers have had difficulty in getting successful stands of clover or alfalfa. On testing the soils where the poor stands resulted, I found that they were lacking in potash, phosphorus, and lime. These 100 farm boys selected fields of new seedings of clover or alfalfa where they expected to have difficulty with stands in 1941. Through the cooperation of the American Potash Institute and the Tennessee Valley Authority, one 50-pound bag of 60% Muriate of Potash, and one 100-pound bag of 62% T.V.A. phosphate were allotted each boy. This material was applied on a 1-acre plot in the central part of at least a 5-acre field. Fifty pounds of phosphate were applied on a ½-acre strip and 50 pounds of potash and 50 pounds of phosphate were applied on the other ½-acre strip, leaving a strip of at least two rods wide between the two treatments. All of the boys, where the soil test indicated acidity, applied ground limestone or paper mill sludge to the entire 1-acre plot where the treatment was installed. All plots were staked out and a map made of the field and treated plots for future reference.

The boys and their fathers are anxiously awaiting the coming of spring so that they can determine the success or failure of the enterprise. The demonstrations are located in each of the 22 townships in Wood County. Each boy is pledged to make five representative sample cuts from the phosphate, phosphate and potash, and untreated plots and weigh them and record the yields. Already there is a keen County-wide interest in the demonstrations. If a majority of these plots show up better than the untreated plots, it

Peter Buteyn uses this hand applicator for spreading a 10-16-12 fertilizer on his meadow.

will give new hope and new inspiration to Wood County's agriculture.

Thirteen farmers cooperated with the county agent on a timothy hay improvement enterprise. Potash, phosphorus, and nitrogen fertilizers were applied on 1/10-acre plots. Three plots were installed on each of the 13 farms. Nitrogen was applied at the rate of 200 pounds per acre on all three plots. Phosphorus was applied at the rate of 100 pounds on two of the three plots. Potash was applied at the rate of 100 pounds on one plot so that there was a complete check on the value of the three fertilizers. The results were outstanding in every instance. On the W. G. Heuer untreated plot a yield of one-half pound green weight was obtained from 1/1000-acre plots (average of 5 cuts), and three pounds green weight were obtained where potash, phosphorus, and nitrogen were applied. An increase in green weight of nearly one pound was obtained on the average where potash was applied over the phosphorus plot.

Good Attendance at Meetings

More than 500 farmers attended meetings at these demonstrations. Fertilizers were applied on these timothy hay plots with a hand distributor 3½ feet in width. The 10-16-12 fertilizer analysis which was used gave such amazing results that hundreds of farmers have decided to use this combination on their night pastures and to pep up their timothy hay fields in 1941. The yield of hay was tremendously increased and the quality of the hay greatly improved. The hay on fertilized plots was more leafy, had a better color, and contained nearly twice as much protein when cut early as the hay cut on ordinary dates. The fertilized hay matured much earlier and permitted earlier cutting. The increase in feeding value of the timothy and the increase in yield of more than one-third in the fertilized plots over the unfertilized plots brought the demonstration farmers an extra 1½ to 2 tons of high protein hay on the first cutting alone. The second cut was equally as good and additional pasture was available on the fertilized plots. For the first time in the history of Wood County, timothy hay was made to grow so rank on the fertilized plots that it smothered out white and alsike clover. Increase in the rank growth of timothy was easily seen within 10 days after the application of the fertilizer, due largely to the nitrogen applied.

Seventeen farmers cooperated with the county agent in establishing fertilizer demonstrations on oats, barley, wheat, and rye. In these test plots, fertilizer was drilled in with the seed. A new combination drill furnished by the Oliver Company was loaned to the county agent for installing the demonstrations. Fertilizers were applied on Colby Silt loam, Vesper Silt loam, and the Sandy soils. The drill was towed behind the county agent's car for more than 1,000 miles in order to get the fertilizers applied at seeding time. Check plots of one rod in width were left on each field. On each of the 17 farms, ½-acre plots were installed, using 0-20-10 fertilizer and ½-acre plots using 0-20-20. In practically every instance the addition of double the amount of potash brought an increased return over 0-20-10, indicating that potash is necessary for the economical production of oats, barley, wheat, and rye.

Good Money Returns

Five 1/1000-acre cuts were taken from each plot as well as from the unfertilized plots. Sample cuts were dried out in burlap bags (heads down) and threshed at the Wisconsin College of Agriculture. Yields were computed from each threshed sample. The cost of the fertilizer was charged against the increase in yield and the additional value of the straw. The lowest return over the cost of the fertilizer was $3.36 while the highest was $21.63 on the 0-20-20 combination. No value could be attached to the increased yield of the

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PICTORIAL

A FUTURE FARMER WITH A FUTURE PORKER

Above: Sod draw and contour strips in a two-year rotation in Minnesota.

Below: A grassed waterway between corn and oats in Illinois.

Above: Terracing and strip-cropping in Minnesota with a three-year rotation.

Below: July view in Ohio. Note exceptional height of corn.

Above: Planning outlet for contour stripping system in Illinois. Waterway will be bladed in and seeded, and sod flume will be constructed.

Below: This 3% slope is being divided into strips for a four-year rotation on land that has lost one-half of its topsoil.

The Editors Talk

Large Scale Soil Testing

A year ago, in the February 1940 issue of Better Crops With Plant Food, an editorial entitled "Soil Information on a Mass Basis" briefly described a nation-wide program for testing soils in Germany, as reported by the American Consulate General in Frankfort-on-Main. It was stated that this large undertaking, which would involve the testing of 100,000 soil samples annually at each of the 70 agricultural experiment stations throughout the country, was made possible by the development of simple but accurate testing methods involving the use of photo-electric cells. Another advantage claimed for the methods was that they could be carried out by workers trained in the technique of the tests, but without the necessity that they have a scientific background.

This editorial attracted considerable attention, judging from the number of inquiries received from those who wished to have more details on the methods used. This fact, together with the Institute's own interest in the field of soil testing, prompted a search for articles which would throw more light on the technique than would come within the scope of a consular report. After some investigation, it developed that the methods referred to were the Schuhknecht-Waibel colorimetric flame tests for phosphoric acid and potash. The application of the methods is described in some detail by Schmitt and Breitwieser, of the Darmstadt Agricultural Experiment Station, in the magazine Bodenkunde und Pflanzenernährung, Volume 15, Number 5/6, 1939.

In order that those interested might have additional information on the method, the article has been translated and appears in the section on Foreign and International Agriculture in this issue of Better Crops With Plant Food. In making the translation, the introductory part of the article has been condensed somewhat, but the details of the methods and description of the apparatus have been included in full. The original article includes three illustrations of the apparatus, which we have not been able to reproduce here. The Carl Zeiss Company in New York states that it can supply the apparatus.

It will be seen from the article that the soil testing really is an adaptation of the Neubauer rye seedling method, well known in this country for many years. The new testing methods referred to in reports apply to the analysis of the ash of the seedlings, whereby the potash is determined by the flame test, measured by means of a photo-electric cell, and the phosphoric acid is determined by measuring the intensity of color developed by standard reagents and measured by the same photo-electric cell.

Because of the large number of analyses a worker can complete in a day, the authors call this a rapid method for testing soils. Their conception as to what constitutes a rapid method differs somewhat from that usually held in North America. Here it is commonly considered that a rapid test should be completed within a few minutes, or at the most, a few hours, with a minimum of apparatus, and in many cases, in the field. The Neubauer method, even with the recent modifications, requires two weeks' growth of the rye seedlings, following which the plants have to be carefully removed from the soil and sand in which they are grown, ashed, and then the phosphoric acid and potash contents of the ash determined. It is in the latter step that the new methods are introduced, displacing the older, more conventional methods of quantitative analysis.

The Neubauer is recognized as one of the best methods of determining the needs of a soil for phosphoric acid and potash, and the modifications in technique make it even more adapted to making large numbers of tests. Whether these advantages will cause it to displace to a greater or less extent the rapid tests developed in North America remains to be seen.

Back to Work on New Ideas

Southern agriculture has met, frankly aired its troubles, taken stock of the progress made in 1940, and gone back to work on countless ideas for a better South. Like the individual farmer early in the year programming his season's work, the Southern Agricultural Workers meet in early February to consider ways of best serving in their specialized capacities the rural section of our Nation which is suffering most from loss of our export trade, soil erosion, and resultingly lower standards of living. This year's was the 42nd annual convention of the Association, and it was held in Atlanta, Feb. 5-7. Attendance totaled more than 1,200. As previously, the convention was all-inclusive, covering fields of agricultural engineering, economics and rural sociology, information, soils and crops, animal husbandry, dairy science, forestry, home economics, horticulture, marketing, poultry, phytopathology, plant physiology, soil conservation, et al.

Highlighting general sessions and a great many of the group sessions were discussions on ways and means of obtaining better nutrition for the lower income groups. This important plank in our National Defense Program was not a new subject to the South, which for some years has been encouraging diversification of agriculture and a "live-at-home" program. Much progress along this line has been made, with great credit due the untiring efforts of Southern extension forces to wean a rural populace away from long-standing habits of thinking and acting only in terms of the "cash" crop.

The soil, foundation for all nutrition, was the key topic for many of the conferences. To more accurately determine its efficient fertilization, the use of rapid chemical tests was given considerable attention, many of the lines of research presented growing out of papers given at the convention last year. The use of plant-tissue tests was a new development. It was brought out that in many cases soil tests did not give entirely satisfactory results and that the use of plant-tissue tests offered the possibility of getting a better picture of the soil's fertility. In most cases it was felt that the two tests complemented each other, the soil test providing a practical chemical method of determining fertility prior to planting; the plant-tissue test, while the crop is growing. This then affords opportunity to correct unbalanced fertility by the use of top-dressers or by proper fertilization of the following crop.

Great interest was shown in these testing methods, and it was evident that much work on correlating these tests to local conditions needs to be done. That it will be done and that fertilizer practices in the South will be steadily improved are guaranteed by the earnestness and ability of Southern Agricultural Workers.

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

¶ Professor C. J. Chapman, of the Soils Department, University of Wisconsin, gives his annual summary of the large number of fertilizer demonstrations conducted with small grains and seedings of clover and alfalfa in the unnumbered mimeographed report titled "What Fertilizers for Small Grains and Seedings of Clover and Alfalfa." Farmers of this State undoubtedly obtain much of value from the instructive information contained in these reports, since the data show how the proper application of commercial fertilizer not only produces larger yields of grain and bigger crops of alfalfa and clover, but also gradually builds up the fertility of the farm as a whole.

Based on the results of more than 500 demonstrations in 1940 and hundreds of similar comparisons in former years, the Wisconsin authorities are recommending more and more potash for grain and legume seedings, even on the heavier soils of the State. For silt and clay loam soils in average fertility, an 0-20-10 at rates up to 200 pounds per acre is recommended where applied with a grain drill, or 250 pounds where applied broadcast. For the sandier soils where seedings of clover or alfalfa are being made, the officials recommend up to 300 pounds of 0-20-20 per acre. For small grains on the bottom muck or peat soils, 0-9-27 at the rate of 200 to 250 pounds per acre is advised. Some of the thinner light colored silt and clay loams where nitrogen is needed in the mixture should receive such analyses as 3-18-9 and 3-12-12. Certain soils may contain an abundance of plant-food nutrients and yet require no fertilizer, while others may need only phosphate. Farmers are urged to have their soils tested from time to time in order to determine the fertilizer that should be selected.

Professor Chapman says, "The future prosperity of Wisconsin dairy farmers will be measured by the extent to which they carry out a soil-building program. Our soils are wearing out—let's repair them."

"Production and Agricultural Use of Ammonium Sulfate," U. S. D. A., Washington, D. C., Cir. 578, Nov. 1940, C. C. Fletcher, Albert R. Merz, and B. E. Brown.

Soils

¶ A very interesting description of how Michigan's soils were developed during the different glacial stages, dating from about 10,000 to 30,000 years ago for the two or more ice sheets or glaciers known to occur, is ably presented by Dr. C. E. Millar, in Michigan Experiment Station Circular Bulletin 176, "Soils of Michigan." The circular briefly tells how the moraines, outwash plains, and lake-bed plains were formed; describes the soil formation—mineral or upland soils and organic soils; and gives some idea of the quality, or productiveness of the soils based on a State-wide classification of the land.

The author denotes the cardinal points in good soil management so that soil fertility may be maintained. These are: (1) adding lime to acid soils; (2) using a cropping system by which every cultivated field grows alfalfa, clover, or a mixture of grass and alfalfa every four years, or a crop of sweet clover turned under; (3) the careful saving and application to the land of all animal manures; (4) the control of erosion through rearrangement of fields, cropping system, and tillage practices; (5) using winter cover crops to prevent loss of plant food through leaching and erosion; (6) the use of commercial fertilizer to supplement the plant-food supply in the soil and manure.

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"Soil Survey, The Middle Yellowstone Valley Area, Montana," U. S. D. A., Washington, D. C., Series 1933, No. 33, Aug. 1940, William DeYoung, F. K. Nunns, and L. H. Smith.

"Soil Survey, Kaufman County, Texas," U. S. D. A., Washington, D. C., Series 1936, No. 3, June 1940, E. H. Templin and J. W. Huckabee, Jr.

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"Erosion and Related Land Use Conditions on the Mad River Watershed, Vermont," U. S. D. A., Washington, D. C., Erosion Survey 13, 1940, C. H. Atkinson.

"Erosion and Related Land Use Conditions on the Lake Crook Watershed, Lamar County, Texas," U. S. D. A., Washington, D. C., Erosion Survey 14, 1940, Harvey Oakes.

Crops

¶ "Farmers in a Changing World" is the title of the 1940 Yearbook of Agriculture, U. S. Department of Agriculture. Most of the 54 articles in the book record explorations along the social and economic frontiers of agriculture, and were prepared by workers in the Department whose job it is to conduct research in agricultural problems and carry out laws relating to agriculture passed by Congress. A few contributions were by writers who are not in the Department—mostly specialists in various branches of social science.

"The book is divided into seven parts. Part 1, The Farmer's Changing World, is a history of agriculture in the United States from the colonial period through 1939, with special emphasis on changing needs and conditions that have shaped national policies during these centuries. Part 2, Agriculture and the National Welfare, deals with relationships between producers and consumers, agriculture and industry, farm people and city people. Part 3, The Farmer's Problems Today and the Efforts to Solve Them, is a comprehensive survey of current agricultural problems and current efforts to solve them. These problems fall into several different groups—soil conservation and land use; farm management; foreign and domestic markets; credit, insurance, and taxation; rural standards of living; tenancy and labor. Part 4, Farm Organizations, reports the viewpoints and recommendations of three national organizations of farmers in the United States—viewpoints that are sometimes opposed to, sometimes in favor of, specific policies. In Part 5, What Some Social Scientists Have to Say, a few representatives of different social sciences view agriculture as a whole from their particular angles. Part 6, Democracy and Agricultural Policy, deals with the relationship of policy making to democratic processes. Part 7, Essentials of Agricultural Policy, is an attempt to sum up what has gone before in terms of today's and tomorrow's policies."

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"Fall Irish Potatoes in North Alabama," Agr. Ext. Serv., Auburn, Ala., Cir. 201, May 1940, Lyle Brown.

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"Early Tomatoes in Alabama," Agr. Ext. Serv., Auburn, Ala., Cir. 205, July 1940, Lyle Brown.

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"Papaya Culture in Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 350, Oct. 1940, H. S. Wolfe and S. J. Lynch.

"Winter Clover Pastures for Peninsular Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 351, Nov. 1940, R. E. Blaser and F. T. Boyd.

"Cotton Variety Experiments at Seven Locations in Georgia, 1937-1940," Agr. Exp. Sta., Experiment, Ga., Cir. 124, Dec. 1940, R. P. Bledsoe and U. R. Gore.

"Lespedeza and Its Uses," Agr. Ext. Serv., Athens, Ga., Cir. 283, Mar. 1940, E. D. Alexander.

"Austrian Winter Peas and the Vetches for Fertilizer, Feed, and Soil Protection," Agr. Ext. Serv., Athens, Ga., Cir. 284, Aug. 1940, E. D. Alexander.

"Commercial Vegetable Recommendations," Agr. Ext. Serv., Athens, Ga., Elmo Ragsdale.

"How Extension Helps Farm People, 1940 Annual Report," Agr. Ext. Serv., Honolulu, Hawaii, Bul. 38.

"Making Better Use of Legumes and Grasses," Agr. Ext. Serv., Urbana, Ill., Aug. 1940, E. T. Robbins, E. D. Walker, and W. B. Nevens.

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"Farm Woodlot Management in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 201, Oct. 1940, Lloyd F. Smith.

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"Report of the Secretary of Agriculture, 1940," U. S. D. A., Washington, D. C.

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Economics

¶ For the first time the Connecticut Agricultural Experiment Station has included data relative to the tonnage of different grades of fertilizer sold in the "Commercial Fertilizers Report for 1940," Bulletin 441, by E. M. Bailey. Publication of information on fertilizer tonnage sold in the State is the result of a conference between representatives of the fertilizer industry operating in Connecticut and fertilizer control officials, at which it was agreed that such information should be published by the State. Tonnage included in the Bulletin includes only fertilizers which are subject to provisions of the Law of the State and does not include fertilizer materials distributed under the Government's Agricultural Conservation Program.

During the 1939-40 fertilizer year

16,471 tons of materials containing chiefly nitrogen were sold. These consisted largely of cottonseed meal, castor pomace, soybean oil meal, and nitrate of soda. The sale of materials containing chiefly phosphoric acid amounted to 5,941 tons and consisted mostly of superphosphate. There were 2,713 tons of potash materials sold, of which 1,894 tons were cottonhull ashes and 819 tons muriate and sulphate of potash. The 2,624 tons of organic materials containing nitrogen and phosphoric acid which were sold were made up mostly of ground bone and dry ground fish. Mixed fertilizer sales amounted to 32,463 tons, of which 29,648 tons were commercial mixtures and 2,815 tons were special mixtures. The most important grade from the tonnage viewpoint was 5-8-7. Other important grades in the order of the tonnage sold were 6-3-6, 4-8-4, 8-16-16, 5-3-5, 7-7-7, 4-8-10, and 5-10-10. The combined total of these grades represented 66.5% of the total of mixed fertilizers used.

¶ Fertilizer sales in Massachusetts in 1939-40 amounted to 64,998 tons, which was slightly higher than in the previous season, but about 4,000 tons less than in the period ending July 1, 1938, according to Bulletin 105 of the Massachusetts Agricultural Experiment Station, "Inspection of Commercial Fertilizers," by P. H. Smith and J. W. Kuzmeski. The totals do not include the superphosphate distributed by the A.A.A. Plant-food tonnage in 1940 amounted to 3,526 tons of nitrogen, 5,541 tons of phosphoric acid, and 3,967 tons of potash as compared to 3,488 tons of nitrogen, 5,531 tons of phosphoric acid, and 3,871 tons of potash in the previous season. Of the total tonnage 43,736 tons were in the form of mixed fertilizers, 19,673 tons represented chemicals and materials unmixed, and 1,589 tons pulverized natural manures. Leading mixtures in order of their tonnage were 5-8-7, 4-8-4, 6-3-6, 4-8-7, 4-8-10, 7-7-7, 8-16-16, 5-8-10, 5-10-10, and 7-6-6. The 10 leading grades represented 70.5% of the total of mixed fertilizers sold.

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"Fertilizer Report, 1939," Dept. of Agr., Harrisburg, Pa., Vol. 23, Bul. No. 5, Sept.-Oct. 1940, Gen. Bul. 571, John H. Light, Secretary.

"Should My Community Organize?," Agr. Ext. Serv., Knoxville, Tenn., Pub. 241, Nov. 1940.

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"Commercial Fertilizers in 1939-1940," Agr. Exp. Sta., College Station, Tex., Bul. 593, Sept. 1940, G. S. Fraps, T. L. Ogier, and S. E. Asbury.

"Selecting A Farm in Vermont," Agr. Ext. Serv., Burlington, Vt., Cir. 108, Sept. 1940, Hermon I. Miller.

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"South Brazil—New Land of Cotton," U. S. D. A., Washington, D. C., Cir. C-117, May 1940, Omer W. Herrmann.

"Getting at the Facts About Agriculture, Program Building," U. S. D. A., Washington, D. C., DS 19.

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"Production, Farm Disposition and Value of Beans, 1909-37," U. S. D. A., Washington, D. C., Sept. 1940.

"Working Plans for Permanent Farms," U. S. D. A., Washington, D. C., Misc. Pub. 411, Oct. 1940, Glenn K. Rule.

Foreign and International Agriculture

To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

Bodenkunde und Pflanzenernährung, Vol. 15, No. 5-6, 1939

THE APPLICABILITY OF THE SCHUHKNECHT-WAIBEL APPARATUS FOR DETERMINING POTASSIUM AND PHOSPHORIC ACID TO THE FLAME PHOTOMETRIC AND COLORIMETRIC DETERMINATION OF POTASSIUM AND PHOSPHORIC ACID IN SOIL EXTRACTS AND PLANT ASH. *By L. Schmitt and W. Breitwieser, Agricultural Experiment Station, Darmstadt, Germany.*

Extensive investigations by the authors with the use of various apparati for determining the potassium in plant ash showed that a flame photometric determination could be carried out with satisfactory accuracy and great rapidity. Apparatus prepared by the Zeiss company permitted the determination of potassium in ash of plants obtained by the Neubauer rye seedling method so accurately that 42% of the determinations agreed exactly with determinations made by the perchloric acid method, 82% varied no more than 1 mg., 98% varied no more than 2 mg., and 100% fell within 3 mg. of the perchloric acid method results.

The Neubauer method long has been considered the most satisfactory means of extracting the available phosphoric acid and potash from the soil, but the time-consuming and tedious potassium determination of the ash of the plants has acted as a deterrent to its more widespread use. With the development of a method of determining phosphoric acid and potassium in the ash of the rye seedlings, whereby several hundred determinations can be made by an investigator in a day, the authors believe that the Neubauer method can now be classed as a rapid method for the determination of available nutrients in a soil.

The original apparatus was provided with a mirror galvanometer. This required considerable space and has since been replaced by a Siemens and Halske light-beam galvanometer. The latter is somewhat similar in design to a needle galvanometer, but the needle is replaced by a light-beam which is reflected on a scale divided into 100 parts. The light-beam galvanometer has the advantage of ease of installation on any table. While the scale has only 100 divisions, the light-beam is very steady and the readings can be estimated to fifths of a division. Comparative trials with the two types of galvanometer gave satisfactory results with the more easily used light-beam galvanometer.

Details of Method

The rye seedlings are ashed and the silica removed in the usual manner. The residue is taken up with exactly 1 cc 25% HCl and about 10 cc hot water. After solution of the incrustations, all is washed into a 100 cc flask with hot water, and after cooling, filled to the mark. After shaking, the solution is filtered through a potassium-and-phosphoric-acid-free folded filter into a 250 cc Erlenmeyer flask. This is termed solution A.

Determination of Potassium

Compressed air, passed through a glass filter for purification, is brought to 1.5 atmosphere pressure by a reducing valve, and regulated to exactly

.6 atmosphere by a manometer. Acetylene from a tank is passed through a reducing valve, and with a water manometer, brought to 160 mm pressure. The gas enters the burner and is ignited at the nozzle. It is very necessary to hold the pressure absolutely constant during the entire period of the determination. The pressures have to be adjusted to each set of apparatus, according to directions supplied by the manufacturer, the figures given above applying only to the apparatus used in this work, but are mentioned to give a general idea of pressures employed.

The image of the flame, enlarged about threefold by a lens, appears on a white diaphragm screen, which is attached to the photoelectric cell. Behind the diaphragm screen is the red filter which permits only the light of the potassium double line from the potassium spectrum emitted by the flame to pass through. The 80 volt current of the photocell is taken from an anode battery and the photocurrent arising from the light falling on the photoelectric cell is measured by a light-beam galvanometer, illuminated by means of an accumulator.

The positive pole of the galvanometer is connected with the positive pole of the anode battery, the negative pole of which is connected with the negative pole of the photocell, and the positive pole of the photocell is connected with the negative pole of the galvanometer.

The apparatus must be calibrated with solutions of known potassium content. For this purpose, 15.829 g KCl dried in a dessicator over calcium chloride, is dissolved in water to make a liter, this being equivalent to 10 g K_2O per liter. Portions of this solution are diluted to give 15, 20, 25, etc., up to 100 cc per liter, corresponding to the same number of mg K_2O per 100 cc. By regulating the iris diaphragm attached to the photocell, the apparatus is adjusted so that on determination of the standard solution with the highest potassium concentration, the galvanometer light-beam reads 100 on the scale.

The individual solutions are introduced into the atomizer through a glass funnel with a pinchcock. The air laden with the small particles of liquid goes through an intermediate flask to the burner. After reading the galvanometer deflection, the liquid is drawn off through a pinchcock to a jar under the table. The reading on the scale and the K_2O concentration are then plotted to make a calibration curve, or made into a table of standards.

Before running any series of analyses, it is advisable to check the calibration curve with the standard solutions. When shutting off the apparatus, the acetylene should be shut off first, then the compressed air.

The apparatus now prepared by Zeiss is also suitable for analyzing solutions of very low potassium concentration, such as obtained by water or acid extract of soils, which may contain less than 1 mg K_2O in 100 cc of solution. In these cases, the light-beam galvanometer is not satisfactory, and a highly sensitive mirror galvanometer should be used.

Determination of Phosphoric Acid

For the determination of phosphoric acid, the illuminating apparatus, provided with a cell-holder and funnel, is introduced into the path of the light by means of an elevated arm. The acetylene and compressed air parts of the apparatus naturally are not used in this determination. The light of the illuminating lamp goes through the cell to the opening of the white diaphragm screen and thereby to the photoelectric cell. About 10 cc of solution are needed to fill the cell, the filling and emptying of which are done quickly and simply by use of pinchcocks.

Here also a calibration of the apparatus with solutions of known phosphoric acid content must be carried out. A standard solution containing 1.9170 g KH_2PO_4 (according to Sörensen) or 1 g P_2O_5 in a liter is used. Of this, 2 cc are diluted to 500 cc, and 2 cc (=0.2 mg), 3 cc, etc., of the latter are placed in a 100 cc flask with exactly 1.4 cc molybdate reagent made up according to Zinzadze, with about 80 cc hot water. This is heated on a water bath for one-half hour. After 18 hours, the flask is made up to the mark, shaken, and the solution drawn for the cell.

The solution with the lowest phosphoric acid concentration is run first (the opposite to the course followed with potassium) and the light-beam galvanometer is set by means of the resistance of the illuminating lamp and iris shutter so that the mark of the light stands at 100. By running stronger solutions, and plotting the galvanometer readings against concentration of solution, a calibration curve is obtained.

For determination of the phosphoric acid in the solution of the ash (A), 1 cc is colored in a 100 cc flask as described above. The values obtained, multiplied by 100, give the phosphoric acid content per 100 g soil. Continual checking of the standard curve and of the apparatus with the standard solution is necessary. A blue filter also can be used in the determinations.

Summary

Apparatus prepared by Zeiss and Siemens and Halske for determining potassium and phosphoric acid according to Schuhknecht and Waible was tested by the Agricultural Experiment Station at Darmstadt in a large number of Neubauer ash determinations, with the following results:

1. The new apparatus using a light-beam galvanometer of Siemens and Halske is very well adapted to determination of potassium and phosphoric acid content of the ash of Neubauer rye plants.

2. With the apparatus, several hundred potassium or phosphoric acid determinations a day can be carried out without difficulty.

Further work will be necessary to ascertain whether the apparatus is adapted to the analysis of fertilizers and to the determination of other elements such as sodium, copper, calcium, manganese, and others.

Use Boron and Potash for Better Alfalfa

(*From page* 11)

acre. Judging by this experience, some caution should be observed in the amount of borax to apply at the time of seeding if risk of initial injury is to be avoided. Possibly 10 to 15-pound rates would be entirely safe and ample in most cases for seedling needs.

Somewhat larger rates appear safe and may be needed for older plants beyond the seedling stage. For established stands, a 20 to 30-pound rate seems satisfactory. One method of applying such small amounts is by mixing a grade of finely granulated borax with other fertilizers to be used.

Reference has been made to some results obtained from potash applications for alfalfa. Two instances will be cited.

In one trial, two methods of supplying potash were compared. On some plots, all the potash was mixed in the soil prior to seeding, using 500 and 1,000 pound rates of muriate of potash to the acre. On adjacent plots, potash was applied only as top-dressing, for comparison, using 300-pound rates annually for three seasons following. Treatments with phosphorus also were included. The soil is light in texture, underlain with sandy gravel and is classed as Merrimac. In this trial, alfalfa responded well from both methods of supplying the potash. In fact, on this light soil type, the annual top-dressing treatment appeared to be entirely efficient.

A second trial, on the College farm, showed a marked response from applying potash only as top-dressing. In this case, the layout consisted of 12 seeding mixtures varying in amounts of alfalfa. The plots were seeded in 1935 in long narrow strips. During the five seasons this trial was in progress, muriate of potash was the only material used for top-dressing and it was applied only on one-half of the area across all the plots. This section received the muriate of potash each spring of the four years the plots were harvested and at the rate of 300 pounds to the acre. A slight difference in the vigor of plants appeared in the first two seasons due to the potash. This difference became more pronounced during the last two seasons of the trial.

Alfalfa plants especially responded to the potash treatment. During the third season, the yield of hay from the potash treatment was increased by 1½ tons to the acre over that of the untreated sections. In the fourth and final season, the yield from the potash side was increased by 2 tons over that of the no-potash side. After four seasons of harvest on these plots, alfalfa plants had practically disappeared and the yield of grass was low on the section where no potash had been supplied. In striking contrast was the vigorous productive stand of alfalfa remaining on the potash side. Not only had it produced a total of 3½ more tons of hay, but also it was in thrifty condition for further production due merely to a difference of 300 pounds of muriate of potash applied annually at a cost of around $6 to the acre.

Florida's Search for Better Grasses

(*From page* 14)

growth. Plants cut only at the end of the season were dry and retained practically no vegetative parts when harvested. It is now a well-known fact that pasture grasses of practically all kinds should be kept grazed or mowed to keep them succulent.

Because it is subject to cold damage, Bahia has been used as a pasture plant only in Florida. However, new strains show promise of cold resistance combined with palatability and bid fair to spread to other portions of the South. A strain from Paraguay has been tested at Florida for three years and is being pastured this year. G. E. Ritchey, associate agronomist with the Florida Station and the U. S. Department of Agriculture, is highly encouraged by the results secured. The same strain is being grown in 1940 at experiment stations throughout the South.

Bermuda and carpet, two long-time favorite pasture grasses in the South, are still used widely for permanent and improved pasture plantings in Florida. Since Bermuda spreads by underground runners and is difficult to eradicate from cultivated fields, a strain known as St. Lucie grass—without the underground runners—has become popular in some areas. Also giant Bermuda, which grows taller and produces more grazing, is popular along the Florida East Coast and is becoming popular in other States.

Carpet grass, often in combination with common lespedeza, perhaps is still the most widely used grass on moist, fertile soils. A perennial, it is easily seeded during almost any month of the year in Florida, and tens of thousands of acres of Florida land have been seeded to it during the last three years.

Dallis grass, a large perennial, erect, bunch grass, native of South America, stands heavy grazing. It seems best suited to non-acid muck lands, heavy clay soils of a moist nature, and flatwoods lands underlaid with clay. It is more winter hardy than any of the other pasture grasses in use at present and gives some winter grazing. This grass produces seed, but domestic seed usually are affected with a fungus which injures their germination, making imported seed desirable for planting purposes.

Another South American immigrant, Para, introduced into Florida many years ago is among the best available for plantings on fertile lowlands of southern Florida. It supplies some grazing most of the year, and during eight or nine months will carry two or three cows or other animals to the acre. In the Everglades country it is found along the spoilbanks of drainage canals and roadsides. It is propagated by rooted runners or cane cuttings scattered over the land.

Other New Grasses

Another grass which resembles Para, and is propagated in a similar manner, is carib. This was brought to the Florida Station in 1914 from Brazil. It is injured by frost at Gainesville, but thrives farther south in Florida. It has shown up exceptionally well under pasture conditions at the Everglades Experiment Station, Belle Glade.

Cogon grass and *Panicum repens,* both of which may prove to be severe pests if introduced into cultivated areas, have proven a combination apparently very promising for cut-over sandhill lands in tests at the Brooksville Station, operated by the U. S. Department of Agriculture with State cooperation. They develop a very heavy root system, grow rapidly, make a tremendous amount of herbage, and the Cogon grass seems especially well adapted to the light, sandy soil. It furnishes grazing early in the spring and somewhat later in the fall, giving a longer grazing season. It is prone to get tough unless closely grazed, and mowing the pasture is desirable when the Cogon grass gets tall.

This grass has attracted more attention at Brooksville than any other one tested, but it is not yet generally recommended because of its potential pestilential ability. No seeds are available, and vegetative plantings are necessary.

Some strains of wooly-finger grass from South Africa have shown up exceptionally well at both Gainesville and Brooksville, particularly the species *Digitaria marginata.* It seems to require fertile soils.

Another grass tested at the Experiment Station and on Florida ranges is Vasey. In Highlands County it was least affected by the cold weather of 1939-40, and has interested cattlemen for that reason. Mr. Stokes says it is not as good as Dallis, but may be better than Dallis for certain soils and climatic conditions.

Centipede grass from China has been under observation at the Florida Station for the past 22 years, and the grass has made a good showing in pastures in Florida. However, at Tifton, Georgia, it has not been nutritious, and Federal scientists are cooperating with Georgia and Florida workers in an effort to determine the reason for the variation.

No seed of centipedes are available, and vegetative plantings are necessary. It grows close to the ground. For these reasons it is not considered a top rank pasture grass. However, it has proven one of the best lawn grasses for light sandy soils of the Southeast, and it is widely used for this purpose.

Thousands of strains of various kinds of pasture grasses have been and are being tested, and many new ones are showing promise. Florida Station agronomists are recommending principally carpet, Bahia, Bermuda, Dallis, Para, and Napier for pasture and forage.

Pasture Requirements

Tests and experience have shown that moist, fertile soils and desirable grasses can be made to produce good grazing and cheap feed. Permanent pasture grasses can be seeded or started with vegetative plantings almost any month of the year in Florida. The principal requirement is moisture, and consequently the summer rainy season, June to August, is a desirable time to establish a pasture.

On range lands the undergrowth of saw palmetto, gallberry, and other bushes and wiregrass must be eliminated before the improved grasses are planted. Cattlemen are using heavy disk harrows and rotary cutters to eliminate undergrowth on thousands of acres of land.

Dr. Leukel has found that wiregrass can be retarded for more than a year by burning just before the advent of the rainy season in late April, May, and early June. Carpet grass seeds can be sown on the land at the beginning of the rainy season, and the young grass will get a good start before wiregrass can crowd it out.

Well-prepared, firm seedbeds and ample moisture are the other principal requisites for beginning a pasture planting. Mowing from two to three times a year to eliminate weeds and grasses which are becoming tough pays excellent dividends.

Fertilization of Grasses

Considerable work on the fertilization of grasses has been done by experiment stations throughout the country, and this type of research is being rapidly expanded to the point where a vast amount of definite information on the subject will be available in a very few years. The Florida Station inaugurated its fertilizer studies with grass in 1925 and enlarged them in 1937.

In common with the work conducted elsewhere, its research has shown that nitrogen is the principal element needed and gives the greatest increase in early growth and total growth as well as in succulence. However, lime, phosphate, and potash stimulate further growth and favorably influence the composition of the grass, producing more nutritious feed. Cattle prefer the fertilized grasses every time.

Dr. Leukel reported that grasses treated with a balanced fertilizer produced 1.4 times as much green weight as those with low potassium, and 2.5 times as much as plants treated with low phosphorus. Plants with a balanced fertilizer produced approximately twice the dry weight of top growth as did plants with low potassium or phosphorus. The elaboration of carbohydrates showed marked retardation, being about half as much in the low phosphorus and low potassium plants as in plants receiving a balanced fertilizer. Such retardation eventually results in abnormal growth and lower plant production.

Roy Blaser of the Florida agronomy staff reports dry weight yields of grasses almost doubled as a result of being properly fertilized for three years. He gives the following table of dry weight yields per acre of grasses grown on three flatwoods types of soil—Leon, Plummer, and Bladen.

Fertilizer Applied per Acre					Dry Yield per Acre (cwt.)	
Ground Lime	18% Super-phosphate	Muriate of Potash	Nitrogen in March	Nitrogen in August	1939	1937–39 Average
0	0	0	0	0	16.1	14.9
0	0	0	200	200	25.3	26.6
0	0	50	200	200	29.4	26.4
0	400	100	200	200	29.2	27.4
0	400	0	200	200	29.9	27.2
1,000	400	100	200	200	31.4	27.5
	800	100	0	0	20.4	17.7
2,000	...	100	200	200	25.2	24.5
2,000	400	0	200	200	31.3	27.8

The nitrogen applied consisted of half nitrate of soda and the other half sulphate of ammonia. The lime, phosphate, and potash were applied in

March 1937, the nitrogen in March and August each year.

It is seen from the figures in this table that light applications—400 pounds of superphosphate and 100 pounds of muriate of potash, together with 200 pounds of nitrogen each March and August—prove most profitable.

Mr. Blaser, assisted by Dr. Leukel, has carried the research even further and determined the effect of fertilization on composition of carpet grass. They supply the following figures on green yields and composition of carpet grass on a Bladen soil, the yield weights taken April 17, 1940—early in the season.

short on these two essential elements. Blaser says 1940 yields following nitrogen alone will be lower than in previous years. The agronomists believe that phosphorus and potassium deficiencies are common throughout a good portion of Florida. They have noted evidence both in 1939 and 1940 which lends credence to the belief.

Florida Can Grow Clover

One of the most important pasture findings for Florida is that clovers can be grown in this State, and that clovers may be grown satisfactorily in conjunction with perennial summer grasses, providing grazing when badly needed in winter. The legumes serve also to

Lime	Pounds Fertilizer per Acre			Green Yield	% K	% P	% Ca	% Mg	% N
	18% Superphosphate	Muriate of Potash	Nitrate of Soda						
0	0	0	0	63	.670	.132	.349	.161	1.89
0	0	0	200	502	.563	.100	.293	.193	1.89
0	800	100	0	84	....	....	....	....	....
2,000	800	200	200	1526	.430	.170	.544	.257	1.91
500*	200*	50*	200	2289	.794	.234	.572	.181	1.91
2,000	400	0	200	1161	.401	.170	.395	.210	1.91
2,000	0	200	200	961	.874	.106	.254	.153	1.91

* Applied every year; all other lime phosphate and potash applied in 1937; nitrogen applied every year.

It is evident that fertilization can double the calcium, phosphorus, and potassium content of carpet grass on Bladen soils in Florida. Bladen is typical of many flatwoods soils commonly found in the State. It is also evident from these figures that frequent light applications are more satisfactory than infrequent heavy applications of fertilizers.

In some of the studies where applications of nitrate have returned almost as good yields as followed complete fertilizers for the past three years, Blaser and Leukel are now finding evidence of potassium and phosphorus deficiency. In forcing the grass into higher yields the nitrogen has caused the plants to be

improve mineral, protein, and vitamin content of livestock feed and increase soil fertility, thus being doubly desirable.

It was formerly thought that clovers could not be grown in Florida, but B. H. Carlton, a Jacksonville dairyman, kept playing with them for nearly a decade, and finally succeeded in growing some excellent clover. He had done so many things, however, that he didn't know just what was the secret of his success. The Experiment Station inaugurated some studies which soon revealed that moist lands, fertilized with a ton of lime, 600 pounds of superphosphate, and 100 pounds of muriate of potash per acre, planted at the proper time to adapted varieties of clover, with the seed properly inoculated, meant success. The legumes are being grown on thousands of acres this winter.

Varieties found best adapted to Florida conditions have been White Dutch, California Bur, Black Medic, Little Hop, and Persian.

The knowledge about grasses is being greatly enhanced throughout the country, and Florida research workers are contributing their share. Better grasses and fertilization practices are providing greater quantities of more nutritious feeds and at the same time helping to prevent soil erosion and to solve the problem of overproduction of field crops.

Letting Down Barriers to Selling Good Crops

(*From page* 18)

an exception is made for Massachusetts-grown onions. Not long ago most of the dealers in the Northern Ohio Food Terminal, the centralized produce market of Cleveland, pledged themselves not to receive motortruck shipments of fruits and vegetables originating outside of the State.

Investigators say the only group that is likely to gain permanently from limiting the farmers' market to growers or to home produce are the established middlemen and that in many cases even this group is harmed, for such regulations usually limit the size of the market and drive away business. In general, the larger and freer the market the more buyers are attracted to it. Marketplace barriers against distant produce often mean that the truckers sell it on the streets or peddle it from store to store, leading to unstable conditions. In the height of the local season, distant producers cannot compete with the local growers anyway, and at this time the local farmers are likely to have a surplus they want to send to other markets—and then these local growers want to be restricted as little as possible.

Time to Change

Better than non-enforcement of troublesome barrier legislation is the effort to prevent barriers and even to reduce them. Since many States and markets have been given to protective and retaliatory action in this contest of barrier building, a campaign of correction must have wide scope and wide backing.

These are now assured. Governors of several States have called these barriers and many others to the attention of the citizens, and State agricultural officials have protested against them. Members of the National Association of Commissioners, Secretaries, and Directors of Agriculture have pledged themselves to resist future efforts to discriminate against farm products from other States. This Association also sponsored an investigation a year or two ago by the U. S. Department of Agriculture.

In issuing the report in 1939, based on this investigation, the Secretary of Agriculture stated that the situation was becoming of critical importance to every economic group in the country. He pointed out that some of the regulations are really a potential threat to the very industries they aim to protect and some have unexpected and dangerous consequences. Reprisals, retaliatory measures, and generally unwholesome attitudes between groups in different States and between States too frequently result.

The Council of State Governments resolved in General Assembly that "interstate trade barriers, under whatever guise, are detrimental to the economic welfare of the country." The Council called a National Conference on Interstate Trade Barriers. It pointed to scores of barrier bills pending in the State legislatures and declared that if this movement were not halted it would undermine a basic principle of the Constitution of the United States—a principle upon which our well-being largely depends.

Action Under Way

Action speedily got under way. A Federal-State campaign was outlined and set going. In an address before the Conference of Western Governmental Problems, the Secretary of Agriculture stated the goal to be a freedom of trade that will allow each market to admit any healthful and honestly described product from any part of the country. He urged a uniformity among protective regulations that would facilitate safe and satisfactory interstate shipment. He outlined several possible approaches to this goal, the third of which he thought the most hopeful. It calls for joint action by State and Federal Governments, each working within its own sphere but supplementing and reinforcing each other.

At this time the Secretary announced that a committee in the Department of Agriculture had already begun to consider and propose specific partial solutions. During 1939 several regional conferences of State officials were held under the sponsorship of the Council of State Governments, where ways and means of removing specific types of barriers were discussed. In addition, many of the individual State units of the Council, called Commissions on Interstate Cooperation, worked with the units of neighboring States in finding solutions to specific hindrances to trade between their own States.

About a year ago an Interdepartmental Committee on Internal Trade Barriers was formed with representatives of the Departments of State, Treasury, Commerce, Labor, Justice, and the Federal Works Agency, as well as the Department of Agriculture. The wide sweep of the fields affected by these barriers is indicated by this list. This committee is to serve as a clearing house for information on developments, to see what Federal agencies can do to improve conditions, and to act as a point of contact between the Federal Government and the Conference of State Governments.

A little later the Temporary National Economic Committee held hearings on the subject. Some of those appearing compared the threat of these barriers to the economic chaos found among the little tariff-walled Balkan States. These hearings dramatized the situation before the newspaper-reading public.

Results Noted

Results to date have been chiefly preventive. A check-up at the close of the State legislative sessions of 1939 showed that barrier bills had been rejected or withdrawn in more than a dozen State legislatures. Most of these bills related to oleomargarine and to merchant truckers. Almost no retaliatory laws were passed. State officials said these rejections and withdrawals were largely due to the Federal-State campaign.

Actions to remedy existing conditions are next on the program of the campaign. Eyes are now on this winter's legislative sessions. It will be more difficult to correct than to prevent, of course, but as groups are everywhere awakening to the situation, they can be counted upon to support these determined efforts to restore the free movement of farm products.

Johnny: "I fell in a mud puddle."

Mother: "What, with your new pants on?"

Johnny: "Yes. I fell so fast I didn't have a chance to take them off."

"Zoup, sir?" asked the waiter.

"I don't know what you're talking about," said the diner.

"You know what hash is? Well, zoup is looser."

Some Requirements of Fiber Flax

(*From page* 16)

phosphate with potassium and nitrate in the fertilizer has increased yields in three out of four cases on soil that has been cropped for 35 years. The average gain in fiber flax yield has been .14 ton from potassium; .27 ton with potassium and nitrate; and .33 with nitrogen, phosphate, and potassium included in the fertilizer.

Irrigation Proved Profitable

Irrigation has increased the length of fiber flax some six inches. Supplemental irrigation as reported elsewhere by Tomsheck (1936) aids activity of beneficial micro-organisms of the soil and promotes the liberation of nutrients for plants. Irrigation has given a nine-year average increase in yield of .83 ton an acre, an average computed gain in net profit of some $14.62. Irrigation may be helpful in retarding ripening, so that pulling may be completed before the plants are dead ripe. This should aid in securing a high quality of fiber. It may leave soil softer, so flax will be easier pulled. Tall flax is not only of a more valuable grade but is more readily harvested, either by hand or with machinery. With irrigation and fertilizer the total yield has been increased as much as 1.18 tons an acre.

Flax to be given a surface irrigation should be corrugated immediately after planting. Fiber flax should be irrigated early. Recent studies by Jerald Newcomb made as a graduate student show that maintaining the soil moisture supply at above 50 per cent of the useful soil moisture range favors increase in length and yield of fiber flax. Providing an ample supply of moisture and nutrient should prevent rapid ripening, so that pulling may be completed before the flax is dead ripe and a high quality of fiber secured.

The six-year average fiber yield on Willamette silt loam in the irrigation field at the Oregon Agricultural Experiment Station was determined from these plats by Dr. B. B. Robinson and E. G. Nelson. The yield and quality of fiber appear to have been definitely improved both by fertilizer and by irrigation.

Potassium seems to be an especially important nutrient for fiber flax. It appears to give strength, to increase the length of straw, and to render plants more vigorous and disease resistant. This may be due to the action of potassium in keeping lower carbohydrates in solution until they can be translocated to the bast fibers where they are built into tissue. The potassium may aid formation of an enzyme or co-enzyme.

It is suggested that potassium also may be helpful in the formation of beet sugar and potato starch. Full returns may not be realized from potassic salts unless nitrates are also present to accompany potassium ion into the plant. Excess nitrate, according to Robinson (1940), tends to make fiber coarse and weak. A little phosphate may be helpful on old farm land as an aid to root development, and it may increase yield, particularly of seed flax. A low ratio of phosphate in the fertilizer seems desirable for fiber production.

Potash of Prime Importance

The fertilizer requirements of fiber flax may be expected to vary with the soil and its previous cropping and treatments; however, potassium seems to be of first importance among the mineral nutrients needed. Nitrate may be more in demand for early vegetative growth and potassium most needed for fiber formation.

Better growth and yield may be expected when flax is planted very early under western Oregon conditions, and provided with a uniform, moderate moisture content. Since flax responds to a 16-hour day length, as reported by

Redington and Priestley (1925), it is suggested that the value of early planting here is to secure maximum growth during the longest days of the year, and before the field moisture is depleted.

Over half a million acres in Willamette Valley are suitable for fiber flax production.

Potassic salts with nitrogen supplied largely through legume residue may be expected to increase length and value of fiber flax. The potassium may play a catalytic role in synthesis of carbohydrates, or function to keep simpler carbohydrates in solution until they can be deposited in the transforming bast fibers in the flax plant. Microscopic examination of stained cross sections show that potassic salts increase the plumpness of the flax fibers. X-Ray studies show that fertilizers do not change the arrangement of the cellulose units of the fiber.

Supplemental irrigation has increased height and yield of fiber flax, especially when used with fertilizers. One or two irrigations or a total of 6 inches depth appears to be suitable amount on Willamette silty clay loam. Early planting and providing uniform moisture and nutrient supply with the aid of supplemental irrigation in western Oregon tend to delay the maturity and increase the length and value of fiber flax.

Meeting Fertility Needs in Wood Co., Wis.

(*From page* 22)

legumes seeded in the nurse crop in 1941. Amazing results, however, could be seen during the time the grain was maturing as well as after the grain was cut. Farm demonstrators will be anxiously awaiting the coming of spring to determine the value of the fertilizer on the 1941 hay crop on these fertilized fields.

More than 600 farmers attended demonstration meetings on the grain fertilization plots in 1940. Each plot was placarded with complete information so that farmers passing by could understand the test plots. Every effort was put forth to make the plots simple and easy to understand and still demonstrate the value of the application of fertilizer. Fifteen carloads (500 tons) of T.V.A. phosphate have been purchased by Wood County farmers during the year for use on conserving crops such as pastures and meadows. One fertilizer dealer sold 33 carloads of fertilizer in 1940 as compared to 13 carloads in 1939, most of which was applied on Wood County farms.

Fertilizer dealers have been cooperating splendidly with the county agent in an effort to stock the kind and type of fertilizers needed by the farmers and at a price which farmers can afford to pay. In all of these demonstrations, where potash-phosphate mixtures have been used, a greater return was obtained and this is especially true where clover and alfalfa was seeded.

Hope Lies in Plant Food

The hope of Wood County's agriculture lies in replenishing the soil with these important plant foods in such amounts that more efficient production of crops can be obtained. Three thousand Wood County farmers buy annually $500,000 worth of feed. If this amount of money could be spent for fertilizers in 1941 and for many years to come, the soils of the County could be improved, the returns per crop acre would be increased, and the standard of living could be raised. There would be more money for the farmer and his family, a better living and a better education could be obtained, and farmers would leave their fields and farms in a better state of fertility than they found them 50 years ago.

Better Lawns

A Book Review

Warm, balmy days which tantalizingly occur between the blustery days of winter's end make one begin to think about lawns, gardens and golf courses. It is an urge to get out of doors, and back to nature, that seems to come to nearly everyone, regardless of whether he lives in city, suburb, or country. The lawn, since it is the setting in which one lives, naturally tends to receive first and frequently major attention. Very timely, therefore, is Howard B. Sprague's book, "Better Lawns" (McGraw-Hill Book Company, Inc. 1940. $2).

The opening chapter describes the nature of a turf and the general factors affecting it. The next four chapters take up specific factors in some detail. The importance of the soil and such of its characteristics as drainage, texture, organic matter content, and its natural fertility, are first considered. A chapter is devoted to soil acidity, its significance, its bearing on producing and maintaining a good turf, and how to change the acidity, with most attention directed to its reduction through the proper use of liming materials. The following chapter gives practical information on the use of fertilizers for improving the fertility of the soil. The principal nitrogenous, phosphatic, and potash fertilizers are described; the meaning of mixed fertilizers explained; and recommendations on the fertilizing of new and established turfs given. The next chapter shows why organic matter or humus is important.

In order to give background information to permit intelligent handling of seeds and management of turfs, a chapter is included on how grasses grow and develop. This is followed by a chapter describing the most important grasses used for turfs in the areas covered by the book, with illustrations and non-technical methods for identifying the grasses. The good and weak points of each grass and conditions under which it is likely to be the most satisfactory one to use are brought out. The remaining five chapters are devoted to the actual operations of establishing and maintaining a lawn or turf. Time of planting, seed mixtures, preparation of seedbed, rates of fertilization and seeding, spring treatment of turfs, mowing, watering, and control of weeds, diseases, and pests are taken up.

Dr. Sprague has called on his extensive background in practical and investigational work with grasses to prepare a remarkably complete book on lawns. It is written in a style that avoids technical terms, but its completeness will appeal to the specialist as well as to the amateur. Difficult problems are not sidestepped and practical solutions for them are suggested. The section on the control of crab grass alone would justify the book in the minds of many.

A notable feature of the book is the definiteness of the recommendations and directions for making and maintaining lawns. The author has not, however, merely collected a number of rules of thumb which will apply only in the normal cases. He has given reasons for carrying on the several operations necessary for good turfs, and thus the reader is given a background that will stand him in good stead when the unusual cases develop.

While the book is intended to apply primarily in the northern, humid parts of North America, most of the general principles will apply wherever lawns are grown. Those who are responsible for parks, golf courses, and estates and also the householder with a small grass plot will find the book very useful. It is well indexed, thus making it easy to use as a reference or handbook on lawns. It can be recommended as one of the best books written on the subject.

The Cotton Program in Bertie County, N. C.

(*From page* 8)

took this to various communities where a few bushels of seed were treated for each producer who brought seed. Those who had seed treated were requested to plant a few rows of the same variety of untreated seed adjoining the treated seed, with all other conditions the same, so that they might observe the effect of the seed treatment.

During that year we had 14 farmers conduct such demonstrations. Just before chopping the cotton, we made stand counts on treated and adjoining untreated plats. We found an average of 395 plants per 100 ft. of row on the treated plats; but only 249 per 100 ft. of row on the untreated plat. In addition we found 26 dead plants per 100 ft. of row on the untreated plats but only 3 dead plants per 100 ft. of treated row. It was evident that the plants on the treated plats were healthier and more vigorous, and so 100 plants were pulled from each plat to determine the healthiness of the root system. We

Cotton plants from treated seed (left) compared with plants from untreated seed (right).

found an average of 94% healthy plants on the treated plats with 6% showing some disease. On the untreated plats we found only 8% healthy and 92% diseased. Since neither a diseased plant or animal can stand adverse conditions as well as a healthy one, it was evident from these demonstrations that one of the main causes of cotton dying after it has come up in the early season is due to diseased plants.

Yields of seed cotton per acre were obtained from these demonstrations, and we found an average yield of 1,420 pounds from treated plats and 1,225 pounds from untreated plats. Based on 4c per pound for seed cotton, a fair price for that season, the seed treatment paid an average of $7.80 per acre. After having the results from these demonstrations in 1936, we felt justified in advocating the treatment of all planting seed and were able to get barrel seed treaters built. These were so distributed that farmers in all parts of the County had access to them.

In 1937 we put out 12 seed treatment demonstrations with the following results: Average number of living plants per 100 ft. of row from treated plats before chopping 518, from untreated plats 208; dead plants per 100 ft. of row from treated plats 16, from untreated plats 35; Percentage of living plants with sore shin on treated plats 15.5%, on untreated plats 74.4%; Plants per 100 ft. of row after chopping on treated plats 167, on untreated plats 92; Average yield of seed cotton on treated plats 1,158 lbs., on untreated plats 959 lbs.; Average value of seed cotton per acre on treated plats $34.74, on untreated plats $28.77.

In 1939 we set up the seed treatment demonstrations on a 3-plat basis, using 3 oz. of 2% Ceresan on one, 1½ oz. of New Improved Ceresan per bushel of seed on another, and a plat with untreated seed. Seven such demonstrations were conducted with the following results: Living plants per 100 ft. of row on 2% Ceresan plats 346, on New Improved Ceresan plats 376, and on the untreated plats 168; Percentage of living plants with sore shin on 2% Ceresan plats 21%, on the New Improved Ceresan plats 7%, and on the untreated 81%; Average yield of seed cotton per acre on 2% Ceresan plats 724 lbs., on the New Improved Ceresan plats 756 lbs., and on the untreated plats 570 lbs. It was no longer a question of the value of seed treatment, and these demonstrations in addition to results from the Experiment Station showed that 1½ oz. per bushel of New Improved Ceresan was just as effective as 3 oz. of 2% Ceresan. Since there is little difference in the cost of the two, it is more economical to use the New Improved Ceresan.

Additional Potash Pays

Seed treatment has been proven to be of unquestionable value, and the majority of Bertie farmers now treat their planting seed. In 1940 a local firm installed an electric seed treater that will treat from 200 to 300 bushels per hour. Based on the average increase in value of cotton from seed treatment, this one operation is worth $57,600 to Bertie farmers per year if they plant their allotted acreage.

For a number of years we had noted many cotton fields badly affected with rust. Consequently in 1934 we began conducting demonstrations in which additional applications of potash were made. After conducting such demonstrations over a period of years, we advised using 400 to 600 pounds 4-8-4 fertilizer per acre before planting and a side application of muriate of potash at the rate of 50 to 100 pounds per acre mixed with 100 pounds nitrate of soda immediately after the cotton is chopped. In some cases this additional potash is applied before planting by using a fertilizer high in potash, but there is some danger of this affecting the stand if it is applied directly under the seed. When satisfactory side-placement fertilizer distributors are made available, this objection probably will be removed.

We find the additional potash controls rust and enables the plants to hold their leaves later in the season, resulting in an increased yield and better developed bolls that are more fluffy, have better fiber, and are easier to pick.

But with all these improvements most Bertie farmers lost money on their cotton crop in 1938 and 1939 on account of boll-weevil damage, and it was evident that the boll-weevil must be controlled or else most of our farmers would be forced out of cotton production. In 1939 a number of farmers tried mopping their cotton with calcium arsenate and black strap molasses dissolved in water. In many cases the growers started too late to get most effective results, but enough did a good job to show that a reasonable cotton crop could be produced even in an unfavorable season if the boll-weevil was controlled. While the average yield of lint cotton per acre in Bertie County was only 164 pounds, farmers who mopped their cotton made from ½ bale to 1¼ bales per acre, with an average of ⅔ bales per acre. Among those who secured such results were Dr. A. Capehart of Roxobel, E. D. Spruill and Frank Harden of Indian Woods, M. E. Evans of Woodard, and Turner Speller, a Negro farmer of Cashie Neck.

Based on these and similar results secured in other counties, an intensive boll-weevil control campaign was put on in 1940. This campaign consisted of community and county meetings, news articles, circular letters, a pamphlet on cotton production to all growers, and field meetings for mopping demonstrations. There was good attendance of interested growers at these field meetings. Supply merchants, ginners, and fertilizer dealers cooperated in this campaign, and they made calcium arsenate and black strap molasses available to all growers. It was a rare thing to find a grower who was not mopping his cotton, and while most of these who mopped in 1939 did not start in time, most all of them made an early start in 1940.

By following these approved practices and with a cold winter and a dry July, Bertie County farmers in 1940 made the best yield of cotton per acre they have ever made. Reports of 1½ bales per acre were common, and quite a few made close to 2 bales per acre. John Eley Thompson, a 4-H club boy of Colerain, produced 2 bales per acre by following this plan. Other 4-H club boys did not want cotton as a project, but his record proves that cotton is a good 4-H project. Even though cotton is not high in price, both farmers and business men are feeling the effects of a good crop.

We think one-variety-cotton community organizations, whereby the bulk of the cotton from a community is of one variety with a uniform staple, offer the means for cotton farmers to get the most from their cotton crop. Through the use of special gin days for saving seed stocks and a definite program for securing and multiplying new seed, the quality of the cotton may be maintained at a minimum expense. A further advantage is provided for such organized communities through the Smith-Doxey Cotton Act in that they may have their cotton classed for grade and staple without charge by a licensed federal grader.

Through the cooperation of J. A. Shanklin, Extension Cotton Specialist of State College, four one-variety-cotton communities were organized in 1940 in Bertie County, and this year we expect to have such organizations for all gin communities.

Grade and staple reports show that the 1940 cotton crop had the best staple we have ever produced but it was low in grade. This indicates that more attention should be given to picking or ginning the cotton, since the season was ideal for harvesting the crop.

Valentines

(*From page* 5)

and "Snooty"; nothing like that at all. But from that very Valentine pronouncement of forty years ago I have left the bolder, fiercer spirits whenever time was ripe to engage in tributes and admiration for the fairer sex. And strange to say I have found myself in rough company sometimes too, fellows who used to disdain the girls worse than I did back when these men were boys and the world was young. And to those cloistered and sequestered gentlemen among our number who never yielded to the "wimmen folks," I hold a deeper sympathy for them than they entertain for me.

Of course on those Valentine distribution days long gone by there were a number of kids who got few of them and one or two of our number who got none. The dearth of such flattering tokens did not always signify that the particular loser was unworthy of the mark—as a rule it was due to a retiring disposition on his part and to forgetfulness on the part of his daily associates. This human trait somehow persists even beyond the Valentine era of our lives.

IT STRIKES me as I think through this ancient custom of sending Valentines that as one grows mature and stodgy, the bud-bursting theme of undying love and troth-plighting naturally loses out, which makes most of us stop sending them. And as we cannot stoop to coarse invective, comic Valentines are not sent either.

Now Christmas is a time of sending good cheer to mankind in general, more or less with a religious fervor and significance. But on Valentine day one might sensibly start a program of sending tokens of esteem and warm regard for personal favors or deeds of public achievement worthy of praise and encouragement. Naturally you don't think of "loving" another man or "dear sweethearting" a steadfast and progressive woman whose neighborly deeds are kind and helpful, but they might enjoy a pat on the back. Moreover, there are scores of public servants who get no hike in payrolls during the present commercial boom and hardly a comforting word from their patrons and constituents either. One could steal a leaf from our school-day Valentines and begin a campaign to put some of these kind thoughts about others on paper for them to see, on the theory that they appreciate regard while living more than roses and hymns afterwards.

It would do you good some early February eve to take an interval from your bloody newspaper headlines to skim through a few favorite poets to collect suitable bits of rhyme and real poetry to grace your outbound tokens of esteem. For the rough and ready farmers and their kindred scan ye pages of Burns, Riley, Crabbe and Whittier, Frost, and Carlton. For the more critical, fall back on Bill Shakespeare or maybe Browning and Milton. In a pinch you could fix up a sentiment yourself, flavored with the ready wit and mercantile philosophy of the Rotarian brotherhood. The best part is that the recipients would be taken completely by surprise, or else imagine you were mixed up in your holidays. Doubt not that they would reject them.

IT IS to the people who hold jobs and perform manifold services which ordinarily appear to be taken and accepted in a perfunctory way that I would mail these missives of remembrance. Those who do things that we take for granted as bought and paid for with tax money or tithes or donations are the ones who would either feel ashamed or be girded into new and honest endeavor by your Valentines.

Outwardly you or I would not always know whether they would be ashamed because of work ill done or half done, or proud of doing all they could have done under the present circumstances. That would be their own business, not ours. Every man has his moments of strength when he performs great successes, just as he has his moments of weakness when his tasks never go right and he hazards making enemies by his blunders. But if we had any part in electing him or choosing him, or if we could be regarded in the smallest degree to be beholden to him directly or indirectly, maybe a word of encouragement might set him right.

YOUR county supervisors, your alderman, yes, even your assessors, would appreciate a thought or two of cheer. The policeman on the beat, the county agent hustling hither and yon with his motion picture apparatus and his soil charts, the agricultural teacher busy with the project boys afield, the conservation committeemen poring over maps and allotments, the principal who endures somebody else's lack of home discipline with the children, and many similar characters we meet so often and take for granted. If you want to include the butcher and the grocer, you have my permission, always depending on your standing on the credit ledger. I have donated this idea free gratis, expecting few to find time for it—if indeed they even find time to follow me thus far in my rambles. And I shall not be averse to receiving a few from constant readers either, thereby reaping my just reward.

If this movement won't do a lot to help revive and nurture the democratic spirit, then I don't deserve to claim the name of "Jefferson." And if sending such goodly Valentines won't keep your mind off the war, then I feel sorry for you. Valentines are about as far removed from carnage as anything I could conjure up, so that's why I chose the subject for February. Unfortunately I have my doubts of escaping it the next time, for the month certainly has a dubious meaning—March!

COMPLICATIONS

First Little Girl: "I have two brothers and one sister."

Second Little Girl: "I have two sisters and one brother."

Third Little Girl: "I have no brothers and no sisters, but I have two papas by my first mama and three mamas by my second papa."

"So you don't want the green dress?" asked the clerk.

"No, ma'am," replied the large woman of dark complexion. "Ah suttiny don't. Honey, Ah'd look too much like a ton o' coal in a lettuce patch."

A man applied for a job on the railway. He was accepted, and told that he must first learn by heart all the rules of the company.

Having managed this task, he was put on a sleeping-car train to assist the guard. One evening the guard walked along the corridor and saw a red lantern near one of the sleeping berths. He called his assistant.

"What does this mean?" he asked.

"Why," said the new man, "I was only carrying out the rules of the company."

"There's no rule that I know of that tells you to hang a red lantern in the corridor."

The assistant pulled out his book and turned over the pages.

"Rule twenty-seven," he read: "Always hang out a red lantern when the rear end of a sleeper is exposed."

The reason many an old rooster crows before anyone is up is because he doesn't dare open his mouth after the old hen awakens!

TACTFUL SUGGESTION

A Negro minister was caught hugging one of the sisters of his flock, and a church inquiry was called. Witnesses testified, and the minister confessed, but defended his actions as proper and authorized by the Bible.

He maintained that as pastor of the flock he had a perfect right to take one of his lambs in his arms.

When the inquiry was finished, a brother offered a resolution:

"We excuse Brother Johnson from all blame, but hereafter when he wants to take one of his lambs in his arms we suggest that he select a ram lamb."

Wife (to late returning husband)—"Is that you, John?' '

John—"It'd better be."

PARDON ME

"Paul is the most bashful man I ever married."

"What makes you say such a thing?"

"He took along mistletoe on our honeymoon."

Officer: "Are you married or single?"

Applicant: "Married."

Officer: "Where were you married?"

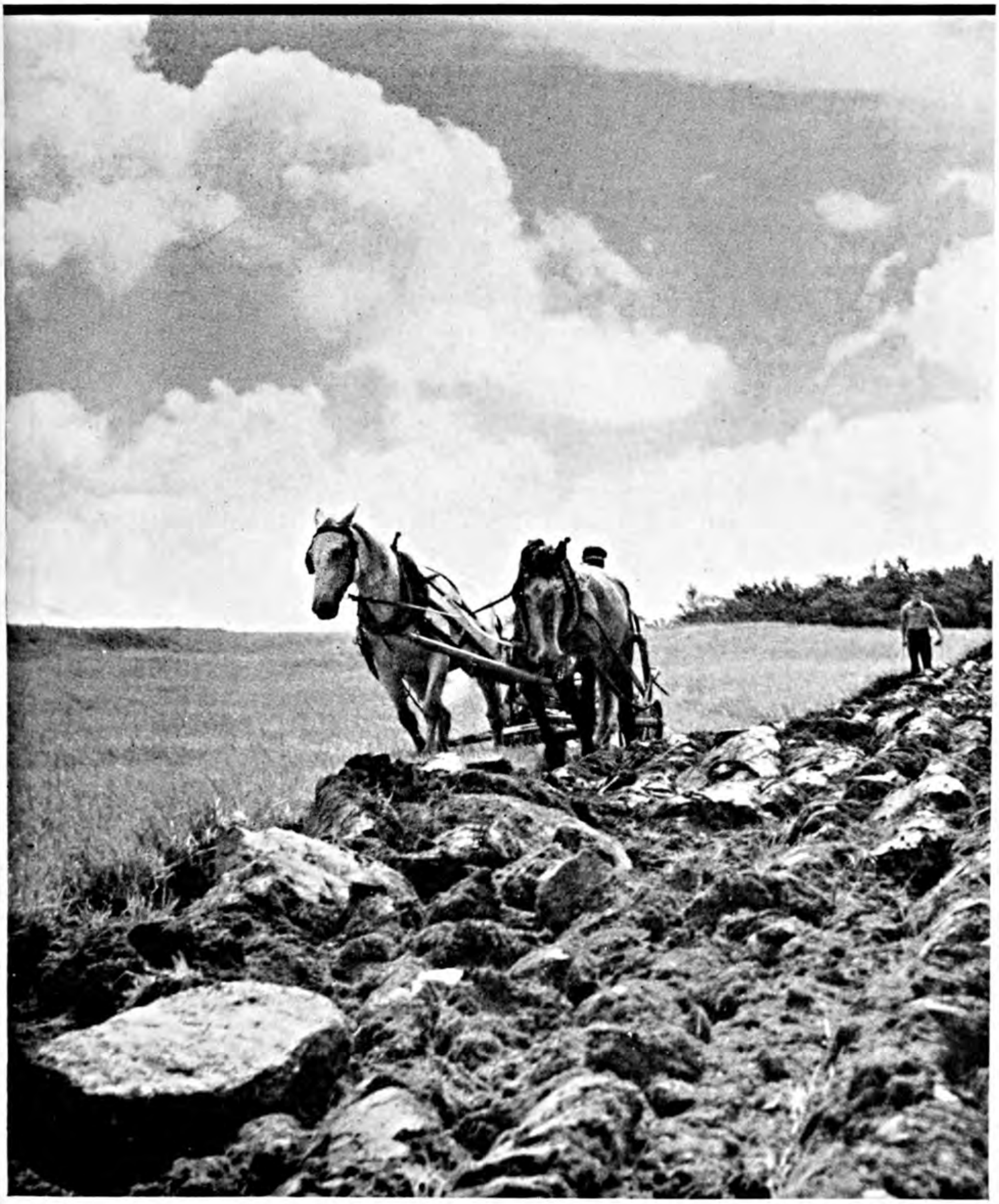
Applicant: "I don't know."

Officer: "You don't know where you were married?"

Applicant: "Oh, I thought you said 'why'."

Better Crops with PLANT FOOD

March 1941 10 Cents



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The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: Investment Bldg., Washington, D. C.

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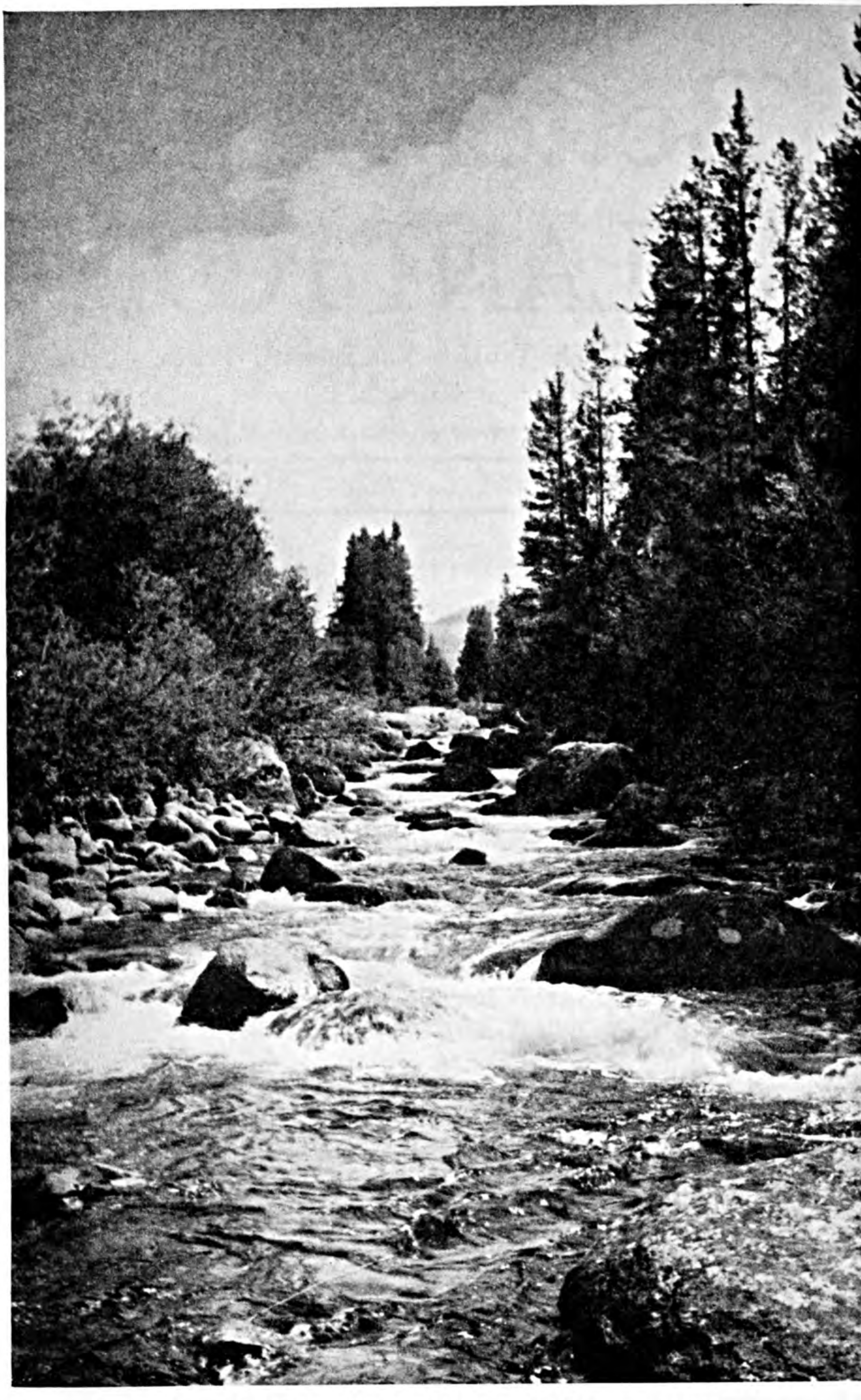

SPRING FRESHETS TRANSFORM OTHERWISE LAZY STREAMS.

Better Crops with PLANT FOOD

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VOL. XXV WASHINGTON, D. C., MARCH 1941 No. 3

Up for attention again is—

Bovinology

Jeff McDermid

"BETTER BULL" talk has been uncommonly scarce among bucolic circles of my bailiwick for nearly a decade, although it shows some signs of revival. Keen competition in that line from other professions may have forced our best rural bull authorities into eclipse. But it's more my belief that the super bovine spellbinders have been too busy since 1933 with the AAA, SCS, FSA, and FCA. At least, judging by the direction in which the best native talent of my township has been going in this "federal farming" period, we have temporarily run out of zealous bull promoters, and may have to train up a good fresh batch out of the Future Farmers.

We've got to do something drastic in bovinology if we keep on "going to grass" at the present rate of conservation. Does it sound reasonable for us to seed down so much land and push the pastures clear up to the Arctic Circle without having more and better cattle to gaze on while they graze? Until they make a breakfast food of a more satisfactory kind out of brome grass and alfalfa than hitherto, I am quite sure that our best customers for such conserving crops will run on four legs and ruminate more than we do anyhow.

Although I have tried to argue some of the dairy boys into sheep husbandry, most of them buck at such an idea. Staff or rope, nose-ring or halter, pen or no pen, it looks like we'll have to tackle the bull question all over again, and many of us are going to be further behind than we were when we left off.

To be sure, I thought we'd said and done about all that fat tests, printers' ink, and lung power could achieve back in the days of the w. k. base period, otherwise known as the "golden age" of farming.

EVERYBODY had a chance then to learn what a little blunder in bulls would do to milk and beef ambitions. But that was before we had the modern insignia known as two-, three-, and four-star bulls—which doesn't refer, be it known, to the amount of concussion of the cranium sustained by the caretaker. It was also prior to the date when they altered the U. S. Department's annual yearbook into a costly compendium of intricate text relating to germ plasm. I presume if we had had access to chromosomes and genes and nuclei back yonder in the boom bull era we would have had less faith in fancy pedigrees and more respect for strong pasture fences.

And yet sometimes I wonder if we could have made anybody's novel array of abracadabra into an elixir powerful enough to overcome bad herd management plus bad times. It takes genius to operate those genes I surmise, and some degree of common sense directs the destiny of the chromosomes on the farm. Thus environment played its part in the frequent defeat of those better bull campaigns in the times before we had genetics brought to the farmer. I mean environment related to personal management and environment concerned with soils and economics as well; both equally affecting the extent to which the superior germ plasm survived when once planted.

The mathematics involved in a genetic calculation is a wonder to behold and always gets me dizzier than usual; but the arithmetic concerned with 10-cent corn, 15-cent butterfat, and an amortized mortgage on an inflated acreage is a far more popular indoor teaser for puzzle fans. The best ways to determine a good bull's future is to run soil tests on his home place and an I. Q. on his owner, not just a fat test on his daughters.

When I first entered the livestock arena as an observer, we used to ask ourselves the question: "When is a bull not a bull?" Answer: "When he is a gold brick."

In those plenteous days of *caveat emptor* a green ruralite did not have to walk the pavements with safety-pins on his pockets to invite predatory strangers. All he had to do was crank his car or hitch up his team and drive to the nearest county consignment sales—often known as bull bazaars. There the slickers were ready for him armed with ribbon-tied catalogs with glossy pictures of seven-day-record cows and lengthy, six-generation-bracketed pedigrees that traced a heifer's lineage clear out of sight.

THOSE catalog architects labored as dutifully and minutely over a bull's distant forebears as the Hebrew scribes when they set down the genealogy of Israel from David the king to Joseph the carpenter. Some gentleman of prodigious memory would chant the bovine family tree while the red-faced auctioneer put his larynx into high gear and set the audience coughing up legal tender or I. O. U's. Some of the notes and checks bounced back no good for groceries, but so did many of the cattle after they were boarded awhile without showing any inclination to perpetuate the pedigree.

It is not my intention to assert that everybody who horned in on the bull business was a barnyard blackguard. That would be unfair to many honest enthusiasts who were "fans royal" in the sport of cattle traffic. Besides I would have to include myself and many other hay-shaking journalists who peddled all the gilded assumptions attached to a sketchy test program and stylish family lines. On the contrary, it was a typical American way of life, borrowed from the stock market by the livestock brokers. There was no more water in our cattle than they would take to fill well, which would be a modest way of describing those bonanza mine stocks floating like corks in the current of Wall Street and westward.

Lax and unconvincing test programs held back the dairy bull business. The sirloin gentry, like the pig pushers, depended almost wholly upon the show

ring circuit for grading their herd sires —speaking only of the corn-belt beef men—as the range boys no doubt had a system of their own. But I understand that in recent years a carcass and growth rate index is being more generally sought for the meat industry.

ANYONE who recalls the earlier cow-testing associations and the erratic and unreliable mode of conducting the private herd tests will applaud the more sensible ways of proving bulls and cows which obtains today along the milk routes.

The herd racing curse was the bane of the cooperative test groups, while the practice of selling all animals from a herd on the basis of figures for a few head tested at random is what upset the private breeder. Thousands of cattle were thus palmed off as sensations instead of sausages.

Yours truly was guilty of playing to the gallery in recording cow-testing association results. I recall fumbling around for months using what we called the "box score of the bovines," running the comparative standings of herds in a given association and for the state. We might have used our time (I won't say our talent) to better advantage by showing each herdsman how to race with himself. And it so happens that the minority who did that very same thing are the ones who survive today among our foremost breeders. Such men did not bother so much about the other guy's butterfat, but they stayed at home and jerked the weeds out of their own stables. This "contest" idea has got the best of us Yankees in many ambitious programs, and it sure put the kibosh on cow profits through misdirected aims.

Fundamentally, the finest gains came when the dairy herd improvement units hired fieldmen who knew something about crops and farm management along with their bullology. Coupling that up with soil-testing and land-feeding programs has turned attention inward toward the all-important thing of environment. Whether the mated blood lines nick or don't nick, they're not worth a nickel to a blundering booby on a barren farm.

Keeping test records for a herd-building and bull-valuing guide is another new plank being nailed into the dairy platform. I have seen herd books neatly kept and regularly reviewed for purposes of selection and progeny saving. But for every such herd book rightly used I have seen two others misused—barn sheets almost impossible to read owing to fly specks and gutter splatter, and records utterly reckless.

SUCH lads are wasting their money and the government fieldmen's time. Have we arrived at a point when dairymen must be classified and paid a bonus for neatness and progress, or does any old muckslinger still qualify for milk production in the age of vitamins? I maintain that you'll find a closer relation in the coming years between the high fat test and the low sediment test—or in other words, knowing what a herd can do and what a herd is for. If we face a deluge of animal products then, it is certain that the gropers and guessers will be strained out like specks in the milk pail.

(*Turn to page* 47)

Soil, the Substance of Things Hoped For

By Firman E. Bear

Agricultural Experiment Station, New Brunswick, New Jersey

SOIL, like faith, is the substance of things hoped for, the evidence of things not seen. Some two billion people depend upon it to supply them with food, clothing, and shelter. By and large, it never fails. But here and there carelessness in the management of the land has brought its certain reward, and those who remain to till the soil reap mostly poverty and poor health.

Yet soil is practically indestructible. It is the residue that remains after the rain, wind, heat, and frost of the centuries have done their work of tearing apart the rocks which originally covered the earth's surface. In humid areas, all but mere traces of any soluble substances which these rocks could be made to yield up have long since been washed into the sea. The insoluble part, the soil, remains as an enduring foundation on which civilizations are built, and rebuilt. Soil is the only one of our natural resources that can not be used up, that can not be destroyed.

But soil may cease to exist as a cover over the surface of the earth. It constantly seeks lower levels and, like the soluble salts that have been washed out of it, may finally find its way into the ocean. In fact, much of the soil which now covers this continent has previously been in the ocean, where it has been reconsolidated into limestone, sandstone, or shale and, centuries later, has been reelevated and remade into soil—often several times over.

Once soil is thoroughly covered with vegetation, it remains in place. For thousands of years before the Americas were discovered, the soil of this hemisphere was sewed to the earth by the roots of trees and grass. But no sooner had our early pioneers cut down the forests, and torn up the sod, than the soil started downhill. Only three centuries had elapsed when the dust storms, blowing Kansas soil out into the Atlantic Ocean, forcibly directed our attention to the fact that both wind and water are rapidly carrying our greatest natural resource away. Hurried investigation of this problem soon revealed that much of our virgin soil had already disappeared and that, over large areas, we were farming subsoil. In some cases erosion had eaten down to the useless rocks beneath.

The farmers of the United States have dug their way down into the subsoil faster than have those of any other nation that ever existed. Our engineers have invented bigger and better plows and tractors to pull them; but one of the most significant developments of recent times has been the rapidly growing realization that we plow too much. Too large a percentage of our land is being devoted to soil-destroying cultivated crops, and too little to the soil-saving sod crops.

Modern Farmers Avoid Plowing

It will be recalled that corn, tobacco, and potatoes were unknown in the Old World, and that our European ancestors had no first-hand knowledge of these crops or of cotton. Our inherited experience had not taught us how to cope with their soil-destroying powers. Around 140 million acres of our best land were being plowed up and planted

Courtesy of Soil Cons. Service, U.S.D.A.

A New Jersey spinach field before terracing.

to these clean-cultivated crops annually before anyone realized what a disastrous effect they were having on the staying powers of the soil. But once this was clearly understood, immediate moves were made to apply correctives.

Modern farmers now avoid plowing their land whenever possible. Usually this either means finding some new methods of dealing with cultivated crops, or some substitute for them. In Missouri, for example, large acreages of corn have been replaced by winter barley, wheat, and rye. These small grains are grown year after year without plowing the land. The soil is merely

Courtesy of Soil Cons. Service, U.S.D.A.

The same spinach field after terracing.

redisked each fall and reseeded to the small grain. Lespedeza, seeded in the small grain, collects the necessary nitrogen from the air and provides profitable grazing for livestock.

In Nebraska, large-scale experiments are now under way in which the natural mulch of crop refuse is allowed to remain on the surface of the soil as a protective measure against loss of land by wind and water erosion. Seed are planted under this mulch and allowed to grow up through it. Thus, the soil is never turned upside down, but such working of the soil as is required is accomplished by the use of a duck-foot cultivator.

In New Jersey, the grassland system of farming, in which grasses and legumes are substituted for corn as silage crops, bids fair to revolutionize soil management systems on dairy farms. This does not mean that corn will be completely eliminated, but that the acreage will be confined to land which is so level, either naturally or by contour farming, that little loss of soil occurs by surface erosion.

Courtesy of Thomas D. Mulhern, Milltown, N. J.

Mercer County Agent A. C. McLean and H. W. Voorhees looking over the luxuriant growth of Italian rye grass in a corn field on the latter's farm.

If a good soil can be kept in place, the problem of making it continue to grow big crops is a relatively simple one. The "food" of crops consists of elements which have escaped into the ocean and the air, and which can be brought back to the land as required. The needed limestone and phosphate and potash fertilizers are obtained from ancient seas which are now dry land. The necessary nitrogen is captured from the air in immense nitrogen-fixing factories that, for military as well as agricultural reasons, are widely scattered over the earth. Some idea of the size of this problem is gained from the fact that our lime and fertilizer bill already amounts to approximately $200,000,000 annually.

Downhill Cropping Systems

But making an exhausted soil grow good crops presents a much more difficult problem than is involved in keeping a good soil good. In the first stages of soil depletion there is a tendency to follow "downhill" cropping systems in which crops with ever-increasing foraging powers are substituted for those which grow only on fertile soils. Thus, rye is often substituted for wheat, timothy for clover, buckwheat for oats, and poverty grass for bluegrass. If this process is continued, there comes a time when nothing worth while will grow, and there will be signs of malnutrition not only in the crops, but in the men and animals that eat these crops. At this stage, the usual procedure is to allow this exhausted land to run wild. It gradually recovers its productivity for better crops as the weeds, grass, shrubs and trees accumulate minerals from the subsoil and leave them behind on the surface in their refuse.

The difficulty with this process is that it takes too long. So, we try to substitute lime and fertilizers for time. However, in proportion as the soil has been exhausted of its fertility, it tends to compete with the crop for the chemicals that are applied. For a time, small amounts of fertilizer, applied in bands along the row, will meet the require-

(*Turn to page* 37)

Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs[1]

By George D. Scarseth

Soil Chemist, Purdue Agricultural Experiment Station, Lafayette, Indiana

¶ *Fifth of a series of practical articles dealing with the principles of soil fertility.*

WITHIN the last 10 years agronomists and soil chemists have given much attention to the development of rapid chemical soil test methods as a means of determining fertilizer practices (2, 6, 7, 8, 13). Numerous comparisons (1, 5, 10) have been made of the different methods used in the various states. One of the outstanding facts resulting from such studies is that no method has yet been devised that is infallible. This has brought on some criticism and doubt about the advisability of using such tests.

The criticism arises out of the tendency of the operator to expect too much of the tests. It is not reasonable to think that these soil tests in all cases should correlate closely with the crop responses obtained from the use of fertilizers nor with the true status of the soil fertility. The reason for this lack of correlation is obvious when some of the peculiarities involved are considered.

Limitations of the Chemical Soil Test. Plant roots absorb elements out of the soil slowly but continuously for several months, while in soil tests the solvents are in contact with the soil materials for only a few minutes.

This would not matter so much in inorganic systems where chemical equilibrium is rapidly established, but in the dynamic, biotic soil complexes it is of utmost importance. Another consideration is that plant roots differ in their feeding properties (12); for example, sweet clover and alfalfa can obtain more phosphate from a tri-calcium-phosphate in an alkaline soil than can corn or cotton. Soil tests, however, are usually designed for general crops and are not standardized for any particular crop or kind of soil. It is to be remembered that soil tests have extracting solvents differing variously in pH and composition from those of the different plant roots; and the presence or absence of free carbonates greatly affects the acidity of the solvent. Moreover, plants feed out of the subsoil as well as out of the top soil, thus soil samples usually do not represent the entire root environment. The plants absorb elements out of the whole soil complex, part of which may be alkaline (subsoil) and part acid (surface soil).

From this it seems clear that the chemical soil test methods can not be used as the sole guide in determining the fertility of soils. Nevertheless, if the user of such tests recognizes these limitations, the rapid chemical tests can be and are invaluable aids in diagnosing the fertility situation in the soil with respect to the static levels of fertility and the soil acidity. In the field of medicine, the determination of a sick patient's temperature with a thermometer is not the sole guide in diagnosing

[1] Presented before the meeting of the Association of Southern Agricultural Workers, Atlanta, Georgia, February 7, 1941.

the illness, but the thermometer is one of the valuable aids in making the diagnosis. Likewise the rapid soil test methods when properly used can be invaluable aids in the diagnosis of soil fertility.

Plant-tissue Tests. Whereas the soil tests tend to indicate something about the static storage of readily available nutrients, the plant-tissue chemical tests developed at Purdue University appear to be another useful technique for determining the nutrient deficiencies of plants.

These tests were first applied by Hoffer (3, 4) in studying disease resistance of corn. The implantation of these tests in the field of plant nutrition grew out of this original work. The first tests were a direct method for nitrates and an indirect method for potash. Later they were supplemented by Thornton to include tests for phosphate and potash. The direct plant-tissue tests for nitrate, phosphate, and potash were combined by Thornton and others with the soil tests, and the necessary materials for all tests were put up in a convenient hand kit (11).

Much confusion in the early interpretations of the plant-tissue tests has held back this technique from proper recognition. The author has studied these tests intensely during the last three years and this paper is intended to point out some of the possibilities of the plant-tissue tests in diagnosing nutritional problems in plant production. Only a few typical case histories are presented.

The details of making the tissue tests have been described by Thornton, Conner, and Fraser (11). These tissue tests indicate which nutrient, particularly nitrate, phosphate, or potash, may or may not be the first limiting factor in the growth of a plant. The tests show in a roughly quantitative manner the presence or absence of these nutrients in unassimilated form. The elements that have been built into tissue parts are not indicated. In this manner this technique differs greatly from the method of foliar diagnosis of Thomas and Mack (9) or from a chemical analysis of plant tissues where the total amounts of the elements are determined whether assimilated or unassimilated.

Since growth will progress only as fast as the plants are able to absorb the nutrient that is present in the least amount, it is enlightening to determine what this particular nutrient is. No attempt should be made at interpreting the tissue tests until tests for nitrate, phosphate, and potash have been made. Most information can be obtained when considering the status of all these elements at the same time. A plant may be growing on a soil, for example, that is "low" in available phosphate and "high" in available potash according to soil tests. If nitrogen shortage should happen to be a more limiting factor than phosphate shortage, the tissue tests would show no nitrates present.

A Purdue Kit containing all reagents and equipment necessary for both soil and plant tests.

In such a situation, the tissue test for phosphate might show "high" in spite of the fact that the available supply of phosphate in the soil was actually low. The potash test would also show "high." The reason for a high phosphate test, in such a case, is that the phosphate was unassimilated in the plant because the plant was too short of nitrogen for protein building, which would have used up the phosphate absorbed from the soil. Since the plant was not functioning normally because of the lack of nitrogen, the phosphate accumulated in the plant tissues, thus accounting for the high test. Investigators have frequently misinterpreted a high test for one of the three important nutrients as indicative of an abundance of such a nutrient in the soil, whereas a high test could mean an unassimilated factor. As soon as one limiting factor is removed a new one will develop unless all other possible elements are adequately supplied.

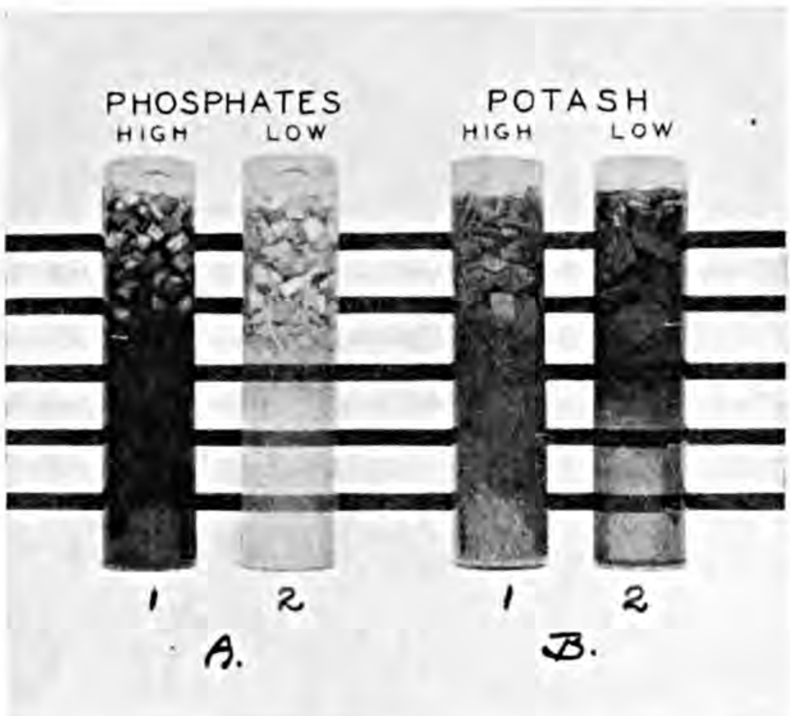
Case Histories in Diagnosing Nutritional Troubles. A few typical cases of the use of soil and tissue tests in diagnosing the fertility needs of plants will illustrate how the two types of tests have been used and what interpretations were possible.

Case 1.—Diagnosis of the causes of a poor growth of soybeans, Graysville, Indiana, July 20, 1938.

The soybeans over the whole field showed marked nitrogen-starvation symptoms. The plants in the limestone-dust strip nearest to the road were about 12 inches high, while those out in the field were about 6 inches in height. Soil and tissue tests were made with the results shown in Table 1.

Interpretations of tests in Case 1.

1. The acidity tests showed that the area near the road, where lime dust from the graveled road had blown onto the field, had a favorable reaction, pH 6.3, yet the plants were starving for nitrogen because inoculation had failed to provide them with it. An inspection of the tissue tests showed that the plants were also starving for potash. This brings one to the conclusion that the rhizobia bacteria (nitrogen-fixing bacteria) were unable to function normally and supply nitrogen to the plants because the plants were too starved for potash to be carrying on normal metabolism. In other words, these plants were starving for nitrogen because of a lack of potash.



Dark blue solution, A1, shows high inorganic phosphate; clear solution, A2, low phosphate. Dark yellowish brown turbidity, B1, shows high potash; lines can be observed, B2, with low potash.

2. The lime dust had helped the soybeans near the road to grow a bit larger than those away from the road, but the lack of available potash prevented better growth. Here the limiting factors were potash, nitrogen, and phosphate in the order listed.

3. Back in the field, away from the road-dust effect, the pH was 5.3, which is too acid for the rhizobia bacteria to grow well. The tissue tests showed an excess of both phosphate and potash,

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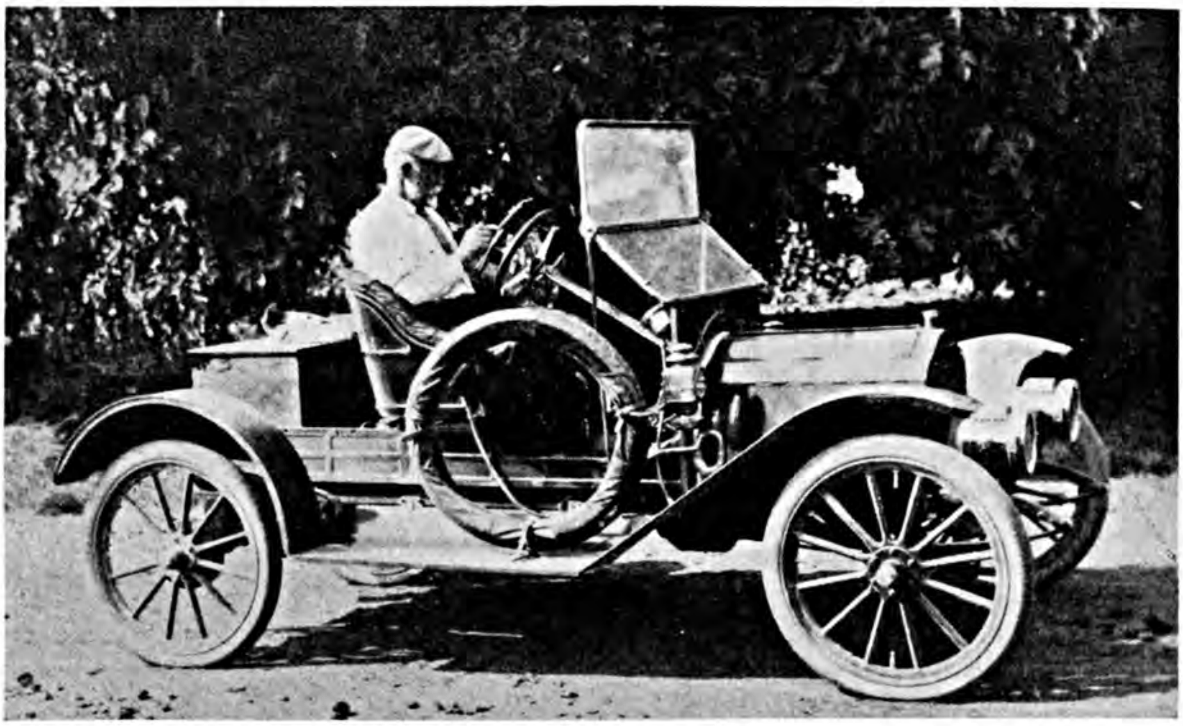

The author, back in 1910, ready to start out to talk fertilization with growers.

Some Early Experiences With Fertilizer on the Pacific Coast

By B. E. Maynard

San Jose, California

¶ *First of a series of articles recounting personal experiences with the use of fertilizer on the Pacific Coast during the past fifty years.*

AMONG my first observations, made before 1890, regarding the need of potash in California soils was that of noting the excellent effect of wood ashes on a strip of gravelly loam underlaid by a stratum of gravel, involving a few rows of grapevines on the edge of a small vineyard of about one acre in extent. These vines in the Santa Clara Valley near San Jose were about 20 years old, and had never been irrigated. It soon became evident to me that they were suffering from some form of malnutrition, but I knew of no one to turn to for advice.

On part of this strip no vines were growing, and so it was decided that this would be an excellent spot on which to burn the prunings from the vineyard, also prunings from some nearby pear trees. The brush was hauled out and deposited in a pile on this spot, allowed to dry, and then burned. Later on the ashes were scattered around the vines and plowed under. The vines thus treated showed marked improvement the first year, and in following years became the most productive in the vineyard, producing large bunches of grapes excellent in quality, sweetness, and size. In fact one of these, an exceptionally large bunch, was displayed for several weeks in the window of a leading real estate office as evidence of the wonderful productiveness of Santa Clara Valley soils.

By this time my interest in potash was so thoroughly aroused that I carried my investigations still further by treating with wood ashes some young peach trees planted as replacements where old apple trees had been dug out. These trees were also unirrigated. The soil was a deep loam, considered rich and not in need of fertilization. With the exception of wood ashes no fertilizer or manure was used on these trees, but four rows of mangel-wurzel beets were grown annually in the space between the trees.

The ashes were broadcast around the trees and plowed under with the natural growth of winter cover crop. Some of the ashes, however, were applied close to the base of the trees in order to note if they would have any effect in controlling the peach-root-borer which at that time had made its appearance in California. The effect of this treatment with wood ashes seemed to be of some benefit, but probably due more to creating a loose, friable soil condition unfavorable to the welfare of this pest than to any other cause.

Trees Responded to Ashes

In spite of the competition of the beets for plant food, the peach trees responded remarkably well to this ash treatment—growing vigorously, quickly coming into bearing, and producing fruit excellent in size and quality. The finest fruit was not produced until the trees neared full production, and, as far as I know, was unequaled in size, quality, flavor, and color by any other peaches grown in the same district. The new wood growth was sturdy, strong, and well-matured. It would invariably fill out with large, plump, healthy bloom-buds, even following heavy crops. This bloom-bud formation meant regular and full production of peaches.

The beneficial results obtained from the use of potash as described above were not just guesswork on my part, but were amply proved by personal observations and comparisons made in certain neighboring peach orchards when picking fruit, and later when pruning the same trees after they had entered the winter period. When gathering the fruit from these neighboring

A properly fertilized Blenheim apricot tree in excellent condition after 50 years.

trees, many of the peaches were found to be decidedly inferior in size, color, and quality, and the trees generally were unthrifty in appearance. In pruning these trees, particularly following a reasonably heavy crop, the new growth of branches and twigs might be sufficient in length, but would be found to be puny and willowy in structure, the twigs almost string-like in texture. The bloom-bud formation would be very scant or none at all. Such conditions, would, of course, mean a very light crop, if any at all, the following season. These neighboring trees must be considered to have had an advantage over those treated with wood ashes as they

A fine Imperial prune tree starting to die-back because of potash deficiency.

were not resets, but original plantings. Also, they did not have to compete with beets for plant food. Soil was of the same type and texture, and apparently just as rich in natural fertility. Consequently, the difference in favor of the trees receiving wood ashes, as compared with those receiving none, could not well be attributed to anything but the potash so applied.

In the spring of 1892 I rented 55 acres of mixed orchard comprised of apricots, peaches, pears, French and Fellenberg prunes—the last better known on this coast as the Oregon prune—and about one acre in table grapes.

Two Distinct Soil Types

The soil in this place consisted of two distinct types. The higher ground, apparently glacial, contained much sharp, broken rock or gravel and boulders of varying sizes intermixed with a loam of a good mechanical type; a soil that should and did respond quickly to good care and fertilization. This upper land was separated from the lower level by a steep slope ranging from about 50 to 75 feet in height. The soil type of this slope, the greater part of which was planted to prune trees, was the same as described above, but rather difficult to work owing to the many boulders it contained. The lower level of about 15 acres consisting of a deep alluvial soil was planted to French and Fellenberg prunes, all in full bearing. This river-made soil would naturally be considered fertile, but quite the reverse was the case. When first seen by the writer, the trees were beginning to emerge from their winter dormancy, but their evident lack of thrift, string-like and puny twig growth, weak fruit-spur and bloom-bud formation, as well as die-back in many of the trees, and meager growth of weeds, plainly indicated the poverty of this soil.

Although deficient in organic matter, it was evident that it would respond quickly to good care and fertilization. The trees on this piece of land blossomed well that spring and set what apparently would be a good crop of fruit. Wanting more information regarding the fertilizer requirements of this soil, samples were taken previous to blossoming time and sent to an authority on such matters, with a request for an analysis so as to determine what plant food elements should be applied in order to restore this piece of land to a fertile and productive condition. In reply it was stated that this type of soil was a familiar one and since analyses had already been made, it was not necessary to analyze the samples sent in; that nitrogen was needed to improve the size of the prunes; but that potash was present in abundance and would not be needed for thousands of years.

Hunger Signs Appeared

As the season progressed, however, the trees began to show unmistakable signs of hunger. Foliage was a sickly yellow in color, and twig growth insignificant and weak. Prunes of both varieties began to dry up at an early stage of growth, sometimes just one side of the fruit or a single spot would be affected. To the casual observer this condition could readily be mistaken for sunburn, but since it appeared on fruit not exposed to the sun, it indicated that sunburn was not the true cause of this trouble. Summer drop also was excessive, continuing right up to the time of ripening, by which time almost no crop was left. The few prunes remaining on the trees, instead of dropping normally as they should when ripe, were a lot of "stick-tights" that had to be beaten off. The resulting crop was only 500 pounds of green prunes per acre of the French and even less of the Fellenbergs. In drying the shrinkage was heavy, and the finished product so poor in sizes and quality as to be almost worthless.

Notwithstanding the report indicating that potash was not needed on this soil, I could not get the conviction out of my mind that the poor condition of these prune trees was due more to a lack of potash than to anything else. At the same time, judging from the slow maturity or ripening of the few prunes remaining on the trees after the summer drop was over, it seemed evident that phosphoric acid was needed. This impression was further corroborated by an examination of the pits taken from a number of prunes. It was found that the kernel formation was decidedly poor. My conclusion was, therefore, that phosphoric acid, as well as potash would have to be considered in the fertilization of these trees.

Following up this work in later years in other orchards apparently in good condition, except for light yields, an examination of the pit of the fruit was decidedly helpful in determining whether or not this tendency to light bearing was due to the trees not having a sufficient supply of available phosphoric acid to draw upon. If the condition of the kernel indicated a possible phosphate deficiency, applications of a phosphate fertilizer, or one with a high content of phosphoric acid, almost invariably would overcome this trouble by promoting a decided and regular increase in production. This increase was often apparent the first year. At the same time, growers who used or wished to use phosphoric acid alone or in connection with nitrogen were cautioned that increased production also meant an increase in the demand for potash which should be given full consideration if their orchards were to be maintained in a healthy and productive condition.

Search for Potash

Having decided to apply potash on this piece of bottom land, the question then arose, "Where could I obtain potash?" I knew that there were sources of potash other than wood ashes, but could find no advertisements, or other matter, in agricultural publications that answered this question. Finally I called upon a number of chemical concerns in San Francisco, but none seemed to be able to give the desired information. Not until getting in touch with the late Mr. George Meyer of Meyer, Wilson & Company, who were at that time importing potash, could I get any help in my quest. Through Mr. Meyer I at once found the solution of this problem.

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Oscar Bledsoe Makes Farm Science Work

By F. J. Hurst

Agricultural Extension Service, State College, Mississippi

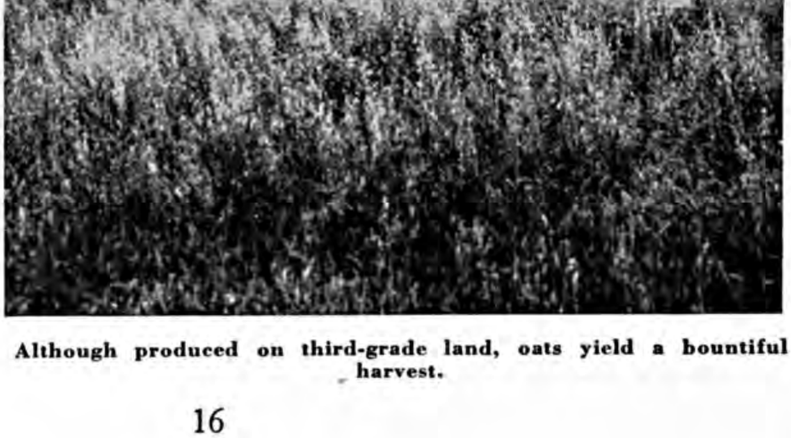
IF INGENIOUS engineers and skilled craftsmen could design and build an automobile or airplane that could travel three times the average rate of all automobiles and airplanes, the machines would be considered new marvels of transportation and the designers and builders would receive world acclaim for their achievement. Unusual accomplishments in the field of agriculture usually are not as spectacular as achievements in the field of engineering and frequently go almost unnoticed, but, nevertheless, may contribute even more to the needs and welfare of the race.

Oscar Bledsoe, Greenwood, Mississippi, delta planter and president of the Mississippi Cooperative Staple Cotton Association, has made a remarkable record in soil-building and cotton production. Because he has put science to work on the farm, he has developed one of the most productive farming systems in the South. In 1939, Mr. Bledsoe produced an average of 826 pounds of lint cotton on 1,570 acres. This phenomenal yield was 3½ times the average yield for the Cotton Belt.

Nor was the remarkable yield of 1939 unusual as 10-year records will prove. The 1928-32 five-year average yield of lint cotton for the plantation before the present improvement program was inaugurated was 314 pounds per acre. The 1935-39 five-year average was 589 pounds of lint per acre. And, in 1940, one of the worst crop years in the history of the State, the yield was 650 pounds per acre.

"Selection of the best land, constant growth of clover, and fertilization of each cut of land according to its needs, have been basic factors in securing high production," says Mr. Bledsoe. A switch from long staple to short staple cotton, planting purebred seed of a high producing variety, planting at the right time, and cultivating the crop clean are other practices which Mr. Bledsoe has followed.

Scientific classification of the soil, combined with accurate records of yields, has been a basic factor in developing the cropping system on the plantation. All of the land has been classified and mapped according to soil type and



Although produced on third-grade land, oats yield a bountiful harvest.

productive capacity. Soil tests have been made and production records kept on every field. Hanging in Mr. Bledsoe's plantation office are two large maps. One of these maps shows by different colors the type of soil on every cut of land. The other shows by figures the actual yield of lint cotton on every cut.

Only the best land as determined by soil type and actual yields is planted to cotton. Cotton yields have been increased by the application of nitrogen and potash fertilizers. In 1939, when the record yield of 826 pounds of lint cotton per acre was produced, a 14-0-14 fertilizer was used. All land that does not produce a good crop of clover receives an application of the right amount of nitrogen and potash; and to be sure that any deficiency of phosphorus is corrected, all crop land in 1940 received an application of 150 pounds of superphosphate per acre. Mr. Bledsoe says, "We strive to put into the land everything that the plant needs."

Bur clover is grown on every acre of cotton land. This crop, which is plowed under as soon as the land gets dry enough in the spring, regardless of the stage of growth, adds humus and nitrogen to the soil, improves the physical condition and increases the moisture-holding capacity of the land. The application of mineral fertilizers supplies needed plant-food elements.

Only the Deltapine variety of cotton is grown on the plantation. Thirty pounds of pedigreed, delinted, ceresan-treated seed are planted per acre on a well-prepared, firm seedbed as soon after April 20 as weather conditions will permit. Ed Jones, capable plantation manager, says their records show that after the last of April every delay of one week in planting will cut the yield of cotton from 50 to 60 pounds of lint per acre. His aim in cultivation is to "keep the grass out." And he says, "Don't cover the cotton up when it is young, and don't plow it up when it is big."

In 1939 the plantation averaged 826 pounds of lint cotton per acre on 1,570 acres.

Mr. Bledsoe sells purebred Deltapine cotton seed as well as lint cotton. No other variety is ginned on his gins. All planting seed are delinted, ceresan-treated, sacked in 100-pound bags, and stored in warehouses.

Soil-building Program

An abundance of feed for plantation needs is produced on the farm. Corn is grown on second-grade land, oats on third-grade land, and alfalfa on a limited acreage to which this crop is adapted. Soybeans are interplanted in corn, and as soon as the corn is harvested, the beans are turned under to improve soil fertility. The thinnest land is planted to oats and seeded to crotalaria, which produces a green manure crop after the oats are harvested.

Thus, it will be seen that Mr. Bledsoe

has developed an intensive soil-building program by growing bur clover on all cotton land during the winter, by interplanting soybeans in corn and seeding crotalaria in oats during the summer, and by fertilizing all crops with superphosphate and by using nitrogen and potash wherever these mineral plant foods are needed.

Not until Mr. Bledsoe had his land classified and crop yields recorded did he realize the tremendous effect of soil type on production. In 1939, for example, yields of lint cotton varied from around 600 pounds per acre to 1,150 pounds per acre due to soil type alone. In fact, cotton on the less productive soil received even more attention than cotton on the best land, because Mr. Bledsoe wanted to bring all of the acreage up to a high productive level.

So important does Mr. Bledsoe consider soil testing and land classification that he has built and equipped an up-to-date soils laboratory and employed a graduate of Mississippi State College to make soil tests and keep production records. He hopes that within the next five years he will have information that will not only be profitable to him but helpful to other producers on similar land.

Turning again to bur clover because it plays such an important part in the soil-building program on the farm, Mr. Bledsoe saves seed patches every year and harvests from 15,000 to 20,000 bushels of bur clover seed annually. Negro women and children are employed to harvest the bur clover seed, which are swept up into piles with stiff brooms and sacked in second-hand bags.

The bulk of the bur clover crop is plowed under early in the spring to improve soil fertility. Turning of the clover begins early in the spring as soon as the soil is dry enough regardless of the stage of growth of the clover. Mr. Bledsoe explains that if he waited until all the clover reached the optimum stage before beginning to plow it under, it might be impossible to get it all turned under in time to thoroughly decay before seeding the next crop.

Since practically all of the land is cultivated by tenant families, Mr. Bledsoe has developed through years of study and experience a written agreement between landlord and tenant that assures equal and fair treatment to both. Comfortable housing, opportunity to make a good living, competent medical

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Bur clover is the main soil-building crop grown on the farm. Both tractor and mule power are used to turn the crop under.

Fig. 1. An airplane view of 14 acres of Muck Soil Experimental plots on Michigan State College Farm at East Lansing.

The Nutrition of Muck Crops

By Paul M. Harmer

Muck Specialist, Michigan State College, East Lansing, Michigan

THE important role which potash plays in the production of high yields of crops grown on muck* soils is fairly well recognized by those who have come in contact with this soil group. The effects of phosphate and sometimes of nitrogen, of sulphur and lime, and of salts of copper, manganese, sodium, and boron, in aiding in producing crop increases, as well as the effects of potash and some of the others in improving crop quality on certain muck soils, have not been so well understood. It also seems safe to say that the amounts of some of these materials, which are annually required on muck for the production of high crop yields, are likewise not generally appreciated.

The absence of any one of these plant-food elements in a muck soil is likely to result in a condition of malnutrition, which may be evident in some deficiency symptom in the growth of the crop. This may appear as an unnatural yellow coloring, a spotting, streaking, or some still different type of chlorosis of the leaves, a drooping or flattened growth of the plant, a cracking of the leaf stems or roots, an abnormal chemical composition of the crop, or some other indication of improper feeding. Since the highest yields of any crop can be secured only by keeping that crop in the healthiest possible condition throughout its growth, the proper balancing of these various plant-food nutrients becomes a matter of great importance in the fertilization of our muck soils.

Early investigations into the plant-food needs of crops, grown on the near-

* The term "muck" is used in this discussion in an all-inclusive sense for soils very high in content of organic matter, thus including peat as well as muck soils.

virgin mineral soils in many States, often failed to show any marked deficiency in supply of available potash in those soils. Since this situation continued for several decades before the need for potash became evident in the crop returns, conservative investigators were rightfully hesitant in revising their fertilizer recommendations. On the muck soils, on the other hand, the need for potash has been almost always immediate and outstanding, from the time the muck was first reclaimed. Yet even here, the adoption by farmers of a mixture containing sufficient potash has seemed comparatively slow. As recently as 1925, a fertilizer having an 0-10-10 analysis was considered as a high-potash muck mixture. Even in 1935, when considering the advisability of recommending an 0-8-40 mixture for certain muck crops, the writer was forced to drop the 0-8-32 analysis from his list of recommended mixtures, for a period of three years, because, in the restricting of the number of mixtures recommended by the group of experiment stations in which Michigan falls, it was decided at that time that the limited sale of 0-8-32 did not warrant its retention in the list.

Since muck soil is naturally so very low in content of phosphate and potash, a fairly good idea of the requirements of different crops for these two constituents can be secured from a consideration of the chemical composition of those crops. In Table 1 are presented the average amounts of phosphate and potash removed in good yields of several different crops, with the amounts expressed in the form of the fertilizer analysis and the rate of application which would be required to replace the quantities of these nutrients removed. These analyses range from as narrow a ratio of phosphate (P_2O_5) to potash (K_2O) as 1 to 2.1, in the case of rye,

TABLE 1.—SHOWING FERTILIZER ANALYSIS AND RATE OF APPLICATION THAT WOULD BE REQUIRED TO REPLACE THE PHOSPHATE AND POTASH WHICH IS REMOVED IN GOOD YIELDS OF SEVERAL DIFFERENT CROPS*

Crop	Bu.	Tons	Fertilizer analysis required to replace the phosphate and potash removed in crop	Rate of application Lbs. per acre
Grain and Corn Crops				
Barley, straw		2.2	0–8–58.4	114
Barley, grain	50		0–8–5.7	261
Total crop			0–8–21.8	375
Oat, straw		2.5	0–8–53.6	186
Oat, grain	60		0–8–5.1	181
Total crop			0–8–29.6	367
Rye, straw		2.0	0–8–32.8	126
Rye, grain	30		0–8–6.1	179
Total crop			0–8–17.1	305
Corn, stover		2.5	0–8–77.6	129
Corn, ears	60		0–8–6.2	276
Total crop			0–8–29.1	405
Average of grain and corn crops			0–8–24.4	363

TABLE 1—(Continued)

Crop	Bu.	Tons	Fertilizer analysis required to replace the phosphate and potash removed in crop	Rate of application Lbs. per acre
Hay Crops				
Alfalfa		3.0	0–8–40	361
Alsike clover		2.0	0–8–28.6	264
Hungarian millet		3.0	0–8–43.2	292
Meadow fescue		3.0	0–8–30.2	342
Reed canary grass		3.0	0–8–28.6	395
Sweet clover		3.0	0–8–40	327
Timothy		2.0	0–8–35.6	184
Timothy and clover		2.5	0–8–36	244
Wild marsh hay		1.5	0–8–36.2	77
Average all hay crops			0–8–35.4	276
Root Crops				
Sugar beet, tops		8.0	0–8–55.5	184
Sugar beet, roots		14.0	0–8–28.3	321
Total crop			0–8–38.2	505
Turnips, tops		5.0	0–8–24.2	229
Turnips, roots		16.0	0–8–38.8	367
Total crop			0–8–33.2	596
Carrots, roots		24.0	0–8–28	836
Mangels, roots		25.0	0–8–50.4	430
Parsnips, roots		15.0	0–8–27.3	689
Rutabagas, roots		16.0	0–8–43.3	458
Table beets, roots		18.0	0–8–44.2	412
Average all root crops (roots only)			0–8–37.2	500
Miscellaneous Crops				
Cabbage (above ground)		25.0	0–8–33.6	430
Celery (above ground)		25.0	0–8–30	1250
Onions, bulbs	800		0–8–19.6	504
Peppermint, hay		2.0	0–8–26	100
Potatoes, tubers	400		0–8–40.7	344
Tomatoes, whole fruit		25.0	0–8–42.3	430
Average all miscellaneous crops			0–8–32.0	509
Average all 26 crops			0–8–32.25	412

* Calculations based on chemical analysis of plant materials from Morrison's "Feeds and Feeding" and various other sources. Since the nitrogen removed in the crop may be largely or wholly secured from the muck soil itself, all consideration of that fertilizing element is purposely omitted in calculating the fertilizer analysis required to replace the fertility removed by the crop.

to as wide as 1 to 6.3, in the case of mangels. Six out of nine of the hay crops listed in the table, and four out of six of the root crops, show a ratio of phosphate to potash greater than 1 to 4. All but three of the 26 crops listed have more than a 1 to 3 ratio, while the average of the entire 26 shows a ratio of phosphate to potash of 1 to 4.03.

Attention should be called to the fact that the available analyses of the root crops in this table in some cases do not include the tops, inclusion of which generally would markedly increase the total amounts of the plant-food constituents required to replace those removed by the crop. On the other hand, the tops of these root crops usually are not removed from the field, therefore, the fertility in them largely remains in the soil. It should also be recalled that, in a muck soil even more than in other soils, potash is lost from the soil by leaching to a considerably greater extent than is phosphate. To compensate for this loss, an excess of potash always should be applied in the fertilizer mixture.

In any muck soil testing program for the determination of the content of plant-food nutrients, it is evident that, due to the leaching processes, the presence of a supply of potash in the soil in the fall or winter months is not an indication of the amount which will be present when planting time arrives. Consideration should likewise be given to the fact that, unlike mineral soils, most of the potash in the muck is in a water-soluble condition, with little reserve in the soil to replace the water-soluble potash when it has been exhausted by crop removal or leaching. On the other hand, phosphate, applied to the muck in excess of the crop requirements, is largely retained in a less available form in the soil as a reserve, which becomes available gradually as the previously available supply is removed. For that reason, a soil test, which shows a higher proportion of available potash than of phosphate in a high-yielding muck soil, is not an indication that the application of potash should be reduced, but rather that the condition is that of a healthy equilibrium, which should be maintained by a continued use of the fertilizer mixture that has produced this situation.

A systematic study into the fertilizer needs of muck soils was begun by Michigan State College in the spring of 1922. On a six-acre, leased field of slightly acid, deep muck, located three miles from the College, a series of plots was laid out with varying fertilizer mixtures and rates of application. For nine years these same plot treatments were repeated. With the experience gained from that set of plots, a new set of 14 acres, considerably more comprehensive than the first, was established on a deep muck on the College farm at East Lansing in the spring of 1931, so that 10 years of experimental data from this field have now been secured. Figure 1 shows an airplane view of the College muck field. In support of this central set of plots, a number of sets of from one to four years duration have been carried along in other parts of the State. Plans are now being made for a still more comprehensive muck experimental farm to be established in 1942 on 200 acres of deep virgin muck, located 11 miles from and owned by Michigan State College since 1855.

Fertilizing the crop. Probably the first important change resulting from these studies was the definite proof brought to our muck farmers that manure can be entirely dispensed with, provided a mineral fertilizer mixture high in potash content is used. After the muck has been farmed for a considerable period of years, an occasional green manure crop is grown, in order to supply live organic matter to the soil. The need for phosphate, along with the potash, is likely to appear in the very first crop on new muck, especially if such crops as onions and celery are being grown. It is almost certain to be needed within three or four years of cropping, even for hay

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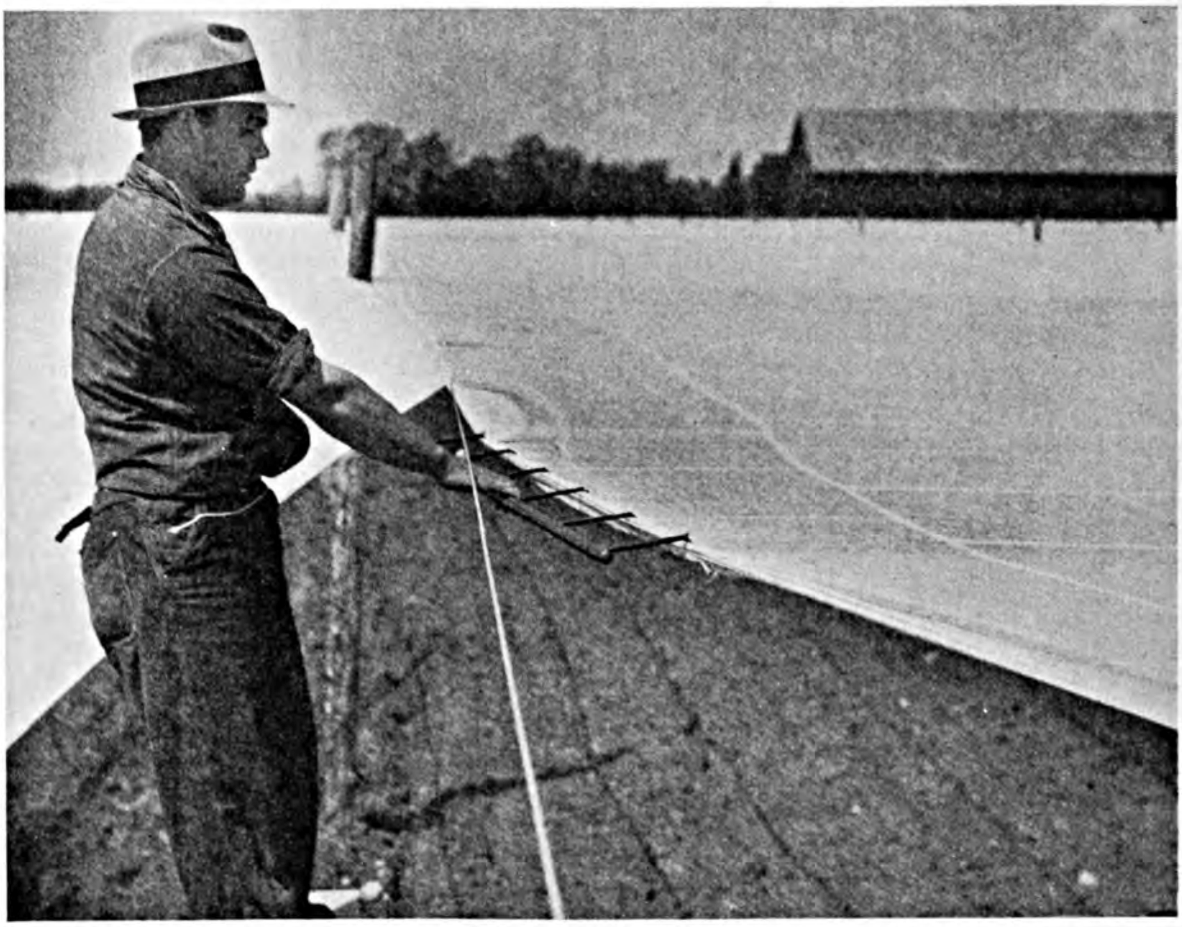
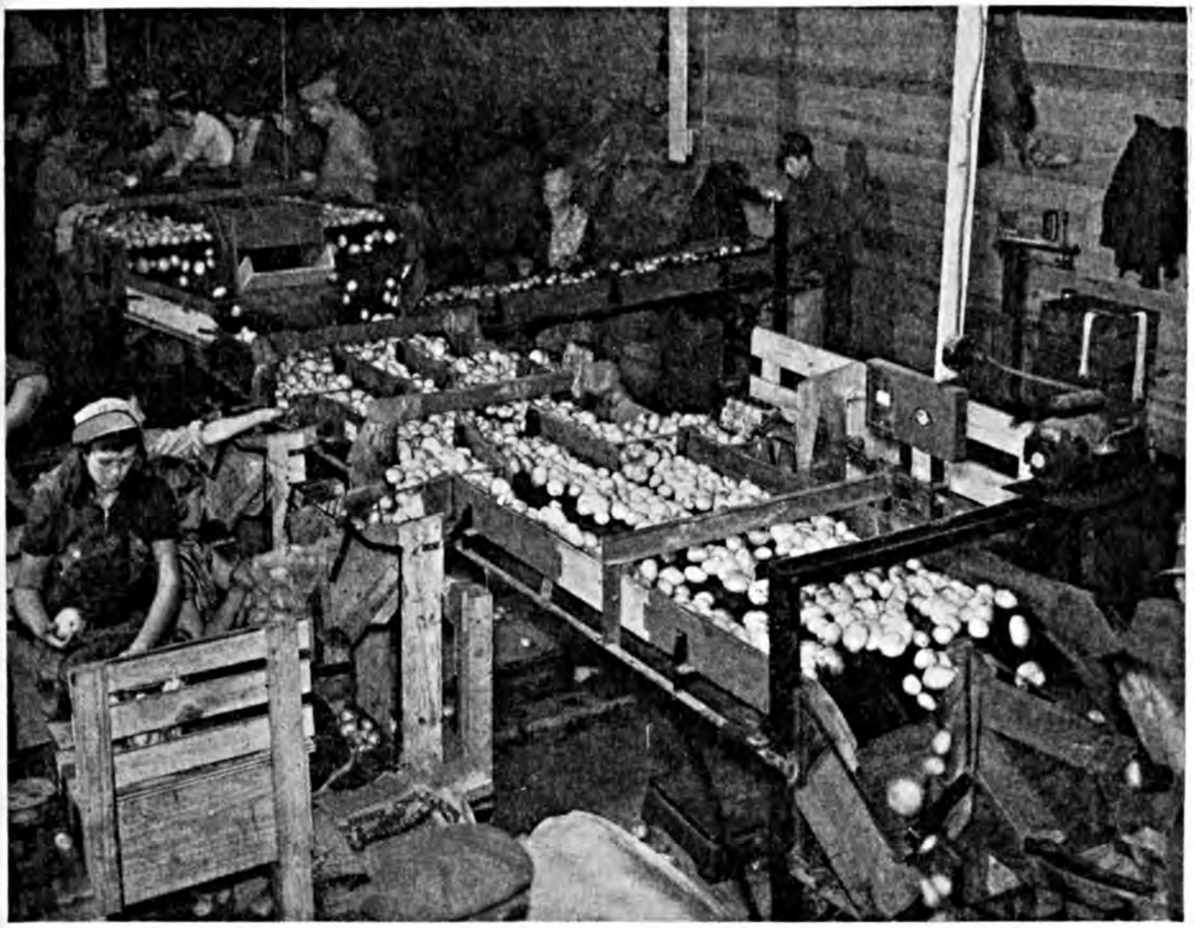
PICTORIAL

APPLYING FERTILIZERS AT PLANTING TIME SAVES LABOR AND HELPS THE CROP GET OFF TO A GOOD START.



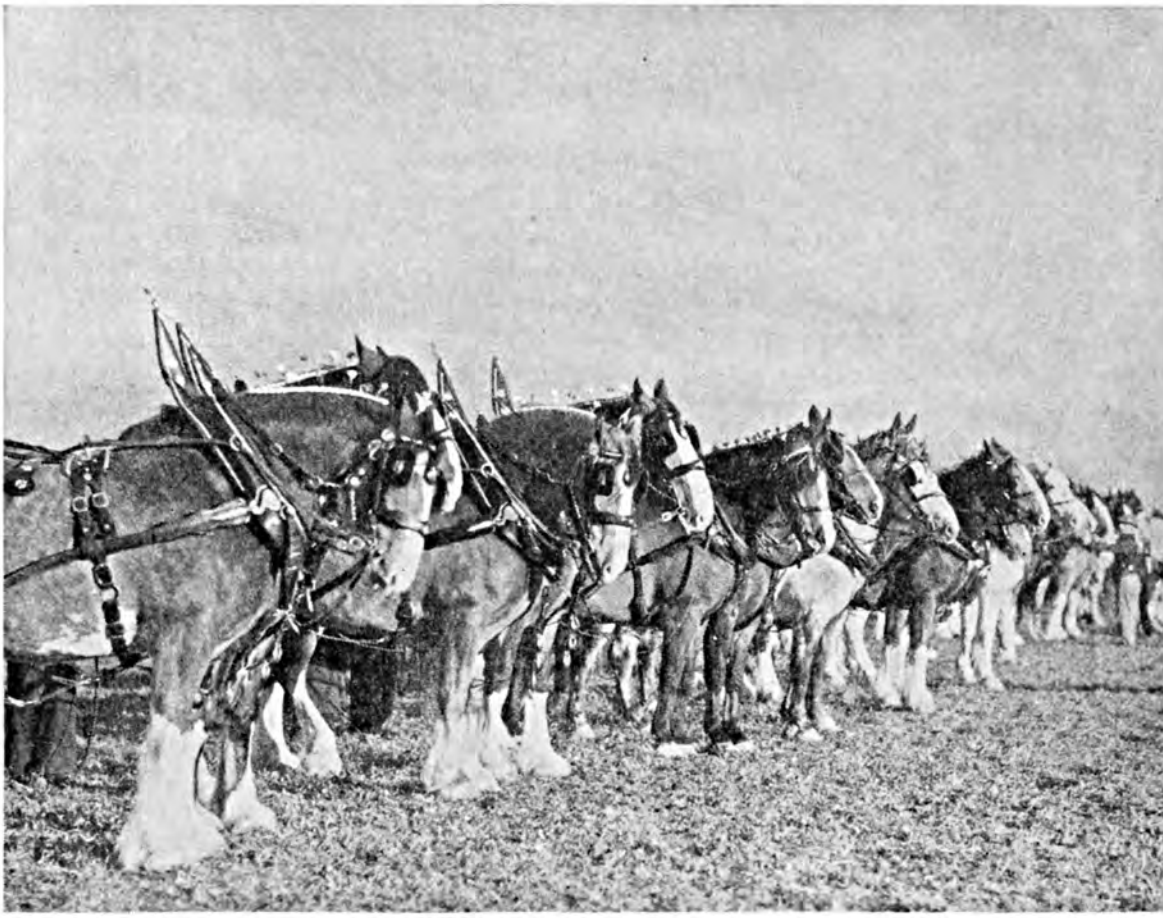
Above: Stretching tent cloth over a shade tobacco field in the Connecticut Valley.

Below: Fertilizing the tobacco with materials for a short but speedy growing season.



Above: Grading and sacking potatoes on the farm of Wm. Gehring, Newlin, Indiana.

Below: Limestone rock quarry being stripped in Hopkins County, Kentucky.



Above: Line-up of teams to be judged at International Plowing Match, St. Thomas, Ontario, 1940.

Below: Eight-horse team of Premier M. F. Hepburn of St. Thomas, Ontario.

The Editors Talk

More Grass Less Labor

Farmers, like other employers, are watching the National Defense Program with more than a little anxiety over the loss or impending loss of employees whose services they value. Already reports of shortage of farm help all over the country are current. How some growers are planning to meet the problem was interestingly set forth in a short article recently received from Paul H. Allen, County Agent, Liberty, New York. Because the plan has application to many other regions, we are pleased to present his ideas below:

"The Number One problem on dairy farms in the Northeast this year is a shortage of farm help. With young men leaving for the Army and industry, the outlook for the immediate future is not too promising. As a result, farmers are beginning to think of ways to save time. They are trying all kinds of labor-saving devices and machinery, as well as giving more attention to labor efficiency in general.

"Dairymen on the heavier soils are beginning to wonder whether they have not been doing too much plowing. With a relatively large part of their farms under the plow, there is a peak in labor requirements at planting time in the spring and again during haying and harvesting. If the weather is unfavorable, the farmer short of help never gets caught up. On the other hand, dairymen who practice all-grass farming never appear to be in a rush. They make silage and hay all summer and the rain that delays their neighbors makes big crops for them.

"The trend towards more grass farming has been slow because we have lacked suitable perennial legumes and grasses. Timothy and clover seedings have to be renewed frequently, and few farmers will risk running short of roughage because they don't have enough silage corn. With yields of ten, fifteen, and even twenty tons to the acre, silage corn has been the most productive crop we have had in the Northeast until recently.

"Now we are finding that certain new types of seedings will actually outyield silage corn in the production of protein and total digestible nutrients per acre. Ladino white clover is the perennial legume we have long sought. Birdsfoot trefoil shows promise, and yellow trefoil is proving useful in many seedings. Orchard grass, especially the improved strains, perennial ryegrass, smooth brome grass, and some others have been found both productive and palatable to cattle.

"With these legumes and grasses, we are able to put down seedings that will produce high yields for several years. They can be used for grazing, silage, and hay and they will not deteriorate after the first years' cutting, as timothy, medium red and alsike clover seedings do.

"These new type seedings must be made in seedbeds adequately limed and fertilized with phosphorus, potash, and perhaps, in some cases, with minor elements such as boron. Then they must be frequently cut and grazed if large yields are to be obtained. A cutting for the silo, a crop of hay, and one to three periods of grazing are possible each season.

"Really enormous yields have been reported from experimental plots at Cornell University. They run from two to more than three tons to the acre of material analyzing from fifteen to thirty per cent protein on a dry basis. Last season a yield of over four tons to the acre of material averaging twenty-two per cent protein was reported from a field of over forty acres. This is equivalent to a yield of about thirty-two tons of corn silage to the acre.

"In this particular case, the field was clipped frequently and the material either ensiled or dried artificially. The seeding consisted largely of an improved strain of orchard grass, perennial ryegrass, and Ladino white clover.

"The yield of digestible protein per acre amounted to well over three-quarters of a ton and of total digestible nutrients to more than two tons. This compares with two or three hundred pounds of protein and not more than a ton of T.D.N. from a good crop of ordinary hay and two hundred and fifty pounds of protein and a ton and three-quarters of T.D.N. from a crop of corn.

"Our present knowledge of grassland management would seem to justify dairymen in considering grass farming as a means of helping solve the labor problem without reducing the amount of roughage produced. Actually a modern system of grassland farming will make it possible to produce more nutrients on the farm and reduce the feed cost of producing milk."

Hybrid Corn's Popularity

Probably no new crop development ever received more publicity or took hold faster than the use of hybrid corn. Introduced to commercial growing about ten years ago, the crop has made phenomenal strides within the last five years. The first survey of the corn belt, made in 1938, showed the concentration of hybrid corn acreage in northern Illinois and east-central Iowa, and even there the hybrid made up less than three-fourths of the total corn acreage. In 1940, 77 per cent of the corn land in Illinois grew hybrids. Iowa reported a percentage of 88. It is believed that of the total corn plantings in the twelve north-central States, estimated at 49,544,000 acres, more than half was planted to hybrids.

With this remarkable acceptance comes the warning that hybrid corn is no substitute for soil fertility. C. M. Linsley, extension soil conservationist of the University of Illinois College of Agriculture, explains that hybrid corn is an efficient crop in using soil fertility to produce higher yields. Good hybrids have the ability to produce higher yields than open-pollinated because they have the ability to take up and use more fertility. However, many Illinois soils, after years of hard farming, cannot supply more fertility than an average crop of open-pollinated corn can use. Consequently, on these soils hybrid corn has little advantage in yields over open-pollinated.

Such warnings are most opportune. Too often, growers in their eagerness to increase yields lose sight of the necessity for a plant-food supply to support such yields. If hybrid corn is to retain its popularity, more and more attention will be paid to the fertility of the soil on which it is grown.

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

¶ A noteworthy study on periods of growth in which nutrients are taken up by pimiento plants is reported by H. L. Cochran and L. C. Olson in Georgia Experiment Station Bulletin 208. The title of this instructive publication is "Uptake of Nutrients by the Perfection Pimiento Plant Under Field Conditions and Its Relation to Fertilizer Practices in Georgia." During the past few years growers of this important cash crop in the lower Piedmont have experienced relatively small profits, due for the most part to low yields. The improvement in fruit type and better cultural practices cannot prove their maximum worth unless they are accompanied by a better knowledge of the nutrient needs of the crop. Data derived from a two-year investigation and presented here should go a long way toward fulfilling this need.

It is evident from the results given that the Perfection pimiento has a fairly large nitrogen, phosphorus, potassium, calcium, and magnesium requirement. An average of 243 pounds of nutrients was found in the above-ground portion of an acre of these plants. Of the total amount, 82 pounds were nitrogen, 56 pounds potash, 51.5 pounds calcium oxide, 36.5 magnesium oxide, and 17 pounds phosphorus. The greatest quantity of nutrients was absorbed during the third month of growth in the field. This amounted to 99 pounds per acre or 40.7 per cent of the total amount absorbed during the six-month growing season. Of the five nutrients considered, more potassium was taken up during any one single month than any other nutrient, followed by nitrogen, calcium, magnesium, and phosphorus. Details of these and other determinations are shown in charts and tables which accompany the text.

The authors conclude that proper fertilization of pimientos is necessary before much improvement in yield can be expected. A complete fertilization should generally be applied as a basic treatment in producing this crop regardless of the price received at the cannery.

¶ According to Michigan Extension Bulletin 159 (Revised), "Fertilizer Recommendations for 1941-42," the increase in use of commercial fertilizers is evidence that Michigan farmers are finding them profitable. Prepared by members of the Soils Department, who urge farmers to buy only fertilizers listed on the front of this Bulletin for good results and low plant-food costs, it predicts that the quantity used, especially by the more progressive farmers, should continue to increase. Fertilizer use on mineral soils should be in conjunction with good tillage, lime, green crops plowed under, rotation, manure, erosion control, and other good soil management practices. The intensive production of crops followed on muck soils requires special tillage and fertilizer practices.

Fertilizer analyses recommended are: 0-12-12; 0-20-20; 0-8-24; 0-8-32; 0-20-10; 0-14-6; 0-10-20; 2-12-6; 2-16-8; 2-8-16; 3-9-18; 3-12-12; 4-10-6; 4-16-4; 4-16-8; 5-10-5; 10-6-4; 0-20-0; the nitrogen carriers; and potash salts. As noted, the list comprises only those fertilizers containing 20 units or more of plant food. The authorities caution farmers that a low price per ton for low analysis fertilizers does not mean cheap plant food.

"Recommendations for Soil Management and Use of Fertilizers," Ont. Dept. of Agr., Toronto, Ont., 1941.

"Fertilizer Recommendations for the Maritime Provinces of Canada," Maritime Fert. Council, Moncton, Canada, J. E. McIntyre, Sec.

"Home Mixing Fertilizers for Truck Crops," Agr. Exp. Sta., State College, Miss., Inf. Sheet 222, Dec. 1940, W. B. Andrews and J. A. Campbell.

Soils

¶ The first National Conference on Land Classification held in the United States was sponsored by the University of Missouri at Columbia, Missouri, in mid-autumn last year. Because of the value of such a record to scientists engaged in land classification work, the decision was made that the proceedings of this conference should be published in full as a bulletin of the Agricultural Experiment Station. Of particular interest to economists, soil scientists, geographers, engineers, foresters, and others, very valuable interpretations can be gained from the papers given and published in Missouri Experiment Station Bulletin 421, "The Classification of Land." Up-to-date material on land classification is brought together by scientists as far apart as Connecticut and California, Minnesota and Arkansas. There are also papers by specialists dealing with grazing problems, recreational lands, and public land policy.

According to Dr. M. M. Kelso, U. S. D. A., Bureau of Agricultural Economics, and Dr. Charles E. Kellogg, U. S. D. A., Division of Soil Survey, "The subject matter of papers might be classified roughly under four principal headings: (1) the materials of land classification, (2) the methods of land classification, (3) the objectives of land classification, and (4) the frame of reference within which land classification is done. Most speakers had something to say on two or more of these subjects, and it is not always clear when one is being discussed and when another. Yet this confusion, or lack of clarity, gives one an initial impression of greater disagreement among speakers than a closer analysis reveals."

The original idea of the Conference was conceived by Dr. C. H. Hammar, Professor of Agricultural Economics, College of Agriculture, University of Missouri. Arrangements were formulated by a committee of the College composed of Dr. Hammar as chairman; Professor O. R. Johnson, Head, Department of Agricultural Economics; Dr. W. A. Albrecht, Head, Department of Soils; Professor H. H. Krusekopf, Professor of Soils; and Dr. C. E. Lively, Head, Department of Rural Sociology. This committee was assisted, particularly in matters relating to the program, by members selected to represent the various agencies of the Federal Government that had shown interest in land classification.

"Saving Colorado's Soil," Agr. Ext. Serv., Fort Collins, Colo., Ext. Bul. 362-A, Sept. 1940, T. G. Stewart.

"Late Holding of Water on Cranberry Bogs," Agr. Exp. Sta., New Brunswick, N. J., Cir. 402, Oct. 1940, Charles S. Beckwith.

"Soil Losses From Cultivated Strips in Strip-cropped Fields in the Ohio Valley Region," U. S. D. A., Washington, D. C., Cir. 588, Dec. 1940, R. W. Gerdel.

Crops

¶ Virginia Truck Experiment Station Bulletin 105, entitled "Vegetable Crops Affected by Boron Deficiency in Eastern Virginia," by E. R. Purvis and W. J. Hanna, presents results of field tests showing that applications of borax in several areas have resulted in increases in yield or quality with a majority of the vegetable crops grown in Eastern Virginia. Boron deficiency, the authors state, has been found to affect at least 16 vegetable crops grown under field conditions in this section of the State as evidenced by growth response to applied borax, or the appearance of malnutrition symptoms in plants.

Vegetable crops are classified according to their tolerance to applied borax as determined by field and greenhouse studies. This classification shows that, assuming normal rates of fertilizer application, borax at the rate of 10 pounds per ton may be safely mixed with fertilizers used for all vegetable crops grown in Eastern Virginia. Precautions necessary for the avoidance of injury in applying borax are stressed.

On soils where any one crop is affected by boron deficiency, it is recommended that borax be applied at the rate of not more than 10 pounds per acre for the following crops: beets, carrots, cauliflower, celery, corn, eggplant, kale, lettuce, mustard, peppers (sweet), potatoes, sweet potatoes, radishes, tomatoes, and turnips. In cases of the more deficient soils, more than 10 pounds of borax per acre will have to be used for certain crops. In such instances, it is advised that the grower consult the Truck Experiment Station before using amounts greater than 10 pounds per acre.

Although certain of the light Norfolk soils have been found to be extremely deficient in boron, this condition is not general with a majority of the trucking soils of Eastern Virginia, where only limited deficiency exists.

The extensive investigations reported were begun in 1938 in an effort to establish the extent of boron-deficient soils in this area, as well as to determine what vegetable crops were affected by this deficiency, and to classify locally grown vegetable crops according to their tolerance to applied borax. The results obtained will be of infinite value to vegetable growers in Virginia and other States whose soils similarly require attention to boron applications.

"Handbook of Alabama Agriculture" (Third Edition), Ala. Ext. Serv., Auburn, Ala., 1941.

"Effect of Date of Planting on Corn Yields, Insect Infestation, and Fungus Diseases," Agr. Exp. Sta., University, La., Bul. 327, Jan. 1941, D. M. Johns and H. B. Brown.

"Commercial and Experiment Station Corn Yield Trials, 1940," Agr. Ext. Serv., University Farm, St. Paul, Minn., Ext. Pamphlet 75, Jan. 1941, Ralph F. Crim.

"A Laboratory Study of the Drainage Requirements of Sweet Clover," Agr. Exp. Sta., University Farm, St. Paul, Minn., Tech. Bul. 144, June 1940, P. W. Manson.

"Sweetpotato Plant Production in Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 349, Oct. 1940, W. S. Anderson.

"Tomato Experiments—1940," Agr. Exp. Sta., State College, Miss., Inf. Sheet, 225, Dec. 1940, J. A. Campbell.

"Management of Korean Lespedeza," Agr. Exp. Sta., Columbia, Mo., Cir. 210, Dec. 1940, C. A. Helm.

"Serving Montana Agriculture Through Research," Agr. Exp. Sta., Bozeman, Mont., 46th and 47th An. Rpts., July 1, 1938, to June 30, 1940.

"Effect of Ensiling Upon the Composition of Forage Crops," Agr. Exp. Sta., New Brunswick, N. J., Bul. 683, Nov. 1940, M. Wight Taylor, C. B. Bender, and Walter C. Russell.

"Inoculation for Legumes," Agr. Exp. Sta., Geneva, N. Y., Cir. 179, Rev. Dec. 1, 1940, A. W. Hofer and J. K. Wilson.

"Flue-cured Tobacco," Agr. Ext. Serv., State College Station, Raleigh, N. C., Ext. Cir. 212, Rev. Jan. 1941, E. Y. Floyd and L. T. Weeks.

"Azaleas," Agr. Ext. Serv., State College Station, Raleigh, N. C., Cir. 246, Jan. 1941, James G. Weaver.

"The Massey Strawberry," Agr. Exp. Sta., State College Station, Raleigh, N. C., Bul. 327, Aug. 1940, George M. Darrow and E. B. Morrow.

"The Trailing Raspberry—Rubus Parvifolius L.—Characteristics and Breeding," Agr. Exp. Sta., State College Station, Raleigh, N. C., Tech. Bul. 65, Aug. 1940, C. F. Williams and George M. Darrow.

"Growing Ornamental Greenhouse Crops in Gravel Culture," Agr. Exp. Sta., Wooster, Ohio, Bul. 616, Dec. 1940, Alex Laurie and D. C. Kiplinger.

"Science Serving Agriculture," Agr. Exp. Sta., Stillwater, Okla., Biennial Rpt., 1938-1940, Dec. 1940.

"Operation of Webber Demonstration Farm, 1929-1938," Agr. Exp. Sta., Brookings, S. D., Cir. 31, Nov. 1940, C. Larsen.

"Fifty-second Annual Report—1939," Agr. Exp. Sta., College Station, Tex.

"Ripening Fall and Winter Pears," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 258, Nov. 1940, John C. Snyder.

"Filberts," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 263, Jan. 1941, John C. Snyder.

"Epistle to the Farm," Agr. Exp. Sta., Morgantown, W. Va., Bul. 298, Dec. 1940, Rpt. of Dir., Biennium 1938 to 1940, C. R. Orton.

"What's New in Farm Science," Agr. Exp. Sta., Madison, Wis., Bul. 450, Dec. 1940, An. Rpt. of Dir.

"Report of The Puerto Rico Experiment Station, 1939," U. S. D. A., Washington, D. C., Oct. 1940.

"Disease-resistant Varieties of Vegetables for the Home Garden," U. S. D. A., Washington, D. C., Leaf. 203, 1940, R. J. Haskell and V. R. Boswell.

"Report of The Chief of The Bureau of Agricultural Chemistry and Engineering, 1940," U. S. D. A., Washington, D. C.

"Report of The Chief of The Office of Experiment Stations, 1940," U. S. D. A., Washington, D. C.

"Report of The Chief of The Bureau of Plant Industry, 1940," U. S. D. A., Washington, D. C.

"Report of The Director of Information, 1940," U. S. D. A., Washington, D. C.

"Lespedeza Culture and Utilization," U. S. D. A., Washington, D. C., Farmers' Bul. 1852, Nov. 1940, Roland, McKee.

"The Maytime, Starbright, and Redstar Strawberries," U. S. D. A., Washington, D. C., Cir. 597, Dec. 1940, George M. Darrow.

"The Atlantic Pemberton, and Burlington Blueberries," U. S. D. A., Washington, D. C., Cir. 589, Dec. 1940, George M. Darrow and J. H. Clark.

Economics

¶ The cost of production in agriculture is a widely varying factor, but is perhaps the most important one affecting farm income. In Special Bulletin 305, "Sugar Beet Costs and Returns," of the Michigan Agricultural Experiment Station, Mr. K. T. Wright has presented a nice analysis of the factors affecting cost and return from sugar beet production in this section of the United States.

Sugar beets are an important crop in Michigan, providing farmers with an annual cash income of approximately 5 million dollars. Michigan usually ranks third or fourth in sugar beet production in the United States. The other three leading sugar beet-producing States are Colorado, California, and Nebraska.

Data for the Bulletin was provided through an analysis of 279 sugar beet cost records kept by producers over a 4-year period, 1933 to 1936. The average farms on which sugar beets were grown consisted of about 150 acres, with 115 tillable. The crops grown consisted of: sugar beets about 15 acres, beans—10, hay—22, corn—17, small grains—31, miscellaneous crops and tillable pasture—20. On the average farm there were about 10 cows, 2 brood sows, 15 ewes, and about 100 hens. The average production cost per acre for sugar beets was $39 per acre, and marketing costs amounted to $9 an acre, making a total cost of $48. The average income amounted to $70 an acre, leaving a net return of approximately $22 an acre. Hand work constitutes the major part of the labor involved in the production of sugar beets. Out of a total of 85 hours of man labor spent per acre, 70 hours were hand work and 15 hours were taken up with other operations.

The most significant figure in production costs is that relating to the cost per unit. Production cost per ton averaged $4.03, but there was a rather wide variation from farm to farm. The marketing cost was 89 cents per ton, making a total average cost of $4.92 per ton delivered at the plant.

Receipts from the sugar plants averaged $6.08 per ton during the 4-year period. Government payments and credit for tops brought the total to $7.12 per ton, which was $2.20 above the cost. The production cost per ton varied from approximately $3 to $10, but a range of 80¢ per ton on each side of the average included one-half of the growers, while a range of $1.20 included two-thirds of the growers. In other words, about half of the growers had a production cost which was between $3.20 and $4.80 per ton, and two-thirds of them fell within $2.80 to $5.20 a ton.

Yield per acre is one of the most important factors determining production cost per unit. The growers having yields of around 6½ tons per acre had a production cost of $5.74 per ton as compared to $3.21 per ton for those averaging approximately 13 tons per acre. The net return per acre was more than 10 times as high for the high-yield producers as for the low-yield.

The author includes such variables as soil type, drainage, amount of manure and fertilizer applied, time of plowing and planting, and row width as the most important factors affecting the yield per acre and cost per ton. He considered other factors, including acres of beets per farm, the grower's efficiency with labor, power and machinery, and the hand labor method, as having considerable effect on the cost per acre and consequently per ton of beets. The distance to the plant, of course, had an important bearing on the marketing cost and consequently on the net return from the beets.

An analysis of the records of three low-cost growers showed that the grower who was lowest in cost had a four-year average production cost of slightly less than \$3 per ton. "This man averaged 13.5 tons of beets per acre on about 10 acres of beets each year. His soil was well-drained Brookston. Corn or beans occupied the field the year preceding the sugar beets, and the ground was not plowed for beets three of the four years of the study. The beets were planted May 7 as an average, in 22-inch rows, with a desired spacing of 12 inches in the row. More than 500 pounds of 2-12-6 commercial fertilizer was applied per acre, and manure was used half the time, two years before the beets occupied the ground. . . .

"The grower ranking next in cost, had an average production cost of \$3.34 a ton. He averaged 12.7 tons of beets per acre on slightly less than 10 acres. The soil was of the Brookston type with fair drainage. The sugar beet field was in corn the preceding year in two of the four years, beans once, and buckwheat once. The ground was fall-plowed three years and spring-plowed one year. This man, located in the northern edge of the sugar beet area, planted his beets May 16 as an average, in 24-inch rows, with a spacing of 10 inches in the row. From 175 to 200 pounds of 4-16-4 commercial fertilizer were used, and manure was used as a top-dressing two years, and a 10-ton application was applied once, the year before the beets. . . .

"The grower ranking third had an average production cost of \$3.46 a ton for the four years. His average yield was about 13 tons per acre on approximately 30 acres of beets. The soil was well-tilled Napanee. The beets usually followed corn, although sometimes clover or wheat. The ground was fall-plowed each year. The average planting date for this grower (in the southern part of the beet area) was May 5. The beet rows were 22 inches apart, and the spacing in the row was 12 to 14 inches. Commercial fertilizer applications ranged from 250 to 350 pounds per acre, and there was usually a light application of manure the year before the beets."

"Fertilizers Used in Alabama, Season of 1940," Ala. Dept. of Agr. and Inds., Montgomery, Ala.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended Dec. 31, 1940," Dept. of Agr., Sacramento, Calif., Bu. of Chem. Ann. FM-17, Feb. 14, 1941.

"Connecticut Vegetable Acreages—1938, 1939, and 1940," Dept. of Agr., Hartford, Conn., Bul. 69, Dec. 1940.

"Agriculture and National Defense, Delaware Farm Family Outlook—1941," Agr. Ext. Serv., Newark, Del., Ext. Cir. 44, Jan. 1941.

"The Analysis of Lattice and Triple Lattice Experiments in Corn Varietal Tests," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 281, Sept. 1940, Gertrude M. Cox, Robert C. Eckhardt, and W. G. Cochran.

"A Farm Management and Cost Study of Strawberry Farms in Southeastern Louisiana, 1937-38," Agr. Exp. Sta., University, La., Bul. 326, Jan. 1941, J. Norman Efferson.

"A Cost of Production Study of Tomatoes in North Louisiana, 1939," Agr. Exp. Sta., University, La., Bul. 329, Jan. 1941, T. M. Montgomery, Jr., and J. Norman Efferson.

"Commercial Fertilizers, 1940," Agr. Exp. Sta., Orono, Me., Off. Insp. 177, Oct. 1940, Elmer R. Tobey.

"Inspection of Agricultural Lime Products," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 106, Oct. 1940, Philip H. Smith and J. W. Kuzmeski.

"Fertilizer Analyses and Registrations—1940," Dept. of Agr., St. Paul, Minn.

"A Survey of Practices and Costs of Producing Grass Silage on 50 New Jersey Farms," Agr. Exp. Sta., New Brunswick, N. J., Bul. 684, Oct. 1940, John W. Carncross, Allen G. Waller, and Emil Rauchenstein.

"Land Use and Crop Practice Survey—Franklin and Harrison Townships, Gloucester County," Agr. Exp. Sta., New Brunswick, N. J., AE 36, Jan. 1940, Allen G. Waller and John W. Carncross.

"North Carolina Cotton Prices and Local Marketing Practices," Agr. Exp. Sta., State College Station, Raleigh, N. C., Tech. Bul. 64, June 1940, Glenn R. Smith.

"Price of Coffee in Puerto Rico from 1900 to 1938," Agr. Exp. Sta. Rio Piedras, P. R., Bul. 54, Apr. 1940, Jorge J. Serrallés, Jr., and Martín Vélez, Jr.

"The Food Supply of Puerto Rico," Agr. Exp. Sta., Rio Piedras, P. R., Bul. 55, Aug. 1940, E. B. Hill and J. R. Noguera.

"Costo De Producción De Tabaco en Puerto Rico, 1937-38," Estación Exp. Agr., Rio Piedras, P. R., Boletín 56, 1940, Roberto Huyke y R. Colón-Torres.

"Summary of Fertilizer and Fertilizer Materials and Customers Mixtures Sold in South Carolina as Reported by Manufacturers for the Period July 1, 1940, through December 31, 1940," Clemson Agr. Col., Clemson, S. C., Feb. 10, 1941.

"Inspection and Analysis of Commercial Fertilizers," Agr. Exp. Sta., Clemson, S. C., Bul. 330, Oct. 1940, B. D. Cloaninger.

"Planning the Farm Layout and Cropping System," Agr. Ext. Serv., Knoxville, Tenn., Pub. 245, Nov. 1940, H. C. Holmes.

"Farm Management Aspects of Soil Conservation on Flue-cured Tobacco Farms in Virginia," Agr. Exp. Sta., Blacksburg, Va., Bul. 327, Sept. 1940, W. L. Gibson, Jr.

"Alabama Handbook, 1941 Agricultural Conservation Program," U. S. D. A., Washington, D. C., SRB-501—ALA, Dec. 1940.

"Louisiana Handbook, 1941 Agricultural Conservation Program," U. S. D. A., Washington, D. C., SRB-501-LA, Jan. 1941.

"Mississippi Handbook, 1941 Agricultural Conservation Program," U. S. D. A., Washington, D. C., SRB-501-MISS, Dec. 1940.

"South Carolina Handbook, 1941 Agricultural Conservation Program," U. S. D. A., Washington, D. C., SRB-501-SC, Jan. 1941.

"The Farmer's Share of the Consumer's Food Dollar," U. S. D. A., Washington, D. C., Leaf. 123, Rev. Dec. 1940.

"European War, National Defense, and American Agriculture," U. S. D. A., Washington, D. C.

"Three Principles of Agricultural Cooperation," Farm Credit Admn., Washington, D. C., Cir. E-24, Ward W. Fetrow.

"Report of The Director of The Office of Foreign Agricultural Relations," U. S. D. A., Washington, D. C., 1940.

"Report of The Chief of The Commodity Exchange Administration, 1940," U. S. D. A., Washington, D. C.

"Report of The Consumers' Counsel, 1940," U. S. D. A., Washington, D. C.

"Report of The Chief of The Bureau of Agricultural Economics, 1940," U. S. D. A., Washington, D. C.

"Some Factors Affecting Fertilizer Consumption," U. S. D. A., Washington, D. C., F. M. 10, Dec. 1940, A. P. Brodell and M. R. Cooper.

"Gross Farm Income and Indices of Farm Production and Prices in the United States, 1869-1937," U. S. D. A., Washington, D. C., Tech. Bul. 703, Dec. 1940, Frederick Strauss and Louis H. Bean.

Oscar Bledsoe Makes Farm Science Work

(*From page* 18)

attention and adequate hospitalization, and good management are afforded every tenant family on the plantation.

Practically all of the tenant families raise a good garden, keep one or more milk cows, produce most of their meat supply, and produce and conserve other food products.

Under the terms of the written agreement covering the acreage to be planted in cotton, which is determined by the landowner for each family on the basis of the amount of cotton the family can pick, 40 per cent of the net income from all cotton and cottonseed is paid to the tenant for his and his family's labor, small tools, and cotton sacks; 40 per cent goes to the landowner for living quarters for the tenant family, cotton land, planting seed, fertilizer, if any is used, or winter cover crops, if planted; and 20 per cent to either party furnishing plow tools, workstock, and feed.

Tenants are financed on the basis of the number of acres in cotton and are advanced cash monthly for living expenses. They are charged a fixed but nominal sum for medical attention and hospitalization, protective poison, supervision and necessary tractor work, any day labor hired and cotton picked, and are credited with any labor performed for other tenant families.

The tenants benefit from the efficient handling and selling of the cotton crop, which is sold on the basis of actual grade and staple. The plantation price of cotton is fixed at ½ cent less than the U. S. Bureau of Agricultural Economics' price at Memphis, Tennessee, which is to cover drayage, storage, and insurance, at the time the cotton is stored, sold, or upon the final settlement. The cotton is also sold on the basis of weights determined by U. S. bonded weighers. This system assures the maximum return for his share of the cotton crop.

A modern clinic has been built on the plantation and a full-time physician employed to administer to the sick. Clinics are conducted each day for the control of certain diseases. This system assures each tenant family modern hospital and medical service at a minimum cost. Marked progress has been made in control of infectious and contagious diseases, and the general health and vigor of tenant families have been improved. The results indicate that for better rural health, the system is not only economical, costing each family very little, but it is highly effective.

Gardening Without Soil

(*A Book Review*)

An appropriate addition to the list of publications dealing with hydroponics, or soilless growing of plants, is "Gardening Without Soil" by A. H. Phillips (Chemical Publishing Co., Inc., New York, N. Y., 1940. $2.00). With the comparatively large number of excellent and indifferent works already published dealing with this rather new and somewhat limited field of biology, one may wonder where there is place for another. This volume is distinguished from the others in that it was written from the English viewpoint, all the other works having been written by Americans.

Mr. Phillips has not written a critique of soilless culture, since his book is more in the nature of a practical handbook for the purpose of introducing the practice to the amateur gardener. The author apparently has made a careful and first-hand study of the subject in the United States and carried on work himself with growing plants in media other than soils.

The introduction deflates some of the wild claims made for soilless culture, and furnishes the basis of a sane approach to this interesting and intriguing type of gardening. The first chapter gives a few principles of plant physiology and nutrition which are little enough background for the average person who is delving into water culture for the first time. The next chapter deals with water culture specifically, telling how to prepare tanks, and provide supports, light, aeration, and heat, with considerable emphasis placed on the importance of the latter. The third chapter takes up some of the modifications of water culture, which the author groups under the term of aggregate culture. This includes sand, gravel, cinders, and other materials used as the medium in which the plant roots grow.

Chapter four goes into the preparation of nutrient solutions in some detail, while the fifth chapter considers some of the problems connected with soilless culture. A helpful section describes briefly the typical appearances of plants when they are over or under supplied with the various nutrient elements, as well as giving the principal functions performed by the elements. The final chapter takes up a phase of the subject that is different in that it considers the use of soilless culture technique on the farm as a practical supplement to orthodox practices. Most of this is devoted to the growing of sprouted grain for cattle and poultry feed, in which apparently there is much interest in Great Britain in order to provide more vitamins in the diet. The subject is presented in a non-technical manner that can be easily understood, and the book should be useful to those who are beginning to take up the soilless culture of plants.

Some Early Experiences with Fertilizer

(*From page* 15)

He not only informed me from whom potash could be obtained, but kindly gave me literature of a helpful nature, as well as other information of value.

Owing to the general teaching and belief at that time to the effect that potash was not needed in California soils and that to apply it to our crops would be a waste of time and money, but little potash was sold in this State. Undoubtedly the bulk of all that then came into San Francisco was intended for use elsewhere.

On learning where potash could be obtained, I lost no time in placing my order, which was given to the Pacific Bone-Coal and Fertilizing Company. In addition to the potash a 6-8 tankage was included in the order so as to supply nitrogen and phosphoric acid, the need for which was also recognized. For use as a general fertilizer, the potash and tankage with the exception of a few sacks reserved for experimental purposes, were mixed in proportions to make a 4½-6-12½ fertilizer, a formula containing 23% of actual plant food. This was applied at the rate of 680 pounds per acre to all the French prunes, except a few trees which were left untreated for further observation. Not having enough to cover the entire piece, only 66 of the 300 Fellenberg prune trees received the fertilizer. The application was made early in January and a heavy rain prevented working it into the soil.

Fertilizer Brings Clover

The effect of this application was particularly surprising on clovers which previously were not known to exist on this soil. They grew "like mad," attaining by the middle of March a height of fully two feet, forming a dense mat as far as the fertilizer went; the roots were massed with nodules indicating that the plants were getting an abundance of nitrogen from the atmosphere. In a space of only 28 square yards, seven varieties of clover were counted although in after years bur clover, by the density of its growth, crowded out all the others. No clover appeared on the untreated ground, and what little vegetation started was scant, making almost no growth whatsoever and scarcely attaining a height of two inches for the entire season. Not only did the use of this fertilizer provide the soil with needed phosphates and potash, but by bringing about such a remarkable growth of clover it solved the problem of supplying humus, and incidentally nitrogen as well.

Trees Respond Well

The response by the trees was all that could be expected the first year. Foliage was excellent and the trees set a good crop of fruit which went through the summer with very little drop. The prunes were free from the so-called "sunburned" spots that formerly were so prevalent, and sizes were better. The French prunes matured earlier, ripened, and dropped normally without having to be beaten off as before. This second year the French prunes averaged fully 5 tons green fruit per acre which ran 55 to the pound when dry, against my first year's crop of only 500 pounds green prunes per acre ranging when dry from 90 to 150 to the pound. The Fellenberg prunes, however, outdid themselves. The 66 fertilized trees averaged 200 pounds of excellent fruit per tree which was sold green, whereas the untreated trees were just as unproductive as formerly.

The following year, to better determine the effect of phosphoric acid on the setting of fruit, about 50 French prune trees which had received the tankage-potash treatment were given an application of basic slag alone. The better setting of fruit as far as this application went showed decidedly the favorable influence of phosphoric acid.

In this case, however, the set was excessive; consequently, the prunes, although they matured normally, were reduced in size, and somewhat in quality. The bur clover crop made an excellent growth among all the trees that previously had received the tankage potash fertilizer, but was still further increased by the basic slag.

Looking back over this period of more than 50 years ago, and the hundreds of careful observations made since then on crops and fruits under varying climatic and soil conditions, establishes the accuracy of the conclusion I had come to before 1890—that many California soils were in need of potash, as well as other fertilizers.

Soil, the Substance of Things Hoped For

(*From page* 8)

ments in getting the crop started, after which it forages fairly effectively for itself. But the net effect of this procedure is to still further exhaust the soil and subsoil of their supply of nutrients.

The time finally arrives when the soil becomes a highly effective competitor against the crop for any fertilizer that is applied. To fully meet the requirements of crops like corn and alfalfa then becomes a difficult problem since, out of every 100 pounds of phosphoric acid applied, the soil may fix 80 of them, leaving only 20 for the crop. Similar difficulties are experienced in the case of potash. In fact, the situation with respect to potash is now such that enormous increases in the rate of application of this nutrient will be required throughout a large part of this country, if its lack is not to be a seriously limiting factor in crop production.

But lime and fertilizer alone do not meet the requirements in building up poor soils. One can not substitute chemicals for sod and its soil-improving effects. If he applies his lime and fertilizer and goes ahead with the same old plowing and clean-cultivation procedures, the soil will still move downhill. And the longer this process is continued, the faster this movement takes place. It finally reaches the point where we are constantly faced with the necessity of making new soil out of subsoil. While this can be done, it is an expensive procedure.

It is high time that we gave more consideration to the development of soil management systems in which there is a judicious mixing of soil-resting crops and clean-cultivated crops, if these latter must be grown. And when we rest the land, there is need to put some thought into just how we can make the most of the time the land is kept out of production of money crops. This calls not only for the growing of some type of sod-forming crop, but for feeding this crop so well that it can develop a good root and a good top growth. The crop should be made to produce its maximum effect on the soil, both while it is being grown and after it has been plowed under.

Benefits Carried Over

It is of importance to keep in mind that a given portion of fertilizer can be used over and over again by plants if these plants are plowed under. Thus, a well-fertilized sod or cover crop, when plowed under, yields up its load of fertilizer to the next crop when it decays. The fertilizing of a high-priced cash crop can well begin a year or more ahead of time, by applying the fertilizer to a previous soil-improving crop.

When we plow down a well-fertilized sod or cover crop, the effects produced are much the same as those obtained by plowing under manure. The combination of organic matter, limestone, and fertilizer at plow depth is exactly what is required to encourage deeper roots. With these deeper roots goes greater foraging power for the water and fertility elements that are located in the subsoil. Plants so fed are not nearly so likely to suffer from drought as those which must depend on row applications of fertilizer and only small amounts of organic matter.

The problem of soil management resolves itself largelv into a planned program designed, first, to keep the soil in place, and, second, if the land must be plowed, to have it so well stocked with organic matter that it will suffer little loss from the action of wind and water. Sooner or later we have to pay the price if soils are mismanaged. At first, this may only mean an unprofitable agriculture on an occasional farm. In time, it may mean a decadent agriculture over a whole county, state, or nation.

The Nutrition of Muck Crops

(*From page* 22)

crops. In Table 2 are given the average increases, over the average of the unfertilized plots, in yields of potatoes and onions on the College muck plots, which have resulted from the application of different mixtures of phosphate and potash. Although potatoes show an increase in yield with increase in potash up to and including the heaviest potash application (plot 7), onions are one of only two of the many crops grown which have given a decrease in yield with an excess of potash. The fertilizer recommendations presented in Table 3 are based on the results of these 19 years of experimental study.

Nitrogen. Since muck soils generally contain from one and one-half

TABLE 2*—SHOWING INCREASES IN YIELD OVER THE UNFERTILIZED PLOTS RESULTING FROM THE APPLICATION OF VARYING PROPORTIONS OF PHOSPHATE AND POTASH ON A REPRESENTATIVE CROP ON EACH OF TWO SETS OF PLOTS—COLLEGE MUCK, EAST LANSING

Plot No.	Fertilized annually. 600 lbs. per acre. 1931–1939	Representative Av. increase in yield over unfertilized plot (1-6-12) Potatoes Av. 9 Yrs. (1931–1939) Bu. per acre	Conclusions from plot yields of various crops	Plot No.	Fertilized annually. 1000 lbs. per acre. 1931–1939	Representative Av. increase in yield over unfertilized plots (1-6-12) Onions** Av. 8 yrs. (1932–1939) Bu. per acre	Conclusions from plot yields of various crops
1-6-12	0-0-0	...	For most general crops, the 1 to 3 phosphate-potash ratio gives best results but, in some cases, a 1 to 4 or a 1 to 5 ratio would be more economical.	1-6-12	0-0-0	...	On most mucks, the fertilizer need varies with various vegetable crops from a 1 to 2 to a 1 to 4 ratio of phosphate to potash.
2	0-0-32	128		2	0-0-24	141	
3	0-4-32	222		3	0-4-24	456	
4-7	0-8-32	258		4-8	0-8-24	509	
5	0-12-32	247		5	0-12-24	518	
8	0-8-24	242		7	0-8-32	502	
9	0-8-16	186		9	0-8-16	554	
10	0-8-8	91		10	0-8-8	501	
11	0-8-0	−13		11	0-8-0	52	

* Tables 2, 3, 4, and 6 taken from a new bulletin, "The Muck Soils of Michigan," soon to be published.
** The stand of onions on these plots was almost entirely destroyed by maggots in 1937, so that the average yield for the eight years was somewhat reduced by it.

Fig. 2. Showing the effect of fertilization on yield and maturity of onions. Crop fertilized at rate of 1,000 pounds per acre of: Upper left, 0-8-0; lower left 0-8-16; upper right 0-0-24; lower right 0-8-24. Neither phosphate alone, with its stunted growth, or potash alone, with its excessive growth of tops, gave as good maturity as did a phosphate-potash mixture. The 0-8-16 gave the best maturity and yield.

to four per cent of total nitrogen which gradually becomes available as the muck decomposes after it is drained, most crops on properly drained new muck are well supplied with nitrogen from the soil itself. As the soil grows older and the rate of decomposition of the soil becomes less and less, a nitrogen hunger may gradually develop in the case of certain crops grown. The poorer the drainage is in a muck, the slower the decomposition will proceed and the greater will be the need for nitrogen, applied either in the regular fertilization, or, with some crops, as a side-dressing during growth. On the very strongly acid, but limed mucks, the decomposition will be limited to the relatively thin, limed surface layer, so that nitrogen will be required in

Fig. 3. The sugar beets on the left received 500 pounds per acre of salt, while those on the right received both salt and 600 pounds of 0-8-24. The average yield of beets was increased by the fertilizer 2.4 to 12.6 tons per acre.

TABLE 3.—FERTILIZER RECOMMENDATIONS FOR MUCK SOILS[5]

(A)	(B)	TYPE OF MUCK			
Crop	**Annual fertilizer application Pounds per acre**	**High-Lime** (Deep or medium depth) Properly drained, pH range 7.0–4.6		**High-Lime**	**Low-Lime** pH 4.5 or less
When two fertilizer analyses are given, the first is generally preferred. Read footnotes very carefully.	(Preferably in drills 7 inches apart and 3 to 4 inches deep).	(C) Newly reclaimed (1–8 years), somewhat fibrous or woody. Heaviest fertilizer recommendation advisable for first few years after reclamation.	(D) Old muck (Well decomposed). If well fertilized in past years, applications can be reduced to the lowest recommendations.	(E) Poorly drained muck, Alkaline muck or Shallow muck.	(F) Very strangely acid muck (Limestone, marl, sugar beet lime or wood ashes required before fertilization).
Broccoli **Cabbage**[2,3] **Cauliflower**[2] **Lettuce**[1,2] **Spinach**[1,2,4] **Swiss chard**[3,4]	**400-600** **500-1000** **800-1500** **500-1000** **500-800** **500-1000**	**0-8-24 or 2-8-16**	**3-9-18 or 0-8-24**	**3-9-18 or 3-12-12**	**3-9-18**
		Apply fertilizer (7-inch drills) before planting. For cabbage and cauliflower, transplanted to field, 400 to 500 pounds per acre can be applied in row 4 inches deep if muck is well supplied with moisture. Side-dressing of available nitrogen fertilizer (75 to 100 pounds) sometimes advisable, especially for cauliflower. These crops responsive to manure, supplemented with 0–8–24 mixture.			
Celery, early[1,3,4] **Radishes, early**[1,2,3,4] **Table beets, early**[1,2,3,4]	**1000-1800** **400-800** **600-1000**	**3-9-18 or 3-12-12**	**3-9-18 or 3-12-12**	**3-12-12**	**3-9-18**
		Row application for beets and celery advisable on wet muck—500 pounds 3 inches below surface. Apply remainder in 7-inch drills or broadcast and disk in. If no manure has been applied for celery, side-dressing of available nitrogen in fertilizer is beneficial, especially in cool seasons and on wet muck. If manure has been applied, nitrogen generally can be omitted from the fertilizer mixture.			
Celery, late[1,3,4] **Radishes, summer**[1,2,3,4] **Table beets, late**[1,2,3,4]	**1200-2000** **400-800** **600-1000**	**0-8-24**	**0-8-24**	**3-9-18 or 2-8-16**	**3-9-18**
Onions[1,2]	**800-1200**	Row application 400 to 500 pounds 2 inches below seed advisable on moist muck. Apply remainder in 7-inch drills. Try 0–20–20 or 3–12–12 if crop tends to mature late.			
		0-10-20 or 0-20-20	**2-8-16 or 0-10-20**	**3-9-18 or 3-12-12**	**3-9-18**
Mint[2]	**200-400**	Fertilizer needed to maintain stand of mint, as well as to increase oil content. Apply broadcast fairly early in spring. Try 0–20–20 if mint is late in blossoming.			
Beans[1,2] **Cucumbers and Melons**	**250-500** **400-800**	**0-10-20 or 0-8-24**	**0-8-24**	**0-10-20**	**0-10-20**
Pumpkins and Squash **Tomatoes**[2]	**300-600** **500-1000**	These crops easily killed by frost, therefore generally not safe on muck soil. Keep soil compact and well supplied with moisture to help prevent frost injury.			

Barley / **Oats** / **Rye** [1,2] — With or without seeding	**250-400** / **250-400** / **200-350**	To secure satisfactory results from fertilizers, grow grain varieties adapted to muck land, such as Gopher oats, Peatland barley and Rosen rye.			
		0-8-24 or 0-8-32	**0-8-32 or 0-8-24**	**0-8-24 or 0-10-20**	**3-9-18 or 0-8-24**
Mangels[3,4]	**300-500**	Row application advisable for sugar beets, not more than 150 pounds per acre with seed, or not more than 300 pounds 2 to 3 inches below seed. Apply remainder in 7-inch drills 4 inches deep before planting.			
Sugar beets[2,3,4]	**300-600**				
Kohlrabi & Kale[3]	**500-600**				
Field corn[1,4]	**250-350**	If row application is made for corn, do not use more than 200 pounds per acre for field corn and 400 pounds for sweet corn, preferably at least 2 inches below seed.			
Sweet corn[1,4]	**400-800**				
Sunflowers	**250-400**				
Potatoes[1,2]	**600-1000**	Row application sometimes advisable for potatoes but not more than 400 pounds per acre preferably in furrow 2 to 4 inches below seed. If mixed with muck with machine planter, 600 pounds can be safely applied. Plant close to avoid hollow heart and to minimize frost danger.			
Permanent pasture	**75-150**	Apply fertilizer broadcast on pasture in spring. Growth increased and palatability and nutritive value of grass much improved by proper fertilization.			
Timothy and Alsike	**200-350**				
Sweet Clover	**200-350**				
Reed Canary Grass	**300-400**	Seeding hay without nurse crop often advisable. Early seeding necessary to beat weed growth.			
Hungarian Millet[1,2]	**200-300**				
Soybeans[1]	**200-350**				
Sudan grass[1,2]	**200-300**	**0-8-32 or 0-8-24**	**0-8-32**	**0-8-24**	**3-9-18 or 0-8-24**
Asparagus	**400-800**				
Parsnips	**600-1000**				
Rutabagas and Turnips[3]	**300-500**	For root crops, apply with fertilizer drill, or broadcast and disk in before seeding.			
Stock Carrots	**300-500**				
Table Carrots[2]	**400-800**				
Blueberries[2]	**500-800**	Blueberries require very strongly acid soil. On slightly acid muck, crop can be improved by application of 1000 to 3000 pounds of sulphur per acre. Crop not recommended on mucks of high pH.			
		0-8-24	**0-8-24**	**0-8-24**	**3-9-18**
Raspberries[1,2]	**500-800**	Raspberries adapted to acid mucks. Light applications of sulphur sometimes beneficial.			
Strawberries[1,2]	**200-600**	For berry production on strawberries, use 100 to 200 pounds fertilizer per acre; for plant production, apply 500 to 600 pounds.			

[1] These crops likely to show marked response to sulphur or manganese sulphate when grown on alkaline muck.
[2] These crops very likely to respond to copper sulphate when grown on acid muck (pH 6.0 or less).
[3] These crops are likely to respond to salt in fertilizer mixture.
[4] These crops occasionally benefited by light application of borax, especially on previously unfertilized muck.
[5] Fertilizer mixtures having the same ratios as those recommended, but of higher or lower analysis, would be equally desirable, a proportionately smaller or larger amount per acre being needed by the crop.

Fig. 4. Showing the effects of potash in improving the stand as well as the yield of the summer spinach crop. From front to rear these plots received 1,000 pounds per acre of the following mixtures: 0-8-0, 0-8-8, 0-8-16, 0-8-24, 0-8-32 and, in the vacant space well down in the field, no fertilizer. Note the effects of potash on stand as well as on growth.

the fertilizer mixture for several years, or until the applied lime has had time to correct the intense acidity for some distance below the surface.

Crops most likely to be benefited by the use of nitrogen include cauliflower, celery, lettuce, and Swiss chard. Cabbage, mint, onions, spinach, and sometimes radishes and table beets also will respond if the crop is sown in early spring, or if the drainage is poor or the muck old and well decomposed. Side-dressing of a nitrogenous fertilizer, such as nitrate of soda or sulphate of ammonia, applied during growth, if the cabbage, celery, cauliflower, lettuce, spinach and, occasionally onions, do not have good color, generally will produce increased yields.

The Soil Reaction. Another factor which has been given much consideration in the management of our mucks in recent years is that of the soil reaction. Experiments have definitely proved that the yields of most crops are likely to be very poor when the pH of the muck is below 4.6. Further, we find in a majority of mucks that the soil pH decreases from the surface downward. Thus a plowed layer with a pH of 5.0 occasionally overlies a second foot with a pH as low as 3.5 to 4.0. For that reason a soil test of the muck at a depth of 20 to 24 inches, along with one in the plowed layer, is always advisable. Wherever the soil test is below a pH of 5.0, even though the crop is yielding satisfactorily, it is advisable to make an application of one to three tons per acre of a liming material every few years and to watch the reaction, since the supply of lime in a soil of that reaction is rather limited. With a certain amount removed each year in a good crop yield, the time is likely to come when the crop will suffer. With a pH of 4.0, from three to five tons per acre of limestone or six to ten loads of marl will probably be required. Since an excessive application of a liming material may result in depressed yields of most muck crops, it is advisable not to overdo the liming. An application of 100 pounds per acre of manganese sulphate in the fertilizer mixture used immediately after liming will insure the crop against any possible depressing effect of the lime.

(*Continued next month*)

Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs

(*From page* 11)

TABLE 1. SOIL AND TISSUE TESTS OF A NITROGEN-STARVED SOYBEAN FIELD

Factor	Area A Near road		Area B Away from road	
	Soil tests	Tissue tests	Soil tests	Tissue tests
pH	6.3	....	5.3	....
Nitrate	Very low	None*	Very low	None*
Phosphate	" "	High	" "	Very high
Potash	" "	None	" "	Medium
Inoculation (nodule growth)	Fair	....	Very poor	....

* Nitrate nitrogen tests are of no significance in the case of legume plants because the nitrogen is present in organic forms not indicated by the nitrate test.

although the soil tests showed "very low" for phosphate and for potash. Here the conclusion was that the plants were starving for nitrogen because of a too strongly acid soil. The order of limiting factors was acidity, nitrogen, potash, and phosphate.

Case 2.—Diagnosis of the causes for failure in a white clover bluegrass pasture, Lafayette, Indiana, May 18, 1938.

This was a poorly growing pasture on a Crosby silt loam soil. The results of the soil and tissue tests are shown in Table 2.

2. The phosphate and potash were accumulating in the tissues of the grass because the grass was not able to grow for a lack of the first limiting factor, nitrogen, with the result that the phosphate and potash were not utilized in the plant synthesis. Note that the phosphate and potash tissue tests were high and medium, respectively, while the soil tests indicated a very low availability of these nutrients.

3. The white clover showed a good color, indicating that it was able to obtain its necessary nitrogen, but failed to grow well because of the very low available supply of both phosphate and potash.

TABLE 2. SOIL AND TISSUE TESTS OF A POOR GRASS AND LEGUME PASTURE

Factor	Soil tests	Bluegrass Tissue tests	White clover Tissue tests
pH	5.6	....	....
Nitrate	Very low	None	None (no nitrogen
Phosphate	" "	High	None starvation
Potash	" "	Medium	None symptoms)

Interpretations of tests in Case 2.

1. Nitrogen was the first limiting factor in the growth of the bluegrass. The leaves verified this by their pale, greenish color.

Case 3.—Diagnosis of a golf green that was showing a browning condition in the leaf tips during late July and early August, Highland Park Country Club, Indianapolis, Indiana, August 10, 1939.

This was typical of many golf greens of the late summer season where a general browning of the grass leaves was occurring on the greens. Complete fertilizers had been added in the spring with bi-weekly treatments of ammonium sulfate throughout the summer. The results of the tests are shown in Table 3.

TABLE 3. SOIL AND TISSUE TESTS OF A GOLF GREEN

Factor	Soil tests	Grass tissue tests
pH	6.8	....
Nitrate	Very high	Very high
Phosphate	" "	" "
Potash	" "	None

Interpretation of tests in Case 3.

1. The soil tests showed "very high" in nitrates, phosphate, and potash, with a satisfactory pH. However, since the arsenic treatments of the soil would interfere with the phosphate test and make it read "high," and the ammonia ion from the ammonium sulfate used weekly would interfere with the potash test and give it too high a reading, the soil tests became useless. Here the tissue tests were invaluable, for they showed the grass to be starving for the lack of potash. When potash was supplied the grass revived to make normal growth. The frequent use of a salt like the ammonium sulfate, along with much leaching from heavy watering, had probably caused the potash to be removed from the soil, and developed an unexpected deficiency in this element, even though it had been liberally applied earlier in the season.

Cases 4 and 5—Tissue tests with corn.

A great many tissue tests have been made on the corn plant. This is one of the most indicative crops to study because corn has such a wide distribution in the world and can be used as a fair guide as to what to expect from many other crops. The two cases presented are very typical as to relationship between the tissue tests, the soil fertility, and the yields of corn obtained. The possible interpretations are discussed.

Case 4. (Data by Harry L. Cook, Purdue University, 1939.) The soil was a Clermont silt loam, low in organic matter content, strongly acid, pH 4.9, and showed "very low" in available phosphate and potash by soil tests.

Interpretations of tests in Case 4.

1. Where no nitrogen was used or only 21.5 pounds of nitrogen had been added to the corn, plots 1, 2, 5, and 6 were handicapped as early as June 7 for the lack of nitrogen. By July 7, plots 1 and 2 were showing marked injury for the lack of nitrogen.

2. By August 14, the corn on plot 4 was suffering for the lack of nitrogen even though 86 pounds of nitrogen per acre had been applied. Here the growth was great enough to cause a demand for potash greater than the soil could supply, even with the 12 pounds of K_2O that had been added in the row. The test showed that potash was limiting the growth here to a greater extent than was the nitrogen.

3. The plants started to be deficient in potash by July 7 where the nitrogen fertilization was the greatest but where no extra potash had been used, plot 4. Note that here the corn yield was only 55 bushels per acre. Plot 8 received an equal amount of nitrogen, but with 100 pounds of muriate of potash extra the yield went to 64 bushels of corn per acre.

4. It is apparent from the tests that the yield from plot 8 was limited by a shortage of nitrogen. This was verified

TABLE 4. TISSUE TESTS OF CORN AS RELATED TO FERTILIZATION AND CORN YIELDS. PLANTED MAY 17, 1940

Plot No.	Lb. cyanamid added per acre*	Lb. extra K_2O added per acre†	Yield bu. corn per acre	Plant-tissue tests and dates made		
				June 7	July 7	Aug. 14
1	0	0	27	L-H-H‡	O-H-H	O-H-H
2	100	0	37	L-H-H	L-H-H	O-H-H
3	200	0	45	H-H-H	H-H-H	O-H-M
4	400	0	55	H-H-H	H-H-M	L-H-O
5	0	50	26	L-H-H	O-H-H	O-H-H
6	100	50	36	L-H-H	L-H-H	O-H-H
7	200	50	47	H-H-H	H-H-H	O-H-H
8	400	50	64	H-H-H	H-H-H	L-H-H

* The cyanamid (21.5% N) was broadcast and plowed under just before planting time.

† All of the plots received 300 lb. per acre of 0-16-4 fertilizer in the drill at planting time; the extra potash was added as muriate of potash and plowed under like the cyanamid.

‡ O = none, L = low, M = medium (doubtful), H = high for the tissue tests. The positional order of the letters is nitrates, phosphate, and potash. Thus the first letter represents the test for nitrates; the second letter, inorganic phosphate; the third letter, potassium.

by other plots the same year on this soil where 118 pounds of N, along with 72 pounds of P_2O_5, and 72 pounds of K_2O produced 72 bushels of corn per acre.

Case 5. (Data by Alvin J. Ohlrogge, Purdue University, 1939.) The soil was a Vigo silt loam, gray in color, showed "very low" in available phosphate and potash by soil tests, and had a pH of 5.0.

Interpretations of tests in Case 5.

1. The tests on May 22 were made only nine days after the corn was planted. Where no fertilizer was used the plants were short of phosphate, but where the phosphate was supplied in the 0-12-12 the first limiting factor became nitrogen. The purplish color of the young corn plants on plot 1 was associated with the shortage of phos-

TABLE 5. TISSUE TESTS OF CORN AS RELATED TO FERTILIZATION AND CORN YIELDS. PLANTED MAY 13, 1940

Plot No.	Lb. ammonium sulfate added per acre*	Mixed fertilizer added at planting at side of seed in row†	Yields per acre		Plant-tissue tests and dates made		
			Bu. ear	Lb. stover	May 22	July 9	July 17
1	0	0	29	1140	H-L-M‡	O-H-H	O-M-H
2	0	0–12–12	26	1310	O-H-H	O-H-H	O-H-M
3	0	3–12–12	31	2660	M-H-H	O-H-H	O-H-M
4	200	3–12–12	63	3450	H-H-H	L-H-H	H-H-M
5	400	3–12–12	82	3830	H-H-H	M-H-H	H-H-L

* The ammonium sulfate (20.5% N) was broadcast and plowed under just before planting time.

† The fertilizers were added at the rate of 600 lb. per acre, in the drill at the side of the seed.

‡ O = none, L = low, M = medium (doubtful), H = high for the tissue tests. The positional order of the letters is nitrates, phosphate, and potash. Thus the first letter represents the test for nitrates; the second letter, inorganic phosphate; the third letter, potassium.

phate, and the pale green color of the plants on plot 2 was associated with a shortage of nitrogen. In plot 3 where 600 pounds of 3-12-12 had been used, the 18 pounds of N in the fertilizer should have been more than enough for the corn at this early growth, but the balances of nitrogen with the other nutrients were apparently unfavorable.

2. By July 17 nitrogen had become a first limiting factor on all of the plots except where ammonium sulfate had been plowed under. On plots 4 and 5 it appeared that the plants were limited in their performance for potash, even though 72 pounds of K_2O per acre had been applied. Note that when the tests showed "medium" and "low" where 200 and 400 pounds of ammonium sulfate had been used, plots 4 and 5, the nitrate tests showed "high." Apparently, the yields would have been still greater if the potash supply had been adequate here. Perhaps sufficient pounds of potash may have been used and the roots were unable to absorb enough of it out of the dry upper soil; at any rate the plants indicated that not enough potash was being absorbed.

3. In comparing the performance of plots 3 and 4, it is noted that 31 bushels of corn were produced with the 18 pounds of nitrogen added to plot 3, and 63 bushels of corn were produced on plot 4 which received 41 pounds more nitrogen than plot 3. Here the 41 pounds of nitrogen on plot 4 produced an increase of 32 bushels of corn over that of plot 3. Thus, one bushel of corn was produced per 1.2 pounds of added nitrogen. On nitrogen-deficient soils where the phosphate and potash supply is lower than on plot 3, a corn increase of one bushel for each 2 pounds of added nitrogen is the usual performance. Note that the stover growth was fairly good on plot 3, yet the nitrate tests were "low" from July 9 on. Apparently the fertilizers used in plot 3 were just about enough to produce a fairly good stalk, but the supply of nitrogen ran out just at the critical time when the ears were to be formed. When the extra nitrogen was applied it supplied the final "push" to produce the ears. Without the use of the tissue tests these types of informative studies would be impossible.

Conclusion. Soil tests have many limitations that need to be considered in evaluating their results. If these limitations are considered, these tests

Plants in the field show nutrient-deficiency symptoms, easily read by those who understand them.

are in many cases helpful in obtaining ideas about the state of the soil fertility. However, plant-tissue tests present a technique that appears to lend itself to very reliable interpretation of the nutritional situation.

Since crop production is a dynamic process that requires constant study as to the fertility of the soil, it should be of advantage to a grower to study the performance of the growing crop with tissue tests. The results will furnish information on the status of the nutrient supply of the plants at any time during the growing season, and if these results are associated with the treatments used to produce them, will give corrective information to incorporate into fertilization practices for the next crops on that soil.

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Bovinology

(*From page* 5)

That's a warning for my fellow citizens in the dense dairy areas, for the percentage of farmers in such states who really know whether their herds are going forward or backward is pitifully small. Even the goat raisers have the edge on them.

Left to fate and their own inertia, those behind-handers are cheerful victims of a rather new sort of racket which has been a nightmare to the purebred devotees. I refer to the all-enticing glamor of having somebody hand you a bull for nothing. Free-for-nothing and good-for-less bulls have dotted the landscape in my countryside at an alarming rate since the original bull prophets enlisted in the aforesaid federal forces. These bull-givers waste no time on catalogs or advertising, but they merely drive in and dump a specimen off the tail-end of the truck and pass on. Your farm is just a training ground for the stockyards to them.

When one looks a gift horse in the mouth it's supposed to be a slam at the giver. But it's wise to look a gift bull in the mouth and lots of other places, including his pedigree papers, the place he hails from and also his progeny.

Hustling any old kind of a male bovine around the community just to get cows in the family way is a slick deal for somebody. But any farmer who uses a scrub sire on a fairly good grade herd is just looking for one biological result—a fresh cow. And the offspring will be nondescript.

Like begets like. The farmer who doesn't have any idea of adding to the beauty of his herd or making it any more economical to keep is the one who beckons to the butcher with one hand and invites the bull jockey to trot in another one of his slanty-rumped rats.

Sometimes you meet a man who says he won't raise any heifers in his own herd, but will buy up good cows and then freshen them with some handy maverick leased from a jockey. That fellow must sell on a mighty high fluid milk market, maintain a good sized wad of jack in his sock to gamble with, or possess more courage than brains. The ones who raise their own kine last longer in a pinch, and maybe we're going to have another pinch sooner or later.

The other excuse given by patrons of the mongrel bull merchants is that he "intends to cross-breed dairy cows with some masculine meat-making male of beef calibre." Oh, yes, it's easy enough to mix them, but the "unmixing" is tough, and the result is neither veal, beef, nor beauty.

WHEN this "free-bull-and-use-him-awhile" plan plays havoc with customary standard methods of improving herds, the leaders of dairy advancement must meet it with similar systems. Getting strong, bred-for-production, high type bulls into isolated rural districts is a real job of organization. Unless they expect to depend upon artificial insemination to grade up and improve production, the breeders with promising bulls must study ways to make their cattle just as attractive as the deals put over by sellers of culls. Lately there is evidence that something is going to happen along this line, even if it sounds like a dollar down and a dollar a week to get it started.

Yet maybe it required just such a dangerous threat to awaken the indolent breeders into a fighting spirit. Like the old hound dawg with pesky fleas, it keeps him lively and alert so he won't fall asleep and have bad dreams.

Speaking of bad dreams, have you ever thought what would happen to the milk price if we doubled or trebled our converts to the use of bulls capable of higher levels of production in their herds? No great fret thereabouts for the immediate present, perhaps, but it's tossed in to show the economists that we know their stuff.

And finally, when we sit back and get a squint-eyed perspective on this better bull campaign dope, I wonder if you see what I see.

TAKE for example a meeting of leaders in a milky community, bending every effort to increase the number of other farmers with better bulls and more productive cows. Where do you find merchants or professional men conspiring to cause a denser population of competing grocers or clothiers or dentists or lawyers? My home state sent several extension trains to Dixie years go and for awhile our farmers sold breeding stock southward. But later there was a slowing up of that income and now they are bothered about the fears of an excess expansion of dairying below the frost belt.

Maybe the careful and successful breeder is so scarce he is lonesome and he may be tired of being a target for envy. Perhaps he wants company to share the misery coming in the wake of the anticipated lactic overflow. At any rate, you can't call him mean or narrow for spending his time boosting for better bulls when he might just as well stick to his own stanchions and benefit by a scarcity of proven bovines.

But thank our stars, the good farmer wants to improve everything he touches. That's the answer. More power to him! Even if he is a mighty small piece of leaven (of energy) in a whopping big loaf (of inertia) he is bound in time to make it rise, and then we won't go hungry!

ENOUGH IS ENOUGH

Elmer, age 13, was puzzled over the girl problem and discussed it with his pal, Joe.

"I've walked to school with her three times," he told Joe, "and carried her books. I bought her ice-cream sodas twice. Now do you think I ought to kiss her?"

"Naw, you don't need to," Joe decided, after a moment of deep thought. "You've done enough for that girl already."

Two dignitaries of the church and a layman were golfing one day recently. One rector made a particularly bad shot and the layman asked: "Don't you feel like swearing when that happens?" . . . And the rector replied with heat: "I don't swear, but I spit—and where I spit no grass ever grows."

Johnny had seen his mother measure a yard by holding one end to her nose and the other at arm's length. One day he came running in with a piece of rope.

"Here, mother," he said, "smell this and see how long it is."

Boy Friend (on the phone) "Whatcha doin' Sattidy night?"

"Gotta date."

"An' next Sattidy night?"

"Gotta date."

"Anna next Sattidy night?"

"Gotta date."

"Well twiddle my moustache, woman, doncha ever take a bath?"

"If there be anyone in the congregation who likes sin let him stand up—what's this, Sister Virginia, you like sin?"

"Oh, pardon me, I thought you said gin."

Old Rastus settled himself in his chair and addressed his wife: "Yes, sah, Gal, dat boss done cut wages half in two again. Some ob de boys is kickin' might pow'ful 'bout it. But I ain't goin' to kick none. Way I figgers it—half of sumpin' is better'n all of nuffin'."

OKE, MONSIEUR

"Consommé, bouillon, hors d'oeuvres, fricassee poulet, pommes de terre au gratin, demitasse des glaces, and tell that mug in the corner to keep his lamps offa me moll, see?"

"Now that I've told you about my past, do you want to marry me?"

"Sure, baby."

"I suppose you'll expect me to live it down?"

"No! I'll expect you to live up to it."

The young author wrote asking an editor for his definition of the perfect short story.

The editor replied that it must be (1) short and to the point; (2) contain a religious touch; (3) have some reference to the aristocracy; (4) have action; (5) possess sex appeal.

Whereupon the author sent along the following:—

"Good Heavens!" said the Duchess, "you're pulling my leg."

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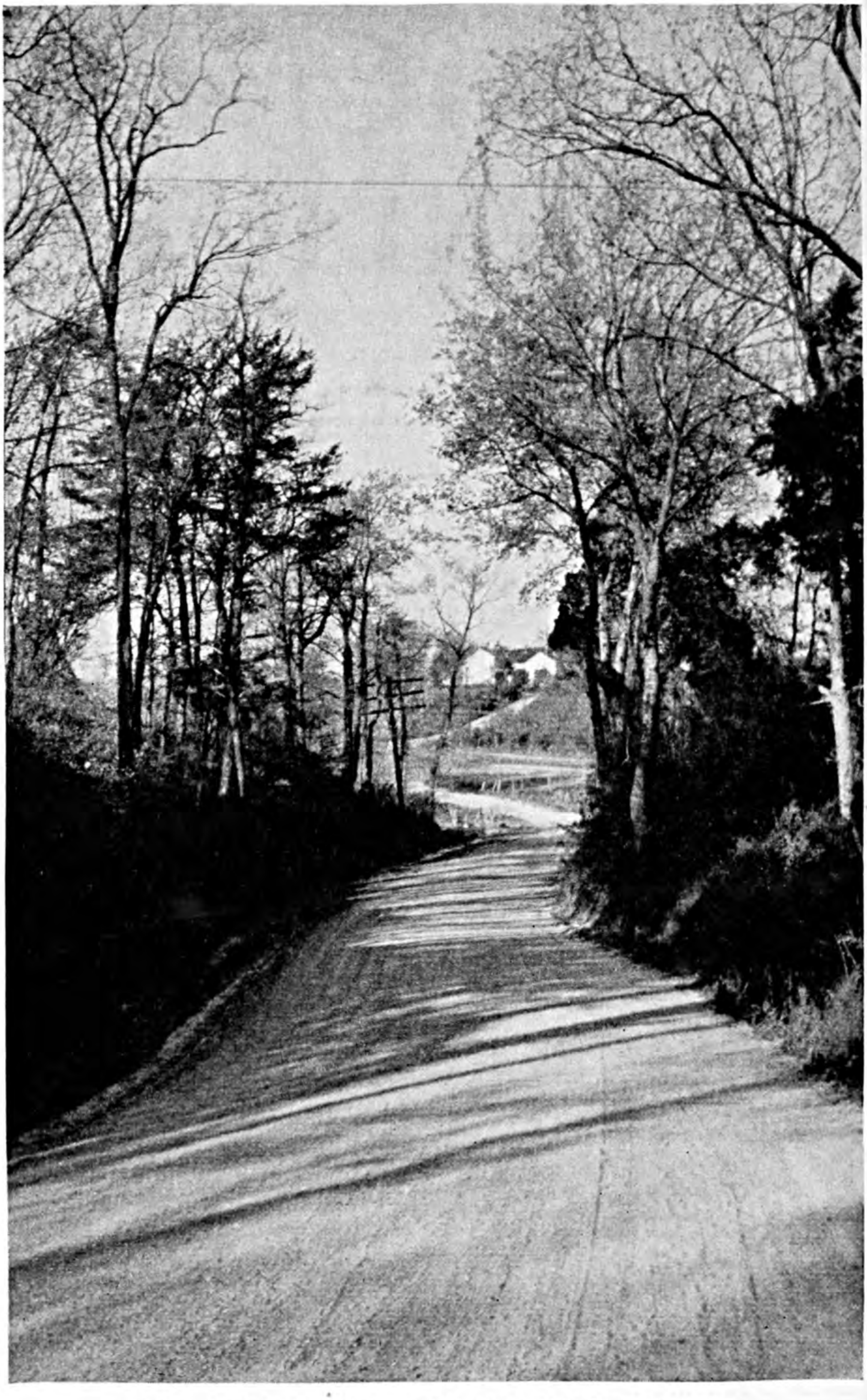

WHEN THE CALL TO THE "OPEN ROAD" IS STRONGEST.

Better Crops with PLANT FOOD

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You can't get away from—

Shares Well Scoured

Jeff McDermid

RETIRED farmers, known of old as "resigned" farmers, have become obsolete in my countryside. To use a modern term that denotes them more explicitly in this age of continual motion, the elder farmers are "re-tired" farmers. They cushion the calluses of time with a new "tread" and so roll on over their last mileage almost as good as new. Consequently no moss collects and age doth not corrode.

In my journeys through loamy settlements I find it well not to submit the question of retirement too bluntly. For no longer does the veteran of countless harvests habituate himself by carriage and deportment to any imminent autumnal relaxation. The farmer of the present is not the bewhiskered ancient relic, clad outlandishly, whose bent figure was so much a part of Main Street on Saturdays when we were young.

Thus to begin with, the personality and demeanor of a more youthful era have laid hold on the American scene so as to eradicate some of those signs and symptoms that caused folks to grow old and weary just by living and looking that way.

Now this is no challenge to social debate or psychological analysis. I merely record my direct and frequent observation that the smooth-faced, clean-jawed fashion of our times, plus easy access to reasonably fitting garments, has added years to the expectancy of farmers—and their wives probably use modish patterns, cosmetics, and nail varnish with the same happy consequence.

While it is not quite true that one is only as old as he looks, let us bring our own childhood impressions in to prove our thesis. We can all remember how the pictures of the statesmen and generals of the conflict in the Sixties made us youngsters think they resembled the patriarchs of the Bible, and how Uncle Bildad looked in that old wet-plate negative, with matted locks and ferocious sideburns.

Those forests of hirsute vigor which no conservation laws regulated, either in the growing or the trimming, merely disfigured and disguised the curving mouths and firm cheeks of youth gone to grass and choked with weeds. When informed that those bushy braves were only in their middle thirties or even younger when fame made them immortal, you ceased to wonder why they often died so young. Old tales of hardship as a shortener of careers were discounted in favor of tangled whiskers. You saw that he who courts old age is not long in winning her.

AND naturally a woman who lives with a man who doesn't want to stay young is apt to become a dowdy dowager before the kids are grown. She was old at thirty by partnership. Moreover, the weight of such whiskers and their tendency to snarl into his work was enough to stoop the farmer's shoulders even after the invention of the reaper. (On the side, I often wonder if McCormick or Gillette furnished the more helpful clipper in the long run.)

Perhaps it took three or four generations of retiring farmers to prove to the younger ones that he who quits work and sinks into somnolence is tempting forces of decay to consume him quickly. Thus men spoke feelingly of "wearing out" and "rusting out" and pointed to retired gentlemen of their acquaintance as evidence enough.

Of course, in reasoning out this doctrine we are obliged to consider the broad differences between small country hamlets now and back yonder. In the heyday of popular farm retirement (before the "California migration") our elder agronomists leased or sold the homestead and moved into the nearest trading post, where they were able to mingle for awhile in town society. They could forget the "cock-crow" of early rising, but they never got over listening hard for the dinner bell.

Undoubtedly he who luxuriates in leisure whilst taking on weight at the accustomed gravy hour is fixing up for himself a nice dose of what the horse doctors call "azoturia." That is the malady of hard-working old plugs which are laid off for a spell on normal rations.

WHERE these complacent retired farmers fitted into a village pattern without reducing their caloric intake of molasses, pancakes, and pork chops, it made a fine market for patent medicine vendors and coffin factories. Minus the early rising fixed by the rooster at dawn with the chores to perform, the retired farmer was obliged to imbibe Doc Slug's "Early Riser" pills for different but important reasons.

There were a minority of retired haymakers who regarded Pasadena as the seventh heaven of the gods. Mount Olympus was a tame affair compared to retiring thither, and it was also noted for its grape juice. All their lives they had read fancy brochures and tourist prospectuses relating the salubrious climatic advantages of the Golden Coast compared to a frigid life on one side and a frying spell on the other, such as Nebraska or Iowa usually furnished its denizens. Then besides it would be so nice indeed to live out there where the bathing gals disported and the movies were made, and send home orange blossom post cards to Uncle Zeke for him to think about while thawing out the pump.

But we must dismiss those lucky gentry as not being within the scope of this excellent treatise. We must stick to the home-staters. Besides, I expect that California supplied so much vitamin tonic with every gulp and every breath that my arguments herein won't hold water "west of the Pecos." In fact, I never heard of the demise of a single emigrant to that fair land of lure.

Returning to Pa and Ma who have retired to town, it was usually Ma who

lived the longer because she kept so busy. She did housework or gardening or else took in kids to mind, or did kitchen duty for the ladies' aid during church socials. When that wasn't enough she used up all of Pa's old overalls for hooked rugs. Poor Pa slunk around and whittled a little, and looked a lot up and down the road and at the sky frequently—a farmer seldom ever gets over looking at the sky, you know. He had personal bothers like bilious attacks and gout, and his eyes troubled him so he didn't care a hoot about the motion picture shows or even the leg shows on Main Street in March. He caught a ride out to the old farm sometimes and tried his hand at pitching or bossing maybe, but it never set well with the renters and he got tired of that in a hurry. So Pa was left flat on his retirement and no mistake.

In this connection, we admit that the backgrounds of lives spent in small towns have faced a change. With that shift in scenery comes less desire and opportunity for loafing. Hence, the elder farmers when thinking of retiring to occupy a niche among the worthies of some bucolic retreat are obliged nowadays to realize that loafing around town is not as much fun as loafing right out on the homestead.

Idleness and loafing to kill what little time there was left used to be a cause of quick decline on the part of our retired plowmen. And why not? The whole atmosphere of our old-time country towns was ideal for idlers. Let's see to what extent my thesis is true, and what's happened meanwhile.

Begin with the "pustoffus," where the folks met to chin together while the postmaster finished reading all the cards and threw open the wicket with a bang to hand out the daily receipts. Here you got all manner of social and personal news tidbits and met political friends and "your country's enemies." But most sizable towns nowadays have postmen to sort and carry out the mail, so there is little excuse to hang around Uncle Sam's domain any longer.

Next perhaps, one went to the corner grocery which was always a haven for the retired farmers, who sat on well-polished benches and commented on sundry events while nibbling prunes and crackers. Indeed this spot was the informal lyceum and forum of the day, the place where reputations were rent asunder under the frank criticism of experts, and where free speech often proved pretty expensive. Yet even this sacred place has undergone a remarkable transformation. It's no refuge for overladen gossips any longer. You enter by a gate, take a basket, and do your own shoplifting; have your change ready at the exit and make it snappy! You won't find any benches or chairs either, for not even the clerks may sit down.

IF you speed in desperation to the blacksmith shop in hopes of finding old cronies there, it's just too bad because there isn't any anvil chorus in the whole burg. Your next best bet is the garage or filling station, and that's too smelly and greasy for breathing or squatting. Of course, you can hang around awhile and let them fill your

(*Turn to page* 47)

Available Potassium in Alabama Soils

By N. J. Volk

Alabama Agricultural Experiment Station, Auburn, Alabama

IT has been said that man in 100 years of farming has about destroyed what it took nature several thousand years to build into our soils. This is undoubtedly true in a great many cases if considered from the standpoint of the destruction of organic matter and the loss of soil through erosion. But in the case of Alabama, let's not blame it all on the farmer—weathering forces had done a pretty good job of wearing out Alabama's soils before they were turned over to modern man.

In the first place, the majority of the soil materials of the State were juggled about severely before being allowed to come to rest in the positions they now hold. For example, weathering agencies tore down the Piedmont Mountains and dumped them into the sea; geological forces raised this material up out of the sea and made the Appalachian Mountains, which were in turn torn down and dumped back into the sea. Later on, after a series of such immersions into the sea, the soil materials of Alabama were raised above water for the last time. In moving these soil materials from place to place and thoroughly washing them with sea water, the forces of nature dissolved great quantities of potassium from the original minerals. This potassium found its way into the sea and is lost to the present soils of Alabama forever.

Not satisfied with the havoc played

When peanuts are harvested, large amounts of potash are removed from the soil and following crops suffer unless this potash is replaced.

by using Alabama's soil materials like a football for a few million years, the forces of nature set up a climate, warm and humid, in Alabama. Weathering agencies, such as hydration, oxidation, reduction, carbonation, solution, and leaching, worked overtime, winter and summer, and at top speed in their attempt to remove the remainder of the potash from the soil. In the northern part of the Temperate Zone weathering processes go on at a much slower rate.

A good example of how thoroughly Alabama soils have been depleted of their potash is presented in Table 1. Note that the best soils of Alabama contain only about as much total potassium as the poorest sands in Wisconsin—the latter soils were chosen for comparative purposes as they are young glacial soils which have not been weathered nearly so severely as southeastern soils. So, let's not blame all our troubles on what man has done. He started with an inferior soil in many cases, a soil robbed of one of its valuable partially frozen assets—total potassium. But man can overcome this lack of native potassium by the judicious use of commercial potassium and good cultural practices.

For the past 25 years or so, agricultural workers have considered that a knowledge of the amount of total potassium contained in a soil was of little or no value. Nevertheless, the amount of total potassium in a soil and the kind of minerals in which it exists are of

TABLE 1. THE TOTAL POTASSIUM CONTAINED IN ALABAMA SOILS (OLD GEOLOGICALLY) AND WISCONSIN SOILS (YOUNG GEOLOGICALLY)

Soil type	State	Number of samples analyzed	Average pounds of total potassium per acre 6⅔-inch depth
Tifton sandy loam	Alabama	1	1,182
Orangeburg sandy loam	"	1	1,454
Colbert fine sandy loam	"	1	3,818
Cecil clay	"	1	5,545
Clarksville sandy clay loam	"	1	6,181
Savannah very fine sandy loam	"	1	6,545
Hartsells fine sandy loam	"	1	6,636
Durham fine sandy loam	"	1	7,090
Decatur clay	"	1	10,817
Davidson clay loam	"	1	12,817
Vilas sand	Wisconsin*	6	9,200
Dunning sand	"	1	9,400
Clyde fine sand	"	2	11,000
Miami fine sand	"	3	13,100
Boone fine sand	"	11	16,200
Clyde fine sandy loam	"	2	19,600
Plainfield sand	"	39	22,000
Vilas fine sand	"	1	24,400
Vilas sandy loam	"	7	25,600
Miami sandy loam	"	1	29,000
Colby silt loam	"	5	31,400
Knox silt loam	"	11	35,000
Miami silt loam	"	13	43,200
Clyde silty clay loam	"	4	43,800
Boone loam	"	4	49,400
Superior clay	"	10	51,000

* Wisconsin Geological and Natural History Survey, Bulletin No. 68, A. R. Whitson, University of Wisconsin.

extreme importance in enabling the soil scientist to predict the ability of a given soil to rebuild its replaceable potash content following the removal of potash by a crop. Soils differ greatly in this respect. Seriously depleting an average Alabama soil of its replaceable potash by one, two, three, or more successive crops is a comparatively easy matter, but not so with the younger types of soils in other regions. The difference is due very largely to the fact that the agencies of weathering left a very low reserve of total potassium in Alabama soils. On an average, they left about 1/10 to 1/5 as much as is found in the young Wisconsin soils. Even so, Alabama soils are able to rebuild their supply of replaceable potassium to some extent through the release of potassium from non-replaceable forms.

During a study of cotton rust, the occasion presented itself for sampling 64 cotton fields in Alabama and analyzing the soils for replaceable potash. These fields were sampled on August 26 and October 29, 1937, and on March 12, 1938. The results, presented in Table 2, clearly reveal that these soils did rebuild replaceable potassium during the winter months to the extent of about 50 pounds per acre.

Further evidence supporting the fact that even the highly weathered soils of Alabama can supply some potash from so-called non-replaceable forms is given in Table 3. In this study, 10 soils were selected which represented a wide variation in the soil types of Alabama. These soils were placed in two-gallon jars, fertilized well for each crop with everything but potash. Four crops were grown on them in one year; namely, soybeans, vetch, peanuts, and cotton. Several of the soils are now growing

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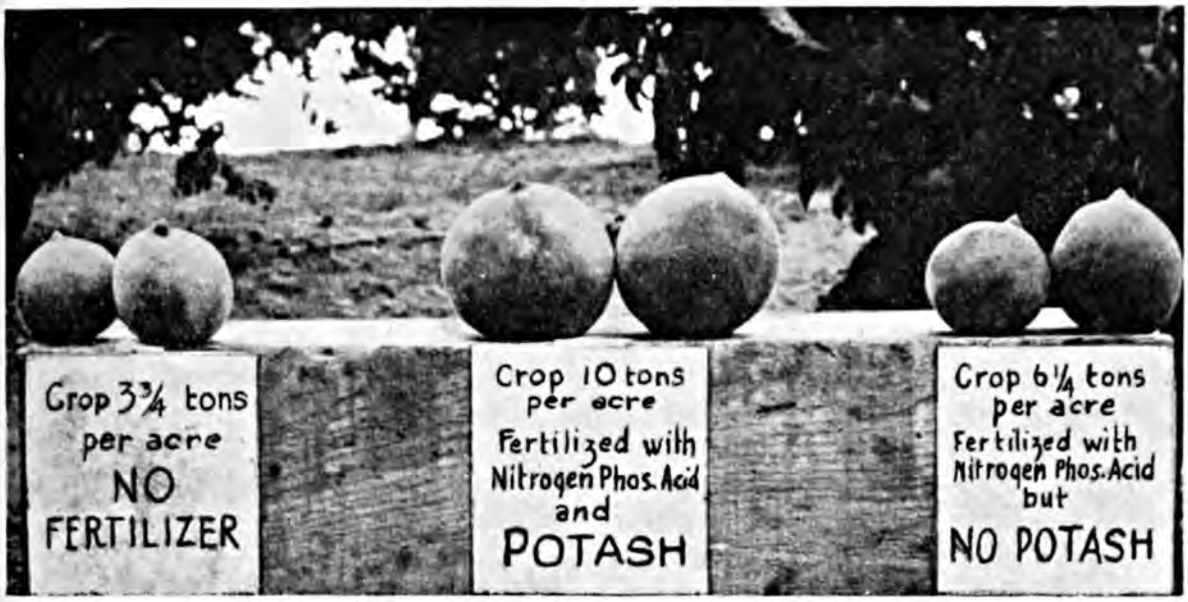
Table 2. The Ability of Soils to Rebuild Replaceable Potassium after a Cotton Crop Is Removed

Date of sampling soil	Pounds per acre of replaceable potassium found in the soil in 64 fields in Alabama*
August 26, 1937	183
October 29, 1937 (day following a frost which stopped the growth of the cotton)	187
March 12, 1938	235

* Samples of soil were composites of 20 borings 8 inches deep taken from about a 1/40-acre area in each field. The same 1/40-acre was used for all three samplings.

Winter legumes, such as vetch, make good cover crops to conserve soil potash by preventing leaching. These crops also use large amounts of potash and if removed make a heavy drain on the soil's supply.



Comparative sizes of fruit from an experiment on fertilizing peaches near Penryn, California, in 1908.

Some Early Experiences With Fertilizer on the Pacific Coast

By B. E. Maynard

San Jose, California

¶ *Second of a series of articles recounting personal experiences with the use of fertilizer on the Pacific Coast during the past fifty years.*

IN a previous article I told of results obtained from potash used as a fertilizer on prune trees growing in a deep alluvial soil. Results obtained on a soil apparently of a glacial formation, composed largely of disintegrated rock mixed with boulders, gravel, sand and soil of a loamy type, were equally favorable. This particular piece of land—about 35 acres—was planted to French prunes, plums, silver prunes, apricots, pears, and peaches, all practically in full bearing. Production was moderate, and fruit fair in quality. However, there was plenty of evidence that the condition and welfare of the trees could be improved by judicious fertilization.

Owing to the idea, prevalent even in the early nineties, that nitrogen was the only fertilizer element needed in California soils, about eight acres of full-bearing apricot trees were given an application of nitrate of soda in April, which application was followed by sufficient rainfall to carry it down to the feeding rootlets. The trees responded well following this treatment, as shown by the healthy appearance of the foliage and vigorous growth of new wood, which continued growing right into November. The large crop of fruit set had to be heavily thinned.

The fruit sized up well, but ripening was greatly retarded. Normally picking should have been well under way about the fourth of July, but in this case was not commenced until the first of August. The fruit, however, when ripe, was soft and tasteless, and shrinkage in drying was abnormally heavy. The green fruit was found to mush badly when handled by the cutters. Many of the pieces when dry were so misshapened and flattened out that they were classed as slabs, and brought a much lower price. The pieces that retained their shape were thin instead of being thick and meaty. This falling off in the quality of the fruit indicated that nitrogen used alone impaired quality and retarded ripening, although tree growth was increased and the size of the fresh fruit was not impaired.

In the following years, to better insure quality and favor earlier ripening, a 3-8-10 fertilizer was applied to these trees at the rate of about 1,000 pounds per acre. Under this treatment the trees increased production, and the quality of the fruit was greatly improved. The vigor of trees was also fully maintained. Bur clover growing among these trees responded by forming a heavy mat of humus-making material to be plowed under, as well as to increase the soil content of nitrogen.

If anything, peaches responded better to applications of this 3-8-10 than did the apricots. About 50 peach trees, Crawfords, Fosters, and Susquehannas (all freestones), adjoining the apricots were given the same application of the 3-8-10, but had not received the former application of nitrogen alone. The response from the 3-8-10 on these trees was marked the first season, and even more so the second year. Although unirrigated, a crop was produced ranging from 200 pounds per tree to as high as 750 pounds from one particular tree.

Horse bean cover crop in Santa Clara Valley prune orchard, fertilized with complete fertilizer.

Won First Prizes

The fruit ran to exceptionally large sizes, a number of Fosters and Crawfords when ripe measuring 12 inches in circumference, and several of the Susquehannas 13 inches. Quality, firmness, and flavor also were unexcelled. The entire crop was dried, the larger amount being peeled by a method known as the sulphur process. As a rule, Fosters and Crawfords were not considered suitable for peeling due to their usual heavy shrinkage in drying. However, the shrinkage of these peaches from the potash-fed trees even when peeled was actually less than in most cases where the peel was left on. The finished product, too, was perfection in color, rich in appearance, and most appetizing in flavor.

One evidence of the improvement and desirable quality of fruits produced on this place was when the Chamber of Commerce came to me for dried fruits that they wished to use for exhibition purposes. I was pleased to let them have the fruit, but unknown to me they put them in as a special exhibit, in competition with all others. The result was that I was awarded five first prizes, and was told that I was entitled to more, but that some concessions had to be made to others. In this exhibit peeled peaches, dried pears, and silver prunes attracted particular attention as they were outstandingly superior to any others shown.

This early work with fertilizers on my own orchards was not confined to potash alone. By the use of phosphates and nitrogenous fertilizers, separately and in combinations, their value was also definitely proved. The most outstanding effect, however, was obtained from potash whether used in the form of wood ashes or commercial forms, as plainly indicated by the increased vigor and production of grape vines; marked response on peach, prune, pear, apricot, and cherry trees in overcoming tendency to die-back; a healthier and more vigorous growth of wood; improvement in fruit-spur and bloom-bud formation; and foliage distinctly better in every respect. In fruits potash showed its value by larger production, better size, increased sugar content, and lower shrinkage in drying.

"Heavy traffic" on Kearney Ave., Fresno County, California—year 1914.

It soon became apparent that the trees had a story to relate which, if properly understood, could be used to determine their potash requirements. For instance, if nitrogen was in a reasonable supply, but potash deficient, twigs might make sufficient growth in length, but would be puny, soft, and string-like in texture. Instead of rounding out as they should, the twigs would be wrinkly in appearance and pale in color. Under these conditions in many trees such as the apricot and prune, fruitspurs would be small and puny, short-lived, and might even die before producing any fruit at all. Weak, diminutive bloom buds or entire lack of bloom buds were characteristic of poor nutrition. This lack of bloom-bud formation, which may even follow a light or moderate crop, is particularly evident in the peach when the trees have an insufficient supply of potash to draw upon. In cherry trees, fruit spurs become soft and brittle, therefore, very easily broken. Instead of forming a crown or cluster of bloom buds at the end, the spur may form just a leaf bud which will give the spur a pointed almost thornlike appearance. It was also found in the early stages of potash deficiencies that leaves would have a tendency to fold by curling inwards, would be thin in texture and lack in glossiness. This occurred before they reached that stage where the deficiency was so great as to cause mottling and leaf-scorch.

When potash was supplied in abundance, quite the reverse of the above would soon prevail. Twigs would become firm and well rounded out, with a marked increase in diameter. Their bark would be a rich, healthy, ruddy brown color. Leaves would be wide open and remain so right through the season, with a glossy, thick texture, and petioles well filled out and strong. Fruit spurs would be sturdy, and supplied with an abundance of plump, healthy bloom buds. Such spurs would last for many years in a producing state. All of these points, which I had learned from observation, proved to be decidedly helpful in enabling me to determine from examination what the trees' potash requirements were.

Sales Agency Started

Through these personal experiences in the early nineties, I had become so convinced of the value of commercial fertilizers, particularly potash, it seemed reasonable to believe that all fruit growers and other farmers, as soon as the value of commercial fertilizers could be brought to their attention, would become potential users. Thus there was

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Fig. 5. On the left these hay crops received no fertilizer, while on the right an 0-8-32 was applied. From the foreground the crop is timothy and alsike, with alfalfa just beyond, and Reed canary grass where the boys are standing.

The Nutrition of Muck Crops*

By Paul M. Harmer

Muck Specialist, Michigan State College, East Lansing, Michigan

Sulphur or Manganese Sulphate. When the writer first began his studies into the causes of unproductivity on Michigan's muck soils, his attention was several times called to unproductive spots, especially in onion fields, in which the soil generally proved to be alkaline. The onions would make a good start in these alkaline spots, then invariably become dwarfed and curled during growth, and remain immature at harvest time; the celery would be yellow and often affected with cracked-stem disease; the spinach, lettuce and potatoes undersize, chlorotic and frequently unmarketable.

The condition was found to be the result of an unavailability of certain plant-food nutrients, due to the alkalinity. Of these the unavailability of manganese generally proved to be the limiting factor, but the availability of the phosphate, potash, boron, and probably other plant-food nutrients was also sometimes affected. Application of manganese sulphate in sufficient amount on such fields usually corrects the situation for one season's crop but must be repeated for the crop of the next year. Although an occasional alkaline muck will produce satisfactorily without any treatment, an application of sulphur, in a fairly fine condition and amount sufficient to correct the alkalinity and leave the soil slightly acid, thus rendering the plant-food materials more available, has proved to be a satisfactory and permanent means of

* Continued from March issue of BETTER CROPS WITH PLANT FOOD.

correcting any unproductive, alkaline muck soil. The need for manganese or sulphur is likely to be greater in a cold, wet summer or on a poorly drained field than if hotter and drier conditions prevail.

In Table 4 are presented the yields of potatoes, as a representative crop grown on a well-fertilized alkaline muck, showing the increases in bushels due to the effects of sulphur and of manganese sulphate applications. Figure 8 shows on the right the characteristic curled type of growth of onions on alkaline muck. On unproductive, alkaline muck, an annual application of 100 to 200 pounds per acre of manganese sulphate or a total application of 500 to 1,000 pounds or more of sulphur, in addition to the regular fertilization, is likely to be needed for the above-mentioned crops. Occasionally both sulphur and manganese can be used at the same time with still greater benefits. The manganese sulphate can be mixed in the fertilizer and applied

TABLE 4.—SHOWING INCREASES IN YIELD OF A REPRESENTATIVE CROP (POTATOES) RESULTING FROM THE USE OF SULPHUR AND OF MANGANESE SULPHATE ON ALKALINE MUCK. COLLEGE MUCK—EAST LANSING

Plot No.	Annual fertilization 800# per acre 0-8-24			Representative increase due to treatment. Potatoes Bu. per acre Av. 2 years 1936-1937
	Additional special treatment—Lbs. per acre			
	Manganese sulphate applied annually 1934-1937	Sulphur application		
		1934	1936	
(Control plots 2, 5, 8, 11)	0	0	0	. . .
1	100	0	0	80
3	100	500	500	117
4	200	0	0	116
6	200	500	500	137
7	0	500	500	54
10	0	1000	1000	101
9	0	2000	1000	113

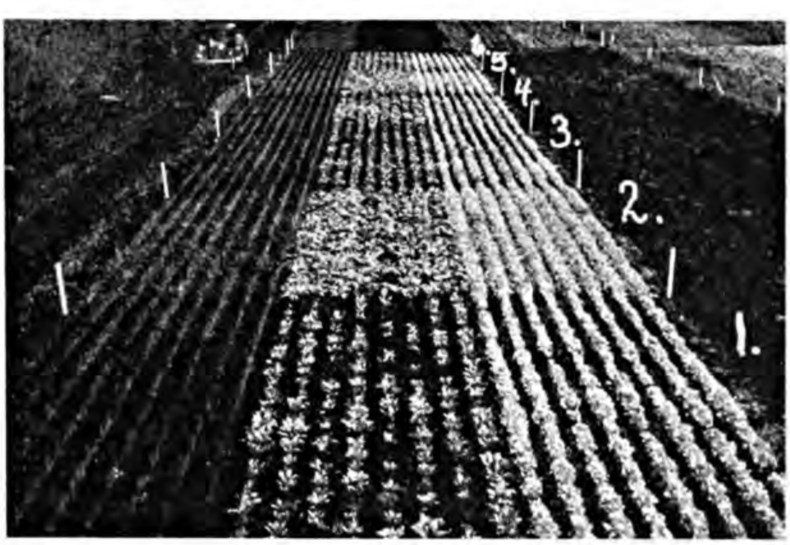

Fig. 6. Onions, spinach, and leaf lettuce, grown on plots which received the following treatments per acre: 1. Horse manure, 20 tons; 2. 3-9-18, 800 pounds; 3. Cow manure, 20 tons; 4. Sheep manure, 20 tons; 5. 3-9-18, 800 pounds; and 6. Chicken manure, 11 tons. Sheep manure proved best of the manure treatments, but none equalled the commercial fertilizer.

just before seeding, but the sulphur preferably should be applied after plowing and somewhat previous to seeding, and disked well into the soil.

Copper Sulphate. Investigation has showed that crops are likely to be benefited by the use of copper sulphate on the more acid muck soils. The more acid the muck, the greater the number of crops which may show a response to it. In addition to increases in yields, the copper produces better color of such crops as onions, spinach, lettuce and carrots, increased sugar content of carrots and beets, and improved flavor of most crops. Under Michigan conditions, most mucks with a pH of 6.0 or less will produce better yields of a number of crops when copper sulphate is applied. Benefits are more pronounced in a hot, dry summer than in a cold, wet one. Mucks with a pH of 6.0 to 6.5 may show a benefit with a few crops, while the two most responsive crops, spinach and lettuce, may give increased yields even on alkaline muck when copper sulphate is applied to the soil. In Table 6 is presented the average increases in yields of spinach as a representative crop, resulting from dif-

Fig. 7. These potatoes were produced on an extremely acid muck soil. With each pile from the same number of hills, the No. 1 pile had received 0-8-24 only, No. 3 marl only, and No. 2 had both marl and 0-8-24. Liming materials should not be used for potatoes unless the pH of the muck is below 4.4.

TABLE 5.—RELATIVE RESPONSE OF SEVERAL MUCK CROPS TO DIFFERENT SOIL REACTIONS AND TO CERTAIN SPECIAL TREATMENTS

No.	Most tolerant of a very strongly acid reaction	Most responsive to copper sulphate on acid mucks	Responsive to salt on most mucks	Most tolerant of an alkaline soil reaction	Most responsive to manganese sulphate or sulphur on alkaline muck	May respond to borax on all alkaline and occasional acid mucks
1	Cranberries	Spinach	Table beets	Sugar beets	Onions	Celery
2	Blueberries	Onions	Celery	Mangels	Celery	Table beets
3	Potatoes*	Lettuce	Mangels	Swiss chard	Spinach	Spinach
4	Spinach*	Carrots	Swiss chard	Cabbage	Lettuce	Corn
5	Lettuce*	Tomatoes	Sugar beets	Cauliflower	Potatoes	Sugar beets
6	Peas*	Potatoes	Turnips	Peppermint	Radishes	Cauliflower
7	Beans*	Cauliflower	Cabbage	Parsnips	Table beets	Mangels
8	Tomatoes*	Radishes	Celeriac	Carrots	Carrots	Swiss chard
9	Squash*	Beets	Kale		Peas	Turnips
10	Reed canary grass*	Peppermint	Kohlrabi		Beans	Rutabagas
11	June grass*	Sudan grass	Radishes		Sudan grass	Radishes
12	Corn*	Oats	Rape		Oats	

* Light lime and copper sulphate applications required.

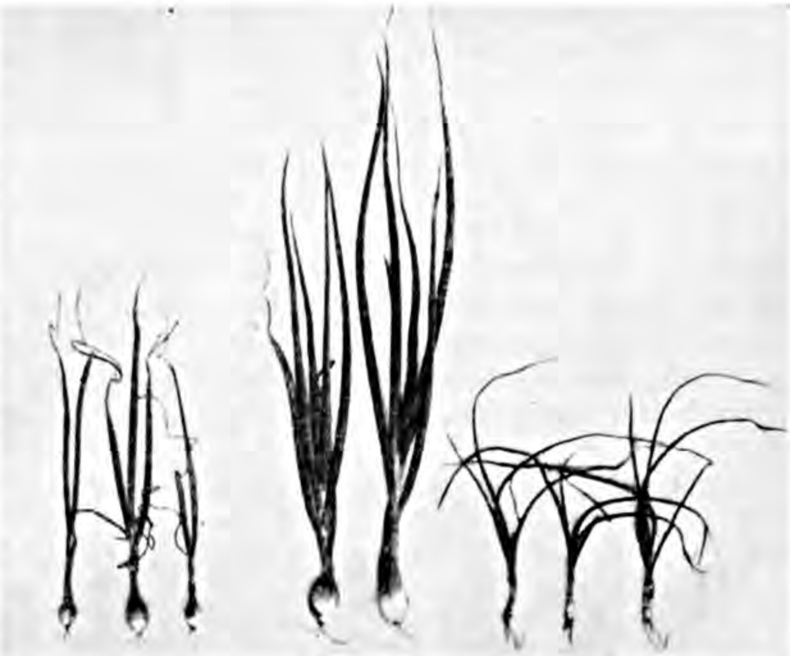

Fig. 8. These onions were all sown the same day and fertilized uniformly with phosphate and potash. The four on the left were grown on the slightly acid (pH 6.0) part of the plots while the four on the right were grown on the alkaline side (original pH 7.8). The three at the left end received no copper. Note the erect growth, with the dying back of the tips of the leaves and a premature maturity of the undersized bulbs. The fourth onion from the left came from the next plot which had received 50 pounds per acre of copper sulphate annually for four years. The erect leaves are green to the very tips and a large size bulb is likely to be developed. The three onions to the extreme right show a curled top growth and delayed bulb formation characteristic of alkaline muck. A similar growth is sometimes produced under wet conditions but, in that case, the growth will become erect as soon as drainage is improved. The fourth onion from the right came from the plot on which alkalinity had been corrected with sulphur. Manganese sulphate would have produced the same result.

ferent rates of application of copper sulphate, and on the left in Figure 8 is shown the characteristic evidence of copper deficiency in onions.

On acid muck which has received no copper sulphate in the past, an initial application of 50 pounds per acre is ample for most crops, although 100 pounds are advisable when spinach or lettuce is to be grown. In succeeding years, half the initial rate is generally sufficient, the application being repeated annually until around 250 to 300 pounds per acre have been applied.

Salt. Investigations at Michigan State College have thus far showed that 12 crops (Table 5) will be benefited on muck soil by the use of ordi-

Table 6.—Showing Increases in Yield of a Representative Crop (Spinach) Resulting From Different Rates of Applications of Copper Sulphate—College Muck, East Lansing

3–9–18 applied annually. 800# per acre on all plots. Av. soil pH 6.0				Spinach. Tons per acre increase in yield due to copper sulphate. Av. 4 years 1934–1937. (3 crops per year)
Plot No.	Copper sulphate Lbs. per acre—Applied annually		Total copper sulphate applied Lbs. per acre	
	1932	1933–'37		
2, 7, 11	0	0	0	....
3	50	25	175	10.3
4, 6	50	50	300	11.4
5	50	0	50	9.4
8	10	10	60	10.4
9	100	100	600	12.5
10	25	25	150	12.3
12	200	200	1200	11.3

nary salt in conjunction with a high-potash fertilizer mixture. Chemical analyses of the crops have proved that these benefits are due to the sodium content of the salt. Application of salt without sufficient potash is certain to result in a crop failure, a 0-8-24 mixture generally giving best results. The effect of salt on the beet crops can be seen in an increased growth of both roots and tops, and on celery in increased growth and better quality of the crop. Some increase in disease resistance of several of the crops has also been observed.

Muck farmers raising any of the 12 crops which benefit from salt are advised to try out salt on these crops on their mucks. An application of from 500 to 1,000 pounds per acre is likely to be sufficient for the first six listed in Table 5; from 100 to 400 pounds per acre are generally sufficient for the last six. Although the yields of some other crops are decreased from the heavier applications of salt applied just before seeding, the residual salt in the muck will have no depressing effect on any crops which may be grown the following year.

Boron. This element, ordinarily applied in the form of borax, recently sometimes has been found to be deficient in muck soils. Thus far three crops, namely, celery, sugar beets, and table beets, have showed definite deficiency symptoms on certain Michigan mucks. A total of 11 crops have showed yield benefits from borax on occasional mucks.

Cracked-stem of celery was first found by Florida investigators on the Everglades muck to be directly due to a lack of boron in the soil. Under Michigan conditions the disease has been recognized for approximately 25 years, where it generally has occurred on the alkaline muck soils. On previously unfertilized and unmanured acid mucks, it sometimes appeared the first year or two after cropping, but the deficiency was by that time entirely corrected, apparently by the boron impurities present in the heavy applications of the lower-grade fertilizer applied in past years to the celery crop. Cracked-stem on the alkaline mucks in Michigan has been prevented successfully for the past 12 years by the use of sulphur to acidify the soil, by which means the availability of the soil's boron is increased.

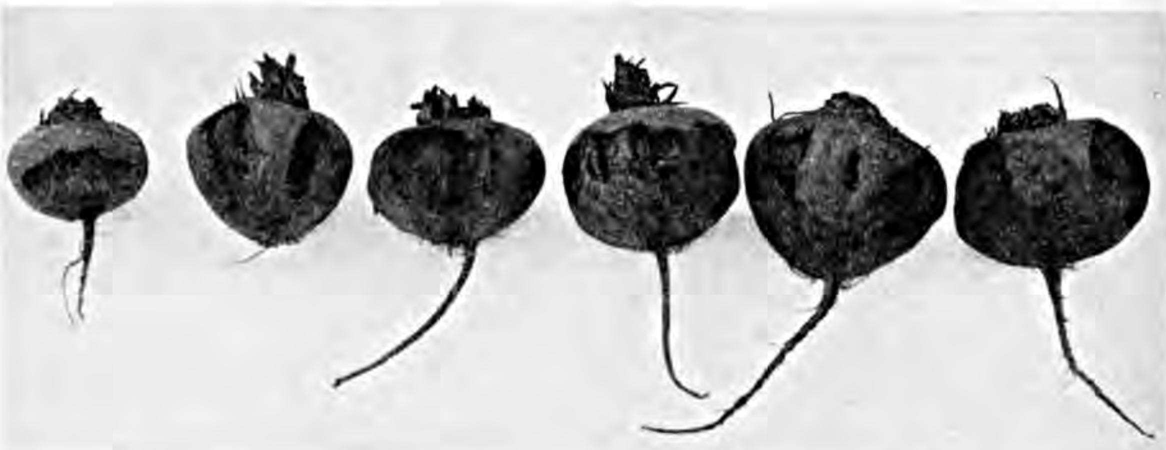

Fig. 9. Boron deficiency of table beets, manifested by the development of a decay known as girdle or canker.

Because of the possibility of the occurrence of cracked-stem, the application of 25 pounds of borax per acre is advisable as a safeguard on acid mucks which previously have not been cropped to celery nor heavily fertilized. On alkaline mucks, an initial application of 100 pounds of borax should be made. Applications of borax at the rate of 50 to 100 pounds per acre, topdressed after the cracked-stem has ap-

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The Champlain Valley Improves Its Apples

By A. B. Burrell

Professor of Plant Pathology, Cornell University, Ithaca, New York

LAKE CHAMPLAIN is a narrow body of water 136 miles long, forming most of the boundary between New York and Vermont. Apples have been grown on the farms of the Champlain Valley since the timber was cleared from the land a century or more ago, but the development of large commercial acreages is largely a matter of the past 35 years. Some of the first McIntosh trees in the United States were planted here, members of the McIntosh family having personally traveled through the region to sell the original stock. The McIntosh has been the leading variety for about 20 years, and constitutes about three-fourths of the total apple production.

Right: Twig with leaf-scorch and defoliation from tree on exceptionally poor soil which received abundant nitrogen, but no potassium, mulch, or manure. Left: Comparable twig from an adjacent tree which was in equally poor condition previous to two annual potassium treatments.

When I first went to the Champlain Valley to do experimental work in 1925, I found mostly slow-growing orchards, producing rather light crops of very highly colored apples which commanded top prices. At that time, most growers used limited quantities of manure in their orchards together with occasional light applications of nitrate of soda and in some cases, a little phosphorus. Most bearing orchards were in sod, but the grass growth was not always heavy. Under these conditions it was not difficult to show sensational increases in yield and growth through liberal applications of any of the common nitrogenous fertilizers. Within three years the use of nitrogen increased several hundred per cent, and has been maintained at a high level ever since.

At this stage a limited number of tests failed to show any direct tree response from elements other than nitrogen. Certain abnormalities in the trees, however, were noted from time to time.

One group of associated symptoms included internal and external cork of the apple fruits, die-back, rosette, a form of leaf-scorch, and internal bark necrosis. It was found that irrigation would partially control the internal cork in the fruits, but this was impractical and did not settle the fundamental nature of the trouble. A little later it was found that die-back, rosette, and two types of leaf-scorch (caused respectively by deficiency of boron and of potash) were partially controlled by four years of any of the following treatments:

1. Continuous heavy mulching with hay.
2. Annual heavy ring of manure.

TABLE 1.—RATES FOR FIRST APPLICATION OF BORAX TO TREES OF DIFFERENT SIZES *

Length of time tree has been in orchard	Approximate trunk diameter one foot above ground	Amount of borax for application on soil
Years	Inches	Ounces
0 to 3	½ to 2½	None
4 to 6	3½	2
7 to 9	5	4
10 to 12	7	6
13 to 15	10	8
16 to 24	14	8 to 12
25 and more	15 and more	12 to 16

* The size of a tree is more dependable than the age for determining the amount of borax needed. If boric acid is used, two-thirds the amount shown would be sufficient. When a second treatment is made after an interval of three years, it may be possible to reduce the amount by one-third.

3. Omission of nitrogen in sod orchards whether or not potassium was applied. (Nitrogen-deficiency thereby reduced growth and yield to unprofitable levels.)

The commercial use of the mulch method gradually gained, but it still was not clear why the mulch was beneficial. The next step was the discovery that boron would prevent internal and external cork, die-back, rosette, and one form of leaf-scorch. This was confirmed by numerous orchard tests, and soil applications of borax were made by most Champlain Valley fruit growers as suggested in Table 1.

The result was the almost complete elimination of these symptoms from the region. On most points the results of boron experiments with apples in various parts of the world have been remarkably consistent. Borax containing 11.34% boron and boric acid containing 17.49% have been equally effective when used in such quantities as to supply equal amounts of boron. In New York State, we use borax because it is cheaper per unit of boron. In British Columbia, they use boric acid because they prefer not to build up the already high sodium content of the soil. Most investigators have had good results from incorporating some such amount as 2 pounds of borax or boric acid per 100 gallons of regular spray mixture in early summer, as a substitute for soil application, but some questions remain about the effectiveness and safety of the spray method of applying boron. Incidentally, the various tree-

Die-back, a symptom which develops only where boron deficiency is severe. Leaves are dwarfed, narrow, and brittle.

Internal cork, late-season type, the most common symptom of boron deficiency in apples. In many varieties the brown areas are principally near the core.

injection methods of supplying boron are too injurious for commercial use, though they were the tools by which the need for boron was discovered in several apple orchard regions.

Passing mention should also be made of the possible injury from boron. Under the conditions of the Champlain Valley, however, no evidence of injury has been secured when borax has been applied to the soil as suggested. Excessive rates or careless distribution can cause injury, a characteristic of boron injury being fading of color near the midrib of the leaf, especially near the base.

Boron Benefits Alfalfa

One other place where boron may come into the picture deserves mention. Of recent years Essex County Agricultural Agent Ray Bender and the Agronomy Department at Cornell have been accumulating evidence to show that borax used in connection with alfalfa may increase the vigor and longevity of this forage and cover crop plant. This may be of importance, since the alfalfa stands of the region often thin out more rapidly than can be explained by other known factors. The possible relation of potash deficiency to unsatisfactory alfalfa performance is covered later in this paper.

But even after the diverse symptoms of boron deficiency in apple trees were cleared up, there remained certain young blocks of apple trees with leaf-scorch. One characteristic of this leaf-scorch was the presence of brown staining preceding and accompanying the necrotic leaf margin. The symptoms were distinct from those caused by arsenical or sulfur sprays, by indiscreet overdoses of cyanamid or other fertilizers, or from simple water shortage. They so closely resembled those overcome in England by potassium applications, and occurred in sand-culture trees from which potash was withheld, that new experiments involving the use of potassium were inaugurated. Although previous experiments with potash had given negative results, it still seemed possible that potash might be needed on certain soils.

In these new experiments, the materials were applied to the soil surface in a very concentrated band, beneath the branches, or were placed in shovel holes in contact with apple tree roots. Such experiments were located in orchards where part or all of the trees showed this particular type of leaf-scorch.

The first year of treatment, no response was apparent. In 1940, which was the second year for experiment I, potash caused an amazing improvement in trees that previously suffered severely from leaf-scorch and general poor vigor, although the leaf-scorch has not yet been completely overcome. This was on an exceptionally infertile soil. In experiment II where the trees were not so bad originally, leaf-scorch was eliminated after the third annual potash treatment.

Fortunately, the Pomology Department at Cornell was able to collaborate by making potassium analyses of leaves from trees involved in these experiments. The treatment was found to have increased the potassium content from about one-third of one per cent on the untreated scorch trees to over one per cent on the treated trees. Scorch was largely overcome both where the potash was dug in and where it was applied in a narrow band on the surface of the soil.

In part of this work muriate of potash was used, in part, sulphate of potash. The results do not show whether either compound was superior to the other. The annual applications usually were from 3 to 5 pounds per tree 7 to 10 years of age. The objective was to apply as much as seemed reasonably safe since the urgent problem was to find out whether the trees would respond to potassium rather than to seek the minimum effective application. It is possible that satisfactory commercial results might be obtained from lighter annual applications or from liberal applications once in several years. If we were to start with trees seriously deficient in potassium, it might be expedient to try two conservative applications the first growing season in the hope that the potassium content might be raised to a normal level as soon as possible.

Potassium for Clovers

In the orchard where these experiments were conducted, alfalfa, alsike clover, and medium red clover exhibited the white spotting near the leaf margin commonly pictured as a symptom of potassium deficiency. Experience in the Champlain Valley with certain farm crops indicates that potash may sometimes be beneficial, especially where manure has not been used freely in the rotation and where the soil is sandy. The use of potassium for clovers on the sandier soils of New England has been recommended for some years, but emphasis in New York State usually has been on phosphorus and lime. Clinton County Agricultural Agent R. W. Foote and the Cornell Agronomy Department are conducting tests to see whether or not potassium should be included in the fertilizer mixture for farm rotations on at least some of the lighter soils of the region.

Adoption of a policy of using liberal amounts of nitrogen about 14 years ago greatly increased yield and growth of Champlain Valley apple orchards. It soon became apparent that on some soils, still better tree performance was obtained by the use of

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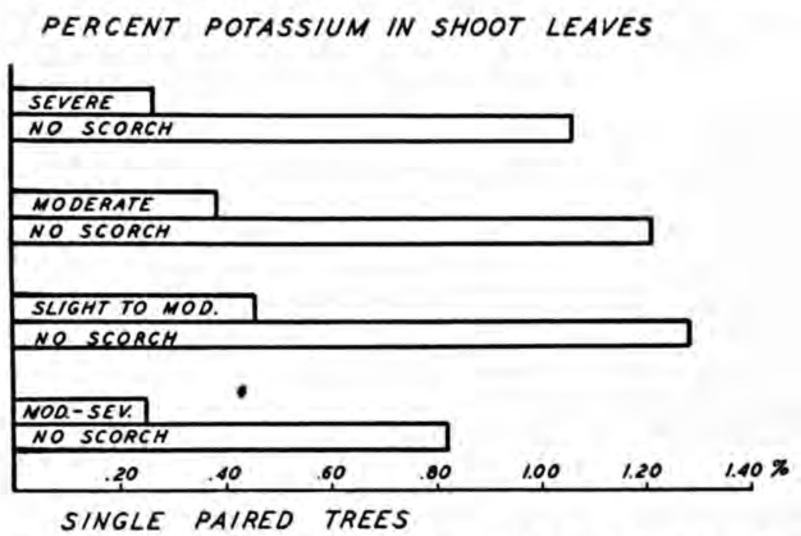


Correlation between low potassium content and leaf-scorch. The upper bar in each pair represents a tree which did not receive potassium; the lower bar a comparable adjacent tree which had three annual applications of muriate or sulphate of potash.

Preparing celery for market on a wet, rainy day. Note sprinkler system and discarded cuffs.

Keeping Celery High in Quality

By L. H. Hartwig

Columbia, Missouri

TYPICAL of Pennsylvania's many outstanding truck farmers is Frank Haug of Lycoming County. His garden crops are equal to or better in quality than any grown in the State. The standard of the 18 acres of celery which he grows each year is particularly high.

One should not be surprised that Frank Haug does such an excellent job of growing celery. "My father grew Pascal celery as far back as I can remember. I helped him care for his crops, and now I'm in the same business myself. It would be hard to tell exactly when I did start helping with the celery crop, but I know that I wasn't very old," he commented when asked how long he'd been in the celery business and where he'd gotten his early training. One thing is true, Frank Haug, now in his prime, has had plenty of experience growing this crop which requires careful attention throughout the entire season, and he has profited by all his experience.

Yes, he grows mighty good celery. Anyone who has seen or eaten any of it will testify to that. State agricultural extension specialists, whose advice Haug has followed more than once, like to point to his methods as the kind that produce results, the kind they like to see other growers follow, for they know full well that only by the right practices can reasonable profits be made on this ticklish crop.

The Haug farm is located alongside

the swiftly flowing Susquehanna river in a picturesque setting not far from the city of Williamsport. Once that river was full of floating logs, but now its main duty is carrying away surplus waters of melting snows and pouring rains. The soil is black and fertile, not too sandy, but just the sort that it takes to grow the kind of celery critical customers like. Too much sand in the soil, Haug explained, has a tendency to make the plants ribby, and ribby stalks don't please the palates of "persnickity" celery munchers.

That black loam soil is fertile, as good river bottom land should be, but even so every opportunity is taken to increase the natural richness. Green cover crops are grown and plowed under to improve the organic content, but that isn't enough. Every year an attempt is made to apply at least 20 tons per acre of manure from a cattle feedlot. This is spread in late winter or early spring.

Fertilizers Recommended

Every year, within a week before the plants are to be set in the field, a ton per acre of a 5-10-5 fertilizer is applied. This is worked well into the soil. If it so happens that insufficient barnyard manure is available, a side-dressing of 300 pounds per acre of the 5-10-5 fertilizer is made. The soil is tested regularly, and lime applied when necessary to keep the ground nearly neutral.

From this it is to be noted that this grower believes in providing his crop with abundant supply of available plant food. On medium loam soils receiving manure or on clover sods, the Pennsylvania Experiment Station actually recommends 1,000 to 1,250 pounds of 3-12-6 or 4-12-4. Where no manure or clover sod is used, they recommend 1,250 to 1,500 pounds of a 3-12-6 per acre, and on sandy loam soils they recommend 1,200 to 2,000 pounds of a 3-12-6 or equivalent amounts of plant food in another analysis in the same ratio.

Although Pennsylvania has very few muck soils as compared to other States, its recommendations for celery grown on recently cleared muck are 2,000 to 2,500 pounds of a 3-12-18 per acre or from 3,000 to 3,750 pounds of a 2-8-12. Where grown on muck soils which have been well fertilized for 10 years or more, they recommend from 2,000 to 2,500 pounds of a 4-8-12.

What kind of celery does Frank Haug grow? Well, his years of experience have taught him that for his market, Emperor fills the bill most satisfactorily. There are a number of varieties that might do almost as well, but not quite. California Pascal, for example, would be easier to handle, and would perhaps meet with the satisfaction of many buyers, but it lacks the fine quality and crispness of the Emperor variety.

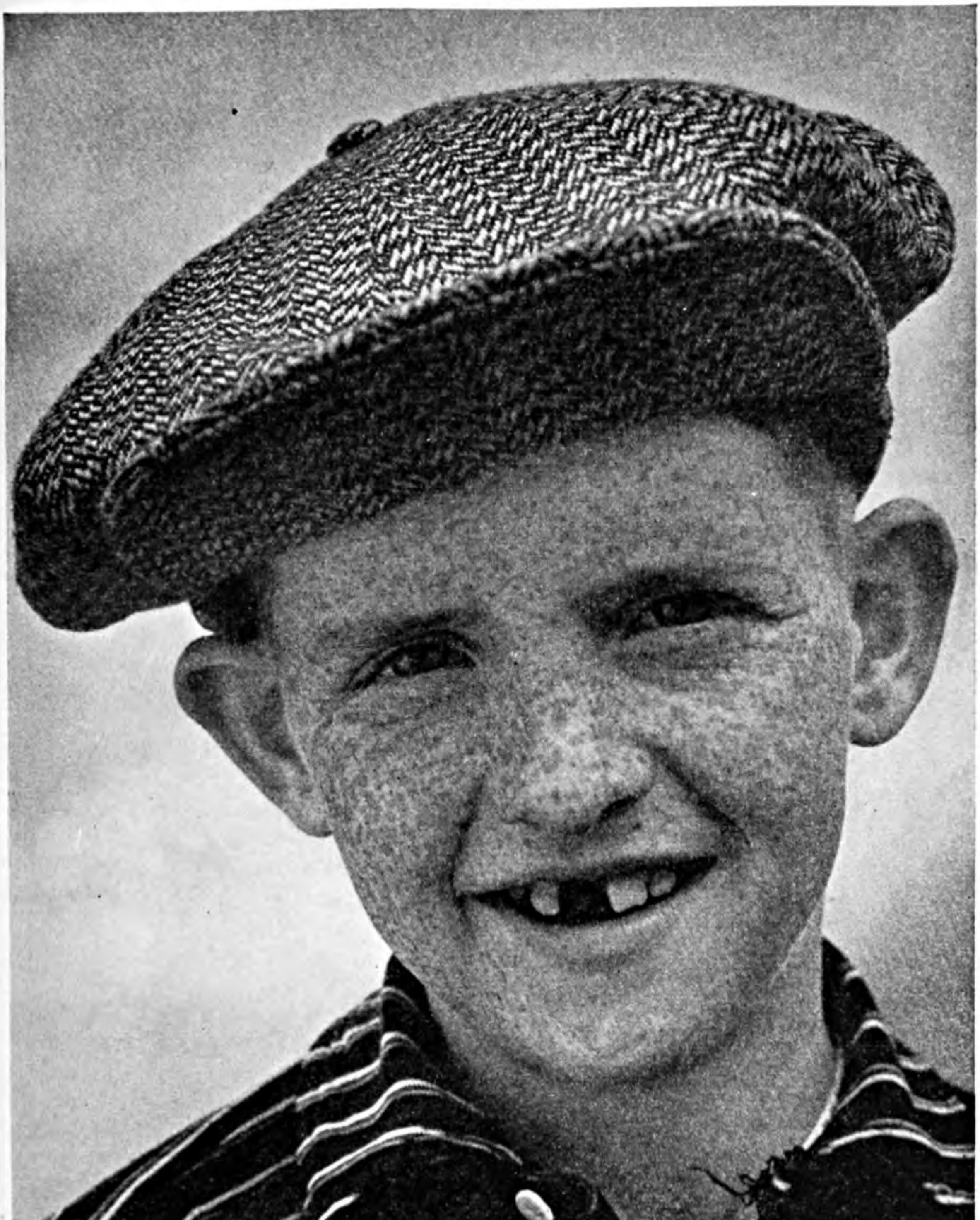
Haug has found that he can secure the best results by growing his own plants, so he does just that. And it takes a good many plants to set 18 acres, about 425,000 to be more or less exact. The seeds are started in steam-sterilized soil. Sterilization of the seedbed kills any disease bacteria that may have been lurking in it awaiting the opportunity to carry on their parasitic activities on young, tender celery plants. Plants started in unsterilized soil begin life with at least one strike against them. As a precaution against molding of the seeds in the seedbed during germination, the day and night temperatures in the greenhouse are kept as nearly as possible at 60 degrees Fahrenheit.

Now here's the thing that has done perhaps more than anything else to place Frank Haug among the top-notch celery growers. It's the rigidity with which he goes about controlling insects and disease. Actually, he doesn't control insects or disease. He absolutely prevents them from gaining a foothold by carrying on a continuous, relentless battle against possible infection or infestation.

Spraying begins at the time the plants are in the seedbed. From then on they're sprayed weekly, depending somewhat of course upon the diseases or insects that may threaten. As a re-

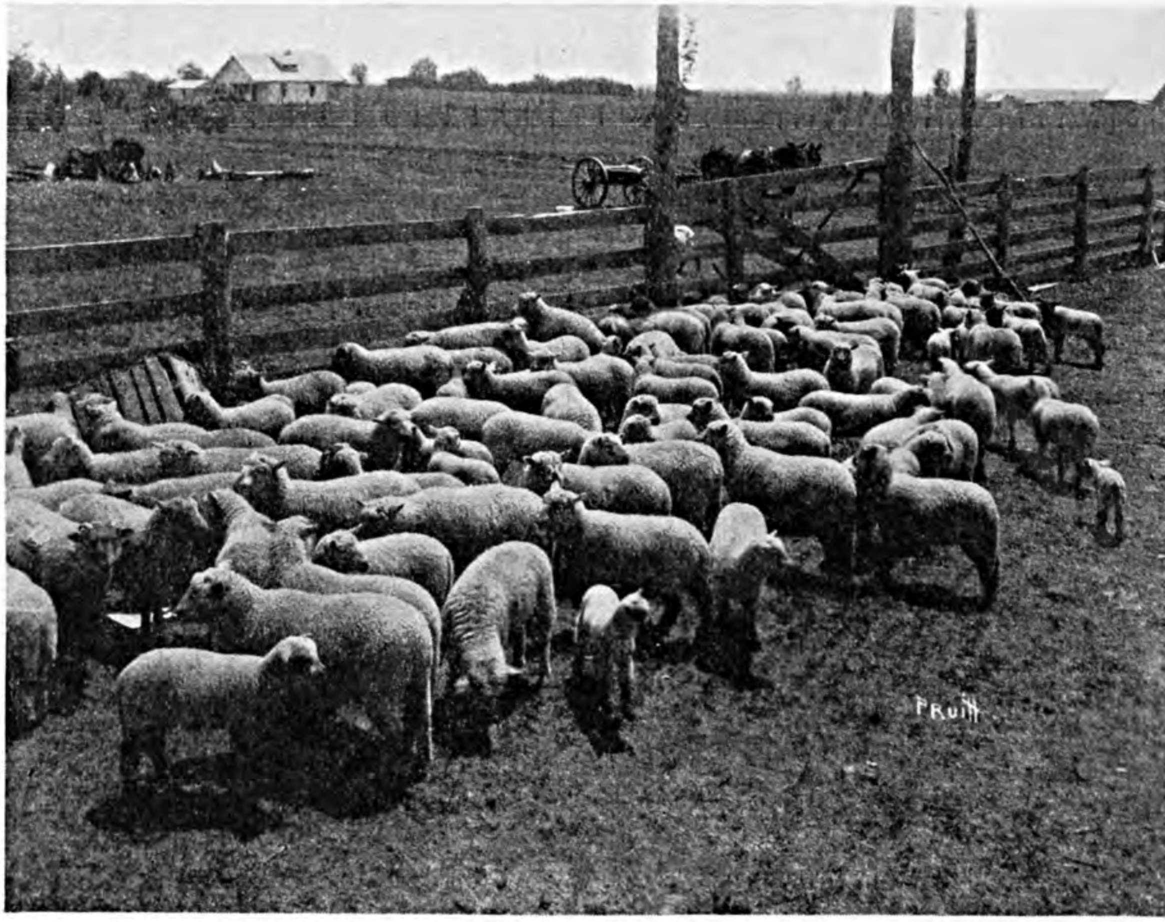
(*Turn to page* 46)

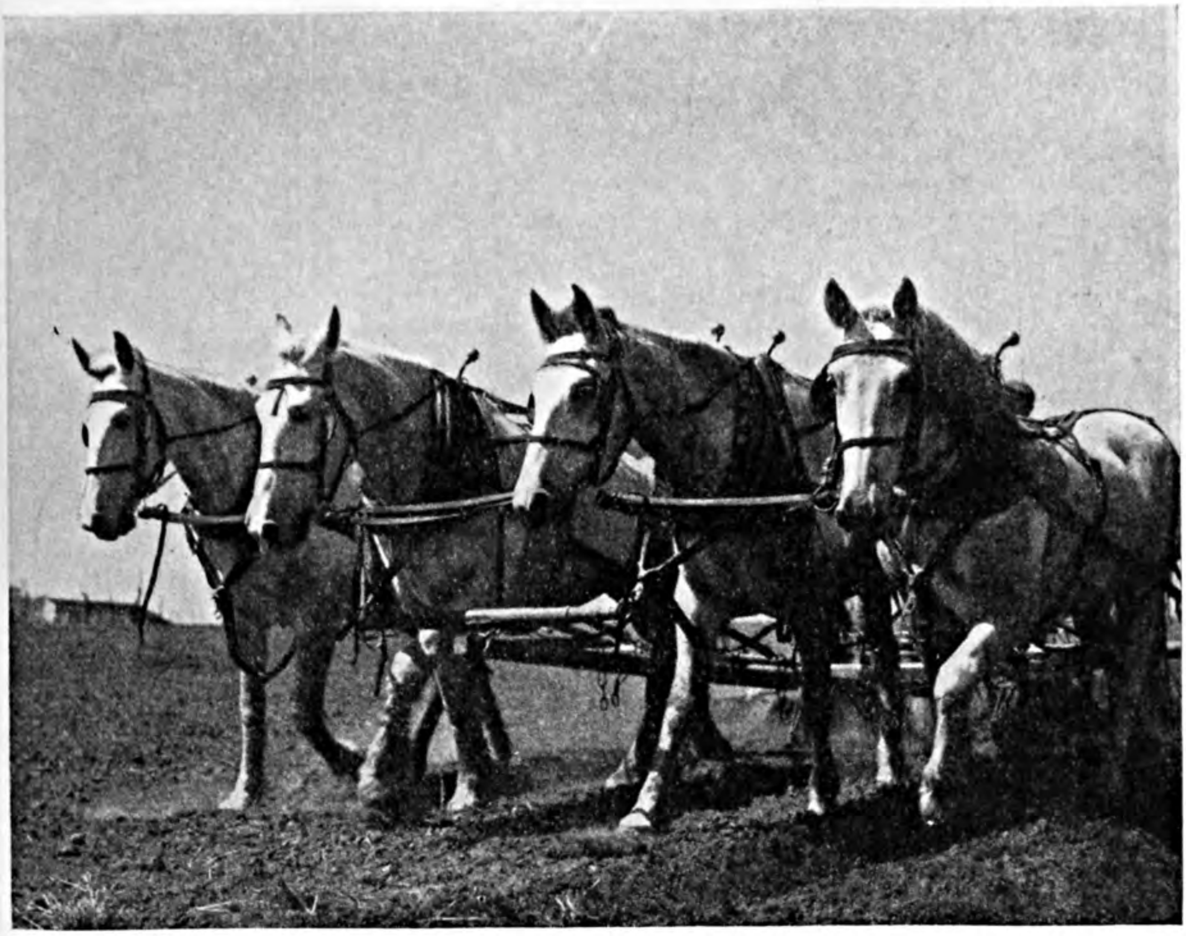
PICTORIAL



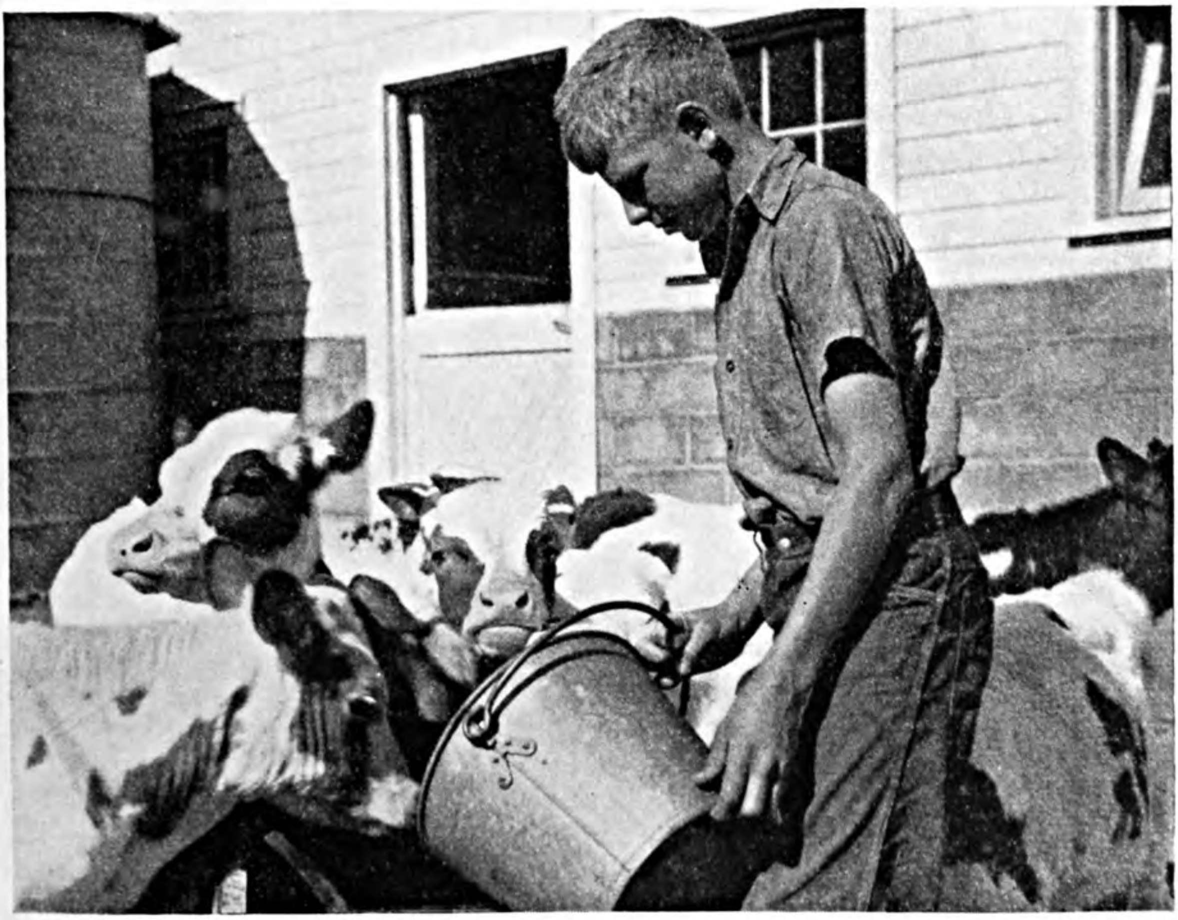
FRECKLES—ONE OF THE FIRST CROPS OF THE SEASON.

Spring on the farm brings new life





And hard work for everybody



Above: Beaver dams, such as this, are a great help in flood control.

Below: A planting of corn, with beans between the hills, in Georgia.

The Editors Talk

Something New in Fertilizer Laws

With new developments in fertilizer manufacture, there is a general tendency toward provisions discouraging the manufacture of analyses with relatively low plant-food content and encouraging the making of high-analysis goods which are more economical per pound of plant food delivered on the farm. Cognizance is also being taken of the increasing need for the secondary plant nutrients, and the newer laws are providing for the guarantee and control of these elements.

North Carolina has passed a new fertilizer law containing some unusual provisions. Regarding same, we are indebted to Louis H. Wilson, Editor of the Publications Division, N. C. Department of Agriculture, for the following news story:

"A North Carolina farmer next season, for the first time in the agricultural history of the State, can look at a bag of fertilizer marked 'low grade' and determine without uncertainty that he is buying an unrecommended mixture, D. S. Coltrane, assistant to the Commissioner of Agriculture said today in reviewing the 1941 Fertilizer Law.

"The Fertilizer Law becomes effective on December 1.

"With the general approval of farmers, farm organizations, farm leaders, the N. C. Experiment Station and State College, manufacturers, and others, the fertilizer law was amended and 'streamlined' by the 1941 Legislature, giving the State a statute termed 'unquestionably essential in the promotion of more economical use of plant food.'

"Fertilizer is considered and labeled on the basis of the number of plant-food units contained in the bag. Plant-food units are expressed in terms of nitrogen, phosphoric acid and potash, although there are other 'secondary' plant foods that may be guaranteed. For instance, a 4-8-4 grade would contain four units of nitrogen, eight units of phosphoric acid, and four units of potash, thus making a 16-unit fertilizer. All of which is by way of explaining that a 16-unit mixture is the lowest grade recommended by the research leaders at the N. C. Experiment Station.

"When the fertilizer law amendments were presented to the Legislature, there was considerable debate and objection to the proposal prohibiting manufacturers from selling a mixture containing less than 16 units of plant food, and opponents to the amendment contended that farmers should be permitted to buy any generally used grade they desired. Proponents of the amendment to limit grades to not less than 16 units contended their proposal was both economically and agronomically sound. A compromise was reached to the satisfaction of farmers, manufacturers, agronomists, and farm leaders.

"There is no fertilizer law in the United States comparable to the North Carolina act, nor is there a law that gives farmers and honest manufacturers any greater protection, in the opinion of Coltrane.

"The compromise amendment, 'designed to save farmers money and give them greater information to be used in more intelligent buying of all mixtures,' reads as follows:

"'Any mixture containing two plant-food ingredients, or mixed fertilizer containing less than 16 units of plant food (total nitrogen—available phosphoric acid—potash) shall be branded Low Grade and shall carry a red tag reading as follows:

"'This Is a Low Grade Fertilizer.

"'It costs too much per unit of nitrogen—available phosphoric acid and potash because it contains only 14 or 15 units (whichever the case may be) of these plant foods. You are paying too much for bagging, freight, labor, etc., on too much inert material (such as sand filler).'

"Thousands of dollars have been spent by research agencies, supported by public funds, in the interest of finding the best suitable fertilizers for all crops in North Carolina. Generally, research leaders and the N. C. Experiment Station do not recognize any grade of fertilizer containing less than 16 units of plant food. However, farmers can continue to buy grades containing as little as 14 units of plant food under the present (1941) law.

"When a farmer goes to buy his fertilizer, it is his privilege to buy any grade (14 or 15 unit goods) that he desires, but the 'minimum plant food' amendment calls his attention to 'unrecommended grades' and he buys such goods with the full knowledge that they are not approved by the Experiment Station, research leaders, and the agricultural leaders who have spent much time and money in research and for experiments in order that all growers may be informed as to the best fertilizers for their crops."

According to Census

"A general reduction in acreage devoted to staple farm crops, but with a general increase in production per acre, are indicated in the 1940 Census report on crop acreages and production released recently by Vergil D. Reed, Acting Director of the Census. Acreage devoted to the staple grain crops, hay, cotton, tobacco, potatoes, and a few more of the important farm products amounted to 301,103,691 in 1939, compared with 345,212,082 in 1929. Some of the important staple crops, despite this decreased acreage, showed an actual increase in physical volume and practically all showed a pronounced increase in production per acre," according to a recent statement from the U. S. Department of Commerce.

More from fewer acres reflects improved management. That a more intelligent use of fertilizers has played an important part is evident. Research, not only in the most profitable amounts of plant food to use but in proper placement, has been active during the past decade. It has not ceased, and new knowledge constantly being brought to light assures further efficiency in land use.

In the report, it was interesting to note that Iowa led all other States in the production of corn, Kansas in wheat, Iowa in oats, Texas in cotton, North Carolina in tobacco, Minnesota in hay, and Maine in Irish potatoes.

Our New Address: On April 28, The American Potash Institute moved its main offices to 1155 16th Street, N. W., Washington, D. C., taking a whole floor in the building newly acquired by the American Chemical Society. The editorial office of Better Crops With Plant Food is also located at this address.

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

¶ Nine of the 11 fertilizer ratios selected by representatives of the agricultural colleges and fertilizer industry for New England seem to meet Connecticut needs, according to Extension Bulletin 302, "Fertilizer Grades for Connecticut." In contrast, 60 ratios represented by 65 grades of mixed fertilizer were sold in the State last year. The bulletin gives recommendations of ratios or grades, together with rate of application, for all classes of crops and plantings grown in the State. The ratios include 0-1-1, 1-1-1, 2-1-1, 2-1-2, 1-2-1, 1-3-1, 1-2-2, 1-4-2, 1-4-5. Among the fertilizers in these ratios are 0-20-20, 7-7-7, 10-10-10, 10-5-5, 8-4-8, 5-10-5, 8-16-8, 4-12-4, 5-15-5, 5-10-10, 8-16-16, 5-8-7, 4-8-10, 3-12-6, 4-16-8, 4-16-20.

¶ Cornell Extension Bulletin 455, "Approved Fertilizers for New York," is a condensed but comprehensive version of Bulletin 281 (Revised, January 1941), entitled "Fertilizer Recommendations for New York." It is a contribution from the Departments of Agronomy, Vegetable Crops, Pomology, and Floriculture and Ornamental Horticulture of Cornell University. Tables give the fertilizer grades and rate of application for field crops, vegetable crops, fruits, and ornamentals growing under various conditions in the State. When large amounts of manure have not been used recently, complete fertilizers are recommended except in the case of legume crops or small grain following legume sod, in which case a phosphate-potash mixture is suggested. The bulletin is a very handy reference for growers with fertilization problems.

¶ Of practical help to farmers in the Province of Quebec, Canada, is the latest booklet of "Recommendations of the Provincial Fertilizer Board for 1941," distributed by the Department of Agriculture, Quebec. Suggestions as to the mixtures given herein are made on the basis of satisfactory results under farm practices.

Most of the recommendations center around 14 grades. They are: 2-12-10, 4-8-10, 5-8-10, 2-12-6, 2-16-6, 4-12-6, 2-12-8, 3-8-15, 0-16-6, 0-16-10, 0-8-16, 2-8-16, 5-8-7, and 9-5-7. The Board states that there is a pronounced trend toward the use of ready mixed fertilizers as opposed to separate ingredients which at one time were almost exclusively used. The Board considers that unless the difference in price justifies the purchase of separate ingredients for home-mixing, farmers should give preference to ready mixed fertilizers, because of their usual superior mechanical condition.

"Lime and Fertilizer Requirements for Asparagus," Agr. Exp. Sta., Newark, Del., Hort. Pamp. No. 1, Feb. 1941, E. P. Brasher.

"Fertilizer Experiments with Potatoes on The Marl Soils of Dade County," Agr. Exp. Sta., Gainesville, Fla., Bul. 352, Dec. 1940, W. M. Fifield and H. W. Wolfe.

"Commercial Fertilizers for Nebraska," Agr. Ext. Serv., Lincoln, Nebr., Cir. 149, Jan. 1941, M. D. Weldon and J. W. Fitts.

"Fertilizer Recommendations for New York," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 281, Rev. Jan. 1941.

"Onion Fertilizer Experiments at Laredo, Big Wells, and Eagle Pass, Texas," Agr. Exp. Sta., College Station, Tex., Bul. 596, Jan. 1941, Leslie R. Hawthorn.

"New Fertilizer Materials," U. S. D. A., Washington, D. C., Cir. 185, Rev. Dec. 1940, Albert R. Merz.

"Results of Cooperative Tests of TVA Plant-

food Materials by the Valley States Land Grant Colleges. Part 1: Agricultural Experiment Station Results," U. S. D. A., Washington, D. C., Nov. 1940.

Soils

¶ Dr. H. H. Bennett, Chief, Soil Conservation Service, gives a popular presentation of the story of soil waste in this country and steps toward conservation in a new Department of Agriculture publication, "Soils and Security." Containing many appropriate illustrations and written in Dr. Bennett's usual free style, "Soils and Security" tells us facts that concern not only the farmer as the first loser from erosion, but everybody. As long as erosion continues to cut away land and impoverish farm people at the present rate, we can never hope to achieve a truly sound and lasting national prosperity.

The laws of soil conservation have been so violated in the United States that more than 280 million acres have been virtually ruined by wind and water erosion. This vast area, nearly eight times the land surface of Wisconsin, was well covered for the most part with a fairly deep layer of fertile soil. As far as records can show, this Nation has wasted its soil resources faster than any other nation that ever attempted extensive agriculture.

The last part of "Soils and Security" concerns work of the Soil Conservation Service and other conservation agencies, especially soil conservation districts organized by farmers throughout the country. The work to date has already controlled erosion, for all practical purposes, on farms comprising about 20 million acres in private ownership, Dr. Bennett says. A solution has been found, or at least partially so, for every type of erosion that occurs on American agricultural land. But despite all this encouraging progress, the country is not yet moving fast enough in the direction of conservation and better land use. Countless tons of fertile soil still go coursing down our rivers with every hard rain. Dust clouds still rise over the Plains whenever there is prolonged dry weather.

Although defenses against rain and wind have been developed and tested, a huge area of farm and range lands remains largely untouched by conservation work. The real job of soil conservation has only just begun.

"Location and Design of Broad-base Ridge Terraces," "Constructing the Broad-base Ridge Terrace," and "Maintenance and Care of Broad-base Terraces," Agr. Ext. Serv., Honolulu, Hawaii, Circs. 101, 102, and 103, Jan. 1941.

"Alkali Reclamation Investigations," Agr. Exp. Sta., Moscow, Idaho, Bul. 233, Oct. 1940, Robert S. Snyder, Mark R. Kulp, G. Orien Baker, and James C. Marr.

"The Migration of Iron and Manganese in Colloidal Systems," Agr. Exp. Sta., Urbana, Ill., Bul. 472, Dec. 1940, Eric Winters.

"Soil Management for Iowa Cropland and Pasture," Agr. Exp. Sta., Ames, Iowa, S-63, Rev. Jan. 1941.

"Landform Types," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 175, Feb. 1941, Louis A. Wolfanger.

"A Study of Land Utilization in Providence County, Rhode Island," Agr. Exp. Sta., Kingston, R. I., Bul. 275, 1940, Basil E. Gilbert.

"Better Farms and Homes for Your Neighborhood," Agr. Ext. Serv., Morgantown, W. Va., Cir. 328, Nov. 1940, Walter C. Gumbel.

"Supplemental Irrigation," U. S. D. A., Washington, D. C., Farmers' Bul. 1846, Oct. 1940, F. E. Staebner.

"The Story of Soil Conservation in the South Carolina Piedmont, 1800-1860," U. S. D. A., Washington, D. C., Misc. Pub. 407, Nov. 1940, Arthur R. Hall.

Crops

¶ Fertilizer experiments conducted with Spanish peanuts in Georgia show that best increases were produced on most soils from fertilizers supplying 24 pounds nitrogen, 24 pounds phosphoric acid, and 24 pounds potash per acre. Professor U. R. Gore, in Georgia Experiment Station Bulletin 209, "Culture and Fertilizer Studies with Peanuts," says these plant nutrients may be applied in 400 pounds per acre of a 6-6-6 fertilizer before planting, or 300 pounds of a 3-8-8 plus a side application of 100 pounds nitrate of soda per acre. Another way to apply the fertilizer is to put 150 pounds of superphosphate per acre under the peanuts and side-dress with a mixture of 150 pounds nitrate of soda and 50 pounds muriate of potash.

On soils of average fertility in a rotation where other crops have received the average amount of fertilizer, it will often pay to fertilize Spanish peanuts, provided a good stand is obtained, proper cultivation is given, and the price of peanuts bears a favorable ratio to the price of fertilizer. On good soils previously heavily fertilized, little increase of peanuts may be expected from the use of fertilizer. A mixture of phosphate and potash is suggested for farmers who think their North Carolina Runners need fertilizer. The Runner type, so far, has indicated little or no response to fertilizer, especially nitrogen, Professor Gore states.

The bulletin describes the varieties of peanuts grown, culture and harvesting methods, and diseases of peanuts, giving control measures.

¶ Another interesting publication of this Station is Professor S. V. Stacy's Circular 126, "Corn Varieties, Hybrids, and Cultural Practices." In this the author gives the variety performance results of the open-pollinated and hybrid types in tests conducted at Experiment, Georgia, for a number of years. Long-time experiments with cultural practices are also discussed.

It is said that yields of 150 bushels or more of corn per acre have been produced in Georgia, yet the average yield for the State remains pitifully low. The crop is grown on many acres which are entirely too poor to be used for this purpose. Much of this land can be improved by practicing proper crop rotation and turning under green manure crops. The wide variation in variety yields grown under the same conditions should encourage corn growers to plant superior strains. Excellent advice on these, both for the open-pollinated and hybrid types, is given.

Corn planted in a rotation with a highly fertilized crop will need from 150 to 200 pounds of nitrate of soda or its equivalent in commercial nitrogen. When the rotation does not include a highly fertilized crop, corn should be fertilized with about 200 pounds of a complete fertilizer and top-dressed when knee high with 100 to 150 pounds of some nitrogen material.

The soil type on which the tests were conducted was Cecil sandy clay loam of medium fertility. The Cecil soil series is by far the most important and widely distributed soil of the Piedmont Plateau and has a wide crop adaptation.

"Studies of the Ripening of Marsh Grapefruit in Arizona," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 89, Jan. 15, 1941, R. H. Hilgeman.

"Science, Servant of Agriculture," Agr. Exp. Sta., Berkeley, Calif., Rpt. of the Agr. Exp. Sta., July 1, 1938, to June 30, 1940, C. B. Hutchison, S. B. Freeborn, and Henry Schacht.

"Alien Plants Growing Without Cultivation in California," Agr. Exp. Sta., Berkeley, Calif., Bul. 637, July 1940, W. W. Robbins.

"Sixty-fifth Annual Report of the Ontario Agricultural College and Experimental Farm, 1939," Ont. Agr. Exp. Farm, Guelph, Ont.

"Making Money from Potatoes," Agr. Ext. Serv., Storrs, Conn., Bul. 292, Feb. 1940, Albert E. Wilkinson.

"Onions," Agr. Ext. Serv., Storrs, Conn., Bul. 293, May 1940, Albert E. Wilkinson.

"Cantaloupes," Agr. Ext. Serv., Storrs, Conn., Bul. 294, May 1940, Albert E. Wilkinson.

"Cucumbers," Agr. Ext. Serv., Storrs, Conn., Bul. 295, June 1940, Albert E. Wilkinson.

"Celery," Agr. Ext. Serv., Storrs, Conn., Bul. 296, June 1940, Albert E. Wilkinson.

"Paperwhite Narcissus," Agr. Exp. Sta., Gainesville., Fla., Bul. 353, Dec. 1940, R. D. Dickey.

"Illinois Corn Performance Tests, 1940," Agr. Exp. Sta., Urbana, Ill., Bul. 474, Jan. 1941, R. R. Copper, G. H. Dungan, A. L. Lang, J. H. Bigger, Benjamin Koehler, and Oren Bolin.

"Growing Pumpkins and Squashes," Agr. Ext. Serv., Orono, Maine, Cir. 135, Jan. 1941, William S. Plumer.

"Agricultural Experiment Station Report, Two Years Ended June 30, 1940," Agr. Exp. Sta., East Lansing, Mich.

"The Detection, Distribution and Mobility of Certain Elements in the Tissues of Plants Growing Under Different Conditions as Determined by the Spectrographic Method," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 176, Feb. 1941, R. P. Hibbard.

"Soybeans for Minnesota," Agr. Ext. Div., University Farm, St. Paul, Minn., Ext. Bul. 134, Rev. Oct. 1940, A. C. Arny, W. W. Brookins, and R. E. Hodgson.

"Building Soil, Security, and Self-reliance," Agr. Ext. Serv., Columbia, Mo., 1940 An. Rpt., Cir. 427, Mar. 1941.

"Science and the Land," Agr. Exp. Stas., New Brunswick, N. J., An. Rpt., 1939-40.

"Bloom Period and Yield of Apples," Agr. Exp. Sta., Wooster, Ohio, Bul. 618, Jan. 1941, C. W. Ellenwood.

"Oklahoma Wheat Improvement, 1939-40," Agr. Exp. Sta., Stillwater, Okla., Cir. 91, Jan. 1941, Horace S. Smith.

"The Cotton Contest—1940—for Better Yield and Staple Value," Agr. Ext. Serv., Clemson, S. C., Cir. 190, Feb. 1941.

"Farm Research in South Dakota," Agr. Exp. Sta., Brookings, S. Dak., 53rd An. Sta. Rpt., July 1, 1939—June 30, 1940.

"Better Crops and Methods in the Farm Garden," Agr. Ext. Serv., Knoxville, Tenn., Pub. 230, Rev. Jan. 1941, W. C. Pelton.

"Garden Planning in a Home Food Supply Program," Agr. Ext. Serv., Knoxville, Tenn., Pub. 236, Feb. 1941, W. C. Pelton.

"Growing a Defense Garden," Agr. Ext. Serv., Knoxville, Tenn., Pub. 247, Jan. 1941, W. C. Pelton.

"Cabbage Variety and Fertilizer Tests in Cameron County," Agr. Exp. Sta., College Station, Texas, 692 Prog. Rept., Sept. 5, 1940, J. F. Wood.

"Research Aids Utah Agriculture, Biennial Report 1938-1940," Agr. Exp. Sta., Logan, Utah, Bul. 294, Dec. 1940.

"Bitter Pit of Apple. 1. In Orchard and in Storage," Agr. Exp. Sta., Burlington, Vt., Bul. 467, Dec. 1940, M. B. Cummings and R. G. Dunning.

"Agriculture of Vermont—Twentieth Biennial Report of the Commissioner of Agriculture, 1939-1940, St. Dept. of Agr., Montpelier, Vt.

"14th Biennial Report of the West Virginia Department of Agriculture, 1939-1940," St. Dept. of Agr., Charleston, W. Va.

"Growing Raspberries & Blackberries in Wisconsin," Agr. Ext. Serv., Madison, Wis., Cir. 280, Rev. Oct. 1940, J. G. Moore.

"Lettuce Growing," U. S. D. A., Washington, D. C., Farmers' Bul. 1609, Rev. Oct. 1940, W. R. Beattie.

"Comparative Chemical Composition of Juices of Different Varieties of Louisiana Sugarcane," U. S. D. A., Washington, D. C., Tech. Bul. 688, Oct. 1939, C. A. Fort and Nelson McKaig, Jr.

"Harvesting Pyrethrum," U. S. D. A., Washington, D. C., Cir. 581, Jan. 1941, A. F. Sievers, M. S. Lowman, and W. M. Hurst.

"Development of Interspecific Tomato Hybrids of Horticultural Value and Highly Resistant to Fusarium Wilt," U. S. D. A., Washington, D. C., Cir. 584, Jan. 1941, William S. Porte and Frederick L. Wellman.

"Range Conservation Practices for the Great Plains," U. S. D. A., Washington, D. C., Misc. Pub. 410, Dec. 1940, B. W. Allred.

"Leaders on the Land, A Report of Cooperative Extension Work in Agriculture and Home Economics in 1939," U. S. D. A., Washington, D. C.

Economics

¶ The Bulletin "Analyses of Commercial Fertilizers, Spring Season 1940," published by the North Carolina Department of Agriculture, contains so much information relative to the fertilizers used in the Nation's No. 1 fertilizer-consuming state that it is virtually a handbook on fertilizer consumption for North Carolina. In the third article in The Bulletin, D. S. Coltrane points out that as a result of efforts to reduce the number of grades offered for sale in the State nearly 96% of the total fertilizer tonnage sold in 1939 and 1940 was represented by 35 grades, which is a virtual reduction from 202 grades in 1938 to 35 grades in 1939 and 1940. Mr. Coltrane attributes the success of this program to the splendid cooperation of the farmers, farm agencies, and fertilizer manufacturers.

During the spring months of 1940, North Carolina farmers used 901,636 tons of fertilizer and fertilizer materials. Sales of mixed fertilizer for the 1940 spring season, January 1 through June 30, totaled 728,963 tons or about 17% less than the 850,735 tons used during the corresponding period in 1939. Despite the fact that 95.7% of the total fertilizer sold in the State represented 35 grades, there were 148 grades included in the remaining 4.3% of sales.

It is pointed out that the relatively high priced low analysis materials are now being replaced by lower priced high analysis synthetic or chemical products. The cost of fertilizers on the farm is determined by two major factors: First, by the price of materials and second, by the cost of manufacture, bags, and distribution.

The cost of distribution is around $10 per ton regardless of cost of the product. Thus, North Carolina farmers by changing from 3-8-3, 2-9-3, and other 14 or 16 unit fertilizers to a fertilizer containing from 17 to 21 units per ton, such as 3-8-6, 3-10-6, 4-12-4, 5-10-5, and 3-12-6, would eliminate filler and could save from 12 to 15% on their fertilizer bill. This saving to the farmers of the State would amount to more than $1,000,000. For example, the 2-8-4 is recommended for peanuts, so is 3-12-6. However, if the farmer used 3-12-6 instead of 2-8-4, two tons of 3-12-6 would be equivalent to three tons of 2-8-4. Two tons of 3-12-6 cost $52.78, whereas three tons of 2-8-4 cost $62.85, representing a saving of $10.07 or 16% by buying the higher grade fertilizer.

Other articles include "Fertilizers for Different North Carolina Crops" by C. B. Williams, giving recommendations for different crops in different parts of the State; "Fertilization of Truck Crops in North Carolina" by E. R. Collins, including data on different crops and different soils; "Discussion of Tobacco Fertilizers" by E. G. Moss; "Fertilization of Peanuts in North Carolina" by E. R. Collins and H. D. Morris; "American Potash Supplies" by J. W. Turrentine; "Soil Testing and Plant Growth" by I. E. Miles; "The Soil Acidity Problems in the Southeastern States" by H. P. Cooper; and "The Different Forms of Agricultural Lime and Their Uses" by A. L. Grizzard. Another section is devoted to recommended field and vegetable crop varieties for North Carolina. On the whole, the publication should prove a very helpful guide to farmers and others interested in agriculture in North Carolina and the Southeastern States.

¶ The Department of Agronomy of New York State College of Agriculture in cooperation with the National Fertilizer Association has published in Mimeo No. 618, "Fertilizer Tonnage for New York," some very interesting data relative to fertilizer consumption in the State of New York. The report covers the calendar year 1940. During that period total sales of all fertilizers amounted to 369,911 tons. Total sales of mixed goods amounted to 212,920 tons consisting of 43,582 tons of less than 20 units, 157,658 tons of between 20 and 30 units, and 8,972 tons containing more than 30 units of plant food. Of the total sales of 133,549 tons of superphosphate materials, only 1,849 tons contained more than 20% superphosphate. There were 16,095 tons of nitrogenous materials, 1,655 tons of potash salts, and 5,692 tons of other fertilizer materials sold.

The leading grades of mixed fertilizers in order of their importance were 4-8-8, 5-10-5, 5-8-5, 4-12-4, 4-8-12, 4-8-5, and 3-12-6. More than 10,000 tons of each of the above grades were sold. Of these grades all but two were recommended by the New York State College of Agriculture.

¶ The Inspection and Regulatory Service, College Park, Maryland, has recently issued its annual release on "Maryland Fertilizer Facts for 1940." According to this release, total sales in Maryland amounted to 160,315 tons, of which 121,089 tons were complete fertilizers, 11,378 tons superphosphate and potash mixtures, 7,153 tons nitrogen salts, 11,545 tons superphosphate, and 642 tons potash salts. It is estimated that there were 3,947 tons of nitrogen in mixed fertilizers sold, 12,-893 tons of phosphoric acid, and 9,296 tons of potash. The leading grades in Maryland in order of their importance were 2-12-6, 2-9-5, 6-6-5, 2-8-10, 3-12-6, 0-20-0, 4-8-8, and 4-8-12. Fertilizer analyses recommended by the Maryland Agricultural Experiment Station comprised 78,520 tons of the total sales.

Mixtures prepared for use as tobacco fertilizers amounted to 10,986 tons. The total sales of fertilizers in Maryland were slightly less than in 1939, and the plant food contained in mixed fertilizers was lower. In 1939, 164,585 tons were sold, and it was estimated that 4,508 tons of nitrogen, 14,143 tons phosphoric acid, and 10,107 tons potash were contained in mixed fertilizers.

¶ According to the mimeographed report compiled by the Soils Department, Michigan State College, "The Tonnage of Different Grades of Fertilizers Sold in Michigan, 1940," total sales amounted to 166,564 tons. Approximately 72% was sold in the spring and 28% in the fall. The compilation is made possible through reports submitted to the Soils Department by the fertilizer companies doing business in Michigan. The total tonnage of mixed fertilizers amounted to 149,124 tons. Nearly 92% of the sales consisted of grades recommended by the Soils Department. About 96%

of total sales of mixed goods contained 20 or more units of plant food. Comparable figures for previous years are as follows: 1939—93%, 1938—89%, 1937—86%, 1936—81%, 1935—78%, and 1934—73%. This shows a very definite trend toward the use of grades of mixed fertilizers containing higher ratios of plant food. Sales in 1940 were 21,753 tons, or 15% greater than in 1939. The best sellers in order of their importance were 2-12-6, 0-20-0, 2-16-8, 2-8-16, 3-12-12, 4-16-4, 0-20-20, 2-12-2, 0-8-24, and 0-14-6. Superphosphate materials, 2-12-2, and 5-10-5, decreased in per cent of total sales in 1940, whereas 2-12-6, 2-16-8, 2-8-16, 3-12-12, 4-16-4, 0-20-20, 0-8-24, and 0-14-6 increased. The 5-10-5 was dropped from the list of the 10 best sellers in 1940 and 0-20-20 was added.

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Foreign and International Agriculture

To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

Die Ernährung der Pflanze, Vol. 36, No. 8, August 1940

INVESTIGATIONS ON THE LOSS OF POTASH FERTILIZERS FROM THE SOIL BY LEACHING. *By v. Nostitz, München, Germany.*

In order to study the movement of potash through a soil, tubes about 20 inches long and 1.5 inches in diameter were filled four-fifths full of soil. A sieve at the bottom of the tube permitted water to drain away, and also permitted the moistening of the soil by means of capillarity. Potash salts at the desired rate of application were added in solution, and then varying volumes of water added to the top of the soil and allowed to seep through. The distribution of the potash was studied by carefully removing the soil from the tube and determining the potash content of the various sections of soil. Owing to the relatively small volume of soil employed, the potash content was determined by the Aspergillus method of Niklas.

In the first experiment, a sandy soil with 2% organic matter was placed in eight tubes and a potash application equivalent to 215 pounds of muriate of potash per acre was given to four of them, the other four being unfertilized to serve as checks. Water in amounts of 100, 200, 300, and 400 cc., equivalent to 3, 6, 9, and 12.5 inches of rain, was allowed to seep through one fertilized and one unfertilized tube for each amount of water. The soils were then removed from the tubes and carefully divided into three sections designated top, middle, and bottom. The determination of the available potash in these layers of soil showed that the added potash had been held in the upper four inches of soil, even with the heaviest water application.

In another trial with a sandy soil of a higher natural available potash content, to which was added muriate of potash equivalent to 645 pounds per acre, similar results were obtained. The use of sulphate of potash, to supply the same amount of potash as the high rate of muriate of potash, showed that there was no difference in absorption by the soil of potash from the two forms.

Soil in eight tubes was treated with the high rate of muriate of potash; half the tubes were leached with 400 cc. of water as rapidly as possible, and the other four with the same amount of water applied in small quantities over a period of four weeks. One tube with each treatment was then further leached. The amounts of water were varied as in the previous experiments, and the available potash in the soils was determined. The data showed that the time over which the water was applied had no influence on leaching of the potash in the soil. Similar experiments with good and poor field soils from various locations all showed that the potash was held in the surface.

A loamy sand and a sandy loam were placed in tubes only 4 inches long, treated as above with muriate of potash at the rate of 215 pounds per acre, and leached with 300 and 750 cc. of water, equivalent to 9 and 23.5 inches of rain, which were the amounts needed to remove all water-soluble material. The results showed that the potash was held mostly in the first inch of soil, with some going through to the second inch, and a little going through to the third and fourth inches in the loamy sand, but not in the case of the sandy loam. When this was repeated, using 10 times as much potash, or over a ton per acre of muriate, and leached with 500 cc. of water, the potash was washed down through all layers of soil. The absorbing capacity of the soils had been saturated with potash, and therefore large amounts could be leached through.

In order to check on the absorption of potash as measured by the Aspergillus method, soils were treated with heavy potash applications, water leached through, and then the upper, middle, and lower portions were separated and used as media in which to grow barley seedlings in a manner similar to the Neubauer method. Soils without potash applications, but otherwise similarly treated, served as checks. The upper portion of the fertilized soil produced a greater growth of barley than the similar layer of unfertilized soil, while the middle and lower layers of both fertilized and unfertilized soils produced about the same growth. This confirmed the previous experiments, showing that the potash is absorbed by the upper part of the soil.

Realizing these results did not agree with a rather common idea that potash will leach from the soil in relatively large amounts, the author compiled data from other investigators who had studied leaching of potash from soils by means of lysimeters. He shows that with one exception the amount of potash lost by leaching over an 11-year period was small compared to the total potash in the soil.

Based on his experiments, the author recommends that potash fertilizers be worked deeply into the soil. A top-dressing with potash should be harrowed in if possible, or else the rate of application should be high enough to saturate the absorbing capacity of the upper layer of soil and permit some to leach down into the root zone.

Some Experiences With Fertilizer

(*From page* 11)

an immense field ahead for the sale of fertilizers just waiting to be opened up. Consequently, it seemed advisable to get in on the ground floor by securing an agency without further delay.

I put in an application with the Pacific Bone Coal and Fertilizer Company from whom I had already purchased fertilizers for my own use. On securing this agency, I immediately started out to see what could be done in booking orders. In the meantime the company had gotten out a booklet listing the fertilizer materials they had for sale, among which were included special mixtures containing nitrogen and phosphoric acid, but no potash. The reason why these mixtures contained no potash was explained in a paragraph to the effect that California soils contained potash in great abundance and, therefore, it would be folly to apply it to any crop grown thereon. However, they went on to say that should anyone desire to use it, they would gladly include potash in their mixtures.

This statement was so contrary to the results I had obtained when putting the question to the plant, that I immediately went into action by sending without comment one of these booklets to the late Mr. George Meyer of Meyer, Wilson & Company for his reaction. Backed by the success I had met with in the use of potash, Mr. Meyer brought the matter to the attention of the Pacific Bone Coal and Fertilizer Company. They responded without delay by having this paragraph blocked out in all their booklets, and added three formulas containing potash to their lists, namely, 3-10-5, 3-8-10, and 0-10-10. It is safe to say that the 3-8-10 was the forerunner of the 4-10-10, which is still a strong favorite on the Pacific Coast. The 0-10-10 is still much used where the addition of nitrogen is not needed. The 3-10-5 met with favor for use on grain or wherever phosphorus seemed to be the chief requisite.

Considerably less, however, of the 3-10-5 was sold than either one of the two containing 10% potash, especially to fruit growers who, when their attention was called to the fact that far more potash is taken up by fruits than phosphoric acid, would consider with favor the formulas containing the larger amount. Particularly was this true when evidence of potash deficiencies could be found in their orchards, as indicated by the trees themselves or by the quality of the fruit produced. Another point that invariably went over was that where a certain amount of potash per acre would be required to be effective, it would be necessary to use two times as much of the 3-10-5 as of the 3-8-10 or the 0-10-10. That these two formulas gave satisfaction was amply proved by repeat orders received, as well as orders from new customers who had noted or heard of the improvement taking place in some neighboring orchard from the fertilizers applied.

Potash Alone Ordered

Repeat orders often resulted in orders for potash alone, since in some cases fruit growers figured that potash was the ingredient chiefly needed and the one most heavily drawn upon; that phosphoric acid was being taken up by the trees in far less quantities; and that a good cover crop supplied considerable nitrogen. The use of enough potash annually to meet full requirements, supplementing it by the addition of phosphoric acid applied every second or third year, and the growing of cover crops proved to be a sound and economical practice in many cases. Health and vigor of trees were maintained, production increased, and quality of fruit improved. Another economical and successful practice that met with favor was to apply the 3-8-10 at the rate of about 500 pounds per acre on one-half of the orchard, and from 100 to 200 pounds of potash alone on the other. The next year the process would be reversed, the potash alone going where the 3-8-10 had been applied the year before and the 3-8-10 following the potash-alone treatment.

Fruit Quality Improved

It was found in some orchards, where potash deficiencies were indicated, that applications of potash alone met all requirements. One prune and apricot grower, whose orchard was on a deep, slightly gravelly loam, applied only potash on part of his apricots and prunes. The application to the apricots was not made until after the crop was thinned and all danger from frost injury was past. It was then applied and followed by an irrigation. Forty days later he was harvesting his crop, all of which was sun-dried. On calling on him, while the fruit was still on the trays, he took me out to his drying ground and showed me the great difference in the quality of the fruit from where the potash had been applied, as compared with that from the trees which had received none.

The fruit then was about dry and ready to be taken up. That from the potash-treated trees was heavy and thick in texture, indicating a low shrinkage in drying. It was perfect in color, rich and tempting in appearance. In the trays alongside, fruit from the trees receiving no potash was thin and light in weight, indicating low sugar content and heavy shrinkage. It lacked the rich, appetizing appearance of the fruit from the potash-treated trees. Later in the season, after his prunes were harvested, he reported that the improvement in the prunes from the use of potash was just as marked as in his apricots. Fully 25 years later this same fruit grower told me that potash was not only the best, but the only fertilizer that had given any noticeable results on his place.

Available Potassium In Alabama Soils

(*From page* 8)

TABLE 3. THE TOTAL POTASSIUM, REPLACEABLE POTASSIUM IN THE SOIL BEFORE AND AFTER CROPPING, AND THE AMOUNT OF POTASSIUM REMOVED BY FOUR CROPS (SOYBEANS, VETCH, PEANUTS, AND COTTON) GROWN ON 10 DIFFERENT SOILS IN THE GREENHOUSE IN ONE YEAR

Soils	Pounds per acre						Percentage of K used by four crops which came from non-replaceable forms	Percentage of K available to four crops which was non-replaceable at the start of cropping	Percentage reduction in replaceable K in the soils due to removing four crops
	Total K in the soil	Replaceable K in the soil before cropping	Replaceable K in the soil after growing four crops	K removed by four crops	K removed by four crops plus that remaining in the soil in replaceable form	K supplied from non-replaceable forms in the soil			
Tifton sandy loam	1,182	42	24	79	103	60	76	41	43
Orangeburg sandy loam	1,454	39	18	74	92	53	72	42	54
Colbert fine sandy loam	3,818	51	36	91	127	76	84	40	29
Cecil clay	5,545	43	45	92	137	94	102	31	0
Clarksville sandy clay loam	6,181	93	61	136	197	104	76	47	34
Savannah very fine sandy loam	6,545	71	39	115	154	83	72	46	45
Hartsells very fine sandy loam	6,636	91	45	127	172	101	80	53	51
Durham fine sandy loam	7,070	55	27	113	140	85	75	39	51
Decatur clay	10,817	175	121	230	351	176	77	50	31
Davidson clay loam	12,817	141	52	180	232	91	52	61	63
Average	6,207	80	47	124	171	92	77	45	40

what appears to be a normal fifth crop, while others are growing plants showing extreme potash starvation. The amount of potassium removed by the crops has been determined. In addition, the soils were analyzed at the start of the experiment for total and replaceable potassium, and again after the fourth crop for replaceable potassium. The results of these analyses show conclusively that the plants were able to remove much more potassium from these 10 soils in one season than was contained in the soils in an exchangeable form at the start of the experiment. Roughly 75% of the potassium removed from the 10 soils in one year came from the non-exchangeable form. In one case, that of Cecil clay, all the potassium removed by the plants came from non-exchangeable forms and in another case, that of Davidson clay loams, only 52% did; all the other soils fell between these two limits. Further comparisons can be made by studying Table 3. The variations between the ability of the soils to release non-exchangeable potassium are dependent on the kind and amount of potassium-bearing minerals they contain. The kind of potassium-bearing minerals is quite important as revealed by the fact that Cecil clay containing only 5,545 pounds of total potassium per acre supplied just as much non-replaceable potassium to plants as did Davidson clay loam which contained 12,817 pounds.

It is commonly believed that soluble potassium applied to soils does not leach. Most investigations on this problem have been done with soils containing a reasonable supply of exchange material. Here, again, the agencies of weathering were severe on Alabama soils in the majority of cases. Our soils have been weathered to such an extent that great areas of the sandy soils have total exchange capacities of only three m.e. or less. Thus, the capacity of our soils for holding soluble potassium is very low in a great many cases and, as a consequence, a portion of the applied potassium will be leached below the feeding zone of the plants by the first big rain. The fact that leaching does take place is shown in Table 4.

The leaching of potassium can be prevented in the South to some extent through the use of winter legumes, most all of which feed heavily on potas-

TABLE 4. THE AMOUNTS OF POTASSIUM LEACHED BELOW THE FEEDING ZONE OF PLANTS IN SOME ALABAMA SOILS

Soil	Total amount of potassium applied in 8 years Pounds per acre	Amount of potassium that leached into and was retained by the 8 to 24-inch depth* Pounds per acre
Norfolk fine sandy loam	80	7
	160	40
	320	92
	640	216
Hartsells very fine sandy loam	80	9
	160	30
	320	64
	640	200
Decatur clay	80	0
	160	9
	320	23
	640	56

* Some potassium undoubtedly leached below the 24-inch depth in many cases but the amount was not determined.

sium. Eight years' results on eight Alabama soils showed that an average of 20% of the potassium applied was lost through leaching when no winter legumes were grown, and only 3% was lost when winter legumes were grown. Thus, aside from supplying nitrogen and organic matter to soils, winter legumes conserve soil potassium for future crops.

It has long been known that continually digging peanuts and removing both the vines and nuts from the soil will reduce the yields of crops that follow to an alarming extent. On the Wiregrass Substation, peanuts harvested for 7 years reduced the yield of seed cotton the eighth year about 900 pounds per acre as compared to continuous cotton. In another test, a 3-year rotation of corn, cotton, and peanuts (harvested) was grown. No fertilizer was applied to the corn or the peanuts, but a 6-8-4 was applied to the first two crops of cotton. After three crops of corn and two crops each of cotton and peanuts were grown, a final crop of cotton was planted. One plot receiving 24 pounds of potash produced 652 pounds of seed cotton, while another plot (similarly treated throughout) receiving 72 pounds of potash produced 1,075 pounds of seed cotton.

The fact that harvested peanuts deplete the soil of potash is further emphasized by a study of the results of plot tests presented in Table 5. In every case where peanuts were harvested, the supply of available potash was reduced to about 30 pounds per acre.

TABLE 5. THE EFFECT OF HARVESTING PEANUTS ON THE SUPPLY OF AVAILABLE POTASH IN SOILS AS COMPARED WITH OTHER CROPPING SYSTEMS

Crop	Fertilizer	Pounds of replaceable potash per acre after last crop was harvested
8 crops of peanuts—hogged off	0	106
6 crops of cotton	0	58
8 crops of corn	0	54
8 crops of peanuts—harvested	0	30
3 crops of peanuts—hogged off, 3 crops of corn, 2 crops of cotton	6–8–4 to cotton	54
3 crops of peanuts—harvested, 3 crops of corn, 2 crops of cotton	6–8–4 to cotton	32
4 crops of cotton, 4 crops of corn	6–8–4 to cotton	100
2 crops of cotton, 3 crops of corn, 3 crops of peanuts—harvested	6–8–4 to cotton	32

During the fall of 1939 a search of the State was made for adjacent fields, one of which had grown peanuts (harvested) for at least two out of the past five years, and one which had had no peanuts grown on it for five years. A total of 44 fields were located and the soil sampled. In every case the field from which peanuts had been harvested was lower in available potash than the adjacent field. The 22 fields from which peanuts were harvested contained an average of 36 pounds of replaceable potash per acre, and the adjacent 22 fields on which peanuts were not planted contained 87 pounds of replaceable potash per acre.

A careful study of the results obtained on 283 cooperative tests conducted by J. T. Williamson of this Station reveals that certain regions in Alabama respond more readily than others to more than 25 pounds of potash. For example, about 55% of the Norfolk and Clarksville groups will respond to extra potash as compared to about 25% of the Decatur and Orangeburg groups (Table 6). It would be of great value to the farmers of the State if a quick method were available for determining which of their fields would respond to extra potash.

Replaceable or available potassium, as it is sometimes called, has reached as low a level in Alabama soils as will probably be found in any state in the Union. About 30% of all Alabama soils contain less than 60 pounds of replaceable potassium per acre, about 60% contain less than 100 pounds, and only about 10% contain over 200 pounds. These meager amounts exist even in face of the fact that farmers apply roughly 33 million pounds of potassium to Alabama soils annually, about 70% of which goes to 2 million acres of cotton, or about 12 pounds per acre per year.

Practically all Alabama soils respond to 25 pounds of potash, and a great many respond to more than 25 pounds when cotton is the crop grown. (Cooperative tests indicate that about 40% of Alabama soils need more than 25 pounds of potash—600 pounds of a fertilizer containing 4% potash.)

TABLE 6. THE DISTRIBUTION OF 283 COOPERATIVE FIELD TESTS ACCORDING TO SOIL SERIES GROUPS AND THE RESPONSE TO MORE THAN 25 POUNDS OF ADDED POTASH

Soil series groups*	Total number of field tests	Average amount of replaceable potash in the soils in pounds per acre	Percentage of tests that responded to more than 25 lb. of added potash per acre	Average increase in pounds of seed cotton per acre for the tests showing a response to more than 25 lb. of potash added per acre
Norfolk	93	74	57	76
Clarksville	29	137	55	94
Hartsells	28	110	36	157
Cecil	28	111	32	53
Decatur	67	231	30	78
Orangeburg	38	142	24	67

* Norfolk group contains Norfolk, Ruston, and Kalmia. Clarksville group contains Clarksville, Colbert, and Susquehanna. Hartsells group contains Hartsells and Hanceville. Cecil group contains Cecil, Durham, Louisa, and Appling. Decatur group contains Decatur, Dewey, and Holston. Orangeburg group contains Orangeburg, Red Bay, Greenville, Cahaba, and Amite.

Many investigators have attempted to devise chemical methods of measuring the needs of a soil for potash. These have been thoroughly tested in Alabama, and the results from 486 experimental plots scattered over the entire State indicate that even when using the best quantitative laboratory methods available (not field kits or quick tests), only 65% of our predictions will prove to be valid and 35% will prove to be incorrect when we attempt to determine which soils will respond to more than 25 pounds of potash. (Soil series and soil texture were considered in all cases.)

In determining whether more than a given amount of some certain fertilizer or fertilizer element is needed to produce maximum net returns, one must always bear in mind that averages will likely give an erroneous picture of the actual situation. A much more reliable method is that of determining the percentage of soils which respond to this or that treatment. This is true because it is a well-known fact that an excess of most any element will cause a decreased yield, and potassium is not an exception. Averages tend to minimize important differences.

The differences in cotton yields on plots containing identical amounts of replaceable potash are due, very likely, to several factors, the most important of which are: (1) variations in previous cultural practices, (2) variations in the organic matter content of the soil, (3) variations in the compactness of the immediate subsoil layer, (4) the kind of crop grown the previous year, and (5) the fact that so-called replaceable potassium is not the only form of potassium that is available to plants.

Most any casual observer in the South has noticed very uneven growth of crops on a given field. In one portion of the field the cotton will be 3 feet high, and not 50 feet away it will be only 18 inches high. Why? Certainly it is not the lack of ordinary plant-food elements, because in most cases a uniform application had been applied to the entire field. It is believed that one or more of the difficultly measurable factors mentioned above is the cause for the variations found in such fields. All in all, these many unmeasurable or difficultly measurable factors which occur in the highly depleted soils of the South have such a profound effect on the crops grown, that the amount of replaceable potassium contained in the soil is apparently insignificant as a measuring stick for determining the needs of a soil for potassium in approximately 35% of the fields. Substation, experiment field, cooperative, and even independent tests by the farmers themselves appear to be the real means by which the fertilizer needs of any given soil can be determined with any degree of accuracy.

The Champlain Valley Improves Its Apples

(*From page* 20)

mulch. Some growers find it economical to obtain mulching material by bringing in spoiled hay or using barnyard manure from their dairies. Nearly all find it expedient to grow grass and other permanent cover crops in their orchards. Some find it feasible to grow much of their mulching material among the trees in the younger blocks. This brings up the problem of increasing the yield of such cover crops, which is sometimes done by top-dressing with manure or nitrogen. In some orchards, new seedings are made occasionally, including some kinds of clover or alfalfa. With these, the need of phosphorus is well established and potash may be desirable on some of the soils. This requires further testing. Although some soils are neutral or slightly alkaline, others require lime for best growth of legumes.

In many orchards, boron is needed about once in three years for the prevention of internal cork and other boron-deficiency symptoms of apples. There are indications that boron may also benefit alfalfa which might assume a more important role as a cover crop if stands did not die out so rapidly, although alfalfa sometimes accentuates the buffalo tree-hopper insect problem.

Potassium has been found beneficial to apple trees exhibiting a certain characteristic type of leaf-scorch. Such scorch is at present largely limited to a fairly small number of young orchards. Potassium-deficiency symptoms are not identical in all apple varieties. However, it is sometimes possible to separate

White spotting of alfalfa and clover leaves such as occurred in orchard where apple trees responded to potash.

the more common types of leaf-scorch by their symptoms.

Further assistance may ultimately be available from leaf analyses, if an objective of the Pomology Department at Cornell is attained. This is to establish the range in potassium content within which trees behave normally, and the point below which potash may be beneficial. At present, however, leaf analysis is of use chiefly in supplementing field tests. Some trees in the Champlain Valley show a rather low potassium content even though actual leaf-scorch is not present. Whether these trees might respond to potassium is an open question. Preliminary experiments have shown that no striking response is obtained, but sand-culture tests by other investigators have shown that a growth response from potassium is possible even in the absence of leaf-scorch. Leaf analysis seems a more promising approach than soil analysis, since no method of soil analysis indicates accurately how much potassium the tree will be able to obtain from the soil. In experiments to date, striking improvement in fruit color was obtained *only* in trees where leaf-scorch was overcome.

More work is needed on the possible effect of potassium on color where the leaf content of potassium is low but no scorch is present. The major factors influencing fruit color seem to be the weather, the carbohydrate supply, and the nitrogen content of the tissues shortly before harvest, a low nitrogen content being conducive to high color. The possible direct and indirect roles of potassium deserve further study. It seems possible that maximum growth of certain cover crops may require the use of potash. It is almost universally accepted by horticulturists and fruit growers that a liberal supply of organic matter should be grown in the orchard or imported.

While supplying the right amount of nitrogen in a suitable form continues to be the major fertilizing problem of the Champlain Valley apple grower, recent experiments indicate that this is not the whole problem. Boron is needed for direct tree use in most orchards, and a case of direct tree benefit from potassium has been established. Studies on the possible need of the trees and cover crops for various elements, now in progress in the region by different groups, may conceivably lead to modification of fertilizer recommendations. Mulching with hay or manure seems a widely applicable method of alleviating nutritional difficulties whether or not their precise nature is understood. However, in common with other practices that cause a high nitrogen content in the apple leaves late in the season, mulching sometimes increases trouble with fruit color and dropping.

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The Nutrition of Muck Crops

(*From page* 16)

peared on untreated fields, have been found in our studies to be very effective in checking the disease and preventing a complete loss of the crop.

Boron-deficiency disease of sugar beets has been reported by numerous investigators as occurring occasionally on mineral soils. It also has sometimes appeared on certain muck soils, both alkaline and acid in reaction. The disease appears as a stunting and curling of the petioles (leaf-stems), especially of those of the later leaves developing during warm weather, sometimes accompanied by a chlorotic yellowing of the older leaves and a rotting of the roots. Girdle or canker of table beets occurs as a cracking of the outer skin of the root near the soil surface, followed by a decaying as shown in Fig. 9. It frequently occurs on alkaline mucks, and has been controlled in our investigations with a 100-pound-per-acre application of borax on alkaline mucks and with 25 pounds on acid mucks.

Row Fertilization. Studies regarding the proper placement of fertilizer for Michigan muck crops have been continued since 1925. The results have been consistent in showing that best results will be secured with row fertilization of such crops as onions, celery, and beets on high-limed mucks which are well supplied with moisture, but that the broadcast method will give better results on mucks which are inclined to be droughty or which are strongly acid. A broadcast application, drilled about three inches deep, generally gives better yields than one spread on the surface and disked in. With ample moisture supply, an application of the fertilizer in the row about two inches directly below the seed is almost certain to give better yields of onions, potatoes and beets than an application at one or both sides of the row. Row fertilization is not advisable for beans or for members of the cabbage family when sown in the field.

For transplanted crops of celery or cabbage, row fertilization at a depth of about three inches below the surface should be made at least one week before the crop is transplanted, in order to prevent injury to the roots of the transplants. When the muck is well supplied with moisture, most of the nitrogen and part of the phosphate-potash mixture, for such crops as celery and cauliflower, may be applied as a side-dressing during growth. Not more than 25 pounds per acre of copper sulphate or borax should be applied in the fertilizer used in a row application, but, on alkaline muck, 100 pounds per acre of manganese sulphate, mixed in the fertilizer, can be safely applied in the row.

Fig. 10. Soybean leaves from College muck plots, showing potash deficiency on left and manganese deficiency on right, with normal leaves between.

Fig. 11. Only a few years ago a dense swamp, this productive muck is yielding a nice crop of celery of excellent quality.

Discussion. Satisfactory returns from the use of fertilizer on muck land depend not alone on the selection of the proper fertilizing materials. Fertilizers can not overcome the disastrous effects of poor drainage or of excessive drought. The muck farmer most likely to secure optimum returns from his fertilizer investment is the one who has such good control of the water level in his muck soil that he is practically independent of the weatherman. He must plant seed of high germination, of a variety satisfactory for muck,

TABLE 7.—SHOWING INCREASES IN YIELD OF A REPRESENTATIVE CROP (SUGAR BEETS) RESULTING FROM THE USE OF SALT ALONG WITH A HIGH-POTASH FERTILIZER MIXTURE. COLLEGE MUCK, EAST LANSING

Plot No.	Annual application per acre, 1932–'39: Fertilizer analysis 600 lbs. ('32–'37). 900 lbs. ('38–'39)	Annual application per acre, 1932–'39: Salt Lbs.	Representative increase over 0–8–24: Sugar beets Av. 8 years Tons per acre: Roots	Representative increase over 0–8–24: Sugar beets Av. 8 years Tons per acre: Tops	Crops benefited by salt application on muck
(Control plots 1, 6, 11)	0–8–24	0	...	...	Sugar beets, table beets, mangels, Swiss chard, celery, celeriac, turnips, cabbage, Kohlrabi, kale, radishes, and rape
2	0–8–12	500	2.7	4.9	
3	0–8–24	500	4.3	5.5	
4	0–8–48	0	3.5	3.3	
5	0–8–24	1000	5.0	6.4	
12	0–8–0	500	−3.4	−0.5	

as well as to the consuming public; he must protect the growing crops from disease and insect injury and finally offer it on the market in an attractive condition.

From the preceding discussion it is evident that, within fairly recent years, the proper fertilization of muck soil has become a very complex operation. First of all, the muck should be tested to determine whether or not it may require lime, or may possibly contain an excess of lime and be alkaline in reaction. The proper fertilizer mixture for the soil and the crop should be determined (See Table 3). To this should be added copper or manganese sulphate, borax and salt, if the reaction of the soil and the nature of the crop (See Table 5 and footnotes to Table 3) indicate they will be needed. This requires careful study and sometimes trials in the field with the different constituents to see what results will be secured on a particular muck, but, in the end, such studies are well worth while. The muck farmer, who would be successful, must be a student in his work, keeping his mind open to new advances in the fertilization of his soil, yet using good judgment in the application of those discoveries to his particular crops and conditions.

Keeping Celery High in Quality

(*From page 22*)

sult, his crop is as free of blight as it is possible to make it, and it is absolutely uninjured by insects. The usual practice is to spray weekly with a 4-4-50 mixture of freshly mixed bordeaux, applied with a high-pressure sprayer. Between spray applications, sometimes as often as once a week, the plants are dusted with a mixture of 44 pounds hydrated lime, 44 pounds superfine sulfur, and 12 pounds monohydrated copper sulfate for the control of tarnished plant bugs. Application of this powder is not made regularly, but is dependent upon the threat of danger.

There's nothing strange or uncanny about the method used by Haug in keeping diseases and insects under control. He merely follows the standard practices which the scientists at the Pennsylvania State College have found most satisfactory for his conditions, and which the State agricultural extension specialists would like to see all growers use. He merely follows the pattern religiously.

The first marketable celery is grown for the market in hotbeds, with the first plants going to the field about May 10. Marketing usually begins about the latter part of June and continues until Christmas. Most of the crop is sold on the local Williamsport market where Haug has a stall at the farmers' market which is open for business every Wednesday and Saturday. By this time, buyers are well acquainted with the quality of the Haug celery, and so he bumps up against little difficulty disposing of his crop at reasonably profitable prices.

Irrigation Important

Another thing that insures quality in the crop is that it is irrigated regularly when nature fails to supply sufficient moisture. A semi-Diesel motor pumping water from a well at the rate of 300 gallons per minute supplies all the water needed to quench the thirst of the 18 acres of water-hungry celery. The entire truck farm is equipped with an overhead sprinkling system that makes watering the crop merely a job of starting the motor and turning a few valves.

Even though the waters of the Susquehanna are so near at hand, Haug is careful to use well water for irrigating his crop. "It's as good as anyone would want to drink. We wouldn't think of using anything else," he claimed emphatically.

Paper cuffs are used for bleaching the crop. Depending on the weather, these are placed around the plants 2 or 3 weeks before the time of harvest. That gives the plants a chance to take on the desirable color that pleases customers.

The remaining 7 acres of the Haug truck farm are planted to any other crops that can be grown in central Pennsylvania. These include spinach, carrots, cabbage, peas, beans, and many others, but all receive the careful attention with which the celery crop is handled.

In general, it might be said that Haug's secret of success is the maintenance of extremely high soil fertility and the strict attention to the most minute details from the time the seed is obtained until the marketable products are in the hands of the customers.

Shares Well Scoured

(*From page* 5)

crankcase, but the very fact that you've refilled it means you ought to go somewhere else. Another hang-out gone!

One used to find solace at times gabbing with the country lawyer, especially before the fall term began and some juicy anecdotes were ripe. But just try to fool away precious moments with a brace of these trained seals in separate glass cages, guarded in the front office by a little snip with an "Information" sign on her desk. No, these young squirts can't equal the old squire, and one more bet is lost.

OR search in vain with me for the weazened but wise old cobbler, that builder of brogans who told many tales while tapping, and who usually had room for a couple of cronies amid the leather and findings of his cluttered nook. Instead, today we have a row of whirring machines and a labor union boss standing guard.

So we turn back with the would-be retirer to seek what we want out in the ozone, and bless me, if we don't find it! There's more leisure and laziness open to the agricultural world than there used to be. Power machinery has come to lighten the long day's toil and bring surcease to stiff backs. Unless you have a big herd to feed or a milk route to handle, the morning hours are not so ungodly early either. One can now do a task in a jiffy that would have taken a night's rest out of a chap in thinking about it when we were young.

THEN besides, the AAA has come along and squashed a lot of endless ambitions to plow up more of the township than one has title to. There's more rested land and more go-down crops and more grass silage, so that weather vagary doesn't run a man ragged so often as of yore. The mailman totes the daily grist right handy to the front porch and the sitting room, and the magazines, newspapers, and radio "broadblasters" make one live the life of Riley. Roads are pretty good all season and there are so many visitors that one begins to call some of them interlopers, especially the farm paper editors. It's got so bad, indeed, that many of my country kinsmen have invested in trailers and spend the winters in Florida, which is the only retiring they stand for now.

Of course there are some codgers who think land values are too durn high to retire anyhow, accepting a doubtful mortgage and leaving the place to fall behind under some youngster's direction. Indeed we realize that the financial side of the picture has checked many older farmers from tossing aside responsibility, with interest to meet and production costs advancing.

As we travel about the countryside we often notice somebody building an extra dwelling, set a bit apart from the old homestead and smaller. These modern shaped houses and their interiors look different from the old upright and wing or square or rectangular houses we knew so well. As a rule this, too, is a sign of permanent partnership, expressing the intention of the father and son to settle down and live forever near the furrows.

But as a matter of reality these days, the *retiring* is not half so dubious and puzzling as the *acquiring*. By this I mean that it is the oncoming generation, despite their advantages in scientific training (and partly because of those higher standards), who find it hard to begin well where Dad left off.

THEIR big problem is to arrange affairs so that financial expansion and upkeep don't outrun the ability of the soil or the size of the farm. That problem is doubly acute in cases where Dad has passed away and left a will which divides the proceeds of the farm among three or four children. The one who sticks to the loam has to hustle to defray the normal expenses, and in addition has the burden of sharing with the others, some of whom are away earning good money in non-farm pursuits. It sort of seems to many of us that it isn't fair for the home lad to be obliged to raise and butcher a calf to feed the prodigals, using an extreme illustration.

So it happens that with this prospect so common there are more "surveys" going on up my way over unsettled and uncertain farm youth crying for deliverance than there are inquiries into the why and wherefore of non-retirement. We look to the soils and the harvests to come rather than the garnered goods of the past. Thus far we just have the survey data tabulated neatly for circulars and talkfests, but we have no decisive program ready to answer it.

MEANWHILE, we are pretty sure as things look now that even in this treasured and sacred zone of family-sized farms we are about to revalue and reconsider the meaning of that hackneyed term. Just as sure as spring is with us, we are going to get larger family-sized farms, not because the birth rate will jump after the war, but because the ability of one or two men to handle a given land area has multiplied many fold. What that means, if power and science and organization keep on making farmers more efficient, is beyond my feeble pen to answer. For the consuming two-thirds it may spell cheaper food, and that is well, provided all the burden of making it cheap doesn't fall on the farmer. In that circumstance, he will want to retire a heap sooner than he does now, and the Lord help the one who takes hold of the plow when he quits!

Temporarily things point to a change in this situation under the stress of compulsory military service, of course. We witness hosts of farm boys turning aside from the spring seeding to the training camps, leaving behind them the elder veterans who must forswear any idea of resting and plunge into the fields for double duty. Hired hands at best are hard to get, so 1941 will not be a popular year for vacations or retirement among the senior planters.

Yet ever since the steel moldboard came into play, the presence of grit in the soil has kept it brightly scoured with constant use. Nothing else in agriculture looks worse than a spotty, rusty plowshare laid aside for the junk heap or the museum.

Action, renewed hopes, and some reward for its owner, betokens the share well scoured. That's my April wish for agriculture and its devoted friends. So not a word more of retirement!

Two English washwomen were discussing the German bombings of the War. One said, "Any night now we may be blown into maternity!" "Yes," said the other, "and with these blackouts we will never know who did it!"

Well—?

"Jack, are you sure it is I you are in love with and not my clothes?"

"Test me, darling!"

Customer: "Remember that cheese you sold me yesterday?"

Grocer: "Yes, madam."

Customer: "Did you say it was imported or deported from Switzerland?"

The other night, it seems, a California constable was getting ready for bed when he thought he heard a noise in the chicken house. He had disrobed clear down to his long underwear, but didn't want to take time to put his clothes on again, so he just slipped on his shoes, grabbed his trusty shotgun and the flashlight, and went out to investigate.

Reaching the hen house he threw open the door and sorta squatted down, pointing the gun and flashlight toward the roosts and peering into the void . . . . Well, you know the seat construction of long drawers. . . . About that time his old collie dog came to see what was going on, touched the rear of the chicken-raising constable with his cold nose, and he unintentionally killed 14 of his best pullets.

A negro woman was standing on the street watching a circus parade. One of the pickaninnies looked up and said: "Mammy, your mouf's open." To which she replied: "Yas, I knows it. I lef' it open myself."

I shot an arrow into the air,
It fell to earth I know not where;
I lost ten of the damned things that way.

Hitler was interviewing his troops and stopped to talk to one private.

"How are things with you?" he asked.

"Oh, I can't complain, sir," answered the soldier.

"I'll say you can't," agreed the Fuehrer.

Been Out Before

He: "I'll be tickled if we find a filling station soon, the gas is running low."

She: "And I suppose I'll be tickled if we don't!"

Breathes there a man with soul so dead, who never hath turned his head and said, "Hmmm, not bad!"

"If you wish to be happy for an hour, get drunk. If you wish to be happy for three days, get married. If you wish to be happy for eight days, kill your pig and eat it. But if you wish to be happy forever, become a gardener."—Chinese Proverb.

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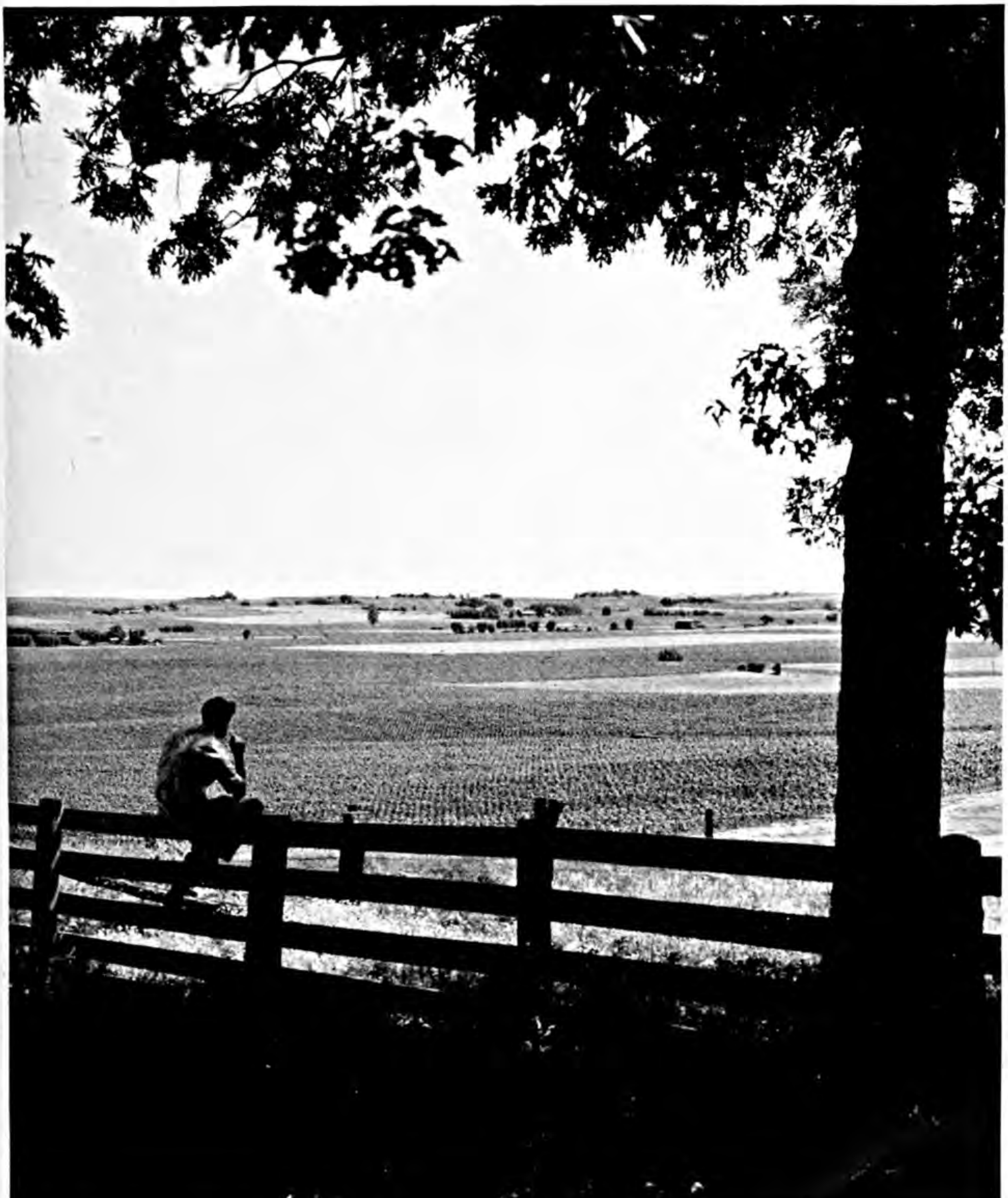

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

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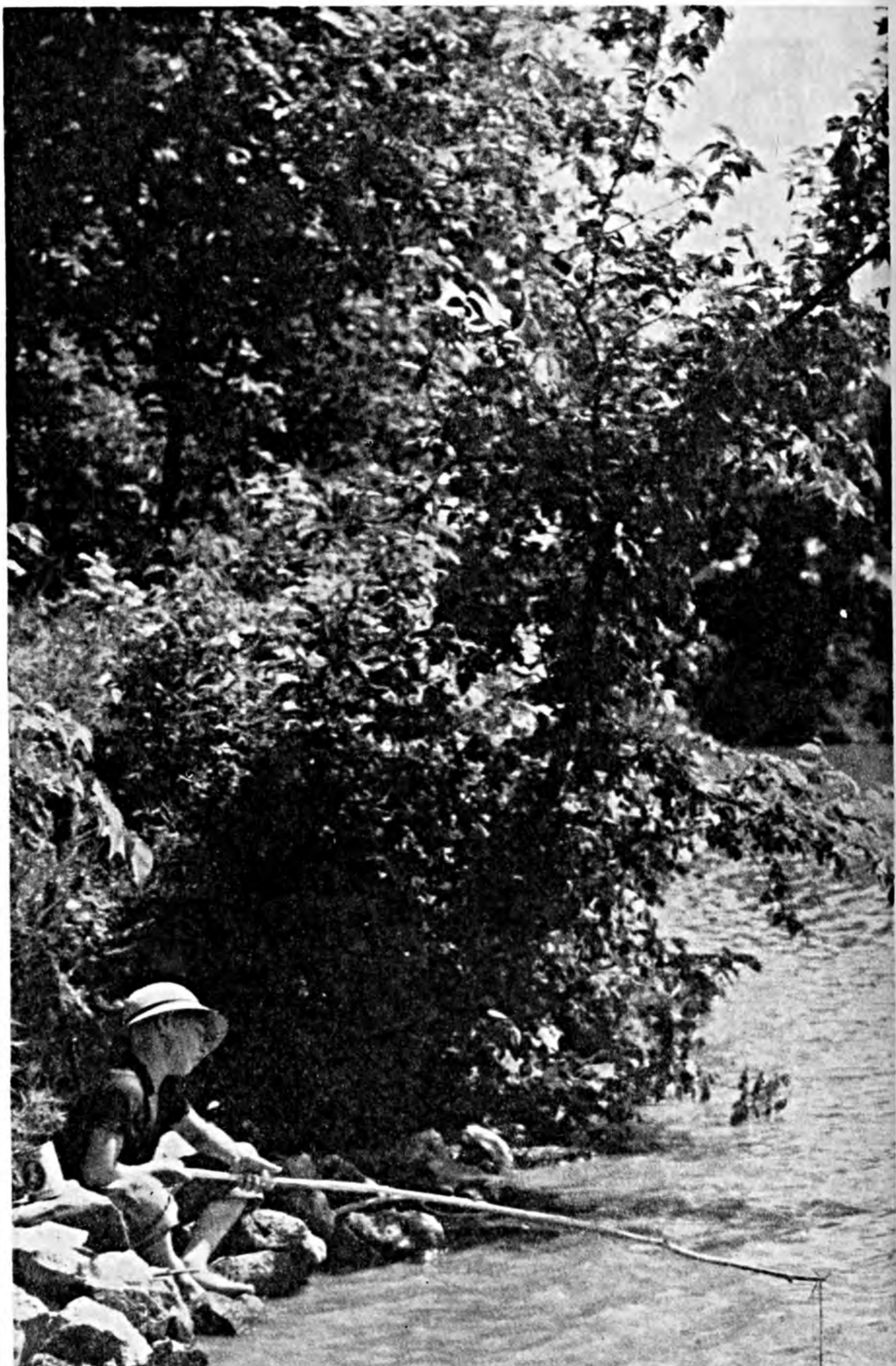

THE DEVELOPMENT OF PATIENCE

Better Crops with Plant Food

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May finds many preparing for—

The Loud Bassoon

Jeff McDermid

I GO to the marriage altar for the second time directly!!? However, I am only playing a backfield position this trip. Be it known (by all these presents) that in spite of my Scotch traits I am *giving away* something *precious*—our eldest daughter! No doubt I shall "beat my breast" as anxiously as the wedding guest of the Ancient Mariner, whose alarm was caused (as I once said in the fifth grade) at hearing the "loud baboon." But since acquiring better working knowledge of musical instruments I should probably adopt a modern version of the classic rhyme: "The roadhouse guest he mixed with zest to the tune of the saxophone."

Yet it is my turn finally to be the host at a wedding feast, with my chief duties consisting of keeping track of the mail-order silverware and preserving my own and the bank balance simultaneously. With little chance for anything stronger than orangeade on tap at the nuptial table, I shall maintain the former with greater ease than the latter.

So I have patiently set down the auspicious date on my somewhat corny calendar, jumbled up betimes quite amazingly with dairy picnics, poultry demonstrations, and fertilizer field days. Our usual clutter of mail matter is now augmented with bids from dress shops, photo studios, and floral decorators—which flatters considerably one whose daily grist comes from grass seed firms, horse doctors, and silo salesmen. Having this red letter day well in hand and no excuse possible, I shall be obliged to disappoint sundry county agents and corn huskers while I put on the kid gloves and listen for the Lohengrin. But I am quite sure they will permit me this brief relaxation in society and save some of the hard cider and doughnuts for my next trip to the hinterlands.

MY JOB of waiting in suspense and financial trepidation for the blessed hour is nothing to the brisk and ceaseless to-and-froings which Mother and the Gals unleash. They arise earlier than I do come morning, which breaks no record at that. They are flying all about the premises, sampling cloth and poking patterns, fingering engraved stationery, matching ribbons, frisking through the Lady's Book for new ideas, making lists of probable guests and prospective presents, and talking to cooks and caterers about cake and condiments. I feel utterly useless, almost "relegated," if you know what I mean (like something fit for the attic), and can only seek a simpleton's solace in writing about it to you. You have borne so many of my tribulations and cheered me in so many of my triumphs that I find myself once more in another "inflicting" mood.

But then I remember the comforting words of an old mountain pal of mine who told me in tearful confidence that any kind of a nuptial botheration ceremony is far better than a "shotgun" wedding. Just like an economic war is nicer than a shooting one!

When I think of myself leading a blushing bride to the preacher I recall the first bride I ever fell in love with, when I was a kid of six years old. Mother got a bid to sit in one of the pews and add her tears to the general pool. I was not really invited but I sneaked in just the same, out of curiosity to see how old Cal Peters got away with the bridal march. Cal was a local stock buyer more inclined toward overalls and a bullwhip than broadcloth and bouquets. My chief wonder always was how he could happen to be the sire of such a siren.

Well, anyway Cal took it all in his usual stride, shackling along like a bogtrotter, with the Vision gliding beside him. The groom was "a personable young man of much promise," according to the Clarion. He taught commercial college in our town, and the bride was one of his graduates better suited to dictate than to take dictation. She looked heavenly to me then, and with the exception of the lady whom I escorted away from the altar some time ago, no other bride has hit me quite so hard on the left-hand side of my vest.

NOW here I am, somewhat like old Cal after all, a votary of bucolic gods, unused to the social amenities of nuptial parades, and destined to lead my daughter up the selfsame rosy path. I think the last time I took her up to a minister she was going there to receive my name and not some other guy's. I never realized how short the road can be between a christening and a wedding, until I peered into the mirror and verified the mileage on my facial map. And perhaps it won't be so many years before I quit being a grump to become a gramp!

In this age of elopements and out-of-town engagements, we can feel comfortably old-fashioned because our daughter is marrying a man who grew up in our neighborhood. Mother fed him cookies in our kitchen and so we know all about his culinary tastes, and nobody can bring us scandal stories at the eleventh hour to throw a spectre into the feast. We know he is no angel and so we feel he is well fitted to marry our daughter, who never inherited any harps and wings from my side of the house.

Some folks may think it romantic to join hands with a strange family, but I prefer to hitch up with a tribe who has camped in our neck of the woods, and this makes it easier for me to talk back to the in-laws and vice versa.

We have always made room for the youngsters to have their frolics and parties, and despite the handy motor car our juveniles have been led to feel they were welcome to do their courting and cavorting amid familiar scenes. It was like that back when we were young. Courtships were sort of fore-ordained affairs, connived and encouraged on the sly by clumsy friends and doting parents. Under such circumstances elopements would not only have

been wholly unnecessary but confoundedly ungrateful to the local parson, who sadly needed the extra five bucks in wedding fees.

I recall that it was during one of my few trips to Gotham that I resolved to hang the welcome sign on our front stoop for decent and law-abiding young gents who came with flowers and candy. On a ride atop a windy bus through lower Manhattan I sat beside a couple who made frank and foolish love, like we were wont to do with the gaslights turned out and the old folks snoring. Looking around me I beheld this spectacle repeated at every turn. It seemed to be the public custom in New York to emote openly, just like discussing the AAA is with us in the corn belt.

There's a reason. Parlors are getting scarcer and flats are getting tighter so that sentimental youth is driven to prehistoric methods in its search for mates. Perhaps our courtrooms are overcrowded because our courting rooms are not so plentiful at home as of yore. A chap should get acquainted with a girl he intends to marry in the vicinity of the kitchen and dining room, even if he has to blab a few hours with the old gentleman before he tires him out and drives him bedward. It gives both prospectives the proper perspective. You can look at the family album if you dare, and see some of the baby pictures if she'll let you.

It's better to grow into a family by degrees and get to know the foibles of the parents by frequent observation. Similarly, if I am going to give my blessing to the happy pair, framed in antique finish and ready to hang up in their parlor, I desire to place my bets on a safe horse. I say "horse" because anybody who isn't ready to wear a halter and swing true on the evener is not the kind of individual to make a matrimonial team successful.

Speaking of my "blessing," however, they haven't asked me for it yet. I have it all dusted off and varnished in hopes that they may find it useful. To date all either of them has said was that they intend to get married; so I'm beginning to wonder if blessings are out of date.

FOR nearly a year I have been expecting the young man to call me aside and stammer out his earnest wish to make our family happy. That's the way I have heard it was done, and most of the Dickens and Bronte novels I was raised on were incomplete without a scene between the suitor and the sire. He has somewhat disappointed me in this regard, as the first and only notice I got of the deal was when Mother asked me if I noticed our girl was wearing a new ring. This disturbed me and ruined my speech which I had carefully prepared to deliver in solemnity to the swain when he bearded me in my den. I don't suppose there will be the slightest opportunity for me to make that speech during the ceremony, but I will consult the parson and see how he thinks it would take

(*Continued on page* 47)

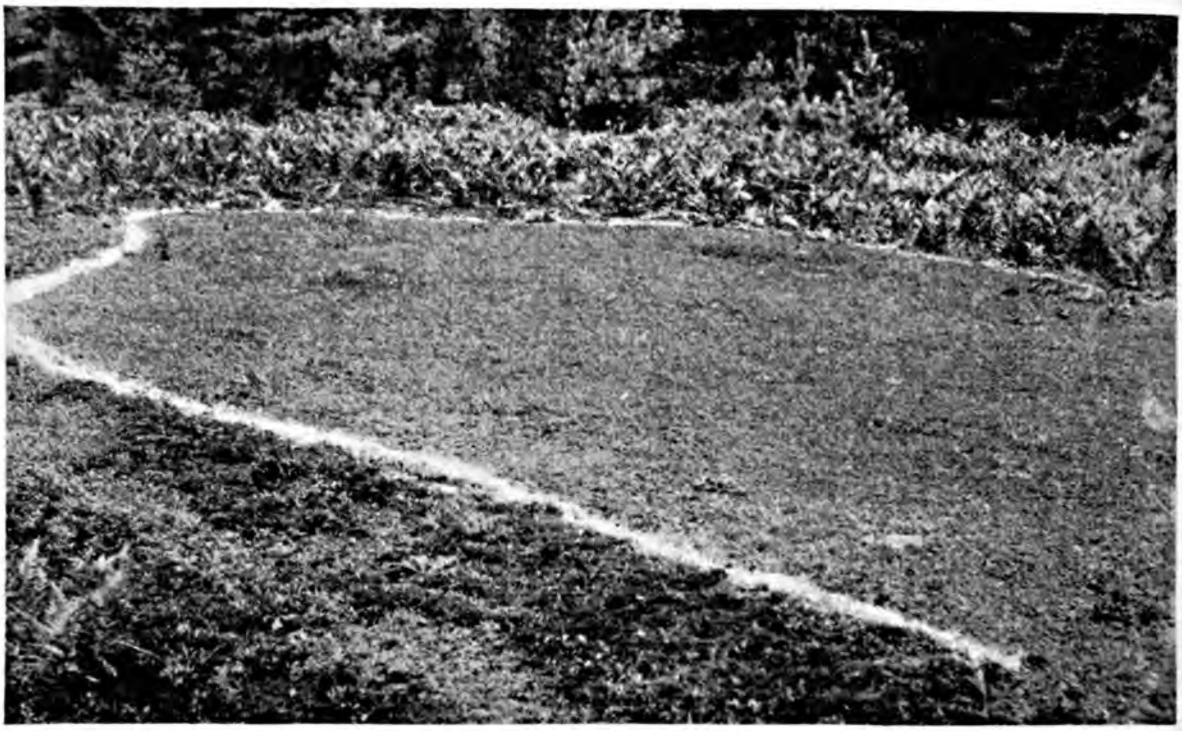

Fig. 1. Vegetative changes on upland pasture from an application of wood ashes produced by a maple syrup evaporator. Within the area marked by lime, the herbage consists of a solid mass of volunteer white clover in contrast with the periphery of moss, ferns, and weeds. Farmers use chemical fertilizers on their pastures in hope of obtaining such desirable changes in vegetation.

Synthetic Wood Ashes Require Boron

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

Vermont Agricultural Experiment Station, Burlington, Vermont

FARMERS in New England, especially in Vermont, boast of their pastures, hay fields, and gardens fertilized with wood ashes. They hoard all that their stoves, furnaces, and maple syrup evaporators produce; sometimes haul them many miles; brave the dirty task of cleaning hot factory chimneys; or pay a considerable price to get them, because they have found them valuable as a fertilizer. Moreover, they are well aware that the ashes must be kept under cover away from rain so that their soluble plant food may not be lost by leaching. A liberal application, one or two tons per acre, often changes a pasture from a mass of brown moss, ferns, and weeds into a carpet of volunteer white clover (Fig. 1). Such changes of vegetation are often phenomenal and often make one think that the ashes directly killed the moss, ferns, and weeds; but it is more likely that desirable plants crowd out the weeds as soon as soil conditions become favorable. While corn, grasses, and other plants are stimulated by wood ashes, alfalfa and clovers in general give the greatest response.

The Romans long ago used wood ashes for fertilizer although they probably were not the first to use them.

Campfire residues must always have left a record behind them in the increased growth of surrounding vegetation, which at one time was erroneously attributed to the burning of the soil. De Saussure proved that ashes from the burned plants were responsible for this increased growth and that the minerals in the plants were obtained from the soil. Liebig, a German chemist, after observing the growth of clover, held that ashes contained all of the elements needed by plants; but Lawes and Gilbert showed that nitrogen was also essential.

In the days of early American agriculture the burning of timber, brush, and stumps previous to plowing provided a generous supply of ashes containing much needed mineral fertilizer. However, when the plant food had been carried away in crops or in drainage water, some soils became non-productive and were then abandoned. In New England a generation or two ago, ashes were so highly esteemed that considerable quantities were imported from Canada when native supplies failed. When German potash salt deposits were developed and potash was sold at relatively low prices, it replaced ashes as a source for this plant food.

Wood ashes contain considerable plant food, especially potash. In fact, the word "potash" is derived from the term "pot ashes" which were obtained by leaching wood ashes with water and evaporating the soluble portion to dryness. Unleached hardwood ashes contain from 2.5 to 12% potash (K_2O) averaging about 6%, from 1.5 to 2% phosphoric acid (P_2O_5), and from 50 to 75% carbonates of lime and magnesia, as well as several minor elements necessary for adequate plant growth. Their soil acidity corrective value approximates 70 to 100% that of limestone. Thus an average ton of unleached hardwood ashes is considered approximately equivalent to 150 pounds of 20% superphosphate, 240 pounds of 50% muriate of potash, and 1,500 pounds of ground limestone. Softwood ashes contain much less plant food, leached ashes still less (under 2% potash), and coal ashes practically none.

Fig. 2. A thrifty stand of alfalfa remained after two years from an application of two tons of wood ashes (right), while a complete alfalfa failure resulted from an equivalent amount of hydrated lime (left). Both plots also received 10 tons of manure and 400 pounds of an 0-20-20 fertilizer per acre.

It is said that Canadian wood ashes carry a lower potash content than formerly, perhaps due to depletion of minerals in forest soils. In spite of the other fertilizing constituents in wood ashes, they are usually bought and sold on their potash content.

Field Trial Conducted

A number of years ago a field trial was conducted on the Windsor Lime Demonstration Farm at Weathersfield, Vermont (Connecticut River terrace). While its object was to determine the kind and amount of lime that could be most successfully used, the data are of interest now because wood ashes were used at two rates. The field was carefully prepared and well fertilized with 10 tons of manure and 400 pounds of 0-20-20 fertilizer. After the lime or wood ashes were applied, they were well harrowed into the soil. In spite of reasonably good care, a poor stand of alfalfa was secured except on the wood-ash plots. The second year an additional 200 pounds of 0-20-20 fertilizer were applied and the field reseeded. No yield data were obtained that year, but the results the following two years are shown in Table 1.

the few remaining plants showed nutritional disorders, the nature of which was not then recognized. Very similar results were obtained on a Sheldon soil at Colchester, Vermont, from a like experiment conducted at the same time. Here, however, the alfalfa died completely after the second year on all but the wood-ash plots (Fig. 2). No better results were obtained where limestone was used in place of hydrated lime, indicating that the form of lime was not an important factor. In spite of the fact that the fields appeared to be in a reasonably high state of fertility, it was thought possible that the amount and form of potash in wood ashes were the cause of their superiority.

Since potash is considered to be the most important constituent of wood ashes and since this potash is in the form of silicate and carbonate rather than chloride or sulfate, it was thought that the type of potash might be a factor in its availability and assimilation by the plant. Different forms of potash (chloride, carbonate, and silicate) were substituted in tank experiments for the potash contained in wood ashes. An amount of lime and superphosphate equal to that in the ashes was used with

TABLE 1—EFFECT OF WOOD ASHES VS. LIME ON YIELD AND LONGEVITY OF ALFALFA

Treatment	Hay yields per acre on Merrimac s. loam		Alfalfa present 3rd yr.
	2nd yr.	3rd yr.	
	lb.	lb.	%
Wood ashes—1 ton	6,900	4,176	95
Hydrated lime—1 ton	4,666	2,559	65
Wood ashes—4 tons	9,980	4,158	96
Hydrated lime—4 tons	4,990	3,345	25

These results show that wood ashes were very much superior to hydrated lime for the production and longevity of alfalfa, at both the 1- and 4-ton rates. On the wood-ash plots, alfalfa remained for many more years in a good vigorous condition; but without ashes, most of it disappeared after the third year and

the individual potash salts. The average yields of alfalfa for two years are shown in Table 2.

Wood ashes again proved superior to a chemical equivalent of potash, lime, and superphosphate. Since the different forms of potash did not account for this superiority, it seemed evident that there was some other contributing factor such as beneficial minor elements. Potassium silicate seemed to be better than the other potash forms, probably because it contains more boron which has been found characteristic of calcium and some other silicates.

TABLE 2—EFFECT OF DIFFERENT FORMS OF POTASH SALTS VS. WOOD ASHES ON GROWTH OF ALFALFA ON MERRIMAC SANDY LOAM

Treatment	Average yield per tank
	gm.
Untreated Check	53
Potassium chloride - lime - phosphate (eq. to 2 tons of ashes)	127
Potassium carbonate-lime-phosphate (eq. to 2 tons of ashes)	143
Potassium silicate - lime - phosphate (eq. to 2 tons of ashes)	163
Wood ashes—2 tons	177
Potassium chloride - lime - phosphate (eq. to 4 tons of ashes)	276
Wood ashes—4 tons	425

Within recent years the symptoms of boron deficiency on alfalfa have been recognized and found in marked degree on heavily limed soils. These were especially noticeable in 1940 on the second crop. Because wood ashes overcame these deficiency symptoms, it was assumed that they contained appreciable amounts of boron. This has since been verified by an analysis of 14 samples of wood ashes sent in by county agents. The amount of boron (as borax) per ton of wood ashes, according to the Berger-Truog colorimetric method, is presented in Table 3.

These results show that Vermont hardwood ashes contain a surprisingly high equivalent of borax—averaging about 20 pounds per ton. The figures may perhaps be a little high because of extra dryness of samples (they had been stored in the laboratory for some time), yet the results give a good idea of the amount of boron in wood ashes.

The superiority of wood ashes over equivalent amounts of lime, superphosphate, and potash is held to be due in

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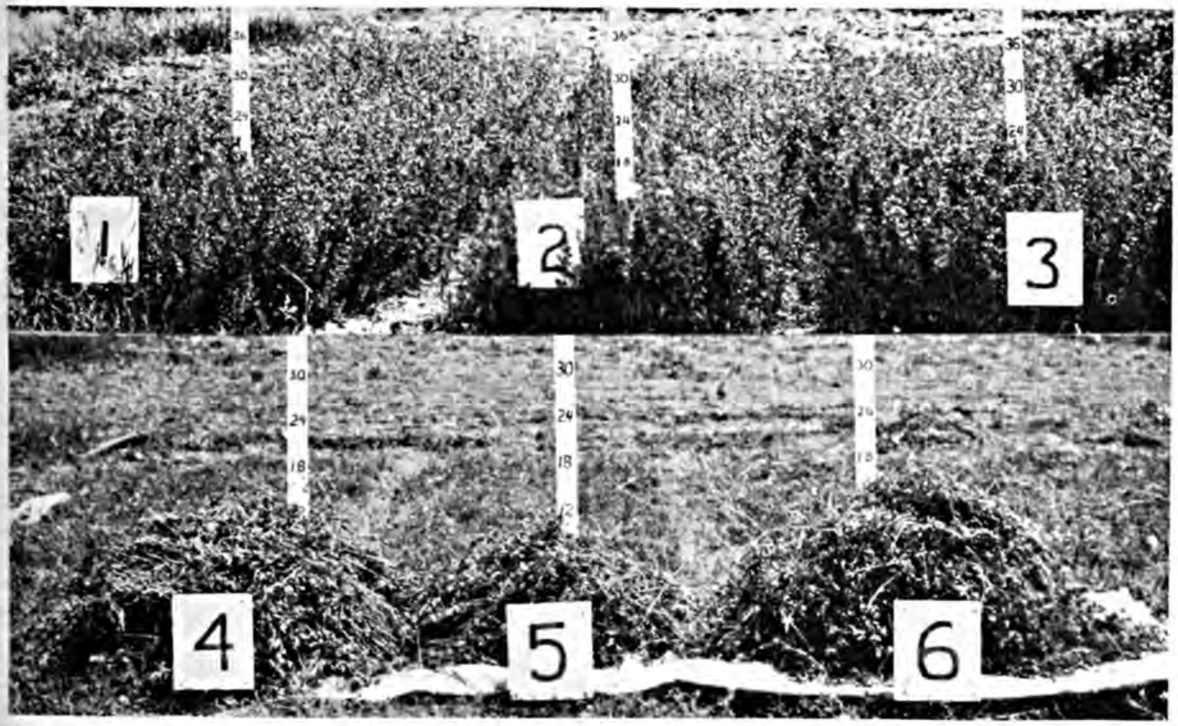

Fig. 3. Alfalfa near Burlington, Vermont, before cutting (1, 2, 3) and the same plots after cutting (4, 5, 6). Fertilizer treatments left to right were hardwood ashes (1 ton); lime, phosphate, and potash equal to the ashes; the latter plus borax. The sparse alfalfa in the middle plot (without borax) produced yellow and bronze terminal shoots in the dry part of the summer. Left for seed in 1940, it failed to set, whereas the other two plots seeded profusely. Much Vermont alfalfa similarly shows signs of needing boron in addition to the ordinary fertilizers.

Florida's Everglades Can Grow Good Cane

By F. D. Stevens

Everglades Experiment Station, Belle Glade, Florida

AGRICULTURALLY, the great tract known as the Everglades of Florida is an exceptionally new country of some 2,500,000 acres of sawgrass peat resting on a solid but semi-porous limerock sheet varying from 6 to 8 feet below in the northern section and outcropping in the southern section along the Tamiami Trail. Underground water, cutting its way through this limerock, accounts for a soil condition bordering on slight acidity to even a neutral reaction.

A neutral to slightly acid peat is, so far as is known, formed in but few other areas in the world. In Finland for instance, where there are vast acreages of agricultural peat soils that are acid, the acidity must be corrected to render them productive. Of these peat soils of Finland, the following is interesting. "If peat is saturated with calcium and potassium ions, the potassium ions reduce the acidity more than the calcium ions. The absorbed potassium ions are attached more firmly than the calcium ions, and their influence must, therefore, be more tenacious than that of the calcium ions. Thus it would be advantageous to add large amounts of potash with lime to correct acidity" (1).

On a basis of wet peat, weight of 1,200,000 pounds per acre 6 inches, analyses at this station show a total of 6 tons of calcium. Six tons of calcium per acre six inches definitely marks this peat as needing no corrective measures to "sweeten" the soil for sugarcane production. The expense of such measures, necessary on acid peats to bring them into economic production, is unnecessary here on our Everglades sawgrass peat. This is shown in experiments in which lime at the rate of 1,000 pounds per acre has been used with 300 pounds of sulfate of potash through several crop seasons on such sawgrass peat with no appreciable increase in tonnage or sugar yield over that obtained by the use of potash alone. This could not be assigned to variations due to several sources of experimental error.

Unusual Conditions

The above is but one illustration of the "topsy-turvey" conditions encountered in this vast and largely underdeveloped region, a region which if reclaimed and planted to cane would go a long way toward producing the needed yearly sugar supply of the entire Republic. Present indications point to the fact that even by paying to field workers our American living wage of \$2 to \$3 per day in harvest, cane can be grown, harvested, milled, and processed with sugar in the bag at a cost on a level with or below that of many tropical cane countries, with their lower standard of living necessitated by low wage standards.

Another peculiar situation encountered in the Everglades is that of the phosphoric acid supply inherent in our sawgrass peat. This is calculated at a total of about 700 pounds, with a dilute acid-soluble supply of close to 75 pounds P_2O_5 per acre 6 inches (4). Removing 1.5 pounds P_2O_5 per ton of mill cane on a 40-ton per acre production, the total would be exhausted with the removal of 12 crops, and the dilute acid-soluble supply would be exhausted by the re-

Second stubble F 31-962, 12th successive crop; fertilizer 75 pounds copper sulfate; yield 13.3 tons per acre; 96 test sugar ton 183 pounds.

moval of one 50-ton crop. A picture of the twelfth successive crop of cane on sawgrass peat is shown in this article.

During this 12-year run, cane has been used successively by plowing out stubble of older, lower-yielding kinds and planting immediately to higher-yielding kinds bred and selected at this station. Land producing this cane has never had phosphoric acid in any form, the crop being made with a yearly application of 300 pounds sulfate of potash, with now and then copper sulfate at 75 pounds per acre. During this 12-year cropping, at least 720 pounds P_2O_5 have been removed in the mill cane, 20 pounds more than analyses show present in new sawgrass peat.

The question arises, are we working the same 6 inches that were put into cultivation 12 years back? Probably not, as many lines run indicate a subsidence of close to one inch per year. Losing one inch of worn-out soil at the top and taking in one inch new soil

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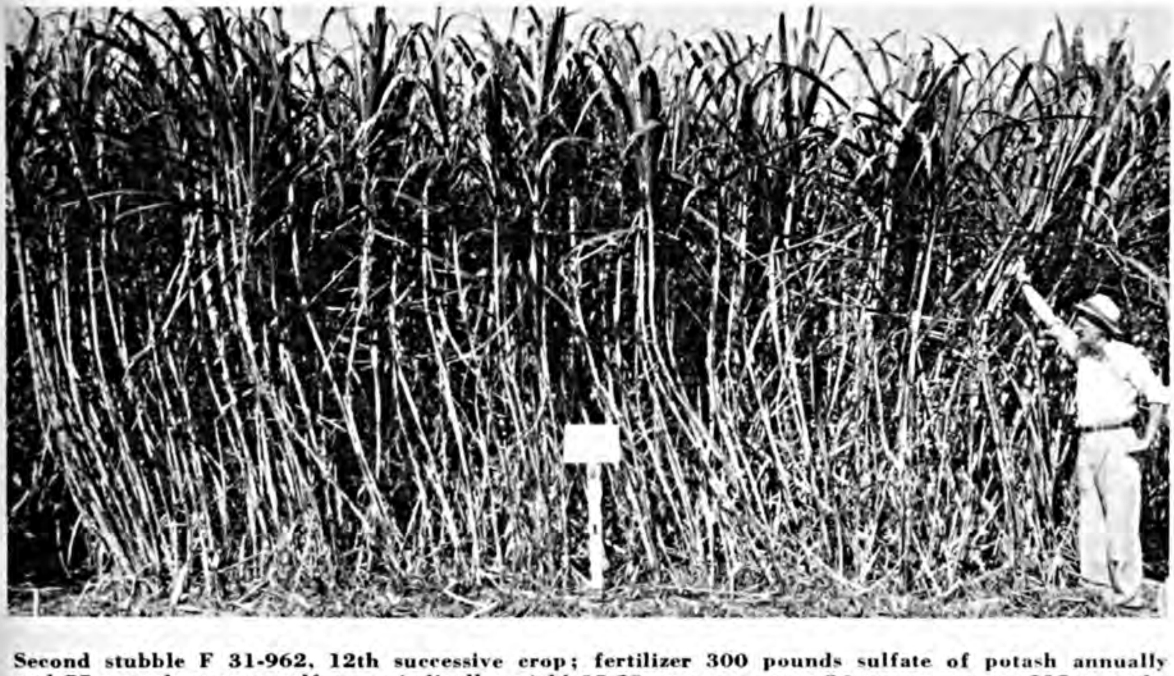

Second stubble F 31-962, 12th successive crop; fertilizer 300 pounds sulfate of potash annually and 75 pounds copper sulfate periodically; yield 39.28 tons per acre; 96 test sugar ton 215 pounds.

Cut-over pine lands in the Pacific Northwest.

Some Early Experiences With Fertilizer on the Pacific Coast

By B. E. Maynard

San Jose, California

¶ *Third of a series of articles recounting personal experiences with the use of fertilizer on the Pacific Coast during the past fifty years.*

UPON accepting a position in 1901 with Victoria Chemical Company in British Columbia, my activities were transferred to an environment in many respects quite different from California. On going out among the farmers, however, I soon found there was much the same prejudice and misunderstanding regarding fertilizers.

From the beginning I had the good fortune to gain the confidence and friendship of farmers in all lines of agriculture, and when calling on them again would be received more as a friend and consultant who had their interests at heart than a salesman whose chief endeavor was to get their names down on the dotted line. Some were of the opinion that all fertilizers were simply stimulants which were only temporary in their effect, and if their use continued for any length of time, soils would become completely impoverished. Other arguments against the use of fertilizers that frequently came up were, "If we start using them, won't we have to keep it up?" and, "Our soils are already so impoverished that there is nothing left in them for fertilizers to act upon."

These were but a few of the problems which had to be explained in a way that would be clearly understood by the farmer and would not leave him with the impression that there was any attempt to impose upon or mislead him. Many farmers, however, wanted all the information they could get about commercial fertilizers and how to use them to the best advantage. The confidence thus gained resulted in my being called upon to address a number of farmers' meetings on the subject of fertilizers. These meetings were always characterized by many questions from farmers wanting more specific information on some points of interest. On one occasion, being called upon to address a farmers' meeting in the town of Nelson, I had talked but a few minutes when interrupted by a question from someone in the audience. As soon as this was answered, questions began coming in from all sides and I was kept on the platform until nearly midnight.

At times considerable opposition from certain authorities had to be met, since fertilizer usage was a new thing. Officials of the British Columbia Department of Agriculture, however, were always ready with their kindly cooperation and friendly good will. In fact, the Deputy Minister of Agriculture considered the question of fertilizers of sufficient importance to arrange a tour for me through some of the leading agricultural sections of the Province, during which I gave a series of talks on fertilizers and their place in agriculture.

One of the first questions that came up with the Victoria Chemical Company was that of the most suitable formulas to offer in mixed fertilizers. A formula they already had been selling was a 1½-5-3½. On asking why they offered a mixture so low in plant food, I was told that agricultural authorities consulted were of the opinion that it would be impossible to make sales unless they had a fertilizer that could be sold at a low price per ton. The company was in favor of putting out concentrated goods provided the idea could be put over with the farmer.

We then went into the matter of formulas. For the time being I suggested that the 1½-5-3½ be retained, but to let me have the same formula with the filler cut out. As the filler, screened sand, comprised one-half the bulk, this gave a 3-10-7, just double the former strength. We worked out two other formulas omitting all fillers, which as I remember them were a 3-8-12 and an 0-11-12. On getting these, I started out on my first trip which took me through some of the best farming sections of the Province.

More for Their Money

In considering as a filler the use of sand, which had to be screened and dried at considerable expense, and the cost of mixing and extra sacks needed to hold the increased bulk, the manufacturer also was glad to get away from its use. As one farmer put it, "We have lots of sand here without having to pay freight on more, therefore, why include it in our fertilizers?" It is needless to say that the demand for mixtures of low concentration ended with this trip and received no further consideration. Six weeks later, on getting back to Victoria, I did not have a single order for the 1½-5-3½, although a goodly number for the others had been booked. Among these the 3-8-12 predominated, despite the fact that it was the highest in price per ton.

Farmers called upon were advised that they would have to purchase two tons of the 1½-5-3½ in order to get as much plant food as contained in one ton of the 3-10-7, also that one ton of the latter would cost $2 less than two tons of the other. In addition, they would have to pay double freight and other handling charges. Invariably this reasoning led to an order for the 3-10-7. Basing judgment along the same lines, the 3-8-12 met with favor wherever there was an apparent need for potash.

It soon became evident that potash was much needed as a fertilizer in many sections of the Province, particularly in the western sections where the rainfall was heavy. Newly cleared pine lands showed the need for fertilizers from the beginning. At first some thought the unproductiveness of these soils was due to accumulations of turpentine from the pine forests that formerly grew thereon. However, it was soon proved that these supposedly barren lands would respond remarkably to applications of fertilizers. Convincing evidence of the need for potash in the pine lands was found in the wonderful growth wild dewberries would make following the burning over of a slash from which none of the felled timber had been removed. These berries not only grew vigorously, but produced heavy crops unexcelled in quality. The effect, however, was not lasting, as the trees when burned produced a very small amount of ash, which in turn was exceedingly low in potash. Therefore, within a short period of time potash had to be added to the soil.

Before fertilization, grain planted on these soils would often simply sprout then die without making further growth. This action was similar to that of grain sown on peat soils where potash was greatly deficient. The 3-10-7 soon became popular for the growing of hay and grain on these soils, but where additional nitrogen was needed it was supplemented by applications of nitrate of soda. The 4-8-12 met with demand for the growing of potatoes and root crops. Some of these soils were deficient in lime, and liming was necessary for the production of beets. Potatoes, carrots, and strawberries would thrive without it. Although these lands were unproductive at first, they were very responsive to the use of fertilizers alone, and some crops later produced here were equal to the best grown on the rich soils of the Fraser River Delta.

Where the farmer on these newly cleared pine lands depended largely upon dairying for a living, the increased production of hay, pasturage, and other crops due to the use of fertilizers would enable him to add very materially to his herd of dairy cows and to the maintenance of other livestock on his place. This increase in livestock would result in a corresponding increase in the manure produced, which on going back to the land actually meant that a very considerable portion of the fertilizers applied was being used over again. This meant an increase in humus, in which these soils were very deficient. Thus with the addition of moderate applications of fertilizer to replace that contained in the produce sold or otherwise lost off the place, the soils would soon be brought up to and maintained in a high state of fertility.

A Nutritional Disease

During my three years' work in British Columbia, through contacts with apple growers, I was able to make many observations in their orchards. A serious trouble noted in apple trees was a disease known as northwestern apple tree anthracnose or bark canker, which seemed to be confined chiefly to the wetter sections of the West Coast. It soon became evident that liberal applications of organic nitrogen, applied in the form of manures or fish, greatly aggravated this trouble. Apparently these slow acting forms of nitrogen would attain their highest availability in the late summer and early fall months. Instead of the trees hardening up as they should for the winter, growth would be prolonged and the trees would enter the late fall and early winter months in a tender, sappy condition, most susceptible to the attacks of this disease. During this period the greatest number and most destructive cankers appear. Young apple orchards, apparently free from this trouble, if heavily manured with fish or barnyard manure, would grow vigorously during the following summer, but in the fall and early winter would be attacked by this disease in a most virulent manner. On the smaller branches the cankers might become confluent, girdling and causing the death of the branch. From these findings it seemed apparent that the use of

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Demonstration Garden of the College of Agriculture. This garden contained one-half acre and supplied enough vegetables for a family of five.

Garden Most Valuable Acre on the Farm

By A. J. Sims

Agricultural Extension Service, Knoxville, Tennessee

THE most profitable land on the average Tennessee farm, according to studies made by the College of Agriculture and Extension Service over a period of years, is that devoted to the farm garden. Each spring some 200,000 gardens are started on 75 to 80 per cent of the farms of the State. Many of these gardens are productive for only a few months; some provide fresh products for the family table the year round. The gross value of products produced in these gardens annually, excluding commercial vegetable production, amounts to 12 or 15 million dollars, or about 12 to 15 per cent of the gross income from all other crops grown in Tennessee.

Studies made by the College show that half or more of the farm family's food supply may come from the garden. Records kept by several thousand farmers in cooperation with the Extension Farm Management Department over a period of years show that the most successful farmers produce most of the food and feed needed to supply their families and livestock. The value of food produced for use at home, including vegetables, fruits, dairy products, poultry and eggs, meats, and cereal grains, frequently amounts to $400 or $500 annually on the average farm.

On farms where the production of these items for home use is overlooked, it is necessary, at present prices, for the farm to produce the equivalent of 6 or 7 additional bales of cotton, 3,500 to 4,000 pounds of tobacco, or 18 to 20

200-pound hogs to provide cash to purchase these needed items of food. Such evidence as this has convinced many Tennessee farmers of the value of a good garden in recent years.

Aside from the fact that few acres on the average farm will bring half as good return from a cash standpoint as a good garden, certainly none will bring as high returns in the health of the farm family. It is now well recognized that many physical and mental weaknesses are traceable to lack of the right kind of balanced diet regularly during the entire year. This reflects itself in many ways in the social, economic, and mental life of the farm family. Most farm families get enough food of a kind, but good living and proper health require more than that.

Nutrition experts tell us there must be a variety and proper amount of the right kinds of foods, including vegetables, fruits, poultry, eggs, milk, butter, and meats. These are required regularly throughout the year. "Nutritional diseases," says an eminent authority of the U. S. Public Health Service, "in all probability constitute our greatest medical problem, not from the point of view of deaths, but from the point of view of disability and economic loss." A recent Gallup poll revealed that 59 per cent of the people interviewed in the Southern States on the question of adequate diets reported that they did not have enough of the right kinds of foods to eat.

Protective Foods

Every food makes a contribution to the diet, but some make more than others. Some are called protective foods, such as milk, green leafy vegetables, and fruits. Recent dietary studies show that the Nation is short on these protective foods—leafy, green and yellow vegetables, 50 per cent; tomatoes and citrus fruit, 25 to 70 per cent; milk, 10 to 20 per cent; and butter, 10 to 25 per cent.

There are wide differences in protein content and in energy values of vegetables, but practically all are important sources of minerals and vitamins. Diets, to be fully adequate for growth and good health, must include liberal quantities of vegetables. In addition to contributing minerals and vitamins, they deserve a special place in the diet because of their laxative properties. They are valuable, also, in giving variety in color, flavor, and texture to the diet. Although fresh vegetables are more desirable, canned or dried vegetables can be used when the fresh supply is exhausted.

Food storage pantries like this are becoming more common in Tennessee farm homes as a result of the State Home Food Supply Program directed by the Agricultural Extension Service.

All gardens should include a liberal supply of Irish and sweet potatoes, a supply of either dried beans or peas, and an abundance of both tomatoes and cabbage. Irish potatoes, for example, are an important source of energy and iron, while sweet potatoes are very valuable for vitamin A. Dried peas and beans are good sources of protein and also yield considerable energy, iron, calcium, and vitamin B. Tomatoes and raw cabbage deserve special mention as sources of vitamin C. Green leafy vegetables are valuable for iron, vitamin A, and vitamin G. The yellow-colored ones are excellent sources of vitamin A.

In 1940 the crisis of southern "money crops"—cotton and tobacco—underproduction of many foods needed for proper nutrition, lack of full appreciation of the "cash-saving value" of a good farm garden, and the need for a better balance of money crops with the production of food, feed, and soil-fertility crops on many Tennessee farms, led to the development of a State-wide Home Food Supply Program. This program was sponsored by Governor Prentice Cooper with the following agencies cooperating: the State Department of Agriculture, the Agricultural Extension Service of the University of Tennessee, the State Department of Vocational Agriculture and Home Economics, the State Agricultural Conservation Committee, the State Grange, the State Farm Bureau Federation, and the Farm Security Administration.

The objective of this program was to promote better living among all farm families in Tennessee by encouraging the production and preservation of a variety and adequate supply of home-grown foods to provide a healthful, well-balanced diet including vegetables, fruits, meats, milk and butter, and poultry and eggs.

All farmers and their wives, landlords, tenants, sharecroppers, white and colored, were eligible to participate. The program was launched in March, and on May 15, the closing date, 61,693 families had enrolled. At the end of the year all families producing 75 per cent or more of the food supplies necessary for a healthful, well-balanced diet were awarded a handsome, framed "Certificate of Recognition," signed by Governor Cooper. Nearly one-third of the families enrolled qualified for certificates which today can be seen hanging on the walls of many homes, and the recipients take considerable pride in them. Families making the highest score in each county were given a dinner by the Governor and were awarded distinguished merit plaques.

Program Being Continued

The program is being continued in 1941 with all indications that well over 100,000 farm families will be enrolled. Interest and enthusiasm in gardening as a profitable enterprise from a "cash-saving" standpoint and as a means of providing adequate supplies of the right kinds of foods for proper nutrition and health of the family are at a high pitch in all sections of the State as a result of this program which has brought the

This garden and orchard on the S. H. Hart farm, Bledsoe County, indicate that Mr. Hart believes in living at home.

garden, as well as other food products that can be produced on the farm, into the spotlight. The program has attracted the attention and cooperation of the Tennessee Council of Chain Stores, which is assisting in preparations for a "Better Nutrition Week" to be proclaimed by Governor Cooper.

Some 15 years ago garden specialists of the College of Agriculture started an experimental garden on the Experiment Station farm at Knoxville to demonstrate the value and possibilities of the farm garden in contributing to the farm family's food supply. This garden was no petted or pampered thing. It received no more time than the average farm family can afford. It was carefully planned and records were kept for a period of 10 years. It contained one-half acre, and the aim was to produce an adequate supply of vegetables for a family of five. Changes were made in the plan of the garden from time to time as they appeared desirable. All of the vegetables needed to supply an adequate, well-balanced diet were grown. Different varieties were tested, and planting dates, spacing, fertilization, crop arrangement, disease and insect control, harvesting methods, and value of products grown were carefully studied.

It was found that half or more of the farm family's food supply required for a properly balanced diet could be produced much more cheaply than it could be purchased. It was also found that with proper planning and reasonable care one-half acre, or at most three-fourths acre, of land is sufficient to produce an adequate supply of vegetables for a family of five.

While vegetable crops can be grown successfully on a wide variety of soils ranging from those of a rather light sandy nature to the heavy clay types, it was found to be a distinct advantage to have a soil which warms up reasonably early in the spring, one which can be worked rather quickly after a rain, and one which does not bake and form clods easily. These qualities are considered of greater importance than high fertility, because the plant-food materials may be supplied according to the needs of the plants.

Because of the importance of an early spring garden, it is usually wise to plow the soil in the late fall or early winter. If the location is such that there is danger of washing during the winter, and there is no more desirable location available, it may be wise to seed a cover crop in the fall and delay the soil preparation until spring. However, such a plan will usually result in a late start and will cause the garden to compete with other farm work during the busy season. If the soil is fall-plowed and left rough during the winter, the freezes will put it in excellent physical condition and make the cultivation easier during the entire season. The final preparation of the soil by disking, harrowing, and smoothing should be done shortly before the crops are to be planted and should be very thorough.

Fertility Recommendations

The fertility of the garden should be secured by a program of gradual improvement rather than the application of comparatively large quantities of readily available fertilizers at planting time. Such an improvement program should include, as its most important step, the incorporation of large quantities of humus into the soil. If the soil is inclined to be rather light, so that crops suffer quickly during dry weather, the addition of humus will increase water-holding capacity. If the soil is inclined to be heavy, so that it warms up late in the spring and drys slowly after heavy rains, the addition of humus will greatly improve the condition. The application of liberal quantities of manure, where it is available, will add humus and build the fertility of the garden.

If sufficient suitable land is available, it is very desirable to include in the garden an area large enough so that approximately one-third of it may be planted in a soil-improving crop such as crimson clover, vetch, or soy beans

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Indiana's Latest Tomato Champions

By Roscoe Fraser

Agricultural Extension Service, Purdue University, Lafayette, Indiana

THE fact that youth leads the way is brought home to us more forcibly every day. Last December a 4-H Club girl won the Grand Championship with her steer at the International Fat Stock Show. The year before, the International Grand Champion Barrow was raised by a boy. Two of the top 10 box office attractions in the movie world are a young girl and a boy. And in the announcements of the 1940 Indiana Tomato Championships, it is noted that the winners are mere youths.

Maurice Johnson, who lives 5 miles northwest of Kempton, is the Indiana "U. S. Won" Tomato Champion Grower for 1940. He is a young man, only 25 years old. The fact that he is the son of Harry Johnson, the 1935 State Winner, may have been of some help to him; but his father assures us that "Bus" actually did all the work connected with the crop, while the father worked on the county roads as assistant supervisor.

Maurice Johnson of Kempton, Indiana "U. S. Won" Tomato Champion Grower for 1940.

Maurice, or "Bus" as he is better known, has been helping his father farm as far back as he can remember. Besides their own 110 acres, they rent 80 acres. Like most Indiana farmers, they feed all the grain they raise to 15 brood sows and their pigs, 4 horses, and 17 cows and steers.

On their 6-acre tomato field they put 55 loads of manure, 80 pounds of granular "Aero"-cyanamid per acre, and 80 pounds of 50% muriate of potash per acre, which was all plowed under in the spring. As soon as the plowing was done, a pole was dragged over the ground to smooth it down.

The last week in April the ground was double disked and 190 pounds of 2-16-8 fertilizer per acre were put on with a big fertilizer drill. Then 100 pounds of 2-12-6 were drilled in with the corn planter, at the same time ½ pound of seed per acre was drilled in with two Planet Jr. garden seeders hitched behind the planter. The stand was so bad because of poor seed germination that the plants were disked up and Bus almost decided not to grow tomatoes.

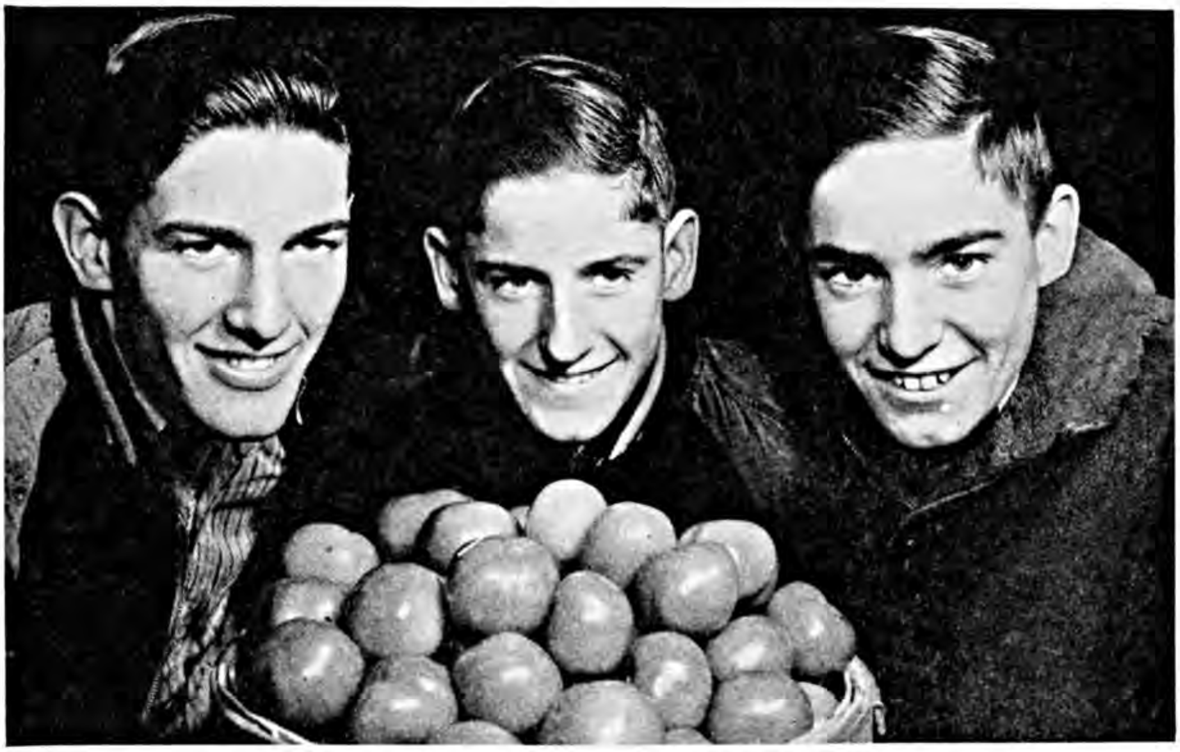
However, due to the persuasive powers of the fieldman and the fact that there was so much already invested in fertilizer and labor, Bus changed his mind, and on the 5th and 6th of June, set out 21,000 certified Georgia tomato plants after he had disked the ground 3 times more. A ½ pint of starter solution made up of 4 pounds of 16-40-9 to 50 gallons of water was used on each plant. The plants were set 3'6" x 3'6". They were cultivated four times and hoed once.

When picking began Bus hired two neighbors and four transient pickers. If a low grade was reported, he just kept telling his pickers to pick only red-ripe tomatoes. From August 29 to October 4, 13.75 tons of tomatoes per acre were delivered to the Kempton factory. After that factory closed, two tons per acre were sold to an Indianapolis factory. His grade for the season was 85.8% U. S. No. 1's.

This tomato field was the same field where the State Champion tomatoes were grown in 1935. In 1936, it was in corn and in 1937 and '38, in clover and oats. In 1939, corn (100 bu. per acre) was grown here, on which 100 pounds of 0-10-20 were used.

In the Double Tonnage Club, 3 boys share the honors. They are Arnold, 17, Vernon, 15 (both Vocational Agriculture students at Arlington High School), and Virgil, 13, sons of Lester Parks. They live on the 217-acre farm of Mr. Fon A. Miller, 1½ miles S.E. of Arlington, Indiana, only 2 miles from one of the Willkie farms.

These boys have all been in 4-H Corn Club work, and last year, all had calves in the Calf Club. Last spring, Mr. Miller began thinking about a crop they could handle, one by which they could earn some money for themselves, since he wanted to keep them on the farm. He went to the Roach-Indiana Corporation at Gwynneville to see about getting them into a tomato club, but the requirements for starting a club are 10 members, with an average of 5 acres each. Ten interested boys could not be found, and so the club could not be organized. The Parks boys decided to raise tomatoes anyhow.



Arnold, Vernon, and Virgil Parks of Arlington, Indiana, 1940 winners in the Double Tonnage Club.

Since this was their first year, they went at it as scientifically as possible. They had the soil tested at a tomato school early in March and followed exactly the instructions of the Purdue extension workers and the fieldman. They had a 3.032-acre field and produced 15.266 tons of merchantable tomatoes per acre. In Indiana, the Double Tonnage Club is for the growers of those canners who buy on a flat rate per ton. The average of 15.266 tons per acre (highest yield produced

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Soil Productivity In the Southeast

By W. H. Garman

College of Agriculture, Athens, Georgia

ALMOST all soil fertility problems can be considered from chemical, physical, and biological aspects. There is little doubt of the fact that we have in the past given considerably more attention to the chemical side of soil productivity than to either the physical or biological, or both combined for that matter.

Our fertilizer consumption alone goes a long way toward bringing out this point. During the past 25 years we have consumed an average of more than 6.5 million tons of commercial fertilizers per year in the United States. This is ample proof that for over a quarter of a century there has been considerable effort directed toward the chemical side of supplying nutrients for crop production. In some sections of the country this effort has found extensive practical application, much greater than in other sections where the inherent chemical nutrient supply in the soils has more nearly supported the predominating agriculture.

If we consider the five Southeastern States, North Carolina, South Carolina, Georgia, Florida, and Alabama, we find that in the three years 1937, 1938, and 1939 there were 11,404,598 tons of commercial fertilizers consumed, or an annual average of 3,801,532 tons. This tonnage amounted to approximately 47 per cent of the entire consumption of the United States. In the same three years the remaining 43 states and the District of Columbia used a total of 11,852,752 tons, or an average of only 149,384 tons more per year than the five Southeastern States. This leaves no doubt as to where the supply of available nutrients in the soils of this country has been most limiting. Yet, is it not possible that in this same section factors other than the amount of available nutrients might be of importance in determining the productivity of the soils? Could it be that we have overlooked the importance of fundamental, physical, and biological phenomena?

If one has any appreciation of physical characteristics of soils (other than the sands of the Coastal Plain) and has had an occasion to travel through the states of certain other regions, it is very apparent that the soils are in no way similar. If this contrast is carried to the laboratory, we might expect to find the answers to these differences which we see. In most instances we would, first of all, find a lower content of organic matter in the southern soils, a lower level of active calcium and magnesium, and a lower pH as well. These, when added to studies with regard to infiltration rates, water-stable aggregates, water-holding capacity, subsoil aeration, and erosion or dispersion ratios, and then to a biological examination of the soil organisms, would surely give more than a little evidence that all of these factors must have undoubtedly played some part in determining the relative natural productiveness of the soils in the respective areas. Consequently, factors other than those which can be considered strictly as available nutrient supply of nitrogen, phosphorus, and potassium must have been at least partially responsible for the concentration of the fertilizer industry in the Southeast. So far, we have given little attention to these factors in scientific studies and in the application of research information in our agriculture. Perhaps the fertilizer industry itself would be benefited by such studies.

In general, approximately 15 to 30 per cent of the cash income of agriculture in the Southeast goes for fertilizers. This is obviously a large expenditure for any one commercial item, and it is likewise obvious that the farmer would be better off financially if a smaller portion of his income had to be spent for commercial fertilizers. Most of us are agreed that the average farmer uses less plant nutrients than he should, so to use still less would certainly not be economical, at least in most instances. If the net income is to be increased, just what is the most logical, or the more promising method of procedure? To this end there is insufficient speculation in progress today.

Diversification Desirable

One of the first thoughts that comes to our attention is a change in the type of agriculture, not implying a complete change, of course. From the standpoint that diversification of efforts tends naturally toward greater agricultural self-sufficiency, this seems desirable. Whether or not this may be absolutely true and whether it will come about in the future are not to be dealt with in this discussion. It is my present purpose to consider agricultural conditions as they exist today, and attempt to investigate the possibilities of building up farm income through education and land improvement without drastic changes in our agriculture.

As far as acre yields enter into determining income, we in the South have room for improvement. Our average acre yields of corn and small grains are below the national average, and our cotton yields are by no means high. We have need for efforts toward higher yields, but these increases must be economical, that is, they must be made to pay.

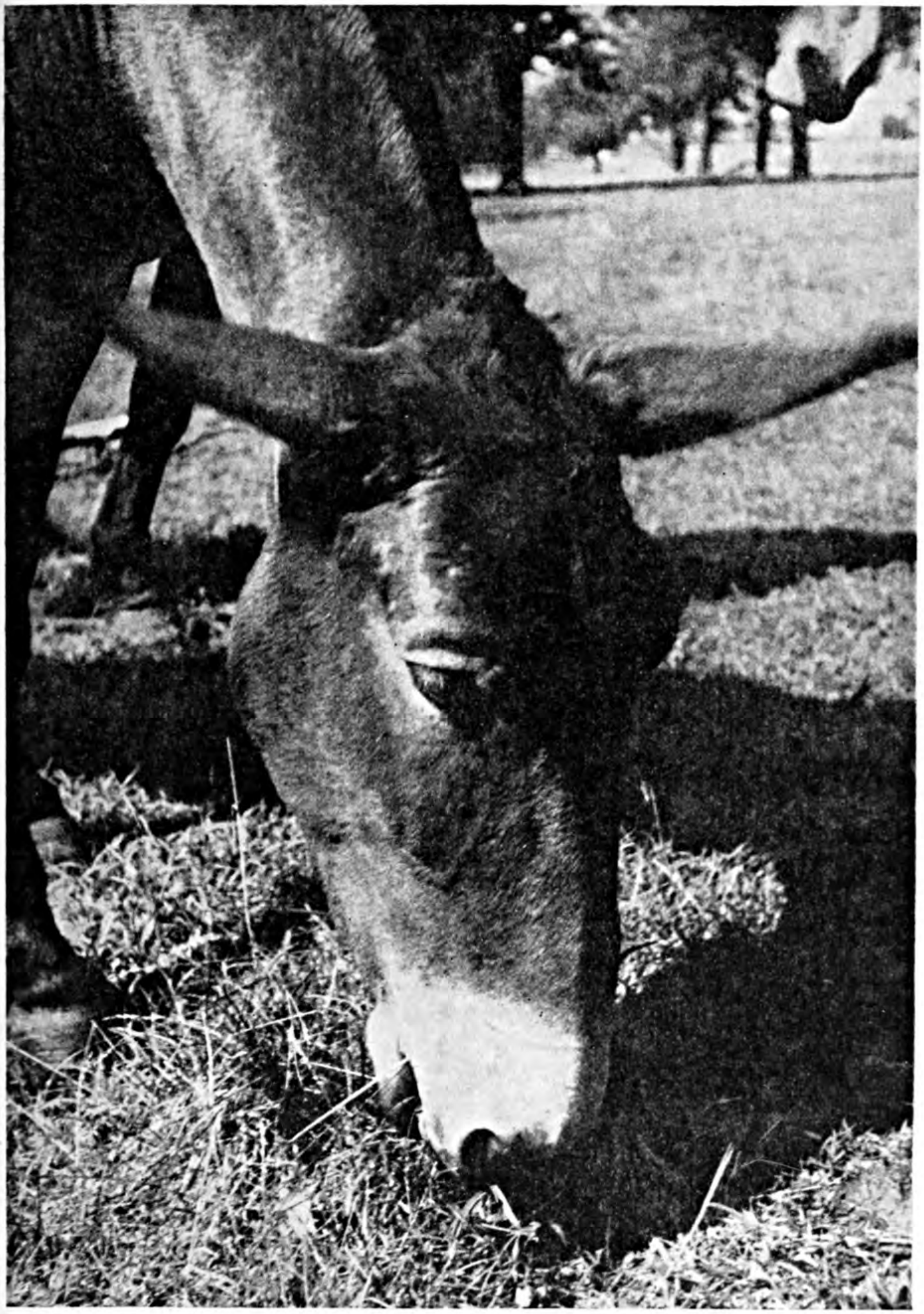
Perhaps we have given insufficient attention to factors other than fertilization which place limitations upon soil productivity. Just as surely as an inadequate supply of available nitrogen, phosphorus, and potassium will limit crop yields, so will insufficient active calcium and magnesium, absence of desirable bacteria and fungi, lack of aeration, impervious subsoil, low water intake, low water-holding capacity, low organic matter, and lack or low availability of the so-called minor elements such as boron, manganese, copper, and zinc. In addition, such factors as quality of seed, land preparation, insects, diseases, rainfall, drainage, erosion, depth of soil, humidity, light, and temperature may, and often do, exert profound effects upon plant growth.

It is only too true that much of our soil is low in natural fertility and that vast areas have been extensively exploited through the years of producing cultivated crops, so that today there are hundreds of thousands of acres of formerly good agricultural land which no longer possess a top soil, and thousands of our farmers are in reality what we might term "subsoil" farmers. This loss of topsoil has removed from the soil the most available nutrients which it possessed, as well as a very large part of its organic matter. What these farmers have left to secure their livelihood from is of necessity vastly different from the same fields which their grandfathers knew. With these changes, many new and complicated problems have arisen.

Water alone is of far reaching importance. With the permeability of the soil to water reduced, less of any given rainfall actually finds its way into the soil. This means added surface run-off, which of necessity means greater soil losses, thus accelerating the rate at which conditions are becoming more acute. With the water-holding capacity of soils reduced, crops suffer from unreasonably short periods of drought. In the South, we should not be limited by lack of soil moisture, inasmuch as we

(*Turn to page* 38)

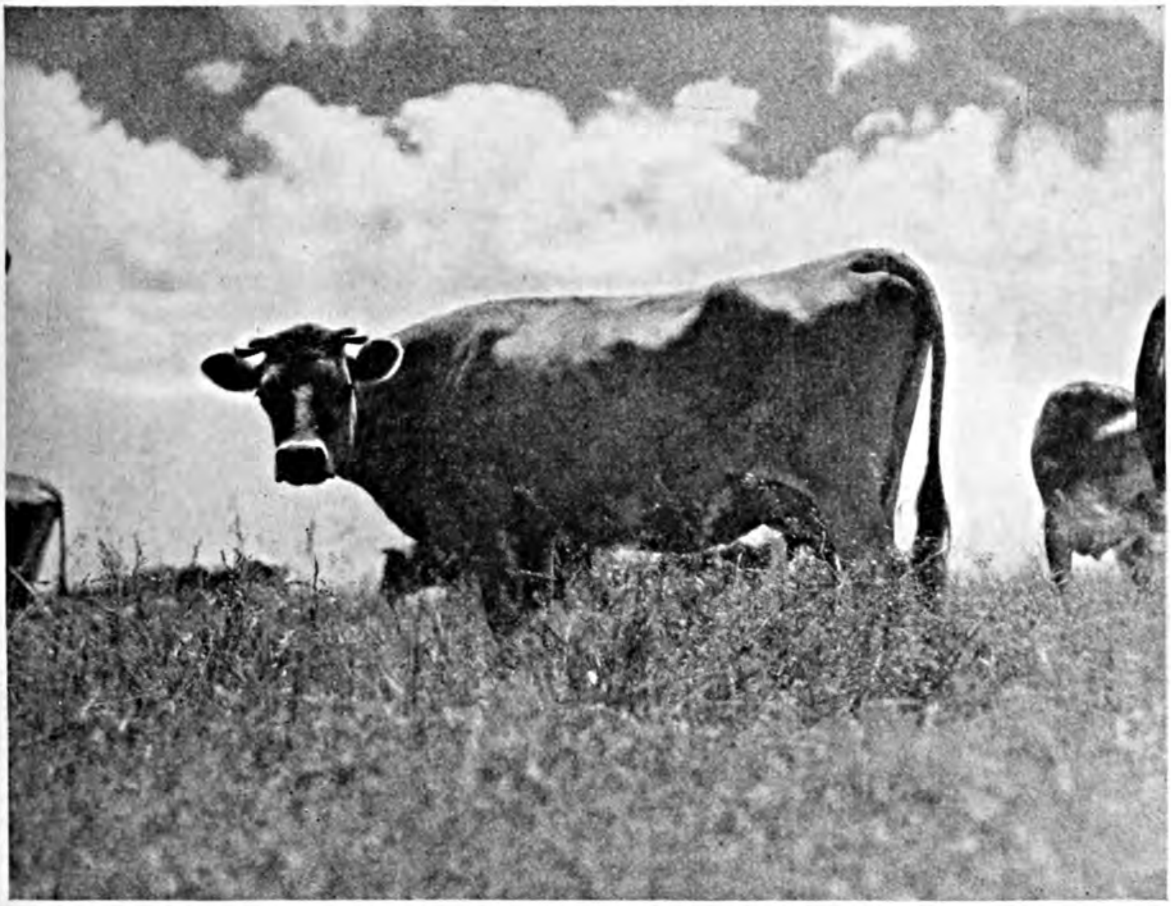
PICTORIAL



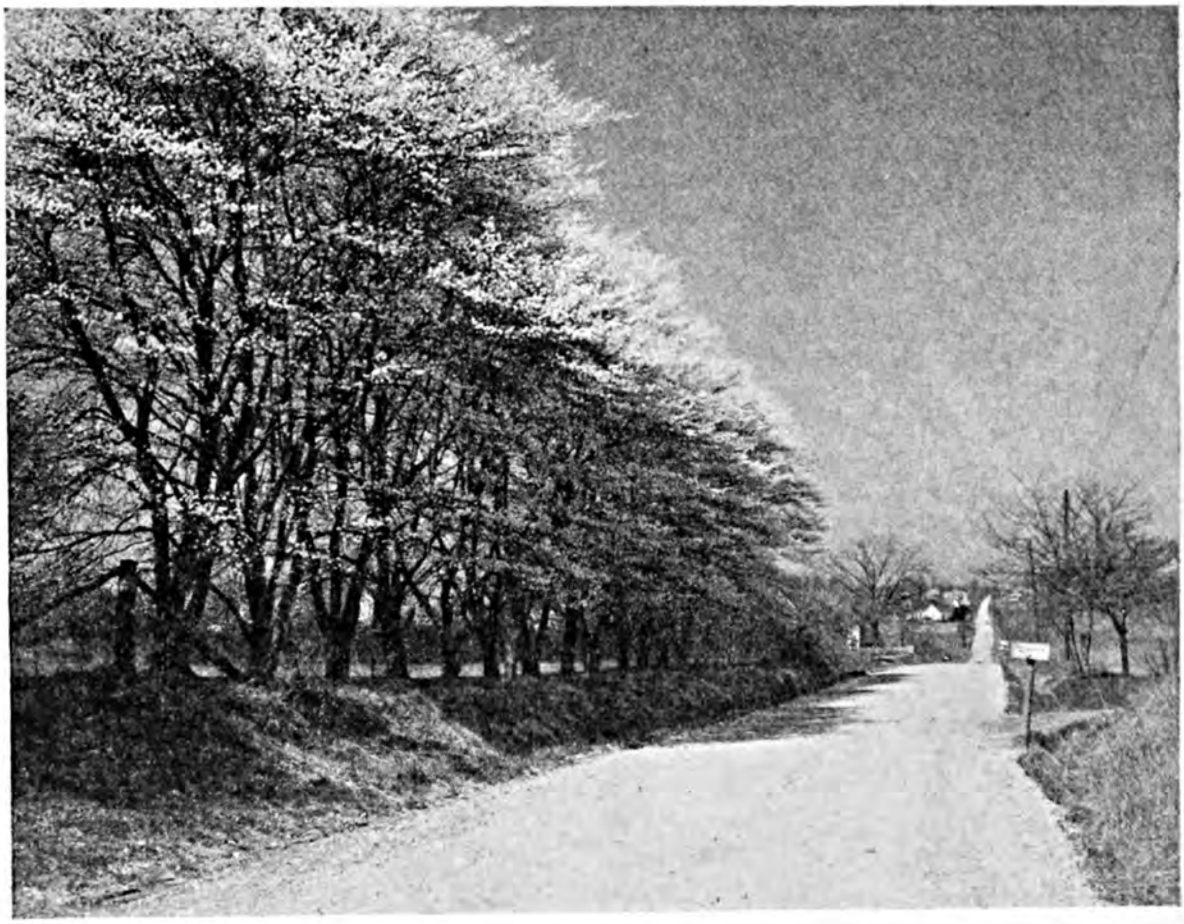
A MISSOURI COMBINE—MOWER AND BALER

Above: Sheep, like other animals, enjoy a good shade tree.
Below: The morning rush to pasture for more "raw materials."

Above: Good beef grows fast when pastures are lush and green.
Below: A contented "Belle of the Herd" knee deep in clover.



Above: A quiet and peaceful landscape in the Ozarks.
Below: Sorbus berry trees blooming along an Indiana highway.



The Editors Talk

The Growth of the Topdressing Idea

What has now assumed an importance to justify its being called a new development in the use of fertilizers is the growth of the idea and practice of applying potash as a topdresser. The profitable use of quickly acting nitrogen fertilizers during the growing season has long been known. It has been practiced particularly by the growers of cotton, corn, and small grains in the South and for small grains and leafy vegetables in the North. But the use of potash in this manner is a comparatively recent development, originating apparently in the South, where it was demonstrated that potash applied with the nitrogen topdresser would control cotton rust.

Like most innovations in accustomed farm practices, the nitrogen-potash topdresser "took" slowly. Farmers thought that they were applying enough potash at planting time. The fertilizer trade, long accustomed to making mixtures high in phosphate, was slow in seeing a place for this new combination. It was not until the spring of 1928 that the trade offered it to any extent.

An idea as to the growth in the use of nitrogen-potash topdressers can be obtained from the surveys conducted by the National Fertilizer Association in cooperation with the U. S. Department of Agriculture in 1934 and 1939. According to the data obtained in 1934, no one grade of nitrogen-potash topdresser was used to the extent of 1,000 tons. Five years later, the survey showed that nearly 12,000 tons of 10-0-10 were reported used in 10 states, this analysis ranking sixty-first in tonnage for the country as a whole. Smaller amounts of other analyses such as 9-0-15, with less than 1,000 tons each, probably aggregated several thousand tons.

One of the principal reasons for using nitrogen-potash topdresser is to supply sufficient amounts of these nutrients in a way that is safer from the viewpoint of the farmer than applying all the nutrients at planting time. Another reason is to supplement rather poorly balanced fertilizers which may be used as a matter of habit but which do not supply enough of these plant foods for a full crop. Loss of nutrients due to leaching also is reduced by the use of topdressers.

These factors are of importance in the growing of such crops as cotton, which may be easily injured if large amounts of fertilizer high in nitrogen and potash are applied by ordinary means at planting time in a dry season. Extra potash as a topdresser was naturally thought of by cotton farmers who had been using nitrogen fertilizers in this way, but many of them did not want to go to the trouble of making two applications, or of mixing the materials before application.

With the introduction of nitrogen-potash topdressers mixed by the fertilizer trade, it is now possible to apply both nitrogen and potash in one application. Another inducement to the use of these topdressers is the fact that they are usually very reasonably priced, due to economies the fertilizer manufacturer is able to effect in the mixing of such goods, and which ordinarily would not be possible to the individual farmer. Sufficient nitrogen and potash thus can be applied at little or no extra outlay of money.

The large number of results from carefully controlled experimental work and from field work under practical conditions show conclusively that extra potash supplied as a topdresser is highly profitable on many crops in the South and probably in other sections of the country. This potash may be supplied by applying 50, 100, or 200 pounds of muriate of potash per acre. Since under many conditions extra nitrogen also is needed, the logical procedure is to apply the two together in the form of nitrogen-potash topdressers. The use of 200 to 400 pounds per acre of such analyses as 10-0-10, 9-0-25, 9-0-15, etc., at chopping time on cotton, as a topdressing in the spring on fall-sown grains, on corn a month or six weeks after planting, and on vegetable crops when they are up and well established or when they are beginning their period of fastest growth can be recommended as a profitable and safe way of supplying enough of these nutrients to make good yields of quality crops.

It is logical to assume that as research work goes on, and particularly as the results of the whole new field of experimentation on fertilizer placement begin to take shape, more and more use of topdressers will be recommended. One can see in such a development an easing up of the rush of spring work for growers, a more efficient use of nutrients by the plants, a lengthening of the season for the fertilizer trade. All would be welcome.

Fulfills Its Promise

When announcement of the forthcoming publication of the book "Hunger Signs in Crops" was made a few months ago, there undoubtedly was the hope among others, as there was with us, that the book would prove a real guide to the maze of plant-food deficiency symptoms which have come to light during comparatively recent years. The hope has been fulfilled. As one interested in birds would take a bird-guide book on a pleasure hike, "Hunger Signs in Crops" tempts one to start afield in search of plants to compare with the beautifully produced color pictures and other illustrations and add to his knowledge of the mysteries of the soil.

To agriculturists working in advisory capacities, the book must surely prove a valuable aid. Numerous Experiment Station bulletins have contained limited material on certain crops and certain deficiencies, but nowhere in one conveniently sized volume have so many crops and so many deficiencies been discussed and depicted. To the grower, it is a dictionary of plant needs and a key to successful farming.

Gove Hambidge, who edited the book, emphasizes that apart from its immediate practical value, the contents mark one more step in the study from the soil on up through man. What the soil does not have, plants will not get, and animals and men will lack also. The welfare of man is intimately bound up with the welfare of soils and plants because all of our food comes in the first instance from plants; even our meat, milk, eggs, and fish are simply plant substances rebuilt into other forms.

The book brings a further realization of these principles and a greater appreciation for the arduous years of research work which brought such information to light. We congratulate the American Society of Agronomy and the National Fertilizer Association, who are the publishers of the book, for gathering this information and presenting it to the public in such concise and attractive form.

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

¶ Mimeo-Leaflet 47 of the University of Idaho, "Alfalfa Yellows," presents the findings of several years of research on the cause and control of the type of yellowing affecting many alfalfa fields in the State. Work in northern Idaho, and also of many investigators elsewhere, has shown that yellows will occur in soils which do not have sufficient available boron for plant needs.

The authors, G. O. Baker, W. E. Colwell, and J. M. Raeder, recommend the following control for alfalfa yellows:

1. Apply 40 pounds of agricultural granular borax per acre. Under no conditions should larger amounts be used.
2. Best results have been obtained with fall applications after the alfalfa has become dormant but before the ground freezes. Spring applications may be made, but the data obtained so far indicate results are not as satisfactory.
3. The borax should be spread uniformly.
4. The application rate should not exceed 30 pounds of borax if the alfalfa is to be plowed up before producing at least two crops.
5. Re-applications should not be made oftener than every three years.

Users are cautioned not to apply more or make more frequent applications than are recommended. Large amounts or too frequent applications are dangerous since borax in large quantities is toxic to plant growth.

¶ Of particular interest to many farmers in the State of Washington who are engaged in the production of intensive crops is Dr. L. C. Wheeting's informative publication, "Cooperative Field Experiments with Commercial Fertilizer Mixtures," Agricultural Experiment Station Bulletin 392. The results of a five-year study of fertilizer applications in different ratios to a variety of soils in Washington are reported for oat hay, mixed hay, alfalfa hay, grass-legume pastures, oats for grain, wheat, potatoes, corn for silage, sugar beets, and canning peas. The author has prepared a convenient chart based on these data, which shows the fertilizer requirements in terms of available nitrogen, phosphoric acid, and potash per acre of the crops mentioned when grown on different soils of the State. This information is given in accordance with previous cropping and the use of farmyard manure on the preceding crop.

Common ratios often giving good results are 1-2-1, 1-2-2 and 1-1-1. In these studies smaller applications than 20 pounds of available nitrogen, 40 pounds of available phosphoric acid, and 40 pounds of available potash per acre were not effective in giving increased yields when these elements were deficient in the soil. As might be expected, it is difficult to obtain economic returns with low-priced crops, but with crops such as potatoes, canning peas, and sugar beets, satisfactory profits from the use of fertilizers are possible.

According to Dr. Wheeting, there is no difficulty in obtaining in the State mixed fertilizers such as the 3-10-7, 3-10-10, 5-10-5, 5-10-10, and 5-6-8 analyses. In most cases, it is possible to purchase the mixtures that approximately meet the requirements denoted in the chart for the various crops. Small variations of 10 pounds one way or another are said to be unimportant.

"The Effect of Nitrogen and Phosphorus on the Growth of Apple and Peach Trees in Sand Culture," Agr. Exp. Sta., Lexington, Ky., Bul. 410, Dec. 1940, C. S. Waltman.

"Effects of Mineral-nutrient Deficiencies and Excesses upon the Vegetative Growth and Flowering of Sweet Peas," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 745, Dec. 1940, Kenneth Post.

"Fertilizer Placement Under Irrigation in Washington," Agr. Exp. Sta., Pullman, Wash., Rep. from Jnl. Amer. Soc. Agron., Vol. 33, No. 2, Feb. 1941, C. Emil Nelson and L. C. Wheeting.

Soils

¶ "Soil Reaction (pH) Preferences of Plants," Special Bulletin 306 of the Michigan Agricultural Experiment Station, by C. H. Spurway, contains a listing of plants with their soil acidity or alkalinity preferences, compiled in comprehensive form for immediate reference. The pH values given are considered to be the best information on the subject available to date. Because of the many important factors of plant growth acting in conjunction with pH, this value must not be considered the only soil condition needing adjustment for any particular soil or crop. The soil reaction is a major factor in good soil management, but the other vital factors of plant growth cannot be neglected. Favorable soil conditions for any crop demand a suitable soil texture, the right temperature, and an adequate plant nutrient and water supply.

Hundreds of plants, their common name and botanical or scientific name for a more accurate designation of the plant, are listed in this worthy compilation. The optimum pH range given in the list is considered to be the most favorable for growth provided that the other soil conditions are met. In many cases the minimum and/or maximum pH limits are also given.

Professor Spurway is to be complimented. The bulletin places important information on soil reaction preferences of plants in the hands of growers in ready reference form.

"Why Is Subsoil Unproductive?," Agr. Exp. Sta., Fort Collins, Colo., Bul. 464, Feb. 1941, Robert Gardner.

"Save the Soil with Contour Farming and Terracing," Agr. Ext. Serv., Urbana, Ill., Cir. 513, Apr. 1941, E. W. Lehmann and R. C. Hay.

"Montana Soil and Moisture Conservation Practices," Agr. Exp. Sta., Bozeman, Mont., Mimeo. Cir. 27, Nov. 1940, Philip T. Allen.

"Analyses of United States Soils," N. J. Agr. Exp. Sta., New Brunswick, N. J., June 1940, J. G. Lipman, J. S. Joffe, and Adrienne B. Conybeare.

"Anjou Pear Responses to Irrigation in a Clay Adobe Soil," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 374, July 1940, W. W. Aldrich, M. R. Lewis, R. A. Work, A. Lloyd Ryall, and F. C. Reimer.

"Soil Survey of Tarlac Province, Philippines," Dept. of Agr. and Comm., Manila, P. I., Soil Rpt. 6, 1940, M. M. Alicante, D. Z. Rosell, R. T. Marfori, and S. Hernandez.

"Nature of Organic Matter in Western Washington Prairie Soils as Influenced by Differences in Rainfall," Agr. Exp. Sta., Pullman, Wash., Rep. from Jnl. Amer. Soc. Agron., Vol. 33, No. 1, Jan. 1941, R. H. Fowler and L. C. Wheeting.

"Rock Weathering and Soil Profile Development in the Hawaiian Islands," U. S. D. A., Washington, D. C., Tech. Bul. 752, Feb. 1941, G. J. Hough, P. L. Gile, and Z. C. Foster.

Crops

¶ Professor C. E. Phillips, in Mimeo. Circular 3 of the Delaware Extension Service, "Delaware Pastures," writes, "A good pasture is one that will supply continuous grazing of palatable nutritious grass from very early in the spring until late in the fall. . . . Since the factors influencing grass production vary considerably from one section of the country to another, so will the pasture management practices necessary to obtain good pasture." Well-fertilized pastures in adjoining areas are said to carry as high as 1.5 cows per acre for the entire season. Some few pastures in Delaware, because of good fertilization and management practices, produce many times the feed that the average pasture produces. Many pastures in the State, according to Professor Phillips, are simply areas of indifferent grass and weeds.

In addition to lime in accordance with the soil requirement, the application of 300 to 500 pounds of 20 per cent superphosphate or 0-14-6 fertilizer per acre is recommended every 2 or 3 years to improve permanent pastures. A portion of the pasture area might receive some nitrogen fertilizer not later than April 1 to provide earlier spring grazing. Where new pastures are to be established, 2-12-6 for the heavier soils and 2-8-10 for the sandy soils are advised. If the land has not been limed recently, 1,500 to 2,000 pounds of ground limestone per acre should be used, as well as manure, especially over thinner areas.

The many additional points of proper pasture management stressed in this circular include factors influencing seasonal production, providing for continuous grazing, and seeding mixtures appropriate for each of the four pasture districts outlined.

"Genetic Relations of Sparse Lint, Naked Seeds, and Some Other Characters in Upland Cotton," Agr. Exp. Sta., Fayetteville, Ark., Bul. 406, Jan. 1941, J. O. Ware.

"The Mesa Experiment Farm Helps Farmers Help Themselves," Agr. Exp. Sta., Tucson, Ariz., Bul. 171, Feb. 1941, R. S. Hawkins and D. C. Aepli.

"Celery in Alberta," Dept. of Ext., Univ. of Alberta, Edmonton, Alta., Bul. 35, Dec. 1940, J. S. Shoemaker.

"Functional Disorders of Apples," Dept. of Agr., Ottawa, Canada, Pub. 694, Tech. Bul. 28, May 1940, C. A. Eaves and H. Hill.

"Blue-cured Tobacco Growing in Ontario," Dept. of Agr., Ottawa, Canada, Pub. 715 Farmers' Bul. 101, Feb. 1941, E. A. Stinson and H. F. Murwin.

"War-time Production Series," Agr. Sup. Bd., Dept. of Agr., Ottawa, Canada, Sp. Pamphlets: 1—Flaxseed, 6—Soybeans, 8—Fibre Flax Production in Canada, 9—Sudan Grass, 15—Pasture Improvement for Cheaper Production, 21—Coarse Grain Crops for Eastern Canada, 22—Hybrid Corn, 23—Field Corn, 27—Farmyard Manure, 40—Potato Culture, 42—Tomato Culture, and 43—Certified Seed Potatoes.

"Progress Report of the Superintendent for the Years 1931-1936," Dom. Exp. Farm, Ste. Anne de la Pocatiere, Que., 1938.

"Home Vegetable Gardening," Agr. Ext. Serv., Newark, Del., Ext. Bul. 34, Mar. 1941, Pearl MacDonald, William H. Phillips, Claude E. Phillips, Kenneth J. Kadow, and Louis A. Stearns.

"Gather Health from your Own Garden," Agr. Ext. Serv., Gainesville, Fla., Cir. 53, Mar. 1941, J. Lee Smith.

"Corn Varieties and Hybrids and Corn Improvement," Agr. Exp. Sta., Gainesville, Fla., Bul. 355, Feb. 1941, Fred H. Hull, J. D. Warner, and W. A. Carver.

"Dahlia Variety Test—1940," Agr. Exp. Sta., Experiment, Ga., Cir. 124, Dec. 1940, H. L. Cochran, David D. Long, Norman La Motte, and Theo. L. Bissell.

"Hawaii Agricultural Experiment Station Report, 1940," Agr. Exp. Sta., Honolulu, T. H., 1941.

"Annual Report of Iowa Agricultural and Home Economics Extension Service, 1939," Agr. Ext. Serv., Ames, Iowa.

"1940 Iowa Corn Yield Test," Agr. Exp. Sta., Ames, Iowa, Bul. P19, Feb. 1941, Marcus S. Zuber and Joe L. Robinson.

"Report on Agricultural Research for the Year Ending June 30, 1940. Part I. Project Reports, Publications, Staff, and Financial Statement. Part II. Iowa Corn Research Institute, Fifth Annual Report," Agr. Exp. Sta., Ames, Iowa.

"Tenth Biennial Report of the Directors, 1938-1940," Agr. Exp. Sta., Manhattan, Kans.

"Strawberry Growing in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 203, Jan. 1941, R. J. Barnett.

"Kansas Corn Tests, 1940," Agr. Exp. Sta., Manhattan, Kans., Bul. 292, Jan. 1941, R. W. Jugenheimer, A. L. Clapp, and H. D. Hollembeak.

"Fifty-third Annual Report of the University of Maryland Agricultural Experiment Station," Agr. Exp. Sta., College Park, Md., Vol. 53, 1939-1940.

"Ornamental Trees," Agr. Ext. Serv., East Lansing, Mich., Ext. Bul. 160, (First Revision), May 1941, Charles W. Barr.

"Oats in Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 348, Sep. 1940, Roy Kuykendall, John Pitner, J. F. O'Kelly, J. L. Anthony, and C. Dale Hoover.

"Dry-land Pasture Experiments at the Judith Basin Branch Station, Moccasin, Mont.," Bul. 388, Mar. 1941, Ralph M. Williams and A. H. Post.

"Nebraska Pasture, Seeding and Management," Agr. Exp. Sta., Lincoln, Nebr., Cir. 67, Feb. 1941, A. L. Frolik and E. F. Frolik.

"Fruits and Nuts for Home Use," Agr. Ext. Serv., State College Station, Raleigh, N. C., Ext. Cir. 210 (Rev.), Jan. 1941, H. R. Niswonger.

"Lettuce Growing in North Carolina," Agr. Ext. Serv., State College Station, Raleigh, N. C., Ext. Cir. 248, Feb. 1941, Robert Schmidt.

"High-bush Blueberry Culture in Rhode Island," Agr. Exp. Sta., Kingston, R. I., Misc. Pub. 8, Dec. 1940, A. E. Stene.

"Fifty-third Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for the Year Ended June 30, 1940," Agr. Exp. Sta., Clemson, S. C., Dec. 1940.

"Uton—A New High-yielding White Oat Resistant to Loose and Covered Smuts," Agr.

Exp. Sta., Logan, Utah, Bul. 296, Apr. 1941, D. C. Tingey, R. W. Woodward, and T. R. Stanton.

"Extension Work in Agriculture and Home Economics, Annual Report, December 1, 1938 to November 30, 1939," Agr. Ext. Serv., Blacksburg, Va., Bul. 148, June 1940.

"Fiftieth Annual Report—For the Fiscal Year Ended June 30, 1940," Agr. Exp. Sta., Pullman, Wash., Bul. 394, Dec. 1940.

"Report of Agricultural Research and Other Activities of the Western Washington Experiment Station for the Fiscal Year Ended March 31, 1940," Western Wash. Exp. Sta., Puyallup, Wash., Dec. 1940, J. W. Kalkus.

"Supplementary Pastures and Hays," Agr. Ext. Serv., Madison, Wis., Cir. 315, Feb. 1941, H. L. Ahlgren, G. M. Briggs, and L. F. Graber.

"Practical Results from the State Experiment Farms," Agr. Exp. Sta., Laramie, Wyo., Bul. 243, Jan. 1941, W. L. Quayle.

"Fiftieth Annual Report of the University of Wyoming Agricultural Experiment Station, 1939-1940," Agr. Exp. Sta., Laramie, Wyo.

"Ramie Fiber Production," U. S. D. A., Washington, D. C., Cir. 585, Dec. 1940, Brittain B. Robinson.

"The Imperial Strains of Lettuce," U. S. D. A., Washington, D. C., Cir. 596, Feb. 1941, I. C. Jagger, Thomas W. Whitaker, J. J. Uselman, and Walter M. Owen.

"Culture of Orchids," U. S. D. A., Washington, D. C., Leaf. 206, David Lumsden and Furman Lloyd Mulford.

"Strawberry Culture, South Atlantic and Gulf Coast Regions," U. S. D. A., Washington, D. C., Farmers' Bul. 1026, Rev. Dec. 1940, George M. Darrow.

"Feeding Dairy Cows," U. S. D. A., Washington, D. C., Farmers' Bul. 1626, Rev. Nov. 1940, T. E. Woodward.

"Yield, Chemical Composition, and Feeding Value for Milk Production of Alfalfa Hay Cut at Three Stages of Maturity," U. S. D. A., Washington, D. C., Tech. Bul. 739, Oct. 1940, J. R. Dawson, D. V. Kopland, and R. R. Graves.

"Residual Effects of Forcing and Hardening of Tomato, Cabbage, and Cauliflower Plants," U. S. D. A., Washington, D. C., Tech. Bul. 760, Dec. 1940, M. F. Babb.

Economics

¶There has perhaps been no time in history when data relative to the consumption of farm products were of more concern to the Nation than at present. With the world confronted with the most destructive war in history, and agricultural nations struggling with problems involving supplies against demands, various data relative to the per capita changes in consumption of the leading farm commodities are of great value.

The Bureau of Agricultural Economics, U. S. Department of Agriculture, has recently published a report entitled "Consumption of Agricultural Products." According to this report, per capita consumption of food in the United States during the past 30 years has remained fairly stable, with but 2 significant exceptions—the recession occurring during the first World War and the depression beginning in 1929. This does not mean, however, that the consumption of all farm products has exhibited the same trend. There have been some important shifts, as for example, between beef and pork, butter and other fats, and fresh fruit and canned and dried fruit. But the net effect of these shifts on the total has been comparatively insignificant.

The year 1934 brought to an end the decline in per capita consumption of foods in the United States and a general increase in food consumption got underway. This continued to 1940 and may continue through 1941 because of the abundance of supplies and the increase in consumer income. Although there has been a considerable change in the composition of our population, it appears to have had little effect on total per capita consumption of food, but there have been striking changes in the per capita consumption of many of our food items. For example, we eat less wheat and other cereals per capita, fewer potatoes and apples, less beef and veal, and drink less tea than we did in 1909. We consume more vegetables, fruit, sugar, poultry and eggs, fluid milk, manufactured dairy products, edible fats and oils (other than lard and butter), cocoa and chocolate, and we drink more coffee.

It is not clear just what has brought about these changes in the individual items. Some changes have occurred in population, and ratio of city to rural population has increased. Some shifts have taken place because of a greater variety of foods than was available 30 years ago. It is noted that the decline in the consumption of apples probably was the result of the development of the large-scale production of many other fruits. The development of more efficient methods of transportation and refrigeration has no doubt had a great influence on the rise in consumption of fresh fruits and vegetables. Changes in mode of living probably have affected consumption.

In the non-food items tobacco consumption has increased about 17 per cent during the last 30 years. During the first World War there was an artificially high wartime consumption, followed by a decline in the early '20's and then an upward trend when economic conditions began to improve. The increase in per capita consumption of cigarettes is about fifteen-fold, which might indicate that tobacco consumption has increased more than it actually has. This unusual rise in cigarette consumption has been offset to a considerable extent by the drop in the use of chewing tobacco, and cigars, and a slight drop in smoking tobacco and snuff.

The per capita consumption of rubber has shown a spectacular increase. Cotton has fluctuated widely during the period, beginning and ending with about the same per capita consumption. Other fibers including manila fiber, hemp, jute, sisal, and henequen have shown a decline in total and per capita consumption since 1909. Nonedible fats increased.

¶The Department of Agronomy of the University of Illinois recently issued a statistical report entitled "Fertilizers Sold in Illinois in 1940." During that year 8 new analyses were added and 11 of those sold in 1939 dropped, resulting in a total of 63 analyses in 1940 compared to 66 in 1939 and 73 in 1938. Most of the tonnage was included in the leading analyses, with 97.8 per cent of the total tonnage included in the first half of the different analyses sold. Over 91 per cent of the total tonnage of mixed fertilizers sold contained 20 units or more of plant food. In 1940 the 10 leading analyses were the same as those in 1939. The average plant-food content of the 10 leading grades has changed only slightly in the past 5 years. In 1936, for example, the average was 1.9 N, 11.6 P_2O_5, and 9.2 K_2O; whereas in 1940 it was 1.8 N, 11.6 P_2O_5, and 9.7 K_2O.

The leading grade sold in the State was 2-12-6, representing 30 per cent of the total tonnage. The 0-12-12 was second with about 12 per cent, and 3-12-12 was third with about 9 per cent, followed by 2-8-16 with 7 per cent. The total sales of mixed goods and materials amounted to 49,753 tons, of which 34,992 tons were sold in the spring and 14,761 tons in the fall. In addition to the above, there were 47,823 tons of rock phosphate sold in Illinois in 1940.

¶Fertilizer sales in Ohio in 1940 amounted to 363,320 tons, according to "Spring and Fall Fertilizer Sales in Ohio—1940," compiled by the Department of Agronomy, Ohio State University. Spring and fall sales were divided about equally with 192,316 tons in the spring and 171,004 tons in the fall. The 2-12-6 was by far the leading analysis sold, constituting 205,107 tons. The next most popular grade was 0-14-6 with 22,885 tons, followed by 2-12-2, 0-12-12, 3-18-9, and 4-24-12. In the materials list, 0-20-0 was the most popular material, representing 21,265 tons. Total sales of phosphate materials amounted to 27,361 tons, ammoniates 9,050 tons, and potash salts 613 tons.

The report has a very interesting table showing the total sales of fertilizers and their plant-food content for each year since 1928. In that year sales amounted to 320,866 tons, containing 3,941 tons of N, 42,756 tons of P_2O_5, and 10,597 tons of K_2O. The depression low point was in 1932 when 169,239 tons were sold, containing 3,342 tons of N, 22,926 tons of P_2O_5, and 5,959 tons of K_2O. The year 1940 was the peak for fertilizer sales in Ohio with a tonnage of 363,320, containing

8,506 tons of N, 47,224 tons of P_2O_5, and 22,045 tons of K_2O.

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"Five-year Summary of Fruit and Vegetable Unloads in Honolulu, 1936-1940," Agr. Ext. Serv., Honolulu, T. H., Cir. 109, Mar. 1941, Kenneth I. Hanson and Kenichi Murata.

"Index Numbers of Prices and Production of Farm Products in Kentucky," Agr. Exp. Sta., Lexington, Ky., Bul. 411, Jan. 1941, Dana G. Card, A. J. Brown, and O. M. Farrington.

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"Land and Fiscal Problems in Reynolds County, Missouri," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 324, Dec. 1940, Ross J. Silkett.

"Land Ownership and Tenure, Huntley Irrigation Project—An Analysis of Their Evolutions and Implications," Agr. Exp. Sta., Bozeman, Mont., Bul. 385, Jan. 1941, P. L. Slagsvold.

"Commercial Fertilizer Report for 1940," Agr. Exp. Sta., Bozeman, Mont. Bul. 387, Feb. 1941, John T. Kelly and A. R. Patton.

"Inspection of Commercial Fertilizers for 1940," Agr. Exp. Sta., Durham, N. H., Bul. 329, Nov. 1940, T. O. Smith and H. A. Davis.

"Agronomic Farm Practices in Franklin County, North Carolina," Agr. Exp. Sta., State College Station, Raleigh, N. C., Tech. Bul. 66, Sept. 1940, J. F. Lutz and C. B. Williams.

"The Effect of an Unstable Price Level on Farming," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 447, Nov. 1940, G. E. Brandow.

"Land Use and Production Costs on Dry-land Wheat Farms, Columbia Basin, Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 373, June 1940, A. S. Burrier and W. W. Gorton.

"Some Economic Considerations of Marketing Oregon Fruits and Vegetables Through Cooperative Canning Associations," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 377, Oct. 1940, Daniel B. DeLoach and Charles W. Peters.

"Some Economic Considerations Affecting the Marketing of Oregon Dried Prunes Through Cooperative Dried-prune-packing Associations," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 378, Nov. 1940, Daniel B. DeLoach and Charles W. Peters.

"Ranch Organization and Range Land Use in Coos and Curry Counties, Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 381, Dec. 1940, Harold R. Hochmuth and William W. Gorton.

"Production and Marketing of Dry Peas in the Palouse Area," Agr. Exp. Sta., Pullman, Wash., Bul. 391, Dec. 1940, Woodrow W. Rufener.

"Economic Conditions and Problems of Agriculture in the Yakima Valley, Washington—The Yakima-Tieton Irrigation District," Agr. Exp. Sta., Pullman, Wash., Bul. 393, Dec. 1940, Edgar B. Hurd and Harold F. Hollands.

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"Wheat Marketing Quotas," U. S. D. A., Washington, D. C., Apr. 1941.

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"Publications Dealing with Farm Management: 1903-June 30, 1940," U. S. D. A., Washington, D. C., Dec. 1940, M. A. Crosby, M. R. Cooper, and Della E. Merrick.

"Agriculture's Requirements for Transportation in 1941," U. S. D. A., Washington, D. C., Mar. 1941, E. Orth Malott and William E. F. Conrad.

The head of the house entered the room. "Now, young man," he said sternly to his daughter's suitor, "all lights are turned out in this house at eleven prompt."

"Suits me, sir," replied the young man, blithely. "As a matter of fact, I was just going to turn this one out when you came in."

"Shine, please, boy!" said the six-foot-five soldier to the shoeblack.

The boy looked down at the vast expanse of boots before him and shook his head questioningly. Then a determined look covered his face.

"Bert," he called out to another boy, "Gimme a hand! I've got an army contract!"

Foreign and International Agriculture

To supply information on agricultural research and practice in other countries, brief abstracts of articles in foreign publications are given here. Due to space limitations, only articles of general fundamental interest are included, although the publications may contain other articles and reviews.

Die Ernährung der Pflanze, Vol. 36, No. 8, August 1940

THE FORMATION AND TRANSFORMATION OF SOILS IN THE MOIST TROPICS. *By H. Kuron, Soil Science Institute, Berlin, Germany.*

The author discusses in some detail the various factors that determine the kind of soil produced in a given location. It is stated that the process by which rock is transformed into soil consists essentially of only a few subprocesses, regardless of the highly variable conditions existing in various parts of the world. The first of these is the decomposition of the labile aluminosilicates in the stones. The second subprocess is the addition of organic matter of one kind or another to the decomposed rock material. The third process determining the character of the soil is the rearrangement of the component soil materials under the influence of various outside forces prevailing in the locality. The time during which these processes act is also an important factor in determining the character of the soil.

INVESTIGATIONS ON THE AMINO ACID CONTENT AND THE SUSCEPTIBILITY OF POTATOES TO VINE AND TUBER ROT (PHYTOPHTHORA INFESTANS DE BY). *By F. Alten and H. Orth, Lichterfelde Agricultural Experiment Station, Berlin, Germany.*

Experiments and practical experience had shown that potatoes lacking potash were especially susceptible to infection by Phytophthora infestans. The action of the potash appeared to be somewhat indirect, in part at least, since nitrogen relationships in the plant seemed to be a factor in the development of the organism, which used the nitrogen compounds in the plant as its source of this nutrient. The authors analyzed variously fertilized potatoes in order to obtain further information on these relationships. The tubers were inoculated with the organism and grown with no fertilizer treatment, a nitrogen and phosphorus fertilization, and with three rates of potash fertilization in addition to nitrogen and phosphorus. Three series with such treatments were grown, one with manure in addition to the mineral fertilization, another with lupine green manure and fertilizers, and the third with only the fertilizers. The tubers showed greater rotting due to the organism when potash was omitted from the treatment. The differences were greater when no manure or green manure was used.

After harvest, the tubers were analyzed for total nitrogen, non-protein nitrogen, protein nitrogen, and alpha amino acid nitrogen. As the potash fertilization was increased, the non-protein and amino acid nitrogen decreased, and infestation with the Phytophthora organism likewise decreased. The higher potash fertilization, by decreasing the easily decomposable amino acid nitrogen, reduced the nitrogen available to the organism and limited its development.

Plants grown in nutrient solutions showed the same relationship of potash fertilization to form of nitrogen present in the leaf as in the tuber. With very high nitrogen fertilization, however, it was not possible to reduce the nitrogen compounds in the leaf. The relationship of potash fertilization to nitrogen compounds in the tuber, and susceptibility to the organism was found to hold with several varieties of potatoes.

THE ACTION OF SOME COMPLETE FERTILIZERS ON ANNUAL FLOWERS. *By Dr. Vogel, Weihenstephan, Germany.*

While the soil is of great importance in the growing of flowers and ornamentals, the use of fertilizers to improve its fertility is finding increased acceptance among growers. To obtain further information on the response of plants to fertilizers, four ornamentals were grown with five different fertilizers. The plants were aster, zinnia, snapdragon, and salvia. The fertilizers were Albert's Flower Fertilizer, amsupka, nitrophoska, new hakaphos and old hakaphos. The plants were grown in pots. New hakaphos and nitrophoska produced the best general plant development and flower. The fertilizers not doing so well in some cases seemed to have too high a salt content, in some cases too little phosphoric acid, and in others too little potash.

Soils and Soil Management

(*A Book Review*)

A NEW addition to the literature on soils is A. F. Gustafson's book, "Soils and Soil Management" (McGraw-Hill Book Company, New York, N. Y., 1941. $3.00). This volume covers the whole field of the subject indicated by its title, including the formation and properties of soils and their management and fertilization.

Following the introduction, in which the fundamental importance of soils to our very existence is brought out, the first chapter tells how soils are formed and gives the various agencies instrumental in producing different kinds of soil. A typical soil profile is described, using the modern nomenclature. The second chapter discusses the physical properties of soils under sections devoted to particle size and characteristics, weight of soils, and soil temperature and factors influencing it. The next chapter is devoted to soil organisms with most attention paid to the microorganisms. Chapter four deals with organic matter and factors influencing its gain and loss.

Soil moisture takes up the next two chapters. The form, movement, amounts of water and its influence on certain soil properties, the use of water by plants, gain and loss of water by the soil, drainage, irrigation, and dry-land farming are covered. The seventh chapter is devoted to tillage in its various aspects, with several types of equipment described and illustrated. The following two chapters treat in some detail soil erosion and its control, utilizing to advantage the latest work being done on this important phase of soil management. Soil acidity and its control by liming is the subject of the tenth chapter. In this the significance of the pH scale of acidity, methods of determining the acidity of soils, and the use of different kinds of lime are discussed. The following chapter deals with alkali soils, and tells how they can be handled for crop production.

Most of the remaining chapters are devoted to the various aspects of soil fertility. Chapter 12 considers the nitrogen relationship in the soil. The next chapter covers the importance and utilization of farm manure in relation to organic matter and the plant nutrients it furnishes, while chapter 13 rounds out the organic matter picture with a discussion of green manure and cover crops. The next two chapters deal with commercial fertilizers, giving brief descriptions of the composition, origin, and mode of production of most of the important nitrogen, phosphorus, and potassium fertilizer materials, the principal functions of these nutrients, the mixing of fertilizers, and methods of application. The secondary and trace elements in fertilization are touched on. The rotation of crops takes up the seventeenth chapter and the following chapter brings together the teachings on soil fertility maintenance. The final chapter is devoted to peat and muck soils, their origin, and management.

As will be observed from the contents of the book, it covers a broad field. With such a wide scope it was necessary to omit much detail. The result is a book of a rather general nature. Numerous references given through the text will enable the student or reader to obtain further information as desired.

The subject matter is presented in a clear manner so as to be easily understood. The practical aspects of soil management have been stressed over the purely scientific phases, although fundamentals rather than mere rules of thumb are given. The author has called on his extensive experience as teacher and writer to prepare a book well adapted to the needs of a general course in soils or as a general reference.

Some Early Experiences With Fertilizer

(*From page* 14)

any slow acting form of nitrogen should be avoided, or used very sparingly.

Contrary to the effect of organic nitrogen, applications of potash seemed to have a most beneficial effect in building up an immunity in apple trees against attacks of this disease. On examining apple orchards where this disease was prevalent, a few trees would be found growing near the houses that were practically free, if not altogether free, from this trouble. On inquiry I invariably was told that the wood ashes from the houses were scattered around the nearby trees.

In the City of Vancouver, I examined several apple trees growing in a residential plot which, from the numerous scars visible but healing over, showed evidence of having suffered severely from this anthracnose a number of years before; one tree particularly so. At the same time it was evident that there had been no recurrence of this trouble for several years. My curiosity being aroused, I asked the owner for an explanation. He told me that some years ago all of his trees were in a bad way from this disease, particularly the one I had observed as having been so much worse than the others. At that time he had considered this one hopeless and thought it would have to be dug out, but as luck would have it he obtained some potassium nitrate, a 13-0-42, and began using it as a fertilizer. The disease apparently was checked the first year the application was made and there had been no recurrence since. He could not attribute the recovery that had taken place to anything but the potassium nitrate used, as no other fertilizer had been applied, and the trees had not been sprayed. Outside of the fertilization the trees had received no change in care.

The above example so strongly indicated the value of potash in building up a resistance to this disease that further proof seemed to be well worth seeking. On examining other apple orchards, where potash had been applied for the first time, evidence was found indicating that this disease was already showing distinct signs of being checked. However, it was also noticeable that where heavy applications of stable manure or fish had been made they seemed to offset the beneficial effect of the potash.

I was soon able to obtain further and convincing proof of the efficacy of potash in controlling this disease. My work took me across the line into the

State of Washington, and I learned that their Horticultural Commissioner, Mr. Van Volkenberg, in carrying out tests with potash and lime to determine their effect in controlling this apple tree anthracnose, had met with marked success. He had also issued a bulletin covering his work. Unfortunately, although I endeavored, I failed to meet him and get information regarding his findings at first hand. Better luck awaited me in the town of Puyallup where I met Mr. Paulhamus, then president of the Puyallup Berry Growers Association. He told me that his two apple orchards which were in a bad way from this disease had been completely cured by Mr. Van Volkenberg through the use of potash and lime as a fertilizer. Mr. Van Volkenberg also condemned the use of organic manures in apple orchards, as nitrogen in such forms certainly aggravated this trouble by creating a condition in the trees favorable to its attacks.

In British Columbia up to this time no tests had been made with lime to determine its value in controlling this disease in apple trees. Potash used alone seemed to be all that was necessary. At the same time the good effect noted from wood ashes would indicate that lime, too, might be of value.

When I left British Columbia to take up my work in California again, the value of potash in building up immunity in apple trees against this bark canker was so well established it seemed that this information must spread and be applied widely, but unfortunately such was not the case. Fully 20 years later I had occasion to again visit the State of Washington and the Province of British Columbia, but with the exception of Mr. Paulhamus, who was still president of the Puyallup Berry Growers Association, I could find no one who seemed to have any knowledge of the work accomplished by the use of potash in combatting this apple tree anthracnose. Mr. Paulhamus not only corroborated the statements he had made 20 years before, but was still firmly convinced that potash used as a fertilizer did create an immunity in apple trees against the ravages of this bark canker. Furthermore, he was so impressed with the value and need for potash in the growing of other fruits that he was strongly advising berry growers in his organization to use a complete fertilizer containing 10% potash on their berry crops.

Soil Productivity in the Southeast

(*From page* 22)

are blessed with one of the most favorable agricultural climates in the world. Why should a land with such an abundant spring and early summer rainfall be faced with the insufficiency of soil moisture to the extent that the Southeast is? The answer has already been given. Our sandy Coastal Plain soils and clayey Piedmont soils have such low water-holding capacities that almost every season inestimable damage is wrought by lack of sufficient soil moisture. For a crop with a relatively high water requirement, such as corn, only our lower lying areas with sufficient organic matter to afford water-holding ability are suited to supply the necessary water throughout the average growing season.

In addition to low water intake, low water-holding capacity, poor aeration, and lack of adequate energy and active calcium and magnesium to support the necessary biological processes, many of our Piedmont Plateau soils possess undesirable physical characteristics, even to such an extent as to somewhat limit proper root development, especially at depths of 7 to 12 inches where the soil may be so impervious as to limit root extension both as a physical barrier and by affording insufficient aeration to support respiration in the cells of the growing root tips. Thus, we do not have to extend our consideration of cultivated soils very far, especially in conjunction with practical agricultural knowledge, to clearly realize the immense importance of factors other than those directly concerned with nutrient supply.

The fertilizer industry has done much toward solving problems and furnishing valuable information relative to the supply, availability, and application of plant nutrients. In addition, the state experiment station workers have devoted major attention to these and related factors. Naturally, we are more advanced as a whole along these lines today than we are along certain other fundamental lines, such as those referred to above.

It is obvious to most agricultural workers in the South that under the conditions of the average farmer the returns from commercial fertilizers, per dollar invested, are below what they should be, not so much because of the kind or quality of the fertilizers, but more because of the limitations placed upon the productivity of soils by these other factors. It is well known to most farmers that to produce a half-way respectable yield, some sort of fertilizer must be used. Though this may be but two or three hundred pounds per acre of a relatively low analysis, they know that it will pay them to use it. If twice as much were used, the return per dollar invested could well be twice as great, but if this quantity were again doubled, a corresponding return on the investment would certainly not be forthcoming under most farming conditions. An adequate response to heavy fertilization can not result mainly because of the limiting physical and biological factors, and not because of insufficient nitrogen, phosphorus, or potassium. If these limitations can somehow be removed, or at least remedied, then in all likelihood it will not be unreasonable to expect the average farmer to secure greater profits from his fertilizers, even beyond the levels of application in pounds per acre of nutrients which he now considers to be unreasonably heavy.

Despite current efforts to control agricultural production through controlling acreages planted to important crops, modern man has always, and always will, strive to produce larger and more economical yields per acre. His main desire is naturally to do this ever more economically. If he cannot produce even normal yields economically, then should not more effort be made to reach this goal than is being made? As has already been stated, the average yields of corn and small grains in the South can not be considered as normal in relation to the national average. This is all the more reason why we should become more desirous of putting our agriculture on a more prosperous basis.

A Program Needed

We should endeavor to devise and undertake some sort of a state-wide educational program of intensive character designed to enlighten our farmers regarding the nature and importance of some of the fundamental problems which place untold limitations upon them. It is true that since the advent of the Soil Conservation Service and the Tennessee Valley Authority, many farmers touched by these organizations have come a long way toward realizing the importance of legumes, lime, and superphosphate, and are without doubt better off today than previous to the advent of these advocated practices.

If we could in the near future undertake a campaign to reach the average farmer of the South, taking advantage of the experience gained by the above and by our state organizations, it is not unlikely that in six to eight years the South, as a whole, would begin to realize far reaching results. Under the present set-up it will be a much longer time before the "average" farmer is directly or perhaps indirectly benefited.

In this improved agriculture most farmers would have some appreciation of lime and magnesium, of fixation and availability of potash and phosphoric acid, of cover and green manure crops, of organic matter, of biological activity, of water intake and water-holding capacity, of aeration in root development and biological activity, of the importance of minor elements, of the low nitrogen level maintained by nature in this climate, of rotations, of improved varieties, and diseases and insect control, as well as of methods and rates of applying fertilizers and of the use of adequately balanced and higher analysis fertilizers.

Garden Most Valuable Acre on the Farm

(*From page* 18)

each year. This plan will permit the rotation of the crops and avoid the repeated planting of any crop on the same space.

A third point in the soil-improvement program should be the application of moderate quantities of commercial fertilizers. From 300 to 500 pounds of a good grade complete fertilizer may be profitably applied to the average farm garden of one-half acre. This material may be broadcast just before the soil is disked, or it may be placed under the rows and thoroughly mixed with the soil before planting. Different crops vary greatly in their fertilizer requirement, but a complete mixture containing 3 to 5 per cent nitrogen, 8 to 10 per cent phosphoric acid, and 6 to 8 per cent potash will be satisfactory for general application, results from the College experimental garden showed.

Garden use of commercial fertilizers has taken a new trend in Tennessee in recent years. Not only is it now felt that generous use of commercial fertilizers will release manure for application elsewhere on farms, but that a surplus of fertilizer plant foods beyond what plants actually need for their own growth is by no means a loss. Phosphorus and lime, when in excess in animal foods, have produced added growth in animals, and it is supposed they may do the same for humans when present in garden vegetables. Potash, when in short supply in garden soil, may be supplemented from commercial sources with expectation that improved growth of many vegetables will bring better food values for farm families. Extension workers in Tennessee are calling attention not only to more food from the garden, but to food richer in the minerals needed for strong bodies.

Another conclusion drawn from the experimental garden is that crops should be arranged in such a way that the space will be used efficiently and yet so that the soil preparation, planting, and cultivation can be done most conveniently. To accomplish this the following group plantings, based on experimental garden results, are recommended:

1. Quick-maturing vegetables—planted in early spring: Lettuce, kohlrabi, cauliflower, peas, radishes, onions (green), spinach, mustard, turnip greens, etc.
2. Long-season crops—planted in early or mid-spring to remain during summer: Irish potatoes, cabbage, beets, parsnips, salsify, carrots, and onions (dry).
3. Crops tender to frost—planted in late spring or early summer: Corn, beans, sweet potatoes, tomatoes, cucumbers, peppers, lima beans, okra, peas (dry), eggplant, pumpkins, etc.
4. Fall crops—planted in late summer or early fall to mature during cool weather: Turnips, mustard, kale, Irish potatoes, and turnip greens.
5. Perennial crops—planted in spring to remain for several years: Asparagus, horseradish, rhubarb, onions (multiplier), parsley, etc.

With proper care the crops may be arranged in such a way that a considerable space can be prepared and planted at one time, and they will mature so that the area can be worked and another crop planted in the same place. This practice is known as succession planting, and is very desirable in the garden if the soil is fertile, abundantly supplied with humus, and in good physical condition. It prevents the discarding of some parts of the garden after a crop has been harvested and weeds from producing seeds to give trouble in the future.

One of the most important factors in the production of any crop is good seed. Of course, good seed is no guarantee against failure if cultivation is neglected or if the weather is extremely unfavorable, but the use of poor seed makes success almost impossible under the best conditions. For the home garden the necessary plants, such as cabbage, tomato, pepper, eggplant, etc., can be economically produced in a hotbed. In this way they can be made available at the proper time and can be set into the garden with best chances of success.

There are numerous methods in common use which help to control insects and diseases in the garden. Many of these practices have only an indirect effect but they are of great importance. For example, fall-plowing exposes to the extreme winter weather many insects which have been harbored in the soil, and results in their destruction. An important rule in the avoiding of many plant diseases is crop rotation; that is, the same crops should not be planted year after year in the same place.

One of the most important methods of avoiding serious trouble from pests in the garden is the careful destruction of all refuse and the thorough cleaning up of fence rows, terraces, and any other cultivated land immediately around the garden. In this way insects, which are passing the winter in the trash on these neglected areas, will be destroyed, and trouble from such insects as the Mexican bean beetle, Colorado potato beetle, and harlequin cabbage bug will be greatly reduced.

The turning under of organic matter of all kinds, including the remains of crops, is frequently recommended for increasing the fertility and improving the mechanical condition of the soil. However, in the garden these crop remains may frequently carry diseases which will be a menace to future crops, and, therefore, it is a good rule to rake off and burn all of the crop remains in the garden. A very small quantity of manure or a good commercial fertilizer will do as much good as would these crop remains without the danger of carrying important diseases.

Indiana's Latest Tomato Champions

(*From page* 20)

by any Indiana grower) makes these boys champions.

Their tomatoes were grown in one corner of a 63-acre field. In 1939, this field was in clover, pastured by hogs; in 1938, in wheat; and in 1937, in corn. There were 6 loads of manure per acre spread on this field and after it was plowed April 1, two tons of lime were broadcast on it. Just before the plants were set, 500 pounds of 2-8-16 were applied per acre. Arkansas plants, grown from Indiana Canners Association Certified Seed, were set in rows 3′6″ x 3′6″.

The tomatoes were cultivated twice with a two-horse cultivator and once with a one-horse cultivator. It has been said there was never a chance for a weed to get started, for the boys were always in the patch with their hoes. They, with the help of one neighbor boy, did all the picking.

The accomplishments of these youngsters will make the "oldsters" step lively just to stay in the running.

Synthetic Wood Ashes Require Boron

(*From page* 9)

the main to their boron content. Several field and laboratory trials, the results of which are shown in Table 4, bear out this contention. Replicated field plots of alfalfa were established on a Colton sandy soil to which lime, superphosphate, potash, and boron were applied in order to make, as it were, synthetic wood ashes. Commercial Canadian hardwood ashes, sown at 2- and 4-ton rates, were compared with their chemical fertilizer equivalents of hydrated lime, 20% superphosphate, muriate and sulphate of potash (half and half), with and without borax (20 and 40 pounds per acre). The yields of alfalfa, measured in 1939 and 1940, are shown in Table 4 and Fig. 3.

TABLE 3—BORAX IN WOOD ASHES

Origin	Borax per ton*
	lb.
Ontario, Canada	10.0
Ontario, Canada	14.3
Stowe	15.0
White River Junction	15.7
Franklin	15.7
White River Junction	15.7
Newport	17.9
White River Junction	17.9
White River Junction	19.4
Canaan	20.1
Newport	20.8
Guildhall	22.2
Beecher Falls	25.8
Guildhall	25.8
Randolph	26.5
Guildhall	29.1

* All samples were dry and unleached.

Borax Increased Yield

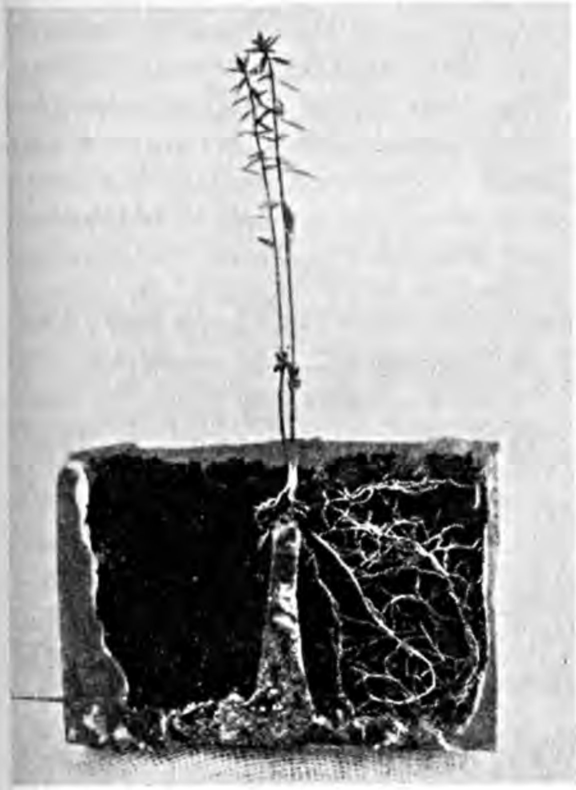
The results show that without borax on this soil ordinary mineral fertilizers were ineffective for the production of alfalfa. In conjunction with borax, however, alfalfa yields doubled with practically all cuttings. Chemical fertilizer with borax was even superior to wood ashes. This is at present unexplainable unless it is due to a higher availability of the applied elements in the fertilizer. When 40 pounds of borax per acre were applied, the yield

TABLE 4—THE EFFECT OF HARDWOOD ASHES, AND THEIR CHEMICAL FERTILIZER EQUIVALENT WITH AND WITHOUT BORAX ON YIELDS OF ALFALFA

Treatment (per acre rate)	Yield per acre (dry wt.)			
	1939		1940	
	1st cut	2nd cut	1st cut	2nd cut
	lb.	lb.	lb.	lb.
Wood ashes—2 tons*	1,500	1,100	2,900	900
Fertilizer equivalent to 2 tons of ashes	1,300	500	1,700	400
Fertilizer equivalent and 20 lb. borax	2,400	1,400	3,500	1,300
Wood ashes—4 tons	2,600	1,600	3,600	1,400
Fertilizer equivalent to 4 tons of ashes	3,200	1,100	2,800	700
Fertilizer equivalent and 40 lb. borax	4,600	1,800	3,900	2,500

*The commercial Canadian hardwood ashes used contained 1.5% P_2O_5, 6% K_2O, 89% calcium carbonate equivalent, and 10 pounds per ton borax equivalent.

was much superior to that secured when less was used. With borax healthy stands were grown, of which any farmer would be proud, and they still remain dense and green. Furthermore, the borate-fertilized second crop, which was allowed to go to seed in 1940, produced more than 35 times as much seed as the unborated. This appears to be an outstanding, even though preliminary, finding.



Most discouraging results were secured when borax was omitted from the fertilizer. The terminal leaves of the alfalfa plants were yellow and bronze colored, especially in dry weather; the plants blossomed defectively, failed to set seed, and even grew more sparse. These results are leading to further field trials in cooperation with farmers who wish to grow alfalfa seed but who have had innumerable failures.

Four more alfalfa field plots were established in the spring of 1940 to test borated and non-borated fertilizers (borax at 30 pounds per acre). Counts already indicate legumes to be one-third more dense where borax was added to the fertilizers. One of the plots is located on a clay soil where such favorable responses were not expected.

Boron is therefore an important crop-producing constituent of synthetic wood ashes, being in terms of alfalfa growth almost as essential as lime, phosphate, and potash. Its absence explains the failures from the use of these other three essentials. On this crop, which is

Fig. 4. An extreme case where boron is required —flax plants grown in a divided paraffin pot on an A_0 podzol soil. Both halves were slightly overlimed and abundantly fertilized with N, P, K. The right half received borax (50 pounds per acre); left half, no borax. Liming this organic soil to neutrality or slightly above causes it to fix large amounts of boron in a form unavailable to plants. In the high-fixing borate free media (left), roots failed to develop or even venture forth to obtain the other plant food present. The cause of borate fixation is more fully explained in Vermont Station Bulletin 460.

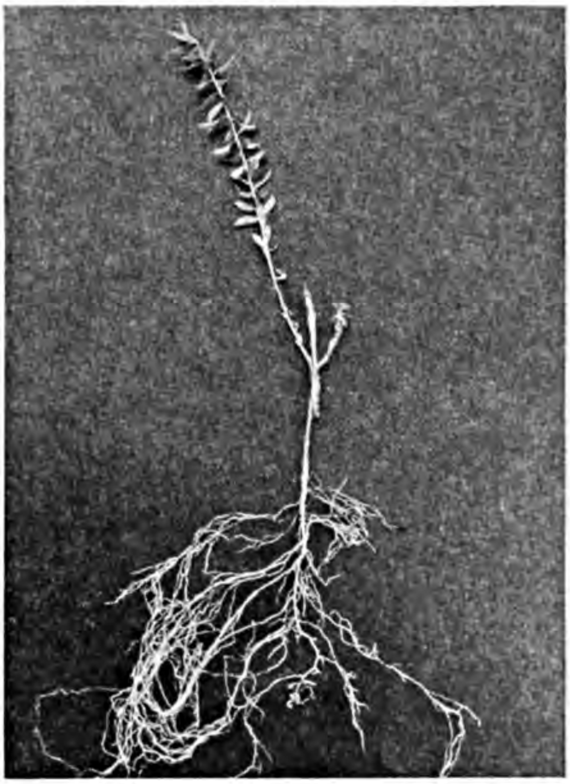


Fig. 5. A flax plant recovering from severe lime induced boron deficiency. When grown on a heavily limed podzol soil, it developed necrotic, yellow terminal buds, three short multiple branches, and a single stubby root (see main root in the center of the picture). After borax was applied to the aerial parts as a spray and to the roots as a solution, the plant was actually resurrected from the dead, producing an abundance of side roots and a normal shoot from one of the three branches.

recognized to have a high boron requirement, the need for borax in Vermont appears to be growing more acute If it is not used, the stands will fail. In fact, its lack explains why many stands have failed shortly after seeding and why others have failed where once good stands existed. In supplying the abundance of lime which alfalfa requires, farmers unwittingly have induced and aggravated a serious boron deficiency on soils already low in boron, which then spells doom for all legumes they sow. (Figs. 4 and 5.)

Boron is known to be essential in Vermont apple orchards and may also be essential in the field for other lime-loving plants, such as red clover, field and garden beans, tomatoes, lettuce, beets, cabbage, and spinach (See Vt. Sta. Bul. 460). Borax may be effectively spread on the surface of the soil in granular form; but since there is much danger of burning the foliage if too heavy applications are made, farmers should consult their county agents before attempting to use it. The writers suggest that chemical fertilizers made for use in Vermont, northeastern New York State, and probably other New England States, be enriched with small amounts of borax. Perhaps a borated superphosphate would answer this need as it does in some foreign countries.

Florida's Everglades Can Grow Good Cane

(*From page* 11)

at the bottom bring approximately 117 pounds P_2O_5 into use each year, and this will continue so long as subsidence continues. This yearly supply of 117 pounds P_2O_5 would answer, provided it is all available, for a yearly crop of 78 tons mill cane.

Those who do not care to accept this reasoning may find solace in the explanation for large crops on peat soils deficient in phosphate offered by Hilgard, who recognizes such cases of excellent plant response on peat soils which are deficient in certain elements. His explanation fits conditions obtaining in the Everglades peat to a tee when he says, "Large quantities of organic matter offset low phosphoric acid, which is, on the other hand, rendered inefficient by much ferric oxide. Generally phosphoric acid less than .05 per cent indicates deficiency, unless much lime is present" (2).

As a matter of interest regarding ferric oxides, an average of 1,547 mainland mineral soils shows the presence of 33.4 tons per acre 6 inches (3). For our sawgrass peat, total ferric oxide is found to be 2.1 tons per acre 6 inches (3). From this one might judge that ferric oxide is present in such relatively low amounts as to interfere but little with efficiency of the phosphoric acid in our sawgrass peat, and at the same time the high organic content clearly offsets any phosphate deficiency in the matter of vegetative growth.

This new country began settlement about 1910, the first settlers penetrating inland by boat and taking land on a narrow ridge bordering Lake Okeechobee. This border, amounting to some 10,000 acres, is now classified as custard apple muck, a name taken from the trees originally found growing thereon. This peat is more plastic and of higher ash than is the sawgrass peat, and from the first, excellent crops of truck and cane were grown upon it. In fact, so luxuriant was the cane growth that observers, thinking peat is peat, arranged for a sugar house which was in shape for grinding the crop of 1924.

It so happened that a large portion of the land in the hands of the sugar company was sawgrass, the custard apple already planted would not begin to supply the mill during the season.

To expand then meant a large planting on sawgrass peat. These plantings came to poor stands, with surviving stools stunted as though seriously diseased. Crop prospects on such sawgrass peat appeared so discouraging that extension of the enterprise appeared ended. Extending on custard apple peat seemed out of the question, as the great bulk of it had been taken up by independent farmers who found the revenue from truck crops such that if purchasable at all, it would be at exorbitant prices.

About this time, a few truckers who had extended their plantings to the marginal sawgrass peat noted that truck crops improved through successive years, where bordeaux mixture had been used on previous crops. "In 1924 Director Wilmon Newell made a series of pot experiments using manure, garden soil, lime, gypsum, copper sulfate, superphosphate, potash, and other materials, testing them by the growth of Brabham cowpeas. In these trials best growth and vigor of the plants were secured following the application of copper sulfate, followed somewhat closely in the order named, by sulfate of potash, hardwood ashes, and manure" (5). These findings were later confirmed by field tests instituted and still preserved in original form, though replanted to superior cane varieties bred at this station since 1930.

Potash Effective

The effect upon cane of potash and copper applied to sawgrass peat soil is shown in the illustrations. These are of second stubble F 31-962, the one on peat receiving copper alone, the other adjoining in the same series showing the effect of potash with copper sulfate.

To be complete one should be able to show cane growth resulting from potash alone, which from experience is known to be even more restricted than from copper alone. After photographing, the cane was cut as for mill, the weight from copper alone indicating a yield of 13.3 tons per acre, while the copper and potash plots had a yield of 39.28 tons mill cane per acre. This is not yet the whole story.

Can there be any influence on juice quality attributable to the use of potash? Canes from the above plots were milled and the juices analyzed immediately; that from copper fertilization showing on a 78 mill extraction a 96 test sugar recovery of 183 pounds, that from copper and potash 215 pounds per ton, a difference of 32 pounds per ton in favor of the potash-copper treatment. In sugar per acre this stands at 1.2 tons from cane grown on land treated to copper only, and 4.17 tons when potash is used with copper.

In the above test, potash was applied at the rate of 300 pounds per acre. Commercial applications average around 200 pounds per acre. There seems to be ample evidence that the 200 pounds are close to the economic limit of use. Calculating a removal of 2.2 pounds K_2O per ton of mill cane, a 40-ton crop would carry away 88 pounds. One hundred and eighty-three pounds of 48 per cent goods would furnish this, and the 200 pounds would give 8 pounds to spare. Thus the original content per acre 6 inches, totaling about 1,000 pounds with 60 pounds exchangeable, need not be touched except in cases of yields exceeding 40 tons of mill cane.

(1) Aarnio, B., 1927. Influence of Absorbed Ions on Soil Reaction. First Ing. Cong., Soil Science, Vol. II, Comm. 2, pp. 65-76.
(2) Hilgard, Soils.
(3) Burgess, Hawaiian Sugar Planters Assn., Agric. Series Bul. 45.
(4) Analyses of soils made at this Station by Dr. W. T. Forsee, Jr.
(5) Allison, R. V., Bryan, O. C., Hunter, J. H. Bul. 190, Univ. of Fla., 1927. The Stimulation of Plant Response on the Raw Soils of the Florida Everglades Through the Use of Copper Sulfate and Other Chemicals.

Thanks for reading and making suggestions are extended to Drs. J. R. Neller and W. T. Forsee, Jr.

Three Out Of Four Corn Growers Use Fertilizer

RECORDS of 1,813 of Indiana's best corn growers, whose yields were checked in the Five Acre Corn Club last year, show that three out of four growers reporting used fertilizer on corn. These are the men, say the agronomists of Purdue University, who are making a special study of the best practices to follow in successful corn production in this State, and what they do may be taken as a safe guide to follow. The percentage of Five Acre members who use fertilizer on corn has increased each year from a low of 36.3 per cent of the growers in 1933 up to 74.3 per cent in 1940.

Another point on which these good corn growers seemed to be in general agreement was that of the best method of applying the fertilizer for corn. Last year 99.9 per cent of the growers applied all of their fertilizer in the row or hill through the use of a fertilizer attachment on the corn planter. In most cases the fertilizer was placed in bands on either side of the hill or row and not actually placed in with or directly above the seed. Ten years ago many of the growers applied all of the fertilizer broadcast, or part in the row and part broadcast. But the rapid improvement in equipment for applying fertilizer near the row or hill, without injury to germination, has brought farmers to adopt this method of placement.

Another change that has taken place in the matter of using fertilizer as practiced by Five Acre Corn Club members has been in the analyses used. In 1931, 68 per cent of the growers used complete fertilizer for corn and 30 per cent used phosphate and potash mixtures. Last year these figures were practically reversed when 27 per cent of the growers reporting used complete fertilizer and 70 per cent used mixtures of phosphate and potash. Evidently these good growers are becoming convinced that nitrogen in addition to phosphate and potash for row application is not the most profitable.

Growers are in rather general agreement on the amount of fertilizer to apply in the row or hill for corn as 75 per cent of them used 100 pounds per acre or less, 21 per cent from 101 to 150 pounds, and the remainder 151 pounds or more per acre.

Almost all growers reported increases in yield from the use of fertilizer, the average estimated increase being 12.3 bushels per acre.

In addition to the increase in yield, growers were almost unanimous that fertilizer advanced maturity of the crop and the average estimates were 9.9 days earlier.

Practices Compared

How do these practices of farmers compare with results of experiments conducted at Purdue? In a fertilizer experiment conducted on the Soils and Crops Farm near Lafayette, for a period of seven years, it was found that fertilizer was most efficient and yields greatest when both fertilizer and corn were hilled. Broadcasting all of the fertilizer for corn was the least efficient method of application. Drilled corn gave larger responses to drilled fertilizer than hilled corn. To obtain the same increases in yield from fertilizer on drilled corn as on hilled corn, it was necessary to double the rate of application. The most profitable treatment was from 63 pounds of fertilizer applied on both sides of the hill, which gave an average increase of 14.5 bushels per acre. Although 125 pounds of fertilizer in the hill gave only slightly greater increases than 63 pounds, it should be pointed out that the smaller application did not compensate for the extra plant food removed by the increased production.

Large numbers of experiments conducted throughout the State over a period of years show no increase for the usual application of nitrogen in addition to phosphate and potash when applied in the hill or row.

On the basis of information now available, it is recommended that a fertilizer containing both phosphate and potash is best under most conditions. The ratio of phosphate to potash will vary from a one to one to a two to one ratio, except on the mucks and black sands where the potash percentage should be from two to three times that of phosphate. The amount of fertilizer recommended for hill application, using modern equipment, should vary from 100 to 150 pounds and for row application from 200 to 250 pounds per acre. The use of the quick soil test for available phosphate and potash is a helpful guide to proper fertilizer analysis to use for corn.—*Purdue News Service*.

The Loud Bassoon

(*From page* 5)

with the customers. When an Indian chief gives anything valuable away he insists on having a chance to tell the world how generous he is. Am I less than an aborigine? Must I thrust this Present at the groom without saying, "It's only a slight testimonial of my regard, but I hope you'll like it!" But as he didn't have the consideration to ask me for her in the first place I presume silence is consent with me.

Of course, he might come back at me and claim it isn't simon-pure generosity after all; because according to the unwritten law of matrimony the burden of gewgaws and groceries descends upon the shoulders of the groom. And as I have no dowry to bestow, he could accuse me of looking to the windward on the financial horizon prior to the next tax levy, which, as I am led to believe, will be a levy to end all levies. But if he lands in the selective service before the year is out, I may get my gift back again for awhile—either singular or plural.

PARTS of the precious remarks I intended for the bridegroom may be set down as a means of winding toward the close of this essay. I feel that they may do some of you as much good as they might have done him.

I do not believe that romance should be confined to balmy nights of June or faded knights of heraldry. It ought not be laid away amid crumbling rose petals and beaded slippers just as an old epitaph on forgotten dreams. Speaking as one who has sometimes overlooked sending flowers to the wife on wedding anniversaries, I believe that flowers often are as sustaining to life as groceries. Affection plus recognition with a nosegay is better than affection taken for granted, and nothing else but.

No true woman ever gets beyond the romantic stage, but she hates to have to mark the calendar to remind him of coming marital milestones. I know there is grave danger for the husband in forgetting those occasions, but sudden and unforeseen attacks of romance are apt to make a wife suspicious, so there we are, caught between the horns of a dilemma. Acute romance at unexpected intervals is not so stimulating as the chronic kind that stays with you to the end.

If it is true that all the world loves a lover, it is likewise true that tenderness and constancy in the elderly wedded couples are the best proof of the pudding. When my bride and I went on our honeymoon we saw a grandpa proudly tender a bouquet to his faded spouse. We saw him help her over the rough places and find her a sheltered seat. My little spouse confided in me then and there that she hoped my ardor and devotion would be as lasting on the down grade as when we saw the sunrise on our wedding morn. I have never forgotten that admonition, and she has done nothing on her part to make that sentimental treatment less probable.

Pink cheeks, glowing eyes, and curving figures do not last forever. They are only the tempting preface to the chapters of a textbook of many devious pages, often hard to read and sometimes difficult to understand.

MAYBE the lack of proper hymeneal education in America is the cause of so many poorly mated couples who fail to carry the spark of romance toward their golden wedding day. From the time when adolescents are told that sentiment is "silly" to the time when the judge fixes the alimony, what sort of conjugal curriculum do we provide for maturing youth?

Thus far, next to nothing, except the litter of trash and filth which disgraces the average drug store window. We have experimental colleges and doctors galore in liberalism; we have professors of eugenics and genetics, stressing the biological above everything else like certain conquerors abroad; we have authorities on weight reduction, camp cookery, and hooked rugs—but we lack a complete and intelligent course in things that underlie the making of happy wedded life. Some students matriculate in romance languages and musical harmony, but they are often deaf and dumb to both things after they hasten from the altar.

I am never done wondering, though, how successful and promising so many young married pairs seem to be in the midst of a nation that puts its sentiment in cheap magazines and loads the news with the horrors of war. I think we owe them a heap of credit for going along minding their own business and keeping sweet and dutiful when so much of their preceding generation has gone haywire.

We can't stand up and preach to the young folks about the rigors and virtues of a self-sacrificing era of pioneers, pointing out to them how much they have to cheer them compared to the settlers of the wilderness. That is, we can't do that and keep a solemn face. It won't soak in very far, because the kids know right well that the present era is one of the toughest mix-ups it has been the misfortune of mankind to behold. I honor and reverence the twain who lock arms and start the wedding march amid the roar of impending guns or the uncertainty of economic bombing. It shows that they have the will and the courage to carry on under the banner of love and hope and youth and romance and work, facing the ill wind as calmly as the zephyr, believing that in time the world will come to its senses and the next generation will have lasting peace.

NO, I AM not going to disturb the great day with any such croaking or bemoaning. I shall pull on my pants, yank my tie into fairly decent shape, comb my thinning locks, and brush my coat and vest with extreme care. It will do no good to cloud their glory with any lamentations. They are aware of things that stand in the way to happiness, and they know Mother and I wish them well and had nothing to do with all this conquest and confusion. We are all just straws in the hurricane, hoping to land somehow right side up in some familiar field. This may be "defeatist" in tone but it is not so intended. He who knows his limitations and wants to enjoy his little to the fullest can never be accused of welching. He is merely freshened and prepared for anything that comes, so long as love and romance may live yet a little longer in the Land of the Leal.

And live it will, for no country has a sturdier and a better nourished zest for love and liberty than ours. Its foundations rest upon the home. I shall be proud and happy to help lay the foundation for just one more of many homes that you and you and the rest of you are planning to consecrate in this sweet and serious summer.

Jockey (who has just won the Kentucky Derby)—I just kept whispering in my horse's ear a little poem I made up—"Roses are red, violets are blue, horses what lose are made into glue."

MEMORY

The story is told of the Kentucky colonel who had an argument with the devil. The devil said that no one had a perfect memory. But the colonel maintained that there was an Indian on his plantation who never forgot anything. The colonel agreed to forfeit his soul to the devil if the Indian ever forgot anything.

The devil went up to the Indian and said: "Do you like eggs?"

The Indian replied, "Yes." The devil went away.

Twenty years later the colonel died. The devil thought, "Aha, here's my chance." He came back to earth and presented himself before the Indian. Raising his hand, he gave the tribal salutation, "How?"

Quick as a wink the Indian replied, "Fried."

Liza: "Dey says dat young niggah Exodus Johnsing done got a terrible position wiv de army."

Mandy: "Is dat so? What sort ob position is it?"

Liza: Why, dey says he's done attached to a flyin corpse."

Stern Parent (to applicant for daughter's hand)—"Young man, can you support a family?"

Young Man (meekly)—"I only wanted Sarah."

Little Girl (to policeman): "Can I trust you?"

Copper: "What?"

L. G.: "Can I trust you?"

Copper: "Why, certainly, all little girls can trust policemen."

L. G.: "All right, then, please button my panties."

. . . The preacher finished his sermon with "All liquor should be thrown in the river," and the choir sang "Shall We Gather at the River?"

THE YOUNG FOLKS?

First Old Timer (in a thin, piping voice)—"Say, Lem, ye reckon thar's as much spoonin' going on as thar used to be?"

Second Old Timer—"No, Henry, don't seem that they be."

First Old Timer (after a thoughtful pause)—"Don't quite agree with ye thar. I calc'late thar's just as much of it goin' on, but I 'spect it's a different crowd what's doin' it."

Dear Tom:

Come tomorrow evening sure. Pappa is at home, but he is laid up with a very sore foot. See? Mary.

Dear Mary:

I can't come tomorrow evening. I'm laid up on account of your father's sore foot. See? Tom.

Getting the baby to sleep is hardest when she's about eighteen years old.

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

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

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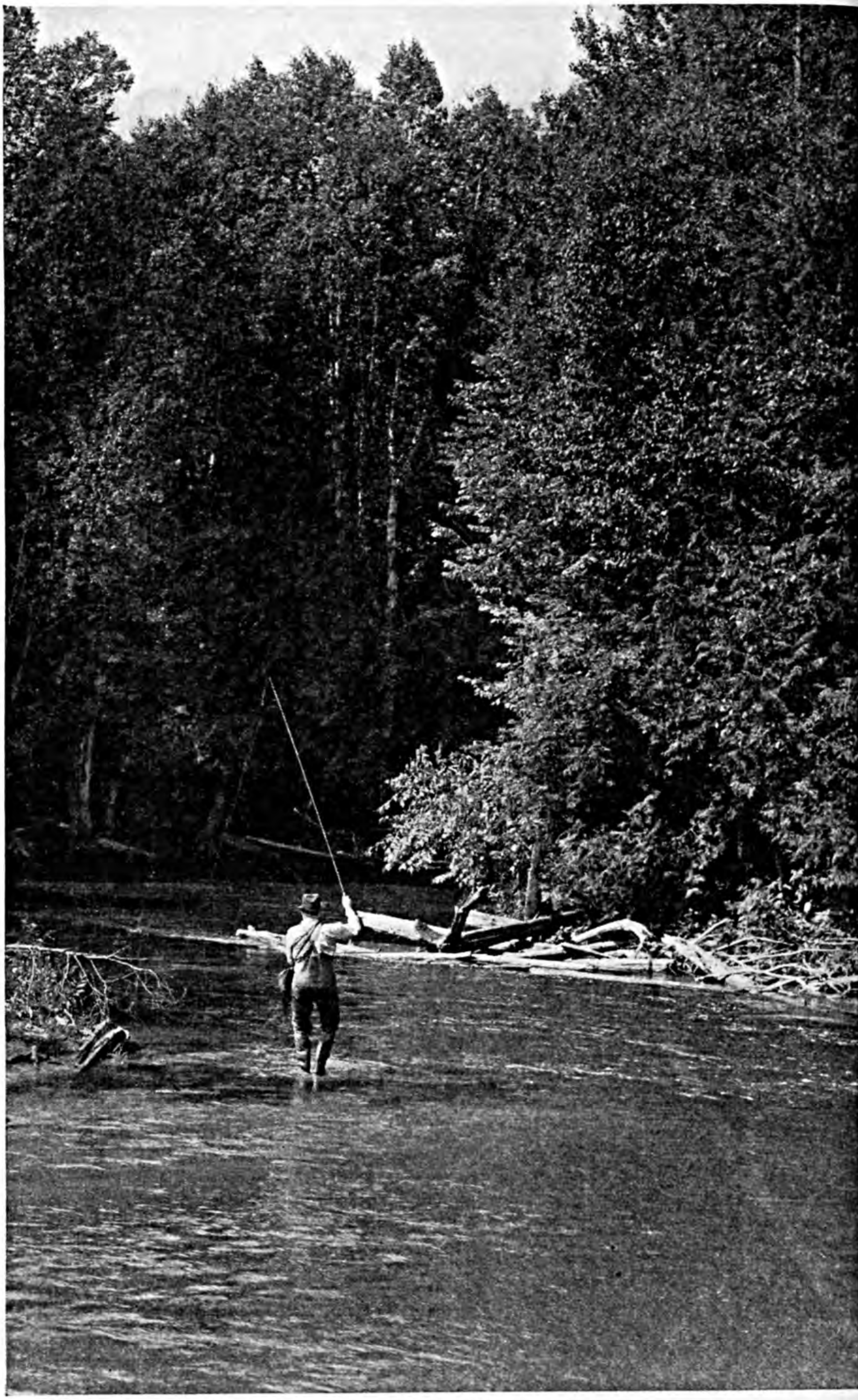

A LAST WINTER'S DREAM COME TRUE

Better Crops with PLANT FOOD

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Vol. XXV WASHINGTON, D. C., JUNE-JULY 1941 No. 6

There is no Lack of—

Corncrib Loyalty

Jeff McDermid

INDUSTRY is being mobilized to beat Hitler; agriculture is being mechanized to beat Hunger; while the precious family-sized farm is being compromised to beat Hades!

And that isn't the only thing that's unsettling my mind either. War scares are bad enough without the weather taking a hand amid giddy boom plans afloat. In some parts of the country we have drenching rains and flooded furrows, and in whole sections of the East we have had parched pastures and dry river beds.

On top of that we have had some places where they complain about having more country-bred folks looking for jobs than the planters know how to take care of; while up in our bailiwick we have just the reverse, sons and brothers hiking away to the cantonments or cannon factories, leaving one tired man to do the work of three hired men (who are as scarce as peace talk in Washington).

All of which sums up to the common opinion among us yokels in the Midwest corncrib country that we can stand awhile to take a tip but we refuse to listen long to lectures. Give us all the current information as fast as the State Department or Mister Wickard's foreign service sleuths can dig it up; tell us what can be utilized quickest and safest. Tell us how to raise it, pick it, pack it, and pay for it maybe; but for gosh sakes leave out that blubber about our being behindhand in foresight and deaf to duty.

For when I scan the remnants of

what were once a set of well-painted farm houses in some of our outlying districts and think what happened to their owners who plunged too hard and bit too deep into the tempting golden apple of World War No. 1—and when I think how hard some of us worked in the original AAA to salvage some of the ruins of the other fiasco—then it makes me too turbulent to take a lecture course on democratic obligations.

It doesn't set well with chaps who get their mitts calloused doing four men's work from dawn to darkness, especially when there's a plant with communistic labor bosses thumbing their beaks at E Pluribus and all the other Unums; demanding a dollar an hour and two times two for overtime, with scented soap and initialed towels in the lavatory.

IT isn't a case of our loyalty out here either. Anybody who knows us knows that anyhow. But we don't propose to have our loyalty made into a personal liability while some other citizen shirks and turns his loyalty into personal luxury. I speak for hosts of the reputable yeomen of the silo belt. They don't seem to have the ear of these fancy columnists, so somebody has to ladle it out for them where it will be understood and do the most good.

To begin with, we of the hinterlands beyond the mountains know pretty well what it's all about, at least almost as much as some of the high-toned argufiers on the radio who have no direct burdens to bear in solving the situation. We love America because we helped to make it worth loving. Or leastwise plenty of our parent stock had a horny hand in taking it away from the Injuns, ventilating and fumigating it, and finally plastering it with mortgages during the other war boom.

We've lived so long with irksome interest and toxic taxes that we even love the banker and the assessor, because they are part of the scenery and furnish the main incentive to keep on plowing. We are just as much sold on liberty as any high-priced guy in the magazines, although not very articulate about the why and wherefore, or whether we deserve to keep it.

Yet that doesn't make us want to sit down and ruminate about it, for we hire the cattle to do that for us. We lack the stomach for ruminating, as it were. We can do better at dusting around and flaxing things up lively.

WE like to take our liberty in more natural doses. It means going fishing where the trout jump in the brooks; going cooning with trained hounds; tearing around the bases in Dad Hunker's pasture; pitching horseshoes over behind the garage; taking Nelly for a flivver ride; raising tea roses in the back garden near the turnips; and going to anybody's church with a welcome sign on it. We practice what we preach out here where liberty's roots strike deep. We prefer it to regimentation or goose-stepping and want the next generation to have its share without robbing some other fellow of his.

It's sort of bred into us like our nasal twang and our nervous temperament. Being dedicated daytimes to professional patriotism and then worrying all night about whose wolf is going to get Grandma's government—it hasn't come to that pass in our parts yet. We figure that a cuss with frazzled nerves isn't much good defending anything that deserves holding onto. We feel that the more we make love to America the more we're going to be willing to sock the first interloper who insults her. And if we fill all the waiting war orders between now and the zero hour, there's going to be ample outdoor exercise to keep us trim and tough.

If you think we can't get tough, scan the list of volunteer wars we've "fit in" since the ox teams toted us out here. We don't need any senators to egg us on, because it will take three of them to hold us back when we get started.

Neither it is a bad case of isolation with us. For history shows we sent heaps of lads to Mexico, Cuba, the

Philippines, Manila Bay, and left a few of them in the Argonne Forest too, to say nothing of Archangel and such foreign parts. Our homeopathic boxing matches have taught us the value of a long reach plus a first punch. We can drop that "ism" out of the picture entirely.

In fact, most of us refuse to wear badges with anybody's "isms" stamped on them in this crisis. We refuse to follow any upstarts who intend to make political capital out of prejudice or

ignorance. But while we keep still on those "isms" and saw wood, we would like to rear up and smite the traitors who turn liberty into license. For even free speech can get tolerably expensive.

Having disposed of isolation and loyalty dope, let's take a kink out of the charges we hear about profiteering and price-kiting by selfish corn-belt operators. They are said to be "holding up consumers with one hand and rifling the treasury with the other for benefit payments."

When I get this far my collar gets so hot it melts. If some folks would be as zealous protecting the consumer in lines other than raw foodstuffs, they might get along faster. So we can start slowly and build it up gently, and eventually like Charlie McCarthy we hope to "mow 'em down."

First off, farm labor is squeezed dry both from the draft and industrial wage offers. Take a map of the Nation and spot the intensive farming regions and then check closely and note that they are often bordered by heavy centers of munitions or machine manufacture, at least close enough to tempt away hosts of the ablest mechanics we have in agriculture. The exceptions are the deep South and part of the Midwest from Missouri through to the Rockies. But the South has a surplus of home farm help anyhow, and we are talking about the corn belt mostly.

This means that the family-sized farm has dwindled in manpower to oldsters, women, and kids. The milking machine and implement plants are doing the heaviest rush of business in two decades. Corn-belt farmers with less help are forced to buy more new machinery, some of which they would not have tackled in ordinary times because of excessive cost. Maybe some of the new machinery will permanently displace farm hands. But that's not the issue now.

NOW farmers as a whole have no basic, gilt-edged guarantee equal to that pledged to the heavy industries. The farmer makes his machinery investment on faith and hope, plus a little federal market support for awhile. In the absence of adequate protection the farmer is caught with the machinery regardless of the outcome. Unless his prices are sufficiently high to give him and the family a safe return and some spending money, the machinery will get him down, if rheumatism and lumbago don't get there first.

When machinery and other capital investment fasten themselves on a community in a broad and hitherto unheard of scale, the erstwhile owner-operators under inadequate returns may sooner or later become tenants or hired men. Then the same situation as in industrial labor obtains. Factory labor gets indifferent to the income and growth of a plant because the workers have little or no pride that comes with a slice of ownership. Maybe this is the remote cause of their following rebellious leadership. At any rate, we don't like to see it happen to any large segment of our soil workers.

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A typical Vermont pasture where $14.55 spent for a complete fertilizer gave 1,694 pounds more milk per acre.

The Making *of* Better Pastures

By T. H. Blow

County Agricultural Agent, St. Johnsbury, Vermont

FIVE years of work with the agricultural conservation program and two years' land-use studies in Caledonia County, Vermont, have definitely shown problems and progress for the betterment of the hay and pasture land and the general improvement of the agriculture in the county.

Caledonia County lies in the northern part of Vermont and is sandwiched more or less by the Green Mountain range on the western side and the Connecticut River and the White Mountains on the eastern side. Being principally a hay and pasture area, the farmers find themselves in the dairy business, with the job of helping to supply fluid milk to the Boston milkshed. This area formerly produced sheep and beef cattle, but the deterioration of the pasture land necessary for heavy grazing made it impossible for the Vermont farmer to compete, on a large scale, with the Mid-western farmer who had large tracts of fertile open pasture land. The shift to the dairy business meant that the Western farmer would have the job of providing the mixed grains and dairy ration for the Eastern farmer, but it also meant that more grass per acre for hay and more grass for summer pasture would have to be produced.

In producing more hay, the Vermont farmer has done a pretty good job, but pastures have been going bad and are continuing to get worse year after year. With a rainfall conducive to good grass farming, one of the first necessary requirements is no handicap. The county has an average rainfall of 35 inches and the heaviest of this is received during the growing season. The growing season varies from 110 days in the northern part of the county to 120 days in the southern part. The last spring frosts usually occur not later than May 22, and the first fall frosts come around September 25. Thus the dairy farmer has a natural benefit from these factors.

Unified County Developed

For 3 or 4 years the county developed discussion meetings known as agricultural policy groups. These groups were made up of representative men and women from each town, and factors pertinent to successful farm operation were discussed and brought into the limelight. Developing out of these meetings was a unified county, in which every one of the 17 towns agreed to work toward the same goal for certain definite procedures. Town committees elected a county committee which drafted resolutions and offered them to a state and national committee. The result is that in the second year of unified county work, the following phases of educational and practical work are being carried on.

The first phase of work recommended for attention was pasture improvement. The committee felt that during the last 50 years the pastures of Caledonia County have been grazed successively year after year without the addition of any replaceable plant nutrients. This has placed a serious burden on many of the dairy farmers in that they are now forced to feed hay, grain, and green feed during the summer months in order to maintain the milk production of their herds. The old pastures, after the spring growth is over, serve mainly as an exercising ground. Today, it is quite generally recognized that pasture is the cheapest source of protein for summer milk production. Therefore, the dairyman to most efficiently produce milk during the summer months must produce that milk from pasture feed.

Those farmers who have followed

A good dairy farm in Caledonia County. The tillage land in the foreground suffers severely each spring from heavy deposits of lighter soil that wash down from the once permanent pasture shown back of the buildings. Maintaining the pasture sod a few years ago could have prevented this situation.

the pasture-improvement recommendations of the Extension Service realize the value of their pastures and are also receiving substantial returns from the money which they invested in fertilizer materials. The committee feels that the hay and crop land is in a much better state of fertility than it was five years ago because of the improvement practices that have been carried out under the Conservation Program of the Agricultural Adjustment Administration and very definitely feels that the pastures should be given more attention.

Among the recommendations made was one that the Agricultural Conservation Program continue to furnish lime and superphosphate as grants of aid and that they be included for any crop in the rotation except cash crops, but preferably on pasture land. It was also recommended that the payment for the old practice of a 1-2-2 ratio complete fertilizer be revived for cases where it was used on pastures. Recommendations for the setting up of pasture fertilization demonstration plots on different soil types and the conducting of a series of pasture fertilization and management meetings by the county agent were also made. The state and county agricultural conservation committees had already taken action to increase the payment for potash under the 1940 program.

Soil tests in Caledonia County have consistently shown a decided lack of potash not only in crop land, but in hay and pasture land as well. With the continued use of lime and phosphorus, much more efficient results can and will be seen from the use of potash. Caledonia County has been the most consistent user of increased amounts of potash under the program in the State, and one has only to talk with those farmers who have used it to get a good reaction to its benefits. Each of the towns has devoted one meeting to pasture improvement, and the three important factors for better pastures would seem to be built around selection, fertilization, and management. These three go hand in hand, each being only as strong as the others make it.

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Trees planted on the right some 18 years ago are holding this eroding sidehill pasture from further damage. The pasture on the left is still unprotected and will eventually wash down and destroy the tillage land in the foreground. Neither soil or trees will be left.

Maximum yields of crimson clover can be produced with lime, superphosphate and potash.

Plant's Contents Show Its Nutrient Needs

By Frank Moser

Agricultural Experiment Station, Clemson, South Carolina

COASTAL Plain and Piedmont soils in southeastern United States require fertilization in order to maintain a profitable agriculture. These highly leached soils are moderately acid in reaction, low in organic matter, and low in essential plant nutrients, but by and large respond very favorably to proper fertilization. Much attention has been given by research workers to the development of suitable indices for estimating available soil nutrients in order to make as correct a recommendation as possible for fertilizer application for crop production.

Field and pot tests have been the most widely accepted methods for determining fertilizer responses, but were most applicable to respective crops on similar soil types; whereas plant analyses have also been emphasized since the work of Wolff, who clearly demonstrated that plant composition was affected by the nutrient content of the growing medium. More recently rapid chemical tests have come into prominence and are considered by most agronomists as supplemental aids for making fertilizer recommendations, as such tests must ultimately be interpreted in terms of crop yields.

The present tendency is gradually turning to the plant for more definite information as to its nutrient needs. Foliar diagnoses, either as deficiency symptoms or as chemical analyses of dominant nutritive elements in the leaf, have become suitable aids for plant scientists and are considered most valuable when used with definite keys of interpretation. A more practical basis for studying nutritional requirements may be obtained from the plant itself by determining the percentage composition at its maximum growth for such critical nutrients as calcium, phosphorus, and potassium. The amounts of fertilizer material corresponding to such plant analyses can be computed and applied for growth of the respective crop.

Fertilizer recommendations based on plant-food content of crops have been used with much success in old-farming countries of Europe, and since the soils of the Southeast are some of the oldest in the United States, such methods should be applicable to these lateritic soils because they have been thoroughly depleted of their native fertility by erosion and continuous cropping. Consequently, many lateritic soil types have a low productivity rating and many common soil characteristics which necessarily require similar fertilization for identical crops regardless of the soil type.

Numerous Questions Arise

Soil conservation and the much publicized diversification programs recommended for the Southeast have caused a shift from the usual acid-tolerant crops, as corn and cotton, to more close growing ones. Certain legumes have been widely advocated for this section without sufficient attention given to their ecological adaptation. As a result numerous questions have arisen relative to their optimum fertility needs and to what extent either fertilizer or lime can compensate for the changed soil and climatic factors. Experiments were conducted with lespedeza, crimson clover, and winter peas to determine optimum growth by growing these crops at varied pH and fertility levels, while the harvested portions of the plants were analyzed for certain critical elements to determine the nutrient absorption.

That calcium is undoubtedly a limiting element for crop production was exemplified by a recent summary of pH values for South Carolina soils which classified approximately 80 per cent from extremely to moderately acid having pH values ranging from 4.0 to 6.0. The available supply of soil calcium appears to be directly proportional to the pH values since with increasing pH the replaceable calcium content of Cecil sandy loam soil becomes significantly higher as the reaction approaches neutrality.

Additional evidence accumulated for lespedeza emphasizes the importance of calcium for growth in spite of the fact that this crop has been so widely advocated as an acid-tolerant legume. The yields for lespedeza hay show that the optimum pH range for growth was from 6.0 to 6.5 which produced a maximum yield of 40.9 grams per pot. A much lower yield of 29.3 grams was secured at pH 4.5, while 38.9 grams and 39.4 grams were the yields produced at pH values of 5.5 and 7.5, respectively.

Plant composition indicated marked differences in calcium absorption by plants at the various pH ranges and showed that the increased calcium supply of soil resulting from the addition of calcium hydroxide for pH adjustment was reflected in the calcium content of the plant since an increase from 0.88 per cent to 1.28 per cent occurred where the replaceable calcium was varied from 300 pounds per acre to 1,340 pounds. The corresponding pH change was from 4.5 to 7.5. Further increases in calcium content were obtained at each pH level, results from the addition of superphosphate suggesting that soluble phosphates were very beneficial in the absorption of calcium and phosphate ions. Doubling the superphosphate application gave the highest percentage calcium, whereas superphosphate and potash were not as effective in increasing plant calcium, which was probably due to the competition of the phosphate and chloride ions. The chloride and potassium ions, being more readily absorbed, naturally reduced the calcium and phosphate absorption and lowered the percentage of these ions within the plant.

The chemical analysis of lespedeza shows that the phosphorus content was not appreciably affected by the higher pH values, these producing an absolute variation of 0.04 per cent or 30 per cent on a comparative basis. However, total phosphorus absorption was markedly increased on those pots receiving superphosphate. At the lowest pH the phosphorus absorption was increased by fertilization from 13 to 21 pounds per acre, while at the optimum pH an increase from 21 to 36 pounds was obtained. The superphosphate and potash treatment resulted in lowering the absorption at the optimum pH range, the phosphorus being increased from only 21 to 26 pounds.

The potassium content was least affected, being approximately the same at pH value from 5.0 to 7.5. Superphosphate applications caused an increased potassium absorption from 62 to 88 pounds per acre, while the same amount of superphosphate along with potash fertilizer increased the potassium content from 62 to 120 pounds.

The data accumulated for lespedeza at optimum growing conditions are presented in Table 1. The data suggest that high yields and optimum nutrient absorption usually occur simultaneously, whereas luxury consumption of nutrients will result where excessive amounts of available nutrients are provided for plant absorption.

The results also show that lespedeza is most responsive to the higher fertility levels and to only slightly acid soils. Phosphate fertilizers appear to be very important as the oven-dry weight of lespedeza hay was significantly higher, at all pH levels, on the pots where superphosphate was applied, than on pots receiving no phosphate. This beneficial effect was especially noticeable at the lower pH level where the yield was increased from 29.3 grams to 40 grams per pot. It was probably due to the fact that superphosphate inactivated the soluble aluminum as well as supplied available phosphate and in that way was beneficial in offsetting the deleterious effects of low pH values.

These data in Table 1 propose that lespedeza requires an approximate pH value of 6.0 for optimum growth and further suggest that a nutrient requirement corresponding to 175 pounds of

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Even lespedeza is most responsive to the higher fertility levels. To provide a good cover for erosion control, phosphorus and potash fertilizer along with a small application of dolomitic limestone will assure good growth of lespedeza.

Basing a Program on What the Soil Tells

By F. G. Hall

County Agricultural Agent, Findlay, Ohio

THAT Hancock County, Ohio, believes in signs is borne out by the results of soil testing during the past few years. In 1935 a series of tests were made in cooperation with the Soils Testing Service at Ohio State University, and each year since the work has been repeated either by holding clinics at the High Schools in the county through the use of a portable laboratory, or the collection of samples for testing at Ohio State laboratory.

Soil has been tested and recommendations prepared on the use of lime and fertilizer for 495 farmers. The tests cover 991 separate fields and represent approximately 2,700 separate soil samples. Analysis of all samples shows an average pH of 6.4. Eighty per cent of the samples are "Very High" or "High" in active calcium. Seventy-seven per cent are "Low" to "Very Low" in phosphorus. Ninety-one per cent are "Low" to "Very Low" in potash.

The first conclusion derived from reading those signs was that potash was certainly deficient on most of the soils of the county. Acting on that conclusion, more potash was talked. At the same time the indicated shortage of phosphorus and the fact that lime was needed on the light colored soils of the county, which constitute about 65 per cent of the crop land area, were pointed out. About a ton of lime was needed per acre to correct acidity and grow good crops of legumes.

While the following figures do not show total lime consumption, they do accurately show a trend toward the use of more lime. The lime companies report lime sales to the Ohio State University soils department. Such sales are reported below:

Period	*Tons Sold*	*Years Reporting*
1920–1924.....	31	1923–24 only
1925–1929.....	555	1925–27–28–29
1930–1934.....	285	5 years complete
1935–1939.....	1,331	5 years complete

In order that speedy, consistent recommendations might be made for the use of lime, the following table was prepared. The recommendations are based on ground agricultural limestone with a screen test of 40 to 60 per cent through a 100-mesh screen. When screenings are used the rate of application is doubled.

Lime Requirements When Soil Is
Light Yellow - Clover Fair

and the Reaction is	and the Active Calcium is	then the Lime Recommendations are
		(lb. per A.)
pH 4.0–4.9....	VH–H	2,000
	M	3,000
	L–VL	4,000
pH 5.0–5.9....	VH–H	2,000
	M	3,000
	L–VL	4,000
	VH–H	500
pH 6.0–up.....	M	1,000
	L–VL	2,000

Similar tables have been prepared with relative amounts of lime for: Light Yellow — Clover Good, Brown Dominant — Clover Fair, Brown Dom-

Soil clinic at Arcadia High School. County Agent Forest G. Hall (left) and Extension Specialist J. A. Slipher (right) show a group of vocational agriculture students the how and why of soil testing.

inant — Clover Good, Gray — Clover Fair, Gray — Clover Good.

The signs relative to fertilizer pointed in many directions, soil type, crop to be grown, former treatment, manure available, and reaction from soil test itself. In order to simplify the system somewhat, certain crops were first indicated. Phosphorus shortage being generally recognized as a deficiency led to the use of the phosphorus reaction as basic. Subdivisions were then indicated for potash, and a table similar to the one on lime prepared. Below is a sample as worked out for wheat to be followed with clover. Other crops, corn, truck, alfalfa, etc., are covered by similar tables. The reactions are reported on the basis of availability, "Very High," "High," "Medium," "Low" to "Very Low."

With 77 per cent of the tests showing "Low" to "Very Low" on phosphorus,

Close-up of sugar beets on the E. L. Thomas farm, Findlay, Ohio. Beets on left received no fertilizer, while those on the right received 200 lbs. of 2-8-10.

CROP - WHEAT FOLLOWED BY CLOVER

Phosphorus Reaction	Potash Reaction	Fertilizer Recommendations	
		Pounds per Acre	Analysis
VH-H....	VH-H	...	....
	M	200	0-14-6
	L-VL	200	0-10-20
M.........	VH-H	250	0-20-0
	M	250	0-14-6
	L-VL	250	0-10-10
L-VL.....	VH-H	250	0-20-0
	M	250	0-14-6
	L-VL	300	0-10-10

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A Balanced Diet For Nursery Stock

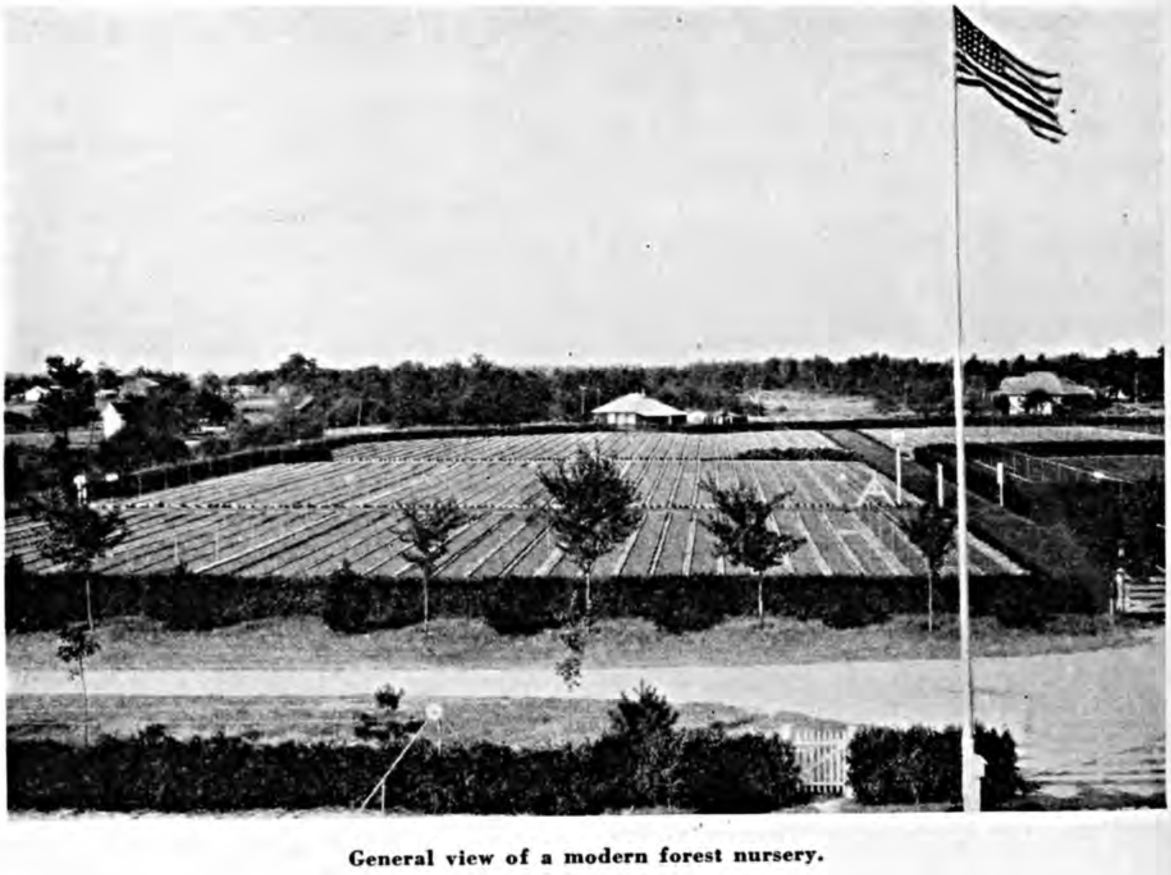
By S. A. Wilde

Agricultural Experiment Station, Madison, Wisconsin

THE question, "Will it pay to apply fertilizer?", is one that does not bother a nursery manager. The value of the crop produced on one acre of seedbeds varies from $5,000 to $10,000, and the cost of the fertilizers constitutes but a small fraction of the total expense. The reason why some nurserymen are reluctant to use commercial fertilizers lies elsewhere.

Until recently there has been little reliable knowledge of the nutrient requirements of different tree and shrub species. The application of fertilizers in nurseries is a rather delicate operation which, if conducted unskillfully, may injure germinating seedlings by salts in solution or may encourage damping-off and root-rot diseases. The increase in the size and weight of seedlings caused by fertilization does not necessarily mean an improvement in the quality of planting stock, as its vigor may be lowered by unsatisfactory root-top ratio, succulent tissue, and inferior physiological make-up.

The complications involved in the problem of nursery soils fertilization have been considerably increased by a number of misconceptions introduced by the early students of silviculture. Some of the theories advanced dis-



General view of a modern forest nursery.

An example of well situated and adequately protected nursery beds.

counted the importance of nutrients for the growth of trees, and others refused to acknowledge the beneficial effect of fertilizers, particularly mineral salts. These ideas were carried so far that some European nurseries advertised starving seedlings raised on infertile soils as especially well suited to reforestation.

The prejudice against mineral fertilizers had developed chiefly because of the failure of silvicultural experiments designed with an insufficient knowledge of soil chemistry. An unsuitable reaction of the soil, deficiency of buffering colloids, ineffectual one-sided fertilization, disruption of nutrient balance, high carbon-nitrogen ratio, and fixation by the soil were commonly overlooked, so one or more of these adverse conditions was responsible for the failure of fertilizer treatments.

The assumption that trees are not dependent upon mineral plant food had a much more involved background. Observations of the fact that highly productive forest stands are often found on soils with a low content of nutrients were misinterpreted to mean that seedlings needed little nutrients.

Large trees are able to utilize nutrients from an enormous volume of soil. They can make use of difficultly soluble minerals and protein compounds; they store plant food in their leaves and return it to the soil as leaf litter. In these ways a forest not only maintains the fertility of the soil, but over a long period converts barren wastes into productive land. Nursery stock, on the other hand, is raised at a great density; its roots seldom penetrate below a 10-inch depth; no crop residues are left in the soil of the nursery because even the root systems are removed. Under such conditions the maintenance of a satisfactory fertility level in nursery soils requires applications of fertilizers at a much higher rate than is common in farming practice.

How to solve the task of nursery soils fertilization with all its complicated aspects? How to establish a balanced diet for various tree species which would produce morphologically and physiologically vigorous planting stock?

These were questions to be answered.

In the earlier days of soil investigations there was only one way to study the balance of nutrients, i.e., by empirical greenhouse and sample plat trials. Such purely inductive methods proved to be of little value in studying the variable and mutually interrelated factors of nursery soil fertility.

Virgin Soils Analyzed

The recent progress in analytical determinations of soil reaction, exchange properties, and available nutrients, however, enabled the use of a much more fruitful deductive approach, namely the analysis of virgin soils under productive stands of various tree species. The statistical data derived from analyses of such natural seedbeds give the closest approach to the physiological optimum of growth conditions. Such data provide not only the amount of nutrients, which may be somewhat variable, but the constant ratio of various constituents, which is the chief prerequisite to balanced nutrition of seedlings. As experience in nurseries and greenhouses has shown, the natural fertility levels help to prevent both the starvation of nursery stock and the unreasonably rapid growth and abnormal one-sided development.

In the course of the past five years, the Wisconsin Soils Department has analyzed several thousand soil samples collected under productive stands of representative species throughout the Lake States region. The average values obtained by means of statistical treatment of the results are presented in round numbers in the accompanying table and are suggested as the standards for the maintenance of nursery soil fertility. The N-P_2O_5-K_2O ratio of available nutrients approaches 1-2-5 for all conifers and yellow birch, and 1-3-5 for the remainder of the hardwoods studied.

The use of the suggested standards has been tested with satisfactory results in the forest nurseries of Wisconsin and several neighboring states. Field-planting experiments conducted by the Wisconsin Conservation Department in cooperation with the University have shown a higher survival and more rapid growth of planting stock

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STANDARDS OF FERTILITY FOR NURSERY BLOCKS RAISING DIFFERENT SPECIES OF TREES

Species	Reaction pH	Base exchange capacity m.e./100 gm.	Total N per cent	Approximate level of avail. N	Available P^2O^5	Available K^2O	Replaceable Ca
				Pounds per acre			
Jack Pine	5.6	5.0	0.10	20	40	100	1000
Red Pine Scotch Pine*	5.4	8.0	.12	30	50	150	1500
White Pine	5.4	10.0	.14	35	80	200	2500
White Spruce Norway Spruce*	5.2	15.0	.25	45	100	250	3000
Yellow Birch	5.3	12.0	.16	35	60	175	2000
Hard Maple Am. Elm, Basswood	5.8	14.0	.20	45	150	275	3500
White Ash	6.2	16.0	.22	55	185	300	4500

* Standards extended on the basis of practical nursery experience.

BORON—

a Minor Plant Nutrient of Major Importance

By W. L. Powers

Oregon State College, Corvallis, Oregon

DURING the past two decades replacement of animal power by farm tractors, introduction of pure synthetic fertilizers, and intensive specialized agriculture on leachy, humid-climate soils have contributed to manifestation of numerous deficiency diseases of crop plants. Part of the boron, sulphur, and iodine may have been roasted out of the basaltic lava from whence came the major soil-forming material in the Pacific Northwest.

During the past 25 years the essential nature of very small amounts of several of the so-called minor or trace elements has gradually become apparent. Various obscure types of malnutrition in plants are prevented or corrected by the presence of traces of such elements as boron, manganese, zinc, copper, molybdenum, or other elements for which essentiality is less definitely established.

For 12 years the Soils Department of the Oregon Experiment Station has done exploratory work with minor elements on Oregon soils, including an intensive study of the need and value of iodine, followed by boron and recently by manganese investigations. Striking improvement in vigor and yield has been secured from the use of boron on leached soils. Use of boron as a fertilizer for alfalfa west of the Cascade Mountains promises to be as profitable as sulphur has been on the more arid basaltic soils to the east. In former reports (Powers, 1937, 1939) (Powers and Bouquet, 1939) the earlier studies with boron in relation to soil fertility in the Pacific Northwest or Columbia Basin were reviewed. The purpose herein is to present a progress report covering continued and recent boron experiments, particularly in Oregon and the Pacific Northwest.

Evidence of the essentiality of boron as plant food was reported by Agulhon (1910) and Maze (1919) and confirmed by Warington (1923) and Sommer and Lipman (1926). The latter grew large numbers of plants in solution cultures built up from purified chemicals in redistilled water and from successive generations of seed. According to Purvis (1939), 24 states have reported boron-deficient areas, and no plant nutrient has received so much notice in recent literature. Boron, like most of the trace elements, is helpful only at concentrations of the order of one-fourth part per million. Two parts per million in solution may be toxic, so great care is needed in its use. An excess leads to spotting, discoloration, and defoliation of lower leaves, while a deficiency causes bronzing, then yellowing or blighting of terminal growth.

Boron As a Control

A score of plant malnutritional symptoms have been related to boron deficiency. Boron has been used in the Columbia drainage area to control "corky core" and "drought spot" in apples, "yellow top" in alfalfa, celery "stem crack", turnip "brown heart", discoloration of broccoli and asters, and "growth strain" of potatoes. Frequently, marked increase in yield and quality resulted from the treatment.

Boric acid was used by the writer to correct a certain type of chlorosis in water-culture experiments as early as 1926. Alfalfa grown in the greenhouse in 2-gallon jars of Springdale and Mission soils from Stevens County, Washington, in 1936 developed yellow top before the third cutting. Two hundred cc of solution containing one part per million of boric acid corrected this in a few days. The yellow top reappeared as the plants approached maturity for the fifth cutting. Boron promoted blooming and branching of alfalfa and should aid longevity. Similar response was obtained the same season in British Columbia by McLarty (1936).

Good control of beet canker was secured, perhaps for the first time, with 30 pounds of borax an acre in experiments started by Powers and Bouquet in 1937. Celery stem crack has been controlled by use of 20 pounds of borax an acre the past 4 years in experiments in cooperation with Professor A. G. B. Bouquet. Little leaf of stone fruits near The Dalles was controlled more completely when borax was included with the zinc spray. Boron is now rather generally used in the Hood River Valley to control corky core, following results of McLarty (1936). Potato growth strain and cauliflower discoloration have been corrected in Oregon experiments. Chemical determinations show unfavorably low boron content in soils, waters, and vegetation in affected areas. Use of boron in such areas has increased the boron content of plants and raised the chlorophyl and the vitamin A contents as much as 50 per cent. Standards are being developed for boron content of normal leaves.

Beets grown in 1936 on Newberg loam. Those on the left show canker, while those on the right received 30 pounds of borax an acre, which gave commercial control of canker.

Boron appears to give elasticity to the plant cell membranes and to aid cell division (Johnson and Dore, 1929). It seems to regulate respiration, lessen effect of drought, has improved keeping quality of apples and prunes (Roberts, 1940), and prevents swelling and blocking of roots (Sommer and Sorokin, 1928) and pollen tubes (Denis and O'Brien, 1937). Boron prevents breakdown of conduction tissues (Warington, 1923), is important in nitrogen metabolism, and aids development of nodules and nodule bacteria (Brenchley and Thornton, 1925). Boron affects carbohydrate translocation (Johnson and Dore, 1929) and pectin formation and amount of calcium in tissues. Eaton (1940) reported boron to be essential to formation of auxin in plants, and Goldsmidt and Peters (1932) reported it essential in metabolism of brown algae. Boron is a constituent of animal tissues (Bertrand, 1912).

Major Field Trials

Results of major field trials with boron for alfalfa and clover and grass are summarized in Table 1. Thirty-six trials have been conducted on 24 crops and 20 soil types including 236 plots. Also, material has been furnished the past 2 years to 24 county agents for demonstration tests. Use of boron in the Great Basin and in southern Oregon has been ineffective, and in field trials control of beet canker has not affected total yield very consistently. Increase in alfalfa yields has been as large as two tons an acre per season. A single application of 40 pounds of boric acid an acre on Willamette loam at the Hagg brothers' farm gave a total increase in yield of some 5 tons alfalfa, and yellow top has not reappeared after 3½ years. The increased yield occurs particularly with old meadows and dry-weather cuttings. Legume crops are relatively good indicators of boron need. Bountiful beans in the greenhouse make quick growth and yield goodly amounts of leaves, stems, and pods. (*Turn to page* 36)

TABLE 1—CROP RESPONSE OF ALFALFA TO BORON ON OREGON SOILS. SOILS DEPARTMENT, O. S. C. EXPERIMENT STATION, 1937 TO 1940 INCLUSIVE

Soil	Kind of treatment	Rate per acre	Duration of test	Yield		Gain or loss	Net profit over cost of treatment
				Plus boron	No boron		
		Lb.	Years	Tons	Tons	Tons	$
Willamette silty clay loam...	Boric acid	10	4	3.31	2.90	.41	2.78
	Boric acid	20	4	4.03	2.90	1.13	8.04
	Boric acid	30	4	4.88	2.90	1.98	14.34
Willamette loam............	Boric acid	20	4	4.35	3.84	.51	3.08
	Borax	30	4	4.49	3.84	.65	4.22
Willamette loam............	Boric acid	40	4	4.88	2.83	2.05	14.40
	Borax	30	3	4.29	2.83	1.46	10.70
Willamette silt loam........	Borax	25	1	4.32	3.27	1.05	7.58
Amity silty clay loam.......	Boric acid	10	2	4.10	3.73	.37	2.46
	Boric acid	20	2	3.78	3.73	.05	−.60
	Boric acid	30	2	4.30	3.73	.57	3.06
	Borax	15	2	3.52	3.73	−.21	−2.17
	Borax	30	2	4.18	3.73	.45	2.62
	Borax	45	2	4.67	3.73	.94	6.05
	Borax Superphos	30 300	2	3.43	3.73	−.30	−3.38
	Borax Boric acid	40 40	4	3.90	3.73	.17	−.29
Salkum gravelly clay loam...	Boric acid	20	2	2.88	1.24	1.64	12.12
loam....................	Borax	20	2	9.71	9.27	.45	2.95
Wapato silty clay loam*....	Borax	30	1	2.27	1.81	.46	2.70
Salem gravelly loam*........	Borax	30	2	2.80	2.71	.09	−.26

* Clover and grass.

The Concept of 'Available" Nutrients In the Soil

By S. R. Dickman

Soil Chemist, Agricultural Experiment Station, Urbana, Illinois

SINCE the days when van Helmont and Glauber were searching for the "principle of vegetation," agricultural workers have studied the question, "Why and by what methods do plants grow and develop?" DeSaussure was among the first to recognize that the mineral elements were essential to plant growth, and his conclusions were later confirmed by the work of Boussingault, Liebig, Lawes, Gilbert, and many others. Once the importance of soil minerals became recognized, chemists began to experiment with methods of measuring them. A vast number of total analyses of different soils were made, yet the general correlation between the total amount of an element and crop response to an added fertilizer was very low.

A more selective technique was published by Daubeny in 1845 (8) in which he proposed to separate the "active" from the "dormant" mineral constituents of soils. His paper might be cited as the beginning of the "modern" era in soil fertility, for since that time agricultural workers have continued the search for rapid, accurate procedures which will yield information about the fertility of a given soil and its need for fertilizers. Although the methods have changed considerably with the passage of years, the terminology and basic concepts underlying the work have altered surprisingly little. The object of this paper is to examine present viewpoints in relation to those of the past and to offer a few suggestions that may possibly be of use in the future.

Although Liebig, Knop, and others were concerned with the status of nutrients in the soil, the first well-recognized attempt to measure chemically those portions of the soil phosphorus and potassium that were immediately available to plants was made by Dyer in 1894 (10). Phosphorus and potassium soluble in one per cent citric acid under the conditions of the extraction he called the "available phosphorus" and "available potassium" respectively. Tollens (13) and Stutzer (18) had previously used citric acid in the examination of manures, but Dyer was the first to suggest that it measured the available phosphorus and potassium in soils. In his two papers (10, 11) he gave the results secured by this method on many of the Rothamsted plots and showed that there was a correlation between the quantity of these elements extracted, the fertilizer treatment, and crop yields.

It is now generally agreed that the theoretical basis of Dyer's selection of one per cent citric acid was incorrect, and Russell and Prescott (16) have further pointed out that the amount of phosphorus in the acid extract does not represent any single form of phosphorus, but is the equilibrium resultant of two opposing factors: (1) the quantity of phosphorus dissolved from the soil by the acid, and (2) the quantity so liberated that is adsorbed by the soil.

A citric acid extract contains more phosphorus in a given experiment than comparable normalities of hydrochloric acid or nitric acid, not because it dissolves more phosphorus, but because the readsorption is less. They continue, "Thus it is incorrect to call the net amount brought out the 'available P_2O_5' as if it were something real in the soil; it is simply an analytical result, which will vary when the conditions of the treatment are varied." This criticism of Dyer's work seems to have been generally overlooked by many soils workers, and the trend in soil chemistry for some years was to imitate root action in the determination of the "available nutrients."

Results of Investigations

In 1909 G. S. Fraps (12) published the results of his thorough investigations in the use of N/5 HNO_3 as an extracting agent for phosphorus. Fraps, too, recognized that the acid extraction did not measure a definite form of phosphorus in the soil. He further stated, "Soils may contain equal quantities of phosphoric acid soluble in N/5 HNO_3 and yet give unequal quantities of phosphoric acid to plants on account of differences in the phosphate present. Only those soils should be compared which probably contain the same kinds of phosphates. Two soils might expose the same amount of the same kind of phosphate to the plant roots and yet give up very different amounts to an acid solvent, or they might expose different amounts and yet give up nearly the same quantities."

Comber (7) was among the first to realize that the solubility of a fertilizer or soil constituent does not wholly determine its availability, and further suggested that soil colloids and root colloids form one system. Casale (6) postulated a type of exchange mechanism whereby the ions are transferred from soil colloid to root colloid. This mechanism has been recently studied intensively by Jenny and co-workers (14) and must be considered as one of the factors which influence nutrient uptake by plants.

The estimation of the phosphate most closely concerned with plant growth received added impetus in 1929 and 1930 with the publication of "A Field Test for Available Phosphorus in Soils" by R. H. Bray (1) and "The Determination of the Readily Available Phosphorus of Soils" by E. Truog (19). These papers simplified the technique of measuring phosphates and have been widely used during the past decade. Truog attempted to simulate plant feeding by employing a dilute acid, and furthermore implied strongly that the method distinguished two separate and distinct kinds of soil phosphates which he designated as "readily available" and "difficultly available." To the extent that dilute sulfuric acid, or any acid solution, separates two or more chemical forms of soil phosphates, Truog is justified in setting up differences in their availability to plants; but it must not be forgotten that any acid-extraction method is subject to the factors mentioned by Fraps and by Russell and Prescott. A separation of soil phosphates into classes on the basis of an acid extraction is simply not justified by the facts of crop response. In Illinois a number of soils which test "high" in "available" phosphate by Truog's method still exhibit a definite response to added phosphate as superphosphate for wheat.

A Matter of Definition

It is but a matter of definition to say that the readily available phosphorus has a higher availability than the difficultly available or any other form of soil phosphorus, yet all data that bear on this question show that the acid-extractable phosphorus does not represent any one chemical form of soil phosphorus. The forms contributing to a "high" test in one soil may have an availability very different from those contributing to a "high" test in another soil.

In still another way a classification of soil phosphates into "readily available" and "difficultly available" is poorly chosen because sharp, definite, chemical distinctions cannot be discussed within its framework. It ignores the present and future chemical methods on which an eventual solution of the soil phosphate problem must be based. By this is meant that the above classification is inelastic and non-extensible. On the other hand, a classification of each form of phosphate in terms of its chemical structure can be extended as long as new forms are discovered. The necessary experiments to determine the absorbability of each form can then be carried out.

The footnote by Bray in Illinois Bulletin 337, in which he explains that "available phosphorus" has been used for want of a better term and whenever used in that bulletin means only that phosphorus detected by the test seems to have been generally overlooked by most soils workers. As a consequence of this failure to understand his use of the term, the field test of Bray has been adversely criticized when it did not determine the "available" phosphorus in other states with soils, crops, climate, etc., differing widely from those in Illinois.

Definition Lacking

Even though the terms, "the available nutrients," or in the older literature, "the available plant food," occur very often in soils literature, a thorough search through many publications has failed to reveal a single satisfactory definition of them. The soil chemistry commission which met in Munich in 1914 agreed to "use the term 'available' only in cases where plant physiological evidence proves the availability of the concerned plant food in soils" (9). It is evident that this statement is neither a definition nor a description.

A recent attempt to define "available" has been made by Spencer and Stewart (17). They discuss the various ways in which available is used, and conclude that "all the factors operating to insure the presence of assimilable nutrient in the plant's zone of absorption" is the best use of the term. Still, their definition of available, "possessing both chemical and positional availability; implying the satisfactory condition of *all* the factors necessary to insure the assimilation of the nutrient by the plant," not only is a circular type definition but would make an analysis of the plant ash after the crop had grown the measure of the amount of an available nutrient.

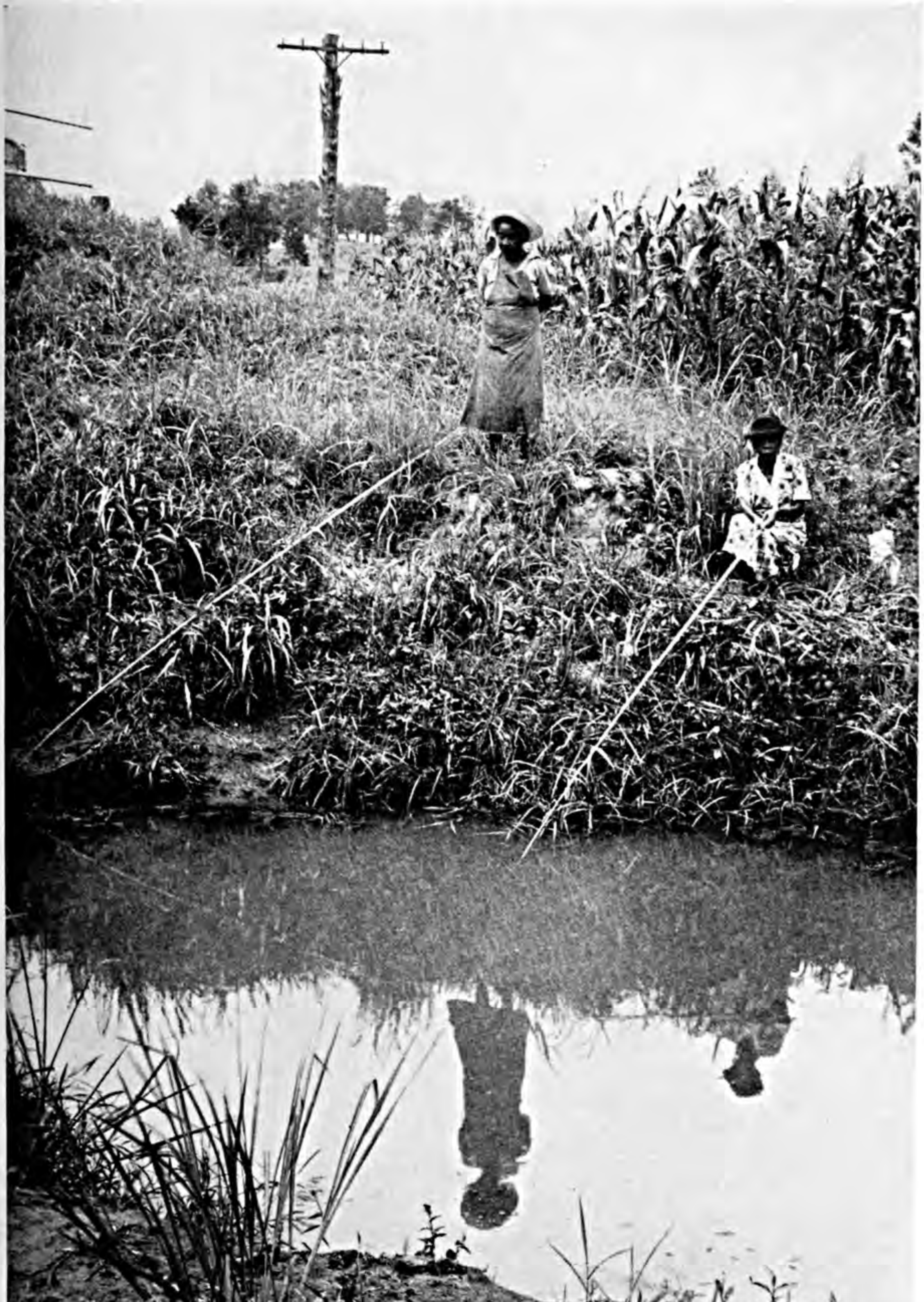
Mitscherlich's (15) use of "available nutrient" in the mathematical treatment of the nutrient-fertility problem is probably one of the causes of the controversy concerning his work. The evaluation of experiments with fertilizers consistent with the view adopted in this paper will be developed in a subsequent article.

What operations are there by which we can determine if a substance is available or not? An analogy may help to clarify the point. If a hungry man with only a nickel enters a cafeteria, is the amount of "available food" the same for him as for another hungry man with a dollar? No matter if we answer yes or no to the above question, we should be able to justify our answer logically by the use of some operation or method of measurement. It is the writer's judgment that a relationship exists between the food in the cafeteria and a particular person there and that this relationship can best be expressed by the quantity of food actually eaten by the individual. This amount would be an expression of the availability of the food to the individual. A similar relationship exists between the plant and the soil. Plants differ with respect to their ability to utilize the ions in the soil, and analysis of the plant ash serves as a measure of the availability of a particular ion when no other ion has limited absorption.

The striking advances in some fields of the physical sciences in recent years are the direct result of a new viewpoint and method of attack by physical scientists toward their problems. In physics this point of view has resulted in the

(*Turn to page* 42)

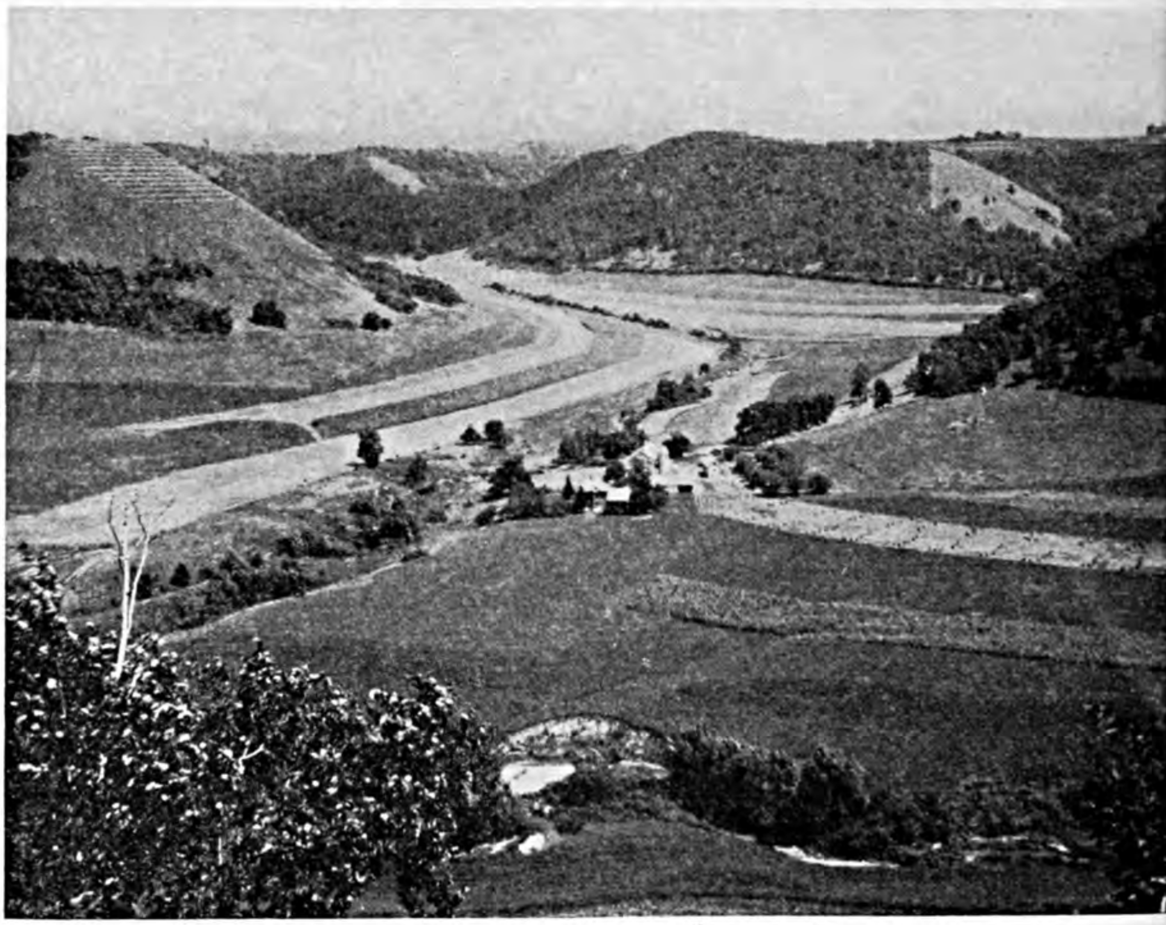
PICTORIAL



FISHING IS AN IMPORTANT SOURCE OF FOOD AND RECREATION TO COLORED FOLKS OF THE SOUTHEAST.

Above: Haying on permanent alfalfa and sweet clover strips in North Carolina.

Below: A general view showing strip cropping on a Minnesota farm.



Above: Cutting small grain grown in contour strips between corn in Iowa.

Below: Mowing oats, vetch, and Austrian peas in North Carolina.

Left: Chaff and dust can't keep youngsters from the harvest field.

Below: Shade in the harvest field is scarce but much appreciated.

The Editors Talk

A New Emphasis On Plant Food

Better nutrition, one of the important planks in the Nation's Defense Program, is placing a new emphasis on plant food—the basis of all plant, livestock, and human nutrition. Although research work has uncovered much in the way of the respective nutritive values of crops grown on fertile and infertile soils, for the most part these findings have been obscured in technical, scientific publications. A notable exception was the recent statement of Dr. William A. Albrecht, Chairman, Department of Soils of the University of Missouri.

> "Mining our soils of their fertility is bringing us face to face with the simple fact that plant factories are not running as efficiently for feed production as they once did. Our farm meat and milk factories are, consequently, also operating on less efficient levels—all our knowledge about better nutrition notwithstanding. Hope lies not so much in diagnostic surveys in the animal factory but more in the simpler approach to treating the animals to more nearly normal nutrition by way of normal feeds grown on fertile soils."

In news stories during the past year, Dr. Albrecht described how farm animals can detect forage that has been produced from fertilized fields and will consume it with decided preference if offered with herbage from unfertilized fields. However, he pointed out, domestic animals cannot roam at will to find their preferred forage. If they are confined by fences to fields deficient in lime and fertilizer elements such as nitrogen, phosphorus, and potash, then they must suffer the consequences of malnutrition.

Dr. Albrecht believes that if dumb animals can show the way toward better agricultural practices, then it is time human beings, themselves, admitted the values of such a program. For instance, a program of pasture improvement through the use of fertilizers not only produces grasses richer in essential minerals, but promotes more rapid growth on depleted land. It provides a diet essential to the healthy growth of livestock, helps to conserve the soil, and adds to the long range value of the farm.

R. M. Evans, Administrator of the Agricultural Adjustment Administration, has stated that "Impoverished soil cannot produce good food. Just as surely as poor soil makes poor people, poor soil makes poor diets. We can't go on squandering our soil, wasting its substance and its richness as in the past if we expect to have a well-nourished, strong people in the future."

It is true that in the publicity which is being given the Better Nutrition Program in National Defense, there is little definite mention of a wiser use of plant food. More stress is being placed upon methods of marketing foodstuffs in order to retain essential minerals and vitamins in available supplies and the distribution of these supplies to low-income groups. However, when about 32 per cent of the young men who up to now have come before draft boards for physical examination have been rejected by local doctors for health reasons and of the remaining 68 per cent that have gone into the army 18 per cent have been rejected by army physicians, it is apparent that lack of essential plant foods in the growing of foodstuffs must assume some of the responsibility. It has been brought out that malnutrition in this country is prevalent on a very wide scale, not only in urban, but in agricultural communities.

More closely was this responsibility defined by Secretary of Agriculture Wickard in his address on "Agricultural Policy and National Nutrition" before the National Nutrition Conference for Defense in Washington, D. C. on May 27. Secretary Wickard said, "As a matter of long-standing public policy, our State and Federal agricultural agencies are engaged in research up to the hilt, as you know. And much of this research relates to food and nutrition—better handling of our soils, conservation of our soils, better crops, better livestock, more efficient farm and home management, the battle against diseases and insects that waste our resources, better nutrition for farm animals—and better nutrition for human beings. These and more are within the scope of agricultural research, which deals with social and economic problems (yes, even psychological problems) as well as with problems in the natural sciences. Here is a fertile seedbed for such an effort as this conference is making.

"I will say frankly that in my opinion not only the United States but modern civilization as a whole will have to use this science of ours for the benefit of mankind much more fully, much less half-heartedly, than it has been used so far. We could feed and clothe and house the masses of our people far better than we do if we dared to turn science loose to tackle the job. But we have hesitated and sometimes this was because we have been afraid we might make a wrong move and upset somebody's apple cart. I think it is time to be afraid that if we don't make some vigorous moves, our civilization won't have any apples to put in the carts, and it won't matter any more whether they are upset or not."

With this challenge and the tremendously increased interest in nutrition as a vital factor, not only in physical fitness but morale, in the Defense Program, it can be predicted that more of the relationship between a well-fed soil and a well-fed people will come to light. Such an emphasis is sound, because from the beginning of time a sound people has depended upon a sound soil.

Using Research

"The farmer's thinking has undergone a reorientation during the past two decades. No longer is the emphasis in agriculture laid on producing more, on making two blades of grass grow where only one grew before. The battle for production quantity has largely been won. Unfortunately, the victory has come at a time where mere quantity of production is no longer enough to bring success to the farmer's enterprise. . . . To achieve success he must strive toward low unit costs of production, high quality of product, constructive management of his resources, and efficient marketing. To attain these goals he needs the aid of those whose knowledge goes far beyond that of most men actively engaged in agriculture. He must make use of the results of research performed by scientists familiar with problems of engineering, sociology, economics, nutrition, chemistry, and the life sciences."—*C. B. Hutchison, Director, California Agricultural Experiment Station.*

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

¶ Professor Claude Eby, in Circular 408, of the New Jersey Agricultural Experiment Station, "Ladino Clover," advises that the crop must be liberally fed with superphosphate and potash to maintain a satisfactory stand and produce optimum yields. The same practices in seedbed preparation as for any legume-grass mixture are followed on the Station farms. The method used is to plow under 12 tons of manure per acre and apply enough limestone to the plowed soil to raise the pH to 6. Where Ladino is seeded with grasses, 400 pounds of 5-10-10 are broadcast at seeding time. For Ladino-alfalfa mixtures 800 pounds of an 0-12-12 per acre are used.

Each spring a top-dressing of between 400 and 500 pounds of an 0-12-12 is applied. In addition, a late fall dressing of about 6 tons of manure per acre is applied as a combined fertilizer and winter mulch.

The experience at the Dairy Research Farm has shown that spring seeding with a companion crop of oats that is planted as soon as the ground can be worked has proved the most satisfactory time of seeding Ladino. Successful seedings have also been made in August, without a companion crop, and in March, on stands of fall-sown winter grain and timothy. Whatever the method of seeding, the companion crop should be pastured early or made into grass silage.

"Purpose and Working of the Bureau of Chemistry," Dept. of Agr., Sacramento, Calif., FM-21, April 18, 1941, Alvin J. Cox.

"Chemical Investigations of the Tobacco Plant. VIII. The Effect Upon the Composition of the Tobacco Plant of the Form in which Nitrogen is Supplied," Agr. Exp. Sta., New Haven, Conn., Bul. 442, Nov. 1940, Hubert Bradford Vickery, George W. Pucher, Alfred J. Wakeman, and Charles S. Leavenworth.

"The Use of Phosphate in the Agricultural Conservation Program," Agr. Ext. Serv., Urbana, Ill., Feb. 1941, C. M. Linsley and A. L. Lang.

"Iowa Fertilizer Law of 1941," Dept. of Agr., Des Moines, Iowa, Bul. 84-A, Mark G. Thornburg.

"Suggested Fertilizers for Iowa," Iowa State Coll., Ames, Iowa.

"The Influence on Cotton Production of Nitrogen, Phosphorus, and Potassium and Their Combination," Agr. Exp. Sta., State College, Miss., Bul. 357, Mar. 1941, J. L. Anthony and John Pitner.

"1941 Fertilizer Recommendations," Agr. Exp. Sta., State College, Miss., Inf. Sheet 227, Jan. 1941, Clarence Dorman.

"Fertilizer Rates and Analysis Tests, Holly Springs, Mississippi," Agr. Exp. Sta., State College, Miss., Inf. Sheet 234, Feb. 1941, E. B. Ferris and Russell Coleman.

"Soil Fertility Experiment with Cotton—Schaefer Field—Yazoo River Soil in the South East Delta," Agr. Exp. Sta., State College, Miss., Serv. Sheet 299, Feb. 1941, Roy Kuykendall.

"Soil Fertility Experiments with Cotton—Ladd Field—North of the Central East Delta," Agr. Exp. Sta., State College, Miss., Serv. Sheet 305, Feb. 1941, Roy Kuykendall.

"Soil Fertility Experiments with Cotton—Hemphill Field in the Central East Delta," Agr. Exp. Sta., State College, Miss., Serv. Sheet 306, Feb. 1941, Roy Kuykendall.

"Commercial Fertilizers and Winter Legumes for Cotton Production—Gary Field—Tallahatchie River Soil," Agr. Exp. Sta., State College, Miss., Serv. Sheet 307, Feb. 1941, Roy Kuykendall.

"Food Storage in the Peach Tree in Relation to Nitrogen Fertilization," Agr. Exp. Sta., Raleigh, N. C., Tech. Bul. 67, Mar. 1941, C. F. Williams.

"Use of T. V. A. Phosphates and Limestone on Pastures," Agr. Exp. Sta., Raleigh, N. C., Agron. Inf. Cir. 129, Feb. 1941, W. W. Woodhouse, Jr.

"Proceedings of Fertilizer Conference, Nashville, Tennessee, January 24, 1941, Agr. Ext. Serv., Knoxville, Tenn., CL-9837, Mar. 15, 1941, H. E. Hendricks.

"Effect of Lime on the Nitrogen Content of Cow Manure," Agr. Exp. Sta., Burlington, Vt., Bul. 456, Apr. 1940, A. R. Midgley and W. O. Mueller.

"Sources and Available Supplies of Commercial Fertilizers," U. S. D. A., Washington, D. C., Misc. Pub. 400, Dec. 1940, C. H. Kunsman.

Soils

¶ "Rapid Soil Tests for Determining the Fertilizer Requirements of Vegetable Crops in Eastern Virginia" is the title of Virginia Truck Experiment Station Bulletin 106, by E. R. Purvis and J. M. Blume. The method described by the authors for estimating fertilizer requirements of soils differs essentially from those in common use only in the case of the phosphate and potash procedures. Instead of determining the amounts of these nutrients which are removed from the soil by a specific extractant, the quantity of phosphate and potash ions absorbed by the soil from a solution of standard strength is determined.

The soil tests proposed in this bulletin have been calibrated for vegetable crops grown in Eastern Virginia. Excellent correlation between the tests and field response to applied fertilizer has been obtained with several crops. These studies are being continued and the results will be published later.

¶ Practical information of much value to Wisconsin farmers who wish to avail themselves of the opportunity to put into effect at low cost practices which will be of lasting benefit to their soil is given in the Special Circular, "Soil and Crop Practices in Wisconsin," by F. H. Turner of the Extension Division. Under the agricultural conservation program, the greater part of the expense of liming, seeding of legumes and grasses, erosion control, forestry planting and management, weed control, and the application of phosphate and potash under certain conditions is returned to the farmer in soil-building payments.

Only 20 per cent of the acid soils in the State have been limed, although Wisconsin farmers have been applying lime to soils in various forms for a quarter of a century or more. Something like 6,000,000 acres of sour, lime-deficient soils will require lime to bring back clover or to fit them for alfalfa. Fertility has been returned to the soil in the manure from home-grown and purchased feeds and by fertilization with phosphate and potash, but this falls far short of meeting the soil needs today. Erosion is taking the rich topsoil from the fields, and the subsoil is being farmed in many cases.

The contents of this comprehensive publication should materially aid those farmers who, because they could not meet the cash investment, have been unable to carry out practices which are recognized as badly needed.

"Soil Survey Map of County of Haldimand, Province of Ontario," Ont. Agr. Coll., Guelph, Ont., Canada, Soil Survey Rpt. No. 4.

"Soil Survey Map of County of Welland, Province of Ontario," Ont. Agr. Coll., Guelph, Ont., Canada, Soil Survey Rpt. No. 5.

"Farming Point Rows," Agr. Ext. Serv., Honolulu, T. H., Agr. Ext. Cir. 111, Apr. 1941, Norman King.

"Conservation of Massachusetts Soils," Agr. Ext. Serv., Amherst, Mass., Leaflet 193, Mar. 1941, A. B. Beaumont and Karol Kucinski.

"Soil and Field-Crop Management for Southeastern New York," Cornell Univ., Agr. Exp. Sta., Ithaca, N. Y., Bul. 746, Dec. 1940, A. F. Gustafson.

"Tables of Characteristics of Tennessee Soils According to Soil Regions," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 129, Sept. 1940, L. J. Strickland.

"Strip Cropping to Control Erosion," Agr. Ext. Serv., Madison, Wis., Ext. Cir. 317, Mar. 1941, O. R. Zeasman.

"Toward Soil Security on the Northern Great Plains," U. S. D. A., Washington, D. C., Farmers' Bul. 1864, Jan. 1941, Glenn K. Rule.

"The Mineral Composition of Crops With Particular Reference to the Soils in Which They Were Grown," U. S. D. A., Washington, D. C., Misc. Pub. 369, Mar. 1941, Kenneth C. Beeson.

"Selenium Occurrence in Certain Soils in the United States, With a Discussion of Related Topics: Fifth Report," U. S. D. A., Washington, D. C., Tech. Bul. 758, Mar. 1941, K. T. Williams, H. W. Lakin, and H. G. Byers.

"Guarding a Heritage," U. S. D. A., Washington, D. C., Feb. 1941.

"Erosion and Related Land Use Conditions

in the Conestoga Area, Pennsylvania," U. S. D. A., Washington, D. C., Erosion Survey 15, Oct. 1940, Jay A. Bonsteel and Turner C. Bass.

"Erosion and Related Land Use Conditions in Winona County, Minnesota," U. S. D. A., Washington, D. C., Erosion Survey 17, Jan. 1941, Mark H. Brown and Iver J. Nygard.

"New Landmarks of Soil Conservation," U. S. D. A., Washington, D. C., 1941.

Crops

¶ According to New York State Experiment Station Circular 191, "Increasing Tomato Yields," by C. B. Sayre, successful production of tomatoes depends on attention to certain important details, such as selection of a fertile, well-drained soil rich in organic matter, liberal fertilization with a complete fertilizer high in phosphorus, early transplanting, and proper cultivation to keep down weeds.

Where manure is available, it should be applied to the tomato soil preferably in the fall supplemented with superphosphate or a complete fertilizer such as a 5-20-5 ratio. At least 600 pounds of complete fertilizer per acre should be used. Where manure is not available, more fertilizer should be applied and the ratio of nitrogen and potash increased. A 10-20-10 analysis at the rate of 600 pounds per acre or more is recommended for most soils.

Generally speaking, a high yield per acre is a most important factor affecting net returns in tomato growing. The grower who practices the improved methods of tomato production explained in this publication, and thus increases his yields per acre, will not only aid the government program of increased production, but will also increase his net returns.

Among the starter solutions that have given excellent results are 11-32-14 and 13-26-13 transplanting mixtures at 4 to 8 pounds per 50 gallons of water. If properly used, a starter solution may be expected to increase the yields about 1½ to 2 tons per acre, most of which gain will come in the early pickings. The cost of materials in the transplanting solution is only about 80 cents to $1.00 per acre. The use of nutrient solutions, if poured around the roots at the time of transplanting, will aid the plants in recovering more quickly from the usual setback caused by the transplanting operation.

Varieties and direct seeding of tomatoes are among the other topics discussed.

"Diseases of Truck Crops," Agr. Ext. Serv., Berkeley, Calif., Cir. 119, Sept. 1940, Ralph E. Smith.

"Report of the Department of Agriculture, Province of Nova Scotia for the Year Ended November 30, 1940," Dept. of Agr., Halifax, Nova Scotia, Canada.

"Co-operative Potato Projects In Western Ontario," Dominion Exp. Farms, Guelph, Ont., Canada, Prog. Rpt. 1940.

"Biennial Report of the Commissioner of Agriculture for the Fiscal Period July 1, 1938, to June 30, 1940," Dept. of Agr., Hartford, Conn., Public Document No. 18.

"Annual Report of the Director for the Fiscal Year Ending June 30, 1940," Agr. Exp. Sta., Newark, Del., Bul. 227, Nov. 1940.

"Cucumber Growing in Delaware," Agr. Exp. Sta., Newark, Del., Hort. Pamph. 2, Apr. 1941, W. H. Phillips, Jr.

"U. S. D. A. #34 Sweet Corn Roguing Plants and Selecting Seed," Agr. Ext. Serv., Honolulu, T. H., Cir. 113, Apr. 1941, Ashley C. Browne.

"Sorghum Production in Hawaii," Agr. Ext. Serv., Honolulu, T. H., Cir. 114, Apr. 1941, Ashley C. Browne.

"Flaxseed Production in Illinois," Agr. Exp. Sta., Urbana, Illinois, Mar. 1941, G. H. Dungan and W. L. Burlison.

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Economics

¶ Because of a prolonged period of low cotton prices, farmers in the South are particularly interested in and are seeking new sources of cash income. An example is the sweetpotato starch plant at Laurel, Mississippi, sometimes referred to as the "Chemurgic City." The effects of this new enterprise on farm income and organization in the surrounding countryside are studied and reported in Mississippi Experiment Station Bulletin No. 352, "Factors for Success on Starch Sweetpotato and General Farms in Jones County, Mississippi, 1939," by Marvin Guin, D. W. Parvin, and A. J. Huff.

Climatic and soil conditions seem to favor the sweetpotato crop in Mississippi. It is the most important vegetable crop produced in the Southern States, and Mississippi is one of the leading producing areas. In 1934 the Mississippi Relief Administration obtained a grant of $172,000 from the Federal Emergency Relief Administration for the purpose of establishing at Laurel a project for the purpose of manufacturing starch and by-product pulp from sweetpotatoes. The process to be employed was that developed by the U. S. Department of Agriculture, and the plant was operated by the Department of Agriculture through the Resettlement Administration and the Farm Security Administration.

In 1938 title was transferred to the Sweetpotato Growers, Inc. The plant is now operated by this cooperative under the trade name of The Laurel Starch Plant, and funds are obtained through loans from the Farm Security Administration. It is an interesting project in that it is more or less an experiment in what can be accomplished in the way of rendering the country self-sufficient in an imported material and at the same time providing a new source of income for agriculture. The extent to which the project could be enlarged if it is successful is demonstrated by the fact that it would require about 177 similar plants to make as much root starch as the United States annually imports.

About 25,000 bushels of starch sweetpotatoes were received by the plant in 1934 from fields averaging about 100 bushels per acre. Since then the yield per acre and total production have increased steadily until in 1938 the starch plant received 165,000 bushels of potatoes with an estimated yield of 200 bushels per acre. In 1939 265,000 bushels were delivered for manufacture of 2,700,000 pounds of starch.

In order to study the effect of this enterprise on the surrounding farms, 100 farms in Jones County were surveyed in 1939, a year in which farming was below average because of low yields of crops in general. The total investment per farm ranged from $2,000 to $6,000 and averaged $3,930. The farms growing starch potatoes had a higher per cent of their total capital invested in operating capital than did the group of comparable farms not growing starch potatoes. The average farm in the region surveyed returned about 4.3% interest on the invested capital. The returns ranged from 7.4% on the farms growing starch potatoes to 1.1% on the non-starch potato farms.

Cotton and starch potatoes were the two most important crops grown, representing 73% of the total crop receipts of which 54% was obtained from cotton and 19% from starch potatoes. The livestock enterprise was comparatively insignificant, but the farms growing starch potatoes had more than twice as much income from livestock and livestock products as the farmers not growing starch potatoes.

Total farm receipts for the 100 farms averaged $1,081, ranging from $89 on a one-horse cotton farm with no starch potatoes to $8,495 on a highly diversified farm with $1,200 cash receipts from starch potatoes. Labor income on all farms averaged $157 and ranged from $295 on the starch potato farms to $23 on farms which did not grow starch potatoes. The labor income varied from a loss of $550 on a farm with only cotton as the cash crop to $1,983 on a large diversified farm with starch potatoes. The majority of the farmers fell within the range of $249 loss to $249 income.

The study indicates that farmers who spent less time on cotton and livestock and more time on starch potatoes and other crops used labor and other factors of production more efficiently and obtained more profits per farm. Starch potatoes required a few more man hours per acre than did cotton. The average of receipts per acre from cotton and cottonseed was $30.37, and the average of expenses was $24.57, leaving a net return of $5.80 per acre. The average of receipts per acre of starch potatoes was $49.80 with a net return of $7.92 per acre. In other words, the net return from starch potatoes exceeded that of cotton by $2.12 per acre.

All in all, the farms growing starch potatoes had a much higher receipt per farm, higher farm income, labor income, labor earnings, and per cent return on capital than did the group of comparable farms that did not grow starch potatoes. Starch potato farms were more diversified with higher receipts from livestock and crops other than cotton. However, it should not be construed from the above that starch potatoes were entirely responsible for the more favorable showing of the farms where they were grown, because it was noted that the more progressive farmers grew starch potatoes and as a group they would naturally be expected to have a higher income than the less progressive farmers even though they were not growing potatoes.

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Bachelor (dreamily): "Sometimes I yearn for the peace and comfort of married life."

Married Friend (wistfully): "I always do."

"You drunken beast! If I were in your condition I'd shoot myself!"

"Lady, if you wazh in my c'ndishun, you'd mish yershelf!"

Getting the Most from Fertilizer

PROPER application is a big factor in getting full return from the fertilizer dollar. Applying fertilizer in the right place is fully as important as applying the right analysis or the right amount. This fact was largely overlooked by soils investigators until about 1925. Even today it is not fully appreciated by farmers. Many continue to use antiquated machines and methods whose low efficiency has been shown.

Fertilizer is ordinarily applied in either of two ways: (1) over the entire soil surface by the method commonly referred to as "broadcasting," or (2) in a localized area close to the seed or plant, usually termed hill or row placement. Broadcast applications commonly involve a separate operation in addition to seeding. The fertilizer may be spread on the surface, with or without incorporation, or it may be placed below the soil surface in closely spaced rows using a fertilizer drill. Hill or row applications are usually made through a fertilizer attachment on the planter. Hence, they do not involve a separate operation and save labor.

Cooperative Study

Knowledge of the principles and practice of fertilizer application has expanded rapidly in recent years. Scientific studies in the laboratory, controlled hand and machine placement studies in the field, and performance tests with commercial fertilizer distribution, all have played a part. The Experiment Stations in 20 States and the U. S. Department of Agriculture have cooperated in these studies.

Coming from this work, certain principles stand out as of rather general application, almost irrespective of the soil or crop. One of these is that maximum efficiency from fertilizer treatments is obtained by placing the fertilizer as close to the seed or plant as is possible without injuring germination or seedling growth. With hill or row crops, this means placing the fertilizer in the hill or row in preference to broadcasting.

Too much mixing of the fertilizer with the soil reduces its efficiency because of the power that soils have of rendering phosphates and potash insoluble. When fertilizer injury occurs, it results from too much soluble salt entering the soil solution close to the seed or young plant. Fertilizer salts used to supply nitrogen and potash are apt to be more injurious than phosphates.

No Single Pattern

Fertilizer salts move up and down with the soil water—down following a rain and up when moisture is evaporating from the surface. Almost no horizontal movement of such salts occurs. Crops differ in their sensitivity. In general, the legumes such as soybeans, peas, clover, and alfalfa are more easily injured than corn, sugar beets, potatoes, or small grains.

Contrary to ideas of a few years ago, hill or row application does not tend to limit the spread or penetration of the root system. However, in occasional years of severe drouth, hill application may exaggerate the bad effects of dry weather, sometimes causing the crop to "fire." It is probable, though, that such injury is the direct result of the more rapid early growth resulting from this method of application, and consequently the larger need for water.

No single fertilizer pattern has been found superior with all crops and under all conditions. Almost without exception, however, placing the fertilizer at the sides of the seed has been close to the top in efficiency. On the average, no other placement appears even a close second.

Fertilizer is most apt to injure when it is placed directly in contact with the seed. Placement in bands directly over the seed is usually not advisable, the fertilizer tending to wash down around the seed and injure it. Bands directly below the seed are but little better, especially if placed at shallow depth. This is because the fertilizer tends to rise with the capillary water and cause trouble. Mixing the fertilizer in the row with the seed or under the seed is sometimes satisfactory, but not if the soil happens to remain fairly dry after planting.—*G. E. Ferris, Ohio Agricultural Extension Service.*

Boron—a Minor Plant Nutrient of Major Importance

(*From page* 19)

Some very profitable responses to boron have been realized from horticultural and field crops. While experiments showed an indicated loss from use of boron on some small fruit crops the second year after treatment, there was some increase in cane size and fruit yield. Grass and small grains have relatively low boron contents, yet response to boron has been observed with these crops. Schropp and Arenz (1940) found boron essential for formation of barley kernels. The grasses in mixtures may receive indirect benefit.

Rate and duration of treatment have been varied with several soils and crops. Slight temporary toxicity without economic loss has been observed with corn where a 30-pound application was made inadvertently the second year. Lawn grass was slightly off color for 10 days following an application of 40 pounds of boric acid an acre. Yields of alfalfa have increased with increasing rates of borax applications up to 60 pounds an acre. It appears that 30 pounds of borax an acre can be safely used for most purposes. This rate has given commercial but not complete control of beet canker. Heavier applications than this seem advisable unless placement at the side of the row will give more complete control. A 30-pound treatment appears to be effective for 2 or 3 years. Most prompt results in experimental tests have followed where application was by sprinkling in aqueous solution. The borax may be broadcast with a cyclone type of grass seed hand sower. It has been used successfully by mixing with gypsum or superphosphate. Early application is important.

Some data as to boron in soils and plants appear in an earlier report (Powers, 1939). We are now using the quinalizarin method of Berger and Truog (1940) for nearly available boron. Old soils, leachy soils, peaty soils, or those derived from igneous rocks seem most apt to be deficient in boron. Soil reaction or liming, soil moisture content, colloidality and organic matter contents, and perhaps also the temperature may affect boron availability. So, boric acid may be best used for experimental tests on basic soils. Two pounds of boric acid will supply approximately as much boron as three pounds of borax.

Boron deficiency caused this dark heart of turnips on Chehalis silt loam.

Boron on alfalfa grown on Amity silty clay loam increased seasoned hay yield 1½ tons an acre.

The boron content of plant material tested has ranged from 7 to 50 parts per million and has been markedly lower in plants needing boron than in normal plants or those grown on boron-treated soils.

There are now some 50,000 acres of alfalfa in the Willamette Valley that will yield ½ ton to 1 ton more an acre from the borax treatment which costs about $1 an acre for a 30-pound application. Loss due to beet canker has been 8 to 10 per cent, and loss in celery up to 50 per cent.

Twenty tons of borax were used for fertilizer in Oregon in 1939 and more than 100 tons in 1940. A minor amount of boron is a major factor in plant nutrition over wide areas of the Pacific Northwest, and nutrition is a large factor in national security.

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Basing a Program on What the Soil Tells

(*From page* 13)

and 91 per cent showing "Low" to "Very Low" on potash, it meant one of two things—disregard the signs or step up the use of potash. The latter was chosen, and today a program in which potash is equal in importance to phosphorus, and on the very dark soils is above that figure, is being pushed.

The issue of more potash has taken root with the farmers, over the past six years, because they found the straw just a little stiffer, the test weight a little heavier, the maturity a little more normal, the yield a little higher, and a better, more even, longer lasting legume crop. Like "Topsy" the program for more potash "just grew."

Give Due Consideration To Dominant Soil Types

FOR many years it has been recognized that every agricultural soil type has not only its strong and weak points, with reference to available plant-food resources, but that each possesses certain characteristics and aspects which make it peculiarly better suited for the growth of certain crops and for the practice of certain types of farming. This special crop adaptation to soil types has been strikingly brought out time and again with many crops in our work in North Carolina during the past 10 to 15 years. As a matter of fact almost every crop, *for optimum growth,* seems to have soil requirements which are best met by a particular soil type or types closely related to it.

Two illustrations of special crop adaptation to soil types are seen in tobacco and red and closely related clovers. It has been known for a long time that if tobacco is to attain high quality, it has to be grown on certain kinds or types of soil and has to be fertilized in such a way and at such a time as to best supplement the available plant-food resources of the particular soil. It is well known that generally best results are secured when it is grown on certain types of the Marlboro, Norfolk, Durham, Appling, Granville, and Cecil series of soil. If set on other types of soil, the quality of the tobacco is quite likely to suffer, and bring lower prices.

It has been observed for some years in the Piedmont section of North Carolina that red and allied clovers did much better and were being grown much more generally in some communities than in others in the same counties. In an effort to determine the cause or causes for this somewhat irregular distribution, it was found that successful growth, in many, if not in most cases, was closely associated with type or types of soil which the communities had, and to which these legumes are specially adapted. It became evident that Davidson clay loam is one of these, for wherever one finds this type of soil well developed and occurring to any great extent, red and other clovers will usually be occupying a considerably larger proportion of the total acreage of the cultivated land than will be the case on other types of soil occurring in the same counties. With proper care in seeding, alfalfa frequently, if not most generally, attains its maximum success on this and closely related types of soil.

These observations are significant in pointing the way for a safe and sound plan of promoting the growth of special crops in the South and for establishing untried types or systems of farming.

Especially will this be found true for those crops which appear to be rather exacting in their soil requirements, like tobacco, red clover, and alfalfa. The crops grown or attempted to be grown and the types of farming to be practiced in any community should fit into the character of the dominant soils, if best returns, other things being equal, are to be secured.—*Professor C. B. Williams, North Carolina State College of Agriculture.*

Plant's Contents Show Its Nutrient Needs

(*From page* 11)

calcium, 36 pounds of phosphorus, and 88 pounds of potassium must be provided by the soil for the production of maximum yields and good quality hay.

In terms of plant-food material, an application of 500 pounds of limestone, 400 pounds of 20 per cent superphosphate, and 200 pounds of muriate of potash should be sufficient for maximum yields of lespedeza on soils of lateritic origin.

Crimson clover has been grown in the South for years, but many farmers have abandoned the crop because of the difficulty in securing stands. A field experiment was designed in 1939 to study its fertility and pH requirements. The observations to date show that this legume is best adapted to sandy loam soils and is very responsive to phosphorus. The maximum yield of 4,192 pounds of oven-dry hay was produced on the plat which received 600 pounds of 20 per cent superphosphate, 100 pounds of muriate of potash, and sufficient limestone to obtain a pH of 6.28. The 100-pound potash plat yielded 2,450 pounds of oven-dry hay and the check plat yielded 2,150 pounds per acre. Further observation on high-lime plats (pH values above 7.0) showed symptoms of potash deficiency, indicating that such high pH values are not desirable; whereas from 300 to 600 pounds of superphosphate and 100 pounds of muriate of potash are essential for obtaining a successful production of crimson clover.

Data accumulated from a pot experiment with Austrian winter peas show that peas are a fairly acid-tolerant crop, but are best adapted to only slightly

TABLE 1—THE EFFECT OF FERTILITY ON YIELD AND NUTRIENT CONTEST OF LESPEDEZA AT OPTIMUM pH RANGE OF 6.0 TO 6.5

Fertilizer	Yield Grams/Pot	Plant Composition Pounds per Acre		
		Calcium	Phosphorus	Potassium
0	40.9	122	21	62
600# 0–10–0	46.0	152	30	74
1200# 0–10–0	51.6	175	36	88
600# 0–10–5	46.1	146	26	82
1200# 0–10–5	45.7	126	24	120

acid soils. Maximum yields were obtained at a pH range of 6.0-6.2. The results, as far as fertility requirements are concerned, are similar to those secured for lespedeza. They further emphasize the necessity of providing an ample supply of calcium and phosphorus for crop production and maximum mobilization of nutrients in the crop. The nutrient content at optimum growth indicates that plant-food materials corresponding to 320 pounds of limestone, 350 pounds of superphosphate, and 300 pounds of muriate of potash will provide the required nutrients for winter peas. Thus on lateritic soils, the successful production of legumes can be assured by providing a relatively high fertility level through using lime, superphosphate, and potash.

A Balanced Diet for Nursery Stock

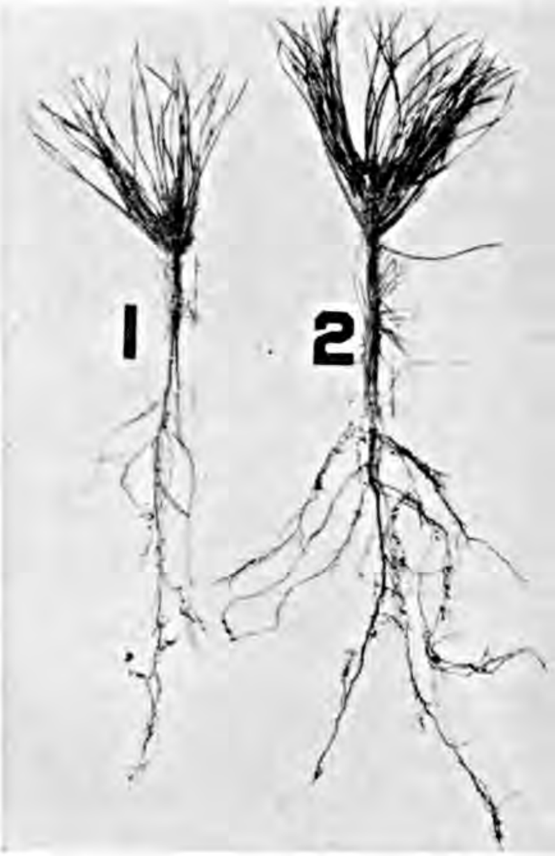
(*From page* 16)

raised on fertilized nursery soils with a well-balanced ratio of nutrients. These findings were fully substantiated by the studies of the Lake States Forest Experiment Station.

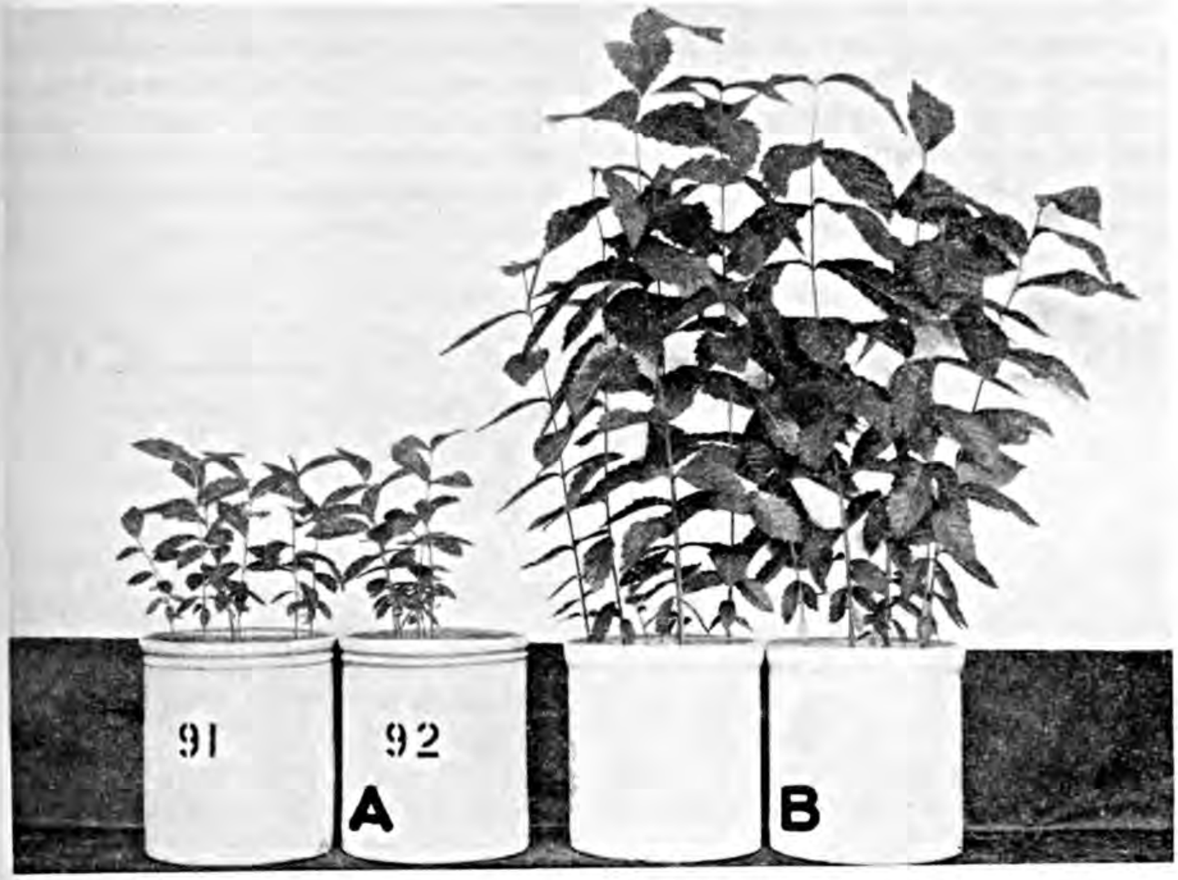
The adjustment of fertility in nursery soils is accomplished chiefly by the application of peat, duff or leafmold, other organic remains, and soluble fertilizers. The commonly applied mineral fertilizers include ammonium sulfate, nitrate of soda, superphosphate, ammonium phosphate, potassium nitrate, and sulfate or muriate of potash. Other commercial fertilizers are used only in exceptional cases. The use of nitrate fertilizers is largely confined to liquid treatments or blocks with hardwood stock. As a rule, the content of nitrate nitrogen does not exceed half of the total content of soluble nitrogen applied. In rare instances the colloidal content of soil is increased by additions of clay, and the soil reaction is adjusted by acidifying agents, such as sulfur or aluminum sulfate. Ordinarily the pH value, colloidal content, and associated fertility factors are brought to the desirable level by an addition of organic remains having suitable reaction, exchange capacity, and content of bases.

The determination of the necessary amounts of fertilizing materials to be applied is a matter of simple arithmetic based on the chemical analyses of the soil and fertilizers.

Not all of the nursery soils may be raised to a satisfactory fertility level by a single application of salts and absorbing colloids. The introduction of large quantities of raw organic remains and mineral fertilizers may bring about a deficiency of available nitrogen or a toxicity of soil solution due to a high



Effect of a complete well-balanced fertilizer (2) upon the development of 2-year-old Scotch pine seedlings grown in Trout Lake State Forest Nursery, Wisconsin. Note the slight difference in the size of the crowns as compared with the large difference in the stem diameters and size of root systems.



Growth of a 4-months-old American elm on a depleted Miami loam soil from the University of Wisconsin Arboretum (A), and the same soil with the fertility adjusted (B).

concentration of salts. For this reason, in soils of a low fertility, it may be desirable to extend the soil-improvement program over a period of several years. Experience has shown that most soils, including those of sandy texture, can be brought into a fully productive state in the course of three 2-year rotations.

It is important in the management of nursery soils to keep in mind the relationship that exists between the total soil fertility, the fraction of nutrients in the soil solution, and the amount of nutrients actually required by seedlings during their 1- or 2-year period of growth.

The amount of a nutrient which is necessary for actual annual metabolism of forest seedlings constitutes, as a rule, but a small fraction of the total available supply of this nutrient present in a productive nursery soil. For example, the amount of calcium annually taken up by the growth of even calciphilous hardwood seedlings is less than 1 milliequivalent per 100 gm., or 400 pounds per acre. Nevertheless, a productive hardwood nursery soil must contain at least 5 milliequivalents per 100 gm. of replaceable calcium, or 2,000 pounds per acre. The presence of this high amount is vital because calcium fulfills numerous functions in soil besides that of a plant nutrient. It promotes aggregation, regulates reaction, counteracts the toxicity of other ions, and stimulates the activity of micro-organisms.

In nursery soils, exposed to rainfall and artificial irrigation, the nutrients in solution are subject to frequent changes. During a period of abundant rainfall, the readily soluble salts are leached away and the soil is saturated with nearly pure water. After the rains have stopped, additional nutrients are gradually released into the soil solution, by hydrolysis and the activity of microorganisms, from the more soluble minerals, exchange material, and organic compounds, i.e., from the storehouses of the plant nutrients. The higher the reserve supply of nutrients, the more stable is the level of the readily available fraction, and the greater is the assurance of an uninterrupted and balanced nutrition of seedlings.

If, in spite of all precautions, prolonged rainfall, severe leaching, or intensive feeding of densely planted stock decrease greatly the content of certain available nutrients, the deficiency must be corrected by the application of liquid fertilizers. Careful observations of stock and periodic soil analyses should serve to prevent any serious disruption of the normal nutrient balance.

The Concept of "Available" Nutrients in the Soil

(*From page* 22)

"independent operational significance of concepts" (5). This means that our concepts should be defined in terms of the operations or methods by which they are measured. Likewise, this point of view demands the elimination of any concept which is incapable of measurement. Such a concept was that of "absolute time."

What factors must be considered in deciding such questions as: Can the various components of a soil serve as nutrients for plant growth, and how much of each is present in any given soil? It would seem well to recognize from the beginning that if a nutrient is "available," it of necessity must be absorbed by the crop, otherwise some reason must be given to explain its non-absorption. Experiments have shown that all the nutrients can exist in the soil in *chemical form or forms* which the plant can absorb. The exchangeable bases constitute the form of those nutrient cations most closely related to plant growth and response. Water-soluble bases are also known to be a nutrient form of these ions.

The knowledge about phosphates is much more meager at the present time, but it is the author's belief that the way to attack this problem is to study the forms of phosphates in various soils and the relationships between them with emphasis on their chemical structures. Once a form or a number of forms has been definitely established, the next step will be to determine which ones are most closely related to plant growth and response. The nitrogen question is fairly definitely settled in that it is generally agreed that the nitrate and ammonium ions are the two most important forms of this nutrient. We may correctly speak then of nutrient forms of the elements in the soil and at the present time are in a position to determine many of them. It should be mentioned that a greater quantity of most of these forms must be present in the soil than the crop can take up in any one growing season. The reason for this lies in the fact that the plant roots contact but a small percentage of the total colloidal surface of the soil where these ions are held.

Why Change Terminology?

It is the writer's view that the term, "the available nutrient," is misleading, and further that such terms as "the available potassium" and "the readily available phosphorus" should not be used to express the results of chemical soil tests. Since the above terms are now commonly used by most soil chemists to express the results of such tests, it might well be asked, "Why change the terminology and what would be accomplished by the change?"

Most agronomists understand the term "available" to mean "usable." In the general sense this term assumes that the substance *can* be used. This assumption includes the following factors: (1) That the element is in an absorbable form; the chemical factor. (2) That a plant can get to it; the positional factor. (3) That the nutrient can be absorbed at a particular stage in the development of the plant; the physiological factor. More factors will probably be added as knowledge of plant nutrition increases. It is thus evident that calling a nutrient "available" solely on the basis of its chemical form involves a number of very questionable assumptions. It seems less confusing to the author to call the replaceable potassium a nutrient form of potassium rather than the "available" potassium.

Although some may claim that the present usage of "available" is synonymous with the writer's usage of "nutrient form," the fact that the phosphate test of Bray has been so widely misinterpreted and incorrectly used in other states constitutes evidence that the term "available" is misleading other workers in their interpretations. Other evidence to support this view is furnished by those quick tests for "available potassium" which do not attempt to measure a definite proportion of the replaceable potassium.

If a chemist finds the replaceable potassium in a soil to be 75 pounds and reports that the soil contains 75 pounds of "available potassium," no one would be justified in predicting that a corn crop which absorbed only 25 pounds of potassium would show a yield increase for further additions of potassium to that soil. Yet this response is a common ocurrence on such soils in Illinois, and to maintain the terminology one is forced to conclude that there was a difference in the availability of the "available potassium." A similar situation results when two different crops, as wheat and alfalfa, are grown on soils containing the same "amount" of "available potassium." The alfalfa absorbs more than the wheat, and again to maintain the terminology one is forced to conclude that the availability of the "available" potassium differs for the two crops.

The present viewpoint then not only accepts a general concept of availability but also includes special types, such as chemical availability, positional availability, etc. If actually followed to a conclusion, this type of reasoning would enable one to say, "All the material in the soil is available to plants, but most of it is not absorbed by a crop because of its extremely low chemical availability." This "explanation" is no more than a play on words. Since there is no evident flaw in the reasoning which leads to such a statement, it is necessary to examine the underlying assumptions of the concept itself. The most outstanding fallacy in the above reasoning is the use of the term, "the available potassium," synonymously with "the replaceable potassium." As mentioned above, the chemical form of an element is but one of the factors determining its availability. It is just this point which is disregarded in the synonymous use of the terms. Further analysis shows that there is nothing in the soil which corresponds to the "available potassium," and since a definite term should be a symbol for something definite in the soil, this term is revealed as meaningless.

If plant nutrients are classified on the basis of their chemical forms in the soil and those which can be shown to be absorbed by plants under test conditions are called nutrient forms, we shall correctly emphasize their structural status in the soil and their functional relationships to absorption by plants.

What Would Be Accomplished?

With regard to quick tests or other chemical methods of determining soil nutrients, the point of view of the author is in essential agreement except in the manner of terminology, with that of Bray (3, 4). As Bray states in another paper (2), "It is not practical to try to measure the relative 'availability' of the replaceable potassium by a chemical test, and our best bet is to measure the total replaceable potassium present and let the crop establish the availability in terms of its own requirement." As mentioned before, it seems misleading to the author to call the replaceable potassium the "available potassium" when some factors which cannot be measured by the test may reduce the availability to zero. It is, therefore, suggested that the results of all chemical soil tests be reported in terms of what the test actually measures. This would accomplish three things: (1) It would emphasize the importance of measuring all of the nutrient form or forms of an element or a known proportional part of each present in the soil. (2) It would emphasize the necessity for a calibration between the amount of a nutrient extracted and crop response in the field to the fertilizer in question. The importance of this calibration cannot be overemphasized and has too often been overlooked in the past. (3) It would present the results of the tests in unambiguous terms.

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The Making of Better Pastures

(*From page* 8)

In the case of selection, only those sods that have sufficient good pasture grass varieties should be fertilized. They should be sods that are fairly deep, have considerable natural moisture, and will not dry out. In many instances pastures even though rough, stony, and perhaps on sidehill land have these qualifications and will respond well. In other words, it is not possible to make grass grow where there is nothing to develop it from.

Caledonia County sods are well supplied with wild white clover, much of the seed lying dormant in the soil only waiting for plant food to give it vitality to push up to the surface and produce a good feed. This has been very noticeable in tests around the county, or where wood ashes have been scattered, and particularly around droppings left by the cows. Experience shows that it is not practical to scatter pasture grass seed hit-and-miss over poor sods unless there is something to cover it and particularly if no plant food is applied. Pasture tests to date show that on a good sod minerals such as potash and phosphorus are of first concern. An 0-20-20 mixture has been giving good results on permanent sods, and where considerable grass exists a 1-2-2 ratio such as an 8-16-16 does exceptionally well. In the case of the latter combination, good results can be secured where hay sods have been recently turned over to rotated pasture.

Management Important

Management of a pasture is all important. Confining a herd on a small area assures even grazing, the consumption of the grass when it is at its best, and the development of a good sod. When the poor and mediocre sods are eliminated, the droppings are made much more effective and thus concentrate the extra plant food where needed. Where hay sods are used in the pasture program, electric fences can be employed to good advantage.

One of the best examples of pasture improvement in the County is on the farm of J. R. Moore and Son of East Barnet. Starting in 1938 on a very rough sidehill permanent pasture, Mr. Moore top-dressed with approximately 300 pounds per acre of an 8-16-16. The response was exceptional, and the same treatment was given again in 1939. In each of these years the grass responded, and the white clover came in and did not choke out. The herd of 20 cows was rotated approximately every 2 weeks on each of the 2 areas into which the pasture was divided. In 1940 most of the area was treated with 0-20-20 and the sod was maintained in good shape. For his own information last year Mr. Moore kept actual grazing data, which showed that the herd was turned out on one plot on May 16, the two plots were alternated at intervals of some two weeks each, and the first green feed to supplement the pasture was not necessary until August 6. Nearly three months of good pasturage was provided.

This area makes up the entire pasture on the farm, and the Moore herd is one of the best Jersey herds in the County, leading the first Caledonia Dairy Herd Improvement Association with an average of 432 pounds of butterfat for the year ending September 1, 1940. The herd averages well over a five per cent butterfat test. Mr. Moore's plans are to use the complete 8-16-16 mixture in alternate years with an 0-20-20 and manage the grazing so as to maintain the sod in a healthy condition, with a good mixture of grass and clover. The soil is of the Worthington fine sandy loam type, having originally had considerable lime in its make-up, and is typical of many soils in the County. The farm also grows alfalfa well.

Other Phases of Program

Other phases of work requiring study include abandoned farms, farm wood lot improvement, soil erosion, farm and home accounts, and side-line enterprises. Concerning abandoned farms, the committee felt that the lack of good roads, good schools, and rural electrification all contributed to the abandonment of much land that could grow good crops, produce good pasture, and support good herds. It will be readily seen that all of these factors are necessary for the maintenance of good family living.

Coupled with the job of maintaining permanent pastures and making them better is the problem of soil erosion. In many sections of the County pastures that provided a good carrying capacity for dairy herds a few years ago are showing sheet erosion and even gullies which will make it necessary to take such pasture sods out of the farm rotation and either abandon the area or plant it to trees to hold the soil. Several years ago it was felt that soil erosion was a far cry from Vermont, but the truth of the matter is that it is here and here to stay. Already three soil conservation districts have been formed with erosion as a major problem for control, and more localities are anxious to form districts as soon as supervision can be established.

The northern end of Caledonia County, containing as it does much of the lighter, sandy soils, is showing the effects of overgrazing on many of the sidehill pastures. Had these pastures been fed fertilizer minerals, particularly potash and phosphorus, and rotated and managed so as to eliminate the effects of overgrazing, they would still be providing good pasturage. The pictures accompanying this article show an area in one of the good agricultural towns and on a main highway, where typical erosion has been taking place. They could have told a much different story had something been done about it a very few years ago. With cows grazing 100 pounds of grass per day or better, the large amount of plant food taken out should have been replaced. There is no other way to do it except through fertilizers or barnyard manure, and most of the latter is necessary for crop and hay land.

This pasture provided good grazing for a large dairy herd 15 years ago. But overgrazing, without plant food being returned, has resulted in the sod becoming so thin that serious erosion is taking place. It now provides little more than an exercise ground.

The Agricultural Conservation Program now completing its fifth year in the state and county, and enthusiastically going into its sixth, has formed a very sound base from which to work for better hay and pasture land. It started in 1936 with some 660 farmers signing up, 579 of these completed the practices. The year 1940 showed 1,222 signed up with a 96 per cent completion, taking in approximately all the farms being operated as such in the county. At the present time, nearly $100,000 in cash and materials in lieu of cash are coming into the farmers' pockets and the farmers' fields annually. Discounting the fact that the payment received is undoubtedly an incentive and a great help in carrying out the practices, the actual value in replacing soil fertility is and will be immeasurable as the years go by.

For years extension agents worked hard to get across in an educational way the story of better hay and better pastures. Many meetings were held and hundreds of demonstrations with various fertilizer strengths and rates of application were made, yet the actual progress was slow. Farmers would come to the demonstrations, see the results, comment favorably, and plan on trying it out on their own farms, but not until the conservation program got under way and sizable amounts were ordered and tried was there much actual response.

It is certainly safe to say that 5 years of agricultural conservation work in Caledonia County and probably in the State of Vermont as a whole, have seen more accomplishment for better hay and pastures than the previous 15 or 20 years of extension education in this line. A sound agricultural conservation program operated by farmers and guided through the State and County offices, along with a sound land use program also built and guided by the farmers and extension workers, has every chance of giving farmers a forage-crop and pasture program of real value for the years that lie ahead.

Corncrib Loyalty

(*From page* 5)

This, however, is likely to follow if the extra investment and accumulated risk penalize farmers who lack the thoughtful consideration of their customers. It might in time mean consolidated farm holdings, corporation estates, more day labor and less responsibility, with a declining zest for liberty and fraternity. Real monopolies in producing food might arise, to add to those in distributing it, and real regimentation of consumers would be in sight. Soils would undergo a fresh wave of neglect for a few years and fortunes from private and public funds would be needed to replenish them.

It seems sounder to pay the farmer a decent going return during the interval of a wartime boom than to thwart his necessity and push him into a series of tailspins that only repeat the sins and errors of the old lamented post-war period.

But right here comes the remarkable twist to this problem. Our corn-belters are going to keep right on stretching their strides and wearing their overalls to a frazzle trying to fill the food list that Uncle Sam and the newly employed have put up to them. They won't balk or lag and shrug their shoulders, sniveling about long hours and having to hire some no-account harvest hand. I've been out on the front where the corn fritters and bacon originate, and take it from me, an old-timer, you won't hear anybody threaten to quit, price or no price.

Most of them are so relieved over dropping the custom which labor and industry taught them—cutting down production—that they are boiling over with ardor to spill out the whole cornucopia of nature's largess. Meanwhile they keep a shrewd eye on the soil balance, which is something they forgot in the former fracas, and the restitution of which was the major task of the nineteen thirties.

Corn-belt sows are doubling up on parturition; worm capsules are being bought by the ton; skim-milk and tankage is being dished out like a longshoremen's banquet; and there are more young grunters in the rape and bluegrass than you would find in an Irishman's happiest dreams.

Wool growers are stuffing sacks like a giant's mattress; tying the separate fleeces with hard twine and grading out the stains and tag-ends; flushing the ewes and docking the lambs in the greatest revival of shepherding since the spinning days of the pioneers.

Adolescent roosters are no longer a drug on the market because the renewed cry for a chicken in every pot is boosting broilers. All the farm women I know and as many of their husbands as can be persuaded are clucking around with messes of baby chicks and infant ducks. Attics, garage floors, and woodsheds are being converted into colony houses, and even cabin trailers are not being overlooked. This expansion carries less hazard than the expansion of larger livestock and poultry matures in a hurry for ready cash. There may be a surplus at times, but it won't fret the farmers much out our way, since they have to feed parish parsons and city cousins sometimes and the wishbones won't be wasted.

When it comes to expanding concentrated protein into convenient packages for overseas shipment, there's where the milk producers get their assignment. The tardy old bureaucrats finally got around to issuing an SOS to the silo fillers, and honestly, instead of a few extra strippings the cows ladled out an inundation. We've seldom had grass so green and luscious, clover so aromatic or alfalfa so noodled with nitrogen. It's so lactic in the Midwest dairy country that the cows milk twice as much night and morning, and we expect to run stainless steel pipelines from the pastures for noonday relief. Cheese and canned milk are the favored articles, and before summer is over the haulers will be draining the butter belt for delivery to the vats and condensers.

OF course, the cow-milking gentry had to get in a few pow-wows about prices and privileges before they admitted that it's paying them well to squat on the milk stool a little longer. That's natural behavior for them, as I have reported to you on sundry occasions in these weighty columns.

For be it known that the lacteal lads always shy at anything which smacks of federal coercion, except fixing milk price orders of their own choosing or taking a slam-bang at the oleo outfit. Organized milkers put the double X on the triple A years ago because all the legal talent in Philly plus the Supreme Court and the Harvard Law School couldn't figure out an adjustment program for the bovines, up, down, or sideways. More brains and bluster have been exerted at endless chatterfests to round up a scheme that would get an encore from the udder tuggers, but it's been one vacant void and a racking headache from Utica to Pasadena.

Hence this open call for more of everything sanitary coming from the cow barn has sent the bosses of the bossies into a panic of ration balancing and teat massaging. We are happy to print herewith that the dairymen and the government see through one periscope at last, and can shake hands without boxing gloves on. Having won support of the reluctant and independent dairy battalion, we can say that the worst fears of a bucolic revolution in the Midwest are over.

THERE'S one thing I'll admit, and that is we are not very warlike out in the sticks. We are not crazy to smell anybody's powder, our's or the other guy's; but we are not averse to snuffing up a batch of cultivator dust or thresher chaff. Our modern tractors suit us almost as well as tanks, as we can go 15 miles an hour and run over gardens and chickens without a qualm. We prefer to operate the dirty orchard pump shooting bugs with lead arsenate rather than start training with a gas machine. Some of our 1920 farm trucks made as much noise as antiaircraft batteries, and the straw boss can holler louder and act uglier than a top sergeant. We've got the feel of a battle zone anyway, and about as much night's rest as a frontline trooper, so if you need any dirty work at the crossroads call on us.

But we like to rest a spell in the shade at lunch time, fanning our brows with the latest war news, and renewing our faith in each other and the rest of America. So if you'll pause awhile with us beside the stubble field, we can show you a bubbling spring, ice-cold and pure, and we can dip you a brimming cup of nature's nectar and toast you all to the United States of America and its citizens and Commander. The Soil Squad salutes!

Little Jim, "Daddy, a man's wife is his better half, isn't she?"

Father, "Well, son, they are frequently referred to as such."

Little Jim, "Then if a man married twice, there wouldn't be much of him left, would there?"

SURPRISE

The farmer's wife had been pestering him for a long time to buy some new clothes. So one day, when he drove to market, he decided to surprise her. He purchased an entire new outfit, which was packed and placed under the buggy seat. Driving home, he had to ford a river and here he paused, took off his clothes, bathed in the river and then tied all his old garments to a rock and threw them into the stream. Reaching under the seat for his new clothes, he was horrified to discover that they weren't there. After a frantic but unavailing search came a pause for meditation. Then he climbed briskly into the buggy, touched up the old horse with the whip, and said, "Giddap, Mariah, we'll surprise her anyway."

They're picking up the pieces
With a dustpan and a rake,
Because he grabbed a silken knee
When he should have grabbed the brake.

One broiling July day an aged "cullard gemman" who was pushing a barrow of bricks paused to dash the sweat from his dusky brow; then, shaking his fist at the sun, he apostrophized it thus: "Fo' the Lawd's sake, whar wuz yuh last Janooary?"

ALSO RAN

"Am I the only girl you've ever kissed?" demanded the pert young thing.

"Well—er—no," blurted her latest find, "but—"

"Then buzz off," was the reply. "If you know the course, and that's your top form, I'm not playing."

Mrs. Jones (at seashore)—"My husband writes that he's feeling good, business is good, and he loves me."

Mrs. Smith—"All on that little scrap of paper?"

Mrs. Jones—"Yes, it's a check for $100."

"You say you want me to give you a divorce from this woman?"

"Yassuh."

"But you've been married nineteen years."

"Yassuh, Ah jes' don' want to get in no rut."

A small boy leading a donkey passed by an army camp. A couple of soldiers thought they would tease the lad.

"What are you holding onto your brother so tight for?" asked one of the soldiers.

"So's he won't enlist in the army," replied the boy without blinking.

AND—

If the U. S. Navy gets much bigger, there won't be enough girls in every port to go around.

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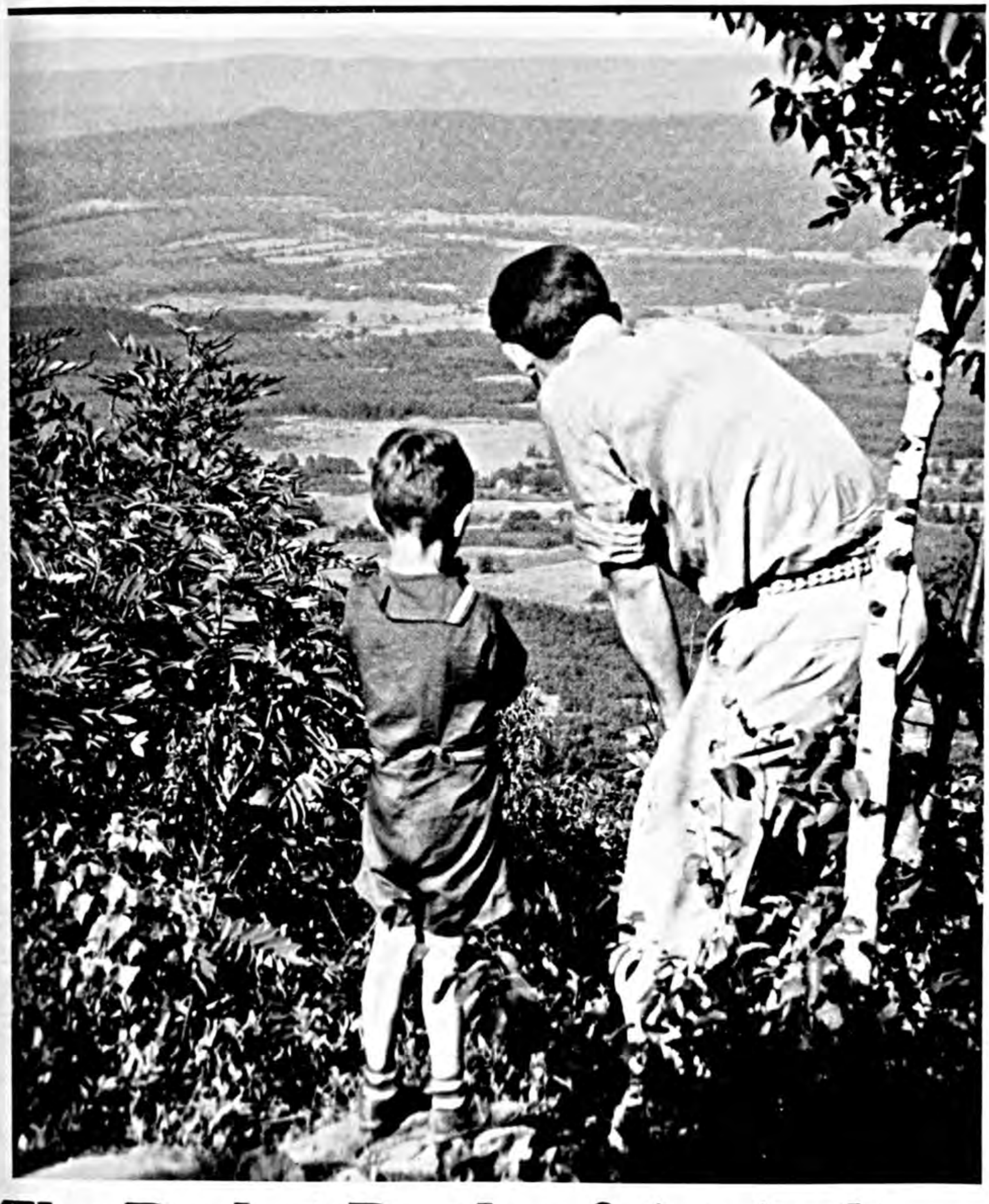

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THE AMERICAN POTASH INSTITUTE

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

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

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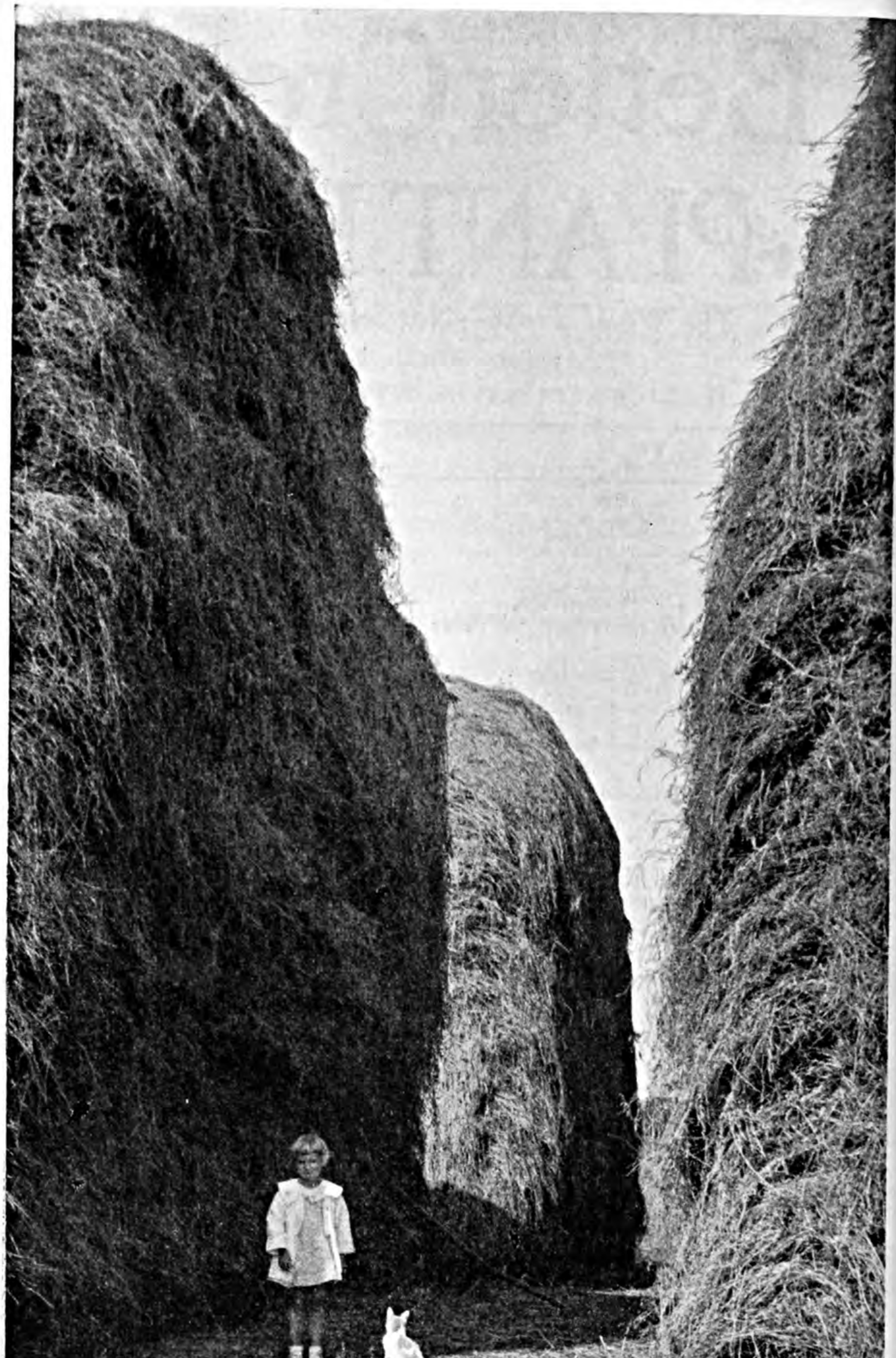

A GOOD "HAY YEAR" RESULTS IN CONSIDERABLE OUTSIDE STORAGE

Better Crops with PLANT FOOD

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Home-grown vs. Drug-store....

Vitamins—the V-Sign

Jeff McDermid

IT'S a hot race between government agencies and nutrition specialists to see who confiscates all the alphabet the soonest. All they are apt to leave for us common folks are the X and Z departments, but they'll be handy to cuss with when we begin to pay up.

There's many a new letter added to the list and much confusion about what both government and nutrition mean since that summer day long ago, before World War 1, when the writer had the privilege of composing the first news story on Doc McCollum's rat lab discoveries in fat-soluble A and water-soluble B. That is to say, despite the ease with which politics and science have appropriated our alphabet, we are still far from letter perfect in either field.

It may take some hefty vitamins, ersatz or otherwise, to finish and win the war for somebody; but take it from me, it will require a devilish lot of them to give us the vim, vigor, and vitality sufficient to manage a peace properly when it arrives. And this not alone for the sufferers from bombs and privation, but also for those who will shoulder the job of uniting a battered world for a better kind of living.

To many minds vitamins are what you buy at the drug store that you should have got at the grocery. To kids they simply signify the magic stuff contained in spinach which always bulges Popeye's muscles opportunely. To oldsters they mean curbing rheumatics, postponing store teeth a little longer, and perhaps restoring dark hair and finding Ponce de Leon's fabled fountain of youth for those who can't sojourn in Florida.

To home ec teachers and extension workers they mean a new angle on old recipes; to druggists vitamins often spell the difference between black ink and red, especially in towns within the goiter belt; and to doctors they afford a harmless substitute for pink candy pills and sugar powders for patients with more imagination than illness.

To high-powered advertising agencies and super salesmen vitamins plugged in everything eatable, drinkable, and chewable provide that last approach to a weary stomach which modern methods dictate.

I doubt very much if Osborne or McCollum and their diligent associates back in the rat-ridden days of small funds and much guesswork could have ever anticipated the diversity of satisfaction, employment, relaxation, hope, and health which the vitamin era has set going. Probably no other practical application of pure science has engendered more lines of activity except the invention of the gasoline and Diesel engines. Lots of it has been bum stuff and poor economics maybe, but that much can also be said of motor mechanics and then some besides.

SOME exclaim that vitamins are just old facts newly proven. Which is true enough; but maybe it's better to know how to make yourself feel good than to just feel good and not know why. Feeling good in past centuries was apparently an accident, due to something folks had "et" without realizing values other than intestinal distention and enhanced pep.

Today vitamins are among the few things left which bind the world together, because their rate of intake is expressed in International Units. It looks as though that form of unity is about all the human family has left. It defies flags and treaties, boundaries, embargoes, arms and oratory.

Fuel oils may be the chief motive of wars, but cod-liver oils are the V-sign in the battle with rickets the world over. It takes strange acids to compound bad medicines of war, but it also requires complex acids to fashion results in the vitamin field. Maladjustment in metabolism probably induces more meanness and quarrelsome habits among human beings than national pride and commercial rivalry. While generals argue over fresh campaigns and we study up new ways to hate each other harder, we behold inquiring scientists smuggling research information back and forth across beleaguered seas. And plenty of that information, thank goodness, has to do with soil balances and vitamin therapy.

I SURE hope the biological chemists and nutrition nurses will keep right on scratching that old V-sign on anything smooth they can locate in this wrinkled world. For you don't have to figure out what word akin to victory it means in anybody's tongue, because all the babies, faded mothers, weak old folks, and starving youths will understand that vitamins spell victory over half the woes which beset mankind and reduce the pressure between the haves and have-nots everywhere.

Certainly in our domestic history there has been a change in both quality and quantity of foods, in some ways better, in others not so good. I recall a grand-aunt of mine whose maidenhood was spent on a pioneer farm, and when we went to her house our diet got a throw-back to deerskin days.

She arose ahead of the fowls and began cooking skillets of oat meal, rashers of bacon, platters of eggs, and plates of corn bread; everything laved in cream and butter, maybe flanked with fresh greens and summer vegetables, and washed down with raw milk and coffee. In season there were fresh fruits and fruit sauces, and we had unrefined molasses on dark bread and apple cider for refreshment.

Of course she belonged to an age when men swung their scythes and walked behind the plow, cleared lands with axe and mattock, and raised barns by main strength and awkwardness. Her customers of the skillet had the appetite and the outdoors lung power to stimulate internal secretions and digest large and bulky food orders.

It was our lot to be raised in the period just at the turn of the century, before men had become addicted to predigested packaged foods and devitalized victuals. I remember when father

brought home the original paper boxes of "Grainose." We began eating it as a sort of dessert and had to explain to visitors that we were not dyspeptic or inclined to copy the table customs of Battle Creek sanitariums.

Gradually, however, the breakfast table slid over into the hay food category and mothers quit serving us the rich natural fodder of our forefathers. The grocers had to adopt the new methods as the years went by, and bakers refined their breads and pastries to the extreme limits of safety—all being so gradual that few noticed or protested it.

Yet I am not so quick to blame the food fads of other days for all the troublesome defects which have since become a national heritage more or less. It seems to me that our mode of living and our mental processes have created in our bodies a peculiarly favorable ground for these defects to dominate. Naturally we must also recognize such potent causes of bad teeth, poor eyesight, weak tendons, and skin and nerve disorders as ignorance and poverty.

When we can combat ignorance and indifference successfully and give more families a decent margin of income for needful variety in their foods, it will get more vitamins into service. But I still maintain that our post-hasty American way of living and our taut, tense, and irregular behavior are apt to give the vitamins a long fight before they cure us.

It is also a question worth proposing whether the matter of securing rigid patent rights on certain processing and compoundng to restrict the source of vitamins to registered items and groups is going to hold back the wider use of vitamins by underprivileged persons; and if warfare between commodity interests to prevent fortification of rival fats and oils with Vitamin A, for instance, is doing any good to either party, and may work injury to hosts of poor consumers.

IN admiration for past discoveries and with hope for new benefits, I consulted a noted authority on vitamins lately. I glean one statement from his dissertation that should be widely read and carefully noted. This biologist said:

"It is the goal of nutrition workers to make available as rapidly as possible all the knowledge necessary to handle the supply of foods and demand for nutrients in such a way that nutritional deficiencies will disappear. But there are some factors such as habit, economic conditions, ignorance, commercial manipulation of food supplies, and misunderstanding which militate against attainment of this goal."

In connection with physical weakness and debility or poor metabolism, folks often expect a doctor to prescribe diets that will bring rapid recovery, even though the condition was brought about by a prolonged consumption of ill-balanced rations. If on the other hand a fellow thinks he can dose himself with vitamins and depends on some knowing young sandwich hound in a drugstore to set him right on nutrition, he

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Fig. 1. Cotton plot on the left received no potash while plot on the right received a 30-pound application of K_2O. Note the open bolls and loss of foliage on the no-potash plot.

Cotton and Corn Response to Potash in South Carolina

By G. B. Killinger

Agricultural Experiment Station, Clemson, South Carolina

THE fertilizer industry, soil scientists, agriculturists, and men interested in crops and soil problems have recognized the importance of a balanced plant-food content in the soil. Many complications come to light, however, when any single element or combination of elements is studied. When certain of the necessary nutrients are added to a soil, physical, chemical, and biological action may convert, combine, or change these nutrients to unavailable forms, causing plants to suffer what might be termed malnutrition. The same nutrients may be added to another soil with excellent results, as exhibited by normal plant development.

Certain deficiencies of plants have come to be recognized by foliar diagnosis. Potassium or potash hunger in cotton plants is quite readily recognized and has often been referred to as brown rust. The advanced stages of this rust may find the plant completely defoliated before maturity. The cotton bolls may not be properly developed and often fail to open properly at harvest time, accounting for a high percentage of cracked bolls. Figure 1 illustrates a plot which has received 30 pounds of K_2O per acre, while the adjacent plot received none. Note the open bolls and lack of foliage in the no-potash plot.

In South Carolina there are considerable acres of cultivatable soils, such as sands and light sandy loams with pervious subsoils, which are often very low in available potassium as well as in total potassium. Such soils as these give the most striking response to potassic fertilizer materials.

The Southern and Southeastern States have a farm management record showing large areas continually cropped to potash-depleting crops, such as cotton, oats, corn, tobacco, and legumes, with other miscellaneous crops to a lesser extent. These crops utilize or take from the soil large quantities of potassium when calculated over a period of years. The utilization of potassium as the oxide by some crops has been shown by Van Slyke (8) and others.

It is generally recognized that leguminous crops such as alfalfa, lespedeza, clover, soybeans, cowpeas, etc., require more potash than non-leguminous crops. During the past decade Southern farmers have greatly increased their acreage of these crops, many of which are taken from the land and utilized as feed. With this situation existing, it is no wonder that serious potash deficiency conditions have developed.

As shown by Truog (7) about 160 pounds of readily available potassium per acre are needed for the production

TABLE 1.—AVERAGE YIELD IN POUNDS OF SEED COTTON PER ACRE FROM EXPERIMENTS ON RATE AND TIME OF APPLYING POTASH TO COTTON

(The Averages for Each Treatment Are from Eight Years' Results)

Pounds of potash applied	Time of application	Average	Average for each rate	Per Cent increase over no potash	Increase of seed cotton for each lb. of potash
None		792	792	...	...
15	All before planting	1001	1010	27.5	14.5
	½ before planting, ½ at chopping	995			
	All at chopping	1035			
30	All before planting (Check Plats)	1201	1136	43.4	11.5
	All before planting	1145			
	½ before planting, ½ at chopping	1126			
	All at chopping	1072			
45	All before planting	1216	1192	50.5	8.9
	½ before planting, ½ at chopping	1215			
	All at chopping	1146			
60	All before planting	1272	1275	61.0	8.0
	½ before planting, ½ at chopping	1287			
	All at chopping	1266			
75	All before planting	1319	1319	66.5	7.0
	½ before planting, ½ at chopping	1344			
	All at chopping	1294			

South Carolina Experiment Station—1940

of normal yields of alfalfa, corn, and cereals.

Attention has been called to great variation in the availability of potassium in different soil types by Bryan (2). It is not necessary to have as high a level of potassium in the Coastal Plains sandy soils, as in the Corn Belt soils. Potash in sands is considered relatively highly available, while in clays the reverse may be true.

Response of cotton to potash on some South Carolina soils is pointed out by Killinger (3). He states that a profitable response has been noted when potash in addition to that already used in ordinary commercial fertilizers is applied to many soils in South Carolina.

Pate and Skinner (4), Skinner (5), and Skinner and Pate (6) found on a number of Coastal Plains and Piedmont soils that potash gave increased yields of cotton, while without the use of adequate potash the cotton was considered a failure on some soils. The sources of potassium in mixtures with phosphoric acid and nitrogen failed to show any wide variations in yield of seed cotton.

Cooper, Schreiner, and Brown (1) recognized that available potash increases the resistance of many crops to disease and that certain diseases of the cotton plant vanished upon the application of potash. These scientists state further that, without potash, or with too small an amount of it, profitable cotton production is practically hopeless, this being particularly true of the general run of cotton soils in the Southeastern States.

Results of Experiments

Experiments have been conducted in South Carolina for a number of years to determine the optimum rate and time of applying potash to cotton and the rate most profitable for corn. These tests were conducted in every part of the State on many different soil types.

Experiments with cotton were conducted using duplicate 1/20-acre plots for each treatment with a check plot bordering every treatment, which allowed for approximately 2/3 of the experiment to be in various treatments and 1/3 in checks. All plots in the tests received the equivalent of 600 pounds of a 5–10–0 fertilizer per acre, and the check plots were treated with a 5–10–5 before planting. The potash applied, both as to rate and time, varied as outlined in Table 1. None to 75 pounds per acre of K_2O were used with 15-pound increments. All plots received an additional 15 pounds of nitrogen from cal-nitro at side-dressing time. The nitrogen in the fertilizer mixture was derived 1/2 from cottonseed meal and 1/2 from ammonium sulfate. The phosphorus was from superphosphate and the potassium from muriate of potash. Dolomitic limestone was applied to all plots in the row at the rate of 200 pounds per acre.

The average of eight years' results from 84 to 137 plots exclusive of checks shown in Table 1 indicates a profitable response from all rates. A 66.5 per cent increase in seed cotton is noted from the use of 75 pounds of K_2O over no potash. The greatest returns per pound of potash are found from the smaller applications. Foliar deficiency symptoms could be noted in some cases with light treatments, while with the higher rates these deficiencies disappeared. The time of application apparently had little effect on the final yield. Some beneficial effect was noted from the lower rates of potash with delayed application, while with higher applications, all the potash applied before planting or 1/2 at planting and 1/2 at chopping time gave slightly the highest yield.

In determining the potash requirements for corn in South Carolina, the soils were divided into the Mountain and Coastal Plains groups. Figures 2 and 3 show the response of corn on plots receiving no potash and 30 pounds per acre, respectively, at the Sandhill Experiment Station. The Mountain soils used were of the Congaree or Toxaway series while the Coastal Plains soils were largely Norfolk, Marlboro, Ruston, and Orangeburg. One-twenti-

Fig. 2. Check plots in potash experiments with corn received 30 pounds of K_2O per acre.

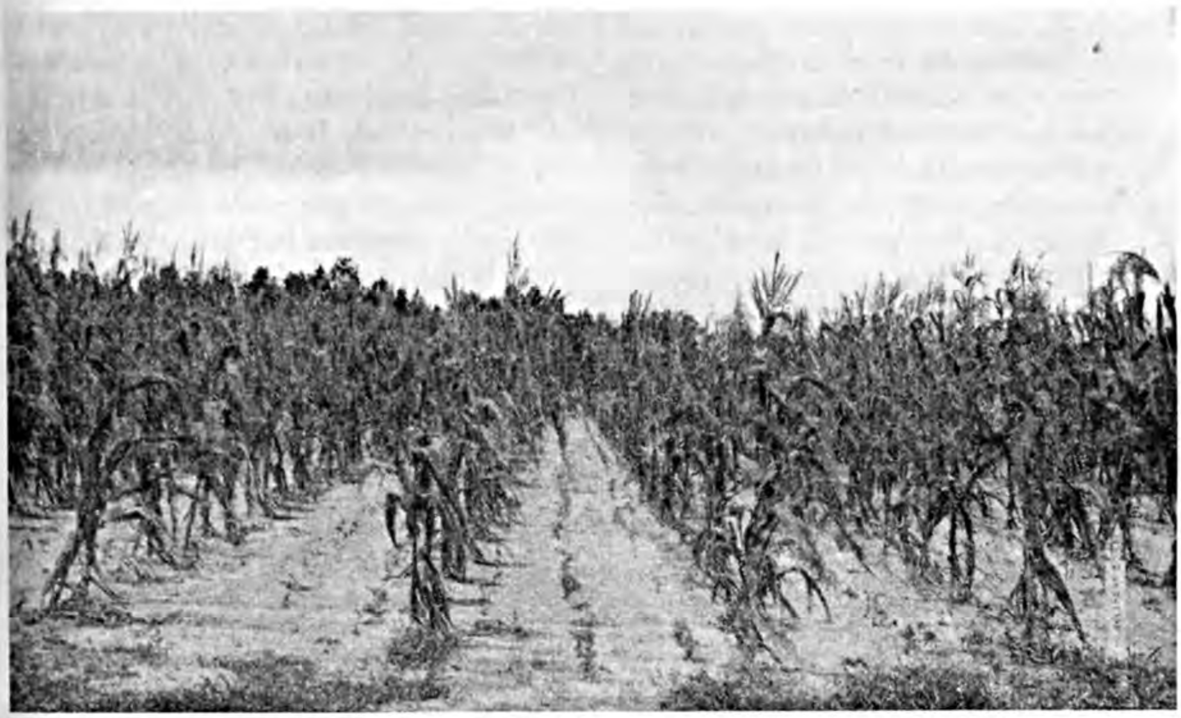

Fig. 3. Adjacent no-potash plot in same experiment.

eth-acre plots, with a check plot beside each treatment, were used throughout these experiments, and the entire plot of each treatment was harvested for yield. Cal-nitro was used as the sole source of nitrogen, superphosphate for the phosphoric acid, and muriate of potash for the potassium oxide. Several additional plots were added to the experiment to indicate the importance of nitrogen and phosphorus; however, the phosphorus set-up was not complete due to the lack of no-phosphorus plots. This factor has been corrected for future experiments. All the fertilizer was applied at side-dressing time to the Mountain soils when the corn was

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The Effect of Borax on Spinach and Sugar Beets[1]

By R. L. Cook and C. E. Millar[2]

THE use of boron in relation to plant growth has become a subject of intensive study throughout the world in recent years. Much has been written regarding the crop response which may be expected from applying boron to natural soils and to sand and water cultures.

Symptoms of boron starvation have been described by various authors for a variety of crops. The writers have grown 27 different crops in greenhouse pot cultures or in field experiments in an attempt to acquaint themselves with symptoms of boron deficiency. To date the symptoms exhibited by sugar beets (3)*, canning beets (5), mangels, chicory, alfalfa, and clover (4) have proved to be most valuable in making recommendations for the application of borax on Michigan soils.

Some few investigators have concerned themselves with the role of boron in plant growth and with the influence which boron may have on the passage of other ions into the roots of growing plants. Schmidt (12) found nitrate assimilation to be increased in sugar beets and barley which were starving for boron. He believes the physiological breakdown of the plant tissue to be due to a toxic concentration of nitrate nitrogen.

In their most recent review of the literature on the function of boron in the plant, Dennis and Dennis (7) cited eight publications in which the investigators reported that boron starvation was accompanied by an increase in content of nitrogen in the plant and two publications in which the opposite was the case. In two publications the writers reported increases in the calcium and phosphorus content and a decrease in the potassium content of boron-starved plants.

Dmitriev (8) found that borax applied for clover lowered the percentage of ash, total nitrogen, and phosphorus in the plant, but did not affect calcium content. Joret and Malterre (10), on the other hand, found that 15 kg. of $Na_2B_4O_7$ added to normal complete fertilizer increased the percentage of nitrogen and potassium but lowered that of phosphorus in sugar beet roots and tops.

Some investigators have maintained that boron does not function within the plant but in the nutrient medium, thereby affecting the intake of nutrients. Maier (11) claims to have disproved this theory by applying boron to the above-ground parts of plants and thereby preventing the appearance of boron deficiency symptoms.

It is the purpose of this paper to present the results of field and greenhouse experiments which may furnish more evidence of the need of certain crops for boron and to present analytical data which may be useful in studying the functions of boron in plants.

Sugar beets were grown on Wisner silt loam, a soil containing free carbon-

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[1] Contribution from the Soils Section, Michigan Experiment Station, East Lansing, Michigan. Authorized for publication by the Director as Journal Article No. 499 n.s. of the Michigan Agricultural Experiment Station.

[2] Research Assistant in Soils and Head of Soils Section, respectively.

* Figures in parenthesis refer to "Literature Cited," p. 42.

ates at the surface but less organic matter than is found in Thomas sandy loam. In this experiment borax was applied as a side-dressing on June 20, after the beets were blocked. Application was made with a hand drill at rates of 20 and 40 pounds per acre. The borax in each case was mixed with 150 pounds of 2-12-6 fertilizer. The plats which served as the controls received the 2-12-6 fertilizer without added borax.

Spinach was grown on Thomas sandy loam, a soil containing free carbonates at the surface and from 14 to 18 per cent organic matter in different parts of the field. Borax was applied in the basic fertilizer mixture at rates of 0, 10, 20, 40, and 80 pounds per acre. All fertilizers were broadcast and worked into the soil immediately before the spinach was planted. The basic fertilizer consisted of the following materials at the rates per acre indicated: 3-12-12, 500 pounds; NaI, 0.5 pounds; $ZnSO_4$, 4.0 pounds; $MgSO_4$, 25.0 pounds; $MnSO_4$, 25.0 pounds; $FeSO_4$, 2.0 pounds; NaCl, 10.0 pounds; and $CuSO_4$, 5.0 pounds. One treatment included only the 3-12-12 fertilizer. Treatments were replicated five times and were arranged in randomized blocks. Spinach was planted on May 5 and harvested on July 6.

Samples of both spinach and sugar beets were saved for analysis at the time of harvest. The spinach tissue, roots and tops separately, was analyzed for its content of boron, nitrogen, iron, calcium, and magnesium. The sugar beet tissue, roots only, was tested for its content of sucrose, boron, nitrogen, and iron. Analytical methods are described below.

Experiment Set Up

As several investigators had reported a relationship between the boron and nitrogen contents of plants, an experiment was set up to study the effect of varying nitrate levels in the soil on the yields, appearance, and composition of sugar beets when grown on a soil deficient in boron and on the same soil after treatment with borax.

Twenty-seven 1-gallon glazed earthenware jars were filled with Thomas

Fig. 1. Sugar beets grown on Wisner silt loam soil. Of the two left piles, grown on a plat which did not receive borax, the larger one contains the beets which showed heart rot symptoms, while the smaller one contains the normal beets. The two right-hand piles were grown on a plat which received 20 pounds of borax per acre. The larger pile contains the normal beets and the smaller one the beets which have heart rot. Note the increase in percentage of normal beets as a result of the borax treatment.

sandy loam soil known to be deficient in boron for sugar beets. A nutrient solution containing sufficient quantities of phosphorus, potassium, magnesium, calcium, manganese, aluminum, iodine, copper, and zinc was applied to all jars. They were then divided into three lots of nine each. One lot was left without borax, one received borax at the rate of 10 pounds per acre, and the other at the rate of 20 pounds per acre. Next, each lot of nine jars was divided into groups of three, one group received no nitrogen, one was treated with NH_4NO_3 equivalent to 95 pounds of NO_3 per acre, and the other with NH_4NO_3 equivalent to 190 pounds of NO_3 per acre.

Three beet plants were transplanted into each jar on March 25. Moisture was maintained at a fairly constant level by frequent weighings and additions of distilled water. Harvest was made on June 17.

The plant tissue analyses reported in this paper were made on tissue dried at 65°C and ground to pass a 1-mm. sieve.

Boron was determined by the Berger-Truog (1) method. Calcium and magnesium were determined from the ash, calcium as the oxalate by titrating with standard permanganate solution, and magnesium by the gravimetric pyrophosphate method.

Iron was determined by titrating the ferric ion with standard titanium trichloride solution. Total nitrogen was determined by the Kjeldahl method. Sucrose was measured in the juice of sugar beets by means of a saccharimeter.

When sugar beets are starved for boron, they suffer certain physiological disturbances which have been termed heart rot. As the symptoms of heart rot have been previously described (3) they will not be repeated here.

According to the data reported in Table 1, 96.86 per cent of the sugar beets grown on Wisner silt loam soil and not side-dressed with borax developed symptoms of heart rot. An application of 20 pounds of borax reduced the occurrence of the symptoms to 11.36 per cent. With an application of 40 pounds of borax the occurrence was further reduced to 4.65 per cent. The piles of beets shown in Fig. 1 illustrate this increase in percentage of normal beets as a result of the application of 20 pounds of borax per acre. The appearance of the beets before harvest is

Fig. 2. Sugar beets on Wisner silt loam soil. Two rows in left center received no borax. The rows at the right received 20 pounds of borax per acre as a side-dressing after the beets were blocked.

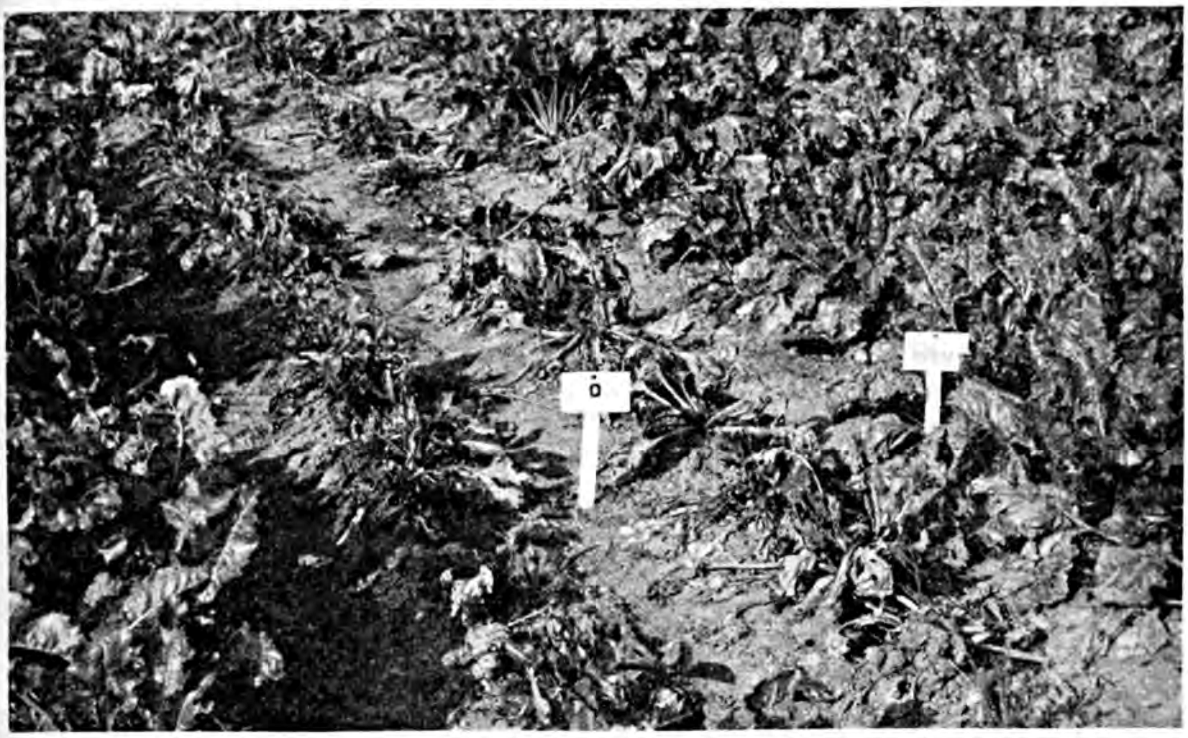

Fig. 3. A close-up of the rows shown in Fig. 2. Note the dead tops on the plants not treated with borax and the healthy tops on those which received borax. The picture was taken on September 17.

shown in Figs. 2 and 3. Note that practically all of the plants in the untreated rows were affected.

The yield of sugar beets was increased from 7.16 tons per acre where borax was not applied to 14.30 and 14.78 tons, respectively, where applications of 20 to 40 pounds of borax were made. The difference between the yield resulting from 20 pounds of borax and that from 40 pounds was not significant. As indicated by the weight per individual root, the increase in yield as a result of the borax applied was mostly accounted for by the size of the beets. This may appear contrary to some reports that symptoms of heart rot occur more often in the larger beets. The latter may be the case on a soil where a deficiency of boron is not acute, but on a soil such as the one in question available boron is at such a low level

TABLE 1. THE EFFECT OF BORAX ON OCCURRENCE OF HEART ROT, YIELD, SIZE OF ROOTS, SUCROSE CONTENT, AND PURITY OF SUGAR BEETS GROWN ON WISNER SILT LOAM SOIL IN 1940

Treatment [1]	Roots with heart rot	Yield per acre	Individual root weight	Sucrose content	Coefficient of apparent purity	Substances in solution other than sugar
	Per cent	*Tons*	*Pounds*	*Per cent*	*Per cent*	*Per cent*
No borax..........	96.86	7.16	0.93	14.11	80.92	3.31
Borax 20 lb. per A..	11.36	14.30	1.79	18.02	84.91	3.19
Borax 40 lb. per A..	4.65	14.78	1.94	18.45	85.97	3.02
F value..........	585.41**	92.14**	91.46**	20.43**	7.80*	1.62
Required for significance........	7.34	1.54	0.63	1.83	2.84	0.64

[1] Borax applied as a side-dressing on June 20 after the beets were blocked.
* Significant to 5% point.
** Significant to 1% point.

that growth is stopped while the beet is still small.

There were no differences in stand as a result of the borax treatment on this soil. This result was to be expected as boron starvation does not become apparent until after midsummer. Presumably, the supply of available boron in the soil is sufficient for the beets during their early growth. Plants, therefore, do not die from heart rot as they do from such diseases as black root. Borax applied as a side-dressing would not be expected to prove toxic and would thus have no effect on stand. Size of beet is then the only source of increased yields.

Sucrose Content Important

One of the most important problems in the production of beet sugar is the sucrose content of the beets. Any treatment which increases the percentage of sucrose as well as the yield of beets per acre is therefore doubly valuable. Further reference to Table 1 shows that roots not side-dressed with borax contained only 14.11 per cent sucrose as compared to 18.02 and 18.45 per cent, respectively, in beets from areas which received 20 and 40 pounds of borax per acre. This means 2,021 pounds of sugar per acre from the areas not treated as compared with a production of 5,154 pounds on the areas side-dressed with 20 pounds of borax and 5,454 pounds on the areas which received 40 pounds of borax per acre.

The difference in yield of sugar from the areas treated with 20 and 40 pounds of borax, although not large enough to be significant, is an indication that even slight benefits from borax may be accompanied by an increase in percentage of sugar and in yield of sugar per acre. This was further indicated by sugar determinations made on beets which showed only leaf symptoms of heart rot and on some which had root symptoms as well. It is assumed that leaf symptoms as a rule appear before root symptoms and therefore indicate an early stage in boron starvation. One would expect the percentage of sucrose to be higher in beets where a shortage of boron had recently appeared than in those roots where the shortage had been serious for some time. Such was found to be the case. Roots from plants with leaf symptoms contained 14.84 per cent sucrose as compared with a percentage of 13.21 in roots from plants which showed both leaf and root symptoms.

This tendency for sucrose content to depend upon the degree of injury from boron starvation might be taken as an indication that on fields where the level of available boron had fallen just to the point of appearance of symptoms, but where symptoms had not yet occurred, sucrose percentage might be slightly increased by an application of borax on beets which never would have exhibited symptoms of boron starvation. Such an increase, however, would no doubt remain within the range of experimental error, so it could not be shown by analyses.

Coefficient of apparent purity is a figure which represents the ratio between the sucrose in solution in the juice and total soluble substances in the juice. The application of borax resulted in a significant increase in this coefficient (Table 1). There are two factors which may cause this coefficient to increase. If the percentage of sucrose increased, the ratio between sucrose and all substances in solution would, of course, increase. A further increase would be obtained, however, if the substances other than sucrose should become less. Both of these factors appeared to play a part in the data reported. While the difference in sucrose content played the major role in raising the purity coefficients, the data reported in the last column of Table 1 show that borax did have a tendency to cause a decrease in the soluble substances other than sucrose.

It is known that besides the sucrose, the soluble substances in sugar beet juice are mostly nitrogenous compounds. A decrease in soluble nitrogenous substances would then indicate that borax was effective in reducing

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Good Farming By Good Neighbors

By M. E. McCollam

San Jose, California

THIRTY-FIVE years ago a lad was being brought up on the California grain and hay farm of the Peukert family, then located at and around the present site of Fremont High School in the metropolitan area of Los Angeles. Not far away a youngster six years old left the Anaheim, California, home of the Arrougé family where he was born, and went on a journey to Southern France for his schooling and early farm experience. At the age of 18 he came back to Anaheim and then dairy farmed for 14 years in California's Imperial Valley.

Sixteen years ago these two men, Peukert and Arrougé, converged finally on neighboring farms in Ventura County near Oxnard, California. They

Mr. Peukert with a specimen of his sugar beets.

Mr. Arrougé with a specimen of his 1940 pepper crop.

both knew the trouble that had to be "licked"—white alkali land that yielded only about three tons of sugar beets and one sack of lima beans per acre. This kind of trouble was multiplied 60 times for Arrougé; he had 60 acres. Peukert was "in" even deeper; he had 112 acres.

Both men had very sound farming experience and believed in some very fundamental soil practices. Aside from this, however, one of their most important ideas was that neighbors can begin their cooperation at home and thereby operate their farms cheaply and efficiently. They demonstrate this by often buying a piece of machinery together, and they figure out their operations so that crops on the two farms can be worked as units. According to these men, it is a big timesaver to work the same machine on both farms during the same period. Their labor is exchanged freely, and there is but little need for extra labor except during harvest.

But let's get back to that alkali land of some years ago. The first thing emphasized was leveling the land. This leveling was perfectly done, and the land has been constantly leveled to keep it that way ever since. Windbreaks of eucalyptus and cypress were planted to warm up the soil and prevent wind damage.

Drainge, of prime importance on alkali land, was next given consideration, and tile lines were laid 200 feet apart at a depth of 7 to 8 feet. By means of this drainage and by subsoiling, which has since been done every three or four years, the salt was decreased, crops began to look better, and yields increased each successive year.

Then crop rotation, cover crops, and fertilizers engaged the attention of these neighbors, and they launched upon a program of soil building. Their rotation includes lima beans, peppers, and sugar beets arranged in a 4-year rotation plan. The large lima beans are planted after a cover crop of barley, planted the previous winter, is plowed under. Usually about 400 to 500 pounds of cyanamid or other nitrogen fertilizer to supply about 100 pounds of nitrogen per acre are applied and plowed under with the cover crop. This treatment plus an irrigation following help the soil to assimilate the organic matter. The beans are given one good irrigation in July, which is sufficient. Marketing of the crop is handled by a growers association which, in their opinion, is the most practical method for securing best prices. All bean-straw residue is plowed back into the soil. Mr. Arrougé sometimes grows Fordbook limas for seed, as his bean crop. Last year these brought him nine cents per pound.

Harvesting a pepper crop of six tons per acre.

Peppers follow the beans in the rotation and are grown for canners under contract for $32.50 per ton. In order to make money on peppers, there must be a high yield per acre and a small percentage of culls. Mr. Peukert says that this crop needs plenty of available plant food in the form of complete fer-

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Dairy cattle on pasture—summer 1940. This pasture was developed from land badly eroded in 1906.

Better Pastures for North Mississippi

By E. B. Ferris

Holly Springs Branch Experiment Station, Holly Springs, Mississippi

PERHAPS never before in the history of Mississippi has more attention been given to the improvement of pastures. In a pasture symposium held by experiment station workers at State College, not only all station employees attended, and the specialists among them took part, but two of the best pasture experts of the Nation led in the discussions and added much to the interest thereof, especially in presenting the best known pasture research methods. Pasture problems are by no means new to the country as a whole, but until recently in Mississippi had been overshadowed by the importance of other work which at least for the time seemed to have a greater dollar and cent value to the farmers; although it is extremely doubtful if any phase of farming, past, present, or future, has held greater opportunities for profit to the landowner than the development of first-class pastures.

It was brought out at this symposium that leading thinkers as many as 100 years ago had seen the need for just such information, and certainly since the establishment of the Agricultural and Mechanical College at Starkville in 1878, the best thinkers connected with it have stressed the importance of such work. The writer's first experience as a student at Starkville was in the fall of 1892, more than 48 years ago, when the professor of agriculture took our class to the dairy farm of Colonel W. B. Montgomery, local trustee of this institution since its establishment, then past 70, and better known as the "Jersey King of the South." Colonel Montgomery's advice to us, as the possible future farm leaders of the State, was to stop trying to kill grass as had been our custom as cotton producers, and make an equal effort to encourage it to grow. He told how for years he had tried out every new grass and clover he had thought capable of growing and reproducing without petting, and how later he had come to taking seed of the more persistent kinds with him as he rode over his pastures, sowing a little here and there, and afterward observing the way they reproduced and afforded forage for his cattle.

Changed Farm Practices

As measured by the methods of today, this may seem quite crude, but his efforts in a little less than half a century have revolutionized the farm practices of the several counties nearby having a somewhat similar type of soil, by changing them from entire dependence on cotton as a money crop to gradually making the grazing of beef and dairy animals the predominant use to which such lands are placed. We shall never forget a word of advice then given by him that in our future efforts to improve farm conditions we should throw away our plows, indicating that he thought disturbance of the land by too much plowing was bad, both for vegetation and for the future control of erosion.

We have since reflected much on the wisdom of his remarks, and while at first regarding them as the expression of one over-enthusiastic about his own interest, have gradually come to regard his advice as coming from one endowed with the gift of prescience. As the study of land protection and preservation, especially against erosion, has increased in recent years, we find the ideas of the ones who have given most thought to it coming more and more into conformity with the advice of this old gentleman who, in more ways than one, gave evidence of his ability to think far in advance of his generation. The lands around Starkville were not of a very erosive nature, nothing to compare with several other soil types of the State. If his advice to his neighbors has been worth so much in preserving and improving the heavier soils of East Mississippi, what would it have been worth if it similarly had been put into effect on the lands of Northwest Mississippi with which we are presently concerned?

Reclamation Started

Surely in no other part of the State would such advice have been worth more, if heeded, than on the lands of Marshall County, typical of thousands of square miles of territory in North Mississippi and West Tennessee where thin layers of loamy surface soils are superimposed on much thicker layers of almost pure sand. The loams themselves are possibly no more erosive than other soil types of the country, but when moving water once washes through these loams and reaches the sand beneath, as expressed by Professor W. L. Hutchinson nearly 50 years ago, these lands "Melt like sugar and slide like hell." So, some 35 years ago, when Professor Hutchinson, as director of all Mississippi experiment stations, and C. T. Ames, as superintendent of the newly established branch station at Holly Springs, took charge of one of the worst eroded farms in North Mississippi, they set to work not only to reclaim and hold such soils against future erosion but at the same time to profitably utilize them for grazing.

The writer came into the picture much later and after most of the work of reclamation had taken place but has had, nevertheless, a good opportunity for observing what may be done with such eroded soils, once worse than worthless, because, like an infectious disease, they contaminate adjacent areas. Thus the sands from a single gully system near Holly Springs are said to have covered more than 600 acres of good bottom land below so deep in sand as to make it worthless for future profitable cultivation. Fortunately for those who were later to study these problems, pictures were made of many of the eroded spots on the station farm before and after treatment so that one may now see with the eye what they looked like before the hand of a man like Charlie Ames filled the gullies, terraced the land, and stopped the frequent use of plows, letting pasture sod bind the soil and gradually develop profitable grazing.

Erosion Control Not Enough

But simply to stop this erosion and get the grasses and clovers started is not enough for most profitable results, for even the naturally productive surface loams, still in place, need additional plant food and need it all the more after much inert sand has been mixed with these loams in the process of filling the washes and leveling the land. Perhaps such reclaimed lands will never produce the pasture forage they might once have produced and perhaps the cost has been more than the land at the time was worth in dollars and cents. This the Federal Government has since recognized and is now making every effort to assist local owners to terrace their lands, plant soil-binding crops, and gradually remove the menace of the free movement of surface water. They are doing this by helping to supply trees, kudzu plants, serecia lespedeza seed, bermuda, and at the same time minerals to hasten their growth.

In 1937 a large number of plots were laid out in pastures at the Holly Springs station where many different fertilizer combinations have since been used to determine the response of such soils to the different plant nutrients. The immediate results of such tests were to show the good effects from minerals applied to such soils, not only in the increased production of pasture forage, but also in the higher percentage of proteins, fats, and minerals contained in the forage itself. The latter was due, no doubt, to the minerals having encouraged a greater growth of legumes, for the fertilizers were used on pastures already set to a combination of grasses and legumes. Light applications of lime have proved helpful.

Just how best to measure pasture results will depend on circumstances. Possibly no method can approach the

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Badly washed land, similar to ones reclaimed at Holly Springs and shown in pasture pictures—summer 1940.

Organic Matter

Conceptions and Misconceptions

By Ford S. Prince

Agricultural Experiment Station, Durham, New Hampshire

MEMBERS of the Agricultural Profession are often criticized for their failure to make statements that are definite and specific. At least I am. In fact, my wife told me recently that she was rather sick of agricultural talks because the three principal words were if, but, and maybe.

Of course, I tried to argue with her by saying that agriculture, unlike mathematics, is a very, very young science and that when we have been figuring things out scientifically in the farming game as long as scholars have been devising devious mathematical formulas, we will be able to nail the facts to the barrel head in better shape. This was a poor explanation for her since her mathematical education hesitated at the multiplication table of twos, and she said so. And there are a great many people who feel as she does, especially if they have had less training in and association with people in agriculture and do not appreciate the vagaries of rainfall, climate, and more especially, the complex nature and functions of the soil itself.

Take soil organic matter as an example. Farmers have long recognized its worth as a soil-building component, for the application of farm manure is one of the oldest methods of soil improvement. Many writers have stated that there is a fairly direct relationship between organic matter and the nitrogen it contains and soil productivity. Yet, what rotations and cropping practices will maintain the organic matter supply of the soil? What is the relationship between organic matter depletion and soil erosion? Once depleted, how can organic matter be most quickly restored to the soil? Is it possible to greatly increase the normal supply of this substance in the soil? What is the relationship between the application of fertilizers and lime to organic matter maintenance? Why is a goodly supply necessary for soil productivity? These and many other similar questions now demand an answer in the face of the fact that our soils are wearing out and washing away and have been doing so at an accelerated rate for many years.

It is only recently that some of these questions have been answered by soil scientists. Others are doubtless in the process of solution. But it is quite apparent that the whole subject has not received enough study by research men up to the moment, and if we are to take more of the "ifs" and "buts" out of the organic matter story, more work will need to be done.

Short Rotation Tried

We started out very blithely in New Hampshire a dozen years ago by undertaking to produce potatoes in a three-year rotation with oats, and one year of clover and timothy hay. The oat crop was removed as grain or hay and the first hay crop was taken off in the hay year but the second crop was plowed under, much to the disgust of the dairymen living near the farms on which the experiments were located. At that time a three-year rotation was considerably shorter than those usually practiced with potatoes in New Hampshire.

Good hay and oat crops were produced, and there was abundant stubble and second crop to plow down as organic residue. We confidently expected that such a system would maintain the organic matter of the soil and that we could practice this rotation indefinitely without worry about organic matter, erosion, and related problems.

But the whole program backfired. On one field serious erosion started at the beginning of the second rotation period and the yield of potatoes was consequently reduced. Fortunately, we had sampled the soil at the beginning of the tests and were able, by analysis, to compare them with samples taken later to determine what had happened. Much to our surprise, most of the plots had lost organic matter at the rate of about 1% of the total supply in the soil each year during the test, although the net change varied somewhat with fertilizer and lime treatments. Perhaps if we had fed the oats and first cutting of hay and returned the manure to the soil the story might have been different.

I cite this instance for two reasons; one is that we made some rather definite statements about such a rotation, since we fully expected that the organic matter would at least be maintained, and further that losses of organic matter when hill land is in potatoes only one year in three may prove serious in the end.

Serious, yes, because organic matter plays such a vital role in soil functions; vital, because it is the source of much of the nitrogen that is going to be available to crops. Because its decay releases phosphoric acid, potash, and trace elements for plant growth and because of the chemical changes it undergoes, soil minerals themselves are acted upon and caused to go into solution and these, too, become a source of nutrients to plants. These things come about not because organic matter is a static substance. It could not possibly be as useful if it were. They occur because, in the soil, it is an ever-changing, dynamic material, imparting this quality to the soil itself.

Even as it approaches, in the end stages of decay, a more or less static condition, organic substance still performs its useful physical and chemical functions. By this time it has reached a colloidal state in which it functions not only in the base exchange complex, absorbing nutrients, holding them until they are utilized by plants but also assists in the build-up of soil structure, causing a rearrangement of the finer soil particles into larger groups making heavy soils more workable, permitting air to enter the soil freely, and enabling water to filter into the soil in greater quantity. Infiltration of water and water-holding capacity are vital points in preventing erosion, erosion which if unchecked will carry away the bulk of this important substance with the topsoil which is most quickly affected.

But why recount all these beneficial qualities of organic matter? They are all well recognized and rarely disputed. What is of much more concern is how the level of organic matter in the soil can be maintained so as to be most propitious for farming.

Climate Most Important

As with many phases of farming, climate not the farmer plays the most important role in determining the amount of organic matter in the soil. Dr. Jenny's work in Missouri exploded many misconceptions on this point. In this work he collected samples of soil from different climatic regions of the United States and analyzed them for organic substance. His main conclusion after his laborious experiment was that nitrogen and organic matter of soils, within regions of similar moisture conditions, decrease from North to South, and that the difference can be calculated mathematically if the climatic factors of different regions are known.

Dr. Jenny undertook his important work, he states, because in the common rotations practiced in Missouri organic matter was not being maintained. His conclusions appear to point to the fact that for each climatic condition and soil group, nature herself tends to maintain the organic matter level at a certain normal point represented by those conditions. Many farming processes work against nature in this respect and tend to reduce the organic matter supply. This undoubtedly accounts for the very serious erosion and soil depletion that have already occurred in our country and points to the need for rotations and farming practices that will maintain organic matter at such a level that soil structure will be maintained so that water can penetrate the soil and not run off the surface with destructive effects.

Even in our own State, which is 200 miles from north to south, we find a difference in the total stocks of organic matter in the soils, those in the northern part being richer in this respect. Contrast northern New Hampshire and its 100-day growing season with Florida where bacterial activity and organic decay proceed during the whole year! Workers at Gainesville, Florida, told me a few years ago that six weeks after a heavy crop of crotalaria had been plowed under, all traces of it had disappeared, so rapid was its decay there. Professor Stokes stated at that time that soil organic matter was the greatest single disturbing factor to Florida farming and indicated, too, that they had come to the belief that the best farmer was the one who had the most weeds in his corn at the end of the season to form a source of organic matter for the next crop.

Organic Matter Losses

Unfortunately it is much easier to deplete the organic matter than to build it up. Dr. Jenny's work indicates this fact, and the point has been emphasized by other workers. Furthermore, with the climatic or temperature factor in mind, it appears much easier, once the organic matter supply has been reduced, to restore it to the level which represents the norm for the climate, than it is to build it up above that level, for additions over and above that point are subject to undue losses. It is easy to work against nature in one direction, but very difficult to overpower her efforts in the other.

Some idea of the losses that do occur to organic matter after it is applied to the soil may be gained from the work of Salter and Green in which they studied the soils of the long-time fertility plots at the Ohio Experiment Station. In one series of plots, seven tons of manure per acre were applied annually. Over a period of 32 years, 46,400 pounds of organic carbon were applied in the manure, but at the end of that time the soil was richer only by about 5,000 pounds of organic carbon. This represents a loss of nearly 90% of the organic matter of the manure.

However, this isn't a cause for worry, since part of the value of the organic substance lies in the fact that it does decay. The data do serve to emphasize the extremely rapid rate of loss and the handicap under which a farmer works in building up the supplies in his soil.

The same authors present other valuable information on the influence of continuous cropping and rotations in relation to organic matter losses. Corn grown continuously caused the most loss, followed by wheat and oats in continuous culture, while losses in a five-year rotation of corn, oats, wheat, clover, and timothy were slightly greater than in a three-year rotation of corn, wheat, and clover. The slightly better results in the three-year rotation are attributed by these authors to the clover, and they state that it appears better from the rotation point of view to have two crops of clover in six years rather than one crop of clover followed by one of timothy in a five-year rotation.

In all of this work the destructive effects to organic matter with continuous culture to any crop are emphasized, and this fact is well worth repeating to Northeast potato and vegetable growers who attempt rotation practices that even approach a one-crop system. Sooner or later they get into trouble and the nearer the approach to the one-crop system, the sooner it is.

Some work at Illinois which is reported by R. S. Stauffer shows how, under conditions there, the organic

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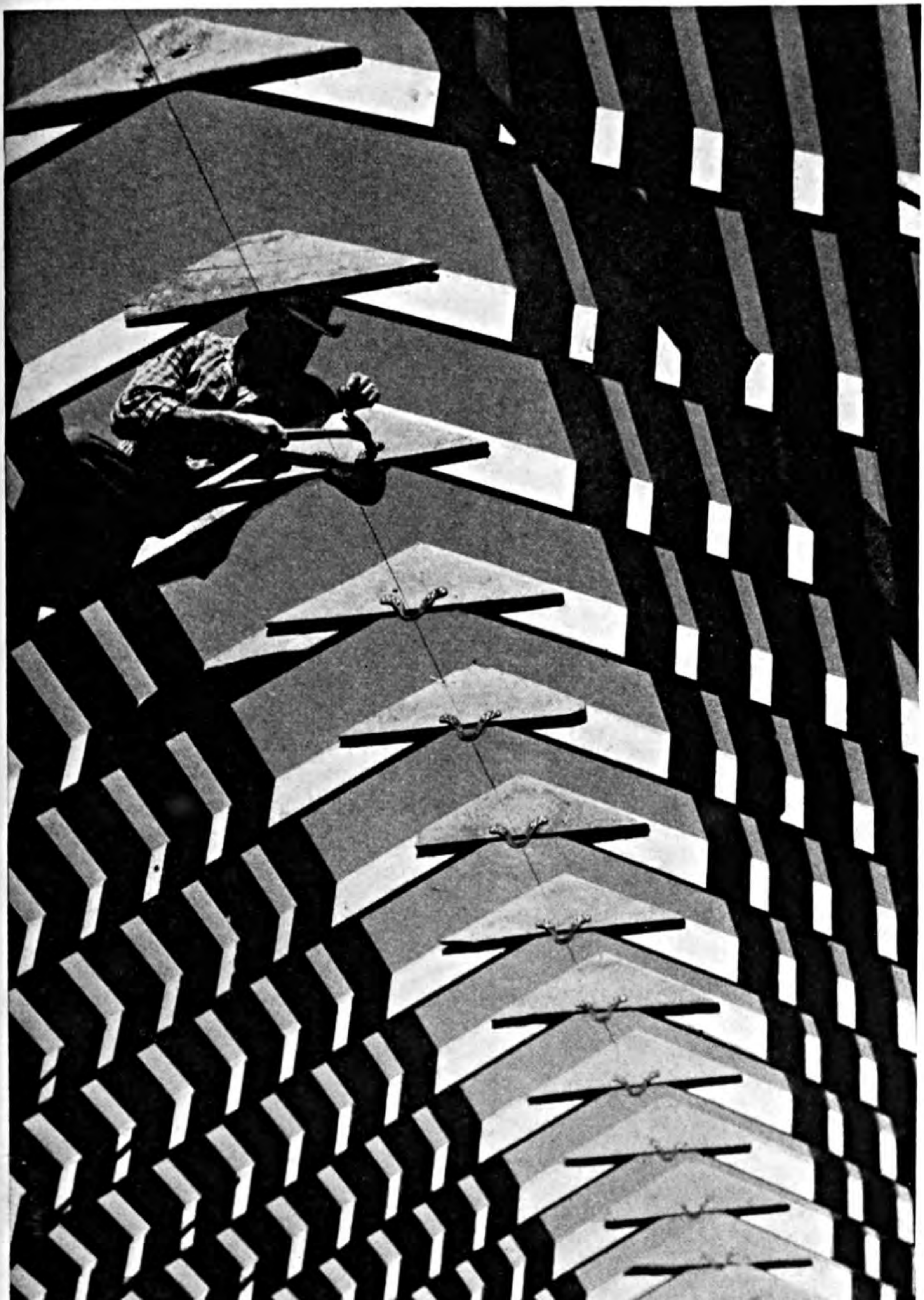
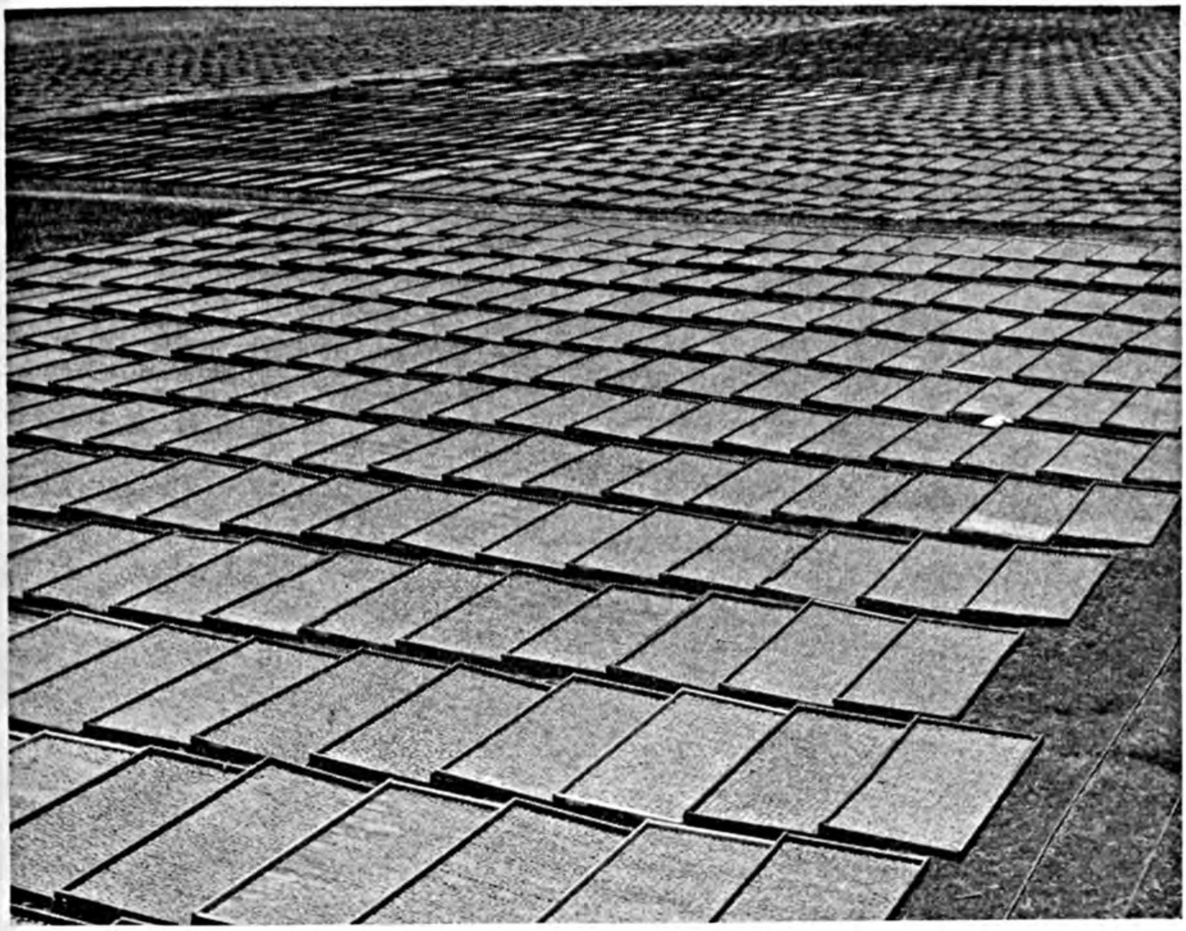
PICTORIAL



AN OPTICAL ILLUSION? NO, THE ROOF OF A BARN.

Above: Harvesting peas near Palouse, Washington.

Below: Beans in Michigan—a bulwark of the Navy.



Above: California fruit being dried for packing.

Below: A load of mint—chewing gum in the rough.

Above: It's worth turning the freezer to get the dasher.

Below: Farmers inspecting experiments at Purdue University.

The Editors Talk

A Good Time to Pay Debt to The Soil

Much advice is being given editorially in the agricultural press and elsewhere, to the effect that the present is a most opportune time for farmers to exert every effort to get out of debt. Rising farm prices are creating a strong temptation for farm operators to expand their activities by means of more capital debt. However, the disasters which followed such a course during the last war are still fresh in many minds and form the basis of the caution which is current today.

It was interesting to note that delegates drafting measures for the 1942 AAA farm program, among other resolutions, adopted one to urge farmers to avoid speculative expansion and to reduce debts and build up reserves of cash and farm commodities during the present period of industrial activity and more favorable prices.

R. M. Evans, national AAA Administrator, said in commenting on the recommendations, "That farm families will unselfishly and patriotically contribute to the defense effort of the Nation is reflected in the recommendations for the 1942 program. During the past year, the 6 million farmers participating in the program have found its flexibility useful for meeting new demands for certain kinds of food and fiber, and for meeting new problems brought on by the war. The reserves of food and fiber that farmers have already furnished the Nation in the Ever-Normal Granary, and the suggested changes for 1942 assure the Nation of the same cooperation in the future.

"Agriculture will put the defense effort first. But there is need for agriculture to keep its condition healthy, also. By continuing the emphasis on soil conservation, farmers can meet the demands made on them without waste of soil resources. And by scaling down their debts and maintaining their farm plants in as sound a condition as possible, they will be further adding to the strength of the Nation's defense effort. Through supplies already on hand, by conserving their soil, and by keeping their farming operations sound, farmers are offering to the Nation an agricultural industry that is a strong force for national strength and unity, but also an industry that will be able to meet its problems after the war is over."

In connection with scaling down debts and conserving the fertility of the soil, it would seem that now is also a most opportune time for farmers to be considering paying their debt to the soil. The soil has often been likened to a bank account, and too many farmers for many years have been withdrawing more fertility than they have been replacing. It is not enough to conserve the balance which is now there. That balance may be too low for adequate operation, and some depositing is necessary.

To maintain farm operations in a sound condition will necessitate a careful check-up on the soil bank account and provision to bring as quickly as possible the fertility balance up to a point where good yields and quality of crops can be assured. Such an investment is sound and in line with the advice and caution which are being given operators. It will be of aid to them not only in meeting the increased demand for farm products but in fortifying themselves for a possible time when this demand subsides, but bills will have to be met just the same.

More Crops Less Acres

The Agricultural Marketing Service of the U. S. Department of Agriculture, in its general crop report as of August 1, had this to say: "Although several crops, particularly barley, beans, rice, some vegetables for canning and probably soybeans, seem likely to exceed previous records, the most notable feature of the crop situation this season is that practically all important crops promise better than average yields per acre. While this has been due in part to abundant rainfall in the Great Plains Area, where droughts in recent years have been most severe, there is increasing evidence that the yields of many crops have been rising as a result of improvement of varieties and use of better equipment and better cultural practices."

From this statement, it is apparent that the use of improved cultural practices is likely to play a very important and significant part in the National Defense Program by increasing the production of crops per unit of land. This involves the use of better varieties, adapted fertilizers properly placed in the soil and used in amounts sufficient for them to exert full beneficial effect, proper mid-season cultural practices, and efficient harvesting, storage, and marketing.

The adoption of these practices is of particular importance to the farmer from the viewpoint of improving his efficiency and thereby increasing the chances of making a profit during a period of rising production costs as well as rising prices for the products he sells. The latter may sometimes cause a grower to overlook the significance of the former and lead him to a sense of false prosperity. Efficiency of production is just as advantageous during times of high prices as during times of low prices.

Another reason for stressing efficiency of production is the farm labor situation, which is becoming a very serious problem in many sections. Increasing the production of crops per unit of land permits a greater utilization of labor, particularly during the planting and mid-season periods. It is in the personal interest of the farmer as well as his duty in the common effort of national defense to utilize all of the known practices which will enable him to produce more and better crops on fewer acres.

"I believe that by the use of extension education more people may be able to get out of the path of future economic disasters. I would suggest that they vigorously seek the truth in terms of advantages and disadvantages, and in this way draw intelligent conclusions. I hold that these conclusions should not be crystallized, but remain fluid and flexible in the face of constantly changing economic conditions. Extension agents have brought and will continue to bring these truths to farmers, leaving to the farmers the course of action to be taken after obtaining a clear conception of the situation."—*Henry A. Wallace, Vice President of the United States.*

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 results of field and greenhouse investigations of the control of internal breakdown of canning beets by the use of boron are given by G. J. Raleigh, O. A. Lorenz, and C. B. Sayre in Cornell University Agricultural Experiment Station Bulletin 752, "Studies on the Control of Internal Breakdown of Table Beets by the Use of Boron." This internal darkening of beets has been causing great trouble and loss to growers and canners in New York, Wisconsin, Oregon, and other places, particularly in dry years, where the beets are grown on soils alkaline in reaction. Preliminary greenhouse work had indicated that the use of boron compounds would control the difficulty to a large extent, and this bulletin reports results under practical field conditions of applying varying amounts of borax over a period of three years.

In the first year, the relatively moist season prevented the appearance of severe breakdown, although the application of borax tended to reduce what little did appear. The use of 25 pounds of borax per acre did not cause any deleterious effects. In the following years rainfall was less and breakdown was severe in many places where no boron was applied. Small applications of borax reduced the breakdown considerably, but increasing the rate of application to 50, 75, and in a few cases 100 pounds per acre usually further reduced the breakdown. There was not much effect on yield due to the borax applications, and no rate caused any harmful effects.

The application of sulphur for the purpose of increasing the acidity of the soil and thereby possibly rendering more available to plants the native soil boron supply was not very effective, with variable effect on yields and frequent increase in the breakdown.

In order to see whether the boron applications made to beets would be injurious to other crops, red kidney beans, a crop known to be very susceptible to boron injury, were grown on soil which received a high borax application the previous year, and also on soil with a high borax application the same year as seeding the beans. There was no injury to the beans growing on soil which had received 75 pounds of borax per acre the previous year, but the crop was injured by applications of 50 pounds of borax the same year as seeding the beans.

As a result of these investigations, the authors recommend that when beets are grown on soils alkaline in reaction, 50 pounds of borax per acre be applied, preferably by mixing with the regular fertilizer used. They suggest that if a double strength fertilizer such as 8-16-16 is used, the borax be mixed shortly before applying so as to avoid poor physical condition of the fertilizer and possible loss of ammonia. They advise that until more is known of the residual effects of the borax, boron-tolerant crops such as cabbage rather than sensitive crops such as beans should be grown the year following the borax application for the beets.

¶ Those interested in the question of vitamin use of plants will find much pertinent material in California Department of Agriculture Bureau of Chemistry Announcement FM-23, "Vitamin B_1 Products Intended for Use on Plants," by Alvin J. Cox. Dr. Cox discusses the occurrence of the vitamin in plants, and quotes numerous authorities on the results of carefully controlled experiments in which Vitamin B_1 was used on plants under various conditions.

¶ "Chemical Composition of Sugarcane Juice as Affected by Fertilizers," U. S. Department of Agriculture Technical Bulletin 754, is a rather detailed and thorough investigation of the effects of fertilizers on the chemical properties of sugarcane juice by Nelson McKaig, Jr., and Lewis A. Hurst. The experimental work was conducted in Louisiana and with fertilizer treatments made according to the Schreiner triangle system. The data represent averages of tests conducted on several commercial plantations. It was found that solids in the juice were increased by phosphate and potash fertilizers; sucrose and purity of juice were increased particularly by potash fertilizer; reducing sugars were decreased by potash fertilizers; phosphate in the juice strangely enough was not increased by phosphate fertilizer, but by potash, while potash and chlorides were increased by potash fertilizers. Many other factors as influenced by fertilization are also reported in this bulletin, which will be of particular interest to those dealing with the growing or processing of sugarcane.

"Evidence of the Value of the Sodium Ion in Cotton Fertilizers," Agr. Exp. Sta., Experiment, Ga., Cir. 127, Apr. 1941, E. D. Matthews.

"Fertilizers for Rice in Texas," Agr. Exp. Sta., College Station, Tex., 730 Prog. Rep., Mar. 17, 1941, A. D. Jackson.

"Fertilizers for Utah Soils," Agr. Exp. Sta., Logan, Utah, Cir. 116, June 1941, D. W. Pittman and D. W. Thorne.

Soils

¶ The use of peat, muck, loam, and similar substances to improve the soil for lawns, gardens, athletic fields, and more recently military establishments is in the aggregate a business running into several million dollars a year. The large use of these materials is due to the fact that a fertile soil necessary for the establishment of a good sward or the production of satisfactory flowers or vegetables is not considered as an important factor in locating dwellings or other enterprises where plantings later are desired. The excavation and grading in building a house usually result in a most unfavorable kind of soil in which to grow plants, while consideration of cost of land and disruption of established life in an area is likely to result in the poorest types of soil being included in military establishments. The addition of ameliorating materials to the soil so as to permit satisfactory growing of plants on such soils within a reasonable time is frequently necessary. Two publications dealing with these materials have recently been issued. Connecticut Agricultural Experiment Station Circular 146, "Loams for Top-Dressing," by Herbert A. Lunt, briefly describes the types of materials that appear on the market under the heading of "loams." Examination of some of the actual materials being sold indicates that almost anything that looks like "rich dirt" may be sold as loam, some sellers apparently innocently foisting off on the unsuspecting buyer material quite unsuited for the purpose intended. The author suggests standards that might be used in selling and purchasing loams, with relative values of different grades. He also gives some idea as to what supplement in the way of fertilizer the loams may need.

The second publication on the subject is "Peat Resources in Alaska," by A. P. Dachnowski-Stokes, issued as U. S. Department of Agriculture Technical Bulletin 769. The use of peat as a soil ameliorant is very common. The source of this peat is partly domestic and, in normal times, partly foreign in origin. This bulletin summarizes the results of a systematic survey of peat deposits in Alaska as a source to supplement the deposits occurring in many of glaciated states and in swampy areas. Many accessible peat deposits were found, and the author feels there is a good possibility of establishing a peat industry in Alaska. He points out some of the problems involved due to local conditions, and also gives a brief discussion of the use of peat as a soil improver, the methods used in exploitation of deposits, and marketing of the product.

"Influence of Colorado River Silt on Some Properties of Yuma Mesa Sandy Soil," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 91, June 1, 1941, W. T. McGeorge.

"Soil Survey of the Fredericton-Gagetown Area, New Brunswick," Dom. Dept. of Agr., Ottawa, Can., Pub. 709, Tech. Bul. 30, Nov. 1940, P. C. Stobbe.

"Questions and Answers on Soil Erosion and Its Control in Vermont," Agr. Ext. Serv., Burlington, Vt., Brieflet 584, Jan. 1941, Paul R. Miller.

"Soil Survey, Hall County Georgia," U. S. D. A., Washington, D. C., Ser. 2, Feb. 1941, John T. Miller, Matthew Drosdoff, and G. L. Fuller.

"Hardpan and Microrelief in Certain Soil Complexes of California," U. S. D. A., Washington, D. C., Tech. Bul. 745, Apr. 1941, C. C. Nikiforoff.

"Quality of Irrigation Waters of the Hollister Area of California," U. S. D. A., Washington, D. C., Tech. Bul. 746, Mar. 1941, F. M. Eaton, Roy D. McCallum, and M. S. Mayhugh.

"Better Harvests Through Conservation Farming," U. S. D. A., Washington, D. C., Mar. 1941, R. E. Uhland.

"Conservation Farming for the Sandy Lands of the Southern Great Plains," U. S. D. A., Washington, D. C., Feb. 1941, Tom Dale.

"Conservation Practices for the Range Lands of the Southern Great Plains," U. S. D. A., Washington, D. C., Feb. 1941, J. S. McCorkle and Tom Dale.

"Conservation Farming for the Hard Lands of the Southern Great Plains," U. S. D. A., Washington, D. C., Feb. 1941, Tom Dale.

"Erosion and Related Land Use Conditions," U. S. D. A., Washington, D. C., Sur. 20, May 1, 1941, H. N. Magness and M. F. Sandoz.

Crops

¶ In an unnumbered folder issued by the Purdue University Agricultural Extension Service, entitled "Food for Defense," the importance of employing the most efficient production and management practices for crop and livestock production is brought out. In the field of agronomy, proper corn and pasture fertilization and the conservation of manure and crop residues are stressed. It is suggested that corn be planted on legume sods, manured, and fertilized with 100 to 250 pounds of fertilizer such as 0-12-12, 0-14-6, or 0-10-20. Adequate fertilization and liming of pastures also are suggested.

¶ The emphasis on food production makes several publications on vegetable production very timely. A. G. B. Bouquet has prepared three Oregon Agricultural Extension Circulars numbered 358, 360, and 361, dealing with lettuce, cauliflower, and spinach respectively. In each case, brief and practical information on climatic, soil, and fertilizer requirements, varieties, cultural practices, diseases and pests, harvesting and marketing are given. For lettuce, a 3-10-10 fertilizer in addition to manure is suggested, with additional nitrogen possibly needed in some cases; for spinach, a complete fertilizer and borax in addition to manure are suggested; while for cauliflower, 5-10-7 or fertilizers in a 1-2-1 or 1-2-2 ratio and boron in addition to manure are recommended.

¶ Home gardens in the aggregate represent an important source of foods, and with proper management can be made to produce large supplies on small areas. Growers in Florida and adjacent areas will find much helpful information in Florida Agricultural Extension Bulletin 107, "The Florida Home Garden," by F. S. Jamison. In addition to suggestions on location of the garden, varieties, cultural practices, harvesting and disease control, he briefly makes recommendations on fertilization. He says if large quantities of manure are available, this with phosphate will probably supply the plant food needed. When manure in unlimited amounts is not available, which is likely to be the case with most of the gardeners, a 5-7-5 fertilizer at $2\frac{1}{2}$ to 5 pounds per 100 square feet is recommended.

¶ Tomato growers will find the answers to many of their problems in New Jersey Agricultural Experiment Station Circular 414, "The Answer to Your Tomato Problem," prepared by a committee of experts on the Station staff. The circular is in the form of 102 questions likely to be raised by the tomato grower, with the answers given for each question. Nearly every phase of tomato growing and handling is touched upon. For the fertilization of the crop under average New Jersey conditions, 1500 pounds of 5-10-10 fertilizer are suggested.

"Fiftieth Annual Report of the Agricultural Experiment Station, 1939," Poly. Inst., Auburn, Ala.

"Fifty-first Annual Report for the Year Ending June 30, 1940," Agr. Exp. Sta., Tucson, Ariz.

"Third Annual Report of the Arizona Fertilizer Control Office, 1940," Agr. Exp. Sta., Tucson, Ariz., Bul. 173, Feb. 1941

"Permanent Pasture Studies," Agr. Exp. Sta., Fayetteville, Ark., Bul. 407, Apr. 1941, Marvin Nelson.

"Newly Developed Vegetable Varieties for Use in California," Agr. Exp. Sta., Berkeley, Calif., Bul. 646, Feb. 1941, D. R. Porter, H. A. Jones, and G. N. Davis.

"Granulation of Valencia Oranges," Agr. Exp. Sta., Berkeley, Calif., Bul. 647, Feb. 1941, E. T. Bartholomew, Walton B. Sinclair, and F. M. Turrell.

"Pear Growing in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 122, Jan. 1941, Luther D. Davis and Warren P. Tufts.

"Foxtail Millet in Colorado," Colo. Exp. Sta., Ft. Collins, Colo., Bul. 461, Nov. 1940, J. J. Curtis, J. F. Brandon, and R. M. Weihing.

"Sugar-beet Growing in Colorado," Colo. Ext. Serv., Ft. Collins, Colo., Ext. Bul. 363-A, Jan. 1941, R. H. Tucker and T. G. Stewart.

"Sixty-third Report of the Connecticut Agricultural Experiment Station, 1939," Agr. Exp. Sta., New Haven, Conn., Pub. Doc. 24.

"General Index for the Year Ending October 31, 1939," Agr. Exp. Sta., New Haven, Conn.

"Agricultural Experiment Station Annual Report for the Fiscal Year Ending June 30, 1940," Agr. Exp. Sta., Gainesville, Fla.

"Comparative Feeding Value of Silages Made from Napier Grass, Sorghum and Sugarcane," Agr. Exp. Sta., Gainesville, Fla., Bul. 358, May 1941, A. L. Shealy, W. G. Kirk, and R. M. Crown.

"Green Feed for Poultry in Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 59, June 1941, D. F. Sowell.

"Growing Cotton for Profit," Agr. Ext. Serv., Athens, Ga., Cir. 287, Mar. 1941, E. C. Westbrook and R. R. Childs.

"Control of Diseases of Canning Crops in Maryland," Agr. Ext. Serv., College Park, Md., Plant Path. 2, Feb. 15, 1941, R. A. Jehle, H. A. Hunter, and C. E. Cox.

"Seventy-ninth Annual Report of the Secretary of the State Board of Agriculture and Fifty-third Annual Report of the Experiment Station, July 1, 1939 to June 30, 1940, Agr. Exp. Sta., Lansing, Mich.

"Growing Beautiful Lawns," Agr. Ext. Serv., East Lansing, Mich., Ext. Bul. 224, Apr. 1941, James Tyson.

"Establishing Conservation Farming Under the A.A.A.," Agr. Ext. Serv., St. Paul, Minn., Ext. Pamphlet 74, Jan. 1941

"Highlights of the Work of the Mississippi Experiment Station, Fifty-third Annual Report for the Fiscal Year Ending June 30, 1940," Agr. Exp. Sta., State College, Miss., Clarence Dorman.

"An Illustrated Guide to Care of Ornamental Trees and Shrubs," Agr. Exp. Sta., State College, Miss., Bul. 354, May 1941, F. S. Batson and R. O. Monosmith.

"Annual Report of the Board of Control for the Fiscal Year Ending June 30, 1940," Agr. Exp. Sta., Reno, Nev.

"Grape Production in Eastern New Mexico," Agr. Exp. Sta., State College, N. M., Bull. 275, 1941, Donald R. Burnham.

"Annual Report of the Extension Service for 1940," Agr. Ext. Serv., Raleigh, N. C.

"Control of Lawn Weeds and the Renovation of Lawns," Agr. Exp. Sta., Wooster, Ohio, Bul. 619, Mar. 1941, F. A. Welton and J. C. Carroll.

"Korean Lespedeza, the Wonder Clover of Oklahoma," Agr. Ext. Serv., Stilwater, Okla., OP-10.

"Hybrid Corn for Oregon," Agr. Ext. Serv., Corvallis, Oreg., Ext. Cir. 355, Nov. 1940, R. E. Fore.

"Experiments with Buckwheat," Agr. Exp. Sta., State College, Penna., Bul. 403, Mar. 1941, J. W. White, F. J. Holben, and A. C. Richer.

"Fifty-second Annual Report, 1939," Agr. Exp. Sta., Knoxville, Tenn.

"A Hybrid Sweet Corn for Tennessee," Agr. Exp. Sta., Knoxville, Tenn., Cir. 75, Apr. 1941, L. S. Mayer and A. B. Strand.

"Lawn Weeds and Their Control," Agr. Exp. Sta., Logan, Utah, Cir. 117, June 1941, D. C. Tingey and Bassett Maguire.

"Hybrid Corn Adaptation Trials in Wyoming, 1940," Agr. Exp. Sta., Laramie, Wyo., Bul. 246, Apr. 1941, William A. Riedl and W. L. Quayle.

"Blueberries," U. S. D. A., Leaflet 201, Oct. 1940, George M. Darrow.

"Dry Land Crops at the Dalhart (Texas) Field Station," U. S. D. A., Washington, D. C., Cir. 564, Nov. 1940, O. R. Mathews and B. F. Barnes.

"California Farm Handbook, 1941," U. S. D. A., Washington, D. C., 1941.

"North Carolina Farm Handbook," U. S. D. A., Washington, D. C., 1941.

Economics

¶ "'Round the World with Cotton" presents very little that is new about any phase of the cotton industry, but it does accomplish one very useful purpose in that it brings together under one cover a vast amount of interesting information about cotton. The story is presented in an easy-to-read, non-technical style utilizing photographs, charts, and pictographs to illustrate in an entertaining fashion what has happened in the cotton industry in the United States and abroad since its legendary origin in India some 5,000 years ago. This publication of the U. S. Department of Agriculture, Agricultural Adjustment Administration, was prepared under the supervision of I. W. Duggan, Director of the Southern Division of the Agricultural Adjustment Administration, and Paul W. Chapman, Dean of the College of Agriculture of the University of Georgia. Many persons inside and outside of the Department of Agriculture participated in its preparation.

The subject matter is organized into three main parts. Part 1, "The Story of Cotton," deals with the importance of cotton, the history of cotton, and world cotton crop. Part 2, "Cotton in Foreign Lands," deals with India, cotton in China, Egyptian cotton, the Soviet Union cotton program, cotton in Brazil, and other cotton-producing countries. Part 3, "Cotton in the United States," deals with our Cotton Belt, improving production methods, how cotton is sold, and changes in our cotton trade.

There are more persons in the United States who are dependent upon cotton than on any other crop grown. Nearly 11% or 13,500,000 persons in this country depend directly on cotton for a living. About one-third of the total population in the United States lives on farms where cotton is grown. There are more cotton farms than those of any other single type.

The cotton plant seems to have originated in India where the fiber was grown and spun into fine cloth many centuries before the United States was founded. It was the desire of the people of Europe to secure the treasures of the Far East, including cotton cloth, that led to the discovery of America. At the time of the discovery of America, Columbus found cotton was being grown in the West Indies. Although cotton was planted by the English colonists early in the history of this Continent, it did not become a commercial crop until after the invention of the cotton gin. At first the expansion of the cotton crop came as the result of increased demand from England for cotton to be used in the growing textile industry in that country. For many years the price for cotton was so favorable that people in the South lost interest in the manufacturing side of the industry.

The textile industry in the United States was founded by Samuel Slater who established mills in New England in 1790. The cotton-spinning industry has gradually migrated to the South, and there are now a larger number of active cotton spindles in this section of the United States than in the Northeast.

The world's cotton crop has been increasing markedly for 50 years. It is a warm weather crop and requires a growing season of about 200 days. The world cotton belt lies in general from about 40° north to about 30° south latitude. Although there has been little or no increase in per capita consumption of American cotton at home for a long period of years, the total consumption has increased with the increase in population.

India is favorably located for selling cotton to the countries of the Far East where there is a large population and a growing textile industry, but the quality of Indian cotton is poor. The yields per acre are very low and the farming methods are still primitive. It is difficult to change the Indian methods because of the caste system and as long as this system prevails it is assumed that little change will take place in Indian agriculture. Furthermore it requires a large part of the farm land to provide food for the 375 million people living in the country, thus limiting the acreage that may be devoted to cotton.

The third largest cotton-producing country in the world is China, and prior to the Japanese invasion cotton production was on the upgrade. The Chinese cotton mills are now supplying most of the cloth used within the country. China has never been an important factor in the world cotton trade but under favorable conditions probably could grow more cotton than is needed at home.

Egyptian cotton is well known throughout the world for its quality. Practically all the cotton grown in Egypt is sold to other countries where there exists an unusual demand because of the long staple which makes Egyptian cotton desirable for certain textiles. Since about 1862 cotton production in Egypt has been expanding. The natural conditions for the growing of the crop are very favorable, but it is pointed out that it is not likely that the expansion in the future will be as great as in the past because food production requires an important amount of available land and cotton must be grown on land irrigated with water from the Nile. It is believed that all of the land suitable for cotton growing is now under cultivation.

In the United States many things have happened in the past 100 years which have favorably and unfavorably affected the position of the United States in the world cotton trade. Since about 1920 domestic sales of cotton grown in the United States have been fairly constant but sales to other countries have fallen off. All exports have declined, but agricultural commodities have declined more than industrial products. Since foreign trade is largely an exchange of goods, the United States must accept goods in return for those which it has to sell. This country has many products to sell but few are acceptable in return. At the present time there exists in the world what is termed a saturated cotton market, which means that there is being produced as much cotton as can be sold. It is impossible to predict the future cotton requirements of the world or the quantity of cotton grown in this country which can be sold at home and abroad.

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"A Special Assembly of Agricultural Statistics, State of Oregon," Agr. Ext. Serv., Corvallis, Oreg., Ext. Cir. 357, Dec. 1940.

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"Vermont Rural Families Face Defense Conditions," Agr. Ext. Serv., Burlington, Vt., Brieflet 599, June 1941.

"Farm Management for Soil Conservation in the Harrison Area," Agr. Exp. Sta., Morgantown, W. Va., Bul. 301, May 1941, Everett C. Weitzell.

"Corn Futures, Volume of Trading, Open Commitments and Prices from January 2, 1936, to December 30, 1939," U. S. D. A., Washington, D. C., Stat. Bul. 74, May 1941.

"Changing Technology and Employment in Agriculture," Bur. of Agr. Econ., U. S. D. A., Washington, D. C., May 1941, John A. Hopkins.

"Loans to Farmers and Ranchers—1940," F. C. A., U. S. D. A., Washington, D. C., Cir. A-22, Apr. 1941.

"Trends in the Consumption of Fibers in the United States, 1892-1939," U. S. D. A., Washington, D. C., Apr. 1941, Robert B. Evans and Rose F. Monachino.

"Production, Disposition, and Value of Citrus Fruits, Crop Seasons 1909-1910—1938-39, by States," U. S. D. A., Washington, D. C., May 1941.

Better Pastures for North Mississippi

(*From page* 19)

actual grazing of animals, but this requires more uniform and level lands than are available at Holly Springs. To this time, small plots repeated often and the use of scales and chemical analyses appear to be the most practical way. Under the skillful direction of H. W. Bennett, Pasture and Forage Crops Specialist of the main station, assisted by the local management of the Holly Springs station, much research work is being done that should throw light on the pasture problems of this section as a whole, especially on the millions of acres of eroded and partially eroded lands of Marshall and adjoining counties of Mississippi and Tennessee.

The pasture crops that have so far done best at Holly Springs are carpet, bermuda and paspalum grasses, with white and hop clovers and lespedeza among the legumes. However, all sorts of combinations of these and other grasses and clovers not so commonly grown are being tried experimentally, all fertilized in many different ways with results so far showing the preponderant need for mineral fertilizer. It might be well to state that as newly cleared lands the soils here were never so deficient in plant nutrients as in many other soil types of the State. For many years after they were brought into cultivation these lands were cropped fairly successfully, except for erosion, without the use of fertilizers under the common farm crops. However, as a result of some 36 years' work in fertilizing all kinds of farm crops at the Holly Springs station, the evidence is conclusive that commercial fertilizers of the proper analysis, in field and pasture, return just as good profits here as they do on other soil types of Mississippi which have never been cultivated without first applying fertilizers.

Cages over 39 pasture fertilizer plots at Holly Springs—summer 1940.

The Effect of Borax on Spinach and Sugar Beets

(*From page* 14)

the intake of nitrogen by the plants.

To verify the conclusion that an application of borax had caused a reduction in the nitrogen content of beets and had possibly affected other constituents, samples were gathered from the areas not treated with borax and from the treated areas and were analyzed for boron, iron, and nitrogen by the methods already described.

According to the data reported in Table 2, an application of borax increased the boron content and decreased the percentage of nitrogen and iron in the dry tissue of the beet roots. As already stated, Schmidt (12) found that sugar beets starved for boron allowed nitrates to enter in such quantities as to become toxic and cause the death of the cells. If this is true, the nitrogen content of the soil might be expected to have some effect on the seriousness of the physiological disturbances and, therefore, on the yield.

With this problem in mind a pot culture experiment was set up in which sugar beets were grown on Thomas sandy loam soil variously treated with respect to boron and nitrate nitrogen. The soil used was known to be deficient in boron available to sugar beets. As shown by the data reported in Table 3, applications of ammonium nitrate reduced the yields of sugar beets in pots which received no borax but increased them in pots which received borax. In other words, where available boron in the soil was low, additions of nitrate seemed to make the condition for growth of beets still worse. This is shown by the decrease in yield of roots from 32.6 to 29.2 grams per pot. This difference is not large but appears to have been actually caused by the nitrate. In contrast to this reduction in yield on pots not treated with borax, the nitrate caused an increase in yield of 2.9 grams per pot on those which received 10 pounds of borax per acre and an increase of 7.1 grams per pot on those which received 20 pounds of borax per acre. That available boron was actually low in this soil is shown by the average increase in yields following an application of borax where no nitrate was applied. The 10-pound application of borax increased the yield from 32.6 to 34.9 grams, while the 20-pound application resulted in a yield of 39.2 grams per pot. The duration of

TABLE 2. THE EFFECT OF BORAX ON THE BORON, IRON, AND NITROGEN CONTENT OF SUGAR BEETS GROWN ON WISNER SILT LOAM SOIL IN 1940

Treatment	Composition of root tissue dried at 65° C		
	Boron	Fe_2O_3	Nitrogen
	P.p.m.	*Per cent*	*Per cent*
No borax	11.8	.011	1.51
Borax, 20–40 lb. per acre*	19.0	.005	1.01

* Applied as a side-dressing after the beets were blocked. Samples for the analyses were taken at random from plats which received borax at the two rates. The analytical data represent averages from four separate samples.

the experiment was 84 days. Had it been allowed to run longer, perhaps the increases in yield would have been larger.

The fact that the increased nitrate content of a soil low in available boron was injurious to sugar beets seems to verify Schmidt's (12) conclusion that breakdown of the tissue was due to toxic concentrations of nitrate in the cells. If this were true, however, one might expect greater differences than were found in the total nitrogen content of the dried tissue.

Another explanation for the relationship between nitrate and boron is indicated by the data on boron reported in Table 3. Where borax was not applied the nitrate applications resulted in a decrease in the boron content of the dried beet tissue. The differences, 3 p.p.m. with the first application of nitrate and 7 p.p.m. with the larger application, were very marked. Perhaps a deficiency of boron allows more nitrate to enter the plant, but also an excess of nitrate may hinder the intake of boron. This might help to explain the observation often made and recently reported (6) that heart rot of sugar beets is often serious on soils extremely high in organic matter. Perhaps the effect of organic matter cannot be entirely laid to its combination with boron to form an unavailable compound, but partly to the fact that it is a source of nitrate which may inhibit boron intake by the plant.

Fig. 4. A spinach plant suffering from boron starvation. Note the numerous small, deformed leaves. The petioles were roughened, crooked, and twisted. These symptoms closely resemble the leaf symptoms on sugar beets.

Further reference to Table 3 shows that the calcium content of dried beet tissue was unaltered by the borax applied but was slightly affected by the nitrate applications. Higher nitrate applications seemed to result in plants lower in calcium. The magnesium content of the beets grown on pots treated with borax was slightly higher (ranging from 0.24 to 0.50 per cent) than of those grown in pots which did not receive borax. The effect of nitrate on the magnesium content of the beets was not consistent.

Fig. 5. Spinach leaves. Those on the left from a boron-starved plant. The one on the right from a normal plant.

There appears to be a definite relationship between the presence of boron and the absorption of iron. The percentages of iron reported in Table 3 show that as the available boron content of the soil was increased by the addition of borax, the iron content of the plants decreased. The average concentration of iron was about one-half as great in the plants treated with 20 pounds of borax as in those not treated. This relative difference is just about equal to that caused by a similar application in the field on Wisner silt loam soil. Further reference to Table 2 shows

TABLE 3. THE EFFECT OF NITROGEN AT DIFFERENT LEVELS OF AVAILABLE BORON ON THE YIELD AND COMPOSITION OF SUGAR BEETS GROWN IN POT CULTURES OF THOMAS* SANDY LOAM SOIL

Treatment		Yield per pot	Composition of roots dried at 65° C				
Borax	NH_4NO_3 equivalent to		Boron	Fe_2O_3	Nitrogen	CaO	MgO
		Gm.	*P.p.m.*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
None	None	32.6	13	0.036	1.10	0.32	0.24
None	95 lb. NO_3 per A	30.6	10	0.020	1.21	0.30	0.34
None	190 lb. NO_3 per A	29.2	6	0.020	1.14	0.26	0.38
10 lb. per A	None	34.9	16	0.018	1.02	0.33	0.40
10 lb. per A	95 lb. NO_3 per A	37.2	17	0.011	1.13	0.29	0.47
10 lb. per A	190 lb. NO_3 per A	37.8	15	0.026	1.21	0.28	0.40
20 lb. per A	None	39.2	18	0.010	0.98	0.39	0.50
20 lb. per A	95 lb. NO_3 per A	41.7	20	0.010	0.98	0.32	0.49
20 lb. per A	190 lb. NO_3 per A	46.3	20	0.009	1.09	0.33	0.44

* An alkaline soil high in organic matter and known to be deficient in boron available to sugar beets.

that beets grown in the field without borax applied contained 0.011 per cent iron, while those treated with 20-40 pounds of borax contained only 0.005 per cent iron. In beets grown in the field as well as in the greenhouse higher boron concentrations were accompanied by lower concentrations of iron.

Very little has been written about the needs of spinach for boron. Hartman (9) reported that spinach seedlings failed to develop normally on soil on which cauliflower had developed boron deficiency symptoms. He found that many of the first true leaves were small and deformed and that many of the plants turned yellow and died at an early stage. The roots of affected plants turned black.

Experimental results have shown that spinach plants do not grow normally when the level of available boron is too low. It is impossible at present to say just what this level should be, but it seems that on soil where sugar beets develop heart rot, spinach will also show symptoms of boron starvation. These symptoms are in many ways similar to those of heart rot.

Spinach planted on May 5 was ready to harvest by the end of June and at that time had developed marked symptoms of boron starvation. The plants, as a whole, were flattened, with the leaves tending to spread out in a horizontal direction rather than to

Fig. 6. Spinach plants, treated with borax at the rate of 80 pounds per acre on the left and untreated on the right. The roots of the treated plants were healthy and widespreading while those on the boron-deficient plants were restricted, deformed, and blackened.

stand erect as in a normal plant. Many of the center leaves were small and deformed as shown in Figs. 4 and 5. There seemed, also, to be a greater number of small leaves, as if the failure of the leaves to reach normal size had stimulated the plant into production of a greater number. Individual leaves were twisted, apparently as a result of faster growth on one side than on the other.

At harvest time the plants on plats not treated with borax were much smaller and were of a light green, almost yellow, color. They appeared also to be less succulent.

It was noticed that the roots of the plants on the plats which did not receive borax were very much restricted, as compared to those of normal plants, and were dark colored, resembling the roots of sugar beets suffering from heart rot. A comparison of healthy spinach roots with those of plants suffering from boron starvation is shown in Fig. 6.

An application of 10 pounds of borax, broadcast before planting, increased the yield of spinach from 8.1 to 14.3 pounds per plat (Table 4). The difference is highly significant and within 0.4 pounds of that obtained as a result of applying 20 pounds of borax. The rates of application of borax in the experiment ranged from 10 to 80 pounds. There was no advantage in applying a quantity greater than 10 pounds per acre. While no attempt was made to record differences in quality, it was noticed that very little of the spinach on the plats which did not receive borax was marketable.

To gain further information on the role of boron as a regulator of nutrient intake, dried spinach tissue was analyzed for boron, iron, nitrogen, calcium, and magnesium.

As shown by the data reported in Table 4, the boron content of spinach tissue grown without borax treatment was very low, both in tops and roots.

TABLE 4. THE EFFECT OF BORAX ON THE YIELD AND COMPOSITION OF SPINACH GROWN ON THOMAS SANDY LOAM SOIL

Treatment	Rate per acre	Yield per plat	Chemical composition of tissue dried at 65° C								
			Boron		Fe_2O_3		Nitrogen		CaO		MgO
			Tops	Roots	Tops	Roots	Tops	Roots	Tops	Roots	Tops
	Lb.	*Lb.*	*P.p.m.*	*P.p.m.*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
3–12–12[1]	500	7.3	5.8	6.2	1.320	0.084	4.23	2.85	1.75	1.48	3.20
No borax	0	8.1	5.6	5.2	1.370	0.091	4.29	3.08	1.87	1.17	3.16
Borax	10	14.3	11.6	10.2	0.082	0.086	4.26	2.64	1.79	1.32	3.28
Borax	20	14.7	15.2	11.0	0.091	0.095	4.33	2.71	1.71	1.34	3.11
Borax	40	13.1	20.2	12.0	0.089	0.090	4.31	2.87	1.84	1.14	3.28
Borax	80	14.5	32.2	15.0	0.095	0.097	4.38	2.63	1.82	1.42	3.29
F value		14.1**	45.5**	9.83**	3.85*	3.00	3.07	3.13	3.31	1.20	1.93
Required for significant difference between means		2.6	4.4	3.4	0.038	0.031	0.27	0.29	0.39	0.46	0.30

[1] This treatment did not include borax or any plant nutrient other than N, P, and K. The materials applied in all other treatments were uniform except for borax, and included the following materials applied as pounds per acre at the rate indicated: 3-12-12, 500; NaI, 0.5; $ZnSO_4$, 4.0; $MgSO_4$, 25.0; $MnSO_4$, 25.0; $FeSO_4$, 2.0; NaCl, 10.0; $CuSO_4$, 5.0.

* Significant to 5% point.

** Significant to 1% point.

In fact, the content was lower than has usually been found in sugar beets exhibiting heart rot in its most severe stages. The 10-pound application of borax resulted in a significant increase in the boron content of both tops and roots, and larger applications of borax had the effect of still further increasing the concentration of this element in the plants. The increase was quite consistent with all applications of borax, and the parts per million of boron in the tissue as a result of the 80-pound application of borax was greater than in sugar beet tissue subjected to similar treatment.

The application of borax caused a decrease in the iron content of spinach tops and in the nitrogen content of spinach roots. Both of these differences were significant, but no differences were found in the iron content of the roots or in the nitrogen content of the tops.

The calcium and magnesium contents of spinach grown in this experiment were not altered by the applications of borax. Very slight differences were obtained in the results of the analyses and none of them proved significant.

In discussing the work of Brandenburg (2), Dennis and Dennis (7) report that boron is not translocated from old to new portions of a plant but that a constant supply is at all times necessary. Brandenburg found that when the source of boron supply was interrupted the new leaves of sugar beets were very low in content of boron while the older leaves, formed while the supply of boron was plentiful, retained the normal amount of boron. He reported further that the new leaves, formed under inadequate supply of soil boron, soon developed symptoms of boron deficiency.

The fact that boron, once fixed within a plant, is not readily translocated to other portions of the plant or to the new tissue makes the problem of fertilization with boron much more interesting and important. It also makes it more difficult and probably accounts for the fact that the appearance of boron deficiency symptoms seems to have some correlation with weather conditions.

Sugar beets and spinach (Chenopodiaceae—goose foot family) are very closely related plants. This fact probably explains why the symptoms of boron starvation are almost identical in the two plants and why both plants are so seriously affected by a shortage of available boron in the soil.

Boron Content Increased

As already mentioned, spinach tissue grown on a boron-deficient soil was lower in parts per million of boron than was sugar beet tissue, but it is interesting to note the increase in content of boron in both crops, both tops and roots, with applications of borax to the soil. Brandenburg (3) has reported that roots of sugar beets having heart rot were as high in boron content as were normal beet roots, but that in the leaves of beets with heart rot the boron content was much lower than it was in the leaves of normal plants. Work in this laboratory shows that greater differences in boron content may occur in the leaves but that very significant differences may occur also in the roots.

The fact that applications of borax cause such marked increases in the boron content of sugar beet and spinach tissue seems to indicate that boron must have some function within the plant and that it does not act entirely as a regulator of the intake of other ions by the roots.

There seems little doubt, however, that boron does have some effect on the intake of nitrogen and iron. This observation has been made by several investigators as respected nitrogen, but so far as the writers are aware nothing has been written regarding iron. As indicated by the data already reported in this paper and by other determinations made in this laboratory and not yet reported, the reductions in iron content of dry plant tissue as a result of additions of borax to the soil are more marked than are reductions in nitrogen content.

It has been suggested that the physiological breakdown of plant cells which accompanies boron starvation is actually caused by too high a nitrate concentration in the cells and not because of lack of boron to build the tissue. This is probably true, but it may also be true that nitrate nitrogen may decrease the permeability of the root membranes to boron and thus cause such a low concentration of boron in the plant tissue as to actually cause the breakdown. This result was indicated by some of the data reported in this paper.

If nitrate nitrogen in toxic concentration is a factor in the physiological disturbance caused by lack of boron, perhaps iron is also a factor, the death of the cells being due to too high an iron concentration. This is probably not true, however, because of the low solubility of iron compounds. In the absence of sufficient boron, iron probably enters the roots and is translocated to different parts of the plant where it is fixed into relatively insoluble and nonmovable forms, perhaps as ferric iron.

Summary and Conclusions

Sugar beets grown in the field on alkaline silt loam soil were side-dressed with borax applied at rates of 20 and 40 pounds per acre, respectively. Heart rot occurrence and yields were measured in the field and dry tissue from field-gathered samples was analyzed for sucrose, boron, nitrogen, and iron.

Sugar beets grown in greenhouse pot cultures were treated with two respective quantities of ammonium nitrate at different levels of available boron. Yields were determined and quantitative tests made for boron, nitrogen, iron, calcium, and magnesium in the plant tissue.

Spinach was grown in the field on alkaline sandy loam soil known to be deficient in boron for sugar beets. Yields were measured and analyses made for boron, nitrogen, iron, calcium, and magnesium contents. From the results of these experiments the following observations may be made:

1. Borax, applied at the rate of 20 pounds per acre as a side-dressing on Wisner silt loam soil, reduced the number of beets bearing symptoms of heart rot from 96.86 to 11.36 per cent and increased the yield from 7.16 to 14.30 tons per acre. The application increased the size of the individual roots from 0.93 to 1.79 pounds. The borax application caused an increase in percentage of sucrose from 14.11 to 18.02 and in the percentage purity from 80.92 to 84.91. An application of 40 pounds per acre produced slight but not significant increases over those resulting from the 20-pound application.

2. Borax, applied broadcast for spinach at the rate of 10 pounds per acre before planting, prevented the appearance of boron deficiency symptoms and caused an increase in yield from 8.1 to 14.3 pounds per plat. Larger applications of borax (20 to 80 pounds) did not prove toxic but did not cause further increases in yields.

3. The boron deficiency symptoms in spinach were found to be almost identical with symptoms of heart rot in sugar beets. This is not surprising since the two plants are very closely related in the plant kingdom.

4. Applications of borax increased the boron content of the dry tissue of sugar beet roots and of spinach roots and tops. This increase was highly significant.

5. Applications of borax reduced the nitrogen content of sugar beet and spinach roots. This result was indicated by a decrease in the percentages of soluble substances other than sucrose in the juice of sugar beets and by nitrogen determinations on the dried tissue of both plants.

6. Ammonium nitrate, applied to pot cultures of Thomas sandy loam, a soil low in available boron, caused a decrease in the boron in dried sugar beet root tissue.

7. Applications of borax caused a decrease in the percentage of iron in the dry tissue of sugar beet roots and spinach tops. The differences were even

more marked than were the differences in nitrogen content.

8. In the case of sugar beet root tissue grown in one pot culture experiment, borax was found to be the cause of an increase in percentage of magnesium in dried tissue. In the spinach, magnesium was not altered by the borax applications.

9. Borax had no effect on the calcium content of either spinach or sugar beets.

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Organic Matter Conceptions and Misconceptions

(From page 22)

matter level fluctuates with different cropping and fertilizer systems in comparison with land in permanent sod. In this report, continuous corn, without fertilization, was the worst offender, but losses in organic matter occurred even when corn grown continuously was manured, limed, and fertilized with rock phosphate. In an unfertilized three-year rotation of corn, oats, and clover, losses occurred, but where this rotation was manured, limed, and fertilized, the organic matter level was raised above that of nearby sod land. Stauffer found a direct correlation between the organic content of these soils and their water-holding capacity.

Wheeting's work in Washington points to manuring and fertilizing as being important in building up the stocks of organic soil substance. In this work, rotation or farming land was compared with stump pasture or cut-over land which had been subjected to slash burning. In two comparisons, one of which concerned itself with a manured rotation and the other in a heavily-fertilized, vegetable-growing system, the organic content was higher in the cropped than in the nearby pasture or cut-over land, while in the third rotation system in which fertilizers or manures were not used, the organic content was lower after many years of farming than in nearby cut-over land. Manure and fertilizers that increase crop residues do, of course, tend to counteract the depleting effects of cropping systems.

With all the emphasis that is being placed upon pasture top-dressing in the Northeast, it is interesting to note the effect of fertilizers upon the organic matter content of sod land. Seitz, at the Virginia Polytechnic Institute, reports a study of pasture soils top-dressed with 200 pounds of 16% superphosphate annually since 1917 and 1933 respectively, and in comparison with untreated sod land these soils gained 95% and 55% in organic matter. This denotes an increase of roots in the soil, and such increase would undoubtedly be in fairly direct proportion to the pasture yields. Any system of top-dressing, therefore, which increases pasture yields will probably show a gain in soil organic matter, and in the Northeast, in most locations, a complete fertilizer would give quicker results than superphosphate alone. This excellent report causes us to wonder how much the depleted organic matter supply of these old pasture soils is responsible for low forage yields where the land has been untreated for a long time.

Seitz also finds a direct correlation between organic matter and soil structure, noting an increase of 21% in water-stable soil aggregates in the soil treated since 1917 and a 19% increase in that treated since 1933. The fact that the increase in water-stable aggregates is not in direct proportion to the increase of organic matter probably indicates that the optimum conditions for structure development are reached long before the soil reaches its possibilities in relation to organic content as affected by treatment.

Smith, Brown, and Russell have investigated organic content in relation to infiltration capacity and they conclude that soils high in organic matter may have an infiltration rate double that of soils with a low organic content. This infiltration capacity of the soil has been shown by many workers to have a direct bearing on erosion, since the amount of water that runs off a field is directly responsible for erosion and conversely, the more that soaks into or infiltrates into the soil, the less erosion will occur.

In view of this fact, it is easy to see why soils cannot be farmed to cultivated crops indefinitely without erosion troubles, and apparently that is what has happened over a wide area in the United States, explaining the reasons why our attention is focused upon erosion today more than ever before.

And now, before I stop, I want to make some of those definite statements I spoke of in the beginning, for it seems to me, in spite of the need for more information, some of the facts in relation to organic matter are quite apparent.

One of these is that crop rotation in and by itself does not supply an adequate method of maintaining organic matter. Manuring, liming, and fertilizing, with a suitable rotation of crops, will tend to maintain or increase it.

One-crop System Harmful

Except for permanent grasses and clovers, there is no one-crop system that will maintain organic matter. Continuous cropping to corn, potatoes, or other cultivated crops will almost certainly deplete the organic matter supply and cause erosion and other soil troubles. Continuous cropping to small grains is not so destructive of organic matter as continuous corn, for example, but even these crops require other soil-building processes if organic matter is to be maintained.

Even with sod crops, such as are found in permanent pastures, an effort must be made to maintain fertility if the organic supply is to be kept up. Good hay crops, with their bulky residues and root systems, tend to conserve organic matter in a rotation in which they are included. This serves to emphasize one of the good and one of the bad points of New England and Northeastern farming. Long rotations, in fairly fertile hay fields (and especially on dairy farms where abundant manure is used on the land), tend to conserve organic matter. But the long neglected pastures have undoubtedly suffered because of depleted organic supplies, since no adequate effort has been made to build up their fertility.

With all these facts in mind it would seem that the potato and vegetable growers of New England have on their hands a difficult problem of maintaining organic matter. And many of them know it because of the accelerated erosion they are now encountering. Some of them have already been forced to construct terraces and adopt contour farming practices and other methods of combating erosion. Even with these aids, yields of crops will suffer without organic maintenance, hence longer rotations with sod crops, the use of more land to spread out their operations, and the adoption of green manuring practices are indicated. Some growers may even court the idea of keeping a few cows.

Even with practices that are entirely desirable, natural forces come into play to prevent a build-up of organic matter above the norm for the climate and soil. Fortunately for the Northeast, this norm is relatively high anyway, and when farmers learn to approach it, less trouble will be experienced. But trouble does occur here just the same as it does in the Midwest and South when soils are mismanaged.

Cotton and Corn Response to Potash in South Carolina

(*From page* 9)

about knee-high. All the fertilizer was applied under the crop in the Coastal Plains soils except for a split application of nitrogen, with 1/4 under and 3/4 to the side when the corn was knee-high.

The results from these experiments are shown in Tables 2 and 3.

It will be noted in Table 2 that either the nitrogen or phosphorus or a combination of the two gave a decided increase in yield. These experiments indicate that most of these rather fertile bottomland soils in the mountain sections will respond to high rates of a high nitrogen-phosphorus treatment. From general observations it has been noted that an occasional field will give response to potash. The custom in many of the mountain sections of South Carolina has been to apply a sack (200 pounds) of superphosphate per acre with no nitrogen or potash added.

TABLE 2.—RESPONSE OF CORN TO FERTILIZER
(Mountain Soils of South Carolina)
Average of Five Years

* Treatment		Average yield in bushels of shelled corn per acre	Response per cent of no potash
No Fertilizer	0–0–0	36.4	.....
No Nitrogen	0–10–7.5	38.0	.....
No Potash	8–10–0	49.9	100.0
15 lb. of K_2O	8–10–3.75	49.8	99.8
30 lb. of K_2O	8–10–7.5	49.4	99.0
45 lb. of K_2O	8–10–11.25	50.5	101.2
60 lb. of K_2O	8–10–15.0	50.6	101.4
75 lb. of K_2O	8–10–18.75	48.8	97.8
90 lb. of K_2O	8–10–22.5	49.2	98.6

* Rate—400 pounds per acre.

TABLE 3.—RESPONSE OF CORN TO FERTILIZER
(Coastal Plains Soils of South Carolina)
Average of Four Years

* Treatment		Average yield in bushels of shelled corn per acre	Response per cent of no potash
No Fertilizer	0–0–0	14.1	.....
No Nitrogen	0–10–7.5	17.7	.....
No Potash	8–10–0	20.9	100.0
15 lb. of K_2O	8–10–3.75	24.8	118.7
30 lb. of K_2O	8–10–7.5	27.1	129.7
45 lb. of K_2O	8–10–11.25	27.7	132.5
60 lb. of K_2O	8–10–15.0	28.0	134.0
75 lb. of K_2O	8–10–18.75	29.7	142.1
90 lb. of K_2O	8–10–22.5	31.9	152.6

* Rate—400 pounds per acre.
All phosphorus and potash applied under the crop.
¼ of the nitrogen under the crop and ¾ as a side application.

Table 3 indicates a decided response of corn to potash on the more sandy Coastal Plains soils. Calculated with the no-potash yield as 100 per cent, the various rates of potash with 15-pound increments to a high rate of 90 pounds of K_2O per acre gave a 52.6 per cent increase in yield of corn. There were indications that the nitrogen and phosphorus in the fertilizer mixture gave a like response, that is, corn treated with a complete fertilizer more than doubled the yield over plots receiving no fertilizer. On the Coastal Plains soils tested, to be assured of a satisfactory yield of corn, a complete fertilizer was almost essential in all the experiments averaged.

In conclusion it should be pointed out that an average of a large number of experiments with cotton on a number of South Carolina soils shows a profitable response to high rates of potash. A more critical analysis of individual experimental data indicates the sandy soils and in some cases clays cropped to legumes give the greatest responses. Time of application was not essential on these experiments.

The response of corn to potash on a number of South Carolina soils has been somewhat varied. The mountain bottomland soils tested gave little response, while an average of results from Coastal Plains soils gave a marked response. An analysis of individual experimental data indicated that corn was not as exacting as cotton in its requirement for potash on most soils. A complete fertilizer seemed essential for the proper development of corn.

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Good Farming By Good Neighbors

(*From page* 16)

tilizer so that it can grow fast and set a heavy crop of high quality peppers. Both he and his neighbor use 500 pounds per acre of a 6-11-6 fertilizer in which a high proportion of organic materials is used. This is applied as a side-dressing by a machine distributor which places the fertilizer about five to six inches from the plants and four inches deep. The peppers are given from four to six irrigations during the season, as they have a relatively high water requirement. They are subject to attacks of aphis and pepper weevil, and this latter pest sometimes requires three dustings with calcium arsenate. Frost and winds may reduce this crop considerably.

Sugar beets follow the pepper crop. Residue of each crop in the rotation is plowed into the soil, and in the case of the sugar beets, Mr. Peukert is convinced that the effect carried over from the complete fertilizer applied to the pepper crop or other crops is very considerable. The sugar beet is a good "rustler" for plant food and gets much benefit from this residual fertilizer. He has observed that the beets growing on this land, fertilized the year before with the 6-11-6 mixed fertilizer, were fully equal to beets fertilized with a nitrogen fertilizer.

Speaking of nematodes, a pest which causes no end of trouble on many crops, not only in Ventura County but in many sections of California, these men say that they have left the nematodes behind. With crop rotation and plenty of nitrogen, phosphorus, and potash for the crop to feed upon, the nematodes do not seem to catch up!

You have probably guessed right that the kind of farming done by Peukert and Arrougé has been a paying proposition. Last year Peukert hung up a county record on his sugar beet crop—a yield of 27 tons per acre. The beets averaged a little over 17½% sugar. His exhibit of beets and chili and pimiento peppers took first premium at the County Fair. Peppers on these two

This is the field of sugar beets that made 27 tons per acre.

farms yield about 6 tons per acre, and now the lima bean yield is 25 sacks per acre.

Farming sense, a neighborly spirit, plus drainage, crop rotation, cover crops, and fertilizers have made that first picture of alkali land and crop failure recede far into the distance. In the future this kind of farming will have to be applied to many California farms. Peukert and Arrougé, the good neighbors, are just a little "ahead of the procession."

Vitamins—the V-Sign

(*From page* 5)

also gets into a peck of trouble sometimes. Maybe if the case is more in his mind than in his metabolism, the patient with the drug-store habit will get relief just because he can take something night and morning. Why, this same relief was afforded long ago in the days of Bosh's Bitters and Lydia Pinkham's pellets.

I knew a drug-store dyspeptic who tried to reform his bowels and blood stream by proprietary advice and frequent reading of everything about vitamins he could find in scientific literature. He was convinced that the main cause of his botheration was B—vitamin B complex, if you know what I mean. I'm afraid I don't. But see what he found.

PERUSING the technical descriptions of the signs and symptoms of B complex in various classes and subclasses, this addict was more confused than ever and got worse fast.

"External symptoms are observed in man and animals which suffer from riboflavin deficiency. These include cheilsosis, glossitis, and keratitis. Use 200 to 300 micrograms per 100 grams of ration.

"Nicotinic acid is a component of cozymase and coenzyme No. II. An inadequate supply causes pellagra. It is needed in larger amounts than other B vitamins, namely two or three mg. per 100 gm. of a ration.

"In connection with the use of pyridoxine it is found that rats on a diet of sucrose, purified casein, salt, thiamin, riboflavin. and vitamins A and D, will grow well for a week and then plateau, with typical acrodynia.

"The following factors are included in the B complex: thiamin, riboflavin, nicotinic acid, pyridoxine, choline, inositol, biotin, factor W, and alkaline labile factors for dogs, factor R and factor S and chondroitin. If all these are needed in human diseases the future of B vitamins seems tremendous."

When I last saw him he was begging for more new discoveries and borrowing money on his life insurance policy to buy more pills and fortified foods. He wondered if he could cure himself before he died of old age and why.

Yet on the whole we may happily conclude that if one doesn't take it too seriously and let homeopathic vitamin dosing get him down, the results are at least harmless. It beats trying to drown out sorrow with alcohol anyhow.

There was another lad sliding into just such a bad state of mind over vitamin deficiency and home treatment who got a job working on a farm to help an uncle in an emergency. After pitching hay in the hot sun, cultivating corn behind a lame horse, milking a dozen cows twice daily, and eating threshermen's meals afterwards, the fellow returned and pitched out all the vitamins in his select stock. Somehow the sunshine and tired-man vitamins cured him without more advice from the soda counter. He can eat dill pickles, ice cream, and salt pork all in one meal now and not feel deficient of anything.

Speaking of summer, by the way, I have always been interested in the apparent connection which exists between the process called "photosynthesis" in plant tissues to make chlorophyl and the action of sunlight on body tissues in health promotion. This mode of absorbing vitamins by skin exposure has caught my daughter along with many other tender young plants. How they love to bask quite bare in the garden behind the house, taking in the vitamins that otherwise would have to be absorbed through spinach and such disagreeable tidbits. If sound health can be had by dermal sun bathing, I shall be the last to discredit the process, as it often improves the scenery along main street. But I wish they would fry themselves evenly.

They claim likewise that the dairy cow chewing her cud in summer on lush green meadows partakes of vitamin surplusage and strains the best of it through her mammary system into the milk bucket, so much so that summer milk is prized above that produced when icicles on the pump interfere with the winter's watering process.

Yet after we have removed the errors due to mistaken zeal from all this vitamin therapy as practiced by the average citizen, it is surely a sign that science has become a real factor in our lives. Folks listen nowadays to the pronouncements of the laboratory more than they did when we were young. It means that scientists have a larger place and a bigger field in which to operate for human welfare. If nobody paid much attention to their discoveries, it would mean just filling a few more old library shelves with cluttered documents.

IT PUTS the biological scientist in a ticklish place. He needs just enough stimulative publicity to aid him in securing enough funds in this critical time with which to continue his research; but if he overplays his hand on half-truths or makes premature announcements about the newer knowledge of nutrition and vitamin cures, he is sure to be misquoted and cause endless confusion and contradiction. So when I find one of the better informed men of the food laboratory reticent about explaining more than he is sure of, I respect his wishes and quit trying to obtain a scoop. The publicist likewise shares the responsibility for leading the hungry public to the best menus.

Doubtless the other side of the picture in the future development of better nutrition will be that relating to improvement in the common foods now making up the usual American diet. The restoration of vital chemical elements in those foods and perhaps the fortification of others with vitamins will soon become the mainstay in nutrition.

In this to some extent already farmers and soil workers play a vigorous and important part, but as time passes and further new facts on the interplay of those chemical regulators appear, I believe that there will be more opportunity for the production of better raw materials containing more vitamin ingredients to the ton.

THE doctors and analysts are busy trying to find out more definitely what amounts and how often the human body needs certain vitamin chemical factors to maintain good health and poise. While this work proceeds and the biological scientist assays more foods to find out their present vitamin content and how it varies under changes in temperature in cooking, I expect that there will be a corresponding movement on the land side to give the producer a part in shaping this vitamin picture.

Studies in summer milk and carotene in hay making and in grass silage have already become known and utilized to marked advantage. I therefore look to the agricultural horizon for more partnership with science in the future welfare of mankind.

Until that day comes may your vitamin intake be at the optimum, and your winters be as rosy and hopeful as the warm and invigorating season we now adjourn. But get your vitality at the table and in action, rather than over the prescription desk. It will make the V-sign stand for something lasting on this side of the globe, far richer than a military victory for us all.

"Miss Epsom," said the colored parson impressively, as he led her into the brook for baptism, "I'se gwine lead you out inter dish heah stream, an' wash out every spot o' sin you's got."

"Lawsy, Pahson," giggled the erstwhile frolicsome damsel, "in that li'l ole shallow creek?"

TOO YOUNG

"Why aren't you in school, my little man?"

"Hell, lady, I'm only four."

"Boy!" said the grasshopper as it hit the windshield, "I'd like to try that again but I haven't got the guts."

A doctor received a call late one night and on a lonely road quite a ways in the country his car broke down. The only life he could see was a light in a home in the distance. He walked to the house and rapped on the door. A very beautiful young woman appeared. He explained his plight and asked if he could stay all night. She explained that she was a widow and lived alone, had only one bedroom, but that she would be glad to let him have it, and she would sleep on the lounge. He went to the room, took off his clothes, and went to bed. He had been there only a short time when the door opened slightly and a soft voice inquired: "Are you asleep?" He answered, "No." "Would you like to have a bedfellow tonight?" "Yes," he replied. "All right," she responded, "Another man's car has broken down and he wants to stay here tonight also, so I'll send him in."

"Hot dog! Last night I finally persuaded my gal to say that little word, 'Yes.' "

"Congratulations, old man. When's the wedding?"

"What wedding?"

Oh, mother may I go out to swim?
Why not, my darling daughter,
You're so damned near naked anyhow
You'd look better in the water.

On visiting his parish after an air raid, a minister asked an old Scottish lady how she conducted herself when Nazi bombs were falling around, and this is what she said:

"When the air raid warning sounds, I tak the Guid Book from the shelf and read the 23rd Psalm where it says 'Though I walk through the valley of the shadow of death I will fear no evil, for Thou art with me.' Then I put up a wee bit prayer. Then I tak a wee drap o' whiskey to steady me nerves. Then I get into bed and pull up the covers; and then I tell Hitler to go to hell."

Down at a Southern camp, a colored outfit, just drafted, was lined up before the clerk for preliminary questions.

Clerk: "Name and address?"

Rastus: "Sakes alive, suh? Yo' ought to know. Yo' all sent fo' me."

AND—

Our idea of an optimist is a man who took the marriage vows at the ripe old age of 90 and started house hunting for a home close to a school.

Better Crops with PLANT FOOD

October 1941 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, D. C.

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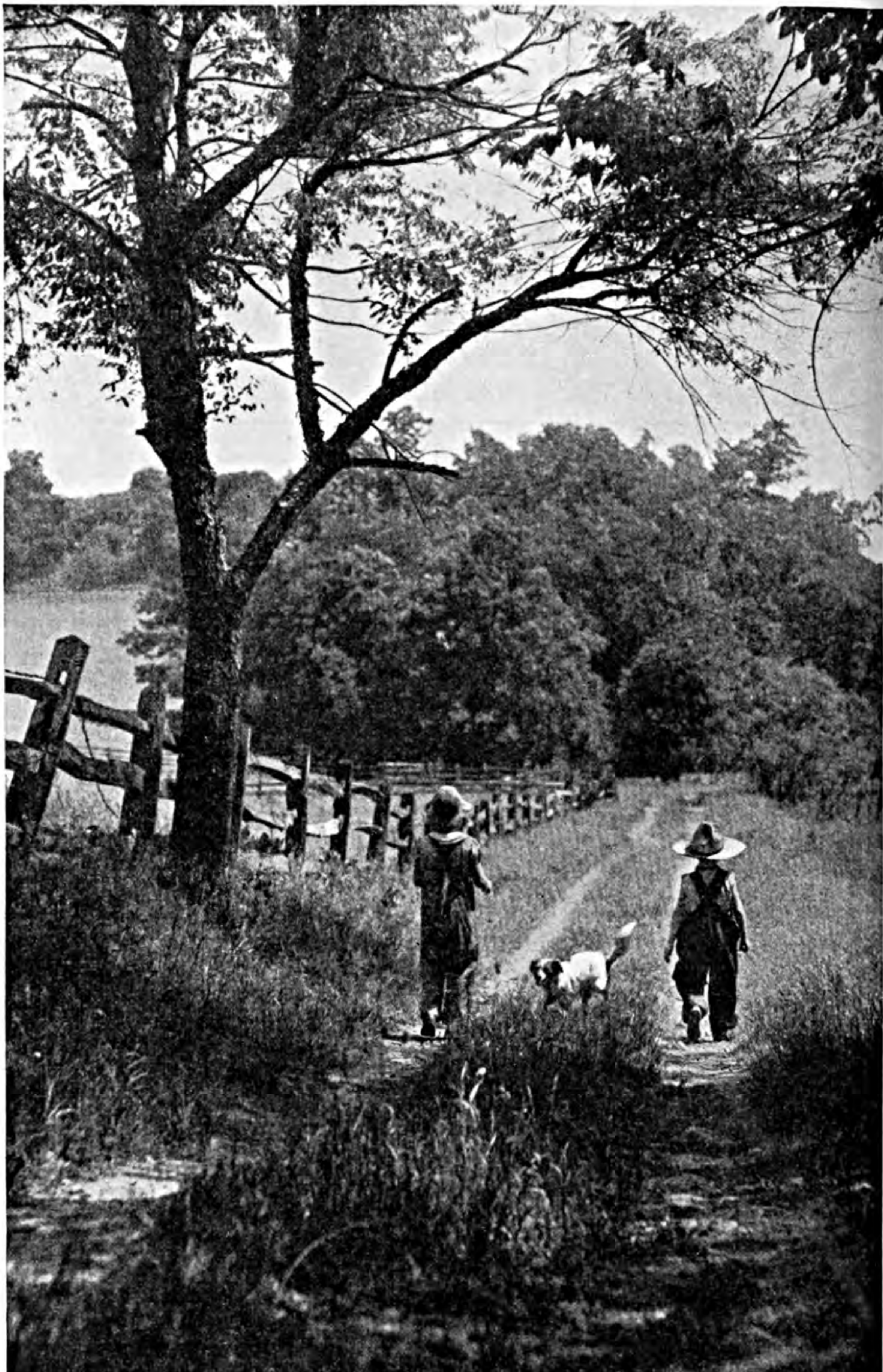

INDIAN SUMMER TEMPTS THE SPIRIT OF WANDERLUST

Better Crops with PLANT FOOD

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Vacationing Among....

Looms and Landscapes

Jeff McDermid

DRIVING through the canyons of the Cumberlands and breathing the rarefied air of the Great Smokies and the laurel-bordered mountain forests of Chilhowee teach us how far America has come and how much we have missed in the coming.

It's modern, streamlined, motorized travel to a land where they glorify the arts and crafts of human hands and simple tools. It's the modern mode meeting original American culture and tradition. It means going over super-engineered highways and all-weather roads to a region of mules and mountain trails. It takes the world-weary denizens of 1941 back to the simplicity and peaceful provincialism of 1741—and sends them home encouraged, invigorated, and refreshed.

One who has completed such an all-too-brief journey to one of our best recreation areas cannot help pausing on his return to take stock of the values and virtues that such privileges provide. Not to do so would rob the vacationist of that retrospective inventory so vital in realizing what man and nature have lavishly set forth to comfort us. Moreover, the telling of these beads of our rustic rosary may help others to plan such restorative meanderings for themselves another season.

Recreation in its best sense is the reanimation of the body and the spirit after workaday humdrums; the turning from something one *must* do to something one *wants* to do. It also implies personal inquiry and a constantly open mind to learn and enjoy and perhaps to participate in the new-found pleasures afield. Ordinary amusement is drab indeed beside it, for amusement is merely passing time without profiting through leisure. It is loafing without learning and gets us nowhere.

Our old-style vacations when many of us were young consisted of seeking some gaudy, bedizined resort full of commercialized claptrap and shoddy souvenirs, like painted shells, tarnished spoons, and paper weights of no earthly use whatever, or gazing at lurid carnival fakes and gorging ourselves on mineral water, crackerjack, and hamburgers.

THIS suggests that there are at least two outstanding differences between the vacations open to average folks in those days contrasted with recreation opportunities today, which are much deeper and more significant than the surface details show.

Item Number One is the revival and maintenance of pioneer mountain handicraft, the teaching of it to others, the display of its beauty and utility, and the resulting benefits both to the backwoods artisans themselves and the visitors who buy it, treasure it, and often learn to imitate it in restful periods at home.

Item Number Two is the active leadership and direction of great outdoor recreation grounds by the states and the federal government. Such public control of natural beauty spots was absolutely unknown when you and I went vacationing. We patronized only the commercial resorts because there were hardly any others within reasonable reach of a short vacation and a shorter purse. The motor car and Uncle Sam's park commissioners, plus the far-flung web of state and federal highways combine to give us a new measure of the meaning of vacation. Hence we can go further, see more, and bring home greater inspiration—and the cost is less than we spent at some "spa" in the days of Dobbin.

To me it is highly important that there are government agencies in nearly every state and throughout the federal network that are dedicated to the preservation of nature's grandeur and the encouragement of original craftsmanship. Less than a quarter of a century ago all government felt its duty done when money was coined, revenues were collected, and policemen were posted. The refreshment of a citizen's body and mind was left to the cook, the preacher, the bartender and the doctor. Uncle Sam never invaded vacationland.

Returning from a satisfying vacation, one realizes that there are two phases of the subject involved—the social or group planning and the land planning. It's like fixing for a baseball game. You must have teams well trained and there must be a suitable area to play on. One finds this particularly true in the Kentucky, Tennessee, and Carolina vacation regions, where both the social backgrounds and the landscape facilities are above par. By this I mean that you get to know real people doing their humble tasks just as their ancestors did them a century and more ago, using the same equipment; and you glimpse vistas of wondrous beauty which make small troubles vanish against sheer immensity.

HERE we see social and educational agencies of a semi-public kind teaming up with state and federal governments, who direct the land planning part of it. Outstanding examples noted in support of such contention are social agencies like Berea College and the Bybee Potters of Kentucky and the Pi Beta Phi sorority and the Southern Highlands Handicrafters of Tennessee. Numerous other similar groups motivate the theme of native crafts in countless nooks of the Appalachian terrain. Of course to know them well one should reside among these people for a summer season instead of merely saying "Howdy" and fleeting forward.

Nearly everybody has heard of the fabulous success of Berea College in providing an outlet for the talented wood carvers, chair makers, potters, rug braiders and weavers—out of the proceeds of which these young persons gain higher learning and attain wider horizons. Its campus is teeming with energetic, purposeful, hopeful young mountaineers, vigorously delving to perfect themselves in the manual and mental goals of democracy. Like their forefathers, the tools they wield are primitive ones, and what they lack in equipment to turn out some new design they promptly fashion for themselves. "Priority" means little to such producers because the woods and fields

contain the materials most needed to start them up in business, and they ask no odds of anyone. It takes us back along the mossy trails of history to the days when the grandparents and great-grandparents of these husky Dixie folks carved out a wilderness from Virginia to the Mississippi and beyond.

Many have also seen the choice homespun arts exemplified by the Pi Beta Phi scholars at their school in Gatlinburg in the Smokies, where beneath the shadow of Mt. Le Conte a better form of patriotism is being developed. Others know the loom art of the Russellville Shuttlecrafters, perpetuated intact from the times of Queen Elizabeth and Walter Raleigh. And home-made chairs are thrust forward to signify warm hospitality on every mountain cabin porch amid the Cumberlands.

Through such work guilds, hosts of mountaineers have become more independent and skillful than ever before. These companies of honest woodsy workers are widely scattered through districts that were practically without outlets for their gems of native artistry only a few short years ago. This is the kind of organization that lasts because it depends on mutual advancement and promises a sure reward for the membership. The only bad note that sometimes threatens to undermine their efforts is the existence of maladroit and selfish commercial adventurers who try to introduce price-cutting commercialism into a realm of decent labor. Here we must rely on the discretion of visiting tourists to patronize only the original clans of bona fide native type and to accept no cheap, hastily made imitations "a la Japan." Let's not let Manhattan spoil the mountains! The laborer is worthy of his hire and the purchaser is worthy of the best.

But to reach these fastnesses of forest lands one goes over roads and through country under the planned guidance of noteworthy public agencies. Among leaders in this planning of the means of access and enjoyment to the Southern Highlands one may mention the Bureau of Public Roads, National Parks Commission, Civilian Conservation Corps, Tennessee Valley Authority, and the legislatures of Kentucky, Tennessee, and the Carolinas.

You may talk as you please about the hard-headed outlook of typical engineers, but take it from me, some of them must have a germ of esthetic appreciation mixed up with their slide rules and surveying instruments—or else we would not go hither so easily from yon, and see the majestic sights en route.

THE social agencies aforesaid encourage that splendid background of rare human skill and devotion to detail of the rugged mountain folk, without which the area would lose so much charm and historic value. But the public agencies plan the dams and roads and tunnels, the grades and overlooks, the parkways and the guidebooks—which enable modern travelers

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A small acreage of Ladino on this farm furnished an abundance of feed for pullets on bare range and laying hens kept indoors.

Ladino Clover Makes Good Poultry Pasture

By G. T. Klein

Agricultural Extension Service, Amherst, Massachusetts

GOOD pasture on a poultry farm is a crop that has a very definite cash value. On a New England farm it far outranks the return from corn, wheat, or oats. It is so important that poultrymen are continually buying up new land that can be used for poultry range. It has been said that the prosperity of a farm community depends to a considerable extent upon the pasture that farmers can raise for their livestock and poultry on their fields.

Ladino clover, introduced into New England for dairy pasture, is rapidly being adopted by poultrymen as a range crop. In it they have found a fast growing plant that stands grazing well and for palatability has practically no equal. It also serves them well as a soiling crop that may be cut and carried to flocks of growing birds with limited range or to layers kept within the confined walls of the laying house.

Though the average life of Ladino on the poultry range is about 3 years, we have farms in Massachusetts where it has been used without reseeding for 8 or 10 consecutive years. It produces far more pasture on fertile lands that are well supplied with moisture than on poorer and drier soils. Poultrymen have also found that Ladino responds well to treatments of commercial fertilizers and applications of poultry manure, and these they use liberally.

For cultural methods, poultrymen

turn to agronomists for instructions. The plant resembles white Dutch clover in appearance and general growing habits except that it is much larger. When the root system is established, it spreads by means of surface runners like a strawberry plant. These runners take root and produce a crop of leaves and blossoms both of which are readily eaten by poultry. It has been found to spread a distance of four feet from the original plant in one year's time. From the numerous joints of the runners, the leaf and flower buds grow in abundance. The leaves form near the ground, grow quickly, and soon attain a height of 12 to 18 inches if not cut or grazed. It appears so much like one of the red or alsike clovers that one usually examines the lower surface of the leaves for a shiny appearance which is a distinguishing feature of Ladino.

On the subject of selecting land best suited for Ladino, Ralph W. Donaldson, Extension Agronomist at Massachusetts State College, has stated that the moist lowland areas are best. Land too wet for corn and alfalfa, yet sufficiently drained to prevent standing water, gives the best yields. Ladino roots are shallow and much of the feeding is from surface runners. It does not thrive on the drier, lighter soils of Massachusetts and on any soil growers find it best to feed the plant heavily.

This small "A" type shelter is well suited for use on Ladino pastures because it can be easily moved.

In seeding this crop for poultry pasture, poultrymen usually include two pounds of seed per acre in a common pasture mixture. If the soil is entirely unsuited to Ladino, the other grasses give a stand, but if it does succeed, the productiveness is greater than would be the case from other mixtures and Ladino is a far better crop than the common grasses or clovers.

Excels for Grazing

Ladino clover excels for grazing, although it is possible that there are less handicaps to overcome on the dairy farm than on the poultry range. It thrives best under intermittent grazing management. Dairymen easily accomplish this by changing pastures. Poultrymen have more difficulty in moving brooder houses and range houses because of their weight and because chickens are likely to be greatly disturbed when their roosting place is moved a great distance. Some poultrymen use small brooder houses that are light in weight and move them only a very short distance at one time but often. Others use a double yarding system for alternating the range, and some limit the number of chickens to the acre to such an extent that the crop cannot possibly be entirely killed by the grazing birds. On any poultry range and more particularly on a Ladino range, feeders should be moved a few feet each day for protection of the sod.

This crop is unsurpassed for cutting and carrying into the flock. One poultryman reports that 10 cuttings of clover, taken off with a scythe, were obtained in a single year. If cut when about six inches tall, it grows back quickly and cannot be surpassed for palatability. This is one of the very best uses that can be made of the crop on the poultry farm. There is hardly a farm where extra green feed supplies would not be very beneficial to the flock, and Ladino meets the needs remarkably well. If the growth gets ahead of the flock's ability to consume the feed, a hay crop may often be taken off the range.

We have little reason to believe that there is danger of a flock of hens eating so much clover either on range or when carried in to them that it will seriously affect the yolk color or egg quality. Ladino ranks high in vitamins. Poultrymen producing hatching eggs look upon this extra vitamin supply as very desirable, and with the present scarcity of vitamin-carrying oils, extra vitamins such as Ladino furnishes, are of great importance. Neither is it likely that such a large quantity of the feed will be eaten that it will reduce consumption of grain and mash to retard egg production or growth of broilers.

Chopping Unnecessary

It has never been found necessary to chop Ladino clover in a green feed cutter for poultry. Experience tells us that it should be cut early in the morning and fed at once before it wilts or it should be held in bushel baskets in a shady cool place until it can be fed. Turkey growers have found the crop to be a satisfactory one for birds confined to the sunporch. When fed in the morning and afternoon it is of great help in holding cannibalism and feather picking in check. Duck growers find it to be a good green feed to mix with the wet mash which they use for fattening during the last three or four weeks of the duck's life.

Dairymen sometimes use the crop for ensilage. Of its value for this purpose I can say but little. Poultrymen have not used this or any other ensilage extensively.

The grass seed mixtures for an acre of range that poultrymen use are similar to five pounds timothy, five pounds red clover, three pounds alsike, five pounds Kentucky bluegrass, and two pounds Ladino clover. Inoculation of seed is not considered necessary. One to two bushels of oats to an acre as a nurse crop usually accompanies it. The grass is usually seeded in April and the oats are pastured off. After the third year, bluegrass is likely to make a permanent sod. If the crop is grazed with poultry the first year, it should only be late in the season and then, lightly. This, growers find, they must watch carefully as stands have been damaged or entirely killed by too early and close grazing.

Ladino clover is sometimes seeded with a grass mixture in July or August without the nurse crop. Such seedings are not pastured until the following spring, and in Massachusetts this method has given very good stands. A third method of establishing a stand is to broadcast the grass mixture on wheat or rye pasture which was fall sown. March or early April is the proper time for this when the ground is in thawing condition. Broadcasting Ladino seed on old sod without the normal seedbed preparation has not been successful. On the poultry range where bare spots are certain to develop around the brooder houses, the areas are harrowed and reseeded in the fall after chickens are removed, provided it is not too late, or in the early spring. Reseeding of these areas should be done with grass mixtures and not with Ladino alone.

Poultrymen of Massachusetts have no misgivings about the use of a range for brooding for two or more consecutive years provided they can keep a reasonably good growth of grass or sod on it. Bare land and particularly the poorly drained areas are what they are fearful of in coccidiosis and worm control. Some land has been used continuously for brooding for 25 consecutive years without serious results. They are careful not to let the bare areas develop, and the range is not used in the spring until it is in good condition. Pullets are removed early in the fall so that there is a chance for the grass or clover to grow back sufficiently in the fall to prevent winter-killing and

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Georgia's Bale-Per-Acre Cotton Farmers

By E. C. Westbrook

Agricultural Extension Service, Athens, Georgia

EACH year hundreds of Georgia farmers produce an average of a bale per acre on all of their cotton land. Despite this fact, the average yield for the State rarely ever reaches one-half bale per acre. In 1940 the average reached the half-bale mark for the third time in all of the Empire State's rich history. With the hope of finding out how some farmers manage to produce a bale per acre almost every year, we sent questionnaires to 1,300 of these growers. We asked a great many questions which were designed to bring out the kind of farming each was doing. We wanted to know whether they were just good cotton farmers or whether they were good all-round farmers.

Of the 1,300 bale-to-the-acre farmers, 375 filled out and returned the questionnaires. We tabulated the data, which not only proved interesting but offered information that should be encouraging to others.

County Agent E. H. Thomas, of Hart County, had a few of his bale-to-the-acre farmers as guests at a Rotary luncheon in Hartwell. They were invited to tell how they grew their cotton, and in addition were encouraged to tell what kind of farming they practiced. The program proved to be so interesting that instead of lasting one hour, as is customary, it lasted two hours. The farmers not only told how they prepared their land, fertilized and cultivated their cotton, and what variety they planted, but they told how they had built up their land by planting soil-improvement crops, about terracing to prevent loss of valuable soil, producing ample supplies of food and feed, intro-

Strip-cropping with cotton and lespedeza.

ducing some additional money crops, increasing returns from their poultry, and feeding out steers, etc.

The Hart County bale-to-the-acre farmers turned out to be not just good cotton growers, but farmers who are practicing many of the things which are recommended by the agricultural colleges, experiment stations, extension specialists, and county agents.

A summary of the 375 questionnaires, which came mostly from the northern half of Georgia, showed that with few exceptions these farmers also planted pure seed of approved varieties of cotton. They used good methods of fertilization, preparation, and cultivation. They practiced crop rotation and soil conservation and had a diversity of enterprises. Many had made a beginning in some phase of livestock production. A great many of them had introduced additional cash crops. The total number of acres planted to cotton on individual farms varied from 3 to 250.

Most of them used high-grade fertilizer on their cotton. A complete fertilizer was used at the time of or before planting, and in the majority of cases there was a second application applied as a side-dressing. The amount of fertilizer used, the per cent of farmers using this amount, the per cent of this number using side-dressing, and the average amount of side-dressing used were as follows:

of nitrate of soda alone, 10 side-dressed with sulphate of ammonia, 7 with a complete fertilizer, 3 with potash, 26 with nitrate of soda and potash, 6 with sulphate of ammonia and potash, 3 with Cal-Nitro, and 13 used other combinations of fertilizer as side-dressing.

There was a total of 67 different fertilizer analyses used in fertilizing the bale-to-the-acre cotton. The 4-8-4 led with 64 farmers, 4-8-6 was used by 51 farmers, 3-9-3 by 37, 5-7-5 by 31, 6-8-6 by 27, 4-10-4 by 10, and 4-12-4 by 6. In addition to the ones who used the above seven analyses, 76 used fertilizers with 18 units or more of plant food, and 20 used mixtures with less than 18 units of plant food.

Two hundred and one said they used continuous row planters to plant their cotton seed, 112 used hill dropper planters, and 17 used both types of planters. More than half used from 2 to 2½ bushels of seed per acre, and most of the others used more than 1 bushel.

One hundred and sixty-two farmers treated their seed with Ceresan before planting and 194 did not treat their seed. With few exceptions, all reported good stands. Most of the farmers practiced thick spacing. Twenty-one of them planted their cotton in 2½-foot rows, 180 in 3-foot rows, 136 in 3½-foot rows, and 24 in 4-foot rows. Fifty-six per cent of the bale-to-the-acre

Amount fertilizer used per acre	Per cent using	Per cent using side-dressing	Average amount side-dressing used per acre
100 lb.	0.56	100	100 lb.
150 "	0.56	100	75 "
200 "	7.02	60	118 "
250 "	1.97	85.7	118 "
300 "	26.40	69.1	120 "
350 "	7.30	73.1	116 "
400 "	33.15	70.3	115 "
450 "	3.37	75.0	108 "
500 "	10.39	64.9	130 "
550 "	1.97	57.1	112 "
600 "	6.18	50.0	132 "
700 "	1.12	50.0	100 "

Sixty-eight per cent of the farmers used side-dressing. One hundred and sixty-three farmers used a side-dressing farmers spaced their cotton 10 to 15 inches in the drill and left from 1 to 4 plants to the hill.

The farmers gave their cotton frequent cultivations. Fourteen of them cultivated 3 times; 95 cultivated 4 times; 116 cultivated 5 times; 55 cultivated 6 times; 28 cultivated 7 times; 13 cultivated 8 times; 10 cultivated 9 to 12 times; 9 cultivated each week; 1 twice each week. Most of them laid by their cotton between July 1 and 25.

Only about one-third used any means of boll-weevil control. Some of them mopped their cotton, some dusted with calcium arsenate, and others picked up

Spreading damp cotton on sheets in the field to dry. If cotton is dry when ginned, the grade is higher than if it is wet when ginned.

squares. Two hundred and seventy-four practiced crop rotation and 77 did not.

Two hundred and twelve said that they thought summer legumes, such as lespedeza, cowpeas, soybeans, and velvet beans, were the most practical soil-building crops for cotton to follow. Ninety-nine preferred cotton to follow winter legumes, and 9 preferred it to follow small grain.

As to the factors which contributed most to obtaining good yields, there was a very large number of reasons given. One hundred and eighty-nine farmers listed proper cultivation and hard work as important factors; 166 considered the use of liberal amounts of high-grade fertilizer as the most important factor; 120 thought that weather conditions were outstanding reasons; 45 good land; 46 use of good seed; 62 weevil control; 74 use of soil-building crops; 18 early planting; 38 good preparation of land; 18 crop rotation; 18 side-dressing with quick-acting nitrogen fertilizer; 13 terracing; 8 picking up fallen squares; and 2 thought that the A. A. A. program was responsible for their good yields.

Many farmers were growing money crops other than cotton. The question, "What money crops other than cotton do you grow," was asked. The replies were: corn 58, truck crops 55, hay 39, poultry 24, seed 25, peas 23, oats 21, dairy products 22, wheat 19, peanuts 19, hogs 16, cattle 16, watermelons 15, potatoes 13, rye 9, fruit 9, pecans 4, and peppers 4.

There were more bale-to-the-acre farmers in Georgia in 1940 than in 1939. Georgia farmers have improved the quality of their cotton crop tremendously during the last 10 years. For example, 82 per cent of the 1940 crop was 15/16 inch and longer staple, as compared with 22 per cent in 1931. More than half of the 1940 crop had a staple of 1 inch and longer, as compared

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The Newer Ideas About Fertilizing Orchards

By J. D. Winter

College of Agriculture, St. Paul, Minnesota

NO APPLE orchard can be successful over a long period of years without the adoption of a sound program to maintain soil fertility. For many years the application of a nitrogen fertilizer has been considered standard practice, based on the justified assumption that this element is the one that is lost from the soil most rapidly and the one most lacking in orchard soils as the trees grow older.

Apple orchard fertilizer recommendations in the majority of states today suggest the use of nitrogen only, largely as a result of plot studies made during the period 1900 to about 1930. However, as new studies are reported, a very noticeable swing may be detected toward recommendations for the use of a complete fertilizer, at least in alternate applications. This is particularly true in the Eastern States where it is being recognized that fertilizer tests conducted on good orchard soil cannot necessarily be used as a basis for fertilizer recommendations on poor soil, and vice versa.

The latter situation is summed up in a recent publication, Bulletin 626 of the New Jersey Agricultural Experiment Station, as follows: "Some orchard soils may be so well supplied with all the common nutrients that they will not show a beneficial response to applications of fertilizers. Other soils may be deficient in one or two nutrients but be well supplied with the remaining elements. In general, however, orchards planted upon Coastal Plain soils will be benefited by annual applications of a complete fertilizer."

Differences in the nutrient requirements of orchard soils were pointed out by the Fruit Testing Committee of the Wisconsin Horticultural Society after a visit in 1940 to the Ontario Experiment Station at Vineland. Professor G. H. Dickson in going over the experiments on orchard soil management pointed out a section of young trees which showed indication of potash deficiency. The leaves were slightly crinkled, hard, and somewhat rusty looking. He said that an application

Loading some of Houston County's 1940 apple crop.

of potash fertilizer cured the trouble and promoted tree growth.

Professor Dickson then went on to explain that in this particular test trees were planted on an area of soil where chemical tests indicated the same amount of potash throughout. On one section of this soil the trees showed the characteristic potash shortage, while on another section they did not. Chemical tests again showed that the soils in both plots were much alike and low in potash.

Finally soil experts were called in, and on further examination it was discovered that the trees showing no potash deficiency were on deep soil, while the others were on a shallow soil where the subsoil was relatively close to the surface.

What may be the situation in some of the richer soils of the Middle West? In Houston County, Minnesota, is located a small but thriving orchard industry where varieties such as Wealthy, McIntosh, Jonathan, and Delicious are grown to perfection. The soil, in general, is a rich silt loam underlaid by limestone formations. For the past 15 years growers here have used ammonium sulphate only, and prior to that time they used nitrate of soda.

One of the experienced growers in this region, Henry W. Leidel, who, incidentally, is president of the Minnesota Fruit Growers Association, writes as follows: "In late years our trees have not been doing so well under this method of fertilizer treatment. We can pep them up if we use enough ammonium sulphate, but this results in poorly colored fruit. Also, we find it difficult to get a good growth of grass between the trees or to get new grass to start at all. The grass is very essential for maintaining humus.

"I have used mixed fertilizers on about half my orchard for the past two years and find it quite satisfactory. You can see the difference on the grass if about four pounds of mixed fertilizer are applied per tree, and you will also notice a very decided difference in the color of the fruit.

"I find it good policy to apply a complete fertilizer the year the trees are bearing their heaviest crop. The following year is a good time to apply more nitrogen if the trees have not made sufficient terminal growth. I have used a 10-6-4 for my mixed fertilizer and shall use the same mixture again. This will make healthy trees and beautiful, perfect fruit."

It is probable that several factors have contributed to the greater use of complete fertilizers in orchards, such as the loss of nutrients from the soil by fruit and pruning wood hauled from the orchard, losses from soil erosion, and induced losses of potassium and other elements as a result of the use of certain nitrogen fertilizers, particularly nitrate of soda. Authorities tell us that when nitrate of soda is used in large amounts over a period of years, the sodium tends to increase the loss of potassium and other fertilizer elements by leaching due to what is known as base exchange.

The Use of Cover Crops

Under the sod-cover system which is in general use for bearing apple orchards in the Middle West, there is little difficulty in maintaining an adequate supply of organic matter or humus. One of the most important functions of humus, and one often overlooked by the orchardist, is keeping available to the trees the nutrients present in the soil. For this reason the maintenance of a thrifty sod growth is desirable. However, care should be exercised to select cover crops that will not compete with the trees for moisture, especially under drought conditions. Recent investigations at Michigan State College show that sheep's fescue, Chewing's fescue, redtop, and Canadian bluegrass are well suited for orchard conditions. Among the crops that compete seriously for moisture are alfalfa, reed canary grass, and smooth brome grass, as indicated by the fact that when used for sod cover in orchards they are likely to remain

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A fine stand of Sericea lespedeza along the margins of cultivated areas produces both feed and cover for game birds.

Farmers Can Raise More Farm Game

By Ross E. Hutchins

Mississippi State College, State College, Mississippi

FARM game, like any other farm product, is a product of the soil and is affected by more or less the same factors. Rich soil producing luxuriant growth will support more game than worn-out soil. The same thing is true of fish ponds on good and on poor soil.

When this country first began to be settled, game of all kinds was abundant, but as time passed and more and more land came under cultivation, wild life began to find fewer and fewer acres suitable for living. Of course, other factors entered into the picture. At first wild game was the chief source of food for the settlers and miners living in the out-of-way places. Animals were so abundant that it seemed impossible that a time would ever come when they would nearly all be scarce, and some even extinct. Unfortunately that is the picture today.

The last heath hen died in 1930, the last passenger pigeon was seen in 1916, and there is little doubt that the last Carolina paroquet was seen many years ago. Yet all these birds were once extremely abundant. The wild game that we have today is but a remnant of what once existed. If we are to have game to shoot at in the future, we are faced with the fact that we must take active steps to conserve what we have left and to so manage our hunting areas that they will produce more.

There is nothing mysterious about

game production, any more than there is about raising cattle or chickens. If we set about raising chickens, we first build a chicken coop to shelter them from the weather; similarly if we wish to encourage quail or rabbits, we should so manage things that there is sufficient cover to shield them from their enemies and the weather. Just as we raise feed for our chickens, so we must encourage food plants that are of value to the game animals.

There are still those who advocate confine our efforts to game that does not migrate, such as quail, rabbits, pheasants, and perhaps small fur bearers? There can be little doubt that our efforts should be confined to game that "stays put." There is little incentive for the average farmer to spend time and money raising game such as ducks that will probably migrate a thousand miles away for someone else to shoot. Projects such as this must be left to federal and state agencies. There are places, of course,

Plantings were made in this area and three years later erosion was completely controlled and an ideal environment for wild life established.

the pump priming practice of rearing game under artificial conditions and then turning it loose. At best this is only a temporary help, because if the proper conditions are not present, these animals will not survive. Of course, if there are no game animals in an area, then we must have some to start off with, but in general if any native game is present, it is best to spend our time and money improving conditions, and let the game worry about nesting and reproduction.

What type of game can we encourage on an average size farm with any degree of success? Can we expect to produce ducks and geese, or should we where migratory game can and has been encouraged on small areas.

As stated in the beginning, game is a product of the soil, and what benefits and conserves the soil helps wild life of all kinds. On many farms there are eroded gullies and other places that are producing nothing. Certainly it is a worthy practice to turn these patches into pleasant grounds where quail and rabbits can find a foothold, especially if at the same time we can stop erosion of our valuable soil. Soil conservation and wild life conservation are tied hand in hand.

Game birds need a variety of situations. On an acre of woodland, it is probable there will be but one covey of birds, but if this acre is cut up into small patches of timber with shrubs and cultivated areas between, perhaps there will be a half a dozen coveys in and around this same area. Game animals like the margins of such areas; the margins of weed patches, wooded areas, brushy gullies, and fence rows with shrubs and weeds. Just as game seldom strays far into deep woods, neither does it stray far into open fields. For this reason these various areas should be connected by overgrown fence rows affording passage-ways from one to the other. Quail usually do not wander far, seldom over a quarter of a mile and rabbits much less.

Native Shrubs Desirable

There is nothing better than native shrubs and trees, both for game cover and for erosion control. These native shrubs are already acclimated and are usually better adapted in every way than introduced species. Small, well-rooted shrubs should be planted during the dormant season. They should be spaced about over eroded areas, along fence rows, and in otherwise useless corners. Specimens of native trees may also be planted at various points. Badly eroded gullies should be fenced off to prevent livestock from destroying the young plants until they have become well started. The application of a complete fertilizer about these plantings will hasten growth considerably.

The kind of trees and shrubs to plant depends upon the locality, but a choice from the following list will not go far wrong.

Pine	Oak
Spruce	Osage-orange
Dogwood	Maple
Greenbrier	Blackberry
Willow	Dewberry
Birch	Rose
Plum	Honeysuckle
Mesquite	Rabbitbrush
Black locust	Hackberry
Sumac	Sassafras
Buffaloberry	
White and red cedar	Hawthorn
Huckleberry	Beautyberry
Sage	Serviceberry
Alder	Mulberry

All of the above plants make good cover, and a large proportion of them produce abundant fruit and seed that is eagerly devoured by game birds. One of the best plants from the standpoint of erosion control is black locust. It is easy to propagate and grows rapidly.

Of the small herbaceous plants which are valuable as game food producers, the following list contains the chief ones of importance:

Beard grass	Tumble weed
Bull grass	Chick weed
Switch grass	Senna
Wild millet	Partridge pea
Crab grass	Bur clover
Canary grass	Sesbania
Bermuda grass	Beggar weed
Blue grass	Vetch
Brome grass	Wild pea
Nut grass	Rag weed
Dock	Sunflower
Smart weed	Dandelion

Almost any of these, if allowed to grow or if planted in unused corners or along hedgerows will afford excellent food and a certain amount of cover. One of the best of the food plants for quail is *Sericea lespedeza.* This crop plant develops an extensive root system that renders it of great value as a soil conserver, and at the same time it is good for hay and silage. It grows best on clay loams, silt loams, and sandy loams but does not do well on poorly drained soil. It will grow well on poor, eroded clays and silts or similar soils. In these situations, however, it should be fertilized, otherwise it probably will not do well.

When harvested, the seed is in a tough hull which prevents the entrance of moisture. This results in a low percentage of germination, if the seed is not scarified before planting. If planted during January and February

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Heavy yields of truck crops now come from well-fertilized muck lands in the Pacific Northwest. Celery, squash, pole beans, and strawberries are shown above.

Some Early Experiences With Fertilizer on the Pacific Coast

By B. E. Maynard

San Jose, California

¶ *Fourth of a series of articles recounting personal experiences with the use of fertilizer on the Pacific Coast during the past fifty years.*

WHILE engaged in selling fertilizer in British Columbia many problems arose, not the least of which was the proper fertilization and management of peat lands. Some work with potash in the treatment of crops growing on peat soils had already been done in a limited way. There was still much need for information among farmers on these lands.

One method at first widely practiced was to plow the peat lands to a depth of a few inches, and when this plowed up portion was dry enough, burn it off. Following this, two or three fair crops could be produced, after which the burning process would have to be repeated or production would cease. The farmer looked rather askance at this procedure as he could foresee the time when his peat fields would be a thing of the past. There was also the danger of the fire getting beyond control and destroying a deeper layer of the soil than first intended.

Another method was to haul out and scatter about 100 cartloads of ordinary soil on one acre of peat, a laborious and expensive operation. In order to maintain production, this process also would have to be repeated every few years, and it was not greatly favored. When it was proven that by the use of potash heavy crops of superior quality could be produced at a small cost for material and a minimum of labor in applying it, farmers found that they were entering a new and profitable era. With careful and proper fertilization large crops of grain and other products, some of which might bring in a high money return, could be advantageously and inexpensively grown.

On these peat soils, where only potash was needed, from 60 to 80 pounds of muriate of potash per acre seemed to be about the maximum required. With larger quantities the growth of stalk would be excessively rank. One oat field where muriate of potash had been applied at the rate of 80 pounds per acre, examined shortly before harvesting, promised an enormous crop although the stalks were somewhat on the coarse side but clean, strong, and standing erect. Alongside, where no potash had been used, the plants apparently had died as soon as the small amount of plant food in the seed had been used up. Later the grower reported that this potash-fed field produced 120 bushels of excellent oats per acre.

Another peat field planted to oats, where a test to determine the value of potash was being carried out, was divided into three portions; the first unfertilized, the second manured, and the third fertilized with muriate of potash alone. I examined this field shortly before harvesting. On the unfertilized portion there was no crop, all having died shortly after the seed had sprouted. On the manured portion the crop was poor, stalks short, weak, and smutty in appearance. In contrast the potash-treated oats were tall with clean, bright, upright stalks. The heads were heavy and filled with plump oats, indicating that a large crop of excellent quality would be harvested. Manure on this soil was simply wasted, showing no worth-while improvement over the portion that had received nothing, whereas it could have been used to considerable advantage on other parts of this farm where organic matter and humus were needed. Too, the cost and labor per acre involved in applying the manure must have amounted to considerably more than that expended in applying the potash.

The proper fertilizer made possible this fine growth of hops on muck land.

In some sections phosphoric acid, as well as potash, was sadly deficient in these peat soils, although this situation was entirely unsuspected by the farmers or anyone else. Some growers were using potash and were satisfied that their crops were benefited where it had been applied. Still it was evident that the potash alone was not meeting full requirements.

One of the first questions put to me on going into this section was, "Can you throw any light on a disease which we call 'softening of the bone,' from which our cattle, particularly calves, are suffering?" I was told calves would be so weak that they would stagger and often fall down, instead of running about as healthy calves should. At times they often seemed to be in great pain, which might end in death. On inquiring further the farmers told me that if they fed grain brought in from outside sources their cattle would be free from this trouble. On asking them why they did not grow their own grain I was informed they couldn't because their land would not produce grain. This seemed to answer the question. Land not able to produce grain under favorable climate and moisture conditions certainly indicated a great phosphate deficiency; consequently, any grain grown on this land must lack the phosphoric acid necessary for bone formation.

This was explained to them, and at the request of one farmer I examined a field of barley that had recently been cut. On this he had used muriate of potash. The barley had grown well where it would not grow before but would not mature, remaining green. Grain would not form and it was finally cut for fodder. Stalks were of good length and all with heads, but apparently not one kernel of seed had formed. Without potash grain would not grow on this soil. With potash it would grow well, forming stalks, heads, and all but no seed, a condition undoubtedly due to a lack of phosphoric acid. It was apparent that livestock fed exclusively on forage grown on this land would suffer from want of the phosphoric acid needed in bone building and other body structures.

Later on through a lecture tour arranged by the Deputy Minister of Agriculture I again visited this section. On this trip I was accompanied by Dr. Tolmie, a well-known and leading veterinarian, who afterwards became Minister of Agriculture. On the way to our destination I acquainted him with my findings regarding this disease which was causing so much trouble among the livestock in this particular section. This interested him greatly as he had had no previous experience with this trouble and was glad to be able to observe it at first hand. At that time there seemed to be very little definite information or knowledge regarding the cause of the disease. However, the doctor believed that a lack of phosphoric acid in the forage fed was the chief if not the only cause. He verified this by looking it up in his medical works.

Proved a Nutrition Trouble

At the meeting called for this section a large number of farmers were present. Dr. Tolmie spoke first, but in the course of his address did not touch upon this softening of the bone affecting their livestock. However, the first question put to him was regarding this. In answering he explained to them that it undoubtedly was a nutrition trouble rather than a disease and apparently was entirely due to a lack of phosphoric acid in the fodder provided for their cattle. To remedy this they would have to feed a ration containing sufficient phosphoric acid. The question then came up as to how their soils should be treated so as to supply the needed phosphates. This brought up the question of fertilization and Dr. Tolmie turned it over to me to answer. From this there developed a general discussion, and the need for phosphoric acid in these soils, as well as potash, was fully emphasized.

At the close of the meeting a number of farmers gathered around us for further discussion during which they stated that men sent to them from elsewhere had prescribed various medicines and treatments, none of them proving to be of any value, and that we were the first men who had thrown any light on this problem. Without question interest, awakened at the meeting and by some follow-up work I was able to do, was the means of establishing in this section a regular and well-maintained demand for phosphates and potash, thus enabling the farmers on this peat soil to produce heavy crops

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Mr. Grubb Rebuilt A Worn-out Farm

By J. O. Tressler

Wapakoneta, Ohio

"A lime-phosphate-potash-legume program leads to profitable farming," according to Cloyd Grubb of Hancock County, Ohio.

Mr. Grubb purchased his worn-out farm in 1925. He consulted the writer, then vocational agriculture teacher at the McComb Centralized High School, and asked, "What tests can you provide to help me with my farm management plans?"

The writer was anxious to organize a class project with his soils and farm management class of junior and senior boys. They started collecting about 60 samples of soils which were taken at random spots over the entire farm. They completed the soils study and wrote up a booklet regarding the management of the farm that school year.

The results of the tests proved that much of the soil was badly in need of limestone, ranging from 1 to 3 tons per acre. Ten acres which were to be seeded to wheat were limed the next summer. In 3 or 4 years, Mr. Grubb had limed his 60 acres of crop land.

The tests also indicated a marked deficiency of phosphorus in the soils. The lowland soils which were more nearly neutral in soil reaction were the lowest in phosphorus content. The class decided that since these soils would still grow some clover due to the more favorable soil reaction, the phosphorus drain upon them had been the heaviest.

At that time a 2-12-6 fertilizer was recommended. It was to be changed to an 0-20-0 analysis as soon as the soils could be built up to a state where a good livestock program could be maintained. Mind you, most of the corn shocks 12 hills square could be tucked under your arm and carried off when Mr. Grubb bought the farm.

Mr. Grubb (left) and hired man.

The first wheat crop with the soil acidity removed and 300 pounds to 2-12-6 fertilizer per acre applied yielded 33 bushels per acre. The second field for wheat was the poorest on the farm as it was more rolling. So 300 pounds of 4-24-12 were applied that year, and with a favorable season a yield of 50 bushels of wheat per acre was secured.

Mr. Grubb became dissatisfied with his grain yields about four years ago. He had been getting good yields of stover and straw but had been slipping a little on the grain yields. He con-

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Grassland Farming in New England

By A. B. Beaumont

Agricultural Extension Service, Amherst, Massachusetts

MOST New England soils are naturally poorly adapted to grass culture. This statement may not be pleasing to the enthusiastic advocates of grassland farming in this section. It is equally true, and perhaps more pleasing, to say that a high percentage of New England soils are potentially well adapted to grass culture. The reasons for these statements will presently be given.

The early New England settlers from the Old World, not being accustomed to clearing land, sought first the natural clearings or those made by the Indians. Natural meadows, or intervales as they were called, first-bottom land along the streams, were highly prized because of the wild hay which they furnished with no effort by the farmer except the harvesting. Consequently, the stream valleys were the first areas settled. Thus we see the Plymouth colonists, in their expansion, by-passing the heavily wooded uplands of the Central Plateau of Massachusetts and settling in the Connecticut Valley before pushing into the wilds of the plateau.

New England colonists found a wooded wilderness. Probably 99 per cent of the area was wooded when settlement began. For 250 years the settlers fought the forests back foot by foot, clearing or "making" land, as they said, a little at a time year after year. Then, when their vigilance lapsed or declined with a decline in agriculture, the forest slowly crept back into much of the land from which it had been ousted. Ingalls, in his well-known tribute to grass, said, "Streets abandoned by traffic become grass-

Productive New England pasture on Gloucester stony fine sandy loam, improved by treating with lime and 8-16-16 fertilizer.

grown like rural lanes, and are obliterated." That statement was very apt for Kansas when it was written. In New England, before the days of heavy vehicular traffic or macadam highways, it was a task to keep the highways from growing up to brush, and some of the towns had laws which required every man to work one day a year in clearing bushes from the highways.

Today, every New England agronomist knows that brush, among which are many tree species, quickly takes over pastures that are improperly managed. In time brush gives way to forests. The well-known Cummings pasture of the Connecticut Experiment Station at Storrs was primarily adapted to woods before it was improved by treatment with certain soil supplements. Posts used for fencing the experimental plots were taken from trees growing on the land. Just how many times this area had been cut over is not known to this writer, but it was probably more than twice. This sort of reoccupation of uplands by tree species is the usual occurrence in New England. Hence no particular ecological acumen is necessary in order to arrive at the conclusion that the forest is the natural climax of these lands. Recognition of this basic truth should prove helpful to all concerned with the management of the soils of this area for grass culture. It should be clear, for instance, that merely removing brush from a pasture causes no permanent improvement.

Grasses Comparatively New

Some plant evolutionists are of the opinion that the grasses are comparatively newcomers in the plant kingdom. They could not exist in primitive soil conditions in which more primitive forms of plant life, such as lichens and mosses, thrive. There are differences among grasses in respect to their requirements for optimum growth, but generally their nutrient requirement is higher than that of the woody plants. There are differences among grasses also as to their value for forage. Generally, the grasses most valuable for forage or grain require a comparatively high fertility level for optimum growth; for example, note corn, wheat, and timothy. This requirement has an important bearing on that question of adaptability to soils and soil management. None of the grasses or legumes now cultivated for forage in New England is a native of the region. The terms "English hay" and "white Dutch clover" are reminders of the foreign origin of forage crops.

The question of adaptability of grasses to New England soils may be approached from different angles. First, consider the general character of the soils. Generous precipitation, forest cover, and a cool climate together have produced podzols and podzolic soils. At elevations above 1,500 feet in southern New England and at decreasing elevations in central and northern New England, and on Cape Cod, are found moderately to well-developed podzols. These "northern gray" soils have had their topsoil severely depleted of basic, and to some extent also of the acidic, nutrients required by grasses. Podzolic soils, likewise, have had their constituents reduced by the podzolization process but to a less extent.

Podzolization of New England soils explains why numerous experiments by the experiment stations and tests by farmers have shown that grasses and clovers generally respond well to basic nutrients and nitrogen. Response to phosphorus has been obtained also, particularly on soils that have been partially exhausted by long-time cropping. Lime, a base that is removed in large quantities by the podzolization process, is the first limiting factor in most New England soils in the production of both grasses and clovers. Potash, another basic nutrient, is likewise required by both types of forage. These remarks apply particularly to soils developed from granites, gneisses, and schists, the kinds on which most of the experiments have been conducted.

The question of adaptability may be

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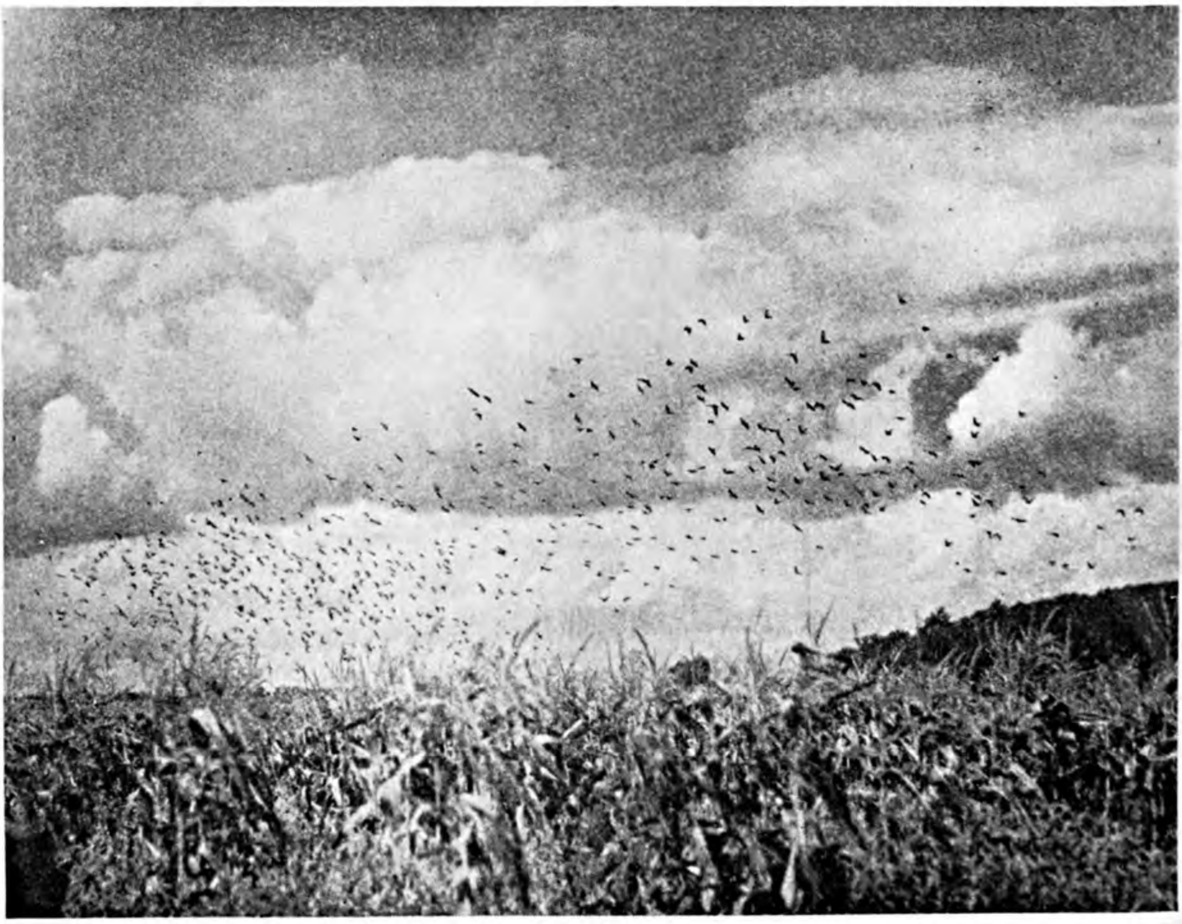
PICTORIAL

THE POISE AND CONFIDENCE OF A BLUE-RIBBON WINNER

Above: These Stark Delicious are ready for the packing shed.

Below: Blackbirds over the cornfield, a certain sign of fall.



Above: Empty and lonely looking now, but wait 'til mail time.

Below: A typical country store offering "one-stop" service.

Above: It takes an awful lot of that "fluffy stuff" to weigh 500 pounds.

Below: The front porch of an Alabama farmhouse piled high with cotton.

The Editors Talk

Agricultural Research and National Defense

With National Defense guiding the actions of so many groups and individuals these days, it is not to be wondered that those in charge of agricultural research are evaluating their work in terms of the national emergency. Of interest is the recent statement of the Agricultural Experiment Station at Geneva, New York, that a survey has been made of the Station's research program with the view to seeing how best it could contribute to the present emergency.

Station officials pointed out that all lines of work at the Station have been set up and developed through the years with due consideration for the agricultural needs of the State, and since agriculture is basic in any national defense program, it would seem obvious that the present research program should be continued, with possibly more emphasis on all problems that have a direct practical application. They believed that the Station can render the best service in the present emergency by stressing those lines of work which will aid the farmers of the State to produce more from their present acreages, find the best possible seed supplies, improve the nutritional value of their products, and prevent wastes in the processing of foodstuffs.

Increased attention, therefore, is being given to research projects having to do with the growing, production, and processing of foods; with the sanitary or nutritive quality of dairy and other food products; with the use and development of food containers other than tin; with the use of fertilizers to increase production or to enhance the nutritive value of crops; and with the improvement of sprays and dusts for the control of insect pests and diseases.

This emphasis on immediate problems and the dissemination it will receive through extension forces should do much toward bringing into immediate use by many farmers the methods and practices which have long been advocated by agricultural experiment stations. Necessity is often the "prod" needed to make us do things which we know should be done but which are left undone through the very human failing—procrastination. National Defense should mean a great deal more to the welfare of American farmers than the increased farm income which they are receiving.

Production Goals

As the intelligent farmer before starting his spring operations decides upon his production goals, so has the United States well in advance determined its agricultural production goals for 1942. To many, these goals recently announced by Secretary of Agriculture Claude R. Wickard may seem like considerable guesswork. For their benefit, he explained in his address over the radio on the National Farm and Home Hour, September 8, the procedure of calculation.

The goal for each product was set up by a committee of experts drawn from all agencies of the Department of Agriculture. First, the nutritionists, or others specializing in consumer needs, told the committee how much of the product under consideration the American people will need next year. After the committee learned about the needs of this country, they began to survey the needs of foreign countries. They called the people who could make a well-founded guess about the usual type of exports, and they guessed pretty small on every product for 1942. Then came the people who are conducting the negotiations for lend-lease supplies of food.

The next thing was to figure out how much was needed to begin building up a stockpile of foods, such as finished foods like canned pork, evaporated milk, canned vegetables, and dried eggs. These are things that will keep and that are needed to insure that our own people have a more plentiful supply of nutritious foods and to give the starving people of Europe something to hope for, something that will spur them on in their resistance to the aggressor.

After the committee had found out the needs for stockpiles, they got estimates of supplies already on hand. Then for each product they reached the ideal goal by subtracting the supplies on hand from the figure for supplies needed for use at home, shipments abroad, and stockpiles.

The final step was to figure out how close American agriculture could come to the ideal goal, taking into account the provisions of law concerning allotted acreages of some of the basic crops; the labor, machinery, and materials supplies; the market outlook; funds available for price support; and so on. Therefore, the 1942 goals represent not only a calculation of what we should produce, but a judgment on how close we can come to it practically.

While there are factors entering into the determination of the national picture which are beyond access of the individual farm operator, there is much in the general pattern which might be applied in the planning of the individual for any crop year. Consumption figures are good guides to needs and current demands. Export data are available. Surpluses are well known. Labor, machinery, and materials supplies come nearer home, but are too often miscalculated by the grower. And in the final analysis—"how close we can come to it"—common ground is reached in the consideration of soil fertility.

Motion Pictures

On the back cover of this issue, the American Potash Institute is announcing the motion pictures which it will have available for loan to agricultural colleges, county agents, teachers of vocational agriculture, and responsible farm organizations and members of the fertilizer trade this fall and winter and next spring. Others will be added as they become ready for distribution.

In the limited amount of space possible for such purpose, a description of the subject matter of the film designates its local interest. It is hoped that these descriptions will help those interested in showings to determine more accurately how the picture will fit into their program and thus not result in the receipt of a picture which has no particular bearing on local agricultural practices.

Due to limitation in the number of copies of each film available for distribution and in light of the great demand for them experienced last spring, requests for films should be made as far as possible in advance of the dates on which they are to be shown. Alternative dates of showing would also help in giving best service when the schedules become crowded.

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

¶ An intensive study into the boron relationships of plants of the cabbage family grown for food has been made by F. B. Chandler, and reported in Maine Agricultural Experiment Station Bulletin 404, "Mineral Nutrition of the Genus Brassica with Particular Reference to Boron." The plants on which most of the investigations were conducted were green cabbage, red cabbage, rutabagas, Brussels sprouts, cauliflower, broccoli, Chinese cabbage, kale, kohl rabi, white mustard, rape, and turnip. Rather detailed descriptions and illustrations of easily observed indications of boron deficiency on each of the plants are given.

A number of investigations were conducted in the greenhouse and field on the effects of varying the amounts of boron on the growth of the plants, the different times of application during the growth of the plants, root development, application to different parts of the plant, and on cell structure in the plant. When grown in the greenhouse, rutabaga and cauliflower seemed to have a higher boron requirement than cabbage, the red type apparently needing less than the green. When studying boron deficiency symptoms, it was observed that the various plants may not respond the same in the field as in the greenhouse.

A study of the effect of time of applying boron to the plants showed that better results usually were obtained when the boron was applied over a longer period of time than when it was withheld during part of the growing period. Withholding boron during the latter period of growth was more deleterious than withholding it during the early period of growth and supplying it later. There were distinct indications of transference of boron from one part of the plant to another during growth, both from older to younger parts, and laterally.

A lack of boron causes leaves to be smaller, but the ratio of width to length is not materially altered. In fact, all parts of the plant tend to be dwarfed in about equal proportion, except the edible part. In another experiment, it was found that boron was most efficient in its effect on plants in the summer and least efficient in the fall.

Applying the boron to the leaves was as effective as applying it to the roots. Varying the concentration of other nutrient ions did not have much effect on the boron nutrient status of the plants, somewhat contrary to the results obtained by other investigators who found high calcium associated with boron deficiency. The cell growth of the plants was materially affected by boron deficiency, particularly the actively growing cells.

An interesting survey of the occurrence of boron deficiency in Maine showed a striking correlation with this occurrence and the age of the settlement of the locality, the older settled sections having much more boron deficiency. There appeared to be no correlation between boron deficiency and the parent soil material, as considerable deficiency occurred in sections where tourmaline, a boron-bearing mineral, was present in the parent rock material.

¶ A useful and practical pamphlet entitled "Soil Management and the Use of Fertilizers in the Home Garden" has been prepared by Karl Baur. This has been issued as Mimeograph Circular 105 of the Western Washington Experiment Station. In tabular form, the rate of fertilization per acre and per 1000 square feet for all the vegetables and small fruits commonly grown in the area served by this station are given, together with remarks on method and time of application. Convenient tables for determining amounts of fertilizer to apply along rows for crops planted in variously spaced rows are given, while an illustration shows how to place fertilizer in bands along rows after crops are up so as to prevent fertilizer burn. A few brief remarks on types and analyses of fertilizers for use are included.

"Fertilizing Avocado Trees on the Redland Soils (Rockdale Series) of Dade County, Florida," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 561, June 1941, S. J. Lynch and H. S. Wolfe.

"The Effect of Fertilizer and Lime on the Yield of Corn," Agr. Exp. Sta., Experiment, Ga., Bul. 214, June 1941, L. C. Olson and R. P. Bledsoe.

"Memorandum Containing Grades of Fertilizers Expected to be Registered for the 1941-42 Season," "Tabulation Showing Tonnage of the Different Grades of Fertilizer Shipped to Each Parish in the State from September 1, 1940, to June 30, 1941," and "Tonnage Showing the Different Grades of Fertilizer Shipped in the State of Louisiana from September 1, 1940, to June 30, 1941," Dept. of Agr. and Imm., Baton Rouge, La.

"County Fertilizer Data: Mixed Goods and Materials, July 1, 1940, through June 30, 1941," Dept. of Agr., Jackson, Miss.

"Registration, Labeling, and Inspection of Commercial Fertilizers; 1940," Agr. Exp. Sta., Columbia, Mo., Bul. 432, July 1941, M. F. Miller.

"Potato Yields and Quality as Affected by Commercial Fertilizers," Agr. Exp. Sta., Bozeman, Mont., Bul. 392, June 1941, F. M. Harrington, V. E. Iverson, and W. E. Pollinger.

"Fertilization of Ornamental Trees, Shrubs, and Evergreens," Agr. Exp. Sta., Wooster, Ohio, Bul. 620, May 1941, L. C. Chadwick.

"Wide Row Spacing and Row Application of Limestone and Phosphate for Sweet Clover Production," Agr. Exp. Sta., Stillwater, Okla., Bul. B-248, May 1941, Horace J. Harper.

"Fertilizer Sales in Oklahoma by Analyses and by Counties—July 1, 1940, to June 30, 1941, St. Bd. of Agr., Oklahoma City, Okla.

"Grades of Fertilizers and Regulations Adopted by the State Board of Agriculture on September 2, 1939, for Sale in the State of Oklahoma," St. Bd. of Agr., Oklahoma City, Okla.

"Summary of Fertilizers, Fertilizer Materials, and Customers' Mixtures Sold in South Carolina from July 1, 1940, through June 30, 1941," Clemson Agr. Coll., Clemson, S. C.

"Fertilizer Ratios and Analyses Recommended to Suit the Requirements of the Different Crops Grown Under the Various Conditions in South Carolina, 1941-42," Clemson Agr. Coll., Clemson, S. C.

"A New Explanation of What Happens to Superphosphate in Limed Soils," Agr. Exp. Sta., Knoxville, Tenn., Bul. 176, Apr. 1941, W. H. MacIntire.

"Grades of Fertilizer to be Sold in Texas from September 1, 1941, to August 31, 1942," Agr. Exp. Sta., College Station, Tex.

"Utilization of Barnyard Manure for Washington Soils," Agr. Exp. Sta., Pullman, Wash., Bul. 395, Feb. 1941, L. E. Dunn and L. C. Wheeting.

"Utilization of Barnyard Manure for Washington Soils," Agr. Ext. Serv., Pullman, Wash., Bul. 267, Apr. 1941, L. E. Dunn and L. C. Wheeting.

Soils

Included among the bulletins received during the month are a large number of soil survey reports. When so many are received at one time, there may be a tendency to overlook the very practical and timely information contained in these publications. Their greatest application is naturally local, since they are usually on a county basis. Those not acquainted with these surveys may not realize that in addition to locating the various kinds of soil in the county, information on their agricultural adaptability, acidity, plant-food requirements, and general management recommendations are given.

"Plot Tests with Chemical Soil Sterilants in California," Agr. Exp. Sta., Berkeley, Calif., Bul. 648, Mar. 1941, A. S. Crafts, H. D. Bruce, and R. N. Raynor.

"Twenty-two Years of Soil Fertility Investigations in the Willamette Valley, Oregon," Agr. Exp. Sta., Corvallis, Oreg., Bul. 387, Mar. 1941.

"Irrigation Requirement of Arable Oregon Soils," Agr. Exp. Sta., Corvallis, Oreg., Bul. 394, June 1941, W. L. Powers and M. R. Lewis.

"Soil Management Club Work," Agr. Ext. Serv., Madison, Wis., Cir. 4-H 36, Apr. 1941, Wakelin McNeel.

"Soil Survey, Sumter County, Alabama," U. S. D. A., Washington, D. C., Ser. 1935, No. 18, Mar. 1941, G. A. Swenson, A. C. Anderson, W. I. Watkins, B. H. Williams, Clarence Lounsbury, R. R. Finley, L. G. Brackeen, M. E. Swann, and Hoyt Sherard.

"Soil Survey, the Casa Grande Area, Arizona," U. S. D. A., Washington, D. C., Ser. 1936, No. 7, June 1941, E. N. Poulson, Robert Wildermuth, and W. G. Harper.

"Soil Survey, Yuma Desert Area, Arizona," U. S. D. A., Washington, D. C., Ser. 1938, No. 1, Mar. 1941, W. G. Harper, E. N. Poulson, and J. Clark Foulger.

"Soil Survey, the Visalia Area, California," U. S. D. A., Washington, D. C., Ser. 1935, No. 16, Dec. 1940, R. Earl Storie, Bruce C. Owen, E. J. Carpenter, M. H. Layton, and W. J. Leighty.

"Soil Survey, Steuben County, Indiana," U. S. D. A., Washington, D. C., Ser. 1933, No. 35, Oct. 1940, L. R. Smith, W. E. Tharp, W. J. Leighty, T. M. Bushnell, and H. P. Ulrich.

"Soil Survey, Jackson County, Iowa," U. S. D. A., Washington, D. C., Ser. 1936, No. 6, Mar. 1941, G. A. Swenson, H. C. Dean, Dallas Hays, D. F. Moine, and E. W. Tigges.

"Soil Survey, Ingham County, Michigan," U. S. D. A., Washington, D. C., Ser. 1933, No. 36, Mar. 1941, J. O. Veatch, H. G. Adams, E. H. Hubbard, Clarence Dorman, L. R. Jones, J. W. Moon, and C. H. Wonser.

"Soil Survey, Pine County, Minnesota," U. S. D. A., Washington, D. C., Ser. 1935, No. 15, Mar. 1941, C. S. Simmons, A. E. Shearin, P. R. McMiller, Sam Hill, G. D. Sherman, I. J. Nygard, Eric Kneen, Olaf Soine, and Samuel Labovitz.

"Soil Survey, Cass County, Nebraska," U. S. D. A., Washington, D. C., Ser. 1936, No. 5, Mar. 1941, T. E. Beesley, M. M. Kuper, W. S. Gillam, and T. K. Popov.

"Soil Survey, Clay County, North Carolina," U. S. D. A., Washington, D. C., Ser. 1935, No. 19, Apr. 1941, S. O. Perkins, William Gettys, and E. F. Goldston.

"Soil Survey, Pontotoc County, Oklahoma," U. S. D. A., Washington, D. C., Ser. 1936, No. 4, Mar. 1941, E. G. Fitzpatrick, A. W. Goke, L. E. Rose, Orville Stout, and C. F. Fisher.

"Soil Survey, Washita County, Oklahoma," U. S. D. A., Washington, D. C., Ser. 1935, No. 17, Mar. 1941, A. W. Goke, C. A. Hollopeter, and C. F. Fisher.

"Soil Survey, Isle of Wight County, Virginia," U. S. D. A., Washington, D. C., Ser. 1937, No. 1, Feb. 1941, Edward Shulkcum, R. E. Devereux, and C. S. Simmons.

"Erosion and Related Land Use Conditions in the Illinois Bayou Soil Conservation District, Arkansas," U. S. D. A., Washington, D. C., Erosion Surv. 18, 1941, C. J. Finger, Jr.

"Erosion and Related Land Use Conditions on the Presque Isle Demonstration Project, Maine," U. S. D. A., Washington, D. C., Erosion Surv. 19, 1940, W. B. Oliver and C. W. Frutchey.

"Erosion and Related Land Use Conditions on the Chehalem Mountain Demonstration Project, Oregon," U. S. D. A., Washington, D. C., Erosion Surv. 20, 1941, H. N. Magness and M. F. Sandoz.

"Erosion and Related Land Use Conditions on the West Tauy Creek Demonstration Project, Kansas," U. S. D. A., Washington, D. C., Erosion Surv. 21, 1940, R. G. Dunmire.

Crops

¶ Two publications on the growing of sweet potatoes under southern conditions have recently appeared. In Mississippi Agricultural Experiment Station Bulletin 358, "Sweet Potato Plant Spacing," W. S. Anderson, E. A. Currey, E. B. Ferris, and J. C. Robert summarize numerous experiments on growing different varieties with various spacings. It was found that the best spacing depended on the variety, time of planting, and purpose to which the roots were to be put. Suggestions on the fertilization of the crop in Mississippi are given and include the use of 4-8-8 at 500 to 600 pounds per acre on Upland Valley soils, 6-8-8 or 6-8-4 at 800 to 1000 pounds per acre on Hill soils, and nitrogen alone on the Delta soils. In North Carolina Agricultural Extension Circular 250, by E. R. Collins, H. R. Garriss, Z. P. Metcalf, and Robert Schmidt, entitled "Approved Practices for Growing Sweet Potatoes," cultural directions are given in outline form. On the Coastal Plain 3-8-8 fertilizer is recommended at 1000 to 1200 pounds per acre for potatoes growing on sandy soils for the early market and 600 to 800 pounds on sandy loams for late harvest. For soils in the Piedmont and Mountain areas 3-8-6 at 600 to 800 pounds is recommended. Four main reasons are given for the production of poor quality potatoes. These are growing the crop on poorly adapted soil, planting poorly adapted varieties and strains, improper disease control, and the use of fertilizers improperly balanced with respect to nitrogen and potash, with the potash not high enough. Growers will find this circular a handy reference publication.

¶ The value of using a combination of good cultural practices in growing potatoes is shown in Ontario Department of Agriculture Bulletin 415, "Results of Four Years' Demonstration Work with Potatoes on Fifty-seven Different Farms in Ontario," by N. M. Parks and G. P. McRostie. As a result of this work it was shown that success in potato production is due largely to five factors: using good seed, having a plentiful supply of plant food and organic matter in the soil, early planting, efficient spraying, and proper harvesting and marketing. In the demonstrations, the one plot was unfertilized and had only a minimum of spraying, while the other plot had 4-8-10 fertilizer at the rate of 750 pounds per acre, and a thorough spray program. Average yields were increased 221 bushels, valued at $154.70, by the improved treatments. The cost of the fertilizer and extra spray treatments was $19.55, leaving a profit of $135.15 per acre. These tests showed clearly the profit to be obtained by the use of good fertilizer and spray practices.

"Adaptability of Grass Species to Arkansas," Agr. Exp. Sta., Fayetteville, Ark., Bul. 408, June 1941, Etlar L. Nielsen.

"Establishment of Bermuda Grass from Seed in Nurseries," Agr. Exp. Sta., Fayetteville, Ark., Bul. 409, June 1941, Etlar L. Nielsen.

"Regrassing Abandoned Farms, Submarginal Cultivated Lands, and Depleted Pastures in the Prairie Areas of Western Canada," Dom. Dept. of Agr. Ottawa, Can., Pub. 720, Farmers' Bul. 103, July 1941, S. E. Clarke and D. H. Heinrichs.

"1940 Annual Report, Delaware Agricultural Extension Service," Agr. Ext. Serv., Newark, Del., Bul. 35, May 1941.

"1940 Report, Florida Agricultural Extension Service," Agr. Ext. Serv., Gainesville, Fla.

"Miscellaneous Tropical and Sub-tropical Florida Fruits," Agr. Ext. Serv., Gainesville, Fla., Bul. 109, June 1941, Harold Mowry, L. R. Toy, and H. S. Wolfe.

"Garden Chrysanthemums for Florida," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 559, May 1941, John V. Watkins.

"Nursery Propagation and Topworking of Mangos," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 560, May 1941, S. J. Lynch.

"The Redland Guava," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 562, June 1941, S. J. Lynch and H. S. Wolfe.

"I. Peanut Breeding and Characteristics of Some New Strains. II. Thiamin Chloride and Nicotinic Acid Content of Peanuts and Peanut Products. III. Peptization of Peanut Proteins," Agr. Exp. Sta., Experiment, Ga., Bul. 213, June 1941, B. B. Higgins, K. T. Holley, T. A. Pickett, and C. D. Wheeler.

"Vitamins in Peanuts and some of Their Products with Special Reference to Vitamin B[1] and the Pellagra-preventative Factor," Agr. Exp. Sta., Experiment, Ga., Cir. 128, June 1941, T. A. Pickett.

"Effect of Pasture on Grade of Beef," Agr. Exp. Sta., Urbana, Ill., Bul. 475, Apr. 1941, Sleeter Bull, R. R. Snapp, and H. P. Rusk.

"Research Aids Farm Progress—Report of the Director for the Year Ending June 30, 1940," Agr. Exp. Sta., Lafayette, Ind.

"Progress Report of the Soils and Crops Experiment Farm from 1915-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 242, Rev. May 1941, A. T. Wiancko, R. R. Mulvey, and S. R. Miles.

"Progress Report of Soils and Crops Experiments on the Bedford Experiment Field from 1916-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 243, Rev. May 1941, A. T. Wiancko, G. P. Walker, and H. G. Hall.

"Progress Report of Soils and Crops Experiments on the Jennings County Experiment Field from 1921-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 244, Rev. May 1941, A. T. Wiancko, G. P. Walker, and Charles Robbins.

"Progress Report of Soils and Crops Experiments on the Herbert Davis Forestry Farm from 1921 to 1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 245, Rev. May 1941, A. T. Wiancko, G. P. Walker, S. R. Miles, and I. A. Pickard.

"Progress Report of Soils and Crops Experiments on the Huntington Experiment Field from 1919-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 246, Rev. May 1941, A. T. Wiancko, G. P. Walker, and Samuel E. Ervin.

"Progress Report of Soils and Crops Experiments on the Sand Experiment Field from 1924-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 247, Rev. May 1941, A. T. Wiancko, G. P. Walker and Charles Warran.

"Progress Report of Soils and Crops Experiments on the Pinney-Purdue Experiment Field from 1920-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 248, Rev. May 1941, A. T. Wiancko, G. P. Walker, and S. R. Miles.

"Progress Report of Soils and Crops Experiments on the Knox County Experiment Field from 1936-1940," Agr. Exp. Sta., Lafayette, Ind., Cir. 264, May 1941, A. T. Wiancko, G. P. Walker, and Charles Lett.

"Aster Culture," Agr. Exp. Sta., Lafayette, Ind., Cir. 200, Rev. May 1941, E. R. Honeywell.

"Sweet Clover—Its Culture and Uses," Agr. Exp. Sta., Lafayette, Ind., Cir. 261, Nov. 1940, A. T. Wiancko and R. R. Mulvey.

"Plum Variety Trials at the Purdue Farm, Bedford, Indiana," Agr. Exp. Sta., Lafayette, Ind. Bul. 458, Apr. 1941, C. L. Burkholder.

"Supervised Practice in Vocational Agriculture in Iowa," Agr. Exp. Sta., Ames, Iowa, Bul. P29, Feb. 1941, Harvey Paul Sweany and J. A. Starrak.

"Soybean Production in Iowa," Agr. Exp. Sta., Ames, Iowa, Bul. P30, Mar. 1941, E. S. Dyas.

"The Vegetable Garden," Agr. Ext. Div., Lexington, Ky., Cir. 355, Feb. 1941, John S. Gardner.

"Biennial Report of the North Louisiana Experiment Station, Calhoun, Louisiana, 1939-1940," Agr. Exp. Sta., University, La.

"Biennial Report of the Northeast Louisiana Experiment Station, St. Joseph, Louisiana, 1939-1940," Agr. Exp. Sta., University, La., C. B. Haddon and John A. Hendrix.

"Biennial Report of the Fruit and Truck Experiment Station, Hammond, Louisiana, 1939-1940," Agr. Exp. Sta., University, La.

"Spraying to Control Preharvest Drop of Apples," Agr. Exp. Sta., Amherst, Mass., Bul. 381, Feb. 1941, Lawrence Southwick and J. K. Shaw.

"4-H Club Flower Gardening Project," Agr. Ext. Serv., East Lansing, Mich., Club Bul. 48, June 1941, Paul Krone.

"Pastures in Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 356, July 1941, H. W. Bennett.

"An Illustrated Guide to Care of Ornamental Trees and Shrubs," Agr. Ext. Serv., State College, Miss., Bul. 117, May 1941, F. S. Batson and R. O. Monosmith.

"Annual Report of Mississippi Extension Service, 1940," Agr. Ext. Serv., State College, Miss., Bul. 122, May 1941.

"Alfalfa in Nebraska," Agr. Exp. Sta., Lincoln, Nebr., Bul. 331, May 1941, H. M. Tysdal and T. A. Kiesselbach.

"Filberts," Agr. Exp. Sta., Geneva, N. Y. Cir. 192, July 1, 1941, G. L. Slate.

"Agricultural Research in North Carolina, 1939-1940," Agr. Exp. Sta., Raleigh, N. C., 62nd and 63rd An. Rpts.

"Sweet Clover for Soil Improvement," Agr. Exp. Sta., Stillwater, Okla., Cir. C-94, May 1941, Horace J. Harper.

"The Home Vegetable Garden," Agr. Ext. Serv., Corvallis, Oreg., Bul. 552, Mar. 1941, A. G. B. Bouquet.

"Annual Report—1939-1940," Agr. Exp. Sta., Rio Piedras, P. R.

"First Annual Report Tropical Forest Experiment Station," Rio Piedras, P. R.

"Citrus Varieties for the Lower Rio Grande Valley," Agr. Exp. Sta., College Station, Tex., Bul. 601, May 1941, W. H. Friend and J. F. Wood.

"Growing Field Beans in Vermont, Agr. Ext. Serv., Burlington, Vt., Brieflet 595, May 1941, P. R. Miller.

"Emergency Practices to Cope with Drought Conditions," Agr. Ext. Serv., Burlington, Vt., Brieflet 597, June 1941, P. R. Miller.

"Factors Which Affect the Vitamin C Content of Apples," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 69, Mar. 1941, Mary Satorius Eheart.

"Wheat Varieties in Washington in 1939," Agr. Exp. Sta., Pullman, Wash., Bul. 398, Apr. 1941, E. F. Gaines and E. G. Schafer.

"Raspberry Culture," U. S. D. A., Washington, D. C., Farmers' Bul. 887, Rev. Jan. 1941, George M. Darrow and George F. Waldo.

"Ginseng Culture," U. S. D. A., Washington, D. C., Farmers' Bul. 1184, Rev. Jan. 1941, W. W. Stockberger.

"Shortleaf Pine," U. S. D. A., Washington, D. C., Farmers' Bul. 1671, Rev. Oct. 1941, Wilbur R. Mattoon.

"House Plants," U. S. D. A., Washington, D. C., Farmers' Bul. 1872, May 1941, Furman Lloyd Mulford.

"Sugarcane for Sirup Production," U. S. D. A., Washington, D. C., Cir. 284, Rev. Nov. 1940, E. W. Brandes, S. F. Sherwood, and B. A. Belcher.

"Slash Disposal Forest Management After Clear Cutting in the Douglas-Fir Region," U. S. D. A., Washington, D. C., Cir. 586, Thronton T. Munger and Donald N. Matthews.

"Indoor Composting for Mushroom Culture," U. S. D. A., Washington, D. C., Cir. 609, May 1941, Edmund B. Lambert.

"Minnesota Farm Handbook, 1941," U. S. D. A., Washington, D. C.

Economics

¶ "The Iowa Farmer and World War II," Bulletin P-31 of the Agricultural Experiment Station and Extension Service of Iowa State College, deals with problems confronting American farmers and the Nation in general at this time. A committee was appointed, largely from the staff of the College, to study the impact of the war on Iowa agriculture. The bulletin contains the summary of the reports of the individual members of the committee and is based on developments in the war and the defense situation up to March of this year.

The committee found the national defense program is temporarily solving many economic and social problems that have plagued Iowa farmers in recent years, but it also believed that national defense activity and the world situation are developing serious problems that will face Iowa farmers a few years hence. The primary impact of the war and the defense program is to increase farm income and draw off surpluses of farm population not needed on Iowa farms. The net results will be expansion in farmers' investments in buildings, machinery, and livestock inventories. If these expansions are financed by borrowing and the demand for farm products falls off after the emergency is over, farmers may then be subject to the same series of foreclosures and bankruptcies that occurred following the first World War.

While the committee is undoubtedly right in this assumption, we must not overlook the fact that the machinery which has been set up in the past few years for controlling agriculture and the widespread development of a federally controlled farm credit system will operate as a check against uncontrolled increases in land values and in agricultural credit expansion.

It is believed by the committee that the war will not reduce the supply of basic foods in this country and there should be no reason for nutritional standards to be lowered as a result of the emergency. On the contrary, the national defense and selective service programs may awaken public consciousness concerning the health program, resulting in better diet and public health work.

Relative to living costs, it is believed that the price rises will follow about the same general pattern as in the first war and that farm prices and income will increase slightly faster than the cost of living. In respect to housing conditions, recent surveys have indicated that most of the houses on Iowa farms were built prior to the first World War and although increases in farm income in recent years have made possible many farm-home improvements, more are needed and in general houses are badly in need of repairs. Farm families in many instances are living in crowded conditions. While building costs may be high due to the war, the higher farm income probably will enable many farm families to improve their living conditions during the next few years.

In the past 25 years there has been a noticeable decline in the amount of subsistence that is obtained from the farm. For example, farm butchering has decreased sharply and the number of gardens is declining. It is believed that the impact of the war in general on home production will be to reduce it. When income rises farmers will tend to decrease their dependence on home production. On the other hand, if prices of consumption goods should move up faster than now seems likely, it will provide a stimulus for more home production.

The national defense program has greatly increased the demand for farm products in the United States. Increases in employment have continued during 1941 and will probably continue in 1942. Although unemployment may not completely disappear this year, the Bureau of Agricultural Economics estimates that it will average less than half of 1940. The national income which was 76 billion dollars in 1940 is estimated to reach 82 or 83 billion in 1941 and, assuming small changes in prices, about 90 billion in 1942. Judging from recent changes in prices and price indices since March of this year, it appears that the above estimates are very conservative.

Supplies of farm products are large and the possibilities for expanding livestock production are great. Indications are that we will not export vast quantities of foodstuffs as we did in the first World War, although shipments to Great Britain are expected to be large. Nevertheless, wartime inflation is a definite possibility unless drastic steps are taken to prevent it.

In general, it is to be concluded from the report that income from hogs, cattle, dairies, and poultry will be considerably higher than 1940 and will continue up in 1942; whereas cash grain prices will not increase as fast but income probably will be higher. Farm costs probably will be up, but will not increase as fast or any faster than farm prices. There will be an increase in mechanized farming insofar as machines are available. Changes in land use are not expected to follow the same pattern as in the first war. Because of the present large supplies of corn and wheat, no great changes in acreages of these crops should result from the defense program.

As a result of the crop control program Iowa farmers at the present time have their farms fairly well balanced from the standpoint of soil maintenance, but still many individual farmers are depleting their soils due to heavy grain farming on hilly land and failure to replace plant-food elements removed through cropping. It is significant that total acreage in intertilled crops is about the same as the planning committees recommended.

Although much of Iowa's crop acreage is fairly well balanced from the standpoint of conservation, much of the land is in need of lime for efficient production of legume crops. It is estimated that 75 to 80 per cent of Iowa soils require lime. The State should use approximately 3,000,000 tons of lime per year for 10 years in order to satisfy requirements. Iowa's consumption of lime in 1939 even with AAA help was only 400,000 tons, about 13 per cent of requirements.

Similar estimates of fertilizer needs indicate a requirement of 250,000 to 300,000 tons whereas Iowa's consumption of commercial fertilizers has been averaging around only 13,000 tons in recent years. Consumption of fertilizers and lime seems to be closely related to the rise and fall of farm income. Increased farm income as a result of the defense program, probably will increase the use of fertilizers in Iowa.

"Factors Influencing Alabama Agriculture," Agr. Exp. Sta., Auburn, Ala., Bul. 250, Apr. 1941, Ben F. Alvord, M. A. Crosby, and E. G. Schiffman.

"Some Economic Aspects of the California Date Industry," Agr. Ext. Serv., Berkeley, Calif., Mar. 1941.

"Tomato Cost and Management Study," Agr. Ext. Serv., Newark, Del., Mimeo. Cir. 8, Mar. 1941, Kenneth W. Baker.

"Major Land Use Problems in Martin County, Indiana, with Suggestions for Programs and Policies," Agr. Exp. Sta., Lafayette, Ind., Bul. 453, Oct. 1940, J. B. Kohlmeyer.

"The Economy of Pastures in the Limestone Area of Southern Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 454, Sept. 1940, F. V. Smith.

"Prices and Receipts of Fruits and Vegetables Sold on the Terre Haute Producers Market," Agr. Exp. Sta., Lafayette, Ind., Bul. 455, Oct. 1940, K. I. Fawcett and F. C. Gaylord.

"An Economic Analysis of the Production of Canning Factory Tomatoes in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 456, Oct. 1940, Mervin G. Smith, Lynn Robertson, J. Carrol Bottum, and F. V. Smith.

"An Economic Analysis of the Production of Peppermint and Spearmint Oils in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 459, Mar. 1941, Mervin G. Smith and Lynn Robertson.

"Small Agricultural Holdings in Two Industrial Areas in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 460, May 1941, H. L. Hawley.

"Part-time Farming in a Rural-industrial Area of Louisiana," Agr. Exp. Sta., University, La., Bul. 333, June 1941, C. A. Boonstra and Hilliard Jackson.

"What Makes Farm Prices," Agr. Ext. Serv., University Farm, St. Paul, Minn., Bul. 223, June 1941, Warren C. Waite.

"Flax Production and Climate of North Dakota and Minnesota—1919-1937," Agr. Exp. Sta., Fargo, N. Dak., Bul. 298, Feb. 1941, T. H. Hopper and Muriel Johnson.

"Farm Price Facts for North Dakota," Agr. Exp. Sta., Fargo, N. Dak., Bul. 299, June 1941, W. L. Ettesvold.

"Ohio Agricultural Statistics, 1939," Agr. Exp. Sta., Wooster, Ohio, Bul. 621, May 1941, Glenn S. Ray, Oakley M. Frost, and P. P. Wallrabenstein.

"Cost, Efficiency, and Management of Dairy Cattle Pastures, Coast Region, Oregon," Agr. Exp. Sta., Corvallis, Oreg., Bul. 390, May 1941, William W. Gorton.

"Cost and Efficiency of Irrigated Farm Pastures in Eastern Oregon," Agr. Exp. Sta., Corvallis, Oreg., Bul. 391, May 1941, William W. Gorton.

"Costs and Grazing Values of Willamette Valley and Southern Oregon Farm Pastures," Agr. Exp. Sta., Corvallis, Oreg., Bul. 392, June 1941, William W. Gorton.

"Cost and Efficiency in Producing Walnuts in Western Oregon," Agr. Exp. Sta., Corvallis, Oreg., Bul. 396, June 1941, G. W. Kuhlman and C. E. Schuster.

"Land Use Planning and Total Defense," Agr. Ext. Serv., College Station, Tex., C-167, 1941.

"A Study of the Farm Business of 160 Farms in Grand Isle County, Vermont," Agr. Ext. Serv., Burlington, Vt., Brieflet 592, May 1941, Robert P. Davison and Lucien D. Paquette.

"Farmer Cooperation in Southwest Virginia," Agr. Exp. Sta., Blacksburg, Va., Bul. 331, Mar. 1941, E. L. Morgan and T. N. Gearreald.

"The Adjustment of New Settlers in the Yakima Valley, Washington," Agr. Exp. Sta., Pullman, Wash., Bul. 397, Feb. 1941, Carl F. Reuss and Lloyd H. Fisher.

"Settlement Experience and Opportunities

on Cut-over Lands of Western Washington," Agr. Exp. Sta., Pullman, Wash., Bul. 399, Apr. 1941, Carl P. Heisig.

"Proceedings of the 1940 Conference on Low-income Farms," Agr. Exp. Sta., Morgantown, W. Va., Bul. 299, Mar. 1941.

"Practical Forest Management for the Cutover Hardwood Lands in Southern West Virginia," Agr. Exp. Sta., Morgantown, W. Va., Bul. 300, Apr. 1941, Lowell Besley.

"Forestry and Farm Income," U. S. D. A., Washington, D. C., Farmers' Bul. 1117, Rev. Oct. 1940, Wilbur R. Mattoon.

"The Eighth Annual Report of the Farm Credit Administration, 1940," U. S. D. A., Washington, D. C.

"Farm-management Problems and Suggested Adjustments on Vegetable Farms in Bristol County, Massachusetts," U. S. D. A., Washington, D. C., Prelim. Rpt., June 1941, Norman R. Urquhart and Charles R. Creek.

"Annual Statistics Relating to Bearing Acreage, Production, and Disposition of United States Oranges and Grapefruit, by Areas of Production, 1919-20 to 1939-40," U. S. D. A., Washington, D. C., May 1941.

New Soybean Outlets

Because of defense needs for adhesives the U. S. Department of Agriculture is exploring the possibility of increasing commercial production of soybean protein by a process developed by Department chemists. The objective is to obtain soybean protein to make up for growing shortage of casein, an adhesive necessary to defense industries and housing. Department chemists say the adhesive qualities of the soybean protein are fully equivalent to casein.

Chemists began working on the problem of extracting the protein from soybeans in a commercially practicable fashion more than 4 years ago in the Soybean Research Laboratory at Urbana, Ill. At that time defense needs were not in the picture, but because of this pioneer research work the soybean protein is now available to help offset the present threat to defense caused by restricted casein supplies.

Because casein is a milk derivative, its production is limited and is becoming progressively more limited by the increased demand for milk in edible form under the food-for-defense program and the Lend-Lease Act. The Office of Agricultural Defense Relations has arranged for the laboratory to study the possibilities of increased production of soybean protein. To obtain the required quantity, capacity will have to be at least tripled. Only one plant is now producing a refined soybean protein.

In addition to its qualities as an equivalent for casein, other new uses have been developed for soybean protein. It is expected that still other new uses will be developed for proteins like casein and soybean. Thus, it is expected that when the present defense emergency is over, there will be demand for both casein and increased supplies of soybean protein.

FFA Youth Proves Potash Helps Cotton

WINDELL YOUNG, member of the Future Farmers of America, of the Magazine community, Arkansas, completed in 1940 some interesting demonstrations of the use of fertilizer in cotton production.

Windell's acre of cotton land was divided into quarter-acre blocks before the fertilizer was applied. A few days before time to plant, he distributed 100 pounds of 6-8-8 fertilizer on one of these blocks. On another he applied 100 pounds of 4-12-4 fertilizer, which is the kind most often used for cotton production on farms in his community. He left the third block without fertilizer as a check plot against the other two.

This student farmer used the same method in preparing these divisions of the acre for planting. He also cultivated each block the same day and in the same manner.

On the block which received the 100 pounds of 6-8-8, he picked 465 pounds of seed cotton. This means, as the computation shows, that he made an acre yield of 1,860 pounds where this fertilizer was applied. On the block which received the 4-12-4 fertilizer, he picked 413 pounds of seed cotton which returned the acre yield of 1,652 pounds. He picked 331 pounds or an equivalent of 1,324 pounds of cotton to the acre on the plot which received no fertilizer.

The variety of cotton which he used gave a yield of 40 per cent lint. Thus an acre of land fertilized with 400 pounds of 6-8-8 would have produced 744 pounds of lint. At the price of nine cents a pound this meant $66.96 for lint and $11.00 for seed, or a total acre income of $77.96 for lint and seed.

Estimating the value of seed and lint in the same way, the acre of cotton on land fertilized with 4-12-4, which is so often used, would return $69.41 income, or a net profit of between $7.00 and $8.00 in favor of the land on which the larger amount of potash was used.

In the same manner one finds that the acre unfertilized would produce only $54.56 in lint and seed, much less than either of the fertilized plots.

This project was entered in the State contest for the control of wilt and rust in cotton production. It indicates that liberal use of potash on cotton does prevent wilt and rust in this section of the State.—*W. A. Bollen, Agricultural Teacher, Magazine, Arkansas.*

Grassland Farming in New England

(*From page* 22)

considered also from the standpoint of soil differences induced by method of formation. The best adaptation is found in well-drained alluvial, lacustrine, and marine soils of medium and heavy texture because such soils represent the cream of other soils from which they have been washed. Examples are Ondawa, Addison, and Orono soils. The next best adaptation is found in the upland till soils so situated and of such texture as not to be droughty. Such soils may be expected to contain moderate amounts of all nutrients required by plants. Examples are Gloucester and Charlton soils. The least adaptable group for grasses consists of outwash soils because they represent the coarser fractions of the upland soils separated from the finer particles which have been carried to lower levels. These soils are often excessively drained externally and internally. Of the outwash soils the Hinckley series with a hummocky topography, and Danby, its podzol equivalent, are the least adaptable to cultivated grasses.

Differences in adaptability of New England soils to grasses are due also to the character of the parent material from which the soils have been developed. Other things being equal, those soils which have more or less limestone in the parent material have relatively high adaptability. Soils from materials in which limestone and schist are important constituents are among the best upland grass soils of the region. Among these, Stockbridge, Lenox, and Worthington soils may be mentioned. There are also those soils derived from lake or marine sediments containing lime, such as Addison and Vergennes from Champlain sediments, and Orono from marine sediments along the northern New England coast. These are good grass soils.

Other points of importance are texture and depth of soil. Some series, such as Gloucester, have a wide textural range. Those of medium to heavy texture are preferred to those of light texture because of better water-holding capacity and also better mineral composition. Gloucester loam is a much better grass soil than Gloucester sand. The heavier members of the Merrimac series, especially with fair depth to the gravel layer, are fair grass soils, although the Merrimac soils as a group are not ideal grass soils. Shallowness of upland till soils is often correlated with stoniness. Shallow soils, especially if associated with steepness of slope, are poorly adapted to grass because of their susceptibility to drought. Conversely, the adaptability of some New England soils to grass is poor because of excess moisture, which in some cases may be removed by drainage.

To summarize: New England soils generally have poor natural, but good potential, adaptability to cultivated grasses suitable for forage. Forests are the natural climax of most of the area. Supplements must be added to most soils to insure quantity and quality of forage adequate for a prosperous and profitable grassland economy. While New England soils are generally poorly adapted to grasses, there are differences among these soils. Some require less supplements than others; some are so poorly adapted to grassland farming that they should not be used for that purpose. The better adapted soils, properly managed, will produce abundant forage of good quality. The way to make them produce is known. The agronomic aspects of the problem are better known than are the economic, but that is another matter.

Farmers Can Raise More Farm Game

(*From page* 16)

in the South, scarification is not necessary. It can be planted on eroded hillsides where careful soil preparation is not possible. All that is necessary is to lightly scratch the surface, plant at the rate of 20 pounds per acre, and cover lightly. After this the bed should be mulched with straw or pine boughs or something similar. In some cases it may be best to mulch the area before planting.

Other plants that are excellent for game feed patches are cowpeas, millet, sorghum, soybeans, and wheat. The non-legumes usually do best when fertilized with 200 pounds or more of 4-8-4 per acre, while for legumes a fertilizer containing a high percentage of phosphate and potash but a low percentage of nitrate is recommended.

To summarize the steps in a program for game production we should provide food, cover, and suitable nesting sites. We should regulate hunting and control game enemies, especially cats and dogs. Woods and other areas should never be burned off, since fire is one of the worst enemies of ground birds.

Quail often become tame enough to be handled.

More Than Increased Yield Needed in Corn Hybrids

By E. N. Bressman

U. S. Department of Agriculture, Washington, D. C.

THERE is no doubt as to the ability of adapted corn hybrids to greatly outyield the open-pollinated or ordinary varieties. This difference in yield has been variously estimated by leading corn authorities to be somewhere between 15 and 20 per cent. For the United States as a whole this means an additional half billion bushels of corn that can be produced each year merely by the use of adapted hybrids. Also, better methods of production and more efficient use of fertilizers have greatly increased the production potentialities of our corn acres.

Aside from the factor of yield, other characteristics have been stressed, or at least recognized by breeders, as important contributions of hybrid corn. Many of these would greatly reduce the hazards of production.

Perhaps the first thing that a grower wants to know about a corn variety, after being assured as to its ability to yield and mature well in his locality, is whether it will stand up well at time of maturity. Many growers now use mechanical corn pickers, and if a variety does not stand well and retain its ears, picking losses are so great that it is not practicable to use a picker. In this connection Professors Dowell and Jesness of Minnesota, who studied the economic aspects of hybrid corn, say, "Hybrid corn involves no additional labor in preparing the soil for the crop or in its cultivation during the growing season. The larger yields may increase somewhat the labor involved in husking and cribbing the larger output. However, even here the increase will not be as great as the increase in yield because of the greater uniformity in the stand of hybrid corn, its stiffer stalk, and the fact that the ears are found at more nearly the same level and position on the stalk so that husking is speeded up. This corn lends itself well to the use of mechanical corn pickers, a consideration of some importance in view of the rapid expansion in their use in the corn belt."

A stiff-stalked variety is of value to growers that use either hand or machine methods of picking, but ears that are hard to pull from the stalk are a handicap to the hand husker.

Resistance Important

Resistance to disease is possibly the next characteristic that a grower would stress. All growers would like to rid their fields of the well-known corn smut disease. The Minnesota Experiment Station has developed several hybrids that are classed as smut-resistant. In studying yields of hybrids, the breeders determine kernel damage as a measure of resistance to ear rots. Possibly the next most-sought-after characteristic is resistance to insects, such as the corn earworm, rootworm, grasshopper, and chinch bug.

Some growers desire hybrids with cold resistance so that they may plant much earlier in the spring. It is not hard to conceive of the development of hybrids of this sort. Just how much value, however, they will have outside of spreading the planting season has not been definitely determined. It is well known that it is poor practice to plant ordinary varieties in ground that is cold and wet. In drought areas early planting may bring corn to maturity before hot, dry weather has a chance to ruin the crop.

Some livestock feeders have complained of the hardness of hybrid corn, which they say is too great to make it of the highest value for feeding. Doubtless this is true of some hybrids but not of all. Among the first developers of hybrid corn were some who did not believe in corn shows, and in their work sought the "smooth types" for obtaining higher yields. This resulted in the development of numerous high-yielding hybrids of the hard, smooth type. No doubt there will be a swing back to the formerly popular soft types, and there will be many high-producing sorts that are not hard. Feeders should put a value on nutritional characteristics as well as increased digestibility and palatability. It has long been known that varieties differ greatly in their oil, protein, and starch content. The new hybrid method offers an opportunity for breeders to develop new types that are high or low in these characteristics. Possibly corn-product manufacturers will also have specific wishes as to protein content, starch content, oil content, color, type of hull, and other characteristics of value in the manufacturing process.

Varieties for Erosion Control

Corn, like other crops grown in rows, increases soil erosion. Breeders have an opportunity of developing types of corn that might reduce this erosion somewhat. Varieties with large mats of fibrous roots near the surface, for example, might help to remedy to some extent this serious shortcoming of corn.

The Illinois Crop Improvement Association states, "During the past three years the best hybrids have out-yielded the best open-pollinated by 10 to 15 per cent. In addition to this increase in yield, the better hybrids average distinctly higher in quality, are much more resistant to insects, and stand much better in the field. With these things in mind, figure the acre value of seed of an adapted hybrid on your farm."

From descriptions of various inbred lines that are the foundations for most of the high-yielding hybrids, it appears probable that there will be some striking improvements in the quality of hybrid corn in the near future. Plant breeders, who on the whole are quite conservative in statements concerning their creations, have described many of these inbred lines in glowing terms, as is indicated by the following phrases quoted from various discussions by them: "Cold resistant"—"excellent root system"—"resistant to rootworm"—"transmits root and stalk quality"—"good foliage"—"good tassel"—"produces an abundance of pollen"—"good seed size and color"—"resistant to grasshoppers"—"two-eared"—"stiff-stalk"—"resistant to corn borer"—"good husk"—"short, heavy ear"—"increases shelling percentage of grain"—"adapted to poor soils"—"raises oil and protein content in crosses"—"resistant to heat, drought, and chinch bugs"—"low-eared"—"excellent root, stalk, and ear quality."

If the corn inbreds now in existence have these various qualities, it does not appear improbable that some of the hybrids will exhibit the same qualities, inasmuch as most hybrids are made up of four different inbreds. It is true that breeders must use various inbreds containing these characteristics in combinations that "nick," that is, produce hybrids that yield high as well as exhibit some of these important characteristics.

Right now growers should insist on adapted hybrid varieties. The Nebraska Experiment Station makes a nice distinction between the adaptation of varieties as follows: "Based on experimental data, a distinction is made between the adaptations of hybrids and open-pollinated varieties. Adaptation of hybrid corn originating from crossed inbred lines is dependent upon component lines and not upon the locality where the seed is produced, as is the case with open-pollinated varieties. All hybrids are not equally good, and they also differ widely as to vegetative size and number of days required to mature. After the local adaptation and superiority of any specific hybrid have been established through trial, it is possible to produce this same hybrid with essentially identical characteristics year after year irrespective of where the seed is produced, provided the same parental seed stocks and proper crossing technique have been used. Thus, if the climate and soil conditions are favorable for the production of sound seed, it is immaterial whether the seed of any specific hybrid is produced in the North or South, and whether on unirrigated or irrigated land."

Regional Adaptation Limited

The Illinois Crop Improvement Association states that hybrids differ and growers should choose wisely. They say, "Because only four lines are concerned in the production of most hybrids, and since inbred lines have rather limited adaptation, hybrid corns are more exacting in their regional adaptation, in their soil requirements, in their temperature, and in insect tolerance or resistance. Some hybrids which are outstanding in their performance in the northern portion of the State will be disappointing when grown in central Illinois. Superior central Illinois hybrids likewise may prove little, if any, better than the best open-pollinated corn under southern Illinois conditions. Two hybrids, when grown on soils of average fertility may appear to be equal. When placed on high levels of fertility or when placed on low levels of fertility, they may differ markedly."

"Not all hybrids are good," says the Iowa Experiment Station, and adds, "There are marked differences in hybrids. Some are good, some rather mediocre and others quite inferior. These differences depend entirely upon the inbred lines used in the combination, upon how the field was isolated, upon how the detasseling was done and upon how the seed was processed. We believe that the purchaser should know what specific hybrid, or combination, he is obtaining. Not all hybrids are equally productive. Some are relatively untried combinations. When a purchaser of hybrid corn seed has found a combination that is satisfactory, he should in the future demand the same specific combination.

"Hybrid combinations vary in the time it takes for them to mature. Some are large and late-maturing while others are small and early, much the same as open-pollinated varieties. The grower in northern Iowa cannot expect a hybrid which is adapted to central or Southern Iowa to mature satisfactorily in his area; neither can the grower in Southern Iowa expect maximum yields from the relatively small, early hybrids of northern Iowa. It is highly desirable for the person who is contemplating the purchase of hybrid seed to know what particular combination is suitable for his farm. The grower who has planted a hybrid unsuited in maturity should not become discouraged with all hybrids, but rather, in the future, should ascertain the maturity dates of the specific combination which he contemplates purchasing."

Food Goals of 1942

Summarizing the farm production goals for 1942, and what they mean in terms of different commodities, Secretary of Agriculture Wickard says: "We need more of practically all meats; we need more eggs, and—especially—we need more milk. We need more cheese, evaporated and dried milk to ship to the British, who have had to kill off many of their dairy cattle because of a shortage of feed. We want to provide these essential dairy products for our friends abroad without lowering the nutritional standards of our own people. We can do this only if we produce more milk.

"To make sure of the increased output of milk, we need more hay and pastures. We especially need more legume crops, some to be used as a substitute for nitrogen fertilizers which may be scarce next year.

"For good nutrition, we need to consume many more vegetables, especially the green and leafy vegetables, so rich in minerals and vitamins. We need to eat more of certain fruits and more tomatoes. Our imports of fats and oils already have been reduced. We must make up the difference with oil crops, such as soybeans and peanuts, and perhaps castor beans. Those are commodities in which our needs are most pressing for 1942.

"A few crops do not need to be increased; rather they should be reduced. Of cotton, we have stored a year's needs, and the 1941 crop will provide as much cotton as American mills will use this year. We have more wheat than we can store properly, enough to last this country for two years if we didn't grow a bushel in 1942. Huge quantities of stored tobacco have piled up because export markets were lost when war began. On these commodities, the 1942 goals call for decreases down to the lowest limits provided by law."

Ladino Clover Makes Good Poultry Pasture

(*From page* 8)

to get a good growth of grass for the next season.

It should not be interpreted from this that the poultrymen of Massachusetts are not enthusiastic about rotation. They do practice it where possible. The farms are small, and adequate range is not always possible without making unreasonable investments in land. Often they find it best to brood on the same land several years in succession and supplement the green feed supply with a crop like Ladino clover if a small acreage well suited for its growth is available.

Shade on the poultry range is considered desirable, but not absolutely essential. Many of our Ladino ranges in Massachusetts are on orchard land which is now used exclusively for poultry. Some ranges are located near a wooded area which furnishes shade around the edge of the field; however, these ranges lack that even distribution

Rows of sunflowers produce an abundance of shade for this flock.

of shade which is important on a commercial poultry farm of considerable size. Crop-grown shade, such as corn and sunflowers grown in clumps, rows, or small areas about the farm, is one of the most satisfactory ways of providing shade in the cultivated fields.

For Ladino, Professor Donaldson recommends the same seeding practices used with the ordinary clover-grass mixtures. Seedbed treatments should include (1) lime, if necessary to bring the soil reaction to around pH 6.0 (2) an application of manure with a 500-pound rate of 0-20-20 or 500 pounds of superphosphate and 200 pounds muriate of potash per acre. Without manure the application recommended is 600 pounds of 4-16-20.

Annual top-dressing using similar treatments is recommended, and is widely followed by poultrymen. Because of the surface feeding habits of the runners, the plant responds well to the top-dressing treatments. Potash and superphosphate are the essential foods and 250 to 300 pounds each of muriate of potash and 20% superphosphate are recommended for application early each spring. Manure in addition is sometimes used, though on the poultry range considerable quantites left by the birds build up fertility, making the manure application less important than on other fields. In fact, poultry pastures usually improve with use, if the bare areas can be prevented from appearing.

The ability of pasture to save feed in raising a flock of growing chickens is not questioned. Requirements for Rhode Island Red pullets are perhaps 32 pounds or more to laying age, but this quantity is reduced to 25 pounds easily with ample green feed. There are no comparative tests with Ladino and other clovers for poultry feeding, but certainly it ranks "excellent" for all livestock feeding, and it is easy to see that poultry rank it highly by their preference. It has all appearances of a very promising poultry crop.

The Newer Ideas About Fertilizing Orchards

(*From page* 13)

green during extended dry periods. This seems evidence enough that they are competing too successfully with the apple trees for moisture, although careful soil moisture tests made at the Michigan State College are available to prove this point conclusively.

The fertility of an orchard soil, as measured by the response in tree growth, goes further than the nutrient content of the soil itself. It involves the physical condition of the soil with respect to depth and extent of root penetration, because a soil that is so impervious as to make root penetration difficult cannot become a good orchard soil regardless of plant nutrients present. The same may be said of a soil in which the water drainage is so poor that the root system of the tree suffers from lack of oxygen. The kind and condition of the sod cover is another factor, as previously discussed. Fertilizers are only a part of this problem.

However, there is every reason to believe that the fertilizer program should be one that will maintain the sod cover in good condition. This conclusion is supported by experimental evidence from a number of apple-producing states. A 25-year orchard soil fertility study reported in Bulletin 294 of the Pennsylvania Agricultural Experiment Station states, "Those treatments which have resulted in the production of larger cover crops have ultimately resulted in the production of more fruit." The cover crop acts in many ways as a barometer of orchard soil conditions, as evidenced by another section of the same report which states, "Any treatment that has influenced the trees at all has done so in the following order: first, the cover crops; perhaps several years later, leaf color; shortly after, branch growth and circumference increase; and last of all yield."

Much investigation remains to be done on this question of maintaining orchard soil in an adequate state of fertility. It is readily observed, however, that the use of a complete fertilizer is commanding greater attention today than it did during the preceding decade, particularly as an application in the year when the trees are expected to carry their heaviest crop. Where tree vigor is low, the off year is preferred for any nitrogen applications that may seem desirable.

Georgia's Bale-Per-Acre Cotton Farmers

(*From page* 11)

with 4½ per cent in 1931. Also, the yield per acre for the State in 1940 was 251 pounds, which was the third largest yield per acre since Georgia began to grow cotton.

The average yield of cotton per acre for Georgia for the period 1935-1939 was 230 pounds, as compared with only 184 pounds for the period 1928-1932. This represents an increase of 25.5 per cent. For the 1935-1939 period 8 counties had a yield of 275 pounds or more, as compared with none for the 1928-1932 period. The top yield was made by Gordon County, which had an average of 310 pounds of lint cotton. In the five-year period, 1935-1939, seventeen counties had a yield of 250 to 274 pounds. No county made a yield that high in the 1928-1932 period. In the 1935-1939 period 77 counties averaged 200 to 249 pounds, as compared with only 29 counties for the earlier period. For the latter period only 27 counties had average yields as low as 150 to 199 pounds, whereas for the 1928-1932 period 85 counties had average yields in that group, and only 2 counties had average yields of 100 to 149 pounds, as compared with 10 counties for the 1928-1932 period.

It is interesting to note that despite

A typical one-variety gin at Jonesboro, Georgia.

reduction in acreage, 28 Georgia counties actually produced more bales of cotton for the period 1935-1939 than they did for the period 1928-1932. Sixteen counties increased their yield per acre 40 per cent or more over the 1928-1932 period. One of them, White County, increased its yield per acre 82 per cent. Twenty-four counties increased their yield 30 to 39 per cent, and 30 counties increased their yield 20 to 29 per cent. Only 3 Georgia counties (Bibb, DeKalb, and Decatur) made a smaller yield per acre in 1935-1939 than for the period 1928-1932.

Georgia farmers planted an average of 30.3 per cent fewer acres to cotton for the period 1935-1939 than for the period 1928-1932, but produced only 12.8 per cent fewer bales. For the period 1935-1939 Georgia planted an annual average of 2,241,600 acres in cotton and produced an average of 1,082,600 bales. This compares with 3,217,600 acres and 1,241,400 bales for the period 1928-1932. Our one-variety cotton improvement program has been responsible for a large part of the increased yield and has been almost wholly responsible for the improvement in quality.

The yield per acre of cotton is not as large as it should be, but the results for the last few years indicate definitely that Georgia farmers are doing better farming. As a result, yields and profits for the main cash crop, cotton, have steadily increased.

Mr. Grubb Rebuilt a Worn-out Farm

(*From page* 20)

sulted Forest G. Hall, County Agricultural Agent, who made soil tests from the identical spots, as near as could be determined from the old map, where the samplings had been made 10 years before.

Only two slightly eroded spots on one field indicated any need for lime. But the available potassium was very low all over the farm. Mr. Hall recommended the use of an 0-10-10 fertilizer, and since then Mr. Grubb has used this, or a fertilizer of similar ratio, with excellent results.

Few farmers appreciate the heavy drain on the potash supplies which our legumes, especially alfalfa, make. Since the first tests were made on this farm, conditions had changed. Excellent stands of alfalfa-clover-timothy mixtures had been obtained. As conditions changed, the limiting factors in soil fertility changed. These legumes were actually depleting the soils of their available potash reserves to such an extent that the lack of potash was affecting the grain crop yields.

Mr. Grubb applies 150 pounds of 0-20-20 per acre on his oat fields just as he does on the fields which are in wheat. In 1937, with a wet spring, the sweet clover got nearly as high as the oats. He clipped the oat heads off with his combine and secured 60 bushels per acre. The heavier applications of potash had held up the oat straw. The amount of fall pasture which this 10-acre field produced was almost unbelievable.

Rotation Maintained

Mr. Grubb maintains a 3-year rotation of corn, oats or wheat, and sweet clover or alfalfa mixtures. He now prefers the alfalfa mixtures for pasture. His corn crop receives nearly 100 pounds of 0-20-20 fertilizer in the row. The corn frequently yields near the 100-bushel mark.

He is very particular about his grass seedings on wheat land. They are made with a grain drill with the grass seed spouts removed. The soil must be neither too soft nor too hard. He watched the weather reports last spring and waited as long as he could. With a storm forecast for two days ahead, he drilled his 12-acre field of wheat with grass seed just one day prior to the last snowfall in April.

Twenty acres in alfalfa mixtures last spring completely covered the ground, although the herbage was short due to the late fall pasturing. "Although sometimes I think that I pasture the new seedings too heavily and too late in the fall", he says, "I have never experienced a loss of stand in legumes. If you feed the soil, it will produce the crop."

For some years, Mr. Grubb rented additional land, farming about 400 acres in all. He found the farming of marginal lands where the landlords are not interested in soil improvement not very profitable. Recently he acquired an additional 40 acres of land and plans to concentrate his efforts in the future on the 120 acres. He still combines about 300 acres of grain and picks about 300 acres of corn for other farmers. About 20,000 tile have been installed during the past two years.

Mr. Grubb believes in making his farming operations timely. He spends considerable time in keeping his machinery in good shape and in taking better care of his livestock. He keeps 10 dairy cows, 4 or 5 brood sows, 25 ewes, and about 100 hens, and believes that the more intensified farming is more profitable. Two years ago, he was awarded the "Master Shepherd" degree in the county.

Some Early Experiences with Fertilizer

(*From page* 19)

of grain where none would grow before, as well as large crops of other desirable products. This disease, or softening of the bone as they called it, which had been prevalent among their livestock was no longer a problem.

Potash was very effective on these peat lands in improving the potato crop. One potato grower applied muriate of potash at the rate of 250 pounds per acre, all of which was applied in the furrow but extended well up on both sides before the potatoes were dropped. From this he harvested 16 tons of excellent potatoes per acre, undoubtedly the largest crop that had been produced in this section. The general run of potatoes grown on this peat soil was so inferior in quality that the growers were obliged to accept a considerably lower price than paid for those grown on the highlands. This grower, however, by actually submitting his potatoes to a cooking test before the buyer, was able to obtain the best market price.

Another grower in testing potash on his potatoes proved conclusively that a so-called blight which was very prevalent could be controlled. Sulphate of potash was used in this instance at rates of 75 and 150 pounds per acre, and a patch which received no fertilizer was left. This man after harvesting his crop wrote us to the effect that the crop from the plot receiving no potash was worthless. The second plot which received an application of sulphate of potash at the rate of 75 pounds per acre had a comparatively small crop of fairly good potatoes, but the third plot which received the 150 pounds per acre had a large crop of potatoes excellent in size and quality. Sulphate of potash was the only fertilizer applied to these plots, therefore, full credit had to be given to potash for the results obtained. Following this experience I carried my investigations still further and soon came to the conclusion that this so-called blight, wherever found, either on peat or other soils, was not a blight but a nutrition trouble entirely due to potash starvation.

Looms and Landscapes

(From page 5)

to reach this spot of sylvan splendor in "high gear."

Indeed we have come a good ways toward ministration to the weary from the cities and the emancipation of the toilers so long shut in by rocky barriers and boggy roads. No finer way of uniting America could be found than this, and if we had had something similar in the early "Fifties," there would probably have been no civil strife to crush us down.

DOWN there one finds so many folks who would make good neighbors! Near the south end of Gatlinburg is a small craft shop operated by Mr. and Mrs. Trentham, who also have neat stone cabins for tourists on their lawn. Mr. Trentham is a native of Old Smoky who makes looms and those mysterious "riggings" of heddles and treadles that go into a well-balanced job for the weaver. He says that until the government built good roads into the district he and his neighbors were "pretty much mountained in," and took several days to reach Knoxville. Like some other sages of the Highlands, this pleasant-voiced Scotch-Irish settler used to think the rest of America was "a fur piece off" from the land of laurel. But now he meets people from every state in the Union, and like the "maker of mousetraps" they have beaten a path to his door.

Then one crosses the street to the show rooms where Mrs. Frank Hyatt displays the treasures of the spinners, dyers, and weavers who snuggle in cabins along the Daniel Boone Trail. Mrs. Hyatt has two distinctions of more than local interest. Her mother, Mrs. Dougherty, at more than 90 years, is leader of the Russellville unit of the Southern Highlands Handicrafters who do their marvelous work in a log loom house built in 1799, using wooden looms which average a century old. Mrs. Hyatt is the author of a noteworthy gem of mountain-craft literature, called "Martha Lou's Kiverlid," based on authentic and personal knowledge, prompted always by her famous mother's lore of the loom.

Thus we have a truly indigenous culture made manifest through dignified tradition, skilled household art, and convincing literary style—beyond and behind which rear the bulwarks of vast rocky ranges in which the drama of American history was enacted. When one gets to know such persons as these and others like them, the comic pictures of "Pappy" and the mountain still seem like foolish caricatures.

Monetary gain is perhaps the least of all reasons why these industrious mountain dwellers patiently whittle, weave, and mould the tasty ornaments so characteristic of their lives. Ask the guild leaders why they continue in this arduous and humble craftsmanship through long winters amid the pines and their usual answer is "To perpetuate the arts of our ancestors, to give employment to the neighborhood people who like to turn spare time into an honest living, and best of all, for the sheer love of doing beautiful things with the hands."

COLORFUL sunsets and morning mists in the Smokies are reflected in the charming patterns harking back to colonial days which these weavers turn out. Besides shearing domestic flocks, carding the wool, and spinning the yarn, these amazing workers manufacture the natural dye-stuffs used to brighten warp and woof.

The art of dyeing with natural materials is of course almost as old as the human race, but it is refreshing indeed to find modern communities actually collecting the raw materials and boiling out of them the substance which provides the lasting colors for these famous fabrics.

For the most part the formulas used by the crafters were brought to America in colonial times. Later the eager settlers tracing their cautious way across the Blue Ridge into the green meadows and beyond to the prairies brought along those same old recipes for making ordinary sheep's wool a thing of permanent beauty and a joy forever.

Rose madder or "madder red" has been handed down through many generations and is said to be the same formula used in England in the fifteenth century. The soft pastel shades of such natural dyes reflect the beauty of nature, such as the sheen of wild flowers, the browns and greens of deep forests, and the bright autumnal variations seen in falling leaves.

There are the rusts and old rose of madder roots, the browns and tans from black walnut bark, the green from brome sedge, taupe from hemlock bark, orange from blackwood bark, yellow from black oak, grey from dock roots, blue from indigo, and grayish brown from the wool of black sheep. The dyeing is done in old-fashioned iron kettles, each color calling for a "secret" process quite its own.

HERE once more we see connections between lives spent in visual appreciation of riotous colors in sunlight and shadows creeping over the lofty crags and distant hills and the reflection of what is thus beheld from infancy worked into the materials which live after the patient hands are still and the calm voices are silent forever.

And, best of all, few of these people regard themselves as remarkable or try to pose as poetic examples. They are so busy figuring out "drafts" on their looms and new designs for their pottery that the romantic aspect of the situation seldom makes them "stagey."

Yes, it's the land which nurtured and inspired such widely separated men as Daniel Boone, Andrew Jackson, and the Hon. Sergeant York himself. No wonder that those who visit it depart with enhanced confidence and courage.

As time goes on I believe Americans are bound to demand more genuine recreation such as these wilderness areas afford and to ask that all the native arts and crafts common to such areas be encouraged and developed in a systematic and faithful way.

I say this with full recognition of the fact that many folks prefer to engage in athletic forms of recreation like rowing, hunting, hiking, riding horseback, and mountain climbing. But to many others in the middle terms of life such stunts are neither safe nor sane behavior, and so all we can do with reasonable precaution is to use our eyes and ears to advantage—at least while we still have them.

IT TIRES me out and irks my awareness of stiff joints to witness too much youthful bouncing and jouncing around the dude ranch forms of vacation spots. But I can be quite comfortable scanning nice scenery and watching somebody else finish a neat job. If there be any attempts made at imitation of such tasks of native labor in our humble family, I fear that my wife will have to undertake it. However, I consider myself a patron and a fervid endorser of such activities, and relish describing them afterwards to persons not too insistent on technical details.

But if I were young and sprightly again and had as much ambition and verve as once surcharged me, I am quite sure that vacation days would not find me bobbing around on a spavined nag when I might be banging away at a loom and the art of whittling and metal working would get as much of my spare time as the diving pier.

Possibly those who have always lived in a flat country and who never worked much with their hands at novel and useful trinkets are, like me, more impressed and refreshed by what is seen in the mountains than others. At least I took something precious away with me which I didn't pay for, and I reckon those mountaineers won't miss it either.

A Few Whinnies

A man walked into a restaurant and ordered four poached eggs and chips, a dozen oysters, and a grilled steak.

After wading through these he finished off with four doughnuts and two cups of coffee.

When the waiter presented the bill he remarked: "Excuse me, sir, but you must enjoy your meals."

"Far from it," replied the diner. "As a matter of fact, I hate 'em—but I'm nuts about bicarbonate of soda."

"Why are you crying?"

"Father called mother a waddling goose."

"Well?"

"Mother called father a stupid ass."

"But why are you crying?"

"Well, what am I?"

Too Good!

Oscar came to the city and got a job as janitor in a girls' boarding school, and was entrusted with a pass key to every room in the building.

The following week the Dean ran across him and asked, "Why didn't you come around Friday for your pay, Oscar?"

"Vot! Do I get wages, too?"

First old maid: "I wish I could stop dreaming about having a husband."

Second old maid: "Some day you'll wake up to yourself."

First old maid: "Say! That's all I've been waking up to for the last forty years!"

Papa—"What's all this scribbling, Junior? It says blow, blow, draw, draw, blow, draw."

Junior—"Why that's the music for my mouth organ, Pop."

A man from a small town attending a convention in a big city, took in a show which featured the display of the maidenly form to a greater extent than that to which he was accustomed, and the next day he was obligated to go to an oculist to have his eyes examined.

"After I left the show last night," he explained, "my eyes were red and inflamed and sore."

The oculist examined his eyes, thought a moment and then remarked, "After this, try blinking your eyes once or twice during the show; you won't miss much."

Moke—"Does yuh really love me or does yuh jes' think yuh do?"

Moka—"Yas, indeedy, Honey, I really loves yuh; I ain't done no thinkin' yet."

You probably heard about the relief client who was so accustomed after years of unemployment to having everything done for him that he went out and married a widow with three children.

And—

The greatest feat of will power we ever saw was by a man who ate only one salted peanut.

FERTILIZER *Films* AVAILABLE

WE shall be pleased to loan to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations and members of the fertilizer trade, films bearing on the proper use of fertilizers, particularly potash. Anyone interested in showing these films should direct his requests to our Washington office.

Potash in Southern Agriculture

Covers fertilization and potash deficiency symptoms of cotton, tobacco, and corn at several Experiment Stations in the South, also crops in the field, fertilizer placement work, and scenes in a fertilizer factory.

16 mm.—sound, color—running time 20 min. (on 800 ft. reel).

Bringing Citrus Quality to Market

Shows influence of fertilizers, particularly potash, on yield and thickness of rind, volume of juice, weight, and general appearance of citrus fruit.

16 mm.—silent, color—running time 25 min. (on 800 ft. reel).

New Soils From Old

Experimental work on Illinois Soil Experiment Fields and the benefits from a balanced soil fertility program using limestone, phosphates, and potash in growing corn, wheat, clover, and other crops.

16 mm.—silent, color—800 ft. edition running time 25 min.; 1,200 ft. edition running time 45 min. (on 400 ft. reels).

Ladino Clover Pastures

Determining proper fertilization of Ladino Clover for best utilization as pasture for livestock and poultry in California.

16 mm.—silent, color—running time 25 min. (on 400 ft. reels).

Potash Deficiency in Grapes and Prunes

Effects of potash deficiency and fertilizer treatments on grapes and prunes in California.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Machine Placement of Fertilizer

Methods of applying fertilizer to California orchards, lettuce, and sugar beets with various types of apparatus devised by growers.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Potash From Soil to Plant

Sampling and testing soils by Neubauer method to determine fertilizer needs and effects of potash on Ladino clover in California.

16 mm.—silent, color—running time 20 min. (on 400 ft. reel).

Requests for these films *well in advance* should include information as to group before which they are to be shown, date of exhibition, and period of time of loan.

AMERICAN POTASH INSTITUTE, INC.

1155 Sixteenth Street **Washington, D. C.**

Printed in U. S. A.

Better Crops with PLANT FOOD

November 1941 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, D. C.

VOLUME XXV NUMBER 8

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The American Potash Institute
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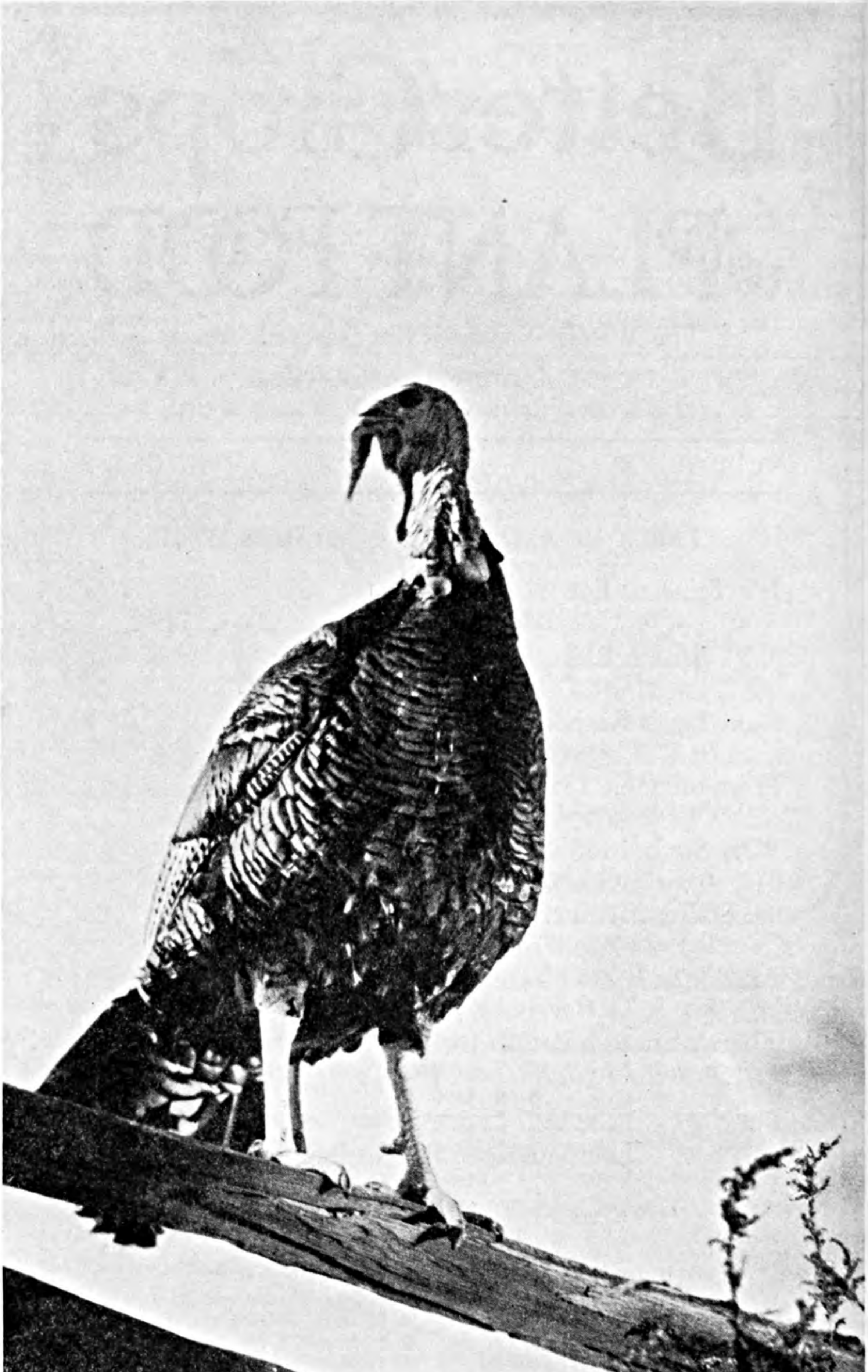

TODAY THE SURVEYOR—TOMORROW THE SURVEYED

Better Crops with PLANT FOOD

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VOL. XXV WASHINGTON, D. C., NOVEMBER 1941 No. 9

Let's get together When . . . . . .

It's Time to Eat

Jeff McDermid

WHAT America needs worse than a good nickel cigar is some plan to make farmers less touchy about consumers and to show consumers that a farm doesn't operate like a factory. As winter sets in, these two groups at opposite ends of the distributing line settle down for another seance of confusion, misunderstanding, newspaper bickering, and prejudiced opinions—all having a tendency to cut appetites and hurt morale.

Producers will soon have a brief surcease from the rush of summer and the toil which bars them from much leisurely contemplation. Farmers and ranchers, poultrymen, and gardeners in the northern breadbasket of America will dispose themselves around the reading lamps or gather in the rural forums for periods of study and discussion.

Some of them are eager to find out for themselves what really "ails" the food customer, but too many producers are bound to cling to the old separatist doctrine of their elders, who thought that idleness and easy money were the chief goals of the urbanite and that living off the fatted calf, stuffed at great sacrifice by the farmer, marked the food policy of city people.

Consumers who have dawdled along fairly well on modest rations and plenty of cold beverages during the vernal equinox are now stoking furnaces and stomachs in unison as the zero waves approach. Their blood and tissues demand red meat plus gravy and kindred condiments, and the cold days fool them into taking on a heavier cargo amidships than a weak-beamed, slow-going vessel ought to negotiate. If city consumers were as husky workers as they are hearty eaters, they would have less chance to complain about food prices or rural selfishness—just because they'd be too sleepy after supper to argue about it.

Many of them put in rowing machines, punching bags, and weight-lifting devices, but they don't realize how much muscular effort goes into the making of foods, whose stupefying effects those artificial gadgets are intended to offset.

WORKING daily in a wonderful maze of mechanical marvels and being able to do four men's work with a push button or a lever, hosts of industrial folks imagine that farms are likewise emancipated and streamlined and that tractors and combines pick the berries, slop the hogs, and milk the cows.

They are satisfied in the main that it takes big and brawny brains to manage a complex technological plant and pay off the help, but they usually regard the farm as a handy place to keep feeble-minded folks, having driven past a few county asylums which are maintained in the open country. They fail to allow anything whatever for business acumen in agriculture, which is presumed to be a gift of God.

There are two broad groups of food producers — those who are solicitous about the contented consumer and the long-time stabilized market; and the other group who are grouchy and peevish about every balk or hesitation, every refusal or protest, or every hint at using substitutes on the part of the customer.

What makes it hard for both sides is the widened gap between the farm and the table. There was a time not so remote when farmers toted stuff to town and filled the storage bins of their urban friends direct, with 'taters and squash, carrots and beets, apples and cabbages; or took orders and delivered canning crops for the housewife in town to process. Butter was sold in firkins and crocks, cheeses were peddled from house to house, hams were cured and furnished to regular customers, often whole sides of beef were contracted for in the country, and poultry galore found its way from coop to kitchen. This movement proceeded for years without the interference of powerful middlemen or sales agencies, and without brands, trade-marks, or slogans, and sans advertising and publicity —save that which went by the good old grapevine route.

Market prices in those dear dead days were just local affairs, matters of private dealing almost like ancient barter. No disturbing revelations of what one store had as "loss leaders" to fool the unwary into trading there, or no rival bargain price sheets bothered the buyer and seller then. What Chicago or New York said was the right price didn't concern the up-state squatters overmuch, if the quantity was measured fairly.

QUALITY in the goods handled was a theme for praise or recrimination, straight from the shoulder, and with the producer unable to dodge responsibility and likely to improve his stance so as to hold his trade next time. Town and country folks rubbed elbows on the market squares—few of which remain in our cities now. Women went over there every morning to haggle and pinch and push and barter, like they say the European people usually do today, at least in normal times. Farmers came to town and parked their teams along hitching racks, unwrapped their loads of plunder, and shooed the flies away while waiting for purchasers. It lacked the highest degrees of public health safeguards, we all admit, but it made both sides appreciate what a good bargain really amounted to—and the farmer often had as much coin in his jeans by nightfall under that ancient system as he garners now through remote contact with ultimate users.

In place of this we have Nation-wide

distribution under fast transport and tiptop refrigeration, and the producer in Alabama never gets to know who buys his melons or who likes or dislikes them; the Georgia peach grower puts his trust in sunshine and rapid transit without much concern beyond having high volume at reasonable returns.

The "cat" of Wisconsin dairymen was "let out of the bag" by Governor Julius Heil this year, when he thanked the Federal Government for huge cheese orders, "which," he said naively, "make it possible for us to get rid of a lot of cheddar." Too many producers are too much like that, wanting to unload in a hurry and get going. It's a symptom of mass mania.

It's too much on the whizz-bang basis of producing and unloading, aiming in the dark at the dollar sign and trusting to judicious advertising and vacant bellies to even things up. Of course as a rule the raw producer does none of the advertising direct to consumers. His truck contains many great and lasting virtues which he failed to cash in on originally, leaving that for the deft skill of the master salesman. Here and there the producer has been attending home demonstration institutes or reading bulletins and he finds out that his produce is the best source of certain vitamins and calories, but when he tries to tack that bit of erudition onto his selling price they give him the mule bray.

Back in former times it was quite unusual for the rural gentry to invest in groceries, meats, and bakery fodder to any extent—except on Grandpa's birthday or a family reunion. What Ma couldn't bake or preserve and Pa couldn't raise, swipe, or shoot wasn't worth eating because you didn't enjoy stuff unless every bite smacked of self-reliance.

Going to the store back yonder meant trading in some country produce for a few nicknacks or spices, maybe some flour or sugar, and often even these items were fresh from the millstones, the sorghum field, or the maple woods.

But today the average farmer buys his store cookies, baker's bread, soap, fruit juices, cheese, canned vegetables, corn meal, tropical fruits, all his flour, nearly all his butter, plenty of meat, both fresh and cured, and sundry fibrous and stringy chips that are called breakfast food, even by farmers. He also buys his molasses and his vinegar and considerable lard.

One might hastily sum this up by surmising that the store-bound farmer of today must thereby more fully appreciate the situation of the city consumer and have deep sympathy for the family man amid skyrocketing groceries. It isn't always disposed of so easy.

The food producer, like all original producers, is rather blind to the costs affecting the sale of his own line of commodities, yet he remains inherently sensitive and vocal about the low buying power of the dollar when it is laid out for non-farm merchandise. To him all things he produces and spreads before the customer must be good and right at any price and anybody who threatens to shift over into some other article is plenty times a darn fool. But when he comes to the counter and asks for a square deal he doesn't want any sharper to give him the run-around—toward which he is often unduly suspicious.

Like one fellow sees it, "It ain't the

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Corn in the shock on Robinwood Farm. This field yielded 75 bushels per acre.

J. T. Brown Rebuilt A Worn-out Farm

By F. J. Hurst

Agricultural Adjustment Administration, Jackson, Mississippi

AGRICULTURE can be rebuilt. Old lands can be made new. Impoverished and depleted soils can be made fertile and productive. Crop yields and pasture production can be economically increased.

Seven years ago Robinwood Farm, eight miles north of Jackson, in Hinds County, Mississippi, was a run-down, worn-out, and abandoned farm. Years of one-crop farming and misuse of the land had left their tragic toll. Gullies marred a once fertile landscape, and eroded areas looked like great sore spots on once productive hillsides. Crop yields had declined. The last family had moved from the farm. There was not a house left on the land.

Robinwood Farm today has fertile fields, productive pastures, fine herds of cattle, miles of fences, attractive and comfortable houses, and contented families. Fertility has been restored, and production has been brought back. This transformation has been brought about by J. T. Brown, a banker of Jackson, who has a deep interest in agriculture, an abiding faith in farming, and a determination to render a distinctive service to his community and county.

For years Mr. Brown had attempted to interest his business associates in backing farm improvement programs. But for the most part his pleas fell on "unresponsive ears." He had long recognized that Mississippi was fundamentally an agricultural state and that if the commonwealth was to prosper, farming had to be made profitable.

When the agricultural depression in 1932, 1933, and 1934 began to bring economic ruin and financial disaster to business and agriculture alike, Mr.

Farmers and agriculturists at a recent forage school held on Robinwood Farm.

Brown realized that something had to be done to aid agriculture. It was then that he decided to buy a run-down farm to demonstrate that farming could be made to pay when scientific practices and sound farming methods are followed.

Terracing, production of winter cover crops and summer legumes, plowing under of green manure crops, application of limestone, and liberal use of phosphoric acid, potash, and all available barnyard manures, are practices which have been used to reclaim the entire farm and make every acre productive. That this soil-building formula has produced the right results is attested by the high crop yields harvested in 1941 when averages of 75 bushels of corn, 55 bushels of oats, 2½ tons of lespedeza, and 1 bale of cotton per acre were gathered.

Mr. Brown standing in bale-per-acre cotton grown on soil improved with a cover crop and fertilizer.

The first step taken by Mr. Brown to conserve and restore soil fertility was the terracing of every acre of pasture and cropland on the farm. He realized that unless gullying and erosion on the steep hillsides and rolling lands were halted, much of his effort to improve soil fertility by growing legumes and applying fertilizers would be wasted. Washing rains would continue to sweep over these areas and carry off the topsoil and with it some of the fertilizers which had been applied on the fields. He promptly arranged for the use of a heavy tractor, bought a terracing level, secured other necessary equipment, started terracing, and never stopped until every acre had been terraced.

Commenting on the value of terracing, Mr. Brown says, "You can't conserve and improve soil on hill lands unless you control erosion. You must stabilize the soil. Terraces slow down run-off to a walk and give the water more time to sink into the soil. They help to save the more fertile topsoil and conserve moisture. With a good system of terraces and contour farming, you get not only the immediate benefits from growing and plowing under legumes and applying limestone and commercial fertilizers but also the long-time benefits from these practices because you reduce erosion and water run-off to a minimum."

Production of winter cover crops and summer legumes together with the application of limestone, phosphoric acid, and potash are rated by Mr. Brown as "must practices" in his soil-building, high-crop-yields program. Last winter he had 77 acres in hairy vetch and Austrian winter peas. These thick-growing, nitrogen-gathering crops trapped the rainfall, held the water on the land, prevented erosion, and when plowed under in the spring added nitrogen and humus to the soil.

In addition, 90 acres were seeded to oats, which furnished a protective cover for the land during the winter and yielded a grain crop in the spring. Of the 90 acres in oats, 64 were planted to lespedeza in February for hay in August and September. A liberal acreage in soybeans and crotalaria rounded out the legume-cropping program, which included a total of 239 acres in soil-conserving, erosion-resisting, soil-building crops.

Although he had been using basic slag and potash on cover crops and a complete fertilizer under cotton with highly satisfactory results from the very beginning of his farming operations, in August 1940 Mr. Brown decided to have soil tests made of every field on the farm to determine the deficiencies of plant-food elements in the soil and to serve as a guide in the fertilization of crops. This work has proved highly beneficial. "Soil testing is a key to soil building," says Mr. Brown. "It reveals what plant-food elements are lacking in the soil. It enables the farmer to make the most efficient use of fertilizers and helps him to produce maximum yields at minimum costs."

The tests showed that the soils on the farm were deficient in lime, phosphorus, and potash. So Mr. Brown

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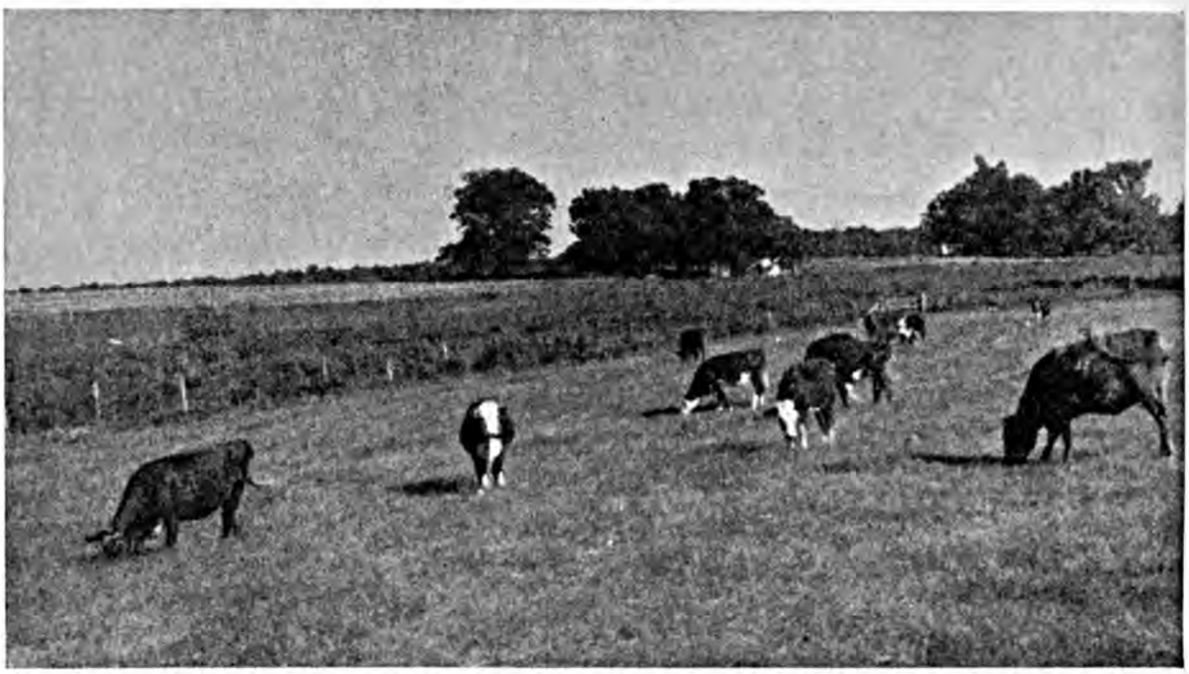

Part of Mr. Brown's beef cattle herd on improved permanent pasture. This pasture was fertilized with 2 tons limestone, 800 pounds phosphate, and 400 pounds muriate of potash per acre.

Cane Fruit Responds To High Potash

By W. L. Powers

Agricultural Experiment Station, Corvallis, Oregon

THREE years ago the berry growers associations at Gresham and Lacomb in the Willamette Valley of Oregon sought the help of the State Experiment Station in overcoming difficulties referred to as "winter injury," "crumbly berries," and "leaf scorch." The growers secured a special fund from the legislature, part of which was assigned to the Station Soils Department for a study of causes of malnutrition in cane fruits. Other studies started included winter-hardiness nurseries and pathological investigations.

Symptoms. "Leaf scorch" or "firing" was found to develop first on the fruiting wood and later during dry summer weather extended to the mature leaves on new canes. The tip and margins of leaves became bronzed and then cupped up and developed brown color, frequently with brown spots farther back in the leaf tissue (Fig. 1). The leaf markings were diagnosed as probable potash deficiency. "Crumbly berries" tend to fall apart when picked or in cooking and canning. "Winter injury" was manifested by dying of terminals. Both the so-called winter injury and leaf scorch were more prevalent on old exhausted land, or on soil having impeded drainage. Similar bronzing of leaves of gooseberries has been found and included in the study.

Procedure. Samples of leaves and of soil profiles from affected and normal areas were collected for chemical analysis. Old cropped land and nearby undisturbed soil of like types were sampled for chemical comparison. Green-

Fig. 1. Blackcap canes. Potash-deficient leaves (left) are bronzed and cupped at edge. Normal leaves at right.

house and field fertilizer trials were established, including major and minor elements with black and red raspberries, boysenberries, strawberries, and recently with gooseberries. The Cuthberts and boysenberries were grown on Powell silt loam, while the blackcaps and strawberries were grown on Olympic silty clay loam. Effects of fertilizers on cane growth, yield size, and canning quality of fruit have been determined. Yields and returns are shown for boysenberries in Table 1, and for blackcaps in Table 2.

Chemical Determinations. Earlier chemical determinations were made largely by Vernon C. Bushnell and recently by Harry E. Clark, Research Fellows. Determinations were made of water-soluble, Neubauer, exchange, and total potassium from numerous experiment field plots.

Results. 1. Untreated soils from affected berry fields are low in the various forms of potassium.

2. Use of soluble potassium carriers in fertilizer treatments has tended to increase the level of available potassium in soils and its content in plant parts.

3. Leaves showing bronzed or brown edges and in most cases interior spots, indicating potassium deficiency, were found to be very low in potassium (0.005 per cent compared to 1.02 per cent for good leaves).

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TABLE 1. CROP RESPONSE TO FERTILIZER ON BOYSENBERRIES ON POWELL SILT LOAM

Soils Department, Agricultural Experiment Station, O. S. C.

Row no.	Treatment kind and ratio	Rate per acre	Treatment cost per acre	2-year average yield		Gain or loss	Net profit or loss from treatment*
				Treated	Untreated		
		Lbs.	*$*	*Tons*	*Tons*	*Tons*	*$*
				WHOLE PLOTS			
35	Check				4.66		
37	5–20–10	500	11.24	5.25		.44	32.76
39	5–20–15	500	12.29	4.75		−.06	−18.29
41	Check				4.96		
43	5–20–20	500	13.34	4.68		−.28	−41.34
45	5–20– 0	500	9.14	4.74		−.22	−31.14
				NORTH HALF—FERTILIZER APPLIED BROADCAST			
35	Check				5.09		
37	5–20–10	500	11.24	4.92		.21	9.76
39	5–20–15	500	12.29	4.47		−.24	−36.29
41	Check				4.33		
43	5–20–20	500	13.34	4.21		−.12	−25.34
45	5–20– 0	500	9.14	4.03		−.30	−39.14
				SOUTH HALF—FERTILIZER APPLIED IN FURROWS			
35	Check				4.28		
37	5–20–10	500	11.24	5.56		.66	54.76
39	5–20–15	500	12.29	4.99		.09	− 3.29
41	Check				5.52		
43	5–20–20	500	13.34	5.10		−.42	−55.34
45	5–20– 0	500	9.14	5.52		.....	− 9.14

* Boysenberries priced at $100.00 per ton.

Humanity on Trial

A Defense of Agriculture

By H. D. Brown

College of Agriculture, Columbus, Ohio

HAVE we adequately developed our agricultural resources and are we making effective use of these resources?

Some idea of our effectiveness can be obtained from a recent statement of the National Research Committee. In 1789 the surplus food produced by 19 farmers was adequate to feed only one city person. By 1937 our efficiency had increased to the point where 19 people on the farm produced sufficient surplus food for 56 city people and 10 persons living abroad. This alone is sufficient proof to drive many prophets of doom to cover. The prophets of 30 years ago predicted over-population and famine. Today these prophets are silent. In fact, the cry of overproduction is our present-day paradox. Actually we now produce enough, but not too much, and are able to step up production manifold if the need arises.

Some of the technological advances which have aided us in achieving these goals are of interest. Discoveries that eliminate wasteful practices are of major importance. Quick capital turnovers and the elimination of excess labor costs are axiomatic for success in our present-day agriculture. In my field we have learned not to attempt to grow certain vegetables under certain environments. Most cabbage, onion, beet, and celery varieties will produce seed stalks, not edible parts, if grown at a temperature of 45° F. rather than at 60° F. Seedsmen, therefore, select 45° F. environments and commercial vegetable growers 60° F. Both groups frequently aid nature by utilizing hotbeds and greenhouses, conveniences of present-day agriculture. By using improved cultural and fertilizer practices and new varieties, our commercial potato growers secure yields of 400-700 bushels per acre compared to an average yield of 100 bushels per acre where antiquated methods are employed.

In the greenhouses tomato fruits without seed are produced by chemical stimulants even when pollen is not effective. Seedless melon, pepper, and eggplant fruits produced in a similar manner are in considerable demand. Seed is produced as a practical means of reproduction of most vegetables, though the potato, the world's most important crop, is produced almost exclusively by vegetative means.

Plants Without Soil

We are now able to grow plants without soil. If the roots are anchored in gravel, cinders, or haydite we call it water culture. The term hydroponics is used if the roots are submerged in the nutrient solution, and we have coined the word aeroponics where the roots are grown in air and kept continuously moistened by atomized nutrient solution. The basic truth evolving from all studies with water culture is that roots must have oxygen. We have known for years that excessive moisture in soils was fatal to many of our cultivated crops and that toxic substances were produced because of poor drainage. Now, thanks to water and related culture, we know that roots must have oxygen as well as moisture. We know that the fertilizing materials will not be absorbed by the roots unless

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Why Soybeans Should Be Fertilized

By Mack Drake and George D. Scarseth [1]
Purdue University Agricultural Experiment Station, Lafayette, Indiana

ONCE agronomists considered all legumes to be soil-building crops. This thought probably came from the experiences with legumes in the first generations of their cultivation. After the first lush growth from the newly broken virgin forest ground, nitrogen soon became the first limiting nutrient element for plant growth, particularly on light-colored upland soils. In the Corn Belt region, phosphorus, potassium, and calcium were still present in sufficient quantities to produce high yields of legumes.

When legumes were grown on these soils, the soil nitrogen content was temporarily increased. The crops that followed the legumes had the benefit of this added supply of nitrogen and the yields increased as a result. Eventually the supply of phosphorus dwindled, and it then became the first limiting factor in the growth of the crops where legumes were used.

During the period 1890-1920, the lime-phosphate-legume program provided a profitable system of farming. After several rotations of this program had been completed, it was found that potassium fertilizers would increase the yields and quality of grains. Now, in 1941, agronomists are recommending increasing quantities of phosphate and potash for corn and wheat, with emphasis on supplying enough of these minerals to the grain crops so that there will be an adequate supply for the subsequent legume crop which must furnish the nitrogen for the whole rotation.

If the supply of phosphorus and potash is inadequate and/or the soil is strongly acid, legumes will not be very effective in producing available nitrogen because the greatest nitrogen production seems to be dependent upon a favorable fertility condition. If the nitrogen is not supplied by the legume, it must be applied in commercial fertilizer.

Many farmers do not realize that legumes cut for hay or soybeans harvested for grain are soil-depleting crops. There are several logical reasons for this lack of information. Legumes plowed under or legumes cut for hay and the manure therefrom returned to the soil increase the soil nitrogen and thus increase the yields of the following corn and wheat crops. In this respect legumes behave as soil-building crops only when the whole crop is returned to the soil either directly or in the form of manure.

Yield Increases May Mislead

In a 25-year-old crop rotation experiment on the Soils and Crops farm at Lafayette, where the original soil was unusually well supplied with available phosphate and potash, soybeans in the rotation have increased the yields of corn and wheat by 6 to 8 bushels per acre as compared to where no soybeans were used in the rotation. Inasmuch as fertilizers were applied at the rate of 200 pounds of 2-12-6 per acre to the wheat and 100 pounds of 0-16-0 during the first 20 years and 100 pounds of 0-12-12 per acre during the last 5 years to the corn in all rotations, in addition to manure equal to the produce re-

[1] Graduate Assistant and Soil Chemist, respectively.

moved, except the wheat grain, it appears that the increases in the corn and wheat yields were due to the additional nitrogen supplied by the soybeans. In this respect the increased yields make the results appear as if the soybeans built up the whole fertility of the soil. It was only the available nitrogen supply that was increased, for the soil had actually been decreased in its content of available phosphate and potash.

Large amounts of plant food must be available in the soil to grow a good crop of soybeans such as the above on an Indiana farm.

Since the following crop yield is sometimes increased after soybeans when the first limiting growth factor is nitrogen, it has frequently been assumed that soybeans harvested for grain were not hard on the land and were not soil-depleting. With the increased sale of soybeans for commercial uses such as oil, plastics, etc., a larger amount of fertility is lost from the farm.

Let us examine the soybean a little further because it is fast becoming an important and favored crop in the Corn Belt, and rightly so. Each bushel of soybeans harvested removes about 0.75 pounds of phosphate (P_2O_5) and 1.0 pound of potash (K_2O) (Table 1). Thus a crop of 20 bushels of soybeans removes 15 pounds of phosphate (equal to 75 pounds of 20 per cent superphosphate) and 20 pounds of potash (equal to 33 pounds of 60 per cent muriate of potash) from each acre. In 1940 a total of 814,000 acres of soybeans were harvested for grain in Indiana and yielded 10,989,000 bushels (Table 2). Roughly this quantity of beans removed 8,240,000 pounds of phosphate (P_2O_5) and 10,900,000 pounds of potash (K_2O), or the equivalent of 45,400 tons of an 0-9-12 fertilizer.

Fortunately, a large portion of the soybeans harvested are fed to livestock, either as ground beans or as processed meal, thereby returning part of the fertility to the farms. However, many of the farmers selling soybeans do not feed livestock and thus do not return the minerals to the soil from which they were removed.

According to the Indiana Crop and Livestock Estimates, 1940 (Table 2), approximately 62,043,000 bushels of soybeans have been harvested for grain in Indiana during the 10-year period, 1931-40. This quantity of beans con-

TABLE 1.—PHOSPHATE AND POTASH CONTENT OF SOYBEANS AND WHEAT GRAIN FROM TWO LOCATIONS IN INDIANA*

Analysis of soybean grain	Percent P_2O_5	Lbs. P_2O_5 per bu.	Percent K_2O	Lbs. K_2O per bu.
3 years at Moses Fell Annex fertility plots, Bedford	1.11	.67	1.74	1.04
3 years at Soils and Crops Farm, Lafayette	1.4	.84	1.6	.96
Analysis of wheat grain				
3 years at Moses Felt Annex fertility plots, Bedford	.90	.54	.51	.31
3 years at Soils and Crops Farm, Lafayette	.88	.53	.52	.31

* From Robert Lucas' M.S. Thesis, Purdue 1941, "Plant Nutrient Composition of Some of the Common Indiana Farm Crops as Related to the Fertility of the Soil."

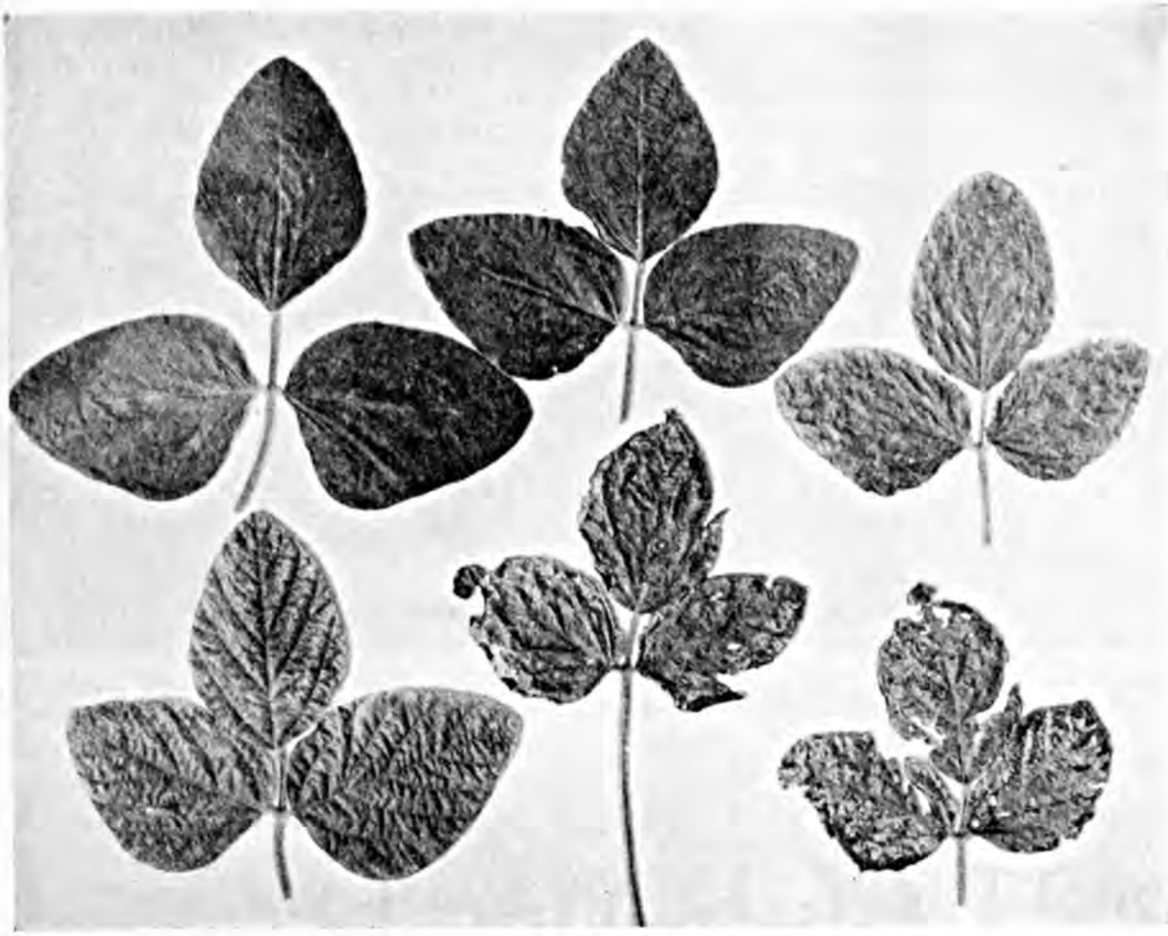
tained approximately 46,500,000 pounds of P_2O_5 and 61,500,000 pounds of K_2O. This would be equivalent to 255,000 tons of mixed fertilizer with an analysis of 0-9-12. Assuming that a freight car hauls 30 tons, this is equal to 8,500 carloads, or 85 trains made up of 100 carloads each. To actually supply the plants with these amounts of nutrients as a commercial fertilizer, allowances would need to be made for phosphate fixation in the soil and minor potash losses. Thus probably for each of the 100 pounds of 0-9-12 indicated, it actually would require about 125 pounds of an 0-12-12 or 75 pounds of an 0-20-20 commercial fertilizer.

As a matter of fact, the total tonnage of fertilizers consumed in Indiana in 1940 for all purposes was 257,000 tons. Probably only a few tons of this were used for soybeans, since soybeans do not respond well to direct fertilization; therefore, it emphasizes again that soybeans cause a great loss in soil fertility and that somewhere in the rotation, preferably to the grain crop, at least double the usual amounts of phosphate and potash must be used to make the soybeans and offset the soil-depleting effect of growing them.

If this quantitv, 62,043,000 bushels, of soybeans were calculated as that many bushels of wheat, the wheat would remove 32,900,000 pounds of P_2O_5 and 19,200,000 pounds of K_2O (.53 pounds of P_2O_5 and .31 pounds of K_2O per bushel). This would be equivalent to 160,000 tons of an 0-10-6 fertilizer. When the plant nutrients removed by soybeans are compared with those removed by other crops, it is plain that this crop is more soil-depleting.

Indiana farmers have complained about frequent clover failures in wheat following soybeans, particularly on light-colored soils. "Dry weather" has been the most common explanation for these clover failures. However, clover

Soybeans about ready for harvest.



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.

seedings were more successful when seeded in wheat on soils where the fertility level was adequate, either as a result of natural fertility, a livestock system of farming whereby part of the fertility removed by crops was returned, or where commercial phosphate and potash were applied somewhere in the rotation in amounts sufficiently high to maintain the soil fertility.

Soybean seed production in Indiana has increased from 40,000 acres producing 400,000 bushels in 1925 to 814,000 acres with 10,989,000 bushels in 1940 (Table 2). Research workers are constantly seeking new uses for soybeans. This crop promises to remain a major cash grain crop in the Corn Belt. It is a crop which is easy to grow, easy to

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TABLE 2.—BUSHELS OF SOYBEANS PRODUCED IN INDIANA IN DIFFERENT YEARS AND THE AMOUNT OF PHOSPHATE AND POTASH IN THESE BEANS*

Year	Acres harvested for grain	Bushels	Pounds P_2O_5	Pounds K_2O
1925	40,000	400,000	300,000	396,000
1930	131,000	2,114,000	1,580,000	2,100,000
1935	410,000	6,970,000	5,230,000	6,800,000
1940	814,000	10,989,000	8,240,000	10,900,000
1931–40 totals	....	62,043,000	46,500,000	61,500,000

* Indiana Crop and Livestock Estimates No. 163, 1940.

Center rows show effect of no cover crops plowed under for three years. On each side cover crops plowed under. Difference in height was much more noticeable in the field than in the picture.

4-H Club Members Often Furnish Clue

By W. R. Vallot

Assistant Agricultural Agent, Ville Platte, Louisiana

IN Evangeline Parish, Louisiana, 4-H club members and some adult farmers have proved that heavy applications of fertilizer high in phosphates and potash will return bigger profits to farmers who follow good farming practices.

Norman Guillory, a Louisiana 4-H cotton champion, produced 1,114 pounds of lint cotton at a profit of $116 on land which ordinarily produced but a half bale to the acre. His 3-year average is a remarkable one for our soil. One thousand and forty-one pounds of lint returned $87.50 net profit per year average. Numerous records made by other boys prove definitely that larger amounts of fertilizer than are commonly used in the parish would be more profitable to our farmers.

From 30 to 50 club members using 300-600 pounds of fertilizers have demonstrated that 600 pounds of lint and 30 bushels of corn can be grown more profitably on lands which ordinarily produce but 300 pounds of lint and 15 bushels of corn, if other good farming practices are carried out in their program. In demonstrating the value of this practice, they have likewise made a fine record in competition for various prizes offered on a State and district basis.

The increased profits and many awards realized through this practice were naturally a source of joy to these club members, but that is not all that pleases them. Their pride in a job well done and the valuable example they have set for their communities, parents, and neighbors are a greater source of satisfaction to them. This was well expressed by a prize winner who made this remark to the agent: "Of course Dad was surprised and pleased at both my yield and profit from my acre of cotton, and Dad jokingly said, 'Maybe I'll try your method next year.' Dad did and so did several neighbors."

In many sections 300-600 pounds of fertilizer may not be a large amount to use on cotton or corn, but in Evangeline Parish where farmers ordinarily use 200 pounds average per acre, this amount seems quite large. When one looks back at the records of fertilizers used in the parish in the past, it is easily apparent that many of the clubsters' neighbors have followed their examples of heavier fertilizer applications and have pocketed bigger profits as a result.

According to official figures of the State Department of Agriculture, about 7 years ago we were using around 950 tons of fertilizer yearly in the parish. From that time on, and especially in the last 4 years, a marked increase in usage has taken place, and this year 3,100 tons were used. Of the mixed fertilizers in this amount, the most used was the 4-10-7 mixture.

Norman Guillory, Ville Platte 4-H Club member and State Champion Cotton Grower in 1939.

The formula 4-10-7 is an unusual one used almost exclusively in our parish. Its origin, fortunately, can be traced to an intelligent study of the soil needs and fertilizer requirements of our parish by the county agent, T. H. Vidrine.

Lack of Plant Food Apparent

Approximately 12 years ago, County Agent Vidrine, after a complete study of fertilizers used in the parish, especially on cotton, became convinced that many farmers were not using the right fertilizers for the highest profits. At that time very little complete fertilizer was being used, and while most farmers were getting good returns from whatever fertilizers they were using, this could be easily accounted for because of a need of all three main plant-food elements in our soils. A study of available experimental data at that time proved his deductions correct. The prairie soils of southwest Louisiana, mostly mixed sandy silt loams, were deficient in nitrogen, phosphate, and potash, but especially the latter two. With this information on hand, he went about preparing for experiments to prove his findings.

The dean of the College of Agriculture and the director of the Experiment Station were contacted and finally approved an outfield experiment station. This station later proved Agent Vidrine was correct in his work on fertilizer needs. Besides the outfield station work, a commercial concern was induced to mix half a ton of 4-10-7, the formula he felt would best meet our fertilizer needs. So well did this experiment turn out, that after 2 years' trial the demand for the mixture was so strong that the formula 4-10-7 was registered with the State Department of Agriculture and put on the market commercially.

Later findings of the outfield station and of the district station have shown a high deficiency of phosphorus and

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American Farm Homes Can Be Beautiful

By R. O. Monosmith

Agricultural Extension Service, State College, Mississippi

THIS subject may seem a bit out of place when sandwiched between today's headlines. The trend of thinking, planning, and action in America today is toward the production of arms, trained men, and food. Reversing the perspective, we see that the arms and trained men are produced to defend American homes. The home is the center of American living. It should be beautiful and held as the symbol of that which we desire most in life.

The tendency, at times, is to lose sight of the real reason behind our desire to grow better crops. Better apples and more productive potatoes are not an end—but a means to an end. In the minds of most thinking folks it means a better home, a more attractive, comfortable, convenient home, and a better way of life.

The art of landscaping the home grounds can be made profitable to the home owner by increasing the value of the real estate and by making the grounds more convenient, more useful, and more attractive. The recreational and educational advantages of landscaping are many, and much may be said regarding the value of orderly, attractive surroundings as an environment for growing children.

Organized effort directed by careful forethought and planning is necessary for successful landscape development. Haphazard methods in locating buildings, fences, walks, drives, and plantings often wreck permanently the opportunity of ever developing a satisfactory landscape arrangement. The locations of permanent improvements such as buildings and roads should be carefully planned to prevent the necessity for changes in these features.

Gradual development of a simple arrangement, following a plan carefully prepared, is the most desirable method of landscaping the home. Rapid development or complex arrangements are expensive, difficult to maintain, and often unsatisfactory. Remember that the plantings in the landscape picture are never stationary, they are growing and changing from year to year. One should plan to revise, replant, replace, or thin plants in the original plan.

Fig. 1. Farm home before landscaping.

The beginning of this lesson in landscape gardening will be an humble one. The home shown in Fig. 1 is imaginary —cut from whole cloth. This is spoken literally. Digressing somewhat from our narrative, an explanation of the pictures should be given here. Small pieces of flannel cloth, cut and painted to resemble buildings and plants, placed piece by piece on a slightly sloping surface of flannel that has been painted to resemble a landscape, where they stick by virtue of the affinity that the two flannel surfaces have for each other, make a most effective demonstration of before and after landscaping.

The neglected home (Fig. 1) with its untidy surroundings was selected as a beginning not because it was a predominant type, but rather to indicate that good planning and endeavor can overcome even the more difficult situations. The unpainted house, rundown fences, rutted drive, livestock in the yard, scattered woodpile, exposed privy, and scattered flower beds are a few of the results of carelessness and neglect. Circumstances sometimes limit the size of the home or the extent of landscaping, but have never limited one's ability to be neat, clean, and tidy.

Fig. 2. The first step in landscape improvement.

In solving this problem the first line of attack would be a campaign that might be labelled "Clean-up, Fix-up, and Paint-up Week." The yard can be landscaped only if livestock such as chickens and pigs are kept in areas made especially for them, and certainly the livestock will find such an arrangement more satisfactory. Painted houses and barns, stacked wood near the kitchen, a convenient clothesline, sturdy fences, and housed farm machinery constitute good farming practices and make a definite improvement in the appearance of the farm home.

A simple landscape plan should be made at this stage of the game—or sooner. The principles to be included in this plan are few and simple. The front lawn should be as large as possible and the lawn expanse unbroken by flower beds or shrub groups. A convenient drive and system of walks should be planned after careful consideration has been given to the highway approach, ease of turning at end of private drive, and directness of travel on walks. Trees are needed for shade, framing, and background. Shrubs and flowers should be grouped along the foundation of the house and around the edges of the yard to enclose the grounds and screen outbuildings.

The home shown in Fig. 1 undergoes a remarkable transformation when the above-mentioned landscape rules are applied to the problem. Fig. 2 shows this home after the pigs and chickens, chicken coop, woodpile, clothesline, wagon, and scattered flower beds have been removed from the front yard. The old implement shed near the highway has been torn down and moved back of the barn. The tumble-down fences have been replaced with sturdy, neat picket fences. The lawn has been plowed, graded, fertilized, and sodded, eliminating the rutted drive and weedy walk. A convenient turn-drive has been built which preserves an open lawn, gives ready access to barn, garage, and house and facilitates easy turning. The walk from drive to house is direct and hard-surfaced. Paint and repair work on the house and barn preserve these structures and add to the beauty of the grounds. It will be noted that a poultry house has been added to the farm building group. The evergreen shrub planted to the left of the house screens the outhouse.

The foundation or base planting on the home grounds is to many home owners the most important part of the home landscape. Figure 3 shows the correct foundation planting for the house in the demonstration.

The following are a few rules which may be applied in making the foundation planting around most homes:

Use shrubs small to medium in size when mature. The foundation planting should not hide attractive features of the house, but should furnish a setting by tying the house to the ground and softening hard lines.

Plant shrubs in groups or masses using three, five, or more plants of the same kind in each group. A large variety of plants is not desirable, but at least a few plants which give variation in foliage or bloom during the year should be used. An entire planting of narrowleaf evergreens often becomes monotonous because of their sameness throughout the year.

Fig. 3. The second step.

Group plants of approximately equal vigor together so that each will be able to compete with the other. Where a mixed planting of evergreens and deciduous plants is used, it is usually desirable to place evergreens near the entrance to add refinement. Use accent plants, such as arbor-vitaes or upright junipers, sparingly. These plants should be placed at entrances, corners, and extremities of building.

Continuous planting around the entire house is not always desirable unless the foundation is high and ugly. It is usually more desirable to allow the lawn to meet the foundation of the house in several places. This creates the impression of stability and eliminates the feeling that the house is resting on a mass of shrubs.

Unless very small plants are used, place inner ones of planting at least four feet from the base of the house. Give plants adequate room for growth.

The front outline of the shrub bed should be gently curved—not square or rectangular in shape. Avoid setting plants in straight rows; they should be staggered.

In most instances a foundation planting is more effective where herbaceous annuals and perennials are not mixed with shrubs or placed in beds in front of them. Such plants are sometimes used effectively alone as a foundation planting for very low houses if the beds are properly maintained. Plan to replace most of the plants in the foundation planting every 8 to 12 years for most satisfactory results.

Border, screen, and enclosure plantings are a vital part of the picture. Figure 4 shows an informal planting of native shrubs and trees such as dogwood, redbud, pine, cedar, and laurel that partially screens the barn and lot. A screen planting has been made between the barn and garage that consists of privet hedge as a background and a bed of hollyhocks or other perennials in the foreground. Another form of screen and background planting is the vine-covered trellis. A trellis should be attached to the house or one of the

Fig. 4. The third step.

outbuildings, arbor, pergola, or strong gateposts. In this picture the rose trellis is attached to the garage and terminates at a gate that opens into the service yard which contains clothesline, woodpile, and garden. An annual flower bed is placed directly in front of the trellis and may be 4 to 8 feet in width. The planting made within the

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There's Enough Potash for National Defense

By J. W. Turrentine

Washington, D. C.

Presented at a meeting of Government Officials and members of the fertilizer industry in Washington, D. C., October 23, 1941, to discuss problems of the industry in the present national emergency.

IN addressing this group it is unnecessary for me to go into any detailed recital to describe the development of the American potash industry which has taken place since 1911 when we as a nation first decided that we should have a potash industry of our own. It will suffice to present some of the highlights of a 30-year period during which this development has been under way.

For example, in the calendar year 1913, the last normal year before the beginning of World War I in 1914, there were consumed in the United States 250,000 tons of K_2O and we produced an amount so small as to escape the notice of the statistician. Ten years later in 1923 there were consumed 227,000 tons K_2O and we produced 20,215 tons. In 1933 domestic consumption approximated 214,000 tons and we produced 143,378 tons. In 1941 there will have been delivered approximately 475,000 tons from domestic production and to date we have imported only 5,000 tons.

Thus in 1913 domestic production amounted to a fraction of 1% of the total, for in that year the only potash industry that we had was strictly embryonic, the plant of the American Trona Corporation, now the American Potash and Chemical Corporation just being started. In 1923 domestic production amounted to 9% of domestic consumption; in 1933, 67%; and in 1941, 101%. During some of these years exports of high-grade muriate amounted to considerable tonnages, but the foregoing figures relate to production and not to the total of the domestic commodity that was consumed domestically. In 1939 at the outbreak of World War II these exports were abruptly terminated by the producers and the equivalent of potash salts was immediately made available for domestic consumption. However, exports were continued by non-producers in increasing amounts, making necessary the imposition of Federal export licenses effective in February 1941 to protect the farmers' interests. Simultaneously, importations from Europe were largely curtailed, being reduced now to the present level of an occasional shipment from Spain.

Wholesale Prices Decrease

It is of interest also to note the changes in wholesale prices which have taken place during this period: 1913, 72.7¢ per unit K_2O in muriate; 1923, 58.8¢; 1933, 66.2¢; and in September 1941 with a 6% discount applying, 50.3¢ per unit K_2O. As is well known to this group, some 90% of the agricultural potash is sold under the maximum discount of 12%, which means the 1941 price is actually nearer 47.1¢. Accordingly, in this showing of decreasing prices over the years it is difficult to find any justification for apprehension over any drastic price increases.

In analyzing the supplies of potash which we have every reason to expect to become available during the current fertilizer year and balancing them against requirements for the agricultural and chemical industries which, of course, must be based on past consumption, we find that against an anticipated requirement of 494,000 tons K_2O which must be supplied by the American industry there is a production capacity already existing or being installed fully equal to that tonnage. To balance the account for the immediate present and pending the completion of expanding facilities, it has been necessary to include 28,000 tons K_2O in the form of crude salts analyzing 22% to 25% K_2O, the balance of 466,000 tons K_2O being refined potash salts principally of the 60% K_2O grade of muriate.

With such progress in meeting a national emergency having been made to date, surely we may look forward to the future with a great deal of confidence, although at present it is difficult to forecast with any accuracy the immediate effects of the contemplated great expansion in food production—"Food for Defense"—and the expansion in fertilizer requirements which may result therefrom. Such increments in consumption are hard to translate into terms of increased demands for plant foods, but it is clear that if they are to be produced with maximum efficiency, plant foods in optimum amounts will have to be employed in their growing.

Production Expanding

But even with the increase in demand to be anticipated within the immediate future, potash supplies should prove to be ample, principally as the result of expansions in production capacities now under way. During the next fertilizer season, 1942-43, it seems reasonable to expect a total of 585,000 tons K_2O in the form of refined salts as available for the agricultural and chemical industries of this country. In addition thereto, there will still be some 50,000 tons K_2O in the form of crude run-of-mine salts.

This represents a probable 25% increase over the current year, adequate of course for a corresponding increase in food production at current rates of application. This estimate assumes continuous operation at capacity and adequate transportation facilities. It precludes exports except to Canada and Cuba. It precludes hoarding or speculative buying and it imposes the necessity of equitable distribution in terms of customer requirements and grades of salts.

The increase in raw salt deliveries referred to represents something of a reversal in form, but to an insignificant degree as shown by the fact that the 28,000 tons K_2O, which are the estimated minimum requirement in this form during the current season, represent only 7% of the total K_2O to be delivered in the form of KC1 as compared with 10% in 1936, 16% in 1935, 30% in 1934, 40% in 1933. Further it should be noted that in these earlier years cited a large percentage of these low-grade salts contained considerably less than the 22% to 25% K_2O content of the raw salts now being delivered from the Carlsbad mines.

These raw salts are still entirely adaptable to the manufacturing of fertilizers, particularly in certain sections of the United States where the total plant-food content of the mixtures has not increased at the same rate as in other sections. This is indicated by citing figures showing the average plant-food content of mixed goods in the several sections of the United States. Against a nation-wide average of some 19% plant food, the average for the New England states is 26%, Middle Atlantic 21%, Southern 17%, Midwestern 22%, and Western 24%. To further illustrate this situation, if raw salts were used exclusively in the preparation of mixed goods in the Midwest, after adding the required amount of 20% superphosphate and of raw salts, there would be only 110 pounds left for the addition of nitrogen carriers and conditioners, while in the Southern states there would still be room for 730 pounds for these additions.

These illustrations are sufficient to show that there are on the market

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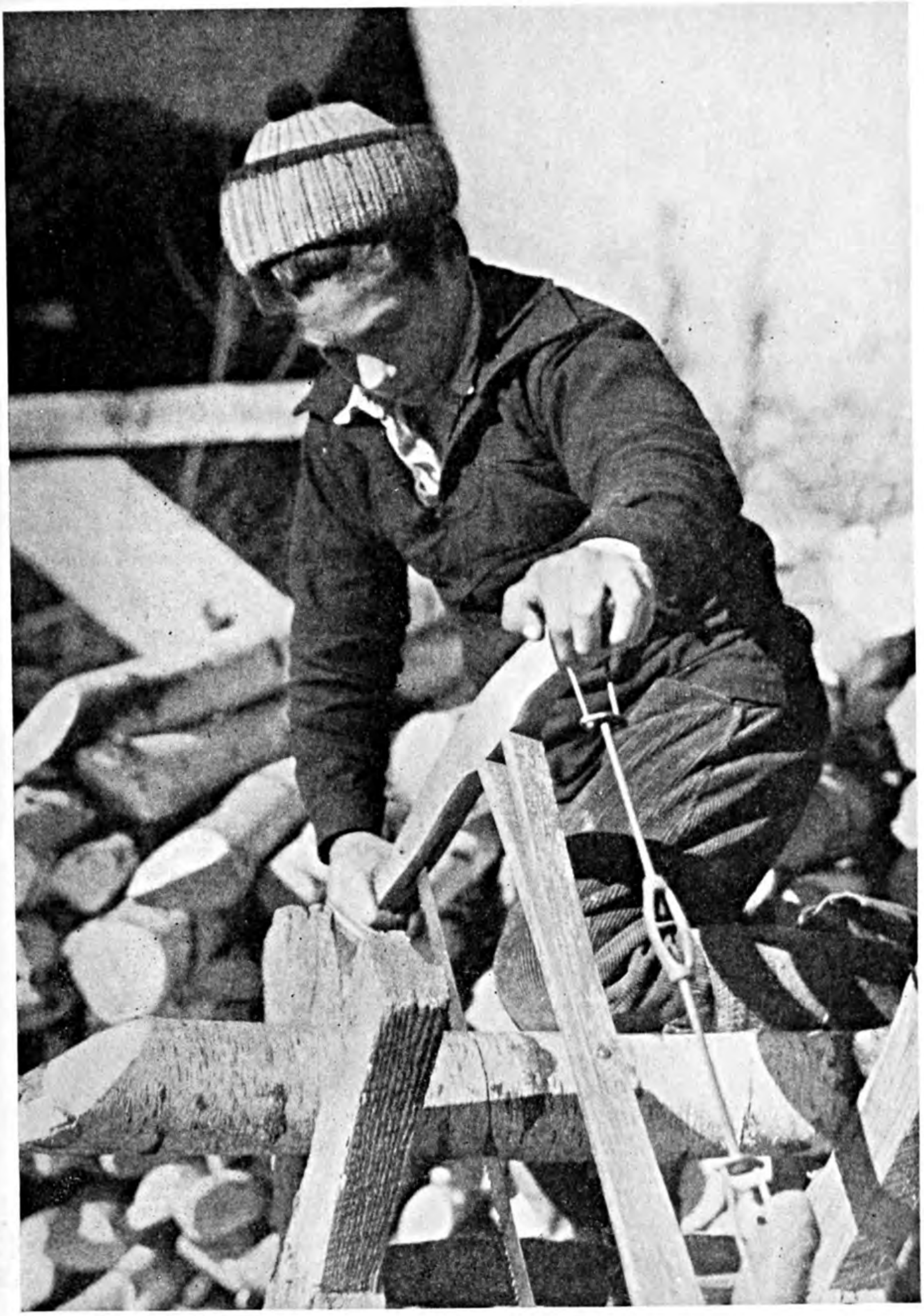
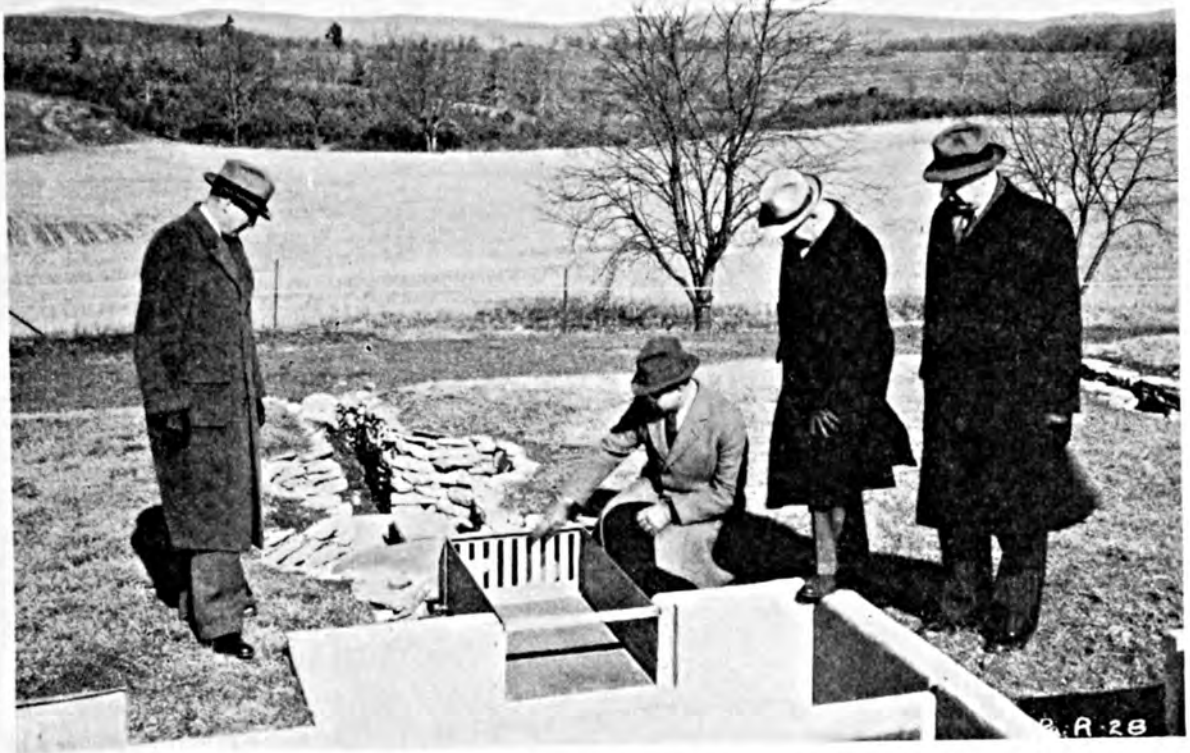
PICTORIAL



AS GOOD AN EXERCISE AS FOOTBALL, BUT . . .

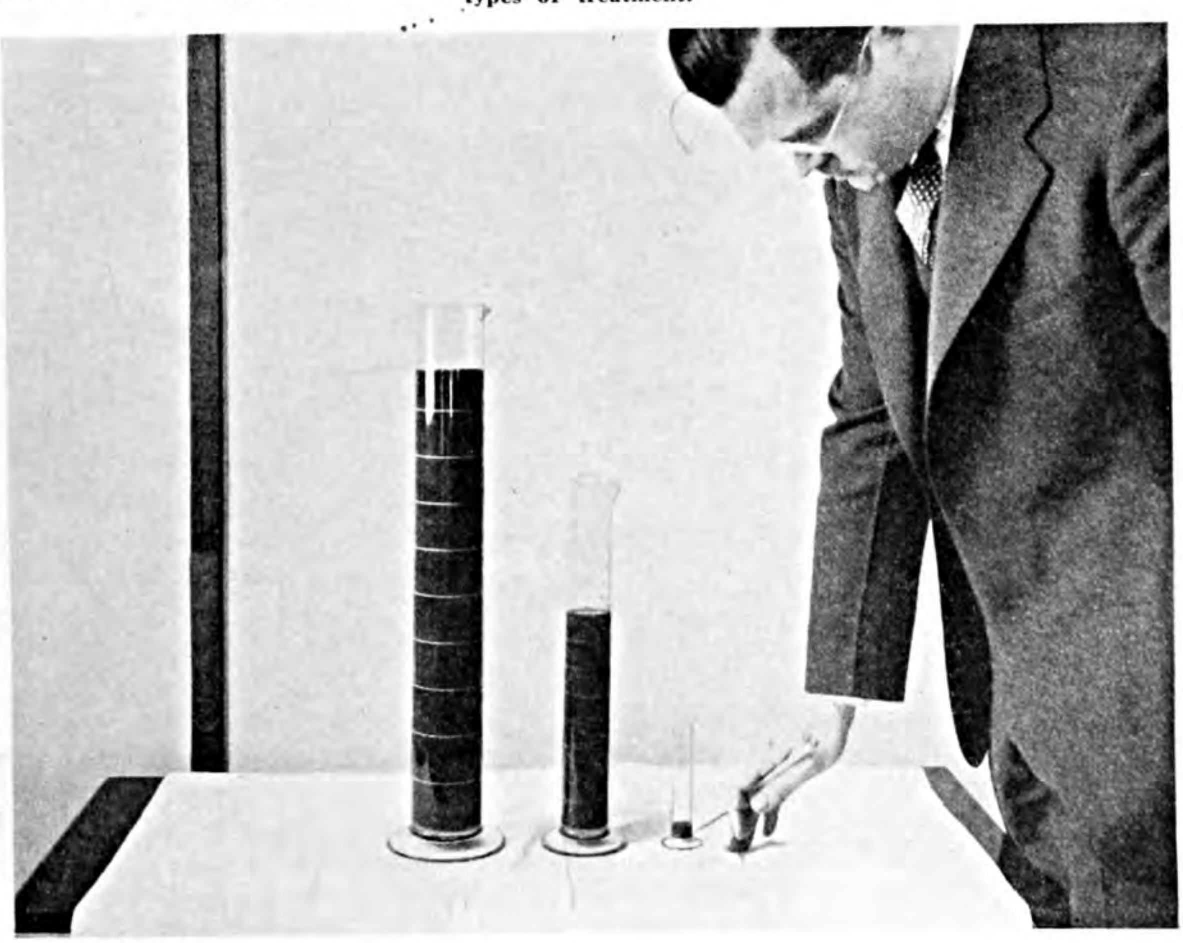
Above: This new pasture in Randolph County, North Carolina, is terrace contoured and affords good cover on a steep slope.

Below: These terraces broke. Made with inadequate knowledge and power, many of the South's first earthworks redoubled ruin.



Above: Soil Conservation Service experts inspecting a catchment basin on one of the plots at State College, Pennsylvania.

Below: Dr. Nolan F. Farris, of State College, examining the differences in soil losses under various types of treatment.



Left: Lime, phosphate, and legumes increased corn yields on this Tennessee farm from almost nothing to 50 bushels per acre.

Below: Corn picker in action on the Borneman farm, Hennepin, Illinois. Yield here was 70 bushels per acre.

The Editors Talk

Fertilizer Ratios

In the belief that the Report of the Sub-committee on Fertilizer Ratios presented at the annual meeting of the American Society of Agronomy in Washington, D. C., Nov. 12-14, 1941, will be of interest to a great many of our readers, we obtained permission to publish it and are pleased to present it herewith in full with the exception of the table mentioned.

"The Committee has given consideration to several questions which have a fundamental bearing on the more efficient production and use of fertilizer, and hence are of interest to both the manufacturers and purchasers of fertilizer.

"The following suggestions and recommendations are made:

"1. That as fast as possible, grades of mixed fertilizer containing less than 8 units of nitrogen, or potash, or of the two together shall be removed from Recommended lists and from price lists.

"2. That in preparing lists of recommended grades, attention be given to a ratio system, with the idea that ultimately all grades, either recommended or sold, shall follow the accepted ratios. (Majority report.)

"3. That for grades in which value is claimed for minor elements, the quantities present be guaranteed.

"4. Only in cases where cooperation between the Industry and agronomists fails to result in the offering for sale of grades considered necessary by agronomists, shall grades appear on Recommended lists which are not offered for sale in the state concerned. (Majority report.)

"Data collected by members of the Committee in the various districts in which they are located have permitted of the compilations presented in Table 1 concerning the grades recommended and sold in the different states.

"It is evident that many states, namely, Oklahoma, Mississippi, Louisiana, Arkansas, Texas, and Alabama, have gone a long way in the reduction of the number of grades offered for sale and in promoting the sale of recommended grades. On the other hand, some states have apparently made little progress in the solving of these problems. In some states, the number of grades sold, and in some cases recommended, that contain less than 20% of plant food, is astounding. WHY WASTE LIMITED TRANSPORTATION FACILITIES IN SHIPPING LOW GRADE FERTILIZER?

"The large per cent of the total sales which is made up of sales of the '10 best sellers,' in virtually all states, is encouraging and indicates that the number of grades offered for sale may be markedly reduced to the advantage of both the manufacturer and purchaser.

"It is recommended that cooperation between the Industry and agronomists be continued in an effort to (a) reduce the number of grades offered for sale in states where the number is large; (b) to promote the sale of Recommended grades; and, (c) to discontinue the sale of grades containing less than 20% of plant food.

Closer association of the Industry and agronomists and control officials is urged in solving the problems continually arising in connection with the production, licensing, and use of fertilizers.

"The Committee expresses appreciation to control officials, representatives of the Industry, and agronomists for the assistance during the year. We shall call upon you for more help."

Fertilizing Soybeans

With National Defense calling for a step-up of acreage of soybeans to be harvested as beans from 5,500,000 acres in 1941 to 7,000,000 acres in 1942, a great many growers are going to be concerned with problems of fertilizing the crop. We feel fortunate, therefore, in being able to present in this issue an article by Mack Drake and George D. Scarseth which includes the first recommendations on the latest results of research. The discussion of soybean nutrition is fundamental to the growing of the crop anywhere, and emphasizes among other things the need for nutrient calcium. The fact that soybeans are no longer considered a soil-conserving crop is borne out by the information on the plant food removed by good yields. Practices to best meet this removal and insure success with the crop are suggested. Reprints of this article will be available.

G. J. Callister

The many friends of G. J. Callister, for so long associated with this magazine as Vice-president and Secretary of the American Potash Institute, will be interested in his recent appointment as General Secretary of the Canadian Society of Technical Agriculturists for the duration of the war, assuming the duties of C. Gordon O'Brien who was called into active military service on October 6.

Mr. Callister resigned his position in the States early in 1940 to return to his farm in Ontario and render service to his country in any capacity possible. Since that time he has taken an active part in relation to the farm labor problem as Chairman of his District Farm Labor Committee. In cooperation with the Ontario Department of Agriculture and the Junior Farmers, he has acted as judge of Farm and Home Improvement projects and as Convener in his District for the Farm Radio Forums. He is a member of the Ontario Pear, Plum, and Cherry Growers Marketing Board, the Ontario Peach Growers Cooperative Association, and of several scientific societies, among them the American Chemical Society, the Soil Science Society of America, and the American Society of Agronomy.

His wide experience in the field of technical agriculture, combined with his contacts with practical agriculture and current farm problems, fit him unusually well for his new duties as Secretary to the Canadian Society of Technical Agriculturists.

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

¶ Everyone who is interested in the growing of apples or in the field of symptomology in plants will find Canadian Department of Agriculture Technical Bulletin 32, "Apple Nutrition," by M. B. Davis and H. Hill worthy of careful study. The authors briefly describe the functions of the nutrients required by apple trees and follow this with a section devoted to the balance of nutrients, a very important factor frequently overlooked.

A major part of this bulletin is devoted to a careful description of the appearances of leaves, bark, fruit, and other parts of the tree that may be of significance in diagnosing nutrient deficiencies. This section is accompanied by some excellent color plates illustrating nitrogen, phosphorus, potassium, magnesium, calcium, and boron deficiencies as well as nitrogen excess. Careful descriptions are given to permit the distinguishing of symptoms which at first glance appear to be similar but which in reality indicate different deficiencies. Specific recommendations for overcoming each deficiency and general fertilizer recommendations for a balanced fertility program are given.

The authors stress the importance of a well-balanced complete fertility program correlated to the nutrient status of the soil and the leaves of the trees. As a general recommendation they suggest a 9-5-7 fertilizer at the rate of 700 pounds per acre. Where leaf-scorch due to potash deficiency is present, it is recommended that nitrogen be omitted from the fertilizer for a season and thereafter a 4-8-10 fertilizer used.

¶ The results of an intensive study of rust (potash hunger) and fusarium wilt of cotton over a period of nine years are presented and discussed in Arkansas Agricultural Experiment Station Bulletin 410, "Relation of Fertilizer Balance to Potash Hunger and the Fusarium Wilt of Cotton," by V. H. Young and W. H. Tharp. Three varieties of cotton ranging from highly susceptible to highly resistant to the fusarium wilt were grown on an alluvial soil in eastern Arkansas known to be rather low in available potash. Fertilizers containing different ratios of nitrogen, phosphoric acid, and potash were applied to the cotton, and the number of plants attacked by the wilt and yield of seed cotton were determined.

The data showed that the amount of wilt varied more among the varieties than within a particular variety due to fertilizer treatment. There were, however, highly significant differences within the varieties due to the ratio of nutrients in the fertilizer applied. Omitting nitrogen reduced the yield and also reduced wilt incidence, especially on the susceptible variety. Reducing phosphoric acid reduced yield less than when nitrogen was omitted but decreased the wilt more than when nitrogen was omitted. Decreasing potash reduced yields to the lowest of all plots except unfertilized plots and increased the wilt to the greatest of all plots. These effects were most noticeable in the susceptible variety but were also evident in the other varieties.

The standard fertilizer application was 600 pounds of 6-8-6 per acre. Increasing the potash to 12% increased yields and decreased the wilt compared to lower applications of potash. Increasing phosphorus and nitrogen but not increasing potash increased the incidence of wilt. The authors state that in the experiment potash applications gave a definite control of rust, or potash hunger, and a very marked control of wilt, while high applications of nitrogen and phosphate or of phosphate alone without potash were either ineffective or even detrimental from the standpoint of rust and wilt control. It was observed that when plants showed more rust or potash deficiency symptoms they were much more susceptible to attacks of fusarium wilt. It is recommended that fertilizers be properly balanced with respect to nitrogen, phosphoric acid, and potash in order to control potash hunger and fusarium wilt.

"Shipments of Various Fertilizers in Arkansas by Counties During the Fiscal Year Ending June 30, 1941," St. Dept. of Revenues, Little Rock, Ark.

"Grades of Fertilizer and Material Approved to Be Sold in the State of Arkansas, 1941-1942," St. Dept. of Revenues, Little Rock, Ark.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended June 30, 1941," St. Dept. of Agr., Sacramento, Calif., Bu. Chem. Anns. FM-28, Sept. 23, 1941.

"Commercial Fertilizer Registrants to Date for Fiscal Year Ending June 30, 1942," St. Dept. of Agr., Sacramento, Calif., Bu. Chem. Anns. FM-29, Sept. 24, 1941.

"Agricultural Minerals Registrants to Date for Fiscal Year Ending June 30, 1942," St. Dept. of Agr., Sacramento, Calif., Bu. Chem. Anns. FM-30, Sept. 24, 1941.

"The Penetration and Availability of Metaphosphates in Soils," Agr. Exp. Sta., Newark, Del., Bul. 229, Tech. 27, Apr. 1941, G. M. Gilligan.

"Phosphate Fertilizers for Soil Improvement in Iowa," Agr. Ext. Serv., Ames, Iowa, B. M. Kilpatrick.

"Commercial Fertilizers in Kentucky in 1940," Agr. Exp. Sta., Lexington, Ky., Reg. Ser., Bul. 26, June 1941, J. D. Turner, H. R. Allen, and Lelah Gault.

"Official Report—Commercial Fertilizers, Feeds, and Agricultural Liming Materials," St. Insp. Serv., College Park, Md., Control Ser., No. 179, Aug. 1941.

"Fertilizer Grades and Fertilizer Materials to be Registered and Sold in the State of Mississippi for the Year 1942," St. Dept. of Agr. and Comm., Jackson, Miss., Oct. 10, 1941.

"Fertilizer Experiments with Acala Cotton on Irrigated Soils," Agr. Exp. Sta., State College, N. Mex., Bul. 280, May 1941, D. A. Hinkle and Glen Staten.

"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 1942," Agr. Exp. Sta., Raleigh, N. C., July 25, 1941.

"Studies of the Causes of Malnutrition in Cane Fruits," Agr. Exp. Sta., Corvallis, Oreg., W. L. Powers and H. E. Clark.

"Fertilizer for Rice in Texas," Agr. Exp. Sta., College Station, Tex., Bul. 602, June 1941, R. H. Wyche.

"Report of Inspection Work, Commercial Fertilizers," St. Dept. of Agr., Charleston, W. Va., Bul. (n.s.) 26, July 1, 1941.

Soils

¶ Organic matter is one of the most important constituents of soil. The primary and secondary effects of organic matter are what determine whether a soil is "live" or "dead." The micro-organisms in a soil, so important in the numerous processes continually going on there, are determined to a large extent by the organic matter present. Fertilizers also cannot as a rule perform in the most satisfactory manner if the organic matter in the soil is not of the proper kind and amount, while many of the chemical, as well as the physical, properties of the soil are largely influenced by the organic matter content. An interesting bulletin on this important subject, "Humus for Oregon Soils," Station Circular 143, Oregon State College, has been prepared by R. E. Stephenson. The author briefly discusses most of the above relationships, as well as methods of building up the organic matter content by means of manure and soil management so as to aid in maintaining a proper organic matter content.

¶ In recent years there has been a great deal said and written on the subject of soil erosion. The disastrous effects of uncontrolled soil erosion on the individual farmer, as well as the Nation as a whole, certainly warrant proper attention to this subject. Three bulletins this month deal with soil erosion from the practical and popular viewpoint. One of these is entitled "Conserving Georgia Soil" by Frank C. Ward, issued as Bulletin 485 of the Georgia Agricultural Extension Service. Another is Maine Extension Bulletin 288 by M. G. Huber and W. B. Oliver. This is entitled "Soil Erosion in Maine and Its Control." The third is Wisconsin Agricultural Experiment Station Bulletin 452, "Cropping Systems That Help Control Erosion," by O. E. Hays and N. Clark. All of these publications use excellent illustrations and short descriptive material to show various ways of controlling erosion, as adapted to the soil, climate, and crops grown in the respective states.

Two other bulletins deal with soil erosion from a more technical viewpoint. In Rhode Island Agricultural Experiment Station Bulletin 277, "A Study of Soil Erosion in the Agricultural Areas of Rhode Island and the Comparative Erodibility of Five Major Soil Series Associated with these Areas," by Ernest A. Perry, the results of a survey of the amount of soil erosion that has occurred in the State are given. While there is some erosion in Rhode Island, fortunately it is not nearly so bad as in some other states due to the large areas that are in grass sod. A study of the erodibility of the soils disclosed that most of those in the State would erode rather severely if improperly handled. Therefore, it behooves farmers to continue and even increase the farming practices whereby soils are covered most if not all the year with sods and cover crops so as to reduce the possibility of erosion.

Since erosion to a large extent is determined by what happens to water when it falls on the surface of the soil, a study of the condition of the surface of the soil and its influence on the action of water falling on it is of fundamental importance in studying soil erosion. Circular 608 of the U. S. Department of Agriculture, "Surface Condition of Soil and Time of Application as Related to Intake of Water," by F. L. Duley and L. L. Kelly presents significant and interesting data on what happens to water when it falls on soils with different types of cover on the surface. It was found that in the case of bare soil the rate of intake of water falling on it decreased very rapidly and finally became constant at a low point, due apparently to the formation of a thin and compact layer of soil on the surface which tended to cause the water to run off rather than to soak in. When straw covered the surface of the soil, the rate of intake did not fall so rapidly or so low since the mulch apparently retarded the formation of the compact surface layer of soil. Of importance in this connection is the fact that even after run-off does begin the straw seems to reduce the erosion greatly since the water carries very little soil material. When the soil was covered with a sod, results similar to those in the case of a straw mulch were obtained, although the final rate of intake of water was slightly lower than in the case of the straw mulch.

¶ A comprehensive study of the soils of Puerto Rico from the chemical viewpoint has been made by J. A. Bonnet and published in Research Bulletin 1 of the Agricultural Experiment Station at Rio Piedras, entitled "Chemical Data of Puerto Rico Soils." Soil samples were systematically and carefully taken in connection with soil survey work and the pH, total nitrogen, organic matter, and one per cent citric acid soluble phosphoric acid, calcium oxide, and potash were determined. Correlations among these various factors for both humid and arid soils were calculated. Significant negative correlations between hydrogen-ion concentration and available calcium oxide were found for both the humid and arid soils. This was the only significant correlation found in the case of the arid soils. In the case of the humid soils, positive and significant correlations were found between available phosphoric acid and lime, between available phosphoric acid and total nitrogen, between available potash and organic matter, and between total nitrogen and organic matter. The humid soils were about 52 times more acid than the arid soils, contained about twice as much organic matter and about half as much available phosphoric acid and lime. Both arid and humid soils contained about the same amount of total nitrogen and available potash. Field results carried out on a limited scale showed fairly good correlation of fertilizer applications of phosphoric acid and potash to the amounts found in the soil by the one per cent citric acid extraction.

"Summer Fallow in Kansas," Agr. Exp. Sta., Manhattan, Kans., Bul. 293, Mar. 1941, R. I. Throckmorton and H. E. Myers.

"Soil Survey, Jefferson County, Tennessee," U. S. D. A., Washington, Ser. 1935, No. 20, July 1941, J. W. Moon, Howard Wm. Higbee, Wallace Roberts, Foster Rudolph, G. M. Welles, and L. J. Strickland.

Crops

¶ Muscadine grapes are with good reason popular in many places in the South. A good bulletin summarizing experimental work on growing this desirable fruit has been prepared by E. F. Savage, et al., as Bulletin 217 of the Georgia Experiment Station entitled "Further Studies with the Muscadine Grape." Botanical characteristics and classification, chemical characteristics of fruit, considerations to be given to locating the vineyard with reference to local weather factors and soils, suggested varieties, planting systems, including suggested locations of the male vines, propagation, planting, training, pruning, fertilizing, harvesting, controlling diseases, insect pests, and utilization of the grapes, all are discussed more or less in detail.

It is suggested that cover crops be used in order to control erosion and supply organic matter to the soil, for which purpose Austrian winter peas, rye, and vetch are suggested. If manure is available, it is stated, this makes an excellent material for fertilizing the vines. Lacking large supplies of manure, fertilizers should be used, those in a 1-1-1 ratio such as 6-6-6 being considered the most desirable. The rate of application should be a quarter to a half pound per vine the first year with increases during the second and third year to about 1 pound per vine in May and again in July. For bearing vines 300 to 400 pounds per acre of this same fertilizer can be used in two applications, one in the middle of April and the other in July. If there is too much vine growth from this fertilization, nitrogen should be reduced.

¶ Considerable interest has been aroused in recent years over the possibility of drilling small amounts of limestone with legume seed in order to obviate the necessity of making heavy broadcast applications of lime to obtain good stands of legumes when grown on acid soil. Results obtained in Missouri experiments are summarized in Missouri Agricultural Experiment Station Bulletin 429, "Drilling Limestone for Legumes," by W. A. Albrecht. The author feels that in the use of limestone so much attention has been given to the acid-correcting properties of this material that the calcium added and available to the plant as a nutrient tends to be overlooked. He feels this calcium is at least as important as the acid-correcting properties of the limestone so far as legumes are concerned. While the calcium requirements of legume crops are comparatively high, the actual number of pounds is not so great, provided the calcium can be applied to the plant in a way that all of it is available to them.

Applying the limestone very close to the seed by means of a grain drill offers a method of getting the lime close to the seed. The limestone should be rather finely ground so that practically all of it passes through a 10-mesh sieve and with more than a quarter of it going through a 100-mesh sieve. In addition to limestone, other calcium compounds such as acetylene plant waste, lime tailings, hydrated lime, and other forms may be substituted for limestone. If the lime is applied by means of a grain drill so that the material is put in rows, about 500 pounds per acre will frequently be sufficient. It need not be drilled deeply and should be applied when the legume seed is planted. This application will take care only of the crop being sown, and when the field is reseeded to a legume an additional application is likely to be needed. The author points out that important as lime is, other factors such as phosphorus, potassium, nitrogen-fixing nodules, moisture, proper drainage, and others should be given proper consideration if success with the crop is to be obtained.

¶ Agricultural experiment stations in practically all states have been effectively advocating the more extensive growing of legumes for many years. The national agricultural programs are giving greater emphasis to this movement, resulting in numerous publications dealing with these crops. Indiana Extension Bulletin 242, "Essentials of Alfalfa Production," by M. O. Pence, briefly points out the advantages of growing this crop, the soils on which it is adapted, the plant foods it removes, drainage needed, the degree of acidity that can be tolerated, seedbed preparation, seeding, desirable varieties, inoculation, fertilization, place in the rotation, time and number of cuttings, top-dressing, and utilization as hay and pasture.

As an average recommendation it is suggested that 300 pounds per acre of an 0-12-12 fertilizer be used when seeding the crop, with a top-dressing in the spring of the same rate and kind of fertilizer on an old stand. If manure is available in sufficient amounts, this also makes a good top-dressing.

Extension Bulletin 258 of the same Station, "Korean and Other Lespedezas," by K. E. Beeson, gives similar information on this group of legumes. A mimeographed pamphlet issued by the Alabama Agricultural Experiment Station entitled, "Lespedeza Sericea for Tennessee Valley," by F. Stewart, gives recent information on soil, fertilization, seeding, and harvesting of this legume which is becoming more popular as its uses are becoming more familiar. On the fertilization of the crop it is stated that the equivalent of 500 pounds of 16% superphosphate and 200 pounds of muriate of potash should be applied when preparing the soil.

¶ A much more elaborate and detailed study of legumes has been prepared by E. H. Graham and issued as Miscellaneous Publication 412 of the U. S. Department of Agriculture entitled, "Legumes for Erosion Control and Wildlife." The use of legumes by man and animal for various purposes and the interesting characteristic of nitrogen fixation by nodules on the plant are discussed, bringing out that not all legumes possess this peculiar ability nor is the phenomenon limited to legumes. Brief sections are devoted to legumes which are considered as weeds and those which are poisonous to certain animals, to the insects and diseases attacking the plants and their use in connection with bee keeping and honey production. Slightly longer sections are devoted to the use of legumes in controlling erosion and in connection with wildlife conservation. The establishment, growing, and fertilization of the plant are very briefly discussed. The main part of the bulletin is devoted to the classification and nomenclature of legumes with brief notes on the characteristics, adaptations, and uses of the many species listed. Common and Latin names are given with drawings of many of the plants. A rather unusual section is one which lists wildlife animals and under them the legumes they are known to eat.

¶ With much more attention being given to livestock production in the South the efficient utilization of pastures is of greater importance than ever. Alabama Experiment Station Leaflet No. 7, "Pastures for Alabama," gives brief and practical information on the subject. Careful consideration to the fertility of the soil is recommended. Lime will be needed if the soil is acid and phosphate usually is required. It is stated that when white clover is in the pasture, potash in many cases is required. On some soils potash, in addition to phosphate and lime, has been found to be essential for any kind of satisfactory growth, while in some other soils the results were not conclusive. It is recommended that 50 pounds muriate of potash per acre be applied annually on at least part of all pastures to see what results will be produced, and from this conclusions can be drawn as to whether potash should be used regularly in the fertility program of the pasture.

¶ Rose growers will find that Virginia Agricultural Experiment Station Bulletin 334, "Experiments on the Culture of Hybrid Tea Roses," by A. G. Smith, Jr., contains much interesting and useful information on the growing of these popular flowers. A summarized literature review covering more than 50 different articles furnishes a good background for the subject. Extensive experiments are then described in detail although only two of the eight general subjects under investigation are covered in this bulletin. The author states that he approached the control of black-spot from the viewpoint that a healthy, vigorous plant is less susceptible to this disease than a plant of lower vitality, and he apparently has been successful in keeping the disease to a minimum in this way. He states in his conclusion that the hardy, vigorous growth obtained in the experiments is to be attributed primarily to the use of fertilizers high in phosphate and potash and low in nitrogen. Manure worked into the sub-soil appeared to be very beneficial, while acidity of the soil did not seem to have much effect in this work. Based on the experiments, the author makes a number of recommendations including thorough drainage; deep and thorough preparation of the soil, including the deep incorporation of manure; the use of generous amounts of complete commercial fertilizer such as 2-8-10 or 5-10-10 except where plenty of good manure is used, in which case 0-14-6 may be substituted with the rate of application 4 to 5 pounds per 100 square feet; the planting of good plants of suitable varieties; the avoidance of crowding; proper mulching and watering; only moderate pruning; and proper spraying to control diseases.

¶ Growers of bright tobacco will find Virginia Experiment Station Bulletin 329, "Experiments on Flue-cured Tobacco," by E. M. Matthews and T. B. Hutcheson, contains much practical information which will enable them to grow their crops more profitably. The function of the more important nutrients in the tobacco and particularly their general effects on the plants are briefly given. The relationship to spacing and height of topping to the best kind of fertilizer to use, sources of the plant nutrients in fertilizers, and time and method of fertilizer application are covered. It is recommended that for the production of cigarette tobacco, plants should be spaced 20 to 24 inches in rows 4 feet apart, and topping should leave 14 to 20 leaves to the plant. In the plant bed 1 to 3 pounds of a 4-8-3 fertilizer should be applied per square yard. Under average conditions a fertilizer analyzing 3% nitrogen, 10% phosphoric acid, and 6% potash at the rate of 1,000 pounds per acre at planting is recommended. On the heavier soils the application may be reduced to 800 pounds or the nitrogen in the fertilizer may be reduced.

It is frequently desirable to apply extra nitrogen or potash in addition to that supplied at planting time. This extra plant food can best be given as a side-dressing about 20 days after transplanting. In experimental work the recommended 3-8-6 was compared with the 3-8-3 analysis, and it was found that the extra value produced by the 3-8-6 fertilizer was more than enough to pay for the entire fertilizer bill.

Growers have frequently found that when they used high-potash fertilizers at planting time they did not get the expected improved results. The authors found that this was due to injury from the large amount of fertilizer near the roots. If the fertilizer is applied in a band to the side of the plant, this injury does not result. Unless modern machinery is available for applying fertilizer in this improved way, a split application of 6% potash in the fertilizer at planting time plus a side-dressing after transplanting is likely to be the most satisfactory.

It has been found that the fertilizer should contain about 2% chlorine for optimum results. If less than this amount of chlorine is used, maximum yields are not obtained, while when more than this amount is used the quality of the tobacco frequently suffers. Information on varieties, rotations, priming, and curing is also given in this excellent bulletin.

"Fall Sown Oats Is Good Feed Insurance," Agr. Ext. Serv., Little Rock, Ark., Leaf. 4 (Rev.).

"Diseases of Fruits and Nuts," Agr. Ext. Serv., Berkeley, Calif., Cir. 120, Jan. 1941, Ralph E. Smith.

"Thirty-fourth Annual Report of the Department of Agriculture for the Year 1939," Dept. of Agr., Prov. of B. C., Victoria, B. C.

"Tobacco Substation at Windsor Report for 1940," Agr. Exp. Sta., New Haven, Conn., Bul. 444, May 1941, P. J. Anderson, T. R. Swanback, and S. B. LeCompte, Jr.

"Spinach Growing in Delaware," Agr. Exp. Sta., Newark, Del., Hort, Pamph. No. 3, July 1941, E. P. Brasher.

"Twentieth Annual Report, 1939-1940," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 31, July 1940.

"1940 Annual Report," Agr. Ext. Serv., Athens, Ga., Bul. 481.

"Processing and Chemical Investigations of Taro," Agr. Exp. Sta., Honolulu, T. H., Bul. 86, June 1941, John H. Payne, Gaston J. Ley, and George Akau.

"Report of Progress in Solving Idaho's Farm Problems—Forty-eighth Annual Report for the Year Ending December 31, 1940," Agr. Exp. Sta., Moscow, Idaho, Bul. 239.

"Extension Projects in Agriculture," Agr. Ext. Serv., Urbana, Ill., ES940, Rev. Dec. 1940.

"Ten Pointers on Tree Windbreaks," Agr. Ext. Serv., Lafayette, Ind., Leaf. 189, Rev. May 1941.

"Twelve Pointers on Farm Wood Lands," Agr. Ext. Serv., Lafayette, Ind., Leaf. 225, May 1941.

"Suggestions for Coaches and Participants in Crops Judging," Agr. Ext. Serv., Lafayette, Ind., Bul. 255, Feb. 1941, F. E. Robbins and W. Robert Amick.

"Grass Silage," Agr. Ext. Serv., Lexington, Ky., Cir. 361, May 1941, W. P. Garrigus.

"Biennial Report of the Rice Experiment Station, Crowley, Louisiana, 1939-1940," Agr. Exp. Sta., University, La., J. Mitchell Jenkins.

"Strawberries for the Home Garden," Agr. Ext. Serv., University, La., Cir. 220, June 1941, G. L. Tiebout.

"Eggplant," Agr. Ext. Serv., University, La., Cir. 222, June 1941, G. L. Tiebout.

"Forest Planting Manual for Louisiana," Agr. Ext. Serv., University, La., Cir. 223, June 1941, John Richard Dilworth.

"History of Cooperative Extension Work in Michigan, 1914-1939," Agr. Ext. Serv., East Lansing, Mich., Bul. 229, June 1941.

"Proso—A Grain Millet," Agr. Ext. Serv., East Lansing, Mich., Bul. 231, Oct. 1941, C. R. Megee.

"Factors Affecting Size and Color of Fruit," Agr. Exp. Sta., Columbia, Mo., Bul. 428, Apr. 1941, A. E. Murneek.

"Grafted Grapes in Missouri," St. Fruit Exp. Sta., Mountain Grove, Mo., Bul. 30, Apr. 1941, Paul H. Shepard.

"Field-crop Experiments at the Conservancy District Substation, 1938-1940," Agr. Exp. Sta., State College, N. Mex., Bul. 279, Apr. 1941, Rufus Stroud.

"Effect of Irrigation Practices on the Growth and Yield of White Grano Onions," Agr. Exp. Sta., State College, N. Mex., Bul. 281, May 1941, A. S. Curry.

"The Production of Quality Hay," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 461, May 1941, E. S. Harrison, E. S. Savage, and H. B. Hartwig.

"Soybean Seed Production in Tennessee," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 145, Mar. 1941, H. E. Hendricks and H. W. Wellhausen.

"Competition Influence on the Root Systems of Jack and Norway Pines," Agr. Exp. Sta., Burlington, Vt., Bul. 472, Apr. 1941, W. R. Adams and G. L. Chapman.

"Twenty-sixth Annual Report," Agr. Ext. Serv., Burlington, Vt., Bul. 26, June 1941.

"Twenty-seventh Annual Report," Agr. Ext. Serv., Laramie, Wyo., Bul. 11, June 1941.

"Pruning Hardy Fruit Plants," U. S. D. A., Washington, D. C., Farmers' Bul. 1870, June 1941.

"The Pan American Tomato, A New Red Variety Highly Resistant to Fusarium Wilt," U. S. D. A., Washington, D. C., Cir. 611, June 1941, William S. Porte and H. B. Walker.

"Studies on the Respiration of Strawberry and Raspberry Fruits," U. S. D. A., Washington, D. C., Cir. 613, Sept. 1941, Mark H. Haller, Dean H. Rose, and Paul L. Harding.

Economics

¶ In "An Economic Study of Truck Farming in Copiah County, Mississippi, 1938-1940" by Marvin Guin and D. W. Parvin, Bulletin No. 361 of the Mississippi Agricultural Experiment Station, the authors have reported the results of an economic analysis of the farm practices in Copiah County. The county is located in southwestern Mississippi and is the most important vegetable-producing area in the State. In order to accomplish the study, survey records were taken on 80 truck farms in Copiah County. The average size of the farms surveyed was 131 acres total farm land of which 55 acres were in crops. The average investment per farm was $4,950 in 1938, $4,198 in 1939, and $4,369 in 1940. Real estate investment constituted about three-fourths of the total farm capital. Corn occupied the largest crop area, taking up 41% of the total acreage of crops. Cabbage occupied 14%, cotton 13%, and tomatoes 12%. Approximately 39% of the total area in crops was planted in truck crops.

During the three-year period included in the survey, farm expenses averaged $1,537 per year. The most important items of expense on these farms were labor and fertilizers, constituting 34% and 27% respectively of the total expenses. Cash receipts for the three-year period averaged $1,733 per year, slightly less than $200 per year above total expenses. In addition to the cash receipts from farm marketing, farmers, of course, receive a certain amount of compensation from so-called farm privileges. On these farms, farm privileges were estimated to average around $296 per year.

One of the oldest standards of measurement of farm efficiency has been labor income per farm. Labor income is the amount that is left for the operator's labor after allowing for all other expenses including a reasonable rate of interest on the farmer's investment. Farmers in Copiah County received a rather small labor income, averaging only $16 per year for the three-year period. In the majority of cases labor income ranged from $250 lost to $250 profit. In 1938, 43 of the farms surveyed had a minus labor income, 35 in 1939, and 36 in 1940.

In 1938 and 1939 the 20 most profitable farms were about the same size as the 20 least profitable farms, but in 1940 the least profitable farms were much larger. In each of the years studied it was found that the most profitable farms employed their capital more efficiently, obtained higher crop yields, secured higher prices for the products sold, and had a smaller percentage of cash receipts from truck crops and a higher percentage of cash receipts from cotton and livestock than did the least profitable farms.

The relative profitableness of the major crops varied from year to year with a different crop being the most profitable in each of the years studied. The average returns to labor per acre of cotton was $17.61, cabbage $13.62, peas $8.01, tomatoes $4.92, and beans $3.53.

The fertilizer used on the different crops varied rather widely. In the case of cabbage the average application during the three-year period was 1,666 pounds per acre. On tomatoes the average was 1,537 pounds, peas 1,369 pounds, beans 1,318 pounds, and on cotton fertilizer application averaged only 295 pounds per acre.

"1940 Orange County Avocado Production Cost Analysis," Agr. Ext. Serv., Berkeley, Calif., Harold E. Wahlberg.

"Profitable and Friendly Farm-rental Relations," Agr. Ext. Serv., Lafayette, Ind., Bul. 256, Mar. 1941.

"An Economic Study of the Dairy Enterprise in Northeastern Iowa," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 278, Sept. 1940, R. K. Buck, J. A. Hopkins, and C. C. Malone.

"Experience of Michigan Rural Banks with Short Term Loans to Farmers," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 311, Aug. 1941, Roy J. Burroughs.

"Costs and Returns from Farm Enterprises," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 756, May 1941, Paul S. Williamson.

"The Economic Relationship Between Feeding and Milk Production in Rhode Island," Agr. Exp. Sta., Kingston, R. I., Bul. 279, June 1941, J. L. Tennant and H. C. Fowler.

"Marketing Ohio Tomatoes to Processors on Grades, 1930-1940," Agr. Exp. Sta., Wooster, Ohio, Bul. 623, Sept. 1941, Chas. W. Hauck.

"A Study of the Farm Business of 89 Dairy Farms in Windsor County, Vermont," Agr. Ext. Serv., Burlington, Vt., Brieflet 607, Sept. 1941, Robert P. Davison and Edward J. Cook, Jr.

"Farm Tenancy Law," U. S. D. A., Washington, D. C., Co. Plan. Series 11.

"Rural Tax-delinquent Lands," U. S. D. A., Washington, D. C., Co. Plan. Series 12.

"Management and Development of State and County Land," U. S. D. A., Washington, D. C., Co. Plan. Series 13.

"State and County Land-purchase Programs," U. S. D. A., Washington, D. C., Co. Plan. Series 14.

"Western Water Law," U. S. D. A., Washington, D. C., Co. Plan. Series 15.

"Farmers and the Second Year of National Defense," U. S. D. A., Washington, D. C., Aug. 1941.

"Wheat Storage on the Farm and in the Ever-normal Granary," U. S. D. A., Washington, D. C., G-106, June 1941.

Humanity on Trial

(*From page* 11)

oxygen is available, and that most roots will grow in water if the water contains 4-18 p.p.m. of oxygen. We know that one of the chief advantages of gravel, cinder, and haydite culture is that a complete change of air around the roots is effected as often as the solution is pumped from the supply tank to the growing bench. This is usually twice daily.

We have also learned much during the past 2 or 3 years about the best concentration of dissolved chemicals and the best relative proportions of some 15 to 20 chemical elements. Some of these new facts are just now finding a use in general agriculture.

Chemicals are also utilized in the form of sprays to prevent premature fruit drop of apples. The spraying of apple trees saved a $5,000,000 industry for the state of Ohio and assured the public of 100% pure apple juice.

When carbon dioxide, another chemical, is added to the air in storage rooms it is possible to keep fruits and vegetables and retain their quality better at a temperature of 45° F. instead of the more costly temperature of 32° F.

According to Professor E. L. Dakan, the story of the hen was for 1800 years the story of the dung-hill fowl living as a scavenger and hatching 15 eggs at a time. Within the memory of living man hatching units have been perfected which with only human attention will hatch 50,000 eggs at one time. In Ohio, where most of these machines have been perfected and are made, some hatcheries are operating as many as 10 of these units. Fifty million chicks are hatched in these devices annually in Ohio.

Incidentally, the old-time fowl produced 50-60 eggs per year—the present-day hen averages 200 eggs, and upwards of 300 per year is a common performance. Additional evidences of improvement of breeding can be secured from all fields of agriculture.

According to Professor Don Kays the dramatic story of men and horses, full of action and color, is staged against a background that is wholly American. From the day when the early American farmer first slapped the ribbons over the back of his favorite roadster till he settled into the cushioned ease of his automobile, the light harness horse was his chief helper in the quest for speed.

In 1810 at Philadelphia, Boston Blue trotted a mile in 2.48½. The horsemen of that day never dreamed that in 1937 Greyhound would trot the same distance over the historic Lexington track in the record-shattering time of 1.55¼.

Colonel Matt J. Winn who manages the noted Churchill Downs speedway at Louisville, Kentucky, saw old Aristides win the first Kentucky Derby in 1875. Little did he dream that he would live to see the sixty-seventh Kentucky Derby on May 3, 1941, and witness Whirlaway establish an all-time record for 3-year-old thoroughbreds over the distance of a mile and one-quarter. The time was 2.1 2/5, setting an all-time high for the most famous turf spectacle that is staged on the American Continent.

Yes, "time marches on." In all areas of livestock production there is abundant testimony in support of the truth made articulate in this slogan. In 1871 old Dowager, a Holstein cow in New York State, gave 12,681 pounds of milk, a record in milk production in this country at that time. Contrast this dairy cow performance with that of Carnation Ormsby Butter King, a Holstein cow that gave 38,606.6 pounds of milk in 1936.

Inoculation for the prevention of hog cholera is an outstanding accomplishment in the field of animal husbandry. In the field of animal nutrition astounding advances have been made during the present century.

At the turn of the century the word "vitamin" had not appeared in the scientific vocabulary. Twelve vitamins have now been chemically identified and the existence of 15 others postulated on the basis of physiological evidence. The need for many of these substances in the feeding of farm animals has been demonstrated, and the occurrence of deficiency diseases in our herds and flocks reported. These discoveries have provided the means of improving productive performance and increasing the quality and food value of animal products.

Medicines From Animals

The animal carcass has uses today never dreamed of a quarter of a century ago. Special preparations from glandular organs and tissues litter the shelves of the modern drugstore and are important items in the medicine case of every practicing physician. The flow of blood is stopped by a preparation from adrenal glands; the wound is closed with a thread made from the sheep intestine; the diabetic's life is saved by insulin from the pancreas of slaughter-house animals; the sheep thyroid brings relief to the goitrous patient; and those doomed to die with Addison's disease are spared by another preparation from the adrenal gland. Other products too numerous to mention are in everyday use, bringing relief to the suffering and restoring health to the diseased.

According to Professor Lewis Bergwald, although dairying has been carried on to a greater or lesser extent for 2,000 years, it was not until the "gay 90's" that important improvements in the production, processing, and distribution of dairy products were developed. Since then the Babcock test, tuberculin test, pasteurization, bottled milk, the control of contagious abortion, and many other improvements have been perfected.

In 1939 the gross farm income from milk and milk products was $1,723,484,000, or nearly one-fifth of the total gross farm income for that year.

Professor Glen McCuen states that agricultural machinery has been one of the outstanding contributing factors in the betterment of the social life of the farmer in this country. Machinery has removed drudgery from agricultural work, has removed the uncertainty in crop production, and has given us the possibilities of plenty instead of just enough without reserve.

The three outstanding basic inventions were the reaper, invented by Cyrus Hall McCormick in 1831; the steel plow, invented by John Deere in 1835; and the threshing machine, invented by Pitt Brothers in 1836. Prior to this period, agriculture was primitive and all of the work was the product of hand methods, which were extremely laborious and time-consuming.

The invention of new material things at this time brought about a great development in industry as the labor for industry was slowly released from the farm. For example, if the wheat consumed today were to be harvested as it was prior to 1850, it would require 47 man hours to harvest and thresh an acre of wheat, to say nothing of the labor that was required to prepare the ground for the crop and the seeding of it. Compare this time-consuming method with the method of today, when one acre of wheat is cut and threshed in one operation and stored with the expenditure of only two man hours time.

According to Dr. R. D. Lewis, the greatest material asset possessed by this State and Nation is soil and its productivity. Formerly, prevailing systems of soil and crop management wastefully exploited this basic national resource; so rapidly in fact, that until recently the annual loss of soil productivity on Ohio farms as a whole averaged .6% per year. A loss of that magnitude continuing over a 50-year period means a one-quarter reduction in the productive capacity of soils.

Improvements Will Continue

Recent agronomic and related researches have led to better soil drainage, to wider use of lime and fertilizers, to the growing of more legumes, to more timely and more accurate cultural methods, to distinctly improved varieties, strains, and hybrids, and to a higher degree of control of plant pests. All of these improvements should have raised acre yields by at least 40% to 50% in the last 50 years, yet these improvements in soil and crop management have been largely offset by the continuing deterioration of the natural productivity of the land.

Nor is soil deterioration inevitable, for soil and crop management science and practices have forcibly demonstrated that average productivity can be conserved and even doubled by scientifically and economically feasible procedures.

All of the credit for advances made in our agricultural methods should not be assumed by the present generation. A high state of civilization and a well-developed agriculture existed many years ago. Theophrastus writing about 250 B. C. described many cultural practices which have only recently been rediscovered. Cato described well-planned and economical farming procedures. Irrigation in Egypt was practiced at least 4,000 years ago. Theophrastus described the growing of onions by the transplanting method (250 B. C.). In our day (1893) Greiner redescribed this method in a book entitled, "The New Onion Culture." For years this was a stock civil service examination question.

However, most of the civilization of 2,000 years ago seems to have been destroyed. Only recently have some of the most important writings been translated and made available—and much of this after the rediscoveries mentioned.

We shouldn't become satisfied with our accomplishments. Neither should we believe that all of our frontiers are gone. Quite the opposite is true. Right now we are embarking on a program to produce fortified foods adequate for any emergency. This program involves breeding for extraction and concentration of the most healthful food constituents. It also involves a study of all new developments and machinery to see what place they may have in agriculture. The future of agriculture is destined to prove more profitable to humanity than the past.

There's Enough Potash for National Defense

(*From page* 22)

many fertilizer mixtures of such grades as to require high-grade muriate, while others could be prepared partly from high-grade and partly from low-grade, and still others representing the larger tonnages could be prepared exclusively from raw potash salts without in any respect requiring any alteration in official recommendations or trade practices. These facts have been recognized fully by both the potash producer and fertilizer manufacturer, thus making it much easier for the producers to meet the American emergency and for the fertilizer manufacturers to meet the requirements of their customers without any reduction in the K_2O content of their mixtures.

American Farm Homes Can Be Beautiful

(*From page* 20)

circle formed by the driveway partially screens the garage and affords an excellent place to display flowering shrubs, iris, or other perennial flowers.

An outdoor living room is made by partially enclosing a portion of the lawn to form a private area. It should be connected with the living side of the house. The border plantings to the left of the house in Fig. 4 are the walls, so to speak, of this "room." These plantings are irregular in outline and preferably should have an irregular topline where the area is to be developed informally. Formal gardens are an exception to this rule. Flower borders may be placed in front of the shrub groups to add color to the summer garden. Pools, rock gardens, and such developments belong in the outdoor living room and require the setting afforded by the border plantings.

Trees are absolutely essential for comfort and beauty. Figure 5 shows the aesthetic value of the tree in making

Fig. 5. The completed landscape.

a picture. Trees supply the frame and background of the picture.

The landscape picture is never stationary. It is constantly changing with each day, season, and year. It will be necessary to maintain the development by repeated painting and repairing of buildings and fences, mowing, cultivating, pruning, and replacement of plant material.

Landscape plantings must be properly maintained if they are to be successful. Cultivation and fertilization of trees, shrubs, lawn, and flowers are very important parts of landscape maintenance.

Facts concerning nutrient requirements of plants comprise a complicated science, but feeding ornamental trees and shrubs can be a relatively simple practice that any gardener will find easy. The most efficient use of commercial fertilizer requires careful consideration of soil types and soil analysis. Satisfactory results can be secured, however, by making simple soil-reaction tests, using a few standard fertilizer mixtures as suggested below, and carefully observing plant response.

Manure Not Enough

Manure is an excellent fertilizer and soil conditioner, but is no longer considered the only fertilizer material to be used with ornamental plants. Commercial fertilizers containing nitrogen, phosphorus, potassium, and minor elements such as iron, manganese, magnesium, zinc, and boron can be used effectively after a simple working knowledge of the effect on plants has been observed.

Small trees, less than 6 inches in diameter, may receive approximately 4 pounds of 6-8-8 fertilizer for each inch diameter of tree trunk measured 1 foot from ground. Large trees, more than 6 inches in diameter, may receive 8 pounds per inch in diameter of tree trunk. The applications should be made every one to three years, depending on kind of tree and growth response. The application can be made in fall or spring.

Two methods of application are used; namely, the broadcast system where the fertilizer is applied on surface, and the punch-bar method where the fertilizer is applied in holes made

8 to 12 inches deep by an iron bar. These holes are made beneath the tree and one-half the spread of the tree beyond the ends of the branches.

Shrubs have a great variation in soil requirements. Soil reaction is very important with many shrubs, especially of the ericaceous family, and simple tests may be made to determine the soil reaction with inexpensive soil test kits.

Soil nutrients should be supplied shrubs before and after planting by first thoroughly preparing the soil in the planting bed and the incorporation of well-rotted manure and superphosphate at the rate of 10 pounds to each 100 square feet of bed. Secondly, the established shrub beds should be top-dressed with 2 to 5 pounds of 6-8-8 fertilizer per 100 square feet of bed each spring. Use 1 to 2 pounds of mixed fertilizer around specimen shrubs that are planted singly. Further application can be made based on plant response or soil tests.

Cane Fruit Responds To High Potash

(*From page* 10)

4. Use of complete fertilizer on blackcaps resulted in striking increases in growth of cover crops and canes the first season and freedom from bronzing of leaves (Figs. 2 and 3).

5. Marked increase in size and yield of black raspberries grown on old grain land on Olympic silt loam and definite increase in yield of boysenberries grown on Powell silt loam that had been grain-farmed some 50 years were secured the second crop season.

6. The economic rate of use of 5-20-10 fertilizer for Cuthbert raspberries when applied in shallow furrows at the sides of the row to Powell silt loam appears to be 500 pounds per acre. More fertilizer is needed if broadcast. The 2-year average for 6 plots broadcast was 4.51 tons compared to 5.16 tons where applied in furrows.

For boysenberries 1,000 to 1,200 pounds per acre appears to be the economic rate of use of 5-20-10 fertilizer, due to the heavier vegetative growth and yield.

7. "Complete" fertilizer or 5-20-20

Fig. 2. Untreated blackcap plot on Olympic silt loam.

Fig. 3. These blackcaps received a high-potash complete fertilizer.

increased the yield in 1941 to 4.88 tons of boysenberries per acre as compared to 4.32 tons for 5-20-15 and 3.88 tons for 5-20-10. However, the 2-year average yield, 1940 and 1941, shows the greatest net profit from use of the 5-20-10 fertilizer.

8. Maximum yield of black raspberries on Olympic silt loam was .98 ton per acre secured with 500 pounds of 5-20-15 when the average for 4 check plots was .61 ton (Table 2).

TABLE 2. CROP RESPONSE TO MAJOR ELEMENTS FERTILIZER ON BLACKCAPS ON OLYMPIC SILT LOAM

Soils Department, Agricultural Experiment Station, O. S. C.

Plot	Treatment kind and ratio	Rate per acre	Cost of treatment	2-year average yield		Gain or loss	Net profit or loss from treatment*
				Treated	Untreated		
		Lbs.	$	*Tons*	*Tons*	*Tons*	$
A	Check				.76		
B	Manure	10T	10.00	.48		−.18	−47.73
1	Check				.55		
2	5–20– 0	500	9.14	.57		.02	− 4.95
3	5– 0–10	500	6.18	.68		.13	21.07
4	Check				.54		
5	0–20–10	500	7.16	.61		.09	11.70
6	5–20–10 (Med. K)	500	11.24	.68		.16	22.30
7	Check				.49		
8	5–20– 5 (Low K)	500	10.19	.48		−.20	−52.11
9	5–20–15 (High K)	500	12.29	.98		.30	50.59
10	Check				.86		

* Blackcaps priced at $209.60 per ton.

9. Sulphate is beneficial with these soils, so sulphate carriers were avoided or checked off and minor elements were usually applied in sulphate form with a blanket application of N-P-K except for controls. Zinc sulphate has profitably increased red raspberry yields in related trials. The 3-year average for 8 check plots in major and minor plot ranges was 2.64 tons; with 500 pounds per acre of 5-20-10 the yield was 2.76 tons, and with 500 pounds 5-20-5 plus 30 pounds zinc sulphate the yield was 3.24 tons per acre. Some evidence of benefit from use of manganese and copper with major elements has been secured.

Similar studies are underway with prunes and mint.

10. Canning tests indicate that the high potash complete fertilizer helps overcome "crumbly berries" for red raspberries from this plot held their shape better and were less mushy when opened.

It was anticipated that high phosphate fertilizer and cover crops might lessen winter injury, and winters have been mild. Results to date are inconclusive. Washington variety is more winter hardy than Cuthbert.

Why Soybeans Should Be Fertilized

(*From page* 15)

harvest, and is high in oil and protein. However, farmers should not be discouraged from growing soybeans, but should be informed that this cash crop, soybean grain, is hard on the land, that sooner or later the phosphorus, potash, and lime supplied by nature will have to be replenished by commercial plant nutrients if crop yields are to be maintained.

Other legumes, such as red and sweet clovers and alfalfa, are as hard on the land with respect to losses of phosphate and potash as are soybeans if these crops are sold off the farm as hay. However, in ordinary practices these types of legumes are returned to the soil as manures and in this respect are soil conservers.

Soybean hay in the shock on the farm of Clint Norris, Frankfort, Indiana.

Soybeans have grown rapidly in importance in the Corn Belt during the last 15 years, are a cash crop well adapted to a wide variation of soil conditions, and fit well in the Corn Belt rotation of crops. This crop is certain to play an important part in the present national defense effort. At present, very little information has been obtained to show a profitable means of directly fertilizing soybeans at the time of seeding. However, other types of experiments now in progress at Purdue, involving plowing under the phosphate and potash, indicate that effective means to fertilize soybeans are being found.

With a favorable price outlook, farmers are faced with the problem of fertilizing their soybeans next spring unless the soils have been adequately fertilized previously in the rotation. If we were to make suggestions for farmers in Indiana on the basis of present facts, these would be our recommendations:

If the soil is acid, lime it adequately this winter. This is very important; otherwise the value of some of the fertilizer will be lost. Add enough lime (about 3 tons per acre for central Indiana) to bring the pH of the soil to about 6.2 to 6.8. Next spring, just before plowing the ground for the soybeans, broadcast about 300 pounds of 0-20-20 or 500 pounds of 0-12-12 per acre and plow under. Then do not use any fertilizer when planting the beans. The benefit from the lime will last for at least 10 years, although it has been found profitable to relime in about 6 years. The benefit from the fertilizers will carry over into the second and perhaps the third crops.

To show the importance of plowing down the fertilizer for soybeans, the following information is presented. The yield on an unfertilized Crosby silt loam (pH 5.2) at Lafayette in 1940 was 15.7 bushels of grain or 3,570 pounds of hay per acre. When an equivalent of 1,000 pounds of 4-10-25 had been broadcast and disked into the topsoil immediately before seeding, the yield was increased only 1.9 bushels. (There was no injury to the stand.) However, when this same amount of fertilizer was broadcast and plowed under, the yield was 23.4 bushels of grain or 4,653 pounds of hay per acre. When lime, at the rate of 3 tons per acre, was used with the fertilizer and plowed under, the yield was 28.2 bushels of grain or 5,377 pounds of hay per acre.

J. T. Brown Rebuilt A Worn-out Farm

(*From page* 8)

immediately planned to apply optimum quantities of these materials under crops and on pastures. On one 40-acre field he applied 2 tons of limestone, a liberal application of phosphorus, and 400 pounds of muriate of potash per acre.

In October 1940 this field was planted to hairy vetch and Austrian winter peas. In early April measured areas showed an estimated yield of 8.9 tons of vetch and 9.78 tons of peas per acre. The vetch and peas were plowed under

Robinwood Farm manager, M. I. Robertson, turning under Austrian winter peas.

about the middle of April and the land planted to hybrid corn on May 10.

This field, which had no fertilizer other than that applied under the cover crops, in the fall of 1941 produced an average of 75 bushels of corn per acre. Soil tests which were made after the corn was harvested showed liberal quantities of plant food still present in the soil for use of future crops.

Similar quantities of limestone, phosphate, and potash were applied on 64 acres of oats, which were seeded to lespedeza in February. This field yielded approximately 55 bushels of oats and 2½ tons of lespedeza per acre. And the oats and lespedeza provided a protective sod crop to prevent erosion on the land throughout the year. Cotton was fertilized with 4-8-4 at the rate of 300 pounds per acre. Land once considered too poor to cultivate yielded a bale of cotton per acre in 1941.

With livestock playing an important role on Robinwood Farm, around 150 acres of improved pasture already have been established for the 155 head of purebred and high-grade Hereford cattle on the farm. All improved pasture land is being fertilized with 2 tons of limestone, a liberal application of phosphorus, and 400 pounds of muriate of potash per acre and seeded to dallis grass, hop clover, white Dutch clover, and lespedeza. Pastures are mowed regularly to control weeds, conserve moisture, and improve grazing. On a portion of the poor land put in pasture, a crop of crotalaria was first grown and plowed under to add organic matter and nitrogen to the soil.

Lespedeza hay, corn stover, blackstrap molasses and cottonseed meal—all farm-grown except the molasses—are feeds used in the winter feeding program for beef cattle. Shredded corn stover is sprinkled with blackstrap molasses and cottonseed meal is added. This together with lespedeza hay provides a feed that keeps the cattle in thrifty growing condition throughout the winter. Breeding cows go on pasture in the spring in better condition, drop a higher percentage of heavier calves, and produce more milk for their offspring. Purebred bulls of approved type are used and the choicest heifer calves are selected and developed to improve the cow herd.

An unusual system of farm marketing enables Mr. Brown to get the highest possible price for cattle and hogs. All animals are slaughtered, chilled, aged, stored, and sold over the counter on the farm during the fall and winter months. Rural electrical current at reasonable rates, a farm refrigeration unit, farm labor, and a farm-owned market make this practice possible and profitable. By this means Mr. Brown not only gets the farm price for his cattle and hogs but he pockets the difference between the farm price of cattle and hogs on foot and the price consumers pay for dressed cuts of beef and pork.

Aids National Defense

And Robinwood Farm is making its full contribution to national welfare and national defense through conservation and improvement of the soil, a basic resource, and through production of surplus food supplies, a national defense need. Mr. Brown has participated fully in the agricultural conservation program. He has always planted within crop acreage allotments in the national effort to adjust and balance production of farm products and conserve soil fertility. He annually carries out sufficient soil-building practices to more than earn his full soil-building allowance.

Robinwood Farm today is a mecca for farmers and agricultural leaders who come from far and near to see at first hand how an abandoned and worn-out farm has been reclaimed and made productive.

"To Mr. M. I. Robertson, farm manager, goes a lot of the credit for the success of Robinwood Farm," says Mr. Brown, who is also utilizing fully the help of the county agent, agricultural agents of the Illinois Central Railroad, and subject-matter specialists of the Mississippi Extension Service.

4-H Club Members Often Furnish Clue

(*From page* 17)

potash in our soils. The potash deficiency was especially serious, due to the prevalence of rust on cotton grown on all these soils. Mr. R. A. Wasson, extension agronomist, in writing Louisiana Extension Circular No. 183, "How to Fertilize Cotton in Louisiana," had this to say, "Twenty-four pounds of nitrogen, eighteen pounds of phosphoric acid, and thirty-six to sixty pounds of potash are recommended for cotton on the prairie soils. Four hundred pounds of 6-10-7 would be a conservative practice and would supply close to the recommended amounts of plant food. Large rates of potash should be used where cotton rusts severely." Only since 3 or 4 years ago, however, have farmers realized that more than the accustomed 100-150 pounds per acre plus nitrate of soda side-dressing could be used for best profits.

This realization probably was brought out, as stated previously, by the larger amounts of fertilizer used by 4-H club members, but the soil conservation program which came in about that time, bringing with it the acreage reduction, also showed the necessity for higher yields and larger profits per acre. Farmers were quick to grasp the idea, especially when in every community there was at least one boy who had proven that larger quantities of the proper analysis fertilizer would pay bigger dividends. Of course, soil-building and maintenance practices played an important part in these increased profits, and on farms where such a program was followed, much better results were obtained from the use of heavy applications of fertilizers.

Up to the time of the soil conservation program, a very small acreage of soybeans and no cover crops were planted in the parish. When vetch was introduced as a cover crop, good results were obtained, and a forward step had been taken for profitable utilization of heavier amounts of fertilizer. When soybeans were planted as a companion crop in 90% of corn land, soil conditions conducive to profitable utilization of large amounts of fertilizer became widespread over the parish.

Experiments carried out with farmers of the parish have shown conclusively that the addition of organic matter was necessary for more profitable use of large amounts of fertilizer on most of our soils. Typical results were those obtained by Cleveland Vidrine, 4-H club member, on his acre plot of sandy silt loam. This plot was planted to vetch for 3 consecutive years with the same five check rows left without vetch during that period. This land planted to cotton, fertilized with 300-400 pounds of 4-10-7 and 100 pounds nitrate as a side-dressing showed a 35-50% increased profit from fertilization where vetch was turned under, over the check plot. This proved true also where summer legume crops were used. On 10 farms where leguminous crops were turned under and followed by heavy fertilization, increases of 25-50% yield and profit over check plots were noted.

Results Convincing

From all results of work conducted through club members as well as adults, it has been brought out that good farming practices and judicious use of heavy applications of fertilizers high in phosphates and potash will return bigger profits to farmers of Evangeline Parish. For cotton lands where rust is prevalent, it has been further shown that larger amounts of potash and legume crops turned under will control this trouble to a large extent.

The 4-H club members are justly proud of their contributions in having brought to their parents and neighbors this actual proof of the benefits to be derived from these practices. They feel that results of their work have not only meant more profits, but a better utilization of resources of their farms, a conservation of these resources, while at the same time they were preparing themselves to become better farmers and citizens of the future.

It's Time to Eat

(*From page* 5)

price I git—it's the price of what I have to git that pesters me most." This doctrine is but an echo of the exchange value and parity price plea. But when parity runs anywhere from eight to twelve dollars a hundred for prime pork on the hoof, it isn't soothing or sustaining to the customer in the meat department to realize that his pork chops have swarmed up faster than his own union wages.

IF this progressive rise above parity keeps on apace, we are going to see more producers returning to primitive ways, doing home butchering and maybe patronizing those nifty new freezer lockers. They simply can't afford to keep step with the consumer buying at retail much longer, parity or no parity.

Of course everybody knows that the high cost of eating begins where the farm leaves off, but doesn't end there. "What happens in the dark" (the twilight zone) was the theme of constant repetition during the early days of cooperative organization among producers. Old wrathy stump speakers ripped the wings off the eagle ranting about the evils of middlemen, whom they classed as con-men.

Bloated fortunes were easily found at the hub of big raw food assembling enterprises, and in some country towns huge mansions were the evidences of such wealth garnered from margins above farm costs. This made organizing the farmers relatively easy on the pleas of shortening the road to consumers—perhaps not just for the consumers alone but to get a mite of revenge as well.

This bore the stamp of righteous indignation and swept whole townships into Townleyism. Nobody is sorry about that exactly, but some of us wonder if any real progress has been made in cutting the market margins much. Current price spreads seldom show it anyhow despite Herculean efforts and fervid oratory. Folks want service and be darned quick about it. This and the rise of organized labor ate up the saving in between by slapping on more fixed charges than ever.

Consumers also made sporadic attempts to come out halfway and meet the loads of food inbound from the sticks. Yet only a few of these clubs got anywhere and stayed there. Furthermore, too many of them got into the European habit of trying to throttle the producers rather than cutting profits from their own city food handling firms.

MEANTIME milk producers criticized margins and yapped a heap about starving infants in the slums. Finally they got all set for business with good membership rolls and fixed up airtight milk sheds. Then they jacked up retail milk prices whenever a hike in farm prices was necessary, keeping the dealers slap-happy and putting the surplus into the churns. Few of them were courageous enough or had funds and legal guts enough to start direct deliveries, and even then they found it cost plenty for wages, hoss fodder, and broken bottles.

This left the forlorn consumer councils organized by some old maiden ladies with inhibitions, and they tried to stem the tide by studying bulletins on diets and keeping budgets. But few of them saw it through and they too faltered. Some said it was because consumers were not "vocal," but our guess is they were too *local*.

This makes me feel that, instead of groping to find demons in the dark spots along market row, the main trouble with consumers is apt to be what "happens in the daylight."

We have too many consumers of food who do not know anything about the investments and the risks inherent in producing it properly and in season. Moreover, we have too many consumers who dismiss all and sundry alarming symptoms of their own recklessness in general and plunk all the blame for the high cost of existing on the food counter. Their main economic eruptions, as it were, arise from the esophagus. All other expenses are necessary evils while eating is a luxury.

I know many a man whose annual bill for choice wines and liquors gargled at home or abroad would make anything he spends for bread and milk look shabby. I have seen such bibulous guys fill up on buzzy water and give dissertations on damnable charges gouged out of city folks by farmers, and then uncork another flask worth more than a double wagon box filled with U. S. grade A potatoes.

I HAVE seen society dames lavish more jack on pet poodles and face varnish, bridge trophies and club dues than any bill they ever paid for butter and bologna. I have noted corky sportsmen with a flair for fancy guns, litters of hound dogs, and cute hunting coats who crabbed continually about the horrid food monopoly and farm profits.

Many a dizzy chap will whizz along at seventy miles an hour and waste gas and ruin tires, and then cuss the daylight out of the first meal-ticket he has to pay for and finally try to run over a mess of Leghorns to get even.

What we need, as I said beforehand, is a little more intense and conscious effort to have the farmer's viewpoint in its sanest form presented to city consumer groups without bias or rancor. Too often we get this deal mixed into politics and that is misery all around. We have bright young aspirants for farm popularity raging far and wide on the prejudice racket, and equally hopeful candidates eager to cut the costs for city folks by banging away at the same theme from the opposite angle. Once elected the status quo returns.

The young farm leaders might well talk to city folks with good explanatory texts and the city candidates might do likewise with the farm audiences, but this won't make votes for them in the home precinct. You can't expect to make economic missionaries out of ambitious office seekers. You can't make an issue out of common sense.

Mayhap if the big manufacturers and processors of leading staple food items would plan a campaign to issue leaflets with every package and parcel of food with some clear-cut and concise text to show the consumers the costs of raw materials, distributing and processing charges, and other mark-ups, we might teach folks something. They obey pure food label laws and print ingredients on many packages, so why not economic formulas too?

PERHAPS if we organized things so that we might have winter meetings in town and country with exchange speakers, it would help a trifle. I know farmers who could talk turkey and lots of other food items with startling clarity, and make consumers see the drift of things in a saner light. Likewise we could get some consumers to be more "vocal" in rural sessions, to give farmers a better idea of how it feels to pay on the nose for everything you put in your mouth.

Of course you couldn't shut out the maligned old middleman either, and so let's have him brought forward to the confessional too. He may have a case to hear also, what with priorities and union wage scales. We might all learn a little to balance our Thanksgiving dinner and keep us a bit more Americanized and solidified through the ensuing year of vexing victuals.

At least we'll have something to think about while carving the buzzard!

A diabetic old lady who, though on a strict diet and watched by her family, was wont to sneak down to the ice box and snitch delicacies. After each such raid she was laid up in bed and finally after a particularly fancy foray it was necessary to send her to a hospital where, owing to crowded conditions, she was placed temporarily in the maternity ward.

The next day her young nephew went to visit her, and was directed to the maternity ward. Stiff-backed, thin-nosed nurse Jones asked the boy what he was doing in the maternity ward, who he was looking for, and why.

Replied the nephew, "Me grandmother—she's been cheatin' again."

No Place for a Drawl

She: "Getting real cold, isn't it?"

He (reflectively): "Winter draws on."

She: "Sir!"

Boy: "Say, whatever became of those old-fashioned gals who fainted when a boy kissed them?"

Gal: "Huh! Whatever became of the old-fashioned boys who made them faint?"

"Does your wife do all her own washing?"

"Yeah, all except her back."

Sweet Young Thing: "Is it easy to learn to play golf?"

Sam: "Sure; all you do is smack the pill and then walk."

S. Y. T.: "How interesting; just like some of the auto rides I've been on."

"Why, pardner, my home town is so small that our fire department consists of a hose cart and four dogs."

"What do the dogs do, haul the cart?"

"No, they find the hydrant!!"

Politeness Plus

Natives of the Carolinas are noted for their great politeness. Once, in the old days, a passenger was enjoying a smoke in the smoking car. From time to time he expectorated with great satisfaction out of the open window.

The rush of air caused by the fast-moving train must have interfered with his aim, for a tall, lean Carolinian in the seat just back of him touched him lightly on the shoulder and remarked with great politeness: "Mistah, you done spit on me foh' times an' I ain't said nothin' about it. I wouldn't say nothin' now, ceptin' I got on my Sunday-best suit of clothes."

The squad of recruits had been out to rifle range for their first try at marksmanship. They knelt at 250 yards and fired. Not a hit. They moved up to 200 yards. Not a hit. They tried at 100 yards. Not a hit.

"'Tenshun!" the sergeant bawled. "Fix bayonets! Charge! It's your only chance."

"What are you wearing your glasses to bed for?"

"I want to get a better look at that gal I dreamed about last night."

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THE AMERICAN POTASH INSTITUTE

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

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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

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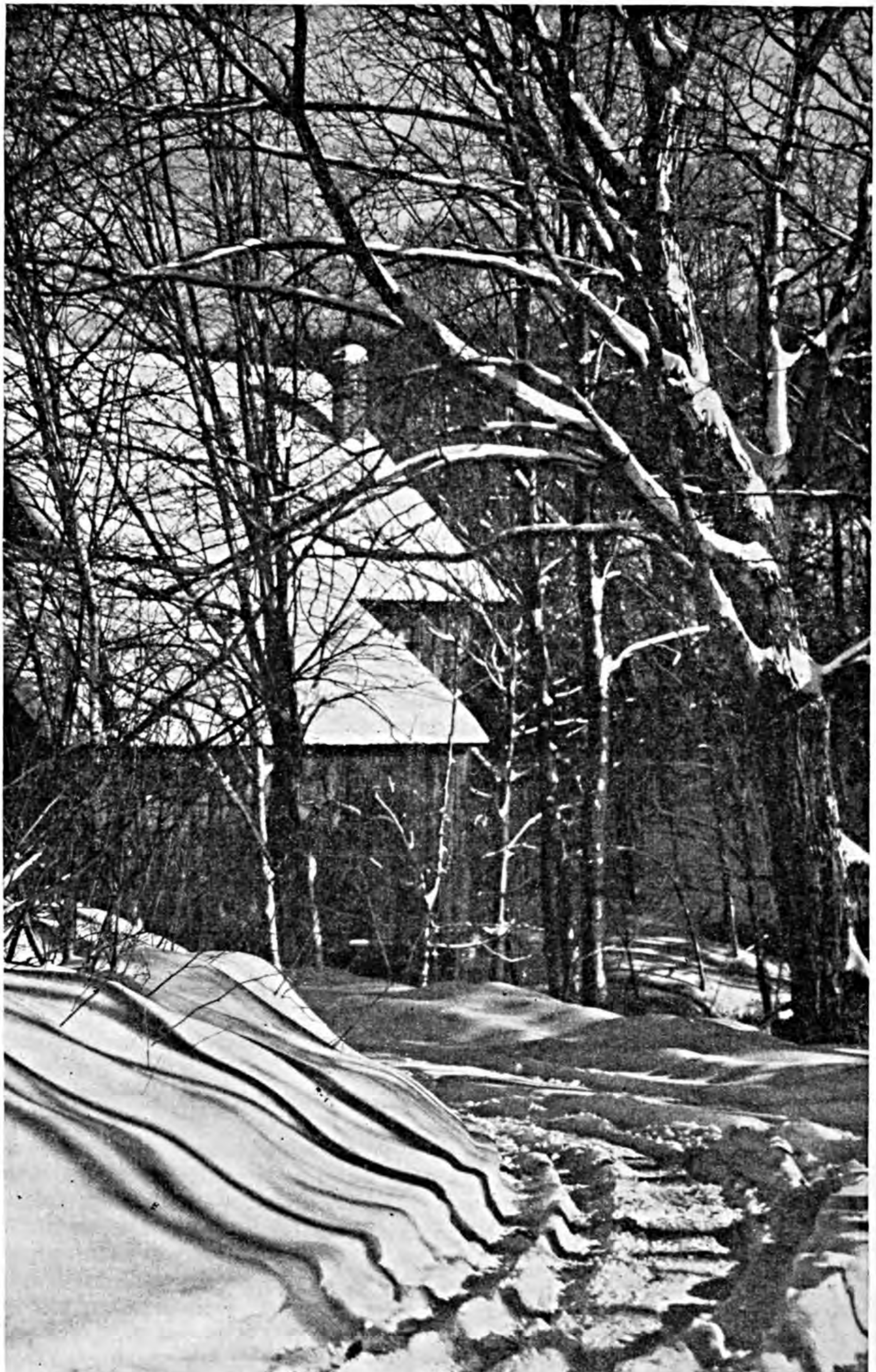

"SILENT NIGHT" IN THE COUNTRY

Better Crops with Plant Food

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VOL. XXV WASHINGTON, D. C., DECEMBER 1941 NO. 10

This Christmas are we . . . . .

Arguing with Angels

Jeff McDermid

WHEN the Sunday school supervisor who ran a barber shop put on his cotton whiskers and talked about "Peace on earth, good will toward men," all the kids in our class snickered. But we laughed at old Charley's make-up and not at the words of the angels. Are the angels still in good standing?

"Peace on earth, good will toward men" as the age-old Christmas message divides itself into two phrases for us plain folk this Yuletide. If we are cynical and realistic, we reject the first one as entirely obsolete; and from this standpoint we find it natural to slide past the second phrase without giving it much thought.

"Why cry peace when there is no peace?" I hear you say. And if you give a second glance at the last phrase at all, it is only to remind yourself of many opinions antagonistic to your own and to feel that if there were really "men of good will" in high places, there would be peace and lasting peace, and less bad reasoning and bitterness.

But to me it seems that peace is like any other mighty much-sought thing of our heart's desire. That is, to attain it we must prepare ourselves and subdue our passions and deny our cravings and be tolerant and keep a bright light burning in our souls for those who blunder and grope and grieve.

Peace is not just a status quo and a quiet, much-desired haven, for that indeed could be said of the grave. Peace to me implies that we must have gone through stress and turmoil and have earned our reward and know how to accept it and turn it to good ends. Peace is truly the great desirable good, the attainable goal after the long race, the prize after the climb, the fruit after the hard labor and sacrifice—not merely a period of rest, of dull do-nothing and of sleep and forgetting.

It is so easy to cast off Christian sentiments and call them shibboleths and dreams that have tarnished and decayed. It is so easy to do this because there are folks who observe Christmas on both sides of this world conflict, and so we get confused and agnostic in trying to fathom their divers viewpoints across the time-worn pages of the same familiar testament. We read texts and so do they. We may be reading the new version and they may have the old one, but it's religion just the same. We often sing the same hymns no doubt, although the language differs. We listen to sermons in hushed somnolence, while theirs are punctuated by the gunfire of other soldiers who are or used to be "Christian soldiers." No wonder we hold our thumbs in the ritual and wonder what there is in it for us.

BRINGING it home to us in our own land, we too, have known a time of hovering war clouds blotting out the verdant sunshine of four bitter years. Both sides in that sanguinary conflict were led by more or less religious generals and captains courageous, who prayed for victory at any cost to attain a Peace which they wanted shaped to their own pattern. Soldier lads on both sides toted bibles and wrote home to mothers who were church members, often of the same church. Yet each side accused the other of un-Christian motives and unholy methods.

For all of that, when Peace came it had little of the balm and satisfaction which either side had hoped and fought for. In some respects for the time being it proved no better than the war itself. In other words, it's the let-down, the reaction leading to demoralization, which makes peace so dangerous and unhappy after the discipline and agony of feverish strife. It happened thus to us in '65 and in 1918 too. Will it involve us once more in negative action after the end of this one?

In the present unpleasantness around the globe we Americans have been dubbed the "haves" by certain men of Middle Europe who chose to be the "have nots" in everything but militarism. Although we are the "haves," we have apparently resolved not to do things by "halves." The present "peace" is surely anything but a comforting one. It's a sort of Irish peace as it were —a state of poised belligerence.

Surely this puts a strain on any but the most self-assured kind of practical Christianity. It leaves the orthodox votary and the ritualist out on a shaky mental limb. Preachment and parchment, sermon and scroll, symbol and saint get all muddled up over the situation and start arguments among us.

But if we stick to the role thrust upon us, and remember we are regarded as the "haves" of both hemispheres, maybe we can bring our religion close to the peace table, if and when they get around to setting it. However, in doing this it's a question of how we use that of which we are presumed to have such a surplus.

WE are the arsenal, the treasury, and the food reservoir of the world. So much for the material and the mundane part of it. What else have we to rely upon in the surplus line? That's where we must do our digging and preparing. It's the spiritual and psychological surplus we need to be thinking about while we are priming the guns, speeding the plows, and spending the money.

To begin with, we've got to prepare for peaceful agreement and peaceful production here at home, right in our own arsenals and agriculture, before we get any complimentary tickets to the peace table abroad. Until we learn to live with one another and submerge selfishness, and sort of practice for peace, we are bound to be one of the "have nots," believe it or not.

Some of us are talking about a truce on social reform and uplift agencies, believing that we can't go all out for Hitler's scalp and engage in home housecleaning at one and the same time. On the contrary, a state of war nerves multiplies the symptoms of such disorders and demands as much control as ever, or even more. As the cartoonist might draw it, a nation with boils on its bottom can't sit easy at the peace table for many courses of controversy.

We talk and brag more or less about our traditional American glories and virtues, which is a perfectly pardonable attitude. I've outdone my neighbors swaggering around extolling the courage and patriotism of my forebears, but I myself have not been put to the test very much.

My excuse for that might be that there aren't any wildcat wildernesses or crude cabins to freeze in, or lurking Injuns to scalp. Of course I went west in my advanced teens and helped my folks squat it out on a quarter-section claim that nobody much wanted to buy afterward. Going without our Sunday paper and telephone and missing ice cream for dessert constituted most of the hardship we had. Probably if we had known about the radio in those days, we would have squawked until we got a mail-order crystal set, despite ample coyote music.

When we make America safe for the Americans by paying more attention to little everyday kindness and solicitude and absorb a bit more public spirit at some sacrifice, and stop pestering Santa Claus for a lot of junk we don't earn—then I figure we'll blend this Christmas spirit into a force more powerful than anything despots created or fanatics fumbled.

In every settlement there is a "set" of critters who belie the American historical tradition for taking it on the chin. Now I am not pointing to any of them as appeasers or pacifists, because some are and some don't know enough to think either way. What I am saying is that we have bellyachers among our unwanted surplus, and as Europe has too many now it doesn't look like much of an export season. Meanwhile, these bellyachers keep on stuffing themselves just the same.

I HAVE acquaintances (not yet ripe enough for friends) who rave and froth at the mouth about impending income taxes, property levies, street improvements and sewage assessments, welfare doles, and everything else that seems to them to bar their pristine and inviolate freedom. Yet many a head of such houses (and a plague on them maybe) are known to smuggle in casks and flagons of liquid loquacity without question of excise fees or dispenser's margins. They'll invite you in and cuss the government for taxes and berate the farmer for the high cost of chicken and custard, while they slop out the highballs without a murmur or a hint of national doom.

I would be the last man to deny the citizen his inherent right to grumble. My wife has taken me up on that plenty, and I'm in no position to exclude myself from the suspect class. But I try not to do it so much at Christmas and I always confine my grumbling to private matters rather than yanking tail-feathers out of the E Pluribus eagle.

Being forthright and showing forbearance toward our armed forces (our kids in camp) appear also to be something most of us can attempt. It isn't enough to knit socks and mufflers or send them jumbled junk. The main thing is to cut out the sympathy racket. It's not "good will toward men."

I know a family where the pa and

(*Turn to page* 47)

Edwin Boss and Brother inspecting corn that took first prize in 1939.

A Five-year Program for Corn-Livestock

By H. B. Franklin

County Agricultural Teacher, Moultrie, Georgia

WHEN a farming community decides that it is necessary to add to its cash income, one of two things usually happens. Farmers either increase the acreage of their best paying cash crop or look for an entirely new crop enterprise. This situation faced the citizens of Colquitt County, Georgia, in 1938. The three primary cash crops, limited in acreage, were bringing in too small an income to meet the needs of the farming population. In three years the farmers have developed a cash crop that is adding at least $500,000 annually to their income.

This was accomplished without following either of the time-honored methods. Instead, two minor cash enterprises in the county were combined in such a manner as to make them pay off in a big way. By applying modern methods of production to the corn acreage and then in turn feeding this corn to good livestock, both hogs and cattle, a new source of income that bids fair to outrival all other crops in the territory and to become the mainstay, not only of this South Georgia County but of the entire Southeast, has been found. Behind this movement and in its accomplishment is a story of rural-urban cooperation and of clear thinking on the part of farm leaders that is well worth emulating.

Early in the winter of 1939 a small group of businessmen of Moultrie, aware of the inter-dependence of urban and rural communities, listened to a plan for increasing livestock production in the county. For several years before that the county had averaged around 75,000 acres of land in corn production. The average yield for the previous 15 years was 11.3 bushels per acre; for Georgia, it was close to 10 bushels. Many Coastal Plains counties were fully as low as the State average. These figures are based on U. S. Department of Agriculture reports. Corn acreage producing such low yields as this doubtless led to the old cries, familiar to Southern farmers: "It costs a dollar a bushel to produce corn in Georgia," and "I can buy corn cheaper than I can grow it." Repeated so long and so often that many farmers believed them, these sayings unconsciously had their effect in low yields of corn and lack of attempt to improve or change the practices that tend to make costly yields. In other words, the farmers had been growing "dollar" corn.

It was pointed out that there is no law against higher corn production and that whenever and wherever a farmer has put into his corn production the proper care and attention, using fertilizers and ploughing under humus in sufficient quantities, he has been able to produce quite satisfactory yields at a cost low enough to allow the feeding of his corn to livestock and making a profit therefrom.

A plan for a 5-year 10-acre corn production contest was proposed and adopted. Each farmer participating was to enter at least 10 acres of corn in the contest. The county was divided into four districts and the corn into two classes, solid corn and interplanted corn. Duplicate prizes were offered in each district and in each class. This made a total of eight prizes of a kind. First prize was a purebred bull calf, second prize a ton of fertilizer, third and fourth prizes purebred pigs. The businessmen, through the local Chamber of Commerce, agreed to furnish the money for the prizes. It was pointed out that by increasing corn yields from 11.3 bushels per acre to an average of 40 bushels and in turn feeding this corn to good livestock, the farmers' income could be increased $2,000,000 annually.

This plan was presented to the farmers by the vocational teachers in all their evening and part-time class work. The county agent mailed letters and application blanks, and the local papers gave publicity to the plan and its progress. About 200 farmers entered the contest for the first year with 2,000 acres of corn.

Edwin Boss and the purebred Hereford bull calf he won.

When measuring time came, the agricultural workers measured each 10-acre plot. The first year yields were quite satisfactory, the highest yield in solid corn being 622 bushels on the 10 acres. The top yield in interplanted corn was 500 bushels. However, the averages were the interesting factors. On solid corn it was 35 bushels per acre and on interplanted 29. When fair allowance was made for the additional feed value of the interplanted crops and this was interpreted in terms of corn, the average yield was 39 bushels.

The farmers were delighted with the 8 purebred bulls and 16 purebred pigs, as well as the fertilizer and feed, awarded as premiums. They were pleased with the plans of the contest, and many of them had more feed for their livestock than ever before.

The second year of the contest saw many farmers interested in the problem of feed production. About 3,000 acres were entered, and many thousand additional acres received fertilizer and proper care. Farmers were asking their vocational teachers for information on corn production. They were talking to their neighbors, comparing methods, soils, and fertilizers, and swapping experiences. They were beginning to awaken to the possibilities of new cash crops.

Outstanding Results

The second year's results were outstanding—300 farmers on all kinds of farms, all kinds of soils over the entire county, yes, all kinds of farmers, were proving something to themselves and to the State. The highest yield on solid corn was 862 bushels and on interplanted it was 598 bushels plus an abundance of additional feed. Here again we have interesting averages. On solid corn it was 43 bushels per acre and on the interplanted it exceeded 30 bushels. On both solid and interplanted corn the average was 37.4 bushels per acre. With the additional feed value of the interplanted crops translated into terms of corn and added, the average was at least 45 bushels of corn per acre.

"Good!" someone said, "but what about the fertilizer cost of this corn?" In measuring each plot of corn a complete history was taken and the fertilizer cost determined. Since this information had nothing to do with whether or not a man won a prize, there was no reason to doubt its accuracy. When we allowed $10 per acre for land rent, labor, seed, etc., and added to this the fertilizer cost of less than $4 per acre, we found that it cost the farmers an average of 30½ cents per bushel to produce this corn. It was conservatively estimated that because of the corn contest Colquitt County farmers harvested and fed to livestock at least 500,000 bushels of corn that they would not have had were it not for the interest created by the contest.

The second year of the contest was a fairly good corn year in the county, and someone wanted to know what would happen when we had a bad corn year. This question was very effectively answered in 1941, the third year of the contest. We had a so-called "bad" corn year, but here are the answers. We did not get 862 bushels from our best 10 acres. We did get 797 bushels—but again let's look at the averages for they tell the real story. On solid corn we rolled up the impressive average of 44.7 bushels per acre and on the interplanted 35.5 bushels, or 41.7 average on all corn measured in the contest. With feed allowances of 15 bushels per acre on the interplanted corn, a grand average of 48 bushels to the acre was made. The cost for fertilizer was 8 cents per bushel, with the total cost under 30 cents per bushel.

Widespread Influence

We have conducted the Colquitt County 10-acre corn contest for 3 years. During that time approximately 8,000 acres of corn have been entered. Many times that acreage has been affected by the practices advocated in the contest. Farmers are planting their entire corn crop on a new basis. They are recognizing the value of good seedbeds, good prolific varieties of seed corn, proper and complete fertilization, and correct cultivation methods. No longer is the corn crop being neglected, no longer is it being treated as a "necessary evil just so's to have corn to feed the mule." It is being cared for just as carefully as the other cash crops on the farm.

Many changed practices are coming into use among the farmers of the county. More winter legumes are being used. Farmers are recognizing the fact that humus, a storage medium for moisture as well as plant food, is absolutely necessary. One very prominent farmer, L. C. Rodgers, told the writer last fall that he had been watching this corn contest and that at first he thought very lightly of it. After two years he had become convinced that it was a good thing (several neighbors had produced

Pile of corn at left represents Colquitt County average yield of 11 3/10 bushels per acre for the past 15 years. Pile at right represents average yield of 86 2/10 bushels per acre on best 10 acres in the county in 1940.

high yields) and he was going to put in 25 acres of Austrian winter peas and enter in 1941. The writer forgot about the conversation until a few days before closing time for the '41 contest when he walked into the office of the county agent and met this same farmer. Immediately Mr. Rodgers asked when his corn was to be measured. He volunteered this statement, "I have more corn on 25 acres than I usually make on 80." When pressed for an explanation, he further stated that he believed he had as good land as Mr. Jenkins or Mr. Watson, two of his neighbors who were getting averages of better than 50 bushels to the acre. The writer measured the corn and it averaged 55 bushels.

Here are the interesting cost facts about this corn. A good crop of Austrian winter peas was turned under, the AAA paid the cost of these. One hundred pounds of 20% superphosphate and 100 pounds of kainite were used as fertilizer. The peas supplied the nitrogen, and at a fertilizer cost of $2 per acre this farmer made more corn from 25 acres of land than he had usually made from 80 acres, and saved the cost price difference on cultivating the 25 acres vs. the 80. This same farmer has covered the county looking for all the calves he can buy to harvest his corn and his cowpeas that were grown along with the corn. This is an actual instance of our corn-livestock program functioning. More interesting stories of changed practices and gratifying results could be related.

Many of the farmers are growing corn interplanted with velvet beans, peanuts, or soybeans. They harvest and store what corn they need for feeding the work stock and for finishing feeder steers or early spring hogs and then turn their hogs and cattle into the fields to harvest the remaining crop. In most instances they have sufficient feed on the field after the corn has been gathered to give several hundred pounds live weight gain to the acre. In addition to the profit from the cattle or hogs thus fed, the farmer is returning to the soil most of the plant food consumed in producing the crop. After the livestock have cleaned the feed from the land all litter left is disked in or turned under, thus adding much needed humus for plant food and water-holding capacity.

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Borax Helps Prevent Alfalfa Yellows in Tennessee

By H. E. Hendricks

Agricultural Extension Service, Knoxville, Tennessee

ALFALFA is not the most important hay crop in Tennessee from the standpoint of total acreage or tonnage produced. Korean lespedeza holds that position. Yet about 10% of the hay produced in Tennessee is alfalfa, and it is very important on those farms that grow it. They not only need the tonnage but also the quality of hay that alfalfa produces.

Outside of the market hay section of the Mississippi Delta, alfalfa is most common on dairy or general livestock farms—farms that are operated somewhat intensively and certainly more efficiently than the average, particularly from the standpoint of the economic use of the cropland.

Alfalfa is a relatively expensive hay crop to get started. To begin with, it is usually seeded on the most productive land on the farm; it must be limed, phosphated, in many cases manure or potash must be used, relatively high-priced seed bought and inoculated, and the land properly prepared. By the time the average Tennessee farmer gets an acre of alfalfa seeded, he has invested from $12 to $15 cash, besides his work.

He then hopes to get at least from 12 to 15 tons of hay off that acre during the following 4 years. In many cases the alfalfa does not last that long, neither does it produce that much hay. In the second or third year the alfalfa often seems to have a hard time surviving the hot, dry periods of late June, July, or August; it then grows slowly, the leaves turn yellow, and the summer showers seem to grow crab grass better than alfalfa.

To those of us who have been trying to increase the acreage of alfalfa, this condition has been, and still is, a serious problem. Unless it is corrected, it is certain that alfalfa production, at least in certain sections of the State, will not continue to increase to the acreage consistent with the best land use and farm management efficiency.

Diagnostic Procedure

This summer occurrence of yellows in alfalfa has been diagnosed frequently by agricultural workers, and it would be interesting to have a collection of all the causes and names ascribed to the trouble and the remedial measures recommended to correct it.

The usual procedure has been to first determine if the land itself is adapted to alfalfa production. Next came the liming history and the amount of phosphate used; then if adequate amounts of stable manure or potash were used, something else was sought. Quite frequently the adaptability of the variety was questioned. All of these things are important. Insects and disease symptoms were also noted.

Leaf hopper injury, "hopperburn," is very common in almost all alfalfa in

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This paper was also published on October 28, 1941, as mimeographed Special Circular 152 of the Tennessee Agricultural Extension Service.

the State and in rainy seasons also causes yellowing and defoliation. While the two troubles are common and are sometimes quite important, they are hard to correct in a farmer's alfalfa field. Besides, neither seems to give a real answer to the yellowing and poor growth of alfalfa under the discussion here.

In 1939 the severity of this situation was brought to the attention of Director C. A. Mooers of the Tennessee Experiment Station. Then, together with Dr. W. H. MacIntire and Dr. C. D. Sherbakoff, Chemist and Pathologist, respectively, of the Tennessee Station, a limited number of test demonstrations were planned on East Tennessee farms whereby potash and borax were applied to old alfalfa stands that had formerly received limestone and phosphate applications, but which had turned yellow during the summer.

In 1940, observations of these treatments indicated that they might have merit, at least that they should be tried out on as large a number of soil and other variable conditions as was feasible.

In 1941, in order to continue these demonstrations, county agents in 21 Tennessee counties, distributed throughout the State, agreed to select test demonstrations, lay out the plots, see that the material was properly applied, and make such observations or record such information as might be requested.

One of the demonstrations in the Foothills of the Cumberland Plateau on the Eastern Highland Rim.

These test demonstrations consisted of applications of muriate of potash at the rate of 100 pounds per acre and borax at the rate of 20 pounds per acre. Each material was used both singly and in combination. The lime and phosphate requirements of the land had been met. Some of the demonstrations had also received an application of stable manure. All of the 21 counties carried out at least two of these demonstrations, and some carried out three.

Some of the demonstrations were spring seeded, and the material applied at time of seeding. Some were seeded the fall before, some were a year old, some two, and some three. Most of the material was applied in March as a top-dressing.

In 1941 Tennessee, like a large number of states in the East, experienced a very severe drought during the early part of the year. At the time of the second cutting, in early July, a number of the county agents in those counties carrying on the demonstrations contacted the writer with reports that the borax, particularly, was showing significantly beneficial results. Typical of such reports was one from D. B. Hendrix, county agricultural agent in Sevier County, who made the following report of the demonstration on the farm of Henry Marshall.

"On the quarter acre where borax was used alone, at the rate of 20 pounds per acre, the alfalfa at the second cutting averaged 4 to 6 inches taller, had a much darker green color and profuse bloom, yielded probably double that of check plots, and had very few yellow plants. On the quarter acre where both borax and muriate of potash were used, the alfalfa appeared slightly denser than either of the other plots, but not remarkably better. On the quarter acre where muriate of potash was used alone, the plants showed some yellowing but the yield was much better than the check plot, though not as good as where the borax was used alone."

The writer saw these particular plots in late August, and even after considerable late summer rainfall, the borax-treated plots still showed marked improvement. It was particularly noticeable that very little crab grass was growing where borax had been applied, whereas, where potash alone had been applied there was a light growth of crab grass. Where no treatment other than limestone and phosphate had been made, there was very little growth at that time with the exception of crab grass.

Borax Increases Yield

Another interesting demonstration was in Williamson County in middle Tennessee. Joe D. Beasley, assistant county agent, measured the yield of the alfalfa on the farm of H. C. Jamison and reported the following:

"At the second cutting, yield per acre of check plot was .56 tons; borax alone, 1.06 tons; borax and potash, 1.21 tons; and potash alone, .75 tons."

This particular field had been seeded to alfalfa three different times in the last 30 years, and had been in alfalfa about half of the time since 1910.

From the reports of the county agricultural agents of the various counties and from personal visits to these demonstrations, it was apparent that this year the borax had little or no effect on the new or spring seedings of alfalfa made in 1941. None of the demonstrations, regardless of the age of the alfalfa, showed effects of the borax at the time of the first cutting.

On seedings a year or more old, about half of the demonstrations in the State reported yellows on the untreated portions at the time of the second cutting. About half of the demonstrations showed little or no response from borax applications at any time during the year, but in these cases the alfalfa was not affected with yellows. In only one demonstration where borax was applied the alfalfa yellows condition was not entirely corrected. It may be that an inadequate amount of borax was applied in this particular case.

The effect obtained from applications of potash seemed to be directly related to the native potash content of the soil, and more particularly to the length of time the land had been in alfalfa. Naturally, where stable manure had been applied little or no response was received from potash, neither was it expected.

It has long been known that it is necessary to lime and phosphate the land to grow alfalfa successfully in Tennessee. Recommendations on the use of potash have been associated with soil types and prior cropping systems. It seems that now the use of borax is definitely in the alfalfa production picture, although our knowledge of the use of the material on the crop in Tennessee is too meager to make specific recommendations and be sure of our ground.

From the limited experience in this State, it seems that borax applications are of value only in the prevention of alfalfa "yellows," although not all alfalfa fields turn yellow even in dry weather. It should be kept in mind also that there is one common yellowing due to the leaf hopper and another to the fungus leaf spot, neither of which could be corrected by applications of borax.

Thus far it is difficult to correlate alfalfa "yellows" with soil type, although this relationship may be found later.

It has not been determined specifically how much borax should be applied per acre, when it should be applied, or how long a given application is likely to be effective. The relationship of borax response to the life of the stand is most important and awaits future determination.

Since it is evident that a reasonably light application will do the job, and since the cost per acre of the borax is

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McIntosh apple orchard 24 years old. Good covers of bluegrass or clover have always been grown. The trees have never lacked for nitrogen, phosphate, potash, and lime. Yields have been more than 500 bushels per acre for 8 years except in 1938 when the crop was killed by spring frost.

Some Newer Ideas on Orchard Fertility

By F. N. Fagan

Pennsylvania State College, State College, Pennsylvania

Editor's Note: The following is the text of an address delivered at the picnic given by Senator Harry F. Byrd at his Rosemont Orchard near Berryville, Virginia, on August 30, 1941. Senator Byrd is one of Virginia's largest orchard operators and for many years has invited more than 1,000 people interested in the production of more and better fruit to be his guests, partake of a delicious dinner, and listen to good speeches and discussions on orchard problems.

AS I sit here thinking over the subject of orchard fertility that Senator Byrd asked me to discuss with his friends this year, my thoughts turn to the several times I have been a guest at the Byrd picnic. Just what is it that brings orchard folks to this picnic year after year? Many guests have driven miles to be here. The thing which brings us is something big, at least I think it is. It is not just for the good dinner Senator Byrd gives us. Most of you could have bought a good meal right at home for the price of the gasoline you used to drive to this orchard. Some people may think it is the apple buyer contacts made here. Some people may say it is politics. I for one will say that I never felt it was politics, but we orchard folks as well as all farm folks can thank our lucky stars that we have Harry F. Byrd, the orchardist, in the U. S. Congress. I wish we had some more of you in Congress.

I truly believe that what brings orchard folks here from the four corners of Virginia, from West Virginia, Maryland, Delaware, Pennsylvania, and even from more distant states, is the enthusiasm, the interest, yes, the love for a real industry, the fruit industry, an industry that has weathered storms of insects, diseases, and hail; an industry that has in the main fought its own battles; an industry that has had its ups and downs, but is still an industry furnishing a living for thousands of people.

The farm and orchard folks east of the Allegheny Mountains can be proud of their industry, for most of their farms are a better place to live today than they were 50 or 75 years, yes, 100 years ago, and many of their acres are producing food in larger amounts than they did 75 years ago. I am glad I am connected with such an industry.

Let me say right now that I feel highly honored to have been asked by Orchardist Harry Byrd to be a speaker at his picnic. I feel highly honored to have him ask me to discuss the fertility problem, for after all, the fertility of the soil is the all-important part of any branch of a successful agriculture.

The food in the soil for the plant or tree is the main key to all crop problems. We may trim our trees and spray them against pests, but if the soil does not contain the right food and in large enough amounts, and is not able to hold moisture, all such work is likely to be lost. We must have enough of the elements of plant food, which by the way includes moisture, in the soil or we can not expect our trees to produce yields of fruit large enough to leave a profit for our labor at harvest time. A high yield of 900 packed bushels of apples per acre has about the same acre production cost as a low yield of 200 packed bushels per acre. A 600- to 900-bushel yield can not be had without plenty of plant food and moisture in the soil.

Yes, I know some of you are thinking "plant food," be it chemical fertilizer or manure, costs too much money. I wish to drive home to you orchard and farm folks that we should hand out a word of praise, right now, to the fertilizer, chemical, and lime industries. They are giving us cheaper fertilizers, spray chemicals, and lime products than ever before, and all of these help to cut our cost of production. Yes, these industries need a word of praise for, in most cases, they are trying to sell us the right materials instead of just tonnage. They know the orchard man and farmer must be successful or he will not be a customer year after year.

Severe potash deficiency on the peach. The two shoots at the right are badly injured from lack of potash.

The fact that we have farm acres that have been under the plow and producing paying crops for 50, 75, and 100 years shows clearly that the U. S. farmer knows his industry, his soil, his Old Mother Nature. Sure we have farmers that get into financial trouble. If I remember correctly, a lot of banks, manufacturing plants, and retail stores also had their financial troubles during the last 12 or 14 years, and just as high a percentage as in the farming game.

Yes, the U. S. farmer knows his industry, knows a lot about his soil fertility and crop production. No group of people know their business better than the farmer knows his business. The past 16 years of American agriculture proves this fact.

Many years ago by Government legislation to help agriculture, a noble experiment, the Farm Board Bill was enacted, and since that time many other noble legislative bills have been enacted to help agriculture. If I am not mistaken, there was nothing really more wrong with agriculture when the Farm Board Bill was enacted than there were things wrong with a lot of other industries. If I remember correctly, one Virginia Senator, Mr. Carter Glass, said then that the act would not help agriculture, but that it might keep some tobacco, cotton, and grain banks, that had been doing a poor job of banking by loaning too much money on warehouse receipts, from failing. If I remember correctly, Mr. Glass never liked the change that was made in the National Bank Law some years ago.

Severe potash deficiency in the apple shoot at the right shows the short slender growth and burned leaves characteristic of severe potash shortage.

During the last 16 years there has been a lot of world "underconsumption" of food and not world "overproduction" of food.

The noble experiments to control agricultural production (tobacco, cotton, wheat, etc.) by reducing acreage and paying the farmer to do so have not reduced production. We still hear a lot of talk about surpluses, even to the tune of a 49¢ tax on a bushel of wheat if Mr. Farmer has produced more than his ratio, whether he has or has not signed on the dotted line. He'll just grow rye, barley, or oats next year. He knows his livestock will eat chops made from grain other than wheat; he knows his livestock will bed down on good straw even if it is not wheat straw; he knows rye, barley, and oat straw, through the barn and feed lot, will make just as good manure.

This same farmer will be buying at the same time his share and maybe more than his share of Defense Savings Stamps and Bonds, and if war comes, we can depend on him to do his part as he did in World War I.

The independent land-owning or good U. S. tenant farmer knows just too much about his soil's producing power for "The Economic Planners" to cope with. He may be a gambler, but if he is, I am sure he knows his cards. Beat him at his game if you can.

Few of you need to be told anything about feeding your trees their nitrogen food, such as from nitrate of soda, cyanamid, sulphate of ammonia, etc. Some of you do not use enough, however. How many of you have been thinking about the following foods for your orchards: phosphate, potash, calcium (lime)? About the organic and water-holding power of your orchard soils? I am sure not enough thought has been given by you, as well as by experiment station workers, to these items of fertility. How many of you would grow wheat without at least the use of phosphate fertilizer or a complete fertilizer such as a 2-12-4, a 2-8-8, or a 4-12-4? Not many of you. How many of you would grow a crop of corn without some fertilizer? Many of you would use some phosphate even if the corn was being planted on land where you had plowed down a clover, alfalfa, or hay land sod to which you had applied that fine fertilizer—manure. Yes, we orchard folks have neglected using phosphate, potash, lime, manure, and cover crops.

It seems funny to me now why we thought we could get along without them. We knew we needed them for farm crops, and trees grow just the same as cotton, corn, tobacco, wheat, and the truck crops. The truck gardener has always been a great user of manure and other fertilizers as well as nitrogen, and we can learn a lot from him if we will. We orchard folks used to practice the fine, clean cultivation system in our orchards. By this method, we unlocked all the natural nitrogen in the soil. The trees grew fast during their young years, then they did not do so well. We then fed nitrogen, in soda and sulphate of ammonia. The trees responded and we were satisfied, but this clean cultivation year after year at last caused all the natural organic material to burn out of the soil. Our good little friends, the soil bacteria, died because we had destroyed their homes. They could not work for us, could not even help with the phosphate and potash liberation. Legumes would not grow, and nitrogen bacteria could not put nitrogen back into the soil.

I know but one thing about soil bacteria, and that is, they are the orchard man's friends. With clean cultivation year after year we did all in our power to keep nature from working for us. We applied nitrogen fertilizer, used it up, and never figured we were also losing our phosphate, potash, and calcium by this method of orchard soil culture. Surface wash took its toll of these plant foods. We cannot have soil bacteria working for us in a clay bank. Good bricks could have been made from the soil in many an orchard by sifting out the stone and burning the clay in the normal brick-making way. We wanted to grow a big tree fast—cultivation would do it.

The fruit tree nurseryman could have told us what we would do to our soil. He was a clean culture man to the Nth degree. In many cases of tree growing he cultivated his land clean for three summers before he dug his trees, but he never put trees right back on the same land. He put his land back to a rotation of farm crops with manure or back to sods of grasses, clovers, or some other legumes. The orchard fertilizer problem is interlaced with the general system of orchard soil management, be it cultivation given or not given, cover crops grown or not grown, stock manure used or not used, sods grown or not grown. Let me read to you a few statements about orchard fertility. These statements come from several different sources and point to the use of complete fertilizers.

Annual Fertilization Beneficial

Turning to recent published work on orchard fertilization we find Professors Blake, Nightingale, and Davidson stating in New Jersey Agricultural Experiment Station Bulletin 626 as follows:

"Some orchard soils may be so well supplied with all the common nutrients that they will not show a beneficial response to applications of fertilizers. Other soils may be deficient in one or two nutrients but be well supplied with the remaining elements. In general, however, orchards planted upon Coastal Plain soils will be benefited by annual applications of a complete fertilizer.

"Orchard soils which are obviously deficient in nutrients and where neither sod, cover crops, weeds, nor trees are making enough growth should receive a complete fertilizer somewhat higher in nitrogen, such as 5-10-5 . . . If the trees and soil are not actually deficient in nutrients, this treatment is definitely unwise.

"Calcium should be regarded as a

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Fig. 1. White beans on an experimental field near Ovid, Michigan. The two rows at the left received potash; the plants were green and thrifty. The next two rows received phosphate; the plants were small and the leaves were yellow. The next four rows received a complete fertilizer; the plants were large and of a normal green color.

Plant Symptoms Show Need for Potash

By R. L. Cook

Michigan State College, East Lansing, Michigan

THERE are several ways of determining whether or not a soil is deficient in nutrients for any certain crop or group of crops. The oldest method now in use is that of field plat experiments. This method is probably the most reliable, but it is also the slowest and most expensive method now being used.

Soil testing, as a method of determining the level of easily available nutrients in soils, has become rather common during recent years. Such tests are very helpful when they are properly performed and the results are correctly interpreted. It is always impossible, however, to be certain that "availability" as determined by a chemical test coincides with "availability" to the plant under consideration.

Of still more recent origin than the soil tests are tests made on green plant tissue. The logic behind the testing of plant tissue is simple. If the plant can obtain sufficient of the nutrient from the soil, it will show up in the test, and if it cannot obtain the nutrient in adequate quantity, the supply of the nutrient in an available form must be limited. In other words, the plant itself becomes a means of measuring availability. While plant-tissue tests may not be sufficient in themselves, the combining of tissue testing with soil testing should lead to more reliable conclusions than may be drawn solely from soil-testing results.

A fourth and still newer means of attack on the problem of nutrient availability is that of plant symptoms—using the appearance of the plant as an indication of the supply of nutrients in the medium which supports the plant. Underfed plants often develop abnormally in much the same manner as do animals

Fig. 2. A white bean leaf showing characteristic symptom of potash starvation. The ends and edges of the leaflets turn yellow first, then the yellowing works toward the center and base until the entire leaflet is yellow.

when certain essential ingredients are not included in their ration.

The use of plant symptoms as a means of diagnosis should become very popular because no expensive equipment is needed and it is not necessary to wait for the results from long, tedious experiments or chemical determinations. Any farmer can make use of this valuable tool by becoming acquainted with the symptom in which he is interested. The following results of some potash studies, made during the past two years, are a good illustration of the methods used in studying symptoms and of the value of symptoms as aids in making fertilizer recommendations.

Greenhouse pot culture and field plat experiments furnish excellent opportunities for studying nutrient deficiency symptoms. While some ideas may be obtained from printed descriptions and black and white photographs, it is well to actually observe plants exhibiting known deficiency symptoms. Colored slides are coming into wide use as a means of recording symptoms after it is no longer possible to save the specimens.

Field plat experiments have led to some interesting observations. In an experiment located on Miami loam soil near Ovid, Michigan, white beans were fertilized with nitrogen, phosphate, and potash fertilizers separately and in all combinations. The fertilizer was applied in a band one-half inch out from and one and three-fourths inches below the seed at the time of planting on June 9, 1939. By July 21 the differences in growth as a result of the fertilizer applications were very marked. As shown in Fig. 1, the plants which had received phosphate alone were small and the leaves were characteristically yellow. This is indicated by their light color in the photograph. A close-up of one of the leaves, Fig. 2, shows that the yellowing starts near the edges and ends of the leaflets. It then works in toward the centers until finally the entire leaf turns yellow. Death follows and the leaf dries up.

The plants which received no fertilizer and those which received nitrogen alone were less yellow than those which received phosphate alone or phosphate and nitrogen. Plants which received potash, as shown in Fig. 1, were larger than those treated with phosphate and were of a normal green color. The largest plants in the field were those which received either both phosphate and potash or all three plant nutrients, nitrogen, phosphate, and potash.

While it seemed certain from the appearance of the plants on the variously fertilized rows that the yellow color was a symptom of potash starvation, it was decided to check further on this by means of potash side-dressings. It happened that a portion of the field at one side of the experimental area had been

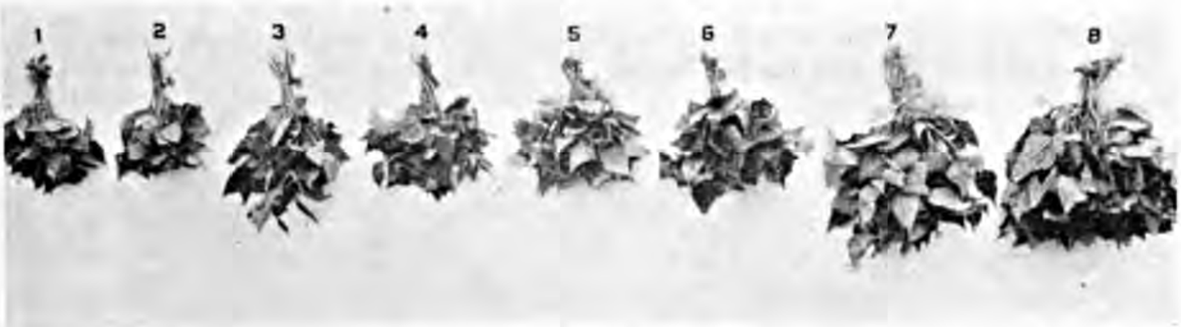

Fig. 3. These bunches of beans taken from the field on July 21 show that a combination of phosphate and potash was necessary. (1) No fertilizer, (2) 4-0-0, (3) 0-0-8, (4) 4-0-8, (5) 0-16-0, (6) 4-16-0, (7) 0-16-8, (8) 4-16-8.

uniformly treated with superphosphate at planting time. On July 22 one-third of the rows on this area were side-dressed with 100 pounds of muriate of potash per acre, one-third with 50 pounds per acre, and one-third were left without treatment. Within three weeks after this treatment the rows which had received the potash had re-assumed their normal green color, and the plants were much larger than those in the rows which had not received potash and had remained yellow.

The bunches of beans shown in Fig. 3, photographed on July 21, show the comparative sizes of the plants on the plats which were variously treated at planting time. By August 25 it was evident that very few pods were setting on the plants which did not receive potash. Some typical plants are shown in Fig 4. There were only 2 pods on the plant fertilized with phosphate, while there were 9 pods on the plant treated with potash and 14 on the plant which received a combination of phosphate and potash.

Potash also hastened maturity of the beans in this experiment. As indicated by the bunches of plants shown in Fig. 5, the beans on all plats which had received potash were well matured, while those on the other plats still retained their leaves and the pods were immature.

The yields of these plats show that potash not only produced a healthy appearance, but also increased the yields (Table 1). The data show that plats treated with phosphate yielded but slightly more than did the untreated plats, while those which received potash produced yields which averaged exactly twice as high as those from the unfertilized plats. While phosphate alone did not appreciably increase the yields, the nutrient caused a significant in-

Fig. 4. Potash was necessary for pod setting on these white beans. The left plant received only phosphate and set only 2 pods. The center plant received only potash but set 9 pods. The right plant received both phosphate and potash and produced 14 pods.

TABLE 1.—THE EFFECT OF FERTILIZERS, APPLIED AT PLANTING TIME, ON THE YIELDS OF FIELD BEANS. MIAMI LOAM.

Fertilizer*	Rate	Yield—Bu. per acre
No fertilizer	....	6.1
4- 0-0	300	6.2
0-16-0	300	7.6
4-16-0	300	6.5
0- 0-8	300	12.2
4- 0-8	300	10.5
0-16-8	300	16.4
4-16-8	300	14.9

* Applied in a band one-half inch out from and one and three-fourths inches below the seed.

TABLE 2.—THE EFFECT OF POTASH, APPLIED AS A SIDE-DRESSING AFTER STARVATION SYMPTOMS HAD APPEARED, ON THE YIELDS OF FIELD BEANS. MIAMI LOAM.

Treatment*	Yield—Bu. per acre
Muriate of potash 100 lb. per acre	19.4
Muriate of potash 50 lb. per acre	17.8
No potash	9.7

* 240 pounds 0-20-0 per acre applied at planting time. Treatments were replicated 8 times.

crease in yield when used in combination with potash. Nitrogen, either alone or in combination with phosphate and potash, did not cause increases in yields.

The data reported in Table 2 show that on the plats where potash was applied as a side-dressing after starvation symptoms had appeared the yields were increased from 9.7 to 17.8 and 19.4 bushels respectively as a result of 50- and 100-pound applications of potash. The increase in yield caused by the 100-pound over the 50-pound application was not large enough to be significant.

During the season of 1940 another white bean experiment was conducted on the Ovid farm. As in 1939, the yellow symptoms of potash starvation appeared rather early on the plats which did not receive potash. At the same time, similar symptoms appeared on soybeans grown on an adjoining experimental field and, as in the case of white beans, the symptoms were not present on plants which had been treated with potash.

It was decided at this time to make a survey of some of the white bean fields to see if these symptoms were confined to the locality of Ovid or were scattered well over the State. Accordingly, during the latter part of July a large number of white bean fields were visited and signs of potash starvation were found in many fields throughout the bean-growing area. Leaf samples for analysis were taken from 40 fields, and record was made of the severity of the symptoms in each field. The samples were taken into the laboratory where the fresh tissue was tested for phosphorus and potassium.

The fresh leaves were finely sliced and extracted with weak acetic acid. The potassium in the extract was precipitated with sodium cobalti-nitrite. Readings were based on the amount of precipitate which formed. Phosphorus in the extract was determined by the ammonium molybdate colorimetric method.

A very good correlation was found between the presence of symptoms and the potassium content of the fresh tis-

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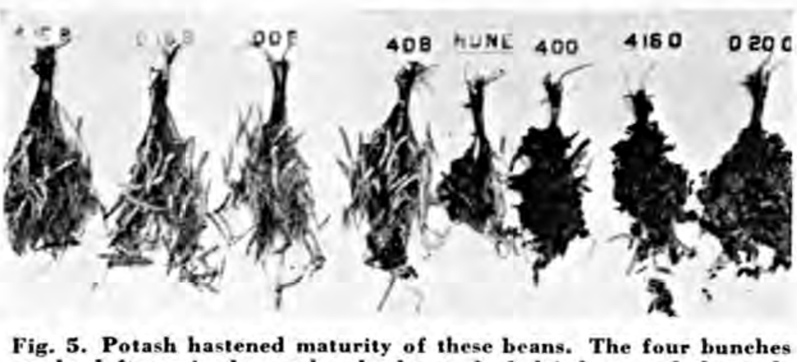

Fig. 5. Potash hastened maturity of these beans. The four bunches at the left received potash; the leaves had dried up and the pods were well matured. The other four bunches were from rows which did not receive potash; they were not mature at harvest time.

Potash Demonstrations on State-wide Basis

By R. W. Shoffner

Agricultural Extension Service, Raleigh, North Carolina

NINETY-FOUR farms in 20 counties in North Carolina were selected in the spring of 1941 to demonstrate the value of potash in a well-balanced and properly managed farm program. The demonstrations are being supervised by the North Carolina State College Agricultural Extension Service. Demonstrating the value of fertilizer materials on an entire farm unit basis is relatively new and is a much larger and more complicated task than carrying out an ordinary test where potash or other fertilizer materials are applied to part of the crop and left off a small check plot.

The real test for any farming practice is the effect it will have upon the farm income and family living over a period of years. With this fact clearly in mind, we are attempting to throw new light on various farming practices by showing how they fit into the whole farming picture and by measuring the effect upon the farm income as a whole over a period of years. We are not attempting to do research work, but are trying to demonstrate proper fertilizing practices, rotation of crops, and many other good farming practices along with good sound farm management.

We expect not only to correct potash deficiency on these farms and to demonstrate to the public the value of using potash and other fertilizer materials where they are needed, but also to demonstrate numerous other good farming practices and to show how all of these practices fit together to make a complete farming unit.

The Farm Management and the Agronomy Departments at State College selected 20 counties to carry out this work. These counties represent all of the different types of farming areas in North Carolina. The eastern part of the State is represented by Duplin, Jones, Bladen, Wayne, Cumberland, Perquimans, Edgecombe, Pitt, Wilson, Hyde, and Bertie counties. The Piedmont area is represented by Alamance, Caswell, Surry, Union, Cabarrus, Davidson, and Davie counties; while the mountain area is represented by Henderson and Buncombe counties. As a general rule there are five farms per county. The individual farms within each county were selected by county committees along with the county agent after each farmer had submitted an application to become a demonstration farmer. In the selection of these farms, special attention was given to soil type, size, and type of farming.

State Department Cooperates

The Farm Management Department is organizing and planning the work. Fertilizer recommendations are being furnished by the Agronomy Department, while the extension agronomist has assisted in working out rotations for most of the farms. Other State College specialists are furnishing information and services as they are needed. The State Department of Agriculture has run more than 1,000 soil samples which came from these farms during the past year.

The farmers cooperating in this work have furnished certain basic information which gives a good cross-section of these farms. This information can be used from time to time in measuring progress on the farms.

The following discussion is based on the summary of information tabulated for the 94 farm management demonstrations using potash. All 94 farms were used to obtain an average for the State, while averages for the eastern counties represent 51 farms; for the Piedmont, 33 farms; and for the mountain counties, 10 farms. In addition to giving the State average, in some cases averages for the three sections have been compared.

What Averages Disclosed

The average demonstration farm contains 143 acres of total farm land, of which 63 acres are cropland and 9 acres open pasture. Total farm land averaged 159 acres in the eastern, 139 acres in Piedmont, and 75 acres in the mountain area. The cropland in the eastern averaged 68 acres per farm, while in the mountain area it averaged only 33 acres. The reverse is true for open pasture as shown by 18 acres per farm in the mountain as compared with only 3 acres in the eastern group. The Piedmont is about midway between the other groups for both cropland and pasture.

The average operator in the Piedmont and eastern groups had been farming 26 years and was 46 years old. In the mountain section the farmers were 15 to 20 years older and had been farming about 10 years longer. The average operator had spent 10 years of his life in school. There was an average of 9 people per farm for the 94 farms and 6 of these were above ten years of age.

The information as to the farm and home revealed that two-thirds of the homes had electricity, and approximately one-third had electric refrigeration. About one-third of the farm homes had running water for the farms as a whole, while slightly more than half of the farms studied in the Piedmont had running water. Of the 94 farms studied, all except 7 had radios. About half of the 94 farms were keeping farm records before this program started, and four-fifths were taking a daily paper. All but one farm were taking some kind of farm paper.

All farmers in the mountain area had a year-round garden and fruit. Piedmont farms had gardens and in most cases their fruit supply. Most eastern farmers had gardens, but only two-thirds had sufficient fruit to supply the farm needs. Only 7 farmers out of the 94 reported insufficient milk supply for the farm; 5 of these were in the eastern area and the other 2 in the mountain area.

Forty-five of the 94 farms were mortgaged, and less than 35% of the 94 had a source of outside income.

Yields of crops reveal that the eastern group had an average of 6.3 acres of cotton per farm with an average yield of 542.5 pounds per acre. The Piedmont had an average of 4.5 acres with an average yield of 491.1 pounds per acre. The tobacco acreage averaged 5.9 in the eastern group, with 1,007.6 pounds per acre. The Piedmont averaged 2.7 acres per farm with 810.5 pounds per acre. There was an average of 19.4 acres of corn for the 94 farms with a yield of 28.7 bushels per acre. The eastern group had an average of 25.5 acres and a yield of 29.5 bushels; Piedmont an average of 12.3 acres with a yield of 24.9 bushels; and the mountain group 11.2 acres with a yield of 32.5 bushels per acre. There was an average of 3.6 acres of wheat for the 94 farms with an average yield per acre of 18.3 bushels. Oats averaged 3.3 acres with a yield of 31.9 bushels. Barley was reported only in the Piedmont and with an average yield of 37.3 bushels per acre. Considerably more lespedeza was grown on farms in the Piedmont than in other sections. More pasture was found in the mountain area, while a small amount was found in the eastern. Sixteen farms in the eastern section had no pasture at all, while a few farms in the Piedmont reported no pasture.

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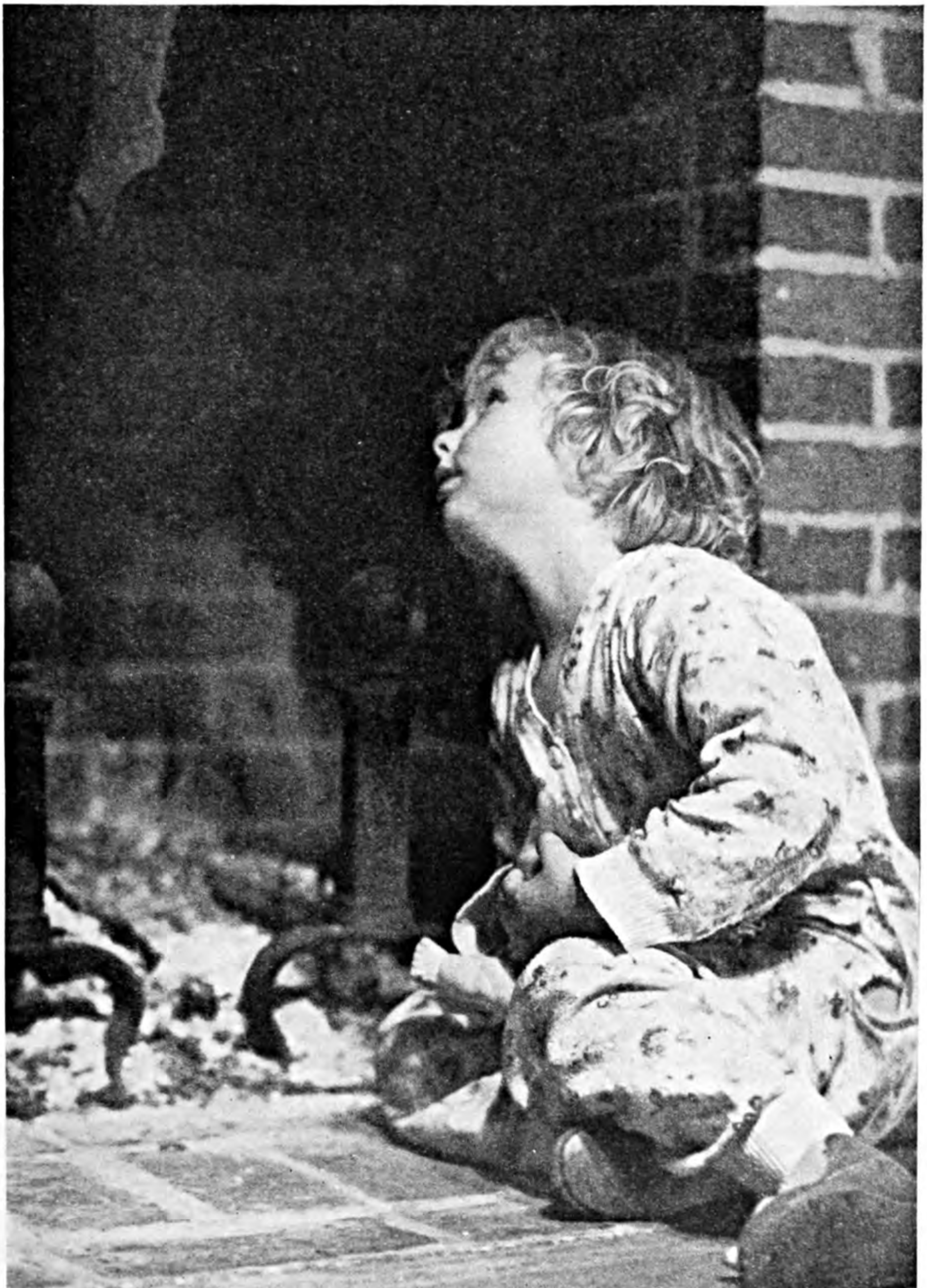
PICTORIAL



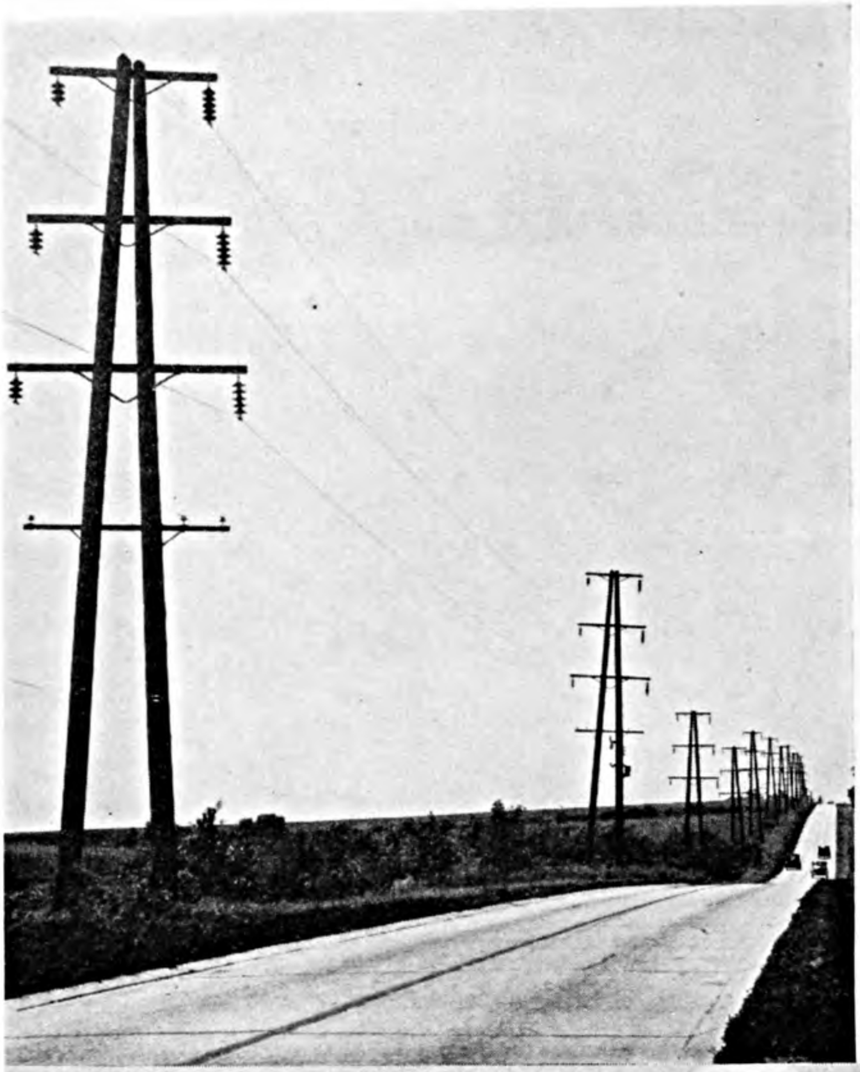
"IN HOPES THAT ST. NICHOLAS SOON WOULD BE THERE."

Above: Mrs. Ottie Leitch, LaOtto, Indiana, won sweepstakes with her entry of Sweet Spanish onions at the Northern Indiana Muck Crops Show.

Below: The Jachim Brothers of Wheatfield, with a yield of 639.79 bushels of potatoes per acre, are 1941 Indiana Potato and Muck Crops Champions.

Above: Floyd Wise (with trophy), 1941 National Corn Husking Champion, and Leland Klein, runner-up. Wise husked 45.37 bushels and Klein 45.21 bushels.

Below: Governor Green of Illinois helps out at the 1941 Corn Husking Contest. Both winner and runner-up this year are from Illinois.



Left: This power line and highway near Platsmouth, Nebraska, are typical of the conveniences enjoyed by many rural areas.

Below: A trainload of molasses on the way to an alcohol plant. This is only one of the many uses to which this product is put.

The Editors Talk

Looking Backward

When pausing to consider the events of the past year, in the light of what has happened in other countries, Americans must admit that we have been very fortunate. We have enjoyed good harvests with record-breaking agricultural production. We have plenty of food and apparently will continue to have enough. According to the Secretary of Agriculture, we might distribute what we have more evenly, but there is no doubt that Americans are the best fed people in the world.

During 1941 industrial activity experienced a greater advance than in any other year on record. Most industries are now operating in high gear at near capacity with total output substantially above previous peak years. We have made vast strides toward demonstrating to ourselves and to the world that the United States can produce guns and butter at the same time. In Europe it was a choice of guns over butter.

From the farmer's viewpoint, 1941 got off to a rather sluggish start. Most of the improvement in farm prices has occurred since the second quarter. Beginning in March farm prices started an upward movement that reached almost inflationary proportions by July. Prices continued sharply upward until September when they leveled off. This advance resulted in the most favorable balance between prices received and prices paid by farmers that has existed since 1920. In September the ratio between farm prices and prices paid by farmers was 101% of the 1910-14 average. It should be noted, however, that due to the advance in prices for most of the products that farmers had to buy, it is necessary for farm prices to be well above the 1910-14 levels in order for farmers to be on a comparable basis with the 1910-14 period.

Farmers enjoyed a combination of two very favorable circumstances—expanding production and rising prices. Production of many agricultural commodities in 1941 has been the highest ever recorded. Total production of all farm products is about 2% above 1940 and 12% above the 1924-29 average. High prices and expanding production resulted in a farm income of about 11 billion dollars, 22% above the 9 billion received in 1940.

Although farm prices as a whole attained parity during 1941 for the first time in 21 years, not all producers have enjoyed the same degree of price improvement. Prices of wheat, corn, and most feed crops are still well below parity. The level of 101% of parity attained in September was largely the result of relatively high prices received for livestock and livestock products, although cotton producers were receiving almost parity and the tobacco producers well above parity.

The year witnessed a change in emphasis in our national farm program and a new test of its adaptability to changing conditions. In September the Secretary of Agriculture announced the inauguration of a new program calling upon American farmers to adjust production for National Defense. This is the first time in the history of the United States that production goals for all essential farm commodities have been established.

With the development of the present crisis, American agriculture is going to be called upon for even greater efforts than had been contemplated only a month ago. It is encouraging for all of us to know that these demands are coming at a time when the farm plant is in a splendid condition to meet them. The most serious deterring factor at the present time is scarcity of labor. It appears that the increase in production will have to be accomplished with fewer farm workers. There was never a time when it was more important for farmers to follow the most efficient methods of production, utilizing to the fullest farm management practices which will result in maximum production with minimum labor.

The importance of fertilizers in such a program is self-evident. In this connection it is significant to note that according to all available related information, 1941 established a new record in total plant-food consumption in the United States. With the improvement in farm purchasing power and a better ratio between farm prices and prices paid by farmers, fertilizer use, which has been profitable in the past, promises to be even more profitable in the immediate future.

Better Fruit

World conditions have moved so fast during the past year and have commanded so much of our attention that it is difficult to realize some of the changes in trends in our agriculture. America is entering a new era of nutrition—an era where balanced diets with an abundance of fruits and vegetables are being stressed. The Government has indicated its goal of doubling the consumption of these essential foods. The Nation-wide campaign to achieve this goal should have a most stimulating influence on demand.

Fruit growers are being urged to grow more and better fruit. They are being asked to take better care of their trees and to see that all fruit is grown and marketed so that this valuable source of health and energy will reach the largest possible number of people. Important as may be fruit for balancing the diet of man, important also is the balancing of the plant-food diet of the trees upon which the fruit is grown.

The official viewpoint on orchard fertilization has been through a number of cycles. In the beginning orchards were treated like an ordinary farm crop. Manure and complete fertilizers were recommended and used. This was followed by the so-called nitrogen era. While no one questions the value or importance of nitrogen in orchard fertilization, its exclusive use results in the depletion of the reserves of other essential plant foods. Eventually a state of unbalanced nutrition develops and is reflected in poor wood growth, declining yields, inferior keeping and shipping qualities, and the appearance of such physiological disorders as fruit pit, water-core, drought spot, and die-back.

In this issue of the magazine we are pleased to present to our readers F. N. Fagan's talk before an important gathering of orchardists. In this talk, Mr. Fagan brings ideas on orchard management up to date.

To Our Readers: Christmas Greetings
and Best Wishes
for the New Year

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

¶ One of the oldest continuous fertilizer experiments on vegetables has been summarized by John Bushnell in Ohio Agricultural Experiment Station Bulletin 622, "Fertilizers for Early Cabbage, Tomatoes, Cucumbers, and Sweet Corn." The work was conducted on river terrace soil characteristic of southern Ohio where intensive vegetable farming is practised.

During the early years of this experiment there was little response to potash by the vegetables growing on this soil, but in the past eight years very marked responses have been obtained on all crops where large amounts of manure were not used. Nitrogen was particularly effective on cabbage, moderately effective on tomatoes and cucumbers, and less effective on sweet corn. Phosphorus was not particularly effective on most of the crops, a rather unusual condition explained on the basis of large residual supplies of phosphate having been built up in these soils by past treatments. Soil tests on other farms in the vicinity, however, also showed rather high phosphorus supplies in the soil, with a surprisingly large amount of water-soluble phosphorus present, indicating that there is a soil condition which is particularly favorable to supplying available phosphorus in these soils. With applications of eight tons or more of manure each year benefits from fertilization were much less than when no manure was applied, although even the generous applications given did not fully take care of the nitrogen and phosphate requirements in all cases.

The bulletin also compares results of several methods for testing soils for their available phosphate and potash, compares the removal of nutrients by the harvested portion of crop with the amounts recommended to be applied, and gives possible modifications of recommendations in line with results of soil tests.

¶ In the nutrition of plants the balance among the various nutrients, as well as the total quantity, are important factors in the health and vigor of the plant. An interesting but technical discussion of this is given by W. Thomas and W. B. Mack in Pennsylvania Agricultural Experiment Station Bulletin 405, entitled "A Foliar Diagnosis Study of the Nutrition of Greenhouse Tomatoes in Relation to the Incidence of a Disease." When growing tomatoes with various fertilizer treatments in a greenhouse, some of the plants became affected with a fusarium disease, so the leaves were analyzed to see what relationship, if any, existed between disease incidence and the chemical composition of the leaf with respect to nitrogen, phosphoric acid, potash, calcium, and magnesium. In making the analyses, leaves from apparently healthy, slightly diseased, and severely diseased plants were taken. Yield data are given which show that the plants receiving the high fertilization gave the highest yield, followed by the phosphate and potash treatment, with a big drop for phosphate, potash, and high nitrogen treatment and a slightly greater drop for the nitrogen and phosphate treatment.

The analytical data were calculated to a milligram equivalent basis and plotted on two sets of triangles. One triangle consisted of the so-called plastic elements, nitrogen, phosphoric acid, and potash; and the other triangle the bases, lime, magnesia, and potash. There was a distinct tendency for the leaves of the diseased plants to be relatively lower in potash and in some cases high in nitrogen and in others high in phosphate. In one case the badly diseased plants tended to be relatively low in calcium, but usually the relationship was more marked in the so-called plastic elements. In addition to the equilibrium among the nutrients, the total quantity of nutrients was also compared to disease incidence. It was found that diseased plants had less nutrients in them than the healthy plants. The authors draw the conclusion that the incidence of the disease appeared to be closely associated with disturbances in the nutritional balance and apparently also the intensity of nutrition of the plant.

"Administration of California Laws Relating to Fertilizing Materials," St. Dept. of Agr., Sacramento, Calif., Rep. from The Bulletin, Vol. XXX, No. 3, July, Aug., Sept. 1941, Alvin J. Cox.

"Amendments to Fertilizing Materials Article of Agricultural Code," St. Dept. of Agr., Sacramento, Calif., Bu. Chem. Anns. FM-32, Oct. 31, 1941.

"Fertilizer, Feed, and Seed Report, January-June 1941," St. Bd. of Agr., Dover, Del., Quarterly Bul., Vol. 31, No. 2.

"Commercial Fertilizers 1941—Analysis of Official Samples and Tonnage Sold," St. Bd. of Agr., Topeka, Kans., Paul Ijams.

"Comparison of Fertilizer Ratios for Tomatoes, 1941," N. Y. Agr. Exp. Sta., Geneva, N. Y., C. B. Sayre.

"Fertilizer Placement Experiments with Tomatoes, 1941," N. Y. Agr. Exp. Sta., Geneva, N. Y., C. B. Sayre.

"Borax Helps Prevent Alfalfa Yellows in Tennessee," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 152, Oct. 28, 1941, H. E. Hendricks.

Soils

¶ A revision of the excellent bulletin entitled "Sandy Soils" has been made by the original authors, G. M. Grantham and C. E. Millar. This publication is issued as Special Bulletin 248 of the Michigan Agricultural Experiment Station and brings up to date information and recommendations regarding the management and fertilization of sandy soils. While the bulletin is written primarily for Michigan conditions, the principles set forth in it are applicable to light soils in the entire northern Corn Belt.

It is brought out that, owing to the problem of moisture supply, very light and sandy soils offer particularly difficult problems if they are to be successfully farmed. In most cases it is advisable to return such land to forests or devote it to uses other than farming.

The importance of maintaining and if possible building up organic matter in sandy soils is emphasized since this is the best way to correct some of the natural deficiencies inherent in them, particularly with reference to moisture supply and retentiveness of nutrients. Rotations in which sods are turned under frequently and the growing of cover and green manure crops in addition to use of manure offer the best ways of improving organic matter in the soil. It is emphasized that in successfully growing green manure crops a certain amount of fertility in the soil and the proper degree of acidity are required. For this reason the use of lime and fertilizer should not be neglected. The use of lime is also important in connection with growing many other crops in the rotation. In order to enable the grower to apply lime with intelligence, it is suggested that the soil be tested every two or three years to determine how much lime, if any, need be used.

Fertilizers for crops growing on sandy soils should be adapted to the peculiarities of the soil and the particular requirements of the crop being grown. Nitrogen, phosphoric acid, and potash usually are required, with particular emphasis placed on the nitrogen and potash. Every effort should be made to grow as much nitrogen as possible by frequently turning under legume sods and green manures. Large nitrogen fertilizer applications at one time are to be avoided since the soils have a low retentive capacity. When large amounts of nitrogen are needed, they should be applied in several applications. Sandy soils are usually naturally low in potash and for that reason the fertilizers should be relatively higher in this nutrient than are fertilizers used on the heavier soil types. The phosphate in the fertilizer should usually be about the same or slightly less than applied on heavy soils.

For fall-sown small grains 2-12-6, 2-16-8, or 3-12-12 are recommended with application of a nitrogen top-dresser in the spring. For fertilizing alfalfa and clover, analyses such as 0-12-12, 0-20-20, and 0-8-24 are recommended. These should be used before planting the crop, and on stands more than 2 years old a top-dressing of a similar fertilizer should be applied after the first cutting. The rate of application in all cases should be around 300 pounds per acre. Space prevents giving further details on the great amount of practical and useful information and recommendations for additional crops commonly grown on sandy soils given in this bulletin.

"Soil-building Practices in the 1941 AAA Program as They Apply to Iowa," Agr. Ext. Serv., Ames, Iowa, Pamph. 4, Mar. 1941.

"Natural Land Types of Massachusetts and Their Uses," Agr. Exp. Sta., Amherst, Mass., Bul. 385, May 1941, A. B. Beaumont.

"Soil Survey of Pangasinan Province, Philippines," Dept. of Agr. and Comm., Manila, P. I., Soil Rpt. 7, M. M. Alicante, D. Z. Rosell, R. T. Marfori, and S. Hernandez.

"Questions and Answers Regarding Wyoming State Soil Conservation Districts Law," Agr. Ext. Serv., Laramie, Wyo., Cir. 78, June 1941, Donald A. Ritter.

"Publications and Visual Information on Soil Conservation," U. S. D. A., Washington, D. C., Misc. Pub. 446, May 1941.

Crops

¶ Many agriculturists are of the opinion that corn yields on many farms of the South are much lower than they should be or even need be. Practices to be followed for increasing yields are given by H. A. Woodle in Clemson Agricultural College Extension Circular 194, "Corn Production in South Carolina." Since part of the problem in increasing corn yields involves an improvement in the general program of the farm, improved rotations including cover crops and legumes are first suggested. Planting of the crop on reasonably fertile soil, combined with the use of adapted varieties, including hybrids, and proper fertilization, soil preparation, cultivation, and harvesting methods are also necessary if good yields are to be obtained.

The fertilization of the crop will vary with the fertilizer practices of the entire rotation. Phosphate and potash will usually be required on all soils except where heavily fertilized cotton or tobacco has preceded corn, in which case a nitrogen top-dressing may be sufficient. Where good supplies of high-quality manure are available, phosphate alone may suffice. Where a legume precedes corn in a grain and hay rotation, 0-12-12 or 0-16-8 at 200 to 400 pounds per acre is recommended. In a similar rotation where a legume crop does not precede corn, 5-10-5 or 4-12-4 at 200 to 400 pounds per acre with nitrogen as a side-dressing is recommended.

Where potash deficiency shows up on corn it is advisable to use more potash. It is stated, "When definite potash deficiency has been observed, 50 pounds or more of muriate of potash or its equivalent should be applied per acre." Best results will usually be obtained if the soil is only moderately acid, which means that lime should be applied on the very acid soils. Magnesium and manganese deficiencies are likely to show on the very acid and very alkaline soils, respectively, and where these deficiencies have been observed, appropriate sources of magnesium or manganese should be applied.

¶ Taro is an important starchy crop in Hawaii and is subject to numerous diseases, particularly if growing conditions are unfavorable. These diseases and methods of combating them are discussed by G. K. Parris in Hawaii Agricultural Experiment Station Circular 18, "Diseases of Taro in Hawaii and Their Control." Owing to the great influence of growing conditions on susceptibility to disease, considerable attention is given to proper fertilization. It would appear that much is yet to be learned concerning the fertilizer needs of this crop, but evidence at hand indicates that fertilizers in 1:1:1 or 1:2:2 ratios are well suited for the crops growing under wet land conditions. In experiments conducted on upland Taro potash appeared to be particularly important. In the limited evidence available there appears to be little direct correlation between fertilizer treatment and control of any specific disease, although the desirability of proper fertilization to build up the vigor of the plant is emphasized.

¶ The production of another tropical fruit, papaya, is very completely covered in Hawaii Agricultural Experiment Station Bulletin 87, "Papaya Production in Hawaiian Islands," by W. W. Jones, W. B. Storey, G. K. Parris, and F. G. Holdaway. The botany, culture, diseases, insect pests, harvesting, marketing, and uses of the fruit are considered. While complete fertilizers usually are needed, information on requirements of this plant is only in process of being obtained. Pending further results of investigations under way, fertilizers such as 6-12-6 or 8-12-6 are recommended.

¶ There probably is nothing that will more easily or more permanently beautify home grounds, whether in the country or the city, than well-cared-for trees. While nature has provided trees with a remarkable ability to adapt themselves to their environment, a certain knowledge of suitable types of trees, their care, pruning, and fertilization is necessary if best results are to be obtained. Information of this type is given in Purdue University Extension Bulletin 252 entitled "Trees, Their Planting and Care" by R. B. Hull. By means of well-chosen illustrations and diagrams, suggestions are made as to location of trees, methods of planting, pruning, fertilization, and general care. A full list of recommended trees for the Corn Belt area is also included.

¶ A lawn is a natural complement to trees around the home, and Purdue Extension Service Bulletin 254, "The Lawn," is a good companion publication to the one on trees mentioned above. Information on the establishment, maintenance, and renovation of lawns is given. Grading, fertilization, liming, seeding, weed control, and pest control are covered briefly and in a non-technical manner. In the fertilization of a lawn complete fertilizers usually are recommended except on dark, fertile soils, in which case the nitrogen may be omitted. Analyses such as 4-10-6, 3-12-12, 2-12-6, 0-14-6, and 0-20-10 are recommended for application when starting new lawns, while 10-6-4 and 4-10-6 along with straight nitrogen top-dressers are recommended for fertilization of established lawns.

¶ Investigators and others having need to look up literature on corn will do well to consult "Maize Bibliography for the Years 1917 to 1936, Inclusive" compiled by J. C. Cunningham and issued as the March 1941 number of Contributions from Iowa Corn Research Institute of the Iowa Agricultural Experiment Station. This comprehensive bibliography contains more than 1,100 citations grouped by subject and by author.

¶ Another subject now being given great emphasis is vegetable growing, particularly in small gardens for home use, and numerous publications on this are being issued. North Carolina Extension Circular 122, "The Farm and Home Garden Manual," by H. R. Niswonger, gives practical points on planting a home garden; how to fertilize it; what vegetables to grow; time, method, and rate of planting; varieties; pest control; and other related information. In connection with fertilization of the crop, it is suggested that good barnyard manure makes an excellent material for fertilization but usually this has to be supplemented with commercial fertilizer, and if large amounts of manure are not available, much more fertilizer is needed. Well-balanced complete fertilizers should be used with the rate of application up to one ton per acre of fertilizer broadcast.

A much more condensed publication on the same general subject entitled, "The Home Garden and the 1941 Agricultural Conservation Program," North Carolina Extension Folder 45, by H. R. Niswonger and M. E. Thomas, states that a 5-7-5 fertilizer is typical of the type used in gardens. Information similar to that contained in the above publications, but in somewhat greater detail, is given in Georgia Experiment Station Bulletin 215, "The Home Vegetable Garden," by H. L. Cochran. Heavy fertilization is recommended, such as about 1,500 pounds per acre of 8-8-6, 8-8-8, or 8-8-10 with extra nitrogen top-dressing sometimes being needed. If large amounts of manure are available, the amount of fertilizer used can be reduced.

Hawaii Agricultural Extension Circular 118 entitled, "The Home Garden," gives information adapted to Hawaiian conditions. A 4-12-8 fertilizer is recommended with additional nitrogen top-dressings sometimes being needed. "The 4-H Way to Profitable Potato Production", Indiana Extension Bulletin 253, by W. B. Ward and W. R. Amick, gives much practical information on the growing of potatoes on a small scale in a garden. It is suggested that 500 to 1,000 pounds per acre of 3-12-12 fertilizer be used except on muck soils, where 0-8-24 should be applied. Proper cultural, harvesting, and marketing practices are given.

Two other bulletins were prepared more for commercial vegetable growers, but in addition to being useful to them they will be of interest to the small gardener. One of these, "Starting Vegetable Plants," by G. J. Raleigh, Cornell Extension Bulletin 448, gives detailed information on starting plants in cold-frames, hotbeds, and glass houses. Soil preparation and fertilization, seeding, transplanting, watering, hardening the plants, and setting them in the field are considered. In "Growing and Marketing Georgia Sweet Potatoes," Georgia Extension Bulletin 482, E. Ragsdale and L. E. Farmer give rather complete and very practical information on the growing of this important staple crop which may be considered either as a vegetable or as a field crop. In connection with fertilization, it is suggested that 600 to 800 pounds per acre of a fertilizer analyzing around 4% nitrogen, 8 to 9% phosphoric acid, and 10 to 12% potash be used.

¶ Anyone considering the growing of mushrooms on either a large or small scale could well consult U. S. Department of Agriculture Farmer's Bulletin 1875, "Mushroom Growing in the United States." The author, E. B. Lambert, has assembled very complete and practical information on the various factors to be considered in growing mushrooms and gives rather detailed information on how to grow this highly specialized crop.

"Peach Varieties in Arkansas," Agr. Exp. Sta., Fayetteville, Ark., Bul. 414, June 1941, J. E. Vaile.

"Thirty-fifth Annual Report of the Department of Agriculture for the Year 1940," B. C. Dept. of Agr., Victoria, B. C., Can.

"Sixty-sixth Annual Report of the Ontario Agricultural College and Experimental Farm, 1940," Ont. Dept. of Agr., Guelph, Ont., Can.

"Annual Report for the Year Ending October 31, 1940," Agr. Exp. Sta., New Haven, Conn., Bul. 446, July 1941.

"Diseases of Taro in Hawaii and Their Control," Agr. Exp. Sta., Honolulu, T. H., Cir. 18, May 1941, G. K. Parris.

"Papaya Production in the Hawaiian Islands," Agr. Exp. Sta., Honolulu, T. H., Bul. 87, June 1941, W. B. Storey.

"The Potato—Its Nutritive Values," St. Dept. of Agr., Boise, Idaho.

"Indiana's Progress in a Changing Agriculture," Agr. Ext. Serv., Lafayette, Ind., 29th An. Rpt. of Dir., July 1, 1939 to July 1, 1940.

"Trees, Their Planting and Care," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 252, Jan. 1941, R. B. Hull.

"The Lawn, Its Making and Maintenance," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 254, Jan. 1941.

"Better Grapes from Indiana Gardens and Vineyards," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 267, June 1941, Clarence E. Baker and Monroe McCown.

"Growing Bush Fruits in Kansas," Agr. Exp.

Sta., Manhattan, Kans., Cir. 204, Mar. 1941, G. A. Filinger.

"Fifty-third Annual Report, for the Year 1940," Agr. Exp. Sta., Lexington, Ky.

"Annual Report of the Director of Agricultural Extension for the Year Ended December 31, 1940," Agr. Ext. Serv., Lexington, Ky., Cir. 363.

"Garlic as a Truck Crop," Agr. Ext. Serv., University, La., Ext. Cir. 210, Apr. 1941, G. L. Tiebout.

"The Vegetable Pear," Agr. Ext. Serv., University, La., Ext. Cir. 211, May 1941, G. L. Tiebout.

"Globe (Bur) Artichokes for the Home Garden," Agr. Ext. Serv., University, La., Ext. Cir. 212, May 1941, G. L. Tiebout.

"Brussels Sprouts for the Home Garden," Agr. Ext. Serv., University, La., Ext. Cir. 213, May 1941, G. L. Tiebout.

"Rhubarb Culture for Louisiana," Agr. Ext. Serv., University, La., Ext. Cir. 214, May 1941, G. L. Tiebout.

"Raspberry Growing in Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 152, Rev. Oct. 1941, R. E. Loree.

"Minhybrid Corn Varieties for Minnesota," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 354, June 1941, H. K. Hayes, R. P. Murphy, E. H. Rinke, and Carl Borgeson.

"Date and Rate of Lawn Seeding," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 355, June 1941, L. E. Longley.

"The Effect of Genetical Factors, Seasonal Differences and Soil Variations Upon Certain Characteristics of Upland Cotton in the Yazoo-Mississippi Delta," Agr. Exp. Sta., State College, Miss., Tech. Bul. 28, Dec. 1940, J. Winston Neely.

"Fifty-fourth Annual Report," Agr. Exp. Sta., Lincoln, Nebr.

"Studies on Bitter Pit of the Apple," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 234, Apr. 1941, R. M. Smock.

"Report of The North Carolina Department of Agriculture from July 1, 1938 to June 30, 1940," St. Dept. of Agr., Raleigh, N. C.

"Annual Report for 1940," Agr. Ext. Serv., Kingston, R. I., Bul. 80, Mar. 1941.

"Fifty-third Annual Report," Agr. Exp. Sta., Kingston, R. I., Contb. 586, June 1941.

"Extension Work in South Carolina, 1940," Agr. Ext. Serv., Clemson, S. C., An. Rpt. of Dir.

"Corn Production in South Carolina," Agr. Ext. Serv., Clemson, S. C., Cir. 194, May 1941, H. A. Woodle.

"Questions and Answers on Fruit Culture," Agr. Exp. Sta., Brookings, S. Dak., Cir. 35, June 1941, Niels E. Hansen.

"Questions and Answers Concerning the Use of Kudzu in Tennessee Under the 1941 AAA Program," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 140, Feb. 1941, H. E. Hendricks.

"Questions and Answers Concerning the Use of Bermuda Grass in Tennessee Under the 1941 AAA Program," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 141, H. E. Hendricks.

"Fifty-third Annual Report, 1940," Agr. Exp. Sta., College Station, Tex.

"Nursery Practice for Trees and Shrubs Suitable for Planting on the Prairie—Plains," U. S. D. A., Washington, D. C., Misc. Pub. 434, Aug. 1941, H. E. Engstrom and J. H. Stoeckeler.

"Mushroom Growing in the United States," U. S. D. A., Washington, D. C., Farmers' Bul. 1875, June 1941, Edmund B. Lambert.

"Crested Wheatgrass," U. S. D. A., Washington, D. C., Leaflet 104, Rev. Jan. 1941, H. L. Westover and George A. Rogler.

"Report on the Agricultural Experiment Stations, 1940," U. S. D. A., Washington, D. C., July 1941, J. T. Jardine, F. D. Fromme, and H. L. Knight.

Economics

¶ "Price Flexibility and Price Movements in the United States and Other Countries" is the title of Cornell University Memoir 239 by Mark T. Buchanan. In recent years much has been said about price flexibility and inflexibility, sometimes referred to as "variations in price flexibility" by the price statisticians. Much of our economic distress in the past has been attributed to the fact that some prices change more rapidly and in greater amounts than do others. The author states that it was his purpose in making the study to examine variations in the price flexibility of internationally important products, and to determine their relation to international price movements and price alignment between countries. The study was based on an analysis of price movements of 56 to 64 internationally important products for four countries—the United States, Canada, the United Kingdom, and France.

The author's definition of "flexible" is in general about the same as that applied by most price analysts, which is, that "flexible" is applied to those products whose prices changed more frequently and/or more in amount than did prices of other products. Conversely, the term "inflexible" is applied to those products whose prices changed less frequently and/or less in amount than did prices of other products.

As a means of measuring price flexibility, an index of frequency of price change was calculated, and in order to measure the amplitude of change an index of amplitude of price change was computed by the author. Comparisons of the relative flexibility of prices in each country were made for the 8-year period, 1922-1929, for the 9-year period, 1930-38, and for the 17-year period, 1922-1938. Comparisons of flexibility between countries were also made.

Generally speaking, it was observed that processed materials had lower price flexibility than basic commodities. The prices of food and raw textiles were more flexible than were the prices of other products. Generally speaking, agricultural prices were more flexible than were the prices of products of other industries. It was also observed that products in higher stages of fabrication and durable goods were less flexible than prices of non-durable and semi-durable goods. The prices of consumers' goods remained more stable than prices of producers' goods.

It was observed by the author that products representing a considerable addition of labor, transportation, and other inflexible charges were less flexible in price than were the products representing smaller amounts of labor and other fixed charges. This suggested that probably a large part of the difference in price flexibility between commodities was primarily based upon the amount of labor, transportation, etc., entering into the price. In general, it was observed that similar products in different countries had about the same price flexibility.

The author does not attempt to prove the relative merits of a flexible or inflexible price system, but the study did indicate clearly that the differences in the degree of price flexibility between different industries and different commodities caused economic disturbances to be more severe during periods of falling prices. It was this factor, of course, that led to the widespread agricultural chaos during the period of falling prices just after the first World War. During periods of rising prices or periods of stability, differences in price flexibility are not nearly so important from the economic standpoint, but when prices decline rapidly, prices of raw materials and other flexibly priced products decline much faster than do prices of the finished goods. In general this disparity between the prices of these two groups of commodities continues until the general price levels turn upward. With a rise in prices the disparity is largely corrected as a result of the same situation which caused it originally—flexible prices moving faster than inflexible prices.

It is the author's opinion that if the prices of all products moved more closely together, business activity would not be so severely retarded during periods of price decline. This is due to the fact that prices of raw materials which decline much faster than finished goods result in a rapidly declining purchasing power of producers of raw materials. This results in a reduction in industrial production because the producers of finished goods produce only about what they are able to sell at a stated price which of necessity is usually high enough to cover at least operating costs. But even though wage rates may remain high, the actual purchasing power of labor declines because with the reduction in business activity less hours of labor are needed and labor's total income declines rapidly, resulting in a vicious cycle.

From the international viewpoint it was observed that prior to the depreciations in the thirties, little or no disparity existed between prices of a given flexibility in one country and prices of similar flexibility in another. The wide disparities appeared with the decline in commodity prices during the great depression in the thirties. The result was that the currencies in each country studied became relatively overvalued in terms of raw products and relatively undervalued in terms of finished goods. The author concluded that the internal overvaluations and undervaluations were probably more important in causing depreciation than the very slight external overvaluations and undervaluations. After the depression large differences in prices between countries appeared because prices in the different countries did not react in proportion to the changes in exchange rates. A part of the discrepancy between different countries may have been due to lagging price adjustment and a part to tariffs, quotas, export bounties, and other trade restrictions which were inaugurated in varying degrees in all countries during the thirties.

"Delaware Farm Production and Prices," Agr. Exp. Sta., Newark, Del., Bul. 230, May 1941, C. E. Burkhead and R. O. Bausman.

"A Study of Celery Farming on the Everglades Organic Soils, Palm Beach County, Florida, Seasons 1937-38 to 1939-40," Agr. Ext. Serv., Gainesville, Fla., Celery AE3, May 1941, R. H. Howard and M. U. Mounts.

"The Community Situation As It Affects Agricultural Extension Work," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 312, Oct. 1941, C. R. Hoffer and D. L. Gibson.

"Marketing Sweet Potatoes in New Jersey and Competing States," St. Dept. of Agr., Trenton, N. J., Cir. 328, June 1941, John M. Fenton.

"Apple Trees in Burlington and Gloucester Counties, New Jersey," St. Dept. of Agr., Trenton, N. J., Cir. 330, July 1941, D. T. Pitt.

"Price Flexibility and Price Movements in the United States and Other Countries," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 239, June 1941, Mark T. Buchanan.

"Level of Living, Social Participation, and Adjustment of Ohio Farm People," Agr. Exp. Sta., Wooster, Ohio, Bul. 624, Sept. 1941, A. R. Mangus and Howard R. Cottam.

"An Economic Study of Land Classes, Blair County, Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 413, Apr. 1941, W. E. Kepper.

"Cotton Marketing in South Carolina," Agr. Exp. Sta., Clemson, S. C., Bul. 335, Oct. 1941, W. T. Ferrier and H. A. White.

"Should Farmers Emphasize Wheat or Livestock in North Central South Dakota?," Agr. Exp. Sta., Brookings, S. Dak., Cir. 33, June 1941, Aaron G. Nelson and Gerald E. Korzan.

"Food for Defense Goals," Agr. Ext. Serv., Knoxville, Tenn., Pub. 255, Oct. 1941.

"1942 AAA Farm Programs," U. S. D. A., Washington, D. C., ECR-601: Kentucky, Aug. 26, 1941; Maryland and Delaware, Sept. 16, 1941; North Carolina, Sept. 3, 1941; Tennessee, Sept. 3, 1941; Virginia, Oct. 10, 1941; West Virginia, Aug. 26, 1941.

"1942 AAA Handbooks," U. S. D. A., Washington, D. C., SRB 601, Oct. 1941: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, Texas.

"1942 Agricultural Conservation Programs," U. S. D. A., Washington, D. C., NER 610: Connecticut, Sept. 25, 1941; Maine, Sept. 25, 1941; Massachusetts, Sept. 25, 1941; New Hampshire, Sept. 20, 1941; New Jersey, Sept. 27, 1941; New York, Sept. 26, 1941; Pennsylvania, Oct. 3, 1941; Rhode Island, Sept. 25, 1941.

Plant Symptoms Show Need for Potash

(*From page* 20)

sue. In all cases the "very yellow" leaves were low in potassium while the "green" leaves ranged in potassium content from medium to very high. Of particular interest were the samples from the same field, one from a "yellow spot" and the other from normal plants. In every instance where this comparison was possible, the yellow leaves contained much less potassium than the normal leaves.

The phosphorus contents of the samples varied widely. There seemed to be a tendency for the yellow samples, low in potassium, to be high in phosphorus, but there were so many exceptions to this condition that no conclusions could be drawn.

During this survey a type of yellowing somewhat different from that observed on the Ovid experimental field was encountered. Instead of the yellowing being more intense around the leaf edges it was uniform over the entire leaf, as shown in Fig. 6. The leaf-tissue tests showed these plants to be high in potassium, so the yellowing must have been due to some deficiency other than potash. Results of some work performed in this department by G. D. Sherman indicated that it might have been the result of manganese starvation.

This is a good illustration of the need for careful study in dealing with deficiency symptoms. It is not sufficient to say that yellowing of beans is indicative of potash starvation, but it is essential that the nature of the yellowing be carefully described. Similar instances have been noted with regard to deficiency symptoms on other plants.

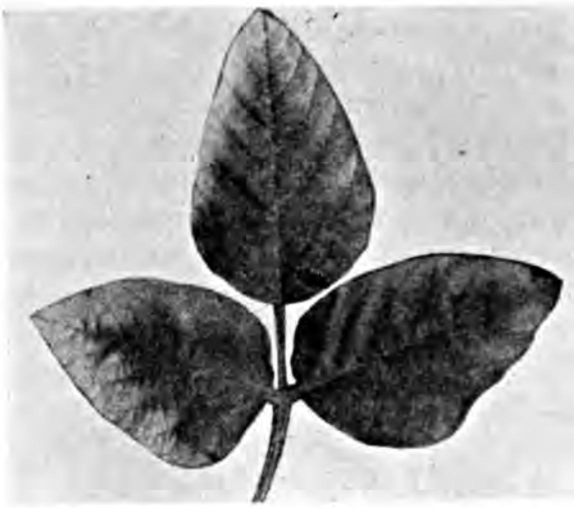


Fig. 7. A soybean leaf showing the characteristic yellowing caused by potash starvation.

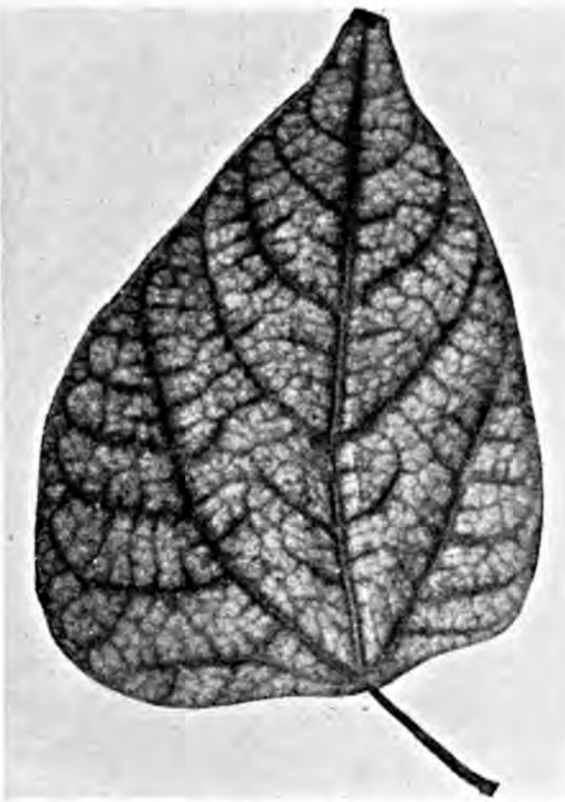


Fig. 6. A bean leaflet yellowed as a result of some deficiency other than potash.

As already mentioned, the field experiments on the Ovid farm showed that soybeans starved for potash developed symptoms similar to those on white beans. Accordingly, leaf samples were gathered from five different fields where the leaves on a part of each field resembled the leaf shown in Fig. 7.

Samples of the yellow-edged leaves from each field were analyzed for potash and phosphorus, and the results were compared with those obtained from the analyses of normal plant leaves taken from different parts of the respective fields. The data obtained showed that in all fields the yellow-edged leaves were much lower in potash than the leaves from normal plants. As in the case of white beans, there was no correlation between the leaf color and the phosphorus content of the fresh leaf tissue.

As a further test of the reliability of the symptoms, several rows of the soybeans on one of the Hillsdale sandy loam farms were side-dressed on August 2 with muriate of potash at the rate of 100 pounds per acre. The potash was applied in a band close to the row with a hand fertilizer distributor. By September 6, the day of harvest, the

TABLE 3.—THE EFFECT OF POTASH, APPLIED AS A SIDE-DRESSING ON AUGUST 2, ON THE YIELD OF SOYBEAN HAY HARVESTED SEPTEMBER 6. HILLSDALE SANDY LOAM.

Treatment	Yield— Lb. dry hay per acre	
	Field 1*	Field 2**
None	3781	2523
Muriate of potash, 100 lb. per acre	4787	3133

* Average of 3 replicates.
** Average of 2 replicates.

rows fertilized with potash had assumed a normal green color and, according to the data reported in Table 3, had made considerably more growth than the unfertilized rows. In one spot where the starvation symptoms were especially severe, an unfertilized row was found to yield at the rate of 3,267 pounds of dry hay per acre, while an adjoining row side-dressed with potash yielded at the rate of 5,228 pounds per acre. The bundles from one rod of each row are shown in Fig. 8.

Fig. 8. Soybeans need potash. The left bundle was harvested from one rod of row which bore symptoms of potash starvation. The right bundle came from one rod of an adjoining row side-dressed with muriate of potash after starvation symptoms had appeared.

While no data on the subject are available, it was noticed at the time of making the side-dressing on August 2 that the roots of normal green plants were more plentifully supplied with nodules than the yellow-leafed plants. Also, the nodules were larger on the healthy plants.

Cowpeas are rather widely grown in St. Joseph County, Michigan, and several fields were found where the leaves of the plants in parts of the fields were yellowed on the edges as shown in Fig. 9. The resemblance to the potash-starved leaves of white beans and soybeans was so striking that samples of the fresh tissue were analyzed. The relationship between the leaf color and the potassium and phosphorus content of the fresh leaf tissue was the same as has been reported for the other two crops.

Summary and Conclusions

As a result of a field plat experiment with white beans, it was decided that a certain characteristic yellowing of the leaves was due to a deficiency of soil potash. On the plats which did not receive potash, the yellowing started at the ends and edges of the leaflets and gradually worked toward the center and base until the entire leaflet was yellow. Three hundred pounds of a fertilizer containing eight per cent potash were sufficient to prevent this abnormal condition and to greatly increase the yields. An approximately equivalent quantity of potash applied as a side-dressing after the symptoms of starvation had appeared was sufficient to cause the beans to regain their normal green color and to greatly increase the yields.

As a means of testing further the reliability of the yellow leaves as a symptom of potash starvation, leaf-tissue tests were made on "yellow-edged" and normal leaves from 40 different fields. Without exception the

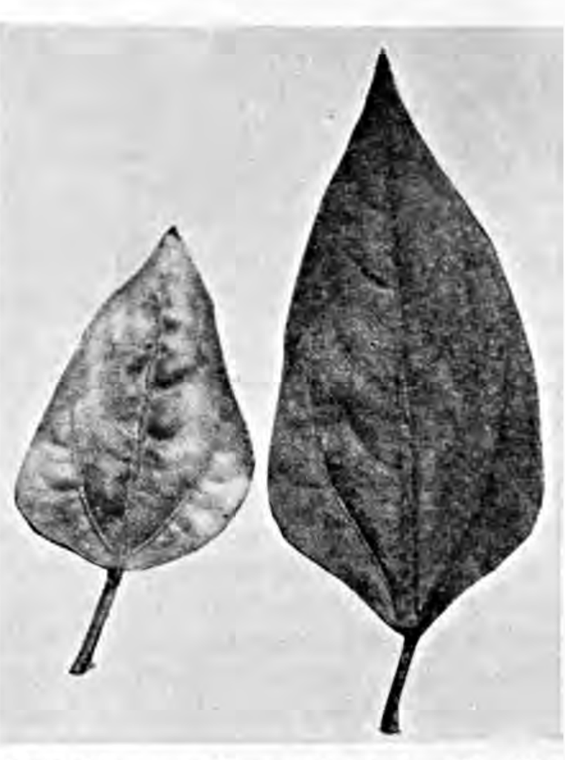


Fig. 9. Cowpeas also need potash. The left leaflet shows the yellowing characteristic of potash starvation. The right leaflet is from a normal plant.

normal green leaves contained much more potash than the "yellow-edged" leaves. There were no consistent variations in phosphorus content. It was concluded, therefore, that the characteristic yellowing was actually a symptom of potash starvation and that the symptoms were rather general through the bean-growing area of Michigan.

Based on plant-tissue tests, the same symptoms were found to hold for soybeans and cowpeas. The reliability of the symptoms in the case of soybeans was further proved by field plat tests. Plants grown on plats which did not receive potash at planting time produced characteristically yellow leaves, while potash-treated plants produced normal green leaves. As in the case of white beans, a side-dressing of muriate of potash, made after the symptoms appeared, caused the plants to regain their normal appearance and resulted in markedly increased yields.

Potash Demonstrations on State-wide Basis

(*From page* 22)

There was an average of 3 work stock, less than 2 beef cattle, and 5 dairy cows per farm. There was an average of 13 hogs per farm, most of these being in the eastern section. Poultry averaged 94 birds for all the farms.

In the estimated budget of receipts on these farms, it is revealed that crop receipts in the eastern were much higher than in the Piedmont or mountain sections, while livestock receipts were somewhat high in the Piedmont and mountain. Receipts for dairy products were very low in the eastern, higher in the Piedmont and mountain areas. The estimated total receipts average $2,345 for all 94 farms. The eastern cash receipts averaged $2,644; the Piedmont $2,099; while the figure was only $1,629 for the mountain group. However, estimated farm expenses were considerably higher in the eastern than in the Piedmont or mountain sections. Expenses averaged $1,086 for all 94 farms; $1,256 for the eastern, $945 for the Piedmont, and $683 for the mountain farms.

The average estimated expense for fertilizer for all the farms was $228 per farm. The eastern averaged $295, the Piedmont $173, and the mountain $67 per farm.

The estimated total family living expense averaged $372 for all farms; $420 for the eastern, $344 for the Piedmont, and only $224 for the mountain. The family living expenses included food, clothing, fuel, household needs, and automobile expense. These added to farm expenses made an average of $1,458 for all farms; $1,676 for the eastern, $1,289 for the Piedmont, and $907 for the mountain farms.

The application of potash for demonstration purposes on these 94 farms was divided on the following crops: 8% on small grain alone which amounted to 228 acres; 13% on soybeans which amounted to 345 acres; 27% on small grain and lespedeza, 529 acres; 10% on lespedeza alone, 262 acres; 4% on crimson clover, Austrian winter peas, and vetch, 120 acres; 17% on meadow and miscellaneous crops, 350 acres; 19% on permanent pasture which amounted to 424 acres. There was also a small amount of acres in other crops. The rate of application varied considerably according to the soil type and section of the State. These recommendations were based upon the Experiment Station's findings in the particular areas. The rate of application in the eastern part of the State was much higher than in the other sections.

All of these demonstration farmers are keeping a complete record of farm operations during the year and this program will be conducted according to the plans originally set up.

A Five-year Program for Corn-Livestock

(*From page* 9)

By adding a reasonable amount of good complete fertilizer to the corn crop and keeping the humus in the soil, many farmers are able to plant the land continuously in this crop and receive better yields year after year.

In 1939 W. O. May of the Reedy Creek community planted his corn in 6-foot rows interplanted with velvet beans and peanuts. He used 200 pounds of 2-10-4 fertilizer under the corn then top-dressed with 100 pounds nitrate of soda. His yield was 48 bushels to the acre plus sufficient peanuts and velvet beans to give 300 to 400 pounds livestock gain per acre. Using the same methods and same fertilizer in 1940 he was again tops in his district on interplanted corn with 52 bushels to the acre plus an unusually fine yield of feed.

Part of the field was used for his tobacco and cotton allotments in 1941 and only about 4 acres were left for corn. His 10-acre contest corn was transferred to another field, but on the 4 acres he received better than 60 bushels per acre. Continuous satisfactory corn yields are possible where proper care is given to fertilizing and humus is added to the soil. This of course would not be practical with solid corn without continuous planting of winter legumes.

Wm. G. Newton and son David last year planted 90 acres of corn, all fertilized and mostly interplanted. They exchanged their cottonseed for cottonseed meal, harvested 30 acres of good oats followed with lespedeza that yielded 34 tons. They ground their own corn and hay and fed out 57 head of cattle that were raised on the place. They sold more than $3,000 worth of cattle, added several good heifers to their herd, fed their work stock, and finished several hundred dollars worth of pork for the market.

In 1941 they produced 509 bushels of corn on 10 acres plus a good crop of soybeans and velvet beans that added another 150 bushels feed value. For the Newtons this won a purebred bull calf worth $150. This bull added to an already good herd of grade cattle, and backed by a general farm program that assures the herd plenty of good feed at a low cost, is putting the Newton family in the livestock business in a big way. Mr. Newton told the writer that 7 years ago it was difficult to obtain a yield of 10 bushels of corn per acre from the land that this year produced in terms of feed an equal of 65 bushels of corn per acre. This increased yield was obtained by a program of interplanted feed crops with corn, harvested mostly by cattle and hogs, and all the litter turned under with an occasional winter legume crop and a reasonable amount of fertilizer. This year they followed a good cover crop of Austrian winter peas with corn fertilized with 175 pounds of 2-10-4 per acre. The actual fertilizer cost was $1.97 per acre. Mr. Newton is Chairman of the County Board of Education and is well past his 70th birthday. He is still an active farmer and a leader in his community.

Below are some of the actual fertilizer practices and yields secured in the 1941 contest:

John W. Good:
400 lbs. 4-8-6 under the corn.
100 " nitrate of soda top-dressing.
Yield, 55.2 bu. per acre.

Mrs. Ella Norman:
275 lbs. 3-8-6 under the corn.
200 " 10-0-10 top-dressing.
Yield, 66.5 bu. per acre.

W. F. Westbrook:
300 lbs. 2-10-4 under the corn.
100 " soda top-dressing.
Yield, 58.4 bu. per acre.

W. F. Brogdon:
Austrian winter peas turned under.
250 lbs. 0-12-4 under the corn.
No top-dressing.
Yield, 57.4 bu. per acre.

Ben Galloway
and
Cooper Brothers:
Austrian winter peas turned under.
400 lbs. 4-8-6 under the corn.
200 " nitrate soda top-dressing.
Yield, 75.7 bu. per acre.

Mallie Norman:
400 lbs. 4-8-6 under the corn.
100 " nitrate soda top-dressing.
Yield, 63.2 bu. per acre.

Davis Jenkins:
75 lbs. 2-10-4 under the corn.
200 " nitrate soda top-dressing.
Yield, 79.7 bu. per acre.

In very few instances where a good crop of Austrian winter peas was turned under before planting corn was there any nitrate of soda used for top-dressing. But a careful study of all the fertilizer practices used by the farmers participating in the contest clearly shows that corn does need a complete fertilizer on Colquitt County soils, and it pays to use up to 400 pounds mixed goods plus either soda or up to 200 pounds per acre of 10-0-10 as a top-dressing. The excessive use of fertilizer has been discouraged by the agricultural workers in the county and the value of complete plant food plus plenty of humus in the soil stressed.

Corn is Food for Defense

In our present National Emergency we are in need of increased food production. The Secretary of Agriculture is calling on the farmers to produce more pork, beef, chickens and eggs, and certain other products. It is estimated that because of the contest 650,000 bushels of corn were added to Colquitt County's 1941 corn crop and that were the entire increase fed to hogs with a return of 100 pounds gain for each 10 bushels of corn fed, we would have an increase of 6,500,000 pounds of pork. This restated in terms of dressed pork, edible cuts that might be served on the table, would make one liberal serving for more than 9,000,000 persons. Thus are Colquitt County farmers responding to the call for food for defense.

Many neighboring counties in Georgia have taken up the 10-acre corn contest idea. Both Thomas and Brooks Counties have put on contests this year that created widespread interest among their farmers and will in all probability rival in yields the Colquitt County results. Many other counties have become interested and are conducting some kind of corn-livestock program modeled after the Colquitt contest.

We believe the practices to be sound. We are encouraging better cultural methods, better crop rotations, along with better livestock. There are several farms with excellent first cross white-faced calves this year, offspring of the first eight purebred bulls given as prizes, that would not have had them otherwise. There is a county-wide interest in livestock. There are many more good purebred bulls, boars, and breeding animals in the county now than there were three years ago. The farmers have learned that they can breed, raise, feed, and sell good hogs and cattle with feed raised at home, cheap feed in abundance, and that they need buy only small amounts of protein supplements, salt, and mineral matter for their livestock.

Results Encouraging

After carefully surveying the results of this new trend and then interpreting them in terms of future results it is hard to be anything but enthusiastic about the program. There is every reason to believe that it will spread to include all the great Coastal Plains belt of the Southeast. It has demonstrated fully that corn can be produced in sufficient yields and at low enough cost to make it a practical and economical source for feed on which to finish our hogs and cattle for the market. Corn can be stored and used when needed. For a long time we have been talking about our livestock program in the South. We have made great progress during the past few years, but we have been handicapped by low yields of basic feeds. It has now been proven that a satisfactory feed can be produced cheaply and in abundance.

The Colquitt County program calls

for one additional thing that, if and when accomplished, should complete this picture. We plan to reduce our corn acreage from 75,000 to 50,000 acres and on the 50,000 acres produce a crop of 2,000,000 bushels of corn annually. The 25,000 acres taken from corn we hope to turn to oats, lespedeza, and permanent pasture. This will, when added to the present pasture lands, supply sufficient improved pasturage for our livestock, and we will be able to market an annual livestock crop worth more than $2,000,000. This crop when marketed will be adding to the fertility of our soils each year instead of depleting it, and fits in well with a general diversified farm program.

Borax Helps Prevent Alfalfa Yellows

(*From page* 12)

relatively small, alfalfa growers in Tennessee who experience trouble with alfalfa "yellows" are advised to use within the range of the application, 20 pounds per acre, with which we have had experience, until further knowledge has been obtained.

Additional test demonstrations are planned to afford a more thorough coverage of soil conditions in Tennessee and when these are integrated with the experimental work of the Tennessee Experiment Station, there should be, in a few years, a more definite answer to the many questions that can be raised now with respect to the value of borax in alfalfa production in Tennessee.

Some Newer Ideas on Orchard Fertility

(*From page* 16)

fertilizer material, rather than a soil corrective."

In Better Crops With Plant Food, May 1937, F. W. HofMann of the Virginia Agricultural Experiment Station states, "If the orchard soil is not strong enough to maintain a good crop of grass or sod, it should receive 600 to 800 pounds of an 8-6-6, 6-8-6, or 10-6-4 fertilizer. If the soil is capable of producing a lush growth of grass or sod, the fertilizer application may be more confined nearer the area under the spread of the tree and to fertilizers with the higher nitrogen content."

In Better Crops With Plant Food, August-September, 1936, E. H. Rawl of Clemson College, South Carolina, recommends the use of a complete NPK fertilizer in the peach orchard plus the use of dolomitic limestone. In the South Carolina peach tests not only foliage and tree growth but size of fruit was greatly improved by the use of complete fertilizer plus the limestone. It is interesting to note that where such fertilization was given good stands of cowpea cover resulted under the spread of peach tree branches.

From Pennsylvania State College Agricultural Experiment Station Bulletin 294: "The fertility of an orchard soil is more than its plant-food content. It involves the nature of the soil, its depth and topography, its previous treatment, the use of fertilizers and manures, the amount and nature of the cultivation, and the cover or sods grown. Fertilizers are only part of the problem of soil fertility.

"In this orchard any treatment that has influenced the trees at all has done so in the following order: first, the cover crops; perhaps several years later, leaf color; shortly after, branch growth and circumference increase; and last of all yield.

"The reason for this sequence of results is that the treatments—whether chemical fertilizers, manure, or cover crops—have influenced yields chiefly by changing the organic matter content of the soil; that is, those treatments which have resulted in the production of larger cover crops have ultimately resulted in the production of more fruit.

"A short, non-legume sod rotation is an efficient means of building up a depleted orchard soil. After a sod of any kind becomes thick, tree growth is checked and yields decline. Orchard sods should be turned under, or partially broken, frequently.

"Trees receiving annual tillage with July seeding of cover crops have not done so well as those under sod rotations. If the cover crops are seeded in early June, as has been practiced since 1929, the difference may not be marked."

Most orchard owners are interested to learn that it took 16 years of clean cultivation and late summer seeding of non-legume covers to so deplete this Hagerstown clay-loam soil of organic material and exhaust the nutrients to points low enough to even show in tree growth and yield. Cover growth began to show the need of food in the fifth to seventh year.

In the case of the legume covers, nitrogen was being returned to the soil by the legume plants. This resulted in better covers each year. The trees with legume covers showed no need of food after 22 years of growth. As orchards grow older, the need of complete fertilizers for both the trees and cover crops will become more marked.

Referring to your Professor Hof-Mann's report on fertilizers for orchard soil fibre in the Virginia State Horticultural Society report for 1939, we find that his studies show much more growth of cover material resulting from the use of phosphate and potash when used along with nitrogen, than when nitrogen was used alone.

Let me here and now make a plea for the use of complete food for our orchards, for the use of phosphate, the use of potash, the use of calcium (lime); for the right use of cover crops, yes, for the use of legume cover crops. If an orchard man gets his land into a condition good enough to grow legumes (clovers of all kinds, including Ladino clover, alfalfa, lespedeza, vetch, etc.) and really grows them in the orchard, he will never need to worry about his soil fertility. So far I have yet to find the farmer who has harmed his land or his farm income by the growing of clovers.

Industries Commended

The word of praise to the chemical fertilizer, and lime industries that I wish to stress is this, they have in the last 15 years worked hard and are able to give a usable complete orchard fertilizer containing as high as 16 per cent nitrogen, 10 per cent phosphate, 8 or 10 per cent potash, along with calcium (with even some of the so-called rare elements, boron, zinc, manganese, copper, iron, magnesium, etc., thrown in).

I have here a jar of a complete orchard fertilizer made in November 1940. It has been in an open bag in a dry wareroom ever since, and it is now usable. It is 16 per cent nitrogen, 10 per cent phosphate, 8 per cent potash (could have been a 10 per cent potash without any trouble). The 16 per cent nitrogen is the same amount of nitrogen you would apply to your orchard when applying nitrate of soda. The nitrogen in this complete fertilizer comes from nitrate of soda, uramon, ammo-phos, cyanamid, and sulphate of ammonia, a nitrogen supply that would not be available to the tree all at the same time but would extend over a longer period of time in the spring than it would if all the nitrogen were from one source like nitrate of soda, sulphate of ammonia, etc. Besides the nitrogen sources there is room in the mixture for enough sulphate and muriate of potash to give 8 per cent and could be 10 per cent potash plus the 10 per cent phosphate. Now besides these 3 important elements of food, there is still room in the mixture for 300 pounds of limestone rock flour, 100 pounds of raw phosphate flour (a good dryer in itself), and 10 pounds of dryer like cocoa shell meal or tobacco stem dust, a mixture with room for the rare elements if wanted.

Yes, I say a word of praise is due the chemical fertilizer industry for making such fertilizer available to the American farmer and fruit grower. A 16-10-8 or a 10-6-4 complete fertilizer could be made that I would not want to use. Let us say one in which all the nitrogen came from one source that was very soluble or fast acting or one made from a nitrogen source that would be slow and long drawn out in its availability. In either case, such a mixture would not be the one I would like to feed my trees.

Prices Based on Units

You will say this complete fertilizer sounds all right but it costs too much money. The price of such a complete fertilizer may sound high, but the fertilizer manufacturer will be making such mixtures as 16-10-8, 16-10-10, 10-6-4, and 10-10-10 and selling them to you growers at the same price per unit of plant food as if you bought your own sources of nitrogen, phosphate, and potash. To be sure, the manufacturer will have to charge for the mixing of a ton of 16-10-10 or 10-6-4. The mixing cost, however, will be no greater than if he mixed a ton of 2-8-4. In 100 pounds of 16-10-10 you get 36 pounds of plant food. In 100 pounds of nitrate of soda you get 16 pounds of plant food. In 100 pounds of superphosphate you get 16 or 20 pounds of plant food, depending on whether you buy 16 or 20 per cent goods. In 100 pounds of sulphate or muriate of potash you get 49 to 60 pounds of plant food. In any mixed complete fertilizer you pay the fertilizer company on the base price of the nitrogen units, the phosphate units, and the potash units. Figure it out for yourself and you'll see that you pay only for the pounds of plant food you get regardless of nitrogen source, phosphate source, or potash source. If we can get to using a good complete fertilizer in early spring soon after the frost is out of the soil, our cover crops will grow better, our grass or legume sods will grow better, and in a few years our tree growth and yields will be better.

Excessive Spray Injurious

We must give a little more thought to the use of lime or limestone under our trees to correct the acid condition of the soil resulting from the use of our sulfur sprays. When the soil under our trees has a covering of green mould-like growth, we can not expect little cover crop seedlings to grow into real plants. Since I have mentioned this spray problem in connection with soil fertility, I might just as well add that many growers are holding back their tree growth by spray damage to the tree leaves. One plant food, carbon, enters the plant by way of the leaf. This element of plant food is just as important to good health and high yields as are nitrogen, phosphate, and potash which enter via the tree roots. I know the plant disease and insect workers think I am wrong, but if a crop of clean apples can be grown with only 1¼ gallons of lime-sulphur (yes, even 1 gallon) to 100 of water, or if 1 pound of bluestone and 2 to 3 pounds of lime to 100 gallons of water will make a bordeaux mixture strong enough for grape, apple, and cherry spraying, then I am all for such sprays. Clean crops have been grown with such weak sprays. In 1942 I am going to try ½ pound of bluestone and 1 pound of lime hydrate to 100 gallons on grape, apple and cherry trees.

I believe much the same as an insect worker once said, "If I could have my way about it, I would have only rain water fall on trees of mine, but unfortunately the bugs and diseases are not killed by rain water."

Referring back to my statement about the importance of growing clover or other legume cover crops and sods, I wish at this time to tell you about and to introduce to most of you a legume cover crop about which there is but little known. It is an old plant, but I never heard of it until November 1939. Extension Agronomist H. R. Cox, New Jersey Agricultural Experiment Station, New Brunswick, New Jersey, knowing my enthusiasm for legume covers asked me how I thought crown vetch would do as a cover. I told him I had never heard of crown vetch. The more he told me about it the better it sounded. He supplied me with about two tablespoons of the seed, enough for a start. We got more and more interested in it as the plants grew in 1940.

In the spring of 1940 John Ruef, extension pomologist of State College, Pennsylvania, came into my office one day with some plant leaves and roots and asked me what the plant might be. The leaves were legume leaves. Just then E. I. Wilde, our florist, came into the office and we asked him what the plant might be. Mr. Ruef told him he understood the plant had a rather pink or pinkish-purple flower when in bloom. Mr. Wilde said it was likely a type of vetch and asked what the seed looked like. Mr. Ruef had some of the seed, and, lo and behold, it was the same seed as the crown vetch I had gotten from Mr. Cox of New Jersey. Where had Mr. Ruef gotten this crown vetch seed and plant? Out of an orchard that was full of it, right in Pennsylvania—the orchard of R. H. H. Aungst, Pine Grove, Schuylkill County. It was growing on this farm when Mr. Aungst planted his orchard. In the early years of the orchard Mr. Aungst thought of it as a weed. He never got rid of this weed, thanks to Old Mother Nature.

Since the spring of 1940 our extension workers have located two other patches of this good weed—a plant of the Coronilla group, perennials, shrubs, and herbs—the crown vetches. Most orchard men know winter or hairy vetch as a good cover crop. If winter vetch is a good cover crop, then crown vetch is a better one for it will spread like quack grass from underground roots or pieces of roots.

In the crop year of 1940, Mr. Cox had children collect by hand in a re-

Young peach tree showing characteristic potash deficiency symptoms (left) and one showing normal growth and development (right).

forestation planting on his farm about 2 quarts of seed for us. This hand seed-collecting work cost us $10. From this seed we now have a stand of the 1941 seeding on about ½ acre of land.

In August 1941, in 3 hours time, I collected by hand with the help of 2 high school boys, 30 quarts of crown vetch seed in Mr. Aungst's orchard. I have become so sure of crown vetch as a fine legume orchard cover crop that I asked Mr. Aungst to collect up to 32 quarts of seed by hand which I told him I would sell at $2 a quart. He said, "$2 a quart is a high price for seed." I told him, "Yes, it is, but any man willing to pay $2 a quart will take care of the seeding he gets from such a seed supply and 1 quart of seed will in 2 years time be supplying him with enough seed for a right sizable orchard seeding." With crown vetch once started, a man's seed supply will be permanent, for it will spread if undisturbed into a solid patch of seed-bearing plants. From our small seeding in the spring of 1940 we learned that it is a great nitrogen collector, the same as winter vetch, clover, and alfalfa.

Seed is Available

Anyone wanting a quart or more of this crown vetch seed can get it from me at the end of this meeting for I have a supply with me done up in one-quart packages. I will supply each man with a printed sheet of instructions for seeding for a seed supply and one quart of crown vetch inoculated soil this fall for his seeding. Our soil is full of the right bacteria or our crown vetch plant roots would not have been so thickly covered with nitrogen nodules at the end of one season's growth.

In a way I feel rather guilty in introducing this crown vetch to you orchard men because of my good fertilizer friends present here today. I know it is a means whereby, through the aid of bacteria, we orchard men can get a lot of nitrogen that will never see a fertilizer bag. We can put a lot of nitrogen into our orchard soil by the use of clovers, alfalfa, vetches, and other legumes, if we use phosphate, potash, and lime in our orchards. At the rate the people in Europe are shooting up nitrogen in the form of gunpowder, maybe we'll have to grow our nitrogen before long anyway.

A word about $2 a quart for vetch seed. Ladino clover was $4 a pound about 10 years ago. Today it is 80¢ a pound. It takes only 1½ to 2 pounds of Ladino clover seed to seed an acre of orchard.

Crown vetch can be grown in the field in condition for machine harvest of seed. In time the seed will be on the market as scarified crown vetch seed so it can be used as a cover seeding in late May, June, or July. The seed I have with me is unhulled and will have to be seeded in the soil frost cracks in November, December, or January, the way nature seeds it. I am having a small supply of seed scarified this winter.

I will not be surprised to see crown vetch partly replace lespedeza as a soil-covering plant since it is more of a perennial type, remaining alive over the winter both in stem above ground and in root below ground, ready to grow strong when spring opens up each year. Crown vetch fills the soil with roots. Lespedeza is an annual plant and new seedings must grow each spring from seed.

Crown vetch as far as I know is not a legume eaten by livestock. In Berks County, Pennsylvania, it is growing on a hillside patch of land in pasture, but the livestock do not eat it. Last week I fed some green fresh-cut crown vetch to two goats and they ate it. No seeds, however, were in this green hay. The seed is very bitter to the taste when you chew it. This bitter taste may be the reason livestock in general do not eat it in this Berks County pasture. We understand the Berks County patch came in when the general field was seeded to alfalfa some 25 years ago.

I wish to thank you, Orchardist

Harry F. Byrd, for the honor you have bestowed upon the orchard work of the Pennsylvania State College when you invited me to speak on the important subject of orchard fertility. I thank your guests for their kind attention, and I trust some good to you all will come from this discussion.

Arguing with Angels

(*From page* 5)

ma just keep up an incessant blather about patriotism and the need for every American to be on his toes. But when their eldest boy was taken by selective service and went to have his eyeteeth cut by a bunch of hard-boiled sergeants, his ma and pa began to whimper. Ma keeps writing tear-splotched letters to Billy, reminding him to keep his fingernails clean and his neckties in order, and to eat the right vitamins and be careful about bad associates. Pa is trying to work up some political pressure so that Billy will get promoted or maybe excused completely.

When Billy came home on a furlough ma wrung her hands and worried because he had to wear such nasty heavy old brogans on his tootsies and spend so much time peeling taters. She tells him he's worth more than "twenty dollars a day once a month" and keeps him in a stew all the time for fear they'll ship his outfit over to Istanbul or Murmansk or somewhere beyond the reach of her missives. Then at her club she wails to the mothers of girls and says they are lucky not to have sons to sacrifice. Maybe she hasn't figured out that for every son there's a sweetheart or a wife; but the way she says it you'd think this whole mess was a put-up job on the mothers of males.

Now I can't believe that's any way to win a war or earn a hunk of peace. I'd rather see it done a la my old auntie, who lost one boy in the first world war and has two grandsons hip deep in this one, both being in the Navy. Sure, she knits for them and packs up stuff to send, but when she writes to the boys on the briny it's all home news and home jokes and family banter, with words of admiration for the way the lads are putting on weight and muscling up. She doesn't egg them on to massacre anyone but she reminds them that every generation of her tribe has seen service and was proud to wear a uniform. Maybe she isn't kidding anybody very much about her deep-down sentiments, but she saves the boys a lot of self-respect and makes them see that an athlete in the navy deserves being rooted for about as much as a football genius. She's wise enough to know that one can't stop a panzer avalanche with nursery mollycoddle, and that the guy who can fight back is the one they let alone the longest.

SO when I pick up a hitchhiker in khaki I never say a word about the way civilians regard the administration or about any bureaucrat's official blunders. All I do is to pry into the soldier's experience about camp routine, Army organization and insignia, and the mechanism of the modern rifle—(of which I care and know little). Anything to show him I'm not spouting sob blubber. And only about one boy in six ever comes back with peevish weeps. Probably most of that was imported from back home, too.

One other way to promote a chunk of good will to men would be for us to wage unswerving mental warfare on our present tendency to get the "dictator complex." Now I know as well as you and a host of commentators (including the high-toned columnists) that some penny-ante participants in public regulatory systems are said to have the bighead bad. But as a rule they get just about so far in their maudlin forays against freedom, whereupon they run smack up in front of old P. O. (which isn't post office, but public opinion).

This "dictator complex" springs up in all manner of conversation both public and private. Farm spokesmen have done their share of "viewing with alarm" the "awful, menacing centralization of power" and have worn out relays of stenographers and linotype men giving forth their opinions anent the rise of dictators and the decline of what we used to call a democracy.

It strikes me that we have had such a universal background of historic hatred of tyranny and abuse of power that we can be trusted on the whole to keep it in reasonable check, without crying "wolf" every time some puppy yips. It's granted that in times of stress we should have a very strong and unbiased central government, run by men who are not going to back water and pull their punches every time some more or less selfish interest gets in the road and insists that Uncle Sam is an old meany.

By ascribing either incompetence or dictatorship, or both, to our civil leaders I believe we are doing some internal injury to our much-cherished form of public management. Countless election reversals from one party to the other and back again should have taught us vividly that neither side has a patent on statecraft or good leadership. The only way we can find out what dictators really mean when they are put there for keeps is to go right on questioning and slurring our present system—bad in spots though it may be.

THAT'S the best way to acquire dictators, because it's the only kind of leadership able to handle that kind of a mob. Hence I reckon a little piece of patience and tolerance and good will to men in office might save us from the fate of Italy and Germany.

That is, I know if you elected me to a job where I might get dictatorial and arbitrary, my background of horse sense, based on what little history I have picked up, would halt me with a jolt long before I ever convinced myself that you'd stand for tyranny. And that's the way it works with every ordinary American elevated to a post of responsibility—his mind checks him from excesses long before the mob does. There may be a few exceptions, but most of them are victims of their own folly, while America still waves!

If you remember what I started out to say (which I'm not too sure I know myself) you'll recall that we dragged in some angels. I didn't do that because I am a frat brother of any celestial beings or have any special knowledge of harps and halos.

They were brought in to give this essay a Christmas setting in the first place, and then to take a sort of text for lots of us who are so prone to argue with foreordained forces of destiny. While I am not a fatalist, it looks to me as though F. D. R. was right when he said this generation has a date with destiny.

THIS suggests to me that the best kind of holiday spirit we can rig up for ourselves would be to retain confidence in our country and its best customs and vow to keep in tune with that strain of music rather than to dial around for dismal things.

You can cheer up a misanthrope by going at it right. If he feels that this is the last Christmas he'll be able to retain his dollars, his dignity, and his dear ones, then tell him if that's so he'd better perk up and trim the tree a little higher and brighter. Because later on when his nightmare is saddled and ready for his canter to calamity he can look back and grin at the fun they all had once more in the old fond way.

And ten chances to half a one, he will be wrong on that sour note of his; and before the year is out, his stock will be rising and his faith in America and the party he supports will be floating on rosy clouds.

So that's the way I want to ring off. That's the outlook I need myself and so I pass it on to you, adding for good measure to show I have no grudge against Angels—Merry Christmas, Peace on Earth, Good Will toward Men.

"Rastus says Parson Brown done ketch 'im in Farmer Smith's chicken coop."

"M-m, boy! Don't Rastus feel 'shamed?"

"Nossuh, de parson am de one what feel 'shamed. He can't splain how come he ketch Rastus dar!"

Mary: "How is it Bill never takes you to the movies any more?"

Helen: "Well, one evening it rained and we stayed home."

"If you kiss me again, I shall tell father."

"That's an old tale. Anyway, it's worth it," and he kissed her.

She sprang to her feet. "I shall tell father," she said, and left the room.

"Father," she said, softly to her parent when she got outside, "John wants to see your new gun."

"All right, I'll take it in to him," and two minutes later father appeared in the doorway with his gun in his hand. There was a crash of breaking glass as John dived through the window.

"I hear there are twins at the Bate's house. Boys or girls?"

"I think one's a boy and the other a girl—but it may be the other way round."

The only difference between a cutie and an old maid is that the cutie goes out with the Johnnies and the old maid sits home with the willies.

Attorney: "Where was the defendant milking the cow?"

Witness: "It's hard to describe, Judge, but if you'll bring in a cow, I'll show you the exact place."

"Billy's downstairs smoking your cigars . . . he says he won't stop until you lay off his electric trains."

Close Friends

"Ah say, Mary, would you jes's soon—?"

"Look here, Jim Jackson, don't you git fresh wif me. Mah name's Miss Smif, not Mary. I don 'low only mah bes' and mos' pa'ticular friends to call me Mary."

"Ah begs yo' pardon, Miss Smif. But, say, Miss Smif, would you shif' to de oder knee? Dis one's gittin' tired."

I hate to say it just because
  It sounds so mean and shocking;
But Nature beat you, Santa Claus,
  At filling Peggy's stocking.

When men wore long beards—a wife allowed her husband to play poker twice a month while she had a party of lady friends. The husband came home one night while all were there, his whiskers loaded with tobacco juice.

Wife: "Dear me, John, couldn't you turn your head to spit?"

Husband: "Nope, not in that game."

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