BETTER CROPS

The Pocket B

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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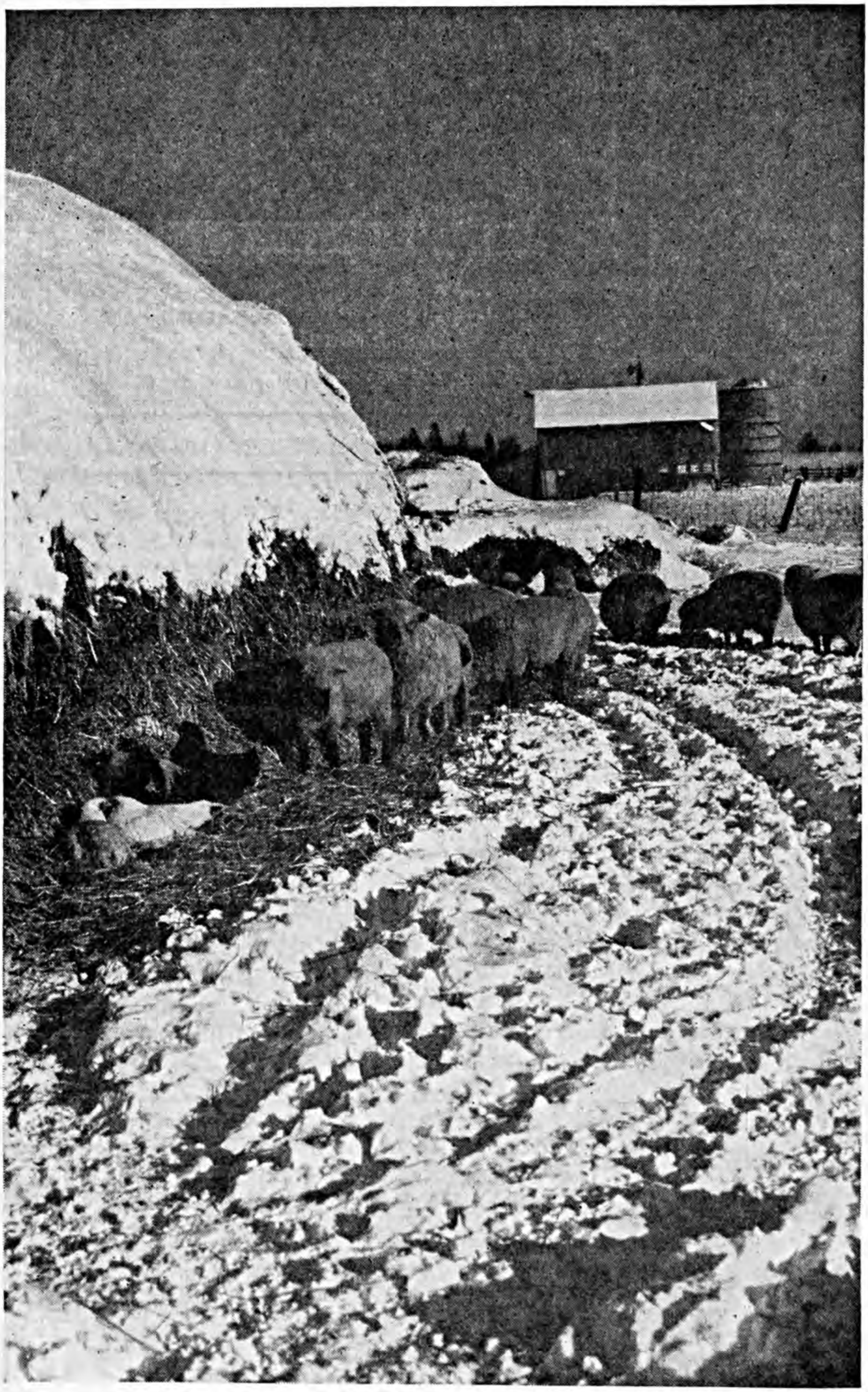

THE SUNNY SIDE OF THE STACK ON A JANUARY DAY

Better Crops with Plant Food

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Vol. XXVIII WASHINGTON, D. C., JANUARY, 1944 No. 1

Looking ahead and analyzing

Victory Vows

Jeff McDermid

NOT an enemy aircraft has showered us with missiles, but the impact of an exploding world has left bomb craters a-plenty in the smug crust of our erstwhile isolation. Our problem now is whether to hide in them or build something better where the wounds exist. My "Americana" impressions, such as they are, come straight, being native and natural and not acquired by adoption or confused by travels abroad. I've always lived in a community that blends commerce, college, and crops—dollar diplomacy, book theory, and bucolic single-mindedness, woven into a typical crazy quilt on the Midwest pattern.

Beginning on a small farm, then to a country court-house town, and finally to a city with a noted campus at one end and a stock-yards at the other with a few factories in between, I have had a chance to watch the sparks fly from clashing opinions and moss-grown prejudices.

Ours is a silo and smoke-stack sky line, bordered by corn tassels and alfalfa blossoms—a queer intermingling which I suppose is not so often seen in the foreign countries we kept so long at arm's length while holding our noses with the other.

We had our weekly commerce club gabfests, our frequent farm emergency sessions over this and that alarm roused by modern horseless Reveres, no end of research by science, debates by solons, and strong demands pro and con by capital and labor.

Pencil in hand and ears dug out for news tidbits, your faithful scribe has lived through all such experiences without losing faith in what some folks call our "destiny," despite everybody hollering at once for some small corner on what little there was left. Probably, I am unique in this retention of a disinterested attitude, not belonging to anything special or having much of anything valuable belonging to me. It's often been a lonesome thing in a way, this always being a watcher on a removed vantage point with no strings tied to my big toe or wearing no man's brass collar.

I GUESS that men and women who took sides to protect their privileges have had more income and made more "profitable" relationships over the pre-war years, but they haven't had any more fun than yours respectfully.

With this preface I will set down a few of the changes of attitude which seem necessary and advisable if we are to render substantial aid to world "salvation," according to our traditional "destiny."

Just to prove I'm no stuffed owl about this business, I'll whack my own profession first and foremost. We have usually rushed our petty foibles and half-cooked hunches to the linotype department before the community had time to cool off or sober down after a dent was made in our traditional way of life. We've dished out nasty doses of criticism we wouldn't take ourselves. We've hugged our provincial pride so tight we couldn't see the next town for sour grapes, and we've ruined the reputations of everybody we had a peeve against, from the garbage hauler to the peer of Great Britain.

Sumner Welles has lately written considerable good stuff in favor of every country maintaining freedom of thought and freedom of expression through press and radio. He says that's not trying to force our republican form of government on anybody, but it's just giving ventilation and fumigation a chance to do its work—but of course not in just those words.

I infer that he rightly thinks that suppression and distortion of facts are bad for mental and moral health. I shout "amen" to that indeed, but at the same time the weakness and cupidity of some members of my own writing clan and their connivers, the publishers and broadcasters, cannot be checked merely by "free speech" privileges. Too many publicists have more to fear from lack of a sound conscience than from an iron-clad gag rule. It must be seen that the future depends more on the capacity and strength of our information service to learn self-control in the public welfare than it does on laws and regulations. In order to be entirely free and subject to decent self-regulation, publicity must divorce itself from financial and commercial exploitation. So you see in the realm of news and commentary we still have some medicine to take, without worrying about quick cures for foreigners and savages. We don't have to send a high-priced correspondent abroad to get a feature story on reform.

Having demonstrated that the press and radio needs to undergo some change of attitude, we can turn to a few other instances of a less class-restricted kind.

IT'S certainly a queer mixup and right-about-face when you stop to think about Midwest attitudes toward militarism and naval power, now and five years ago. Last month I heard some authority say that three or four of my familiar central states, land bound and isolated from the ocean's influence, had contributed more gobs and tars to the decks and gunrooms of our navy than any other area. I recall with clarity the debates in our legislature against compulsory military drill in the state university, and the way the solons regarded expenditures for battleships as just so much foolish waste.

And now numbers of those chaps have graduated into congress or taken posts in other government work. Today they help launch battleships with champagne and brag long and loudly about the victories afloat.

To me this is not anything for conjecture or amazement. I see the reason for it like you do, but what I wonder about is how long will our political leaders and economic bosses continue to maintain this frame of mind after the last shot is fired. Public employment absorbs nearly ten per cent of our total population, if we include sailors and soldiers in the category. Naturally, as long as this means of livelihood occupies so many of our citizens, you'll find the voice of influence raised in support of armament and defense. But how about the opinions of leaders when everyday humdrum home jobs become once more the main avenue for subsistence?

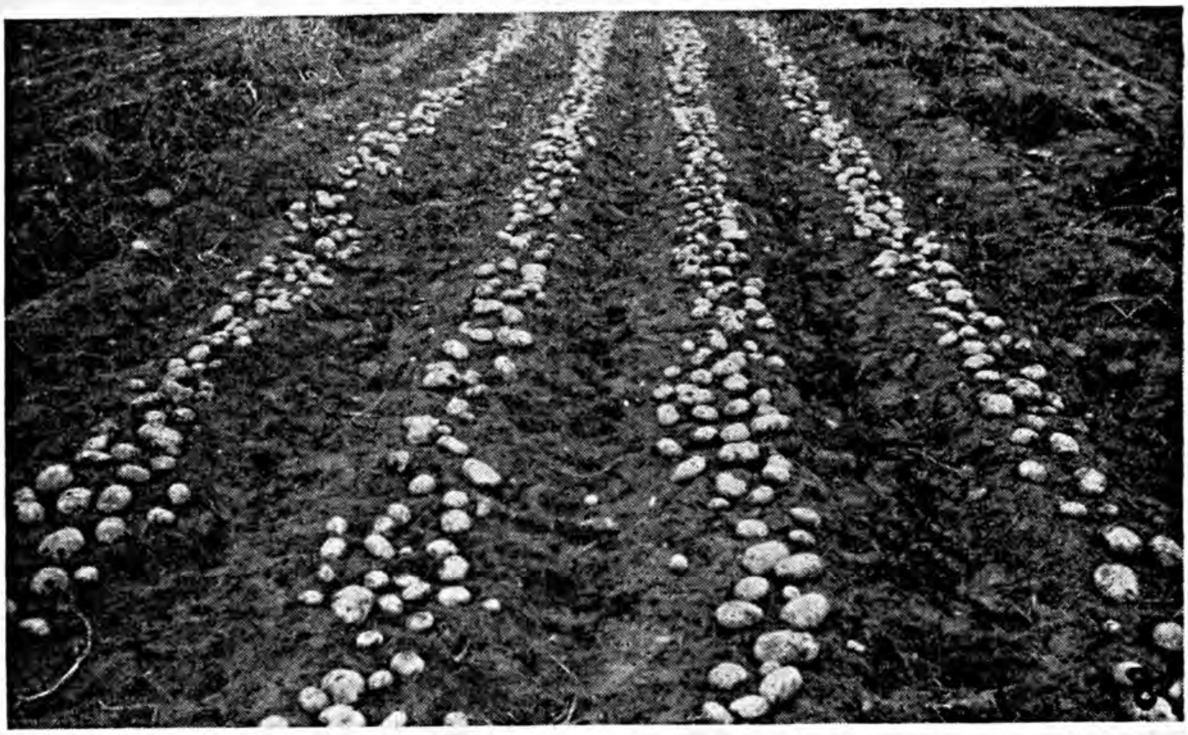
If insulated provincialism dies and stays dead as a result of our living in a smaller world, it may prevent the re-awakening of that same old "beat-all-swords-into-plowshares" instinct. A lot also depends on what kind of trading dickers we can reach a compromise on. Judging by the sayings and doings not so long ago by some of our het-up pressure boys against the Hull reciprocal treaties, we are going to be in for a lot of gallery guff and lobby log-rolling before we can arrange for a satisfactory agreement on overseas commerce, tariffs, and exchanges. The war won't end the smoke screens by any means.

Anyhow as I go about hither and yonning, I see that the state of mind of my cronies has reached a pass where they are not indulging in wishful thinking or being so complacement as we hear Washington experts say. Rather than see heaps of the boys and girls mustered out to take rag-tag jobs and humiliating charity in the wake of a depression, most of them have told me they hope the mustering out process will not be too sudden. They vision a need for soldiering and sailing for some time after the diplomats settle what the generals have spared. Some of their sons have got quite used to wearing officers' emblems and having some degree of impersonal authority and a sense of national dignity. Others have acquired special skills that won't be so much use after the war unless the jobs are more numerous than we imagine possible. Still others will develop a wanderlust and a hatred of confinement in uninteresting jobs and tiresome places

My friends, the parents of service men, also think that the diplomats and food hand-outers will not be sure to succeed in paving the way for the dove of peace to build its nest in blasted countrysides. They think we'll have to tote the big stick and the lariat, even if we lay aside firearms. And all this home-made thinking winds up to the answer that they want their boys back all right, but not until the job is done so it will stay done. Their love of uniforms for the sake of gaudy display and glory is not any stronger than it was when the Populists toured the prairies and the Peace-At-Any-Price mania claimed us for its own. But they admire grit and stamina, they have the American habit of winning, and organizing thoroughly to get something accomplished quick. Hence they refuse to unthink themselves now, after so much painful reshaping of their pet doctrines. So they are in it to see it through, come drought or high water!

The first guy who pops up in congress or my own state assembly to gurgle out namby-pamby nonsense about waste in militarism amid the aftermath of victory is due to be elected to retire. Our folks were fooled once,

(*Turn to page* 51)



Potatoes fertilized with one ton of 4-16-14. Yield per acre 560 bushels. To make sure of high yields, ample fertilizers must be applied.

Where Do We Stand With Fertilizers?

By Ford S. Prince

University of New Hampshire, Durham, New Hampshire

IN times like these, when almost anything can happen, it is well to pause oftentimes to see where we stand. Take this matter of fertilizers. We have already experienced a period of nitrogen shortage. We assume what with new synthetic plants in operation, that this won't happen again. This year we are faced with a tight potash situation due to the greatly expanded demands being put upon our domestic supplies. These supplies are far from consuming centers. A transportation breakdown, a protracted strike, or a well-directed enemy bombing attack, any one of these things could create a very serious situation with potash. There are a great many things, no doubt, that could happen to our superphosphate supply.

Let us suppose then, for purposes of illustration, that one of these critical fertilizer ingredients will be so short that it can be obtained only in limited quantities or not at all. Where would the dairyman stand? Or the potato grower? In other words what is the effect of each one of these elements upon crop production?

Last spring when nitrogen was reduced 20 per cent in all fertilizer grades and even more in the Victory Garden Special, there was considerable talk about the "poor" fertilizer that had to be used. Yet no victory garden failures have come to our attention. At harvest time, many potato growers in New Hampshire tried to place the blame for poor yields on the lack of nitrogen in the fertilizer. But as Maine growers produced bumper acre yields, we must conclude that low yields in New Hampshire should be blamed largely upon the weather and not upon fertilizer quality, since Maine growers used the same quality of fertilizers as did our farmers.

We have made an attempt in New Hampshire when publishing results of research to evaluate separately the effects of the three fertilizer nutrients. In each case these results have applied to specific crops or to pastures. In this article we will make an attempt to summarize these values so far as possible for the entire range of field crops in which we are interested at the moment.

Take the potato crop which was under study in New Hampshire for 12 years in one location and 6 years in another, with fertilizer tests similar in both cases (1).* Potatoes were grown without nitrogen or phosphoric acid or potash, then each element was doubled and all six treatments were compared with a standard check which happened to be a 4-8-7 grade, one ton per acre.

The average yield of these two tests, one of which was conducted in northern, the other in southern New Hampshire, was 312 bushels of potatoes per acre. Variations from this check plot yield where the two sets of figures are combined were as follows:

TABLE I.

Grade of Fertilizer	*Variation from Check, Bu. per A.*
0–8–7	−17
8–8–7	+12.5
4–0–7	−68.5
4–16–7	+32.5
4–8–0	−102
4–8–14	+26

Leaving out an element always depressed the yield as might be supposed. Conversely, doubling an element always increased the yield. Omitting an element caused a greater depression in yield per unit of fertilizer than a similar amount of fertilizer increased the yield.

Turning these figures around, we may say that the first four units of nitrogen returned 17 bushels while the second four boosted the yield only 12.5 bushels. Similar results for phosphoric acid, for the first eight units were 68.5 bushels and for the second eight 32.5 bushels, while for potash the results were 102 and 26 bushels respectively.

In Table II we have presented the average response of these fertilizer ingredients when used in amounts below or above the check plot application. The response per unit has been calculated directly; potatoes have been figured at $2.25 per hundredweight; and fertilizer costs at $40 per ton for sulphate of ammonia, $25 per ton for 20 per cent superphosphate, and $48

* Numbers in parentheses refer to literature cited.

TABLE II. UNIT VALUE OF FERTILIZER NUTRIENTS ON POTATOES

	Gain for First Increment per unit, bushels	Value	Cost of Fertilizer	Net Gain
N	4.25	5.74	2.00	3.74
P_2O_5	8.56	11.56	1.25	10.31
K_2O	14.57	19.67	.80	18.87
	Gain for Second Increment per unit, bushels			
N	3.12	4.21	2.00	2.21
P_2O_5	4.06	5.48	1.25	4.23
K_2O	3.71	5.01	.80	4.21

per ton for muriate of potash, 60 per cent grade. The potato price used presumably represents the floor price for the current season. These figures all vary somewhat from actual values but are close enough to actuality for purposes, of comparison.

Results reported by Chucka, Hawkins, and Brown (2) from the Maine Station place less emphasis upon phosphoric acid and even more upon potash than those discussed in detail from New Hampshire. This difference in phosphorus response is no doubt due to the more intensive system followed in growing potatoes in Maine and to an accumulation of phosphoric acid in the soil from repeated applications of fertilizer.

In the reference cited, (table 9, p. 132), date covering 12 years of work are available.

In Table III the variations in yield from the check plot are presented. One ton of fertilizer was applied in each case, the check plot receiving one ton of a 4-8-7 grade.

TABLE III.

Treatment	*Bushels per Acre*
0–8–7	−84
2–8–7	− 9
6–8–7	3
4–0–7	−103
4–4–7	1
4–8–0	−248
4–8–4	−26
4–8–10	19

The yield variations are somewhat wider than those of New Hampshire where elements are omitted. This is to be expected since total yields are higher, and under conditions that produce high yields, variations will always be wider. Differing from New Hampshire, however, are the responses for increasing the nitrogen and phosphoric acid. In these Maine data very little increase in potato yield was noted when nitrogen was increased to over two per cent, and there was no increase for amounts of more than four per cent of phosphoric acid in the fertilizer.

With potash, however, increases were secured when as much as 14 per cent of this element was included in the fertilizer. In this respect the data are much like those of New Hampshire. The fundamental difference then is the lack of response to phosphorus in the Maine potato-growing systems.

Connecticut (3) results show a decrease of 78 bushels for omitting nitrogen and no increase for amounts over 100 pounds of elemental nitrogen per acre. They also indicate a decrease of 103 bushels for leaving phosphoric acid out of the formula, with no gain for increasing this element to more than 160 pounds per acre. Omitting potash caused a decrease of 121 bushels, with no yields higher than those produced with 120 pounds of this element in a balanced fertilizer.

If we look at the research data from all three states as a unit we find that omitting nitrogen, phosphoric acid, or potash caused decreases on the average of about 20, 30, and 50 per cent respectively, when fertilized normally otherwise and compared with check plot yields. These percentages give some idea of the importance of the three elements and their influence on potato production.

It would be very gratifying in presenting data of this sort if we could predict accurately what each added increment of plant food would return in crop yields. There are some reasons why this cannot be done. In the first place, we haven't all the data; and in the second, the old law of diminishing returns steps in to give the first increment greater influence than the second and so on.

The data from Maine, however, are fairly complete on this point, the nitrogen having been increased two units, while phosphoric acid was stepped up four units and potash from zero to four to seven, then to 10 and 14.

The first two units of nitrogen in these Maine tests gave 80 per cent of the increase recorded for nitrogen, up to a total of six units. The second two units gave nine per cent of the increase,

Potatoes fertilized normally with one ton of 4-8-7.

while the third two units gave 11 per cent, the total increase being 105 bushels for nitrogen.

The first four per cent of phosphoric acid gave all of the increase in the Maine results.

With potash, 81 per cent of the increase came from applying the first four units, nine per cent from the next three, six per cent from the next three, and four per cent for boosting the amount from 10 to 14 units.

The results for nitrogen in the three references cited are fairly consistent, and it seems fairly accurate to say that good corps of potatoes can be produced with 80 pounds of nitrogen, the maximum being reached with around

Potatoes fertilized with 4-8-0. (Photographs taken on same day.)

A mixed stand of clover and timothy: left, check, unfertilized; right, fertilized with K. Livingston farm, Claremont, N. H. First cutting 1938.

100 pounds of nitrogen per acre.

In New Hampshire, good crops of potatoes can be predicted where 160 pounds of phosphoric acid are used, but maximum crops need a slightly higher phosphorus level, probably 240 pounds per acre. In Connecticut, maximum yields can be obtained by using 160 pounds and in Maine by using 80 pounds, although 120 are recommended for safety.

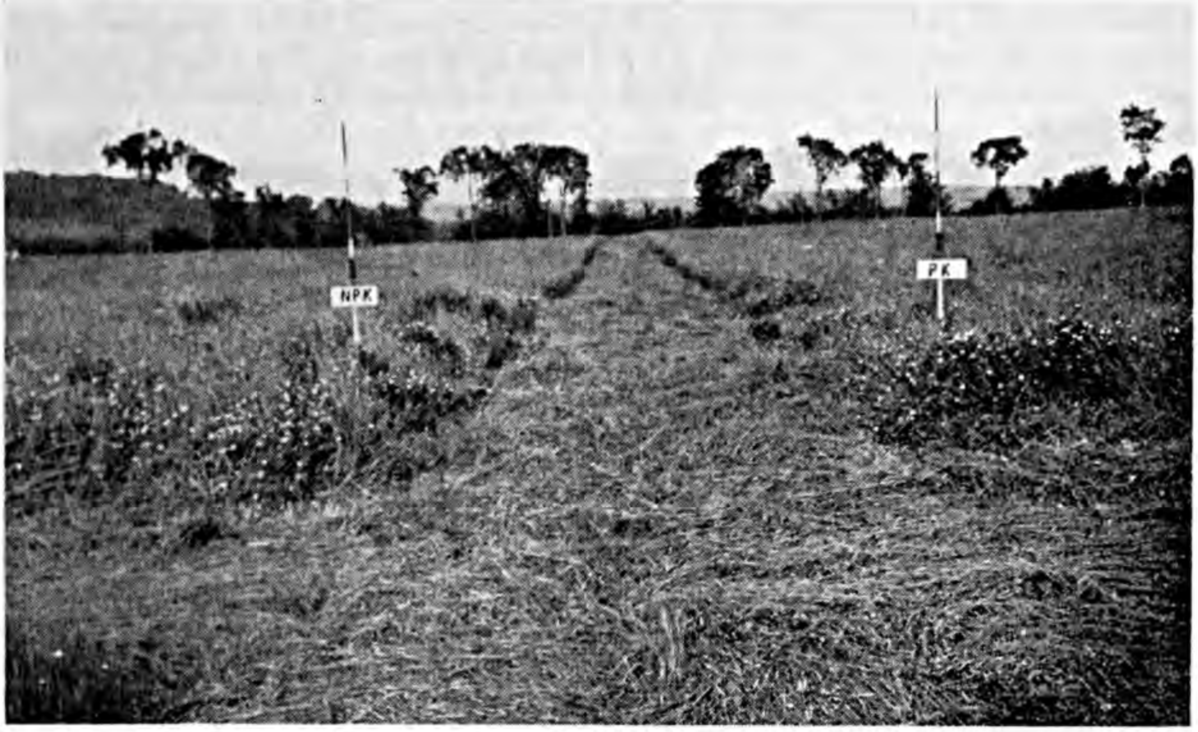
One hundred and twenty pounds of potash appear to produce maximum crops of potatoes in Connecticut, but in New Hampshire and Maine maximum crops need at least 240 pounds, although good crops are produced at a somewhat lower level.

I have summarized data for the potato crop first in this article because almost 50 per cent of the mixed fertilizer used in New England goes to potatoes. Of even more importance to more people in New England is the fertilizer used on forage crops. Of the total fertilizer used almost 18 per cent is applied to hay crops and 13 per cent to pastures, making the impressive total of nearly one third of all fertilizer consumed going to this crop group.

Much research work has been done to indicate what response is likely to be secured from using fertilizer nutrients singly or combined on hay and pasture plants. The crops naturally divide themselves into grasses and legumes in any fertilizer discussion since grasses are more responsive to nitrogen and the legumes to potash and phosphoric acid.

Take grass hay, as an example. We have found in New Hampshire (4) that nitrogen is the biggest limiting factor to high yields, but that the response from nitrogen will be reduced when there is a deficiency of phosphoric acid and potash in the soil. Where this is the case the response from phosphoric acid and for potash will be increasingly greater. In other words, grass hay fields amply supplied with these two elements will continue, for a year or two at least, to yield well with nitrogen alone, but without available supplies of phosphoric acid and potash in the soil a complete fertilizer must be applied. This forms the basis for the 1-1-1 fertilizer ratio which is almost universally accepted as the correct one for top-dressing grass hay lands.

In our work in New Hampshire, in



A mixed stand of clover and timothy: left, fertilized with NPK; right, PK. Livingston farm, Claremont, N. H. First cutting 1938.

which hay lands have been top-dressed with nitrogen alone and with a fertilizer approximating a 1-1-1 ratio, the results have been somewhat varied, and colored by past soil treatment. In one test on a soil in which neither phosphoric acid nor potash were limiting factors, an application of 32 pounds of nitrogen in nitrate of soda brought a response of 1,462 pounds of cured hay per acre, while the same number of pounds each of phosphoric acid and potash caused an increase of 728 pounds. When a complete fertilizer equal to the two separate treatments was applied, the increase was 2,159 pounds. The treatments were all applied at a gain of more than double the fertilizer costs.

In a similar test on a very heavy soil which was seriously deficient in both phosphoric acid and potash, 32 pounds of nitrogen gave an increase of about 600 pounds of hay while a complete fertilizer with 32 pounds of each of the elements gave an increase of 1,600 pounds.

A search of the literature reveals many interesting trials where fertilizers or manure and superphosphate have been used. The results all vary in extent but differ little in trend. They all point to one significant fact, that there is nothing more certain than that nitrogen applied to a straight grass crop will stimulate growth. The extent of the increase, or, stated in another way, the utilization of this nitrogen, will be governed by the amount of available phosphoric acid and potash in the soil. Unless it is known that these elements are present in the soil in amounts so as not to become limiting factors, a complete fertilizer should always be used.

With alfalfa and the clovers the story is entirely different. In fact potash stands in the same place with legumes as nitrogen does with the grasses. The extent then that potash fertilizers are required to produce maximum crops is governed by the amount of available potash in the soil or that which can be made readily available during the growing season.

It is a well-known fact that although the supply of total potash in mineral soils is very large, there is only a small percentage of it available at any one time. Also, that potash in certain minerals is much more usable than it is in others. If soils have been formed from those minerals which yield up their potash readily to plants, the need for potassium fertilizers is much less than where these minerals are slowly soluble. This fact no doubt explains the differences noted in potash response when studying results from widely separated experiments over the United States.

It would appear that native New England minerals yield up their potash slowly in plant growth. Further the reversion of applied potash to native mineral forms is probably higher here than it is in many other places, thus establishing a fairly strong need for potassium in the fertilizer for the groups of crops under discussion. The greater the feeding power (or the larger the crops which are produced), the greater is that need. Nor do we mean to minimize the need for phosphoric acid, and likewise, we must assume that the lime requirement must be met for the crop to be grown. This latter fact, however, only emphasizes the need for potassium in the fertilizer.

Financial Returns from Potash

To be more specific, alfalfa and ladino clover, both rapid growing and highly productive crops, have a high potash requirement. The comparative need in relation to yield is doubtless just as great for the other clovers.

This is well illustrated by the results of research work in our own as well as some of the other New England States. In one report dealing with alfalfa (5) one dollar invested in potash gave a return of four dollars in hay, and compared with $3.50 per ton returns for manure applied at a 20-ton rate. Superphosphate applied at the rate of 500 pounds of 16 per cent superphosphate barely managed to pay its cost and then only with heavy manure applications. Nitrate of soda did pay its way applied at the light rate of 100 pounds per acre.

In another test on the same field (6) in which the alfalfa seeding was further from a manure application, the returns per dollar invested were $2.29 for nitrogen, $1.39 for phosphoric acid, and $3.72 for potash. These results all refer to cases in which the elements were top-dressed annually, but used singly.

Soils of the Connecticut Valley have given good response to fertilizers containing potash in growing legumes. Our preliminary work in this area was with a mixed stand of alfalfa and timothy (7). With hay and fertilizers calculated at normal values, one dollar invested in nitrogen, used with phosphoric acid and potash returned $3.89 in hay. One dollar invested in phosphorus returned $0.97 when used alone, $1.63 used with potash, and $1.79 used with lime and potash. One dollar invested in potash returned $3.07 used alone, $4.78 used with lime, $3.76 used with phosphorus, and $5.93 used with both lime and phosphorus. All of this work pointed to a need for fertilizer balance as can readily be seen.

In other work on this field (7) (8) red and alsike clover were grown either alone or in mixtures. An average of eight crops ascribes a gain in hay values of $1.74 for the use of 100 pounds of nitrate of soda, only $0.41 for 400 pounds of 20 per cent superphosphate, but $9.53 for the use of 125 pounds of 60 per cent muriate of potash. When the superphosphate and potash treatments were combined, the gain was $27.00, again indicating the need for balance so far as phosphoric acid and potash are concerned.

One of the significant phases of this work in the Connecticut Valley has been the persistence of red clover over a period of years in all plots treated with potash, no matter what other treatment was employed. In a seeding made in 1938, this species still exists in the stand and good yields of hay are still being cut. Work is now under way to determine how much potash must be used to secure this effect, also how long the red clover will continue to occupy a fair percentage of the hay stand with the requisite fertilization.

(*Turn to page* 49)

What's in that Fertilizer Bag?[1]

By Vincent Sauchelli, Agronomist

The Davison Chemical Corporation, Baltimore, Maryland

THE manufacturer uses a formula just as a cook uses a recipe. It tells the plant foreman the kinds and amounts of the various materials to use in preparing the complete mixed fertilizer. The formulas used by different manufacturers are not usually disclosed; they may be "trade secrets." Most laws do not require a disclosure. Some manufacturers voluntarily furnish this information on the bag or on a tag affixed to the bag. Such a formula, so disclosed, is called an "open" or "public formula."

The analysis or grade of fertilizer refers to the percentage of nitrogen, phosphoric acid, and potash present without reference to the source of the nutrients.

The analysis is always in whole numbers and the plant foods are always stated in the same sequence, namely: N, P_2O_5, K_2O. For example, 3-12-6 means 3% nitrogen, 12% phosphoric acid, and 6% potash.

Different formulations for the same grade or analysis are possible. The experienced manufacturer knows how to choose the proper materials and so formulate them that the final product will have the required analysis and ratio and be properly conditioned; that is, it will not cake or lump, and neither be too moist nor too dry; in short, be "well cured" and easily drillable—qualities which the modern farmer takes for granted.

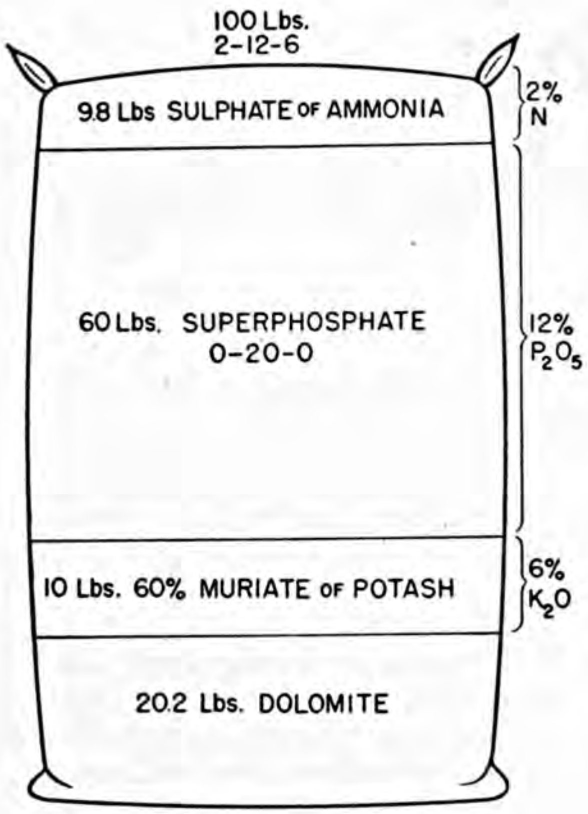
Let us consider 2-12-6 as an example because it is a very popular grade. How is it formulated? What goes into a 100-pound bag?

[1] The second of two articles.

The manufacturer could use a very simple mixture, comprising muriate of potash 60% K_2O, sulfate of ammonia 20.5% N, and superphosphate 20% P_2O_5 with some filler. This is the most simple form. It is diagrammed at the left in Fig. 1. Experience has shown that this is not a practicable formulation where the fertilizer is to be stored any length of time in bags. The commercial fertilizer manufacturer is more likely to use the more typical formulation given in the diagram at the right in Fig. 1.

Some growers insist on more than one source of nitrogen. In this particular formulation three nitrogen carriers are used: sulfate of ammonia, ammonia solution, and tankage. Many farmers prefer a neutral or nonacid-forming fertilizer. In the formula on the left (Fig. 1) 9.8 pounds of sulfate of ammonia furnishing a little less than 2 pounds of nitrogen require the equivalent of about 10 pounds of calcium carbonate to neutralize the potential acidity. (One unit of nitrogen requires 107 pounds of calcium carbonate to neutralize potential acidity.) The bag contains 20 pounds of dolomite, which furnishes more than enough lime to neutralize the acidity. The formulation on the right (Fig. 1) requires 3.8 pounds of dolomite in each bag to neutralize the potential acidity of the nitrogen carriers. As it stands it is practically neutral.

Let us take another example, this time a 3-12-12 fertilizer which is also popular. Several formulations are possible. The simplest is illustrated in the



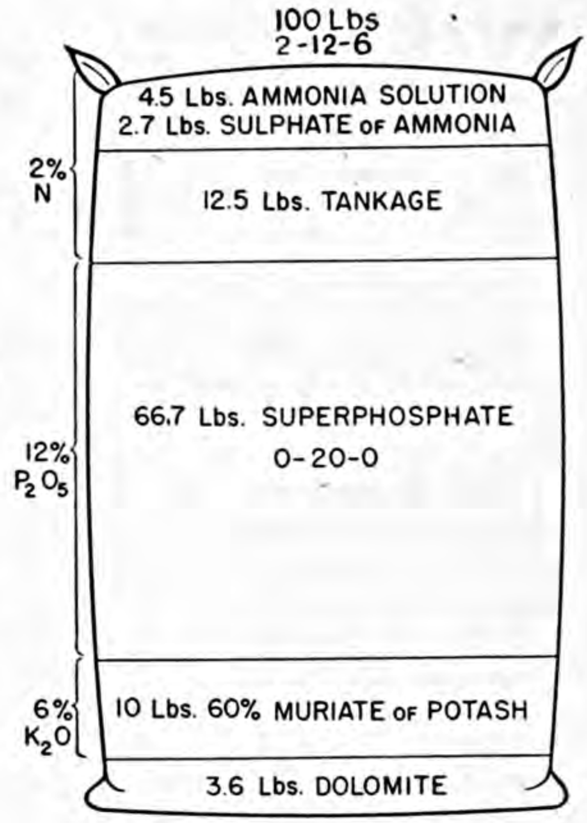


diagram on the left (Fig. 2). Again the fertilizer manufacturer is more likely to use a mixture as represented in the diagram on the right (Fig. 2.)

The first formula is acid-forming; it has an acidity equivalent to 15.5 pounds of dolomite and only 5.3 pounds could be added. Room could be made for more dolomite by replacing some of the 20% superphosphate with triple superphosphate.

The formulation shown on the right in Fig. 2 requires about 10 pounds of dolomite to make it nonacid-forming. To make room for the dolomite, the manufacturer had to select and combine different nitrogen carriers and some ammophos 11-48-0. These adjustments required skill and experience in order to produce a good commercial material that would remain in good mechanical condition over a reasonable length of time. The manufacturer has to prepare a large amount of a fertilizer mixture months in advance of its use so as to have it "well-cured" if it is to be acceptable two or three months later. It used to be that the farmer bought his fertilizer early in the season and put it in his barn until needed. Today under normal conditions he expects to phone the same day the weather forecast is favorable and have the fertilizer delivered right to the field. The manufacturer has to prepare his mixtures well in advance and have them stored and ready for shipment to give this service. I mention this to emphasize the importance of knowledge and experience in choosing and blending materials so as to give the farmer a thoroughly satisfactory product on short notice.

Every state has laws which require the manufacturer to print on the bag or on an attached tag a guarantee as to the plant-food content of the fertilizer. Such a printed statement is the "guaranteed analysis." Nowadays the guaranteed analysis or grade is quite simple, usually stating the percentage of the nitrogen, the available phosphoric acid as P_2O_5, and the available potash content as K_2O. These three plant foods constitute the composition and value for which the purchaser is paying.

Occasionally despite the greatest precaution, there may be a fertilizer bag in which the material is sticky, or moist, or as hard as a rock. The reason for it is that the fertilizer was not properly "cured" before it was shipped. For example, many manufacturers make up "bases" which are usually mixtures of sulfate of ammonia or muriate of potash and superphosphate. A rapid chemical action ensues when these materials are mixed, forming a hard mass. But it is convenient to have this reaction take place and complete itself in advance of formulation with other materials. The "base" is made into large piles which "set up" or harden; the potash base becoming particularly hard. After a period of time the piles cool off, the chemical reaction is completed, and the "base" is cured and can be broken up, ground, and used with other materials to make a complete fertilizer. Superphosphate must also undergo a "curing" process following the acidulation of rock phosphate with sulfuric acid.

A unit represents one per cent of a ton, or specifically, 20 pounds. For example, in a 3-12-12 fertilizer, we say it contains 3 units of nitrogen, 12 units of phosphoric acid, and 12 units of potash. We could also say and mean the same thing by reading the formula as 3% and 12% and 12% of each respective nutrient. To use actual pounds we multiply the number of units by 20 pounds and read the figures as 60 pounds of nitrogen, and 240 pounds each of phosphoric acid and potash.

What Is pH?

pH is the measure of the degree of acidity or alkalinity. It is a symbol which has proved very convenient to designate the degree or strength of acidity. It does not tell anything about the amount of acidity or alkalinity. As in a thermometer, the scale shows the intensity or degree of heat but does not tell anything about the calories or quantity of heat.

A scale is used on which the figure 7 is the neutral point. Each figure below this represents the intensity of acidity and each figure is 10 times that of the preceding figure. For example, pH 6 is 10 times as acid as pH 7 and pH 5 is 10 times as acid as pH 6, but 10 x 10 or 100 times as acid as pH 7.

Likewise, figures above 7 represent the strength of alkalinity, pH 8 being 10 times as alkaline as pH 7.

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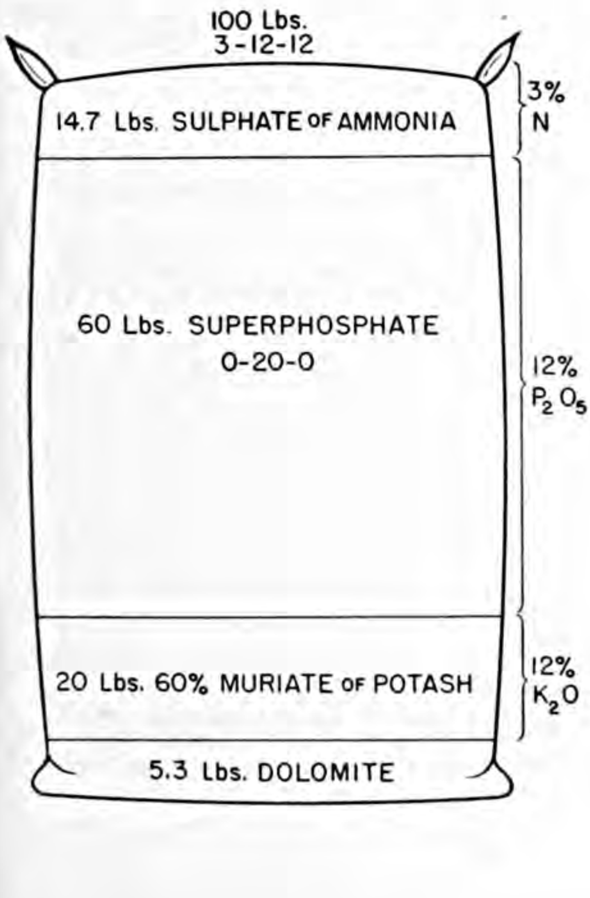
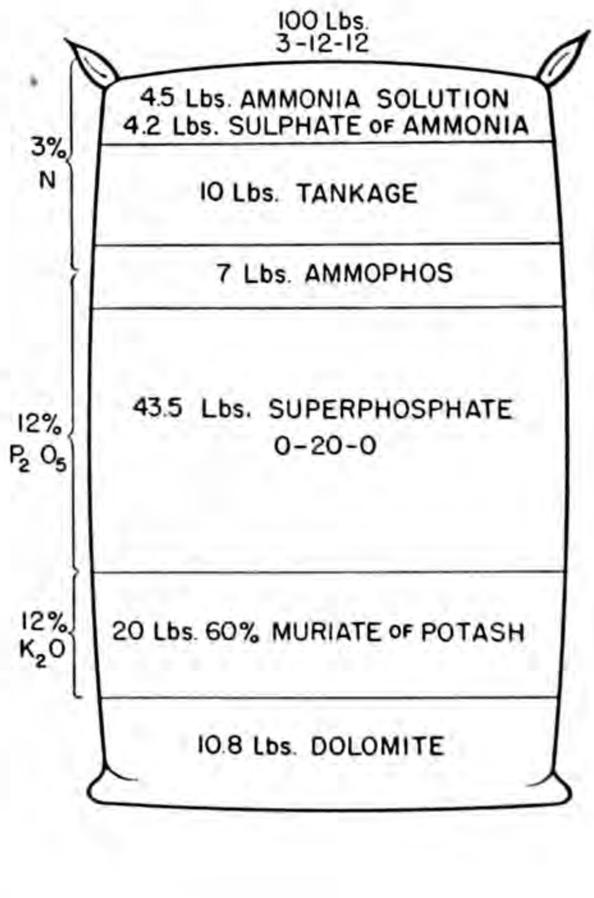




An Agricultural Look at Costa Rica

By Rafael A. Chavarria
San Jose, Costa Rica

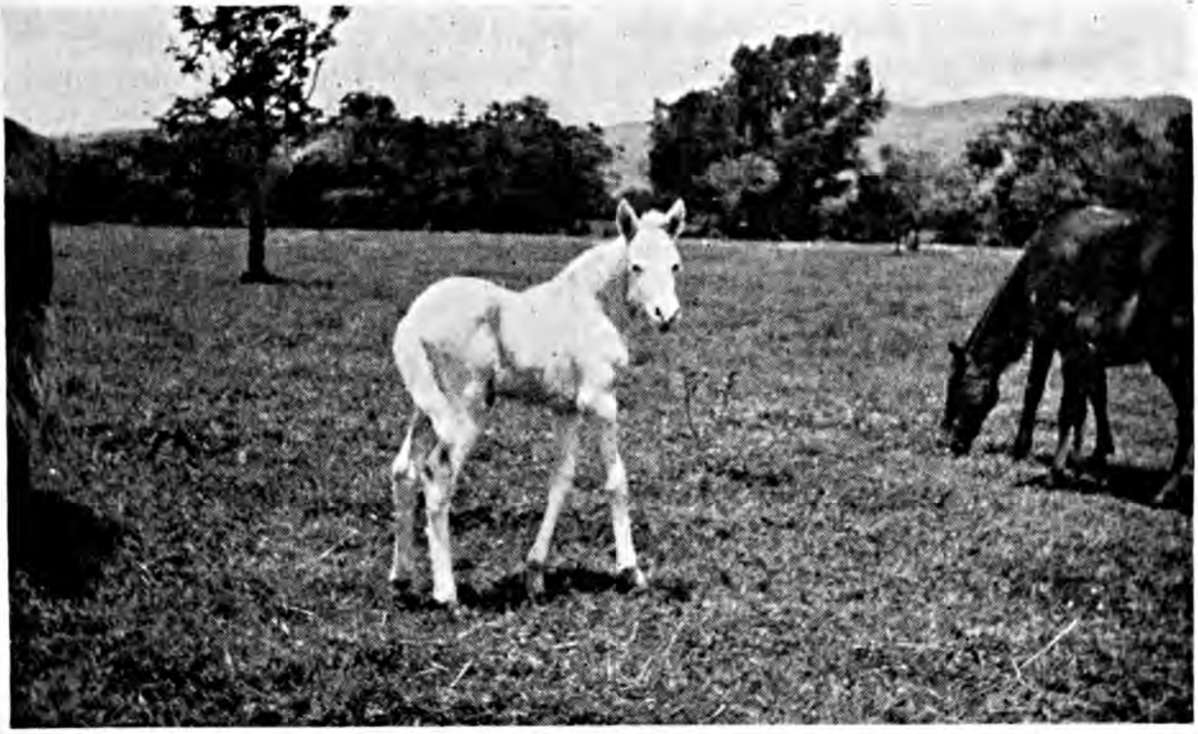
COSTA RICA, one of the smallest Central American republics as far as area and population are concerned, is located geographically in the very heart of the American Continent (between 8° and 12° lat. north).

Its political limits are the following: north, Republic of Nicaragua; south, Republic of Panama; east, Atlantic Ocean; and west, Pacific Ocean. Its area is constituted by 48,500 sq. km. of the most diversified land, as far as topography and agronomic characteristics of the soil are concerned. The population is composed of approximately 680,000 inhabitants of Spanish ascendency, with such a small percentage of native Indian blood that it can hardly be recognized. If it were not for a small number of negroes, once imported from Jamaica to work as laborers in the construction of the railway to the Atlantic Ocean, Costa Rica would have no colored people. From the foregoing, it is easy to assume that this little country ranks as one of the first, as far as the purity of its race is concerned, among all those which south of the United States compose the American Continent.


The author amid a growth of mangoes, peaches, avocados, and apples.

The social and political advantages derived from this state of affairs are obvious, and thanks to them, some of the noteworthy characteristics of this country are its peaceful life and the well-disciplined, easily governed, democratic people. Religious problems are unknown, and notwithstanding the fact that the nation and the majority of the people practice the Catholic religion, liberty of thought, faith, and creed are assured and granted to everybody. As a consequence of the above-mentioned characteristics and peculiarities, there has not been any social problems or agitations.

Costa Rica has a very small percentage of illiteracy due to the fact that elementary school training is compulsory. The national language is Spanish, but the English language is becoming quite familiar. In addition to a great number of grammar schools distributed throughout the Costa Rican territory in such manner that there is no town or village that lacks one, there are several high schools in the different cities; and in the capital at San Jose is located a university composed of eight colleges: law, dentistry, education, arts and sciences, engineering, agriculture, phar-



Young stock—the little colt in the foreground is of Peruvian breed.

macy, and political and economic sciences.

Reference has been made to the human element because of the great significance that it has in the study of the agricultural situation of any country.

The principal productive activity of Costa Rica is agriculture. From it is derived the well-being of the largest percentage of the country's population. The land is fairly well distributed among the inhabitants so that practically all Costa Rican farmers own their farms. These farms may vary in size, depending on location and exploitation, from five acres in the most populated and expensive central regions up to several thousand acres in the more distant and less populated ones. Notwithstanding the fact just mentioned, due to the relatively scarce population the greatest part of the territory has not been opened to agriculture. With the exception of a part of the central high plateau which is located at an altitude ranging from two to six thousand feet above sea level and in which the principal and most populated cities are to be found, including the Capital, and with the exception of a northern portion of the Atlantic Coast and lowlands and a part of the Pacific Coastal Plains, the country consists of unexploited and practically uninhabited woodlands.

Climatic conditions are ideal, and this country could have on that account a very prosperous and diversified agriculture. The rainfall varies from one to six thousand millimeters per year according to locality, and is largely distributed from May to December. Rains are less abundant, and in some localities do not exist at all, from January to March. The mean temperature varies from 16 to 28 degrees centigrade according to altitude. The highest rainfall and temperature correspond to the coastal regions. Topography is so diversified that it is easy to find good agricultural lands at every altitude, ranging from zero to almost ten thousand feet over sea level.

Of course, and as may be expected, the existence of such diversified climatic conditions, etc., as well as the previous action of different geological forces has given rise to a great variety of soil types and classes which may run from coarse sand to heavy clays, provided with different amounts of organic matter and with different contents and proportions of available plant nutrients. The soil thickness varies also from 10 to 12 inches, which is common, to 80 or 100 inches deep. Sub-soils vary as well, and there can be found sandy, clay, or rocky ones. The biological phase of soils is ordinarily active, hence nothing else could be expected from the constant interaction of forces, such as warm climate, sufficient organic matter, and permanent humidity. Thus Costa Rica could very well be considered as the melting pot of the Americas' agricultural treasures. And so ecologically and agronomically—in spite of the smallness of the territory—if properly looked for, there will always be found a good condition for the adaptation and production of practically every agricultural crop of the world.

Therefore, it is natural to expect that agricultural production be diversified, well-balanced, and highly developed. Unfortunately, this is not true. On the contrary, the greatest defects of the agricultural organization of Costa Rica are, besides its relative smallness, the lack of diversification and the absolute absence of a convenient balance or equilibrium, all of which urge the immediate establistment of a well-planned, technical program for the nation's agricultural development.

To give a general idea of what is or could be produced in this country, the most common crops are here mentioned. Corn, rice, beans, and sugar cane are cultivated on a large scale as they constitute a very important part of the rural population's diet; potatoes; cereals other than corn—such as millets, barley, oats, wheat; sweetpotatoes, mandioca or yuca, arrowroot, and other roots and tubers; leguminous crops, other than beans, such as peas and many others; cucurbits and other horticultural crops; flowers of great varieties and species; medicinal plants; oil-yielding crops; fibre plants; small fruits of great varieties; other fruits like citrus, apples, pears, pineapples, papayas, mangoes, avocadoes, etc.

Forage crops of sub-tropical inhabitat such as rye grass, oat grass, orchard grass, alfalfa, clover, etc., and a great number of tropical forages, such as para grass (Panicum barbinode); molasses grass (Melinis minutiflora); Guinea grass (Panicum maximum); giant or elephant (Penisetum purpureum); Bermuda grass (Cynodon dactylon); kikuyo (Penisetum clandestinum); etc.

The principal crops of agricultural production, as far as area cultivated and value of the surplus exportable, are cof-

Growing side by side—bananas, sugar cane, peanuts, sweetpotatoes, etc., a common sight in Costa Rica.

"Volcan Turrialba," an inactive volcano located in the center of Costa Rica. Many subtropical or temperate plants may be found in this splendid dairy region which has an altitude of 7,000 feet or more.

fee, bananas, and cocoa. Of the first one mentioned, there are under cultivation approximately 200,000 acres of very valuable highlands located in the most populated regions of the country in such a way that even the most important city, the capital, is surrounded by coffee plantations.

Not less than 200,000 inhabitants, which means very nearly a third of the Costa Rican population, derive their income from coffee culture. The surplus quantity of coffee harvested is exported to Europe and the United States. It produces an income of thirty to forty million colones per year ($1.00 United States currency equals 5.62 colones). The income obtained from coffee exports represents 50 per cent of the value of the exportable items of Costa Rica. The second major crop is bananas. These are cultivated on the lowlands of the Atlantic and Pacific coasts and their surplus amounts to several million bunches with exportable value of from fifteen to twenty million colones per year, representing 25 per cent of the total exports.

It should be understood that significant places are awarded to these crops in view of their exportable value, and not on account of their general importance to the nation, because others already mentioned, such as corn, rice, sugar cane, etc., need to be regarded simultaneously. In addition, the animal husbandry activities, such as dairying and meat production, can be estimated in over two hundred million colones.

To conclude with this exposition of the agricultural possibilities of Costa Rica, it is worth while mentioning the fact that a growing interest has been evidenced by several U. S. A. government offices connected with the U. S. Department of Agriculture in the promotion of the production of several agricultural goods of great importance and strategic value, such as rubber, fibre, or staple crops particularly manila hemp, medicinal plants such as quinine, etc.

Some Technical Problems

Although inconceivable after what has been claimed in favor of the agricultural advantages and possibilities of Costa Rica, it must be said that little effort has been made, individually or as a nation, to develop in Costa Rica a prosperous, diversified, and well-balanced agriculture capable of yielding the greatest benefit to the largest number and for the longest time.

Perhaps in no other respect is the need of better systems and of a more scientifically planned and conducted agriculture more evident than in regard to the soil problems, such as soil conservation, management, and improvement. As has already been mentioned, practically all Costa Rican soils are capable of production. Of course, there is great variation in geological origin, physical, chemical, and biological characteristics of the soils so that they vary considerably as far as their immediate productivity, potentiality, and total fertility are concerned.

For potentiality and fertility most of the agricultural soils are from fair to good, but many have lost, or very nearly so, their immediate productivity on account of the shortage of available fertilizing or plant-food elements. One of the principal reasons for this shortage is the heavy rate of percolation registered everywhere in Costa Rica and more particularly in those shallow, sandy soils not very rich in organic matter and quite common in the Pacific

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Available Potash in the Surface Soils of Georgia

By L. C. Olson and R. P. Bledsoe
Georgia Agricultural Experiment Station, Experiment, Georgia

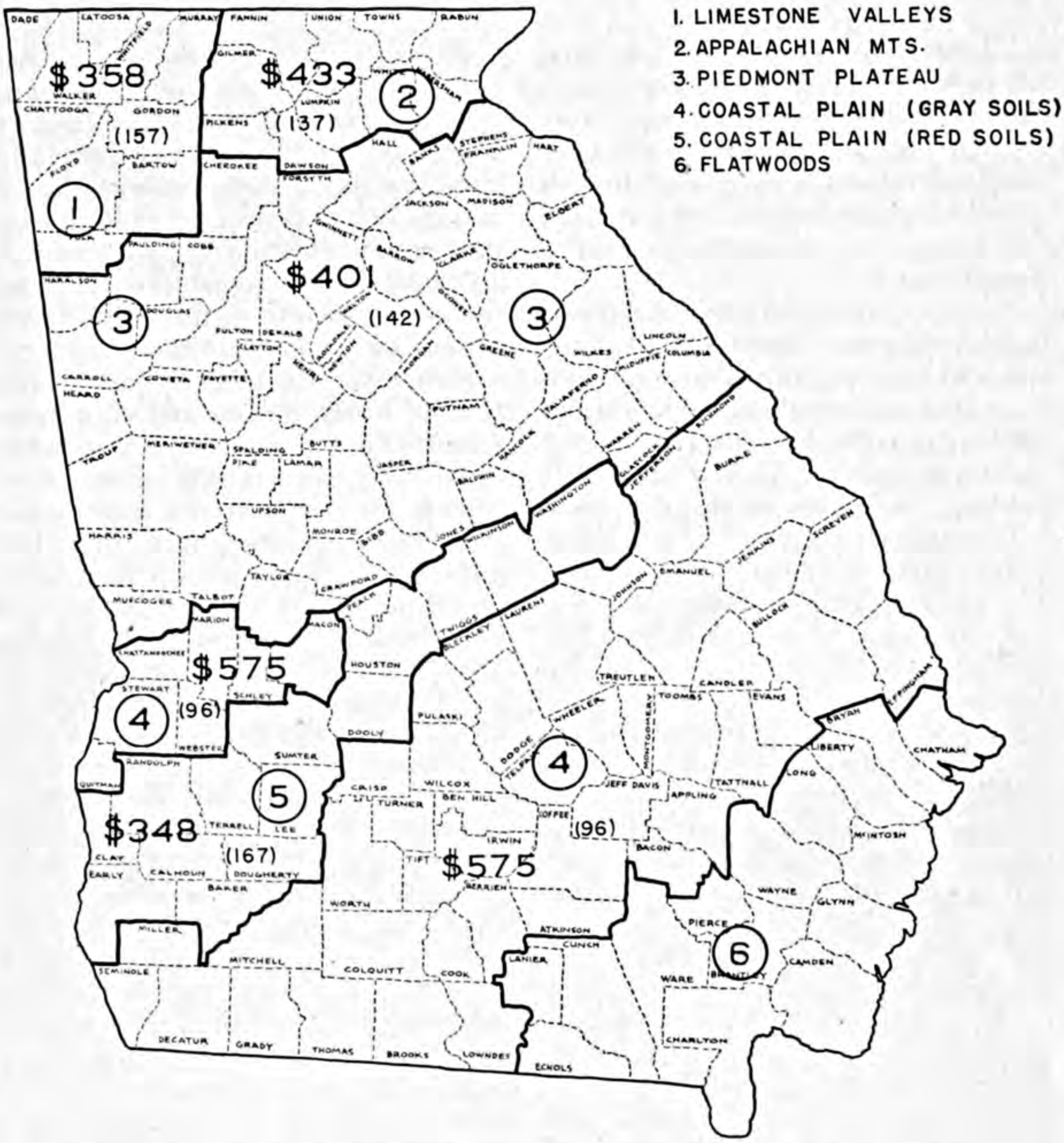

FIG. 1. GROSS RETURNS PER TON OF 60% MURIATE OF POTASH USED ON COTTON AND THE AVAILABLE POTASH IN THE SOILS OF THE VARIOUS SOIL REGIONS IN GEORGIA.

ALTHOUGH the quantity of available plant food in the surface soils of Georgia is constantly changing because of continued fertilization, leaching, erosion, and cropping, a survey based upon a sufficiently large number of samples may be expected to yield information of practical importance. During the past several years many soil samples have been collected from a large number of counties in the State by county agents, teachers of vocational agriculture, staff members of the Experiment Station, and other interested individuals. These samples have been analyzed for acidity, toxic substances, and plant foods such as potash, phosphoric acid, nitrogen, and others. Results of these analyses for pH, P_2O_5, and K_2O have been reported previously (1, 2).

The data reported previously for potash include only the average potash content of the soils for each county. Data of this nature are of value, but in addition, the percentage of samples found at the various levels of potash fertility may be of more practical importance. With this idea in mind, the data previously reported have been revised and retabulated for the purpose of getting at the more practical aspects of the potash fertility of Georgia soils.

In this report "available" potash is used to designate the exchangeable potash as determined by the method of Bray (3). Each value reported for results of field investigations represents the average of 18 replications of 1/20th-acre plots. These experiments were conducted with farmer cooperators by members of the staff of the Experiment Station. The gross returns for potash fertilizer were calculated on the basis of one ton of 60 per cent muriate of potash with seed cotton valued at 8¢ per pound. Cotton was selected as the crop to be used in the estimates for two reasons: first, because of the large acreage involved and the high cash value of this crop in Georgia; and second, because more data were available at this Station for correlating the laboratory data with actual field returns.

In the data reported in Figure 1, several thousand samples representing more than 1,700 locations were used. By making calculations on the basis of the soil regions of the State, it was believed that a reliable value could be obtained. These soil regions are (1) the Limestone Valleys, (2) the Appalachian Mountains, (3) the Piedmont Plateau, (4) the Lower Coastal Plain (mostly gray soils), (5) the Upper Coastal Plain (mostly red soils), and (6) the Flatwoods. Another region, the Fall-line between the Piedmont and Coastal Plains was eliminated from this study because of the small area involved. In addition the Flatwoods region was eliminated because only a few samples were obtained and only a small acreage is under cultivation in this region.

When the counties for which data are available are averaged according to soil regions, the results shown in Table 1, are obtained.

Table 1.—Average Amount of Available Potash in the Surface Soils of the Different Soil Regions of Georgia

Soil region	Samples obtained	Available K_2O per acre
	number	pounds
1. Limestone Valleys	175	157
2. Appalachian Mountains	371	137
3. Piedmont Plateau	927	142
4. Lower Coastal Plain (gray soils)	264	96
5. Upper Coastal Plain (red soils)	55	167

There appear to be no large differences in the available potash in the soils of the various regions with the exception of the Lower Coastal Plain (gray soils) which has a lower average than the others.

Yield data from 40 field experiments, conducted from 1939 through 1942 and tabulated in Table 2, indicate varying response of cotton to potash fertilization, the amount of response depending upon the potash content of the soil. The soils are grouped into ranges of 0 to 140 pounds K_2O per acre representing low potash, 140 to 240 pounds K_2O per acre representing medium potash, and over 240 pounds of K_2O per acre representing a high level of potash. The low-potash soils show an average increase of 175 pounds seed cotton for 24 pounds of K_2O, the medium-potash soils show an average increase of only 34 pounds seed cotton for this amount of potash fertilization, while the high-potash soils indicate a slight decrease in yield with potash fertilization.

When the soils of each region were classified into these three groups, the results reported in Table 3 were obtained. About 79 per cent of the gray soils of the Coastal Plain were in the low-potash range while only slightly over 3 per cent of these soils were in the high-potash range. On the other hand, 45 per cent of the Limestone Valley soils were low in potash and 21 per cent were high. Using the increases for potash fertilization reported in Table 2 and considering the value of seed cotton at 8¢ per pound, the gross returns per ton of 60 per cent muriate of potash were calculated for the various regions, and these data were also shown in Table 3. The greatest profit was realized from the use of potash on the gray soils of the Coastal Plain and the least from the Limestone Valleys and red soils of the Coastal Plain. However, in all regions a large profit was realized. These values are presented graphically in Figure 1.

A somewhat more detailed study of the percentage of samples in the various potash ranges is given in Table 4. In this table the soils are classified into nine groups on the basis of their potash content. Instead of the wider range used above, a difference of 40 pounds of K_2O was used in this tabulation. From this table it will be noted that slightly over 52 per cent of the samples contained less than 120 pounds of K_2O per acre. About 34 per cent of the samples contained from 120 pounds to 240 pounds of K_2O, and the remaining 14 per cent contained over 240 pounds of K_2O. On the basis of 2,000,000 acres of cotton soils of Georgia, these figures would mean that more than one million acres of the cotton soils of Georgia are very deficient in potash and probably require an annual application of 48 pounds K_2O. On 34 per cent or 680,000 acres of the cotton land an application of 24 pounds K_2O would suffice, while on the remaining 250,000 acres

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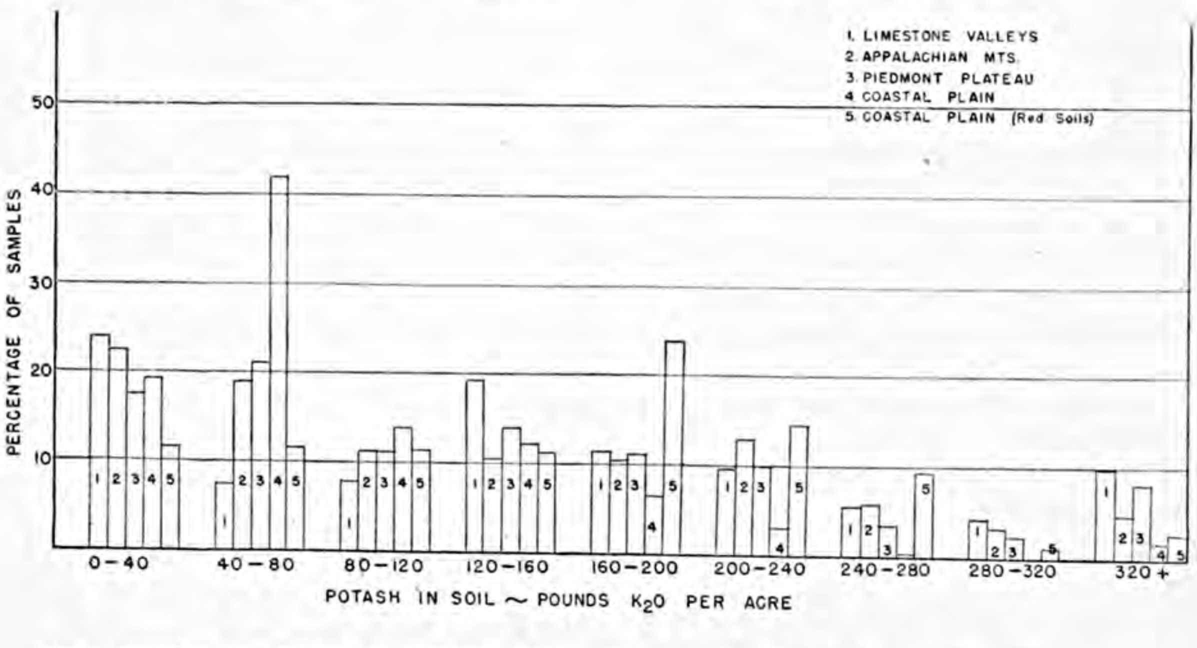

FIG. 2. PERCENTAGE OF SAMPLES OF DIFFERENT POTASH LEVELS IN THE VARIOUS SOIL REGIONS.

Conservation of water in farm stockpond near Paragould, Arkansas. Such ponds serve admirably for fish production.

Adjustment of Agriculture to Its Environment[1]

By H. H. Bennett

Chief, Soil Conservation Service, Washington, D. C.

THROUGHOUT the world there is acute need for a much better adjustment of agriculture to its physical environment, not only to gain a sorely needed increase in agricultural production but also to maintain a healthy agricultural economy, which is currently being threatened in many parts of the world by steadily continuing losses of basic soil resources in dangerously large proportions. This adjustment is vital, moreover, if we are to maintain in efficient production the most widely distributed and greatest possible area of productive land as a safeguard against ever-increasing costs in distribution of agricultural commodities. And most imperative of all reasons: We must make the adjustment if we are to maintain our ability to produce in any adequate way.

Such adjustment can be made. We have the knowledge; we need only the decision. Practical experience to date on a far-reaching scale in the United States shows that the adjustment is possible, practicable, and almost invariably of great and immediate advantage to the farmer and the nation.

A needed adjustment that I desire to emphasize particularly at this time has to do with the elimination of wasteful land-use practices, haphazardly applied,

[1] Taken from the Presidential address, 40th Annual Meeting, the Association of American Geographers, September 18, 1943, Washington, D. C.

and the widespread adoption, in their place, of various conservation practices scientifically fitted to the needs and physical characteristics of the land and the climatic environment. These conservation practices, applied in this way, at once safeguard the soil, increase its productivity, and conserve in the soil for productive use much rainfall normally lost as runoff.

This adjustment is of primary importance because it is the only way by which the agricultural plant of the United States, and of the world, can be kept in condition to support a permanent agriculture, and further, because it is the only way to get from the land anything like sustained, maximum yields.

Stated another way, there is an almost universal need for large-scale soil and water conservation operations to be carried out in accordance with the physical environment—if the world is to be adequately fed.

Problem in United States

To present the situation and the course of action with greater clarity, I will cite the problem in the United States, and what is being done about it, as our principal example and guide for the future.

Here in the United States we have used our fields with such prodigality that approximately 50 million acres of formerly cultivated land have been practically ruined by excessive erosion and cropping. This acreage has been abandoned for cropping, although some of it is in second-growth forest, some is used for wildlife, and some for limited grazing. Another area of about the same extent—50 million acres more —is in a condition nearly as bad and is about ready for abandonment insofar as further cultivation is concerned. On a second 100 million acres of cropland, about a fourth to three-fourths of the topsoil has been removed by erosion, yet thousands of farm families have been using these impoverished lands in an almost hopeless effort to make a living.

Two hundred million acres of cropland ruined for further practical cultivation, or severely damaged, is too much land wastage for any country, especially when there is no real need for wastage of any land at any time.

But similar destructive effects of erosion are practically world-wide. Nearly every country has been affected. A few countries have come close to a solution of the problem on certain lands, but most countries have done little or nothing in the direction of either preventive or remedial action.

There are approximately 4 billion acres now arable in the world on which the world must depend for food. These 4 billion acres must feed 2 billion people. That is two acres per person. Some countries have less than one acre per capita. Yet, some nutritionists say 2½ acres per capita of reasonably productive land are necessary to produce even a minimum adequate diet.

Only about a fourth of the 4 billion acres of the world's presently arable land is really good land. Most of it has been damaged by erosion and exhaustive cropping. In some regions, the land has been made so poor by centuries of cultivation and unwise use that most farmers expect no more than the pitiful return of a bushel or two of wheat per acre, and two or three bushels of corn. We have some land of this kind in the United States, and in various parts of the Western Hemisphere this is the prevailing situation in a number of agricultural areas. Moreover, our best estimates at this time indicate that from two-thirds to three-fourths of the world's immediately available cropland is subject to impoverishment or outright ruin by erosion.

There are some scattered areas of unused good land about the earth, but probably not nearly enough to meet world needs, even if problems of agricultural utilization and transportation and distribution could be solved. And besides, these lands too are largely subject to impoverishing erosion.

Clearly, this means that along with

the good and the non-erodible land, a great deal of land that is subject to erosion, as well as much lean soil, will have to be farmed if basic food requirements are to be met. And since the agricultural lands of the earth, handled as they have been handled, have not adequately met the world's food requirements in the past, the one alternative is to increase in the future the productive capacity of a large share of the cultivable area that is available now. To do this, we shall have to adopt new and better ways of farming.

Goal of Conservation Service

Such new and better ways of farming can be achieved through soil conservation farming and in no other way. Soil conservation farming everywhere calls for various major and minor adjustments and corrections in land use, but when it is put into effect, our experience on a widespread scale in the United States shows that two fundamentally important things are accomplished at the same time: Per-acre yields are increased and the soil is maintained in a continuing productive condition.

The work of the Soil Conservation Service was the first comprehensive, scientific, action effort in the world to achieve conservation of soil and water on a nation-wide scale. From the beginning, one cardinal principle dominated and guided this new program. Some called that principle idealistic and impractical; others failed to grasp its significance.

That basic, guiding principle was at the outset and is today as follows: Effective prevention and control of soil erosion and adequate conservation of rainfall, in a field, on a farm or ranch, over a watershed, or on any other unit or parcel of land, require the use and treatment of all the various kinds of land that occur within that area in accordance with the individual needs and adaptabilities or capabilities of each different parcel of land.

Like any precise statement of a rule, however, this principle requires some qualification.

First, the use and treatment of a given area of land must be determined not only by its physical characteristics, but also wherever possible by such considerations as available facilities, implements, power, labor, financial means, and even by the preference of the farmer, his ability to learn, and his willingness to try new methods. In other words, the treatment for conservation purposes must fit not only the needs and adaptabilities of the land itself but the needs and adaptabilities of the farmer as well.

The second qualification of the general principle is that each distinct tract of land to be treated should be considered and treated, wherever feasible, in its physical relation to the adjacent land—field, farm, or watershed—if there is any important physical relationship. The use and treatment of one area should provide as much protection as may be practicable for adjacent areas. For example, the management of lands on the higher parts of a slope should be determined in relation to downslope and downstream lands. Gullies that pour rock, gravel, sand, and infertile subsoil material of any kind out over lower-lying land should be controlled so as to protect downslope land which cannot otherwise be protected.

Outlets for surface runoff should be located with proper regard to the effect of discharging water and solid materials on adjoining lands. And, of course, the areas devoted to crops, grazing, and forest should individually and together constitute a sound economic unit, or as nearly so as may be practicable.

To carry out such a completely coordinated soil and water conservation program on a nation-wide basis requires a great deal of basic information for the most efficient blueprinting and planning of each farm and for the execution of the conservation job on the land. There are hundreds of different soils occupying varied slopes and subject to different intensities and amounts of rainfall and snowfall. No two parcels of land are identical. Accordingly, each field—even each important part of a field, pasture, or woodlot—may require its own particular set of conservation measures. Conservation specialists have found that in most localities each farm, each ranch, is a special problem within itself.

The soil conservationist has at his command many different types of control measures for handling different types of problems. Completely effective conservation practices, however, have not been developed for all the numerous problems and combinations of problems relating to all the contrasting agricultural lands and practices of the nation. It is necessary to seek constantly for cheaper, sounder, and more efficient ways of conserving our soil and water resources.

Conservation Farming

Soil conservation is the youngest of the agricultural sciences. And so, from the very start, the practical field work has been supported by a program of soil and water conservation research through which new tools or methods of erosion control and better land utilization, as well as improvements on present tools and techniques, are being sought continuously. As fast as discoveries are made, they are carried to farmers cultivating lands to which the new methods apply. They are not stored in the darkness of files or buried in ultra-technical papers and bulletins.

Where good covers of dense vegetation and good stands of forest have been established and maintained, as on steep erodible land retired from cultivation, there usually is no further need for protection against erosion. The losses of soil under such protection are negligible, often too small to measure, and the runoff of rainwater is also much less.

For example, the average annual loss of soil under continuous corn on the principal regional soil at the Zanesville, Ohio, erosion station has been at the rate of 94.6 tons per acre, and the corresponding loss of water as immediate runoff has averaged 42.4 per cent of the total precipitation. Under grass, however, the corresponding losses have been only .02 of a ton of soil per acre (1/4,730 as much as under corn) and 4.8 per cent of the rainfall (or about 1/9 as much as under corn). During a single period of heavy rains—nearly 11 inches falling during January 1937 at the Zanesville station just before the record Ohio River flood—the measured losses of water as immediate runoff from a gullied corn field amounted to 94.7 per cent of all the rainfall, while only 31.5 per cent ran off from woodland, and 25.8 per cent from bluegrass.

Similarly, losses under good rotations, combined with terracing, or contouring, or strip cropping, or all of them, have been much less than under continuous corn and other wasteful ways of farming. These losses are from measured tracts of land, usually small tracts which nevertheless come pretty close to representing average conditions in this vast region of hill land characterized by shallow shale and sandstone soil. At any rate, these measured parcels of land constitute a part of the landscape upon which rain falls and courses away to the regional streams in amounts and rates that depend to a very large degree on how the farmer uses his fields, pastures, and woods.

Other measurements at the Zanesville station and at many other stations throughout the country show that conservation treatment continues to lessen runoff and soil loss regardless of how long or how heavily it rains and regardless of freezing and thawing. We have yet to find a piece of land that becomes so "saturated" with rainfall that it stops absorbing water. Continuing heavy rains do lessen, to varying degrees, the soil's capacity for infiltration of rainfall, but do not stop it. Unfortunately, this fact, only recently ascertained, has not yet got around nearly as widely as it should.

More and more is being learned about the control of erosion, the con-

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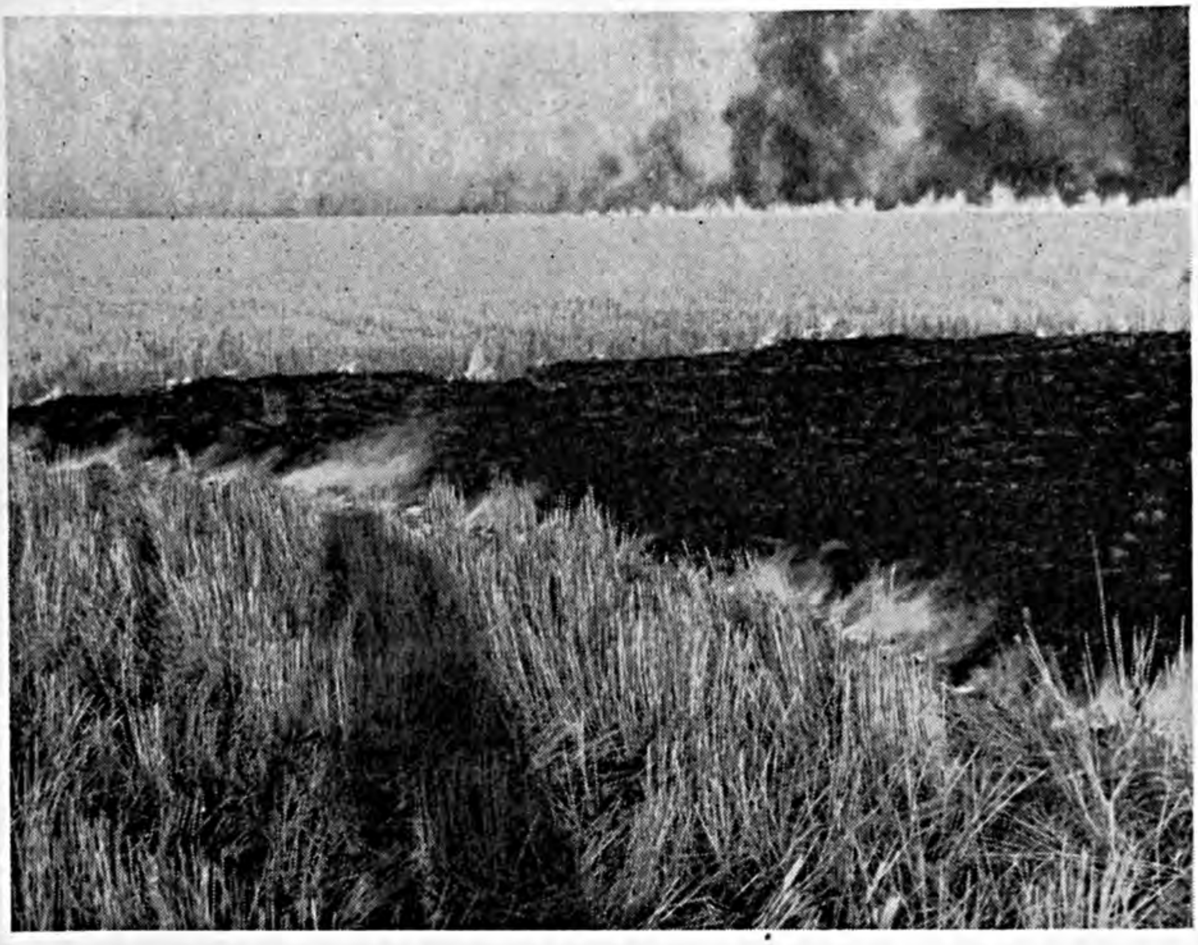
Above: The reservoir on Dan River near Danville, Virginia, is filled with the products of soil erosion.

Below: This Maryland field is losing its topsoil in the muddy water pouring off the land during a rain.

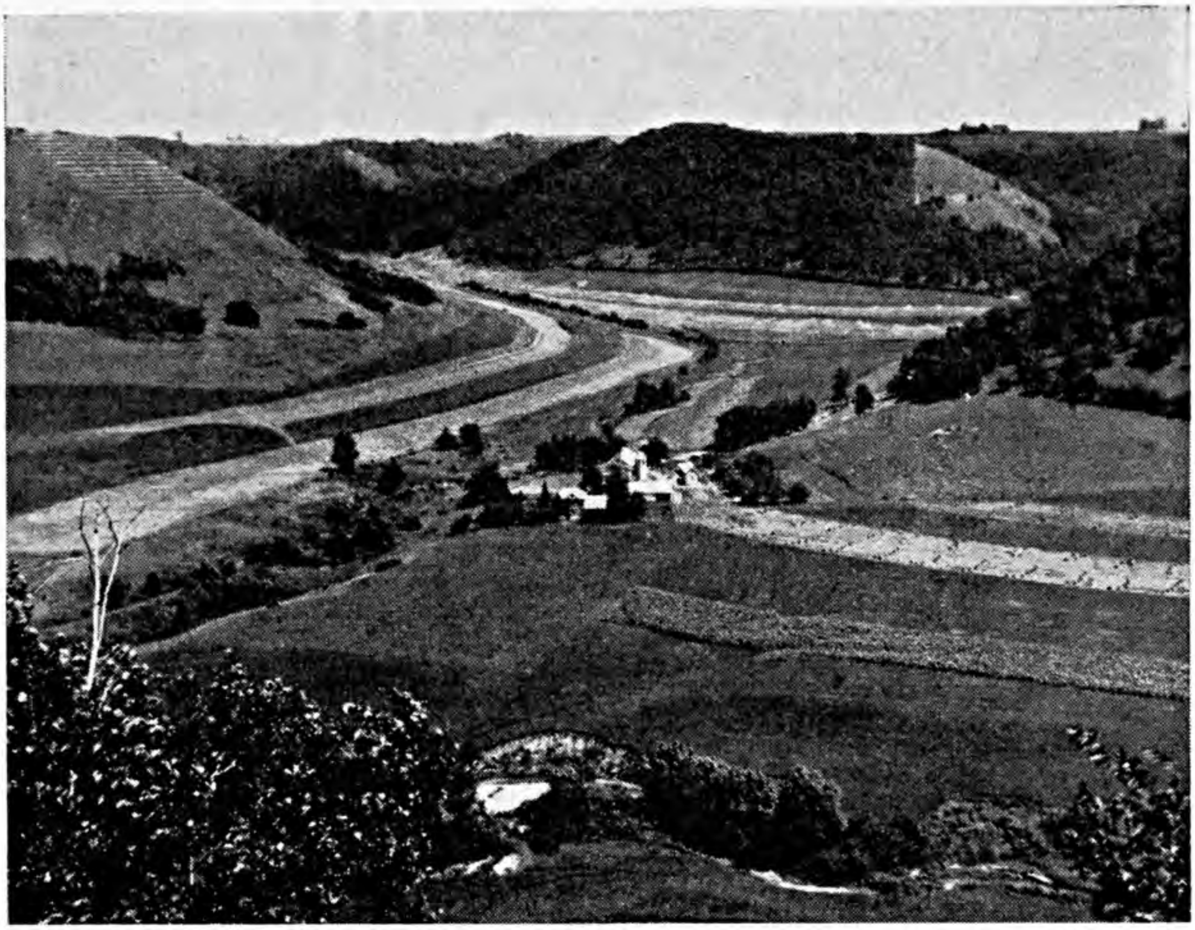
Above: Plowing without turning everything under, with part of the wheat stubble on top of the ground. This Montana field is pretty well protected from blowing.

Below: This steep Michigan slope called for a protective cover of vegetation—grass, legumes, or trees. Trees were dcided on and were duly planted on the contour.



Above: Burning up the life substance of the soil, the stubble of a wheatfield, to make it easy to plow and kill grasshoppers. This is not conservation, but wasteful farming.

Below: Conservation of soil and water with contouring in the south-central prairie section, Oklahoma. Contouring is the central theme of soil conservation in this region.



Above: The result of complete treatment of the watershed of this Minnesota stream—fields, pastures, and woodlands.

Below: This southern California steep slope, which has about lost its topsoil, won't produce so much as a good crop of weeds.

The Editors Talk

Agriculture Post-war

With the end of the European phase of the war in sight, American industries are becoming more and more concerned with their post-war planning. Agriculture, America's major industry, while assured of an active demand for its products for some time after cessation of fighting, is beginning to take stock of its resources and the utilization of these resources not only during the next few years, but for the generations to come.

It is gratifying to us, therefore, to be able to present to our readers in this issue, Dr. Hugh H. Bennett's ideas as outlined in his article "Adjustment of Agriculture to Its Environment." We believe it also pertinent to re-emphasize here his six-point program for the next 10 years, proposed as "the nucleus for a sound, post-war rural works program," which he feels is capable of increasing food and fiber production in the United States by 20 per cent while simultaneously building up the soil and water resources of the Nation. New and more productive methods of land use have now been developed to such a degree of perfection in the United States, he says, that their widespread application to the farm and range lands of the Nation would result in vastly increased production, equivalent to that of a million new farms, without any net increase in the cultivated area of the country.

The six points:

1. An accelerated program of soil and water conservation, geared to complete within a 10-year period the application of all major, needed conservation measures on all the erodible lands of the country normally devoted to clean-tilled crops. This is an area of approximately 242 million acres, and does not include non-erodible land, pasture, or some 76 million acres of farm land normally devoted to thick-growing, soil-protecting crops such as grass, clover, and lespedeza.
2. Drainage of about 30 million acres of good land to improve the production of that part now in cultivation, and to bring into cultivation that part which is now too wet for tillage of any kind.
3. The rehabilitation, development, and better utilization of water resources on approximately 12 million acres, largely in sub-humid regions.
4. A broadened educational program throughout the school and university system of the country, and through other appropriate avenues, to acquaint children and adults with the importance, condition, and needs of their basic agricultural resources.
5. Rapid initiation of scientific investigation into the relationship between soil health and human health and nutrition, an approach to human betterment that has been neglected to an amazing degree by scientists almost everywhere.
6. Widespread development of needed water supplies and improvement of western range conditions through better grazing practices and livestock management to obtain maximum production on a sustained basis.

Steadily continuing losses of basic soil resources in dangerously large proportions, Dr. Bennett says, threaten our ability to maintain a healthy agricultural economy. Citing figures on soil losses in the United States, he declares that 50 million acres of once-productive cropland have already been ruined by erosion. Another 150 million acres have been severely damaged. The threat of erosion to food production is world wide, and only about a fourth of the four billion acres presently arable around the globe is really good land. These four billion acres must feed two billion people, although the rate of two acres per person is less than the amount which many nutritionists regard as necessary to provide a minimum adequate diet.

Dr. Bennett believes that the solution of this problem must lie in the elimination of the wasteful land-use practices now prevailing. He sees in a rapid and widespread shift to conservation farming methods, as outlined in his six-point program, a great increase in our agricultural production, the removal of the erosion threat to our agricultural economy, and the forestalling of increasing costs in the production and distribution of agricultural commodities. And most important of all, this adjustment must be made if agriculture is to maintain its ability to produce in any adequate way for demands which will be put upon it.

Fertilizer Use

The older a cropping system the greater the dependence on commercial fertilizers. Eastern and southern farmers are the big users of commercial fertilizer in this country. But the rest of the country is headed in the same direction, as we have pointed out from time to time.

Thus we find especial interest in a statement issued by Iowa State College agronomists. From field tests they have concluded that Iowa farmers can afford to increase their use of commercial fertilizer, from an estimated 67,500 tons in 1943, to 388,516 tons in 1944.

It is pointed out that in 1938 Iowa farmers used only 11,507 tons of commercial fertilizer. The trend since has been toward a constant increase, but the quantity used is still far behind that used in some other Corn Belt states. In 1938, for example, Iowa farmers spent 67 cents per $1,000 of cash income for fertilizer. In the same year Illinois farmers spent $2.50 per $1,000 of cash income, Missouri farmers spent $7.90 and Indiana farmers $24. It is added that "If Iowa's quota of fertilizer were allotted according to the most profitable response to applications in the field tests, the eastern half of the state would receive about 75 per cent of the total used."

In time all important cropping areas will be large users of commercial fertilizer, for the simple reason that farming won't pay without it. And in that connection it is encouraging that the fertilizer industry has made great improvement in two respects within recent years. Standardization of grades and higher testing mixtures are now the rule; and, secondly, a vast amount of practical information has been accumulated on the most effective use for different soils and crops. Fertilizer today is better and better employed than even just a few years ago.—*Chicago Daily Drovers Journal,* December 29, 1943.

Erratum:

Through a "slip" in the make-up of the December 1943 issue of this magazine, the wrong legend appeared under the picture at the top of page 25. This legend should have read: "A typical case of potash deficiency on White Dutch clover, as reflected in white spots on the borders of the leaves."

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
December	19.55	40.0	111.8	110.3	80.2	110.3	10.46	44.72	....
1943									
January	19.74	35.1	117.8	121.4	88.0	117.5	11.20	44.34	....
February	19.68	18.2	125.7	129.8	90.4	119.5	11.94	44.88	....
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
December	158	385	161	126	124	125	88	207	293
1943									
January	159	338	169	139	136	134	94	205	277
February	159	175	181	148	140	136	100	208	301
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	295
December	160	408	194	215	171	163	127	244	245

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
December	1.75	1.42	5.68	5.77	3.34	4.86	6.53
1943							
January	1.75	1.42	5.68	5.77	3.34	4.86	6.53
February	1.75	1.42	5.83	5.77	3.34	4.86	6.53
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
December	65	50	162	163	110	144	186
1943							
January	65	50	162	163	110	144	186
February	65	50	167	163	110	144	186
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
December	.600	2.00	5.90	.535	.817	26.00	.210	....
1943								
January	.600	2.00	5.90	.535	.817	26.00	.210	....
February	.600	2.00	5.90	.535	.817	26.00	.210	....
March	.608	2.00	5.90	.535	.817	26.00	.210	....
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
December	112	55	121	75	86	108	85	....
1943								
January	112	55	121	75	86	108	85	....
February	112	55	121	75	86	108	85	....
March	113	55	121	75	86	108	85	....
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
December	178	158	147	92	57	154	112	79
1943								
January	182	100	149	92	57	154	112	79
February	178	162	149	92	57	155	112	79
March	182	163	150	93	57	160	113	79
April	185	165	151	95	57	160	119	79
May	187	167	152	95	57	160	119	79
June	190	168	151	93	57	160	119	69
July	188	169	150	94	57	160	119	74
August	193	169	150	94	57	160	119	74
September	193	169	150	94	57	160	119	74
October	192	170	150	95	57	160	119	78
November	192	171	150	95	57	160	119	78
December	197	172	150	96	57	171	119	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

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

Fertilizers

"Fertilizer Recommendations for Wartime in Arkansas," Ext. Serv., Univ. of Ark., Little Rock, Ark., W. E. Publ. No. 2, November 1943, Charles F. Simmons and Earl J. Allen.

"Commercial Fertilizers," Agr. Exp. Sta., New Haven, Conn., Bul. 476, Nov. 1943, E. M. Bailey.

"Tonnage of Different Grades of Fertilizer Sold in Delaware 1942," Dela. Exp. Sta., Dover, Dela., C. E. Phillips.

"Commercial Fertilizers for Minnesota in 1943-44," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Pamphlet 118 Revised, October 1943, C. O. Rost and Paul M. Burson.

"Synthetic Manure," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 470, Aug. 1943, James P. Martin and Selman A. Waksman.

"Report of Analyses of Commercial Fertilizers Sold in New York State, Part I," Dept. of Agr. and Markets, Albany, N. Y., Bul. 343, July 1943.

"Wartime Crop Fertilization in Tennessee," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 265 (Rev.), Nov. 1943, H. E. Hendricks.

"Commercial Fertilizers in 1942-43," Agr. Exp. Sta., College Station, Texas, Bul. 639, Oct. 1943, G. S. Fraps, T. L. Ogier, and S. E. Asbury.

Crops

"Annual Report 1942-43," State Board of Agriculture, Dover, Dela., Quarterly Bul. 33(3), Sept. 30, 1943.

"Twenty-Seventh Biennial Report of the Department of Agriculture," Tallahassee, Fla., July 1, 1940 to June 30, 1942.

"Twenty-Third Annual Report 1942-1943," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 36, July 1943.

"Small Grains in Georgia," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Cir. 314, Sept. 1943, E. D. Alexander.

"Roses," Agr. Exp. Sta., Lafayette, Ind., Cir. 216(Rev.), Sept. 1943, E. R. Honeywell.

"Alfalfa-Brome Grass Silage for Dairy Cows," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 285, June 1943, J. W. Wilbur, R. K. Waugh, S. M. Hauge, and J. H. Hilton.

Soils

"Analyses of United States Soils, South Atlantic States," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., April 1943, J. S. Joffe and Adrienne B. Conybeare.

"Review of Principal Results, 1942," Soil Conservation Serv., So. Piedmont Cons. Exp. Sta., Watkinsville, Ga., May 15, 1943, B. H. Hendrickson, J. R. Carrekor, and W. E. Adams.

Economics

"Arizona Agriculture 1943," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 188, Feb. 1943, George W. Barr.

"Land Tenure in Arkansas III. Income and Changes in Tenure Status of Share Renters, Share Croppers, and Wage Laborers on Cotton Farms," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 438, June 1943, J. G. McNeely, Glen T. Barton, Trimble R. Hedges.

"Marketing the Illinois Apple Crop," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 497, Aug. 1943, J. W. Lloyd and V. A. Ekstrom.

"An Appraisal of Maximum Wartime Production Capacity in Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AE-2094, July 30, 1943.

"Farm Tenure in Indiana by Type-of-Farming Areas," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 488, July 1943, G. G. Quackenbush and O. G. Lloyd.

"Prices of Tobacco in Different Parts of Kentucky," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 448, June 1943, Dana G. Card and James H. Clarke.

"Wartime Farm Plans," Dept. of Farm Economics, Agr. Exp. Sta., Lexington, Ky., Farm Ec. Miscl. 118, December 1942, Geo. B. Byers and R. H. Allen.

"Community Organization in Charles County, Maryland," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. No. A21, Jan. 1943, Linden S. Dodson and Jane Woolley.

"An Economic Study of Land Utilization in Otsego County, New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 791, March 1943, Alexander Joss.

"N. C. Farm Survey, 1942 Crops," N. C. Dept. of Agr., Raleigh, N. C., Jan. 1943.

"1944 Agricultural Outlook Charts," U. S. D. A., Washington, D. C., Oct. 1943.

An Agricultural Look at Costa Rica

(*From page* 19)

section of the country. It is good to remember in this connection that the rainfall in the country varies from one to six thousand mm. per year according to location. The washing-off or percolation of nitrates, soluble phosphates, calcium, and potash is of the greatest significance in diminishing fertility. So considerable is this loss that under certain circumstances, such as sandy soils not well protected by vegetation, the extraction of plant-food elements from the soil, which must be assigned to this particular reason, surpasses the amount that could have been taken from the same area by a very heavy-feeding or exhaustive crop.

The logical remedy for this important problem should be: first, proper selection of the plants to be cultivated in different regions, in such way as to discontinue from places where the rainfall is very heavy and the soils are rather sandy or open the production of those that need a thoroughly clean culture; secondly, substitution, whenever possible, of the "cover-crop" culture for "clean culture" in order to protect the soil from erosion and percolation, particularly during the months with heavier rains—not disregarding the necessary consideration and provision to avoid direct competition from the fast-growing, heavy-feeding cover crops over the cultivated or money crop, especially if it is perennial and has a woody structure, such as coffee. The practice here mentioned has been experimental with cocoa, coconuts, bananas, sugar cane, fruit trees, coffee, and others. With coffee, competition was prompt to appear, especially when the cover crops were legumes.

However, it was remedied by arresting the growth of the cover crop and the immediate fertilization of the cultivated one with available nitrogen, phosphorus, and potassium. The proportions used depended on the type of soil and condition of the plantation as well as the symptoms which, in a physiological or in a pathological manner, showed the competition. In many instances, it happened that the application of potassium alone was enough to solve the situation.

A Guernsey dairy herd on a farm pasture near the Capitol. The altitude here is 6,000 feet.

A third way to remedy this problem of soil exhaustion caused by percolation or washing-off is the improvement of its humus content as well as its supply of available plant-food elements by means of well-balanced fertilization.

Great importance as a cause of soil depletion in Costa Rica, and most especially in the dry sandy regions of the Pacific Ocean, needs to be attributed to the condemnable practice of clearing or cleaning the cultivable fields of native vegetable growth, or else from the remnants of a previous crop by means of fire. The damages, which are manifold, are evidenced particularly in the destruction of humus and organic matter in different states of decomposition, the volatilization of nitrogen, the lowering of the biological activities, and the destruction of certain favorable physical properties of the soils.

Still another cause of soil impoverishment, and unfortunately very common in Costa Rica, is the lack of crop rotation. The "corn after corn and always corn" policy is something that has done and is continuing to do tremendous harm to our agricultural life, and consequently should be banished forever.

It is ordinarily practiced in the production of all annual crops such as cereals, legumes, horticultural crops, potatoes, etc., and to its effects should be attributed the disequilibrium and diminishing productiveness of our soils as well as the appearance of many insect pests and many fungous diseases.

In concluding this brief study on some agricultural aspects and soil problems of Costa Rica, it should be added that although the actual situation of the industry is not very satisfactory for several reasons, some of which have been mentioned, once duly understood, perspectively planned, and technically managed, its flourishing future can be definitively established.

Available Potash in the Surface Soils of Georgia

(*From page* 22)

less than 24 pounds of K_2O are needed.

Figure 2 brings out in graphical form the data presented in Table 4. It is evident from an inspection of this figure that a higher percentage of samples is found in the low-potash range. The lowest percentage of samples appears to be found in the 260 to 320 range and the highest percentage in the 40 to 80 range.

In conclusion it may be said that the situation in regard to potash fertility in Georgia soils may be altered when data from a much larger number of samples are available. Nevertheless, it is believed that the data presented point to an urgent need for potash on cotton soils in this State. Even in the red soils of the Coastal Plain and in the soils of the Limestone Valleys where the lowest returns per ton of potash were obtained, a large profit has been realized from the use of potash on cotton. In addition it must be remembered that the values presented are averages, and in many cases soils may be much more deficient than represented in Figure 1. On the other hand, some of the soils may be amply supplied with potash. Probably the only way for a farmer to decide whether or not his soil is in need of potash will be by means of soil tests or from experience. In many cases the latter method of determining the potash fertility of a soil will be impractical and expensive.

(Tables 2 and 3 on pages 40 and 41)

References

1. Georgia Experiment Station 53rd Annual Report, 1940-41, pp. 28-31.

2. Georgia Experiment Station 54th Annual Report, 1941-42, pp. 23-27.

3. Bray, R. H. A test for replaceable and water-soluble potassium in soil. Jour. Amer. Soc. Agron., 24: 312-316. 1932.

TABLE 2.—YIELD AND INCREASE IN YIELD OF SEED COTTON FROM POTASH FERTILIZER ON SOILS OF DIFFERENT POTASH FERTILITY. EXPERIMENTS CONDUCTED 1939 THROUGH 1942.

Available Potash in soil	Yield seed cotton per acre			Available Potash in soil	Yield seed cotton per acre			Available Potash in soil	Yield seed cotton per acre		
Lbs. K_2O per acre 0–140	No K_2O applied	24 lbs. K_2O applied	Increase	Lbs. K_2O per acre 140–240	No K_2O applied	24 lbs. K_2O applied	Increase	Lbs. K_2O per acre over 240	No K_2O applied	24 lbs. K_2O applied	Increase
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
50	208	299	91	145	567	658	91	250	419	426	7
50	393	570	177	150	648	803	155	250	876	907	31
50	758	941	183	150	717	747	30	280	1142	1174	32
50	452	609	157	175	381	427	46	305	1167	1134	−33
50	157	188	31	175	826	904	78	320	1185	1128	−57
50	702	695	−7	180	1400	1424	24				
50	436	604	168	180	1317	1441	124				
55	595	780	185	185	1378	1329	−49				
60	617	801	184	185	1576	1562	−14				
65	392	765	373	185	1562	1542	−20				
65	694	788	94	200	954	939	−15				
110	850	1022	172	200	1353	1334	−19				
115	570	849	279	210	888	891	3				
120	676	1022	346	210	774	816	42				
120	495	600	105								
120	522	985	463								
130	1222	1349	127								
130	1229	1251	22								
Average	609	784	175	Average	1024	1058	34	Average	958	954	−4

TABLE 3.—GROSS RETURNS* PER TON OF 60 PER CENT MURIATE OF POTASH IN THE VARIOUS SOIL REGIONS OF GEORGIA

Soil Region	Percentage of soil samples at various levels of available K_2O — Pounds of avail. K_2O in the soil			Gross returns** per ton of 60% muriate of potash for the percentage of soils at each of the three levels of potash fertility in the various regions — Pounds of avail. K_2O per acre in the soil			Weighted average returns per ton of 60% muriate of potash
	0–140	140–240	Above 240	0–140	140–240	Above 240	
	per cent	per cent	per cent	dollars	dollars	dollars	dollars
Limestone Valleys	45.1	33.7	21.2	315.70	45.83	−3.39	358.14
Appalachian Mountains	56.6	28.6	14.8	396.20	38.90	−2.37	432.73
Piedmont Plateau	51.4	31.9	16.7	359.80	43.98	−2.67	400.51
Coastal Plain (Gray soils)	78.8	17.8	3.4	551.60	24.21	− .54	575.27
Coastal Plain (Red soils)	40.0	50.9	9.1	280.00	69.22	−1.46	347.76

* State average for gross returns per ton of 60% muriate of potash on soils testing 0–140 lbs. K_2O—$700; 140–240, $136; Above 240, −$16.
** Calculated from the results of fertilizer tests (Table 2) with cotton fertilized with 24 pounds K_2O per acre and the price of seed cotton at 8c per pound.

TABLE 4.—NUMBER AND PERCENTAGE OF SAMPLES FOUND AT VARIOUS LEVELS OF POTASH FERTILITY

Region	Potash level of soil—pounds K_2O per acre																		Total samples
	0–40		40–80		80–120		120–160		160–200		200–240		240–280		280–320		320+		
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.
Limestone Valley	37	23.9	11	7.1	12	7.7	30	19.4	18	11.6	15	9.7	9	5.8	7	4.5	16	10.3	155
Appalachian Mountains	81	22.4	68	18.8	40	11.0	34	9.4	38	10.5	47	13.0	22	6.1	13	3.6	19	5.2	362
Piedmont Plateau	156	17.3	190	21.1	101	11.2	126	14.0	101	11.2	92	10.2	33	3.7	24	2.7	77	8.6	900
Coastal Plain (Mostly gray soils)	47	19.3	103	42.2	34	13.9	29	11.9	16	6.6	8	3.3	2	.8	...	....	5	2.1	244
Coastal Plain (Red soils)	7	11.5	7	11.5	7	11.5	7	11.5	15	24.6	9	14.8	6	9.7	1	1.7	2	3.2	61
Total	328	19.1	379	22.0	194	11.3	226	13.1	188	10.9	171	9.9	72	4.2	45	2.6	119	6.9	1,722

What's in that Fertilizer Bag?

(*From page* 15)

A soil reaction of about pH 6.5 is, generally speaking, satisfactory for most farm crops. A value of pH 4.5 represents the extreme acidity for agricultural soils below which most crops will scarcely grow at all.

Many state laws require that the fertilizer manufacturer shall guarantee the acidity or basicity of the fertilizers. The fertilizer bulletins in such states report on this quality of all fertilizers sold in the state.

Until quite recently most of the mixed fertilizers sold in this country were acid-forming; that is, they increased the acidity of the soil. This was due to the increased use of sulfate of ammonia and other ammonium salts in formulating mixed fertilizers. Forty years ago about 90% of the nitrogen used in fertilizers was derived from animal and vegetable sources; today less than 20% is from these sources. Research has shown that for every unit of nitrogen furnished by sulfate of ammonia there is required the equivalent of 107 pounds of lime as calcium carbonate to neutralize the residual acidity developed. For every unit of nitrogen from tankage or acid fish only about 2 pounds of lime are needed to neutralize the acidity formed. Many other organic materials develop a basic residue in the soil. That is why the fertilizers of a generation ago were not acid-forming. Sodium nitrate develops a basicity or alkalinity in the soil; for every unit of nitrogen it develops a basicity equivalent to that of 36 pounds of calcium carbonate. This is due to the sodium which it contains. Sodium is an alkaline material.

Many manufacturers are now formulating their mixed fertilizers in such a way as to prevent the development of acidity in the soil. Such fertilizers are said to be neutral or non acid-forming. A fertilizer can be mixed so that in the soil it will have a "basic reaction"; that is, it not only will not develop acidity, but it will have a basic character sufficient to neutralize some soil acidity. Such a fertilizer is called "basic."

Potato fertilizers, on the other hand, are formulated so as to be slightly acidic in order to help maintain an acid reaction in the soil to prevent the development of the potato scab fungus.

Since every farmer should use enough lime in his rotation to correct soil acidity and furnish calcium as plant nutrient, the acidity of modern fertilizers should not cause grave anxiety. The savings achieved in manufacturing our present complete fertilizers and passed on to consumers make it possible for any farmer to buy sufficient lime for his soil needs and still pocket a considerable difference. Liming is very important on all farm soils and should always be done prior to the application of fertilizers. Soils that are properly limed will make fertilizers more efficient.

Formerly the materials used in formulating fertilizers contained a relatively low plant-food content. The fertilizer so made was low in plant food. The first 50 years of the industry saw little change in the plant-food content of mixed goods. Then, with the commercial development of nitrogen fixation following the first World War, a remarkable improvement occurred. The new source of nitrogen supplemented or replaced the organic nitrogenous materials—cotton-seed meal, dried blood, and animal tankage. Nitrate of soda and sulfate of ammonia remained the same, but among the newer fixed-nitrogen materials we had ammonia liquor, urea, ammonium nitrate, and ammonium phosphate, all of which have a much higher nitrogen content than the organic materials formerly used almost exclusively. These changes influenced formulation practices and introduced many new grades, especially in the midwest, the northeast, and the Pacific coast sections. There is a tendency to classify fertilizer grades according to plant-food content: those containing 16-20% total plant food are considered as ordinary or standard-analysis mixtures; those containing more than 20% are classed as high-analysis; while those with less then 16% are designated low-grade.

The National Fertilizer Association recently conducted a consumer survey. The survey reveals that a large number of farmers still buy fertilizer on the basis of cost per ton, thus ignoring all the information given by the fertilizer industry and state and federal agricultural authorities which was designed to teach consumers how to evaluate and purchase wisely on a basis of "cost per pound of plant food" and not on "cost per ton of fertilizer."

A recent South Carolina bulletin shows how a farmer who can calculate the cost per pound of plant food can save a lot of money. It cited a comparison between 3-8-3 and 4-12-4. The ton cost of the 3-8-3 was $23.67 and it furnished 280 pounds of plant food. The 4-12-4 fertilizer cost $28.13 per ton, but to furnish 280 pounds of equivalent plant food in the 3-8-3, only 1,400 pounds of the 4-12-4 were required which cost only $21.09, therefore making a saving of $2.58.

A Texas bulletin cites cost for equivalent amounts of plant food supplied in fertilizer of three different concentrations. The comparisons are tabulated as follows:

	Tons	*Analysis*	*Cost*
Equivalent	1.67	3-10-3	$48.13
Plant	1.25	4-12-4	41.27
Food	1.00	5-15-5	39.22

You see from this table that the more concentrated fertilizer, 5-15-5, containing 25 units of plant food, cost $8.91 less for an equivalent amount of plant food than the 3-10-3 analysis which contains only 16 units of plant food.

A Vermont bulletin instructs its farmer readers to appreciate the fact that the cost of plant food decreases as the concentration of the fertilizer increases. It cites examples. At the time of publication the average cost in Vermont was 10.6 cents per pound of plant food in fertilizers having 15 to 17 units, 9.5 cents in those having 20 to 21 units, and as low as 6.5 cents per pound in those having 38 to 44 units.

These facts are not hard to understand. It does not cost any more to manufacture and distribute the more concentrated fertilizer. One ton of 5-10-5 can be trucked for the same price as a ton of 3-8-3. The bag cost is the same. By spreading these costs over a larger number of units of plant food per ton, some real money is saved. While the cost per ton or per pound is not the only criterion in choosing between fertilizers, it certainly is a factor that should always be considered before buying.

Having said the above, I want to emphasize here this other viewpoint, that a better gauge may be *What is the cost per acre?* The latest figures from the U. S. Department of Agriculture reveal that the American farmer spends for fertilizer only 2.37% of his total income. Considering that the return on fertilizer is at least $3 for every dollar spent, this expenditure is hard to understand. Compared with farmers in European countries the expenditure is very low.

To be sure of getting the most plant-food for his money, one should:

(1) Buy those fertilizer grades recommended by the state authorities, as those grades will usually supply plant foods at the lowest cost per unit or per pound, as well as conform to the latest information on the best plant-food ratios for the particular soil and crop conditions involved.

(2) Buy fertilizers on the basis of cost per unit or cost per pound of plant food rather than on cost per ton alone.

(3) Buy fertilizers with as high a total percentage of plant food as possible under local conditions, since basically this should reduce costs because of fewer bags, less freight on smaller tonnage, and less handling. It is assumed that such fertilizers figure lower in cost per pound of plant food, and that one is equipped to distribute ac-

curately the more concentrated grades.

In recent years there has been a trend to double-strength fertilizers. Under present emergency conditions there may be a shortage of double or treble superphosphates, as well as some of the more concentrated nitrogen materials. Some manufacturers temporarily must use portions of raw potash salts, called manure salts, containing around 25% potash. For the present it may be necessary to produce more of the ordinary strength fertilizers.

In my files, I found the following clipping taken from an editorial in the "National Stockman and Farmer" of about 1915. The message is as true today as it was then:

"Every acre of land that has ever been productive may be made so again. This is the message of hope that agricultural science brings to the man who owns a run-down farm. Methods of improvements may vary according to circumstances, but the use of commercial fertilizers is the first essential. Fertilizers to make something grow on this barren land, manure from the crops grown, lime, legumes, and tillage—these are the essentials in the rebuilding of a soil. Properly managed, the returns more than cover the cost of restoration, and the owner has $100 land instead of worthless land after a few years. Is it worth while? It is, and no prejudice or parsimony should delay the start, which calls for the outlay of money for fertility that comes in bags. If the improverished soils of this country are to be made productive by the generation that owns them now, fertilizers must be used to start the process. Nature will restore fertility in the course of time, but this generation will not be here to see the end of her effort. Man's method is quicker and more profitable to him and to the country."

Adjustment of Agriculture to Its Environment

(*From page* 26)

servation of rainfall, and the better utilization of land in general—both through practical farm experience and research. A number of long strides forward have been made in this direction recently and other important possibilities seem close at hand.

For example, the perennial lespedezas and kudzu have wrought profound changes in the use of much severely eroded land in many parts of the southern states. Lands which a little while ago were considered too poor or too steep or too erodible to farm—even some areas that were so gullied they could not be plowed at all—are now producing, with some fertilizer and care to get them started, excellent hay or grazing with these valuable crops. And these crops are holding the soil, retarding runoff, reducing the effects of silting, and generally raising farm income.

Turning soil upside down—according to the traditional way of plowing which has been one of the main functions of the turning, or moldboard plow—is not generally one of the wisest steps in agriculture. It puts the vegetative material, including grain stubble, corn stalks, grass, and legumes, as well as weeds or any other vegetative material, anywhere from 6 to 12 inches underground and turns fresh, loose earth to the top where it is exposed to the ravages of wind and rain.

When grass or other vegetative litter is lodged deeply underground, it cannot protect the surface. Fresh, loose soil exposed to the sun, wind, and rain on top of the ground is a rank invitation to trouble. The sun bakes the life out of the unprotected soil, at least temporarily. When it is dry, it falls loose and lifeless about the plow, so that wind can readily blow it away. And when any kind of rain heavier than a drizzle falls on it, soil washing results—sheet erosion and gullying—with an aftermath of muddy rivers and silt in reservoirs, harbors, and ditches. Where the slope is steep, there may be such a rush of water and soil downhill that crops go along with it. Also, the downhill wash of water and topsoil carries away both the added fertilizer and the natural plant food in the soil, along with the whole body of the soil. Still, there will be uses for the moldboard plow, as for plowing up water-diversion ridges, terraces, and drainage ridges ("lands"), and for use on certain soils of essentially level surface.

Throughout the country, technicians of the Soil Conservation Service and other agriculturists are striving to develop as rapidly as possible the new field methods and machinery precisely adaptable to the erosion control and production needs of each varying agricultural locality. Steadily, all this soil conservation work is taking the form of a new agriculture in our country—an agriculture based primarily on soil conservation farming methods. And to date our progress with it is pacing the rest of the world.

Conservation farming puts first things first by attending to the needs of the soil—by seeing to it that the starting-off place, the base, is put into a condition of productive health and kept that way. Any other approach, no matter what it may be, always has and always must lead to eventual defeat through downfall of the base—the land.

Food is not produced just with written agreements, international or otherwise. Food in good output is produced only through the wise use of agricultural land. Yet from the standpoint of available resources, there is such a shortage of favorable agricultural land in the world that even before this war started, millions of people were always hungry and other millions lived under the almost constant threat of famine.

There is a widespread and a dangerous misconception about the world's productive soil resources. Many people think of the world as an amazingly vast place, abundantly stocked with rich land, much as frontiersmen of an earlier day in America believed there was a boundless reservoir of productive land beyond the western horizon.

Too many people have lost sight of the fact that productive soil is essential to the production of food. Apparently this fact has been so obvious and has been taken for granted so long the human race has just about arrived at the point of ignoring it. It should neither be taken for granted nor ignored, because there is no longer an abundance of productive land around the world. The somber truth is the area of good soil on earth is becoming more and more limited. This means that the world's food production capacity is likewise becoming more and more limited.

Advantages of Conservation

With the area of arable land already subject to grave limitations in many parts of North America and with further losses of productive acreage in prospect, it becomes doubly important to recognize now the production advantages, and the protection advantages, of comprehensive, scientific soil conservation work when undertaken widely.

Conservation farming on many thousands of farms through the United States, producing all kinds of crops, has resulted in an average increase in per-acre yields of at least 20 per cent. In some instances the increase has been 40 per cent, 50 per cent, 100 per cent, and more. And this has been accomplished with very little additional labor, fuel, time, money, or machinery.

Twenty per cent increased production is the equivalent of adding a sixth farm for every five farms now in cultivation. Applied to the nation, it

Everyone is concerned in this; none can escape its implications. Productive soil is life and productive soil is vanishing with each passing year. The farmer, the banker, the legislator, and scientist; the teacher, the preacher, the welder, and clerk; all have a personal stake in the speed and thoroughness with which this nation, and every other nation, moves to the task. Generations yet unborn will curse or praise us, according to our actions with respect to this problem in the years immediately ahead.

A Six-Point Program

I propose for the next decade a six-point program of agricultural adjustment to physical environment to which I believe all informed men can readily subscribe:

1. An accelerated program of soil and water conservation, through soil conservation districts, as determined by the condition and use-capabilities of the land itself. Such a program should be geared to complete within a 10-year period the application of all major, needed conservation measures on all the erodible lands of the country normally devoted to clean-tilled crops, grains, soybeans, flax, cowpeas, and rice; that is, on approximately 242 million acres (not including about 76 million acres of farm land normally devoted to thick-growing, soil-protecting crops, exclusive of pasture, such as grass, clover, and lespedeza). As a necessary support of this program, a detailed physical inventory of the nation's land resources, showing their capabilities for use, should be completed at the earliest possible date.

2. Drainage of about 30 million acres of good land to improve the production of that part now in cultivation and to bring into cultivation that part which is now too wet for tillage of any kind. Much of this land is in drainage districts and most of it has been cleared for cultivation. (This drainage work would help speed up a needed shift away from cultivation on an equivalent or larger acreage of steep, erodible upland which should go out of cultivation and into a permanent protective cover of trees, grass, or legumes.)

3. Rehabilitation, development, and better utilization of water resources on approximately 12 million acres, largely in sub-humid regions.

4. A broadened educational program throughout the school and university system of the country and through all other appropriate avenues for the dissemination of information to acquaint children and adults alike with the importance, condition, and needs of their basic agricultural resources.

5. Rapid initiation of scientific investigation into the relationship between soil health—with particular emphasis on security against erosion—and human health and nutrition. This approach to human betterment has been neglected to an amazing degree by scientists almost everywhere.

6. Widespread development of needed water supplies and improvement of western range conditions through better grazing practices and livestock management. Under modern conservation practices for range lands, maximum production on a sustained basis is possible.

The vigorous prosecution of such a six-point program would increase food and fiber production in the United States by approximately 20 per cent. Stated another way, the carrying out of this program would add to our agricultural production plant a sixth farm for every five farms now in production, or an added production capacity equivalent to that of a million new farms—without any net increase in the cultivated area of the country.

Further, it would provide the nucleus for a sound, post-war rural works program. And in addition to its tremendous wartime and post-war benefits in terms of production and permanently protected soil, such a program would have a timeless value for human welfare far beyond our present ability to realize or estimate.

Where Do We Stand With Fertilizers?

(*From page* 12)

Fink, working in Maine, reports green weight yields of a ladino-timothy mixture as follows:

TABLE IV.

Treatment	*3-yr. Average*
1. 10 T.M. + Super, 60 lbs. P_2O_5	5.2 Tons
2. 80 lbs. P_2O_5 + 80 lbs. K_2O	4.67 Tons
3. No treatment	3.53 Tons
4. 40 lbs. N + P & K as in 2	6.60 Tons

These yields are for the first cutting, or hay crop, and do not include the yields later in the three seasons when the land was pastured.

The author points out that while nitrogen is not needed to maintain a ladino-timothy stand, it does markedly increase the yield of the first cutting. As a matter of fact, satisfactory stands of ladino were maintained in all the plots except that which was untreated.

The amount of phosphoric acid, (80 pounds per acre annually) according to the author, is more than the crop removes from the soil, but a similar application of potash is 75 pounds less than that taken out annually. Since the planting was made on a soil with considerable potash reserve, future recommendations for this element may have to be increased.

From the work reported, which is but a fraction of that which has been done with hay crops, it is easy to see that with a potash shortage or even a scarcity which would eliminate its use on hay crops classed in group B, serious effects would be noted immediately so far as legume production is concerned.

A good deal of effort was expended in the 1930's upon the improvement of permanent pastures. Work started by the National Fertilizer Association was pursued in many states to determine the effect of fertilizers on old pasture sods. The story told by these trials reflects much of the data which has been discussed above with hay crops. The type of response secured was colored by the existing vegetation or by the vegetation that was induced to enter the stand because of the kind of fertilizer applied.

Average results tell the story for an average pasture but not for specific ones. For example, very heavy soils which will support dense stands of wild white clover will respond more to applications of potash and phosphoric acid, while on the lighter soils on which grasses predominate, a greater relative response will be secured from nitrogen.

It seems worth while, because so much effort has been expended in this direction, to summarize this work here. For this purpose and since the treat-

This is the type of pasture that can be developed with adequate fertilization, grass and clover in fairly equal amounts in the sward.

ments were identical (and the results quite similar), data for Maine, (9) New Hampshire, (10) and those published by the National Fertilizer Association (11) have been averaged.

TABLE V.

Treatment	Yield, Pounds Dry Matter per Acre	Yield, Pounds Protein per Acre*
None	1065	145
P	1322	199
LP	1444	236
LPK	1752	299
LNPK	2500	450

* Averages for Maine not included in protein results.

These data cover a large number of pastures and indicate the relative response for adding an element or substance to the previous treatment. Perhaps the data are more valuable for pointing out the reason why so many permanent pastures are relatively worthless than for gaining a judgment as to fertilizer response. If they do mean anything in respect to this, it is that no one substance but a combination of all is necessary for maximum improvement.

Thousands of acres of permanent pasture have been improved by top-dressing largely as a result of the stimulus of work of this sort. One research worker in New England has pointed out that the cheapest feed for dairy cattle is obtained from untreated permament pastures. This is true, without a doubt. But it is also true that the cheapest purchased feed is usually that which is bought with "fertilizer applied to a good pasture sod."

And we do not mean to leave the impression that top-dressing permanent pastures is the answer to the whole pasture problem. High-producing herds need more intensive feeding than a permanent pasture will produce and over a longer period, particularly through the middle of the summer. For this purpose ladino and other clovers, along with timothy and other high-yielding large grasses enter the picture.

It would be ideal, in summarizing an article of this kind, if we could say in evaluating the elements that all have an equal value or that one is responsible for 48 per cent, another for 32 per cent, and another for the remainder of crop increases. The need for fertilizer balance is so great and the effects of fertilizers and lime are so interrelated that actual percentages had best be left to the imagination.

Not all the crops which we have here in New England have been discussed. Vegetables and fruit, corn and many other crops would enter the picture in a complete treatise on this subject. Nitrogen appears to be the paramount need for fruit yields, phosphorus for large corn yields, and yet a certain balance is required here as it is for vegetables and other crops.

From what we have so far reported, the prospect of a possible potash shortage in relation to demand is not a happy prospect. It would be serious for the potato crop if this substance were not available in adequate supply. Dairy crops too, which, as we have previously pointed out, fall into the B group, will suffer from a potash shortage, especially ladino and other clovers which are so vital at this time for high milk yields. Growing legumes is our best method of offsetting the grain shortage. Hence any hindrance in producing them is a positive handicap, particularly in view of their great need.

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Victory Vows

(*From page* 5)

but they recall what Lincoln once said on that topic, and hereafter they will carry munitions with the fuse lit. It isn't just because they won't trust Europe or imperialism—it's because they won't trust themselves to grow indifferent again. Look what it got us into!

My next hop is over into the educational field. In my campus town there lies a field of about fifteen acres which was a military camp in the War Between the States. It presents a different picture today in some ways. In 1861-65 and later in the Spanish war, the soldiers did no "book work" and had no kind of training except that of loading and firing guns and obeying their officers. Today, this arena is often the scene of squads marching to classrooms with books galore under their arms, for knowledge of technical and even theoretical subjects is a requirement of high-power global strife. In meeting this urgent problem of hustling out recruits to meet terrific demands, taking callow youth full of gasgadding and whims, and steadv them into mature experts—our dawdling old college routine has been upset rudely. The result will be, as the lads insist, that in the future we streamline our institutions of learning somehow so as to give students the benefit of the quick route to known goals. Lots of useless clutter and redtape, duplication, delay, and fruitless effort will be done away with, so that the kids who join up with the army of the educated will not take so long to get their "shoulder straps." It will save many a farmer's and day laborer's hard-earned dollars spent on loans to sonny or sister, and ease the pathway of the kid obliged to earn his room and board.

Won't this new deal we should expect in college systems after the war do something to rid us of prejudice against "bookish" folderol? Maybe our farm courses also can be jacked up and oiled and geared to furnish more trained plowmen and less of something else with a semi-agricultural tinge, and do it in as little time as it took to make Sam Brown's boy into a navigator or a trajectory expert.

So here once more we get a glimpse of the vista that victory opens for us, not just to educate the morons on some cocoanut isle, but to make life more fair and understandable as well as more enjoyable, right back here in the well-known "sticks." (Of course I don't advocate drafting everybody for higher learning. That doesn't make sense either in or out of a war.)

Next, I sashay into the organization pasture. Here picking and grazing has been green for some and thin for others, depending on how hard and fast the membership was roped and hog-tied, financially and mentally. I refer to economic special privilege blocs and not to fraternal societies and academic groups.

ONE universal unrest is stirring these days and that is to make representative government truly representative and answerable to an understanding people, and not just a tool and a pawn for some talented fellow with lots of push and no overload of scruples. For as any ninny who knows his pressure groups knows, they are usually run by an inner circle of good fellows, who in turn take their cue from the master mind at the controls.

It doesn't take a Lippmann or any other sage to tell us folks out in the hinterlands that we have been misled and misrepresented and misinterpreted, and that our official agents in the legislative business have been bullyragged and bamboozled by some of the organization lobbyists.

I can remember when laborers and farmers lacked any voice in the halls of legislation or any bold and resourceful pleaders. Nobody wants to go back to those fumbling days either. But some of us bull-headed guys back home have been quietly taking polls of opinion and cross currents of the views held by the folks who pay the expenses of the lobbies. To me it is not strange, but to some gullible ones it may be, that the rank and file of membership in trade or profession or occupation very often deny the attitudes attributed to them by their clever spokesmen. If you want proof, do a little sleuthing yourself in the wake of some publicity appeal and proclamation issued to congress by these mental magicians. Find out if the guys whose names were used were in the same frame of mind.

Most of the trouble from war-time squabbling on the economic front has arisen from such sources. Defense and destiny look like dollars and doughnuts to numerous self-maintained lobby leaders. Their organizations are not alive enough or courageous enough or don't have enough personal gumption to insist that if a lobby is kept to represent them that it does so. I know one state organization (without naming the field) which has its programs and resolutions actually whittled out before hand by ukase from the Washington lobby. By imposing its will on this and other state forums, the shrewd spokesman can point to such prophetic phrases with pride as proof of his genuine testimony. You cook it up in canned sauce of your own manufacture and then serve it as fresh country gravy. How the legislators gobble it too!

OF course we are going to continue to have lobbies and economic societies after the war, but for Pete's sake let's run them and not let them run us! This calls for a change of attitude backed by the mailed fist, maybe special delivery mail too! It's one sure way to clear the air for a free America.

I see my time is almost out and my share of the depleted paper supply is almost used up. I intended to inveigh and decry for a page or two on post-war art and literature, maybe the movies, and a few other entertainments. This must be postponed.

About all I have left on my agenda are class prejudice and international amity. But with only a few paragraphs reserved, I am unable to extend my "talent" fittingly in either direction, were it possible that I had anything safe to advance.

This business of settling class prejudice in one essay, even by such a w. k. intruder as myself, seems impossible. I am aware that this is a question that breeds more two-faced hypocrites than almost any social problem you can trot out. I've heard fellows cuss Hitler for rank treatment of races and creeds and then in the next breath make careful exceptions of what they might agree to with limitations in this country.

I CONFESS frankly that I lack courage or knowledge to whip right into this mess and disturb your cozy evening. I can't solve it anyhow. Maybe all of us together will find it a devilish bother to equalize racial opportunity without equalizing everything else everywhere anytime. It's too big a stump for a man with mental rheumatiz to jump over this late in life. I want something done, but I'll be darned if I know how or what. I guess you are on my side of the fence too. Let's be honest and courageous enough to say we don't know, and not pester the dickens out of audiences with quack remedies for it.

As for that other bogey of post-war nightmares, internationalism and world fraternity, I've lived too long in the narrow confines of the Midwest to get a load of it balanced right on my shoulders. I sincerely want to be a little brother (not bother) to all of the countries you can mention. I want to keep off their corns and I ask them to respect my lumbago. I won't trade them spavined colts or do them dirt. I hope they won't do that to me, in return for lend-lease. Therefore, in the tattered frame of mind I am in, all I can do to them is what I do for you—Happy New Year and Quick Victory!

HOT STUFF

Some American and British soldiers were looking at the molten lava inside of Mt. Vesuvius. An American remarked:

"Looks hot as hell."

An Englishman mumbled under his breath: "You Americans have been everywhere."

"How did you get that bump on your head?"

"My wife threw a vase at me."

"Why on earth didn't you duck?"

"I did, but she allowed for it."

Private: "See that sailor over there annoying that girl?"

M.P.: "Why, he's not even looking at her."

Private: "That's what's annoying her."

Applying for his citizenship papers, Gino was doing all right until he came to the questions about the American flag. "What is it," asked the Judge, "that you always see flying over the Courthouse?"

"Peejins!" confidently replied Gino.

COMFORT GREATER THAN PRIDE

Kindly Old Lady: "You say you've been on the force eight years? Why haven't you some service stripes on your sleeve?"

Cop: "I don't wear them. They chafe my nose."

Sergeant (on rifle range): "This new bullet will penetrate nearly two feet of solid wood, so remember to keep your heads down."

The ship had entered New York Harbor. On board was one colored soldier. As the ship passed the Statue of Liberty there was absolute silence, when suddenly the colored boy broke the silence by remarking: "Put your light down, honey, I'se home."

GET THIS

My lady, be wary of Cupid
And list to the lines of this verse;
To let a fool kiss you is stupid,
To let a kiss fool you is worse.

It was a wet banquet, with the exception of one guest. His glass of milk was furnished, but enroute to him some wag poured in a stiff shot of gin. The exceptional guest sipped the milk, smacked his lips, then gulped down the whole glassful. Wiping his lips gratefully, he murmured in admiration and awe, "Some Cow!"

"Did your garden do well last summer?"

"No, every time my husband started digging he found a lot of worms, so he would quit and go fishing."

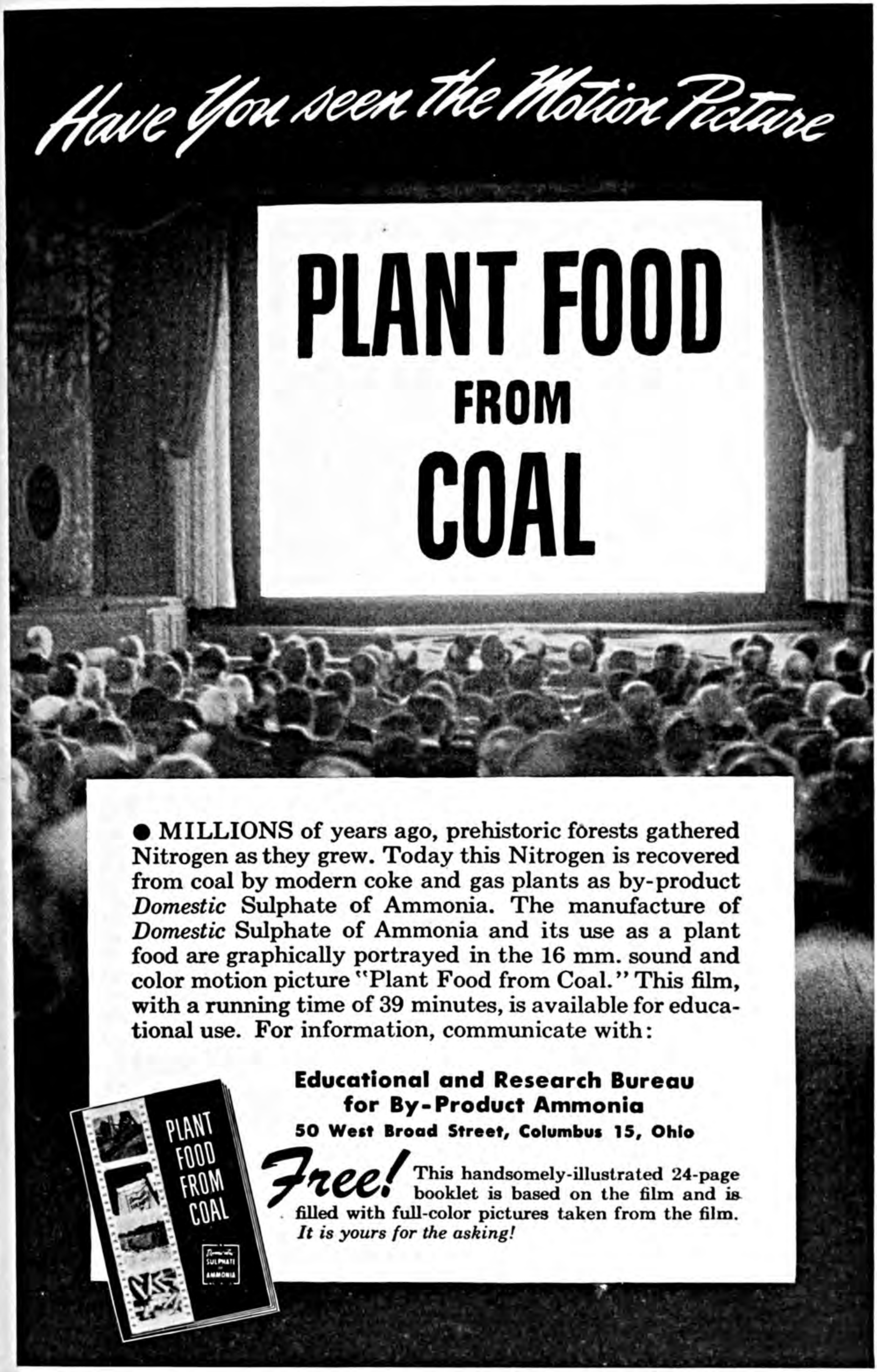
Real Estate Salesman: "Would you like to see a model home?"

Prospect: "Glad to, what time does she quit work?"

Percival's love affair fell through. His lap was bow-legged.

Draftee: "Do you think they'll ever send me overseas, doctor?"

Examining Physician: "Not unless we're invaded!"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VOLUME XXVIII NO. 2

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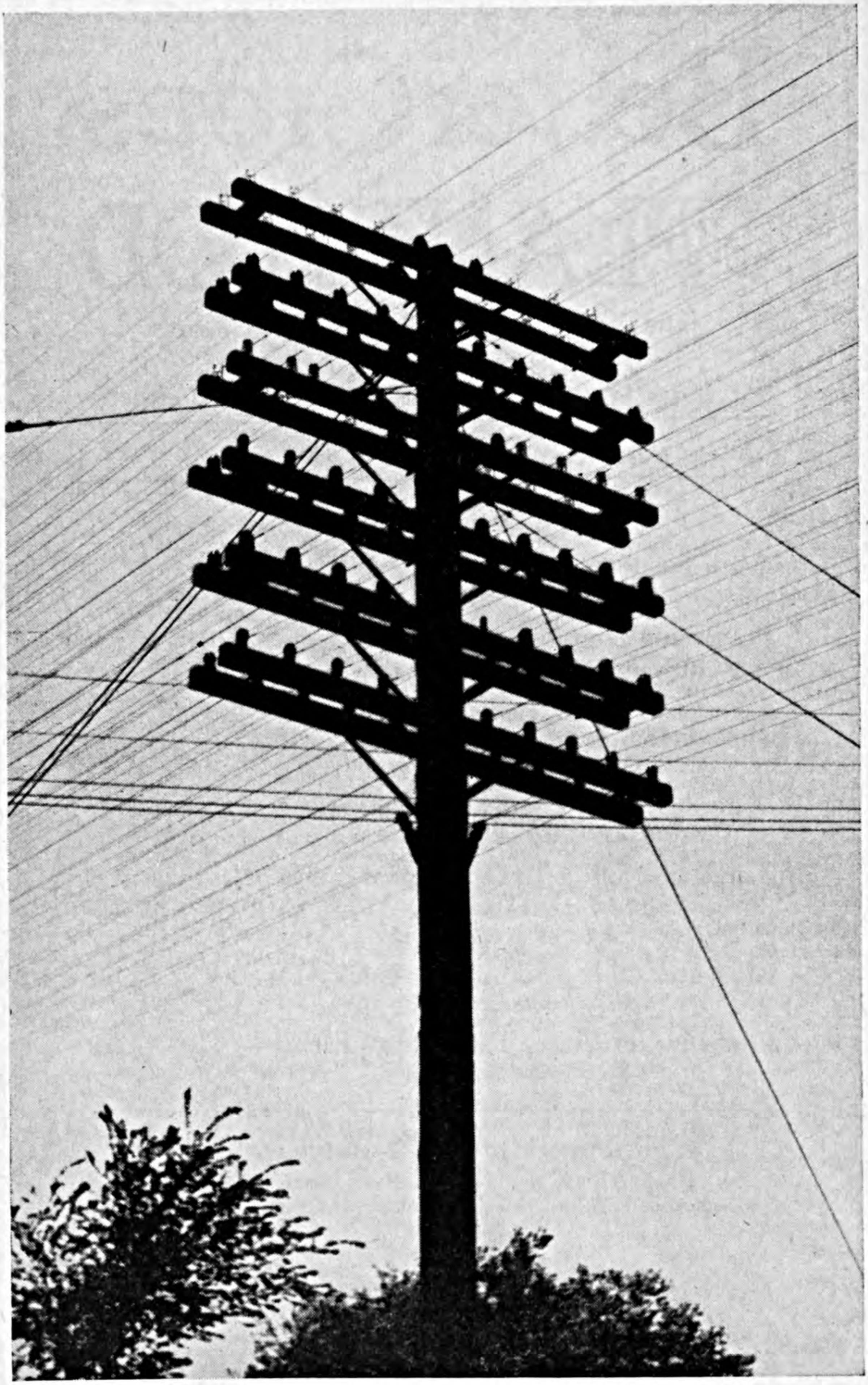

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VOL. XXVIII WASHINGTON, D. C., FEBRUARY, 1944 No. 2

Sizing up the Situation—

With Neck Stuck Out!

Jeff McDermid

DO I STICK out my weatherbeaten neck by saying that agriculture has little to fear and not much to lose should Congress enact compulsory, universal national service? My decision to that effect lies in my belief that no single large segment of the working population in our embattled land has already enlisted in a steady contribution to a basic need to the extent that farm folks have; and that the preparatory training, fitting, and toughening processes for our food and fiber output cost us less in time and money than any other industrial trade or profession requires in order to meet the emergency in production per man.

Likewise in the course of this rambling piece, I want to bring out a point or two about the adjustments that farmers have to make, or have already made in their way of thinking, adjustments which are about as drastic and revolutionary as the adjustments and new viewpoints realized by service men and green factory apprentices in wartime.

By this I do not mean any shifts in attitude by farmers toward doing a good, busy day's work, regarding all idleness, panhandling, and malingering as inventions of the devil; or their inherent distaste for squandering resources and frittering away financial gains. Much as some elements of society hereabouts have set us attractive examples of the profits from sloth and waste, the farmer as a class gives all such and sundry a cold and shrugging shoulder.

Farmers have surprised themselves by the scope and power of their food offensive. I have heard observations by spokesmen at rural meetings during these war days as each new crop and livestock goal was broached and threshed out. Almost always they spoke in highly conservative terms about what food they could furnish and when. There was the usual amount of griping and fault-finding, which is also a trait of the courageous marines abroad whenever they tackle a fierce bit of jungle resistance. Scarcity of help and broken-down implements were mentioned in most farm groups, as the leaders doubted their ability and that of their communities to meet the challenge of Uncle Sam or adhere to his vagueness and vagary.

RIGHT now in the northern states it's the weather which furnishes the text of agrarian debates. Inasmuch as we seem to be having a snowless early winter and no great reserve of soil moisture, with winterkilling of forages threatened, you often hear the wise old-timers bemoaning the outlook and claiming we have overshot our wad.

They do this not in any unpatriotic or disturbing partisan manner, but it's just a streak of gamblers' suspicions which makes them fearful we can't always get the trump cards in such a hazard of natural forces. Seven years of plenty, they opine, may very easily be followed by seven years of dry springs and stunted provender.

They go tramping over the meadows a lot these days prior to the usual drifts, examining the plant crowns and the depth of the frost line, because recent emergencies emphasize the fundamental place of leafy, green hay and lush, verdant pastures in livestock economy. They know well that your annual corn or oats crop is not called upon for the vast amount of constant hourly growth and vigor all season long that we demand of the legumes and mixed grasses, from whence come our main stores of minerals and carotene.

They put some trust and hope in the promise of more nitrogen fertilizers, released as a by-product of the heavy munitions business; overbalanced perhaps by less potash than they'd like to have around handy—but back of it all they register concern because without seepage of water through the soil particles, nothing productive emerges for the emergency, neither vegetable, animal, nor mineral. And when the sly machinations of Jack Frost are seen on the meadows, all hope rests with new spring seeding—and this year the seed is not a hot prospect. Last year's corncobs won't do the trick, and last year's hay-mows are dwindling of fodder.

Despite unforeseen dangers to fetter the food army, my present observations relate to what has gone before, to the gosh-blasted surprise on the faces of the plowmen and threshing and silage crews as the cheerful, glorious returns came in from wonderfully abundant harvests just when the world wanted them the worst. There were probably only a few farmers able to snort with pride and say "I told you so." Farmers usually look for the worst to happen and then take their reward of bounty with a weather eye cast forward to the season ahead. Your average farmer is no Pharisee praying for success because he has been such a slick operator. He is more like poor old Job, sitting amid his tormentors and scratching his blisters, with scant hope of making the grade.

THEREFORE, jot down faith in organized unity as the No. 1 adjustment of the rural think-box. By this is meant accomplishment in an uncommon, historic, and marvelous way, brought about by a sort of unconscious bond of unity and pushful purpose animating all grangers alike from coast to coast.

Hitherto, our rural minds have turned selfward and suspicious-like toward any over-all attempt to work up a lather of sentiment for universal movements in one main direction. For a while, and at irregular periods of stress and in scattered geographic areas, we have seen farm folks respond en masse to orators and publishers and politicians; or maybe get the fever temporarily from circuit-riding zealots during depressions. But not for very long, only perhaps to correct some wrong, and elect somebody soon to forget all about it.

Once or twice in the present successful campaign for food production, mistakes were made that would have assumed tragic proportions had they been left unchecked and without true rural guidance at the last moment. Once upon a recent time, some officialdom wanted a pledge circulated among the farmers to have them sign up to raise more food and do their "duty." This pledge reeked of mock heroics and stank to heaven in the nostrils of the untamed and independent sod-busters. Other examples of a like kind will occur to my observant readers, bearing me out in the contention that farmers respond best to unconscious and unexpressed movements, things lying deep within them as a challenge and a motivating force, rather than to mawkish and bombastic slogans and "resolves."

So this achievement of agriculture finally gives isolated members of the profession more confidence in what organized team-work can do, when it is not camouflaged in a bog of blunders.

Appeals were not made for selfish conquest of the middleman or the money-lender, or the outwitting of some other fancied foe to farming: or based on collecting tithes to launch a new and super-duper rural society to to be run without regard to the other workers of the world. Down in the souls of the crop-raisers was a layer of elemental determination and national trust, sifted in with some local pride, and the plowshare of adversity and danger turned this to the surface to germinate the movement we have seen succeed so well.

Moreover, for the most part they "laughed off" the little irritations and regulations and red-tape which were foisted on them as part of the soil regimental orders. Like the dough-boy Yanks afield, they poked hearty fun at their drill-masters, tore them apart in sarcasm, but knuckled down and won the battle when the going got tough.

THE next adjustment I imagine has taken place since the war among farm folks is a sort of breaking away from the attitude which has not been properly called "provincialism." I don't like that term because in this case it won't quite fit. For the past thirty years farmers as a class have been modernized and acclimated to the social scenery pretty well. I refer instead to what is more like self-sufficiency, or maybe self-righteousness, a feeling so often seen in the open country mind of yore—too much rugged, inward bent, class thinking.

To be sure, even last summer most farmers did not relish having nosey and ambitious city volunteers come out to take a hand at the harvest, but that is not what I mean exactly either. That is mere pride and satisfaction in doing an accustomed job better than the uninitiated.

What I mean is the old idea that farmers were in a separate and dis-

(*Turn to page* 52)

Potassium Content and Potash Requirement of Louisiana Soils

By M. B. Sturgis

Department of Agronomy, Louisiana State University, University Station, Baton Rouge, Louisiana

RECENT experimental work at the Louisiana Agricultural Experiment Station has shown that all of the general soil areas of Louisiana contain some localities that are deficient in potassium and that crops grown in these localities respond to potash fertilization. Hundreds of soil tests and analyses with scores of field experiments furnish data which permit at least a preliminary delineation of the potash needs of the State at the present time.

The available potassium content and need and the crop response to potash fertilizers for the general soil areas or divisions are summarized in the following table.

The greatest needs for potash based on the low potassium content of the soils, the large extent of the area, and the relatively high response of crops to potash fertilizers are in the hilly and rolling areas of the Coastal Plain. Here approximately 24,000 tons of K_2O could be used profitably each year. The flatwoods areas of the Coastal Plain are much more deficient in potassium, but due to the fact that a small percentage of these areas are in crops, only about 3,000 tons of K_2O are needed.

The soils of the Coastal Prairies (Pleistocene Prairie Terrace) are more deficient in potassium than has been formerly recognized, and cotton on these soils responds more profitably than in any other general area. This is where most of the rice in Louisiana is grown. If the rice and pasture crops were judiciously fertilized, the requirement for potash fertilizers in this area would be in excess of 13,000 tons of K_2O annually.

The more extensive use of potash on the soils of the Mississippi terraces and loessial hills has been in progress for several years, and very profitable crop responses are stimulating the farmers' interest. Next to the hilly and rolling areas of the Coastal Plain, this general area has the greatest amount of crop acreage and the greatest farm population. To fully satisfy the potash fertilizer needs of this area, 15,000 tons of K_2O would be required.

The soils of the Ouachita and Red River flood plains are not usually deficient in potassium. Only in Ouachita River bottoms are there extensive and continuous areas showing potassium deficiency. In these areas cotton responds very profitably to potash fertilization. The soils of the Red River bottom are higher in available potassium than those of the Ouachita and the deficient areas are smaller and more localized. It would require approximately 6,000 tons of K_2O annually to support well-balanced fertilizer practices for this general area.

Many relatively small areas showing potassium deficiency occur in the Mississippi bottom, and field tests have proven that potash fertilizers can be profitably used on these deficient areas. The potato, however, is the only crop

(*Turn to page* 51)

Plow-sole fertilizer, 10-10-10 at 700 lbs. per acre plus starter 3-12-12 at 125 lbs., more than doubled the yield of fodder and increased the yield of ear corn from 12.8 to 84.6 bu. per acre on Spangler Brothers' farm at Jefferson, Wisconsin.

Plow-Sole Fertilizers Increase the Profits

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

OCCASIONALLY, our enthusiasm for practices we consider sound, practical, and economical gets ahead of the supporting evidence in actual field trials and yield data. In the early days of my work as an Extension Specialist in Soils, it was frequently said, "Chapman's talks are 95 per cent enthusiasm and 5 per cent facts." This, I admit, may have been true in the early days of my extension career; however, I still maintain I had plenty of supporting data and evidence to back up my enthusiasm even in those early days. I am convinced that frequently my farmer audiences, as well as my colleagues, were either prejudiced or uninformed, and were certainly apathetic toward this idea of commercial fertilizers and their use on Wisconsin dairy farms.

It was only a few years ago that one of our staff professors (now deceased) made the statement, "This man Chapman is recommending potash promiscuously all over my territory." The facts were that my demonstrations in this north-central Wisconsin area had satisfied me that potash was urgently needed, in addition to phosphate. In my test plots, potash had produced spectacular results. I had set up a number of demonstrations on farms scattered over this particular area, and my conclusions, based on actual results, were well founded. Hundreds of field trials in subsequent years in this Colby soils area have conclusively shown that my "promiscuous" recommendations of potash were actually pretty sound, and right now fertilizer dealers, county agents, and other farm leaders, as well as the farmers themselves, are crying for more potash in this area.

It has taken 25 years to sell the idea of commercial fertilizers in Wisconsin, and it is only now after we have built up a tremendous mass of irrefutable evidence and county agents and other extension leaders in the field have "sold themselves" through field trials and soil tests that the interest and demand for fertilizers by farmers has actually taken hold in this State.

Farmers would not have purchased and used on their farms 175,000 tons of commercial fertilizers in 1943 if they were not quite certain it would pay.

But now again it is being said that "Chapman is off the deep end" in his enthusiasm for this new plow-sole method of applying fertilizer.

I reported the results of our 1942 demonstrations in an article prepared for this magazine last year entitled "Plow-Sole Fertilizers Make Good Showing." Some readers of this article wrote me letters stating that I was jumping at conclusions, that my data were not sufficient or even consistent. I answered some of these critics by telling them I was aware of the inconsistencies in the data presented in this article, but that had they seen and followed these plots throughout the growing season, they would doubtless have arrived at the same conclusions I had. It is true that demonstrations without replication sometimes give us yield data that are not always consistent. Had I been the pioneer in this new idea of plow-sole application of fertilizers, and had only my Wisconsin results on which to base my conclusions and recommendations, I would doubtless have been a little more conservative in the endorsement of this new method of applying fertilizer. But I had seen with my own eyes the amazing results of experiments conducted in the State of Indiana. These experiments were set

On the Rufus Gillette farm at Mazomanie, Wis., the yield of corn was increased from 21.5 bu. per acre on the unfertilized plot to 45.0 bu. per acre on the plot receiving plow-sole 10-10-10 at 700 lbs. per acre, plus starter 3-12-12 in the hill at 150 lbs. per acre. The soil here was a sandy loam in a low state of fertility.

Barley seeded to clover on the farm of Clifford Hopkins at Morrisonville, Wis., was fertilized on the plow-sole with 0-20-10 at 450 lbs. per acre, and an additional 100 lbs. per acre of 0-20-10 drilled with the seed. Yields of barley on the various plots were as follows:

0-20-10 at 450 lbs. (plow-sole plus 0-20-10 at 100 lbs., drilled)=54.8 bu. per acre
0-20-10 at 100 lbs. drilled=45.2 bu. per acre
No fertilizer=31.0 bu. per acre

Ranker growth of clover on the plow-sole plots was noted last fall. Hay yields of clover in 1944 will tell the final story.

up by Dr. George Scarseth and his associates at Purdue University; plots had been replicated and carefully laid out. I had seen pictures and heard reports on the results of similar demonstrations carried on in other states. Dr. Scarseth has carried out extensive trials under a wide range of crop and soil conditions in Indiana for some three or four years. The results of his work have now been written up in an attractively illustrated Purdue Agricultural Experiment Station Bulletin No. 482, "How to Fertilize Corn Efficiently in Indiana."

The results of our plow-sole fertilizer trials in Wisconsin in 1943 were more consistent and even more outstanding than the results in 1942. The fields selected for our 1943 plots did vary greatly in productivity. Some fields were low in fertility and some were high; some of the fields had been manured, others not. In all cases, a 10-10-10 fertilizer was used with and without starter fertilizer in the hill. The plots ran the entire length of the field. The rate of application of the plow-sole fertilizer, 10-10-10, ranged from 500 to 700 lbs. per acre on the various farms, except in one of the demonstrations where two rates of application were compared—500 and 1,000 lbs. per acre. Edwin Blaney, on whose farm this particular set of plots was set up, is one of our larger growers of hybrid seed corn. The 500-lb. rate plus starter fertilizer made a 38-bushel increase of hybrid seed corn. The 1,000-lb. application plus starter fertilizer made a 47.6-bushel increase. The extra 9½ bushels for the additional 500 lbs. did not pay for itself, figured on the basis of current market prices for corn. However, at $5 per bushel (net to Mr. Blaney) the 9½ bushels did actually pay and leave a large margin of profit, and, of course, there will be a much greater residual carry-over benefit to grain and legume seedings in 1944 and 1945 where this heavier treatment was made than on the plot receiving the 500 lbs. per acre.

In our 1943 demonstrations, the plot

Hemp on the farm of Louis Rauls of De Forest responded in an almost miraculous manner to plow-sole application of a 10-10-10 fertilizer. This shows the difference in growth in mid-June.

making the poorest showing was set up on the Kindschi Brothers farm near Prairie du Sac. The soil here was a dark-colored Waukesha silt to fine sandy loam; the field had been manured the spring of 1943 prior to plowing. We knew at the outset that this field was in a good state of fertility. But even here the increase in yield (14½ bushels per acre) at current market prices for corn just about paid for the fertilizer. Here again, however, the Kindschi Brothers produce hybrid seed corn and planted this field to hybrid-crossing stocks. At $5 per bushel, this 14½-bushel increase did leave a handsome profit over and above cost of the fertilizer.

Right here it should be stated that in Wisconsin, where manure from our livestock herds is quite generally available and used on our corn land, it is a question whether these heavier applications of high-nitrogen fertilizer applied by the plow-sole method will pay. Rather, we are recommending under such conditions the use of starter fertilizer with an attachment on the corn planter as a supplement to the plant food supplied in the form of animal manures.

In another demonstration on Spangler Brothers farm at Jefferson, the field selected was a level, low-lying, light-colored silt loam (Fox silt loam) in a very poor state of fertility. No manure had been used on this field for many years. Spangler Brothers are growers of hybrid seed corn. However, this particular field was in such a low state of fertility that they did not attempt to grow hybrid-crossing stocks; rather,they planted this entire field, some 20 acres, to silage corn. There was a tremendous response to the plow-sole and hill applications of fertilizer on this field. We had expected to see rather striking results, but the actual yield and response of corn greatly exceeded our expectations. The corn on the plow-sole treated plot never seemed to suffer from a lack of moisture or plant food at any time during the growing season.

The yield of fodder was more than doubled. The actual yield of ear corn was increased from 12.8 to 84.6 bushels per acre. (Nothing but nubbins on the unfertilized plots.) At the time of harvest, Spangler Brothers figured the possible returns had this 20-acre field been planted to hybrid-crossing stocks and all fertilized with 10-10-10 on the plow sole. It would have made a difference of several thousand dollars in the net returns from this field. These brothers have purchased an attachment and are planning to use a considerable tonnage of 8-8-8 on their fields of crossing stocks in 1944.

As I review the results of our plow-sole work both in 1942 and 1943, I think I am safe in making the following general suggestions and observations:

Growers of hybrid seed corn will find it highly profitable to apply a high-nitrogen balanced fertilizer on their thinner fields, especially where corn follows corn and where little or no manure is available. Even where clover sod or green manure is plowed under, but where no manure is used, a liberal application of a fertilizer containing from 4 to 6 per cent nitrogen, from 8 to 10 per cent of phosphoric acid, and 8 to

Table 1.—1943 Results—Fertilizer Demonstrations on Corn

Name & address of cooperator and Soil type	Treatment	How applied	Rate per Acre	Per cent moisture	Yield* per Acre	Increase per Acre
			Lbs.		Bu.	Bu.
Clarence Pester	3–12–12 +	drilled	125			
Whitewater	10–10–10	plow sole	500	20.5	121.5	39.9
	10–10–10	plow sole	500	24.6	115.9	34.3
Clyde	3–12–12	drilled	125	21.6	102.7	21.1
clay loam	No fertilizer			25.5	81.6	
Kindschi Bros.	3–12–12 +	in hill	150			
Prairie du Sac	10–10–10	plow sole	500	35.0	74.9	14.2
	3–18–9 +	in hill	150			
Waukesha	10–10–10	plow sole	500	35.1	69.3	8.6
silt loam	10–10–10	plow sole	500	35.1	63.9	3.2
	3–18–9	in hill	150	35.0	63.9	3.2
	No fertilizer			35.2	60.7	
Edwin Blaney	3–12–12 +	in hill	150			
Madison, R. 3	10–10–10	plow sole	500	31.9	103.3	38.0
	3–12–12 +	in hill	150			
Carrington	10–10–10	plow sole	1,000	31.9	112.9	47.6
silt loam	3–12–12	in hill	150	41.1	78.4	13.1
	No fertilizer			42.0	65.3	
Rufus Gillette	3–12–12 +	in hill	150			
Mazomanie	10–10–10	plow sole	700	34.5	45.0	23.5
	3–12–12	in hill	150	34.3	31.8	10.3
Plainfield	0–12–12	in hill	150	34.3	30.8	9.3
sand	No fertilizer			46.5	21.5	
Spangler Bros.	3–12–12 +	drilled	125			
Jefferson	10–10–10	plow sole	700	38.0	84.6	71.8
	10–10–10	plow sole	700	47.2	48.7	35.9
Fox	3–12–12	drilled	125	45.0	41.9	29.1
silt loam	No fertilizer			55.0	12.8	
					Silage Lbs. per Acre	Increase
Spangler Bros.	3–12–12 +	drilled	125			
Jefferson	10–10–10	plow sole	700		30,597	15,490
	10–10–10	plow sole	700		21,987	6,880
Fox	3–12–12	drilled	125		19,338	4,231
silt loam	No fertilizer				15,107	

* Calculated on 14 per cent moisture basis.

10 per cent potash will be found profitable. In figuring the profit from these heavy applications of fertilizer by the plow-sole method, we must give credit to the possible residual benefit which will carry over to the grain and legume seedings the year following corn. It is not fair to charge the entire cost of the fertilizer against the increases, in the corn yields alone. Our results have shown that on the thinner, poorer soils that will normally produce from 30 to 40 bushels per acre, we can expect a profitable return, even at market values, from an application of from 500 to 800 lbs. per acre of a 10-10-10 or 8-8-8 fertilizer. Starter fertilizer such as 2-12-6 or 3-12-12 is recommended at 75 to 100 lbs. per acre in the hill in addition to the plow-sole treatment. At present market prices for corn there is a greater possible margin of profit than will be the case when corn drops to 75¢ per bushel in years ahead. But bear in mind also that the cost of fertilizer materials, especially nitrogen, may likewise drop when the war is over.

There is one point to remember in connection with these heavy-rate applications of high-nitrogen fertilizers. We must bear in mind that the continuous cropping of our land year after year to corn, or any other soil-depleting crop, will very soon use up what little humus our soils now possess. And the danger lies in the fact that with these high-nitrogen fertilizers, we will be tempted to crop-crop-crop until our soils are worn out. We recommend clover in the rotation and the use of phosphate and potash fertilizer at the time of seeding down, and urge our livestock farmers to conserve carefully and return to their fields the plant food contained in their stable manure. Attention to erosion control by crop cover, strip cropping, and contour farming must be given, and all other soil conservation and crop-management practices must be followed.

However, the placement of fertilizer down on the plow sole at a depth of 5 to 8 inches in concentrated bands is a safe and sound idea. We know that the root systems of most all farm crops completely fill the surface plow layer and even go much deeper to secure adequate amounts of moisture to sustain growth during drouth periods. Plant foods to

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The Rauls hemp field and the plow-sole treated acre in mid-August; the strip on the right was not fertilized.

Where Do We Stand With Fertilizers?

By Ford S. Prince

University of New Hampshire, Durham, New Hampshire

IN the January issue of BETTER CROPS WITH PLANT FOOD, I discussed much of the research work in New England having to do with the relative responses of the three primary elements in plant growth, with a view of arriving at some conclusions as to how important each one is in our system of farming. This article is an attempt to summarize the information presented in the previous one and, insofar as possible, to present conclusions pertaining thereto.

In attempting to do this, thoughts like this came into the picture. What would happen in case it were not possible to get one of these elements for potato growing? When we think of fertilizers in New England, we generally associate them with potatoes, as such a large percentage of the fertilizer used in this region is applied to this crop; and every man, woman, and child is very dependent upon potatoes for his daily diet.

In the previous article we presented data from Maine, New Hampshire, and Connecticut, showing average yields of potatoes grown with no nitrogen, no phosphoric acid, and no potash, also yields where grown with an extra amount of each of these elements. In order to impress upon the general public the idea of supplying at all times ample fertilizer to this crop to avoid a serious potato shortage, we have taken the yield of potatoes for 1943 for Maine and for the remainder of New England and computed what the crop would have been had we been able to secure no nitrogen, phosphoric acid, or potash. We also have calculated what it would have been if more than normal amounts of each of these elements had been applied, assuming of course that in each case the other two elements would be present in normal amounts, which was the basis on which the yield variations were taken. These computations are presented in Table VI.

TABLE VI.—INFLUENCE OF DIFFERENT AMOUNTS OF NUTRIENTS ON POTATO YIELDS

Yield in Millions of Bushels

	Maine	Rest of New England	Total
Actual yield 1943	73.5	11.0	84.5
Yield without N	57.3	9.1	66.4
Yield with extra N	71.3	11.3	82.6
Yield without P_2O_5	53.7	7.7	61.4
Yield with extra P_2O_5	73.5	11.4	84.9
Yield without K_2O	25.8	6.6	32.4
Yield with extra K_2O	79.4	11.3	90.7

The New England States produced almost 85 million bushels of potatoes in 1943. Of these 73.5 million were grown in Maine. The calculated reductions or increases for the omission or for an extra amount of an element show that without any nitrogen our yield would have fallen from 84.5 million to 66.4 million, without phosphoric acid to 61.4 million, and without potash we would have been "in" for a potato famine with but 32.4 million bushels of potatoes. The data also indicate that we could have increased our yield slightly by applying additional phosphorus and that we could have brought the yield to over 90 million bushels by applying potash considerably in excess of normal amounts.

Feed for livestock is just as dependent upon fertilizers as are potatoes. Like potatoes, milk and other dairy products form a part of the daily diet of all of us. It is generally conceded that the best method of meeting the grain shortage, and one which every farmer can practice, is to increase the acreage and yield of all kinds of legume crops, because of their high protein content. These crops are very dependent upon potash and phosphoric acid for high yields.

these crops if each acre were fertilized with 300 pounds of an 0-20-20 fertilizer, over and above that which it now receives, if any. The increases are those which may be expected, not with one element, but by applying a balanced phosphoric acid-potash mixture, and under the assumption that the soil pH is high enough or contains lime enough so that this factor will not limit yields.

These figures, frankly, are partly estimates. For example, we have no data on the acreage or probable yield of a pure stand of ladino clover. But we do know that the acreage to ladino is assuming fairly large proportions, and our own data secured in 1943 would indicate that the unfertilized yield would be at least two tons per acre of oven-dry material whereas properly fertilized this yield would reach three tons. Hence the estimates may be too conservative. Insofar as possible, acreage and yields are drawn from census data, while the yields under the heading "Probable yield, properly fertilized" are based upon round figures representing averages from research data.

In the last column, Table VII, we have calculated from average analyses

TABLE VII.—NORMAL AND PROBABLE YIELDS OF LEGUMES

Crop	Acreage	Total Yield Normally Fertilized	Probable Yield Properly Fertilized	18% Grain Equivalent of Increase
	Acres	*Tons*	*Tons*	*Tons*
Alfalfa	49,000	85,000	122,000	32,000
Ladino clover	40,000	60,000	90,000	26,000
Red and alsike clover	120,000	180,000	270,000	60,000
Total	209,000	325,000	482,000	118,000

In Table VII we have listed the acreage of alfalfa in New England according to the last census. Normal yields are given for this crop, together with the estimated acreage and normal yield of red and alsike clover in hayfields and ladino clover in haylands and pastures.

Probable yields are also given for

the grain equivalent of the increased production of properly fertilized legumes. This is translated into an 18 per cent dairy ration, and the total of the increase amounts to the startling figure of 118,000 tons of dairy feed. At present costs this would be worth a little more than 7 million dollars. The increase could be accomplished with about 30,000 tons of 0-20-20 fertilizer, which would cost in the neighborhood of 1.4 million dollars. The farmers following this practice would save a little over 5 million dollars, to say nothing of easing the strain on our transportation system by more than 80,000 tons of freight.

These data apply merely to the acreage that is presumably already in legumes and do not include the possibility of extending and enlarging the legume acreage to meet our outstanding need. They show in effect that we could, by proper fertilization, save about one-sixth of all the grain we now purchase. Doubling the acreage and fertilizing adequately would mean a saving of a third or more in purchase of these concentrated feeds.

cows to feed and with more than a million head of cattle in the area, this need becomes apparent. Attention to pastures is doubtless just as important from the total forage standpoint as attention to legumes.

What would happen if it were possible to treat one-half acre of pasture for each cow in New England? If materials were available and if farmers were minded to do it, this would mean treating 350,000 acres of pasture at one time, land which is available and susceptible of improvement, too.

Drawing upon data in our previous article (Table V) and using only the data for the untreated and completely fertilized areas, we have constructed Table VIII which shows the possibilities in this respect.

The saving of as large a portion of the grain fed to dairy cows in New England by a method such as this is rather startling. One is tempted to ask, why hasn't it already been done? The answer is, it has on a few farms but up to this point it has been so easy to procure grain that farmers haven't needed to use a method that to them is relatively untried for one which, though more costly, has always worked.

Table VIII.—Normal and Probable Production of Pasture

	Total Yield Dry Matter	Total Yield Protein	Gain in Protein	Grain equivalent in 18% dairy ration
	Tons	*Tons*	*Tons*	*Tons*
Fertilized	437,500	78,750	53,375	296,765
Unfertilized	186,375	25,375	....	....

Nitrogen was purposely left out of the discussion on legumes here, not that it isn't often necessary or profitable to use, but because the response varies more or less with the amount of manure that has been applied, whether grasses have been used in the legume mixture, and like factors. That it is profitable to use, in general, is brought out later in discussing unit fertilizer responses in Table X.

There is never any question about the response for nitrogen when applied to permanent pastures, since in this case we are working with a mixed stand of grasses and clovers. Like the legume situation, an abundance of fertilizers could mean a great deal just now in New England if we had improved or could improve an acre or even one-half acre of pasture for each cow by top-dressing. With 700,000

This material has been presented in some detail for two reasons: First, to indicate how dependent we are upon fertilizers in this area at all times and especially in a crisis; Second, to point out that since we are so dependent upon them, it might be desirable in the future to look forward to building-up stockpiles of these strategic materials in the area.

Since we have suggested the building-up of stockpiles of fertilizer materials, it may be of interest to go further with this study to indicate, if possible, where emphasis should be placed in this connection. Here again it will be necessary to resort to the research data to evaluate the relative responses of the three elements involved.

To do this it appears necessary to eliminate the law of diminishing returns, which if taken into consideration would require the use of more data than have as yet been assembled. There is some compensation in this idea, however, for it makes the job much simpler.

Inasmuch as in this summary we discussed the potato crop first, we present those data first. In order to simplify the material, flat averages of responses in Maine, New Hampshire, and Connecticut are taken in constructing the table, and these only for amounts up to one ton of normal fertilizer.

Perhaps it may be well to repeat that the values in Table IX are flat averages for response of each element when increased from zero to four units of nitrogen, and from zero to eight units of phosphoric acid, and from zero to seven units of potash.

Like calculations have been made for legumes from data which have previously been reviewed. In this case we have taken the liberty to compute values for a combination of one unit each of P_2O_5 and K_2O in addition to their separate value, since much of this work indicates that balance is of especial importance with these two elements in legume production.

These caluculations are listed in Table X. The data are all from New Hampshire, since our work has been so arranged and conducted that the separate values can easily be obtained. Besides, we sometimes feel a little safer when we are playing on our own home grounds. The data, however, cover several experiments and contain an average of 13 values for nitrogen, 16 for phosphoric acid, 15 for potash, and 5 for the PK combination.

Increases for units of nitrogen may

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TABLE IX.—UNIT RESPONSE FOR FERTILIZER MATERIALS UPON POTATOES.

Element	Response per Unit	Value of Response	Cost per Unit	Net over Cost
	Bushels	*Dollars*	*Dollars*	*Dollars*
N........................	15	20.25	2.50	17.75
P........................	11	14.85	1.40	13.45
K........................	22	29.70	.90	28.80

The data in Table IX show the story for potatoes. Fertilizer costs have been calculated in this and succeeding tables at $40.00 per ton for nitrate of soda, $28.00 per ton for 20 per cent superphosphate, $48.00 for 60 per cent muriate of potash, and potato prices have been calculated at $1.35 per bushel.

TABLE X.—RETURNS FROM DIFFERENT NUTRIENTS ON HAY

Element	Increase Hay per Unit	Value of Increase	Cost of Fertilizer per Unit	Gain over Cost
	Pounds	*Dollars*	*Dollars*	*Dollars*
N........................	519	5.19	2.50	2.69
P........................	128	1.28	1.40	−.12
K........................	417	4.17	.90	3.27
PK (one each).............	464	4.64	2.30	2.34

In 1942, 70 per cent of the dairy farms in Tennessee grew alfalfa, as compared with 27 per cent in 1936. Increased use of lime and fertilizer, including borax, is the chief contributing factor.

The Use of Borax in the Legume-Livestock Program of the South

By H. E. Hendricks

Extension Agronomist, University of Tennessee, Knoxville, Tennessee

COMPREHENSIVE information on the use of borax in the legume-livestock program is not available for many important agricultural areas in the South. The South is by no means a uniform section of the country. The climate, soils, topography, and even the people themselves differ greatly. These and other factors contribute to a variable agriculture. Final conclusions of just how and where the use of borax is important in growing legumes and livestock, accordingly, are not justified.

In Tennessee alone, for example, the Unaka Mountain area has a climatic and growing season similar to that around Chicago. Many different conditions can be seen in the 550 miles across the State to the Mississippi delta cotton-growing country. There are successful livestock farmers in all these areas of major differences, and the most successful now follow about the same pattern of legume forage production.

Tennessee conditions have been covered fairly well with test demonstrations, using borax on legumes; and conditions in parts of most of the other Southern States compare with conditions in certain parts of Tennessee. This discussion, therefore, will be confined chiefly to Tennessee, as indicative, at least, of what may be expected elsewhere.

It is a very well-known fact that in the last few years the Southern States have been making gradual but significant advancements in agriculture. This has been brought about principally by an increase in forage production, both hay and pasture, and an increase in the numbers of livestock on farms.

To illustrate, the increase in hay production, between 1936-42, was 51% in 11 Southern States (excluding Texas and Oklahoma), whereas, in the United States as a whole, the increase was only 18%. This has been reflected in the number of forage-consuming animals kept on Southern farms, and the trend is increasing the productivity of the land.

During this same period, the dairy and beef cattle numbers increased in the Southern States 15%, while in the United States as a whole, the increase was only 8%. Grain production during this time did not increase significantly in the South. The increase in cattle numbers has been made possible almost entirely by the increase in hay and pasture. The cattle on Southern farms have also been fed better, as indicated by the fact that the hay consumed per hay-consuming animal unit has increased 38%, whereas in the United States as a whole, the increase was only 1%. The grain feeding remained about the same.

Since the South can not compete successfully with other sections of the country in grain production, it must take advantage of the more favorable long growing season in the production of forage. To utilize this climatic advantage most successfully, at least two distinct disadvantages must be overcome; the first, the naturally infertile and impoverished soil of the major portion of the area; and second, the severe drouth normally experienced some time during the summer, the effect of which is naturally much worse on thin land.

To overcome this first disadvantage, the use of limestone and fertilizer has been greatly increased. In Tennessee, for example, the use of limestone from 1936-42 increased over 200%, and the use of fertilizer increased approximately 100%. This increase in lime and fertilizer use is enabling the growth of forage crops which will better withstand the hot, dry periods of summer and the production of pasture crops through the winter months, thus providing grazing intermittently throughout the year.

In Tennessee this more diversified forage production program is essential to safeguard the livestock farmer by as-

Without borax, alfalfa stands soon deteriorate on thin or infertile land. This Rhea county field is in its second year. Note dense stand at left, treated with borax; thin stand at right, untreated.

Potash and borax, as well as limestone and phosphate, are necessary for successful alfalfa production in Tennessee, as indicated by this Knox county field. Left, potash and borax added at the rate of 100 lbs. muriate and 25 lbs. borax.

suring adequate nutritious roughage to tide him over unfavorable seasons. Accordingly, livestock farmers have been advised to provide themselves with feed insurance by producing moderate acreages of alfalfa for both hay and pasture, and also as much other winter-grazing crops, including crimson clover and small grains, as their land and other facilities will permit. The acreage of these crops, especially alfalfa, has increased materially during the past few years. The use of borax is believed to be partly responsible for this increase and is expected to play a greater part in still further expanding that acreage.

In 1936, a study of 472 farms classified as dairy farms was made to determine their forage production program. At that time, 27% of these dairy farms grew alfalfa, averaging one-fourth acre for each cow on the farm. In 1942, 70% of these same dairy farms grew alfalfa, averaging .4 acre per cow. During this period, the total milk production in Tennessee has increased 22%, in comparison with 14% increase for the Southern States and 16% for the United States as a whole.

In 1938, it was concluded that the acreage of alfalfa in Tennessee could not continue to be increased because profitable yields were not obtained over a long enough period to justify the cost of establishing a stand. It has now been proved that a major cause of failure was boron deficiency; and that by the use of borax along with limestone and fertilizer, alfalfa can be grown more successfully on the farms that had been growing it, and furthermore, that the acreage can be expanded successfully to farms and to types of soil upon which alfalfa could not be grown profitably before borax application entered the Tennessee program of agriculture.

In 1942, reports of the hay yields from 43 field demonstrations scattered over the State from the Unaka Mountains in East Tennessee to the Mississippi River were obtained. These fields were located on what may be termed, for Tennessee, good alfalfa land. The soil had all been limed, and phosphate was added where needed. The addition of 20 pounds of borax per acre increased the yield of hay on an average 26%. Tennessee farmers have never used much potash, but on these demonstrations, where 200 pounds of muriate of potash were used in addition to the borax, the increase in yield was 42%.

County Agents of Tennessee were asked how they thought the use of borax was going to affect the legume-livestock production in their particular counties. A few of their replies may be cited as typical. M. L. Alphin of Hardeman county, a West Tennessee cotton county, bordering the State of Mississippi, wrote: "It is a well-understood fact that no livestock program can be any better than the feed produced for that livestock. Hardeman county is no exception to the rule that applies to all major cotton counties, and feed has been a very limiting factor in the livestock program. Feed, or the absence of it, can very easily determine the side of the ledger on which the red marks will appear.

"The experience of all of our demonstrators has been very good to excellent when borax was applied to alfalfa and red clover. Mr. E. F. Daniel, of the Saulsbury community, says that it means the difference between three tons of alfalfa hay per acre and practically no hay per acre. The experience that he has had has already been directly responsible for three other farmers applying borax to their alfalfa. This same experience has been very evident on all other demonstrations except one. This particular alfalfa demonstration was on real good land and has had almost every available kind of fertilizer applied except borax.

"It seems that with the good start we are getting with borax it will mean that we can grow feed for livestock on a par with farmers in the corn belt and others with high-producing land. We would like to try borax on pastures to determine if it will help our grasses to stand the summer dry season, and if that should prove effective, I think it would mean more toward improving the livestock program than anything since the land was cleared years ago.

"The results of using borax have been most gratifying and I think we have just started in the field of fertilizer research."

Mr. Alphin's perspective toward a livestock program based on local feed production appears to be sound.

From the letter received from County Agent Amos in the Upper East

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S. F. Conner, Dayton, Tenn., the first farmer in Tennessee to use borax on alfalfa, tells Dr. J. W. Turrentine, President, American Potash Institute, how borax and potash have affected his alfalfa and, consequently, his dairy production.

August Pasquali poses in front of his farm home. Part of the barns is visible in the background.

Coalgate, Okla., Farm No "Lucky Streak"

By A. D. Bull

Soil Conservation Service, Atoka, Oklahoma

GRAIN sorghums grew so tall that they could not be cut with a corn binder and were grown with the light rainfall that came in 1943, one of the worst drought years in the past ten in Oklahoma. This is a true story coming from the August Pasquali farm three and one-half miles east of Coalgate.

Pasquali's farm is different from the average eastern Oklahoma farm because it glitters with the fortifications of modernization. It supports a beautiful home of native stone and a flock of big, red barns for the beef cattle, the dairy cattle, and the hogs. There are special farm machinery sheds, a milk house, a garage, and a work shop. There are more than $25,000 worth of farm buildings in addition to the investment in fences, farm machinery, livestock, farm ponds, the water-sewage system, and the finger-tip conveniences that are to be found everywhere.

No ordinary farm can support such an outlay. Pasquali's is no ordinary farm. It has a history that is as thrilling as the story of the discovery of gold in the Klondike. Here is a farm made by a man who discovered that there is gold-dollar wealth in the soil—if the soil is conserved and improved—if the soil is worked as a factory and not as a mine.

Twenty-four years ago August Pasquali was fumbling with the English language, running the gauntlet for a passport, and spending the money that his brother had sent him from Coalgate to buy passage to the United States. No one ever wanted to leave the fatherland more than he; Pasquali had visualized no opportunity in the lands of Italy for a sheepherder.

Starting From Scratch

In the United States he found it so different. Here, personal initiative really counted; one actually could do according to his own choosing and make the most out of it. August started the hard way. First he was a coal miner, digging coal, and in this way paid his brother for the ticket to this new freedom. From 1911 he worked in the mines and during the first World War he was employed as "shotman," very dangerous mine work. The pick and shovel and the coal dust were good enough for a while, but here one did not have to dig coal always, unless one wanted to. August put in a small store and began selling groceries, meats, and milk to his fellow miners, but always he had to buy the meat and the milk; sometimes the quality was not so good. Why, he thought, could he not produce them himself. In 1920 Pasquali bought a farm.

Then it was just an ordinary farm, a piece of land owned and farmed by others for more than 40 years—land that already had suffered from soil depletion and soil erosion. The problem of operating the farm was so completely different from anything that Pasquali had previously done that he had to learn everything from the very beginning. It kindled in his mind a hunger for knowledge about agriculture. Again he thought, why could not anybody get this information when the Department of Agriculture had made it so easy, with a county farm agent right there in Coalgate. From the county agent August had his first insight into the complications of agriculture.

Other farmers were contented to farm as their fathers had, but August observed that their methods were not those outlined by the Department of Agriculture. The soil was washing away; everybody knew it, but few did anything about it.

"Why let the land wash away and be destroyed by gullies when terracing will protect the soil?" asked the county agent.

August was convinced, and they went to the farm with rod and level. He began building a terrace wherever a stake was set. Lee Craig became county farm agent, and the farm building program went on. Then in the rain, neighbors recall, August could be seen with slicker about his shoulders, shovel in hand, wandering over the fields to see that each terrace was doing its work and that every row, which ran with the terraces, was holding that vital rain water where it fell.

One day August pulled up a chair to the county agent's desk and said apologetically, "Mr. Craig, my alfalfa all died!"

"What have you been trying to do?" exclaimed the agent, "Alfalfa will not grow on those upland soils of yours."

"Why not," questioned August, "Can't we make soil grow it?"

Out to the farm again, went August and, this time, Mr. Craig. They went carefully over the field and gathered samples of the soil. Many things were found to be wrong. The soil was acid in reaction, low in lime, low in organic matter, and very low in phosphates.

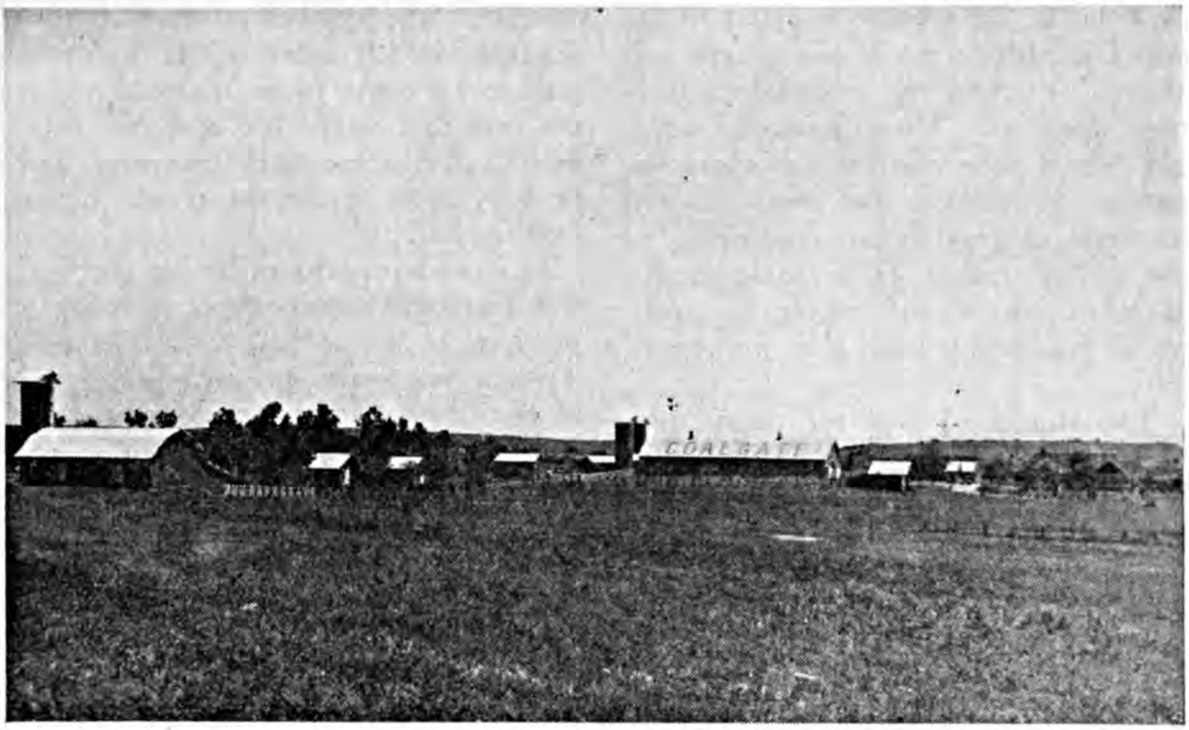
"That Crazy Italian"

Then August Pasquali began another venture. He began adding minerals to the soil—the very minerals that had been removed by soil erosion and soil depletion. First he added lime, tons and tons of it, to counteract soil acidity. Then later he added, according to instructions, sack after sack of phosphate fertilizer. He applied all the manure from the barn and even got some from neighboring farms where it would not be used. Some of his neighbors disapproved by saying, "That Italian is crazy—costs more'n it's worth to go haul and spread that manure."

A couple of years later August had good alfalfa where alfalfa never grew before. He was headed in the right direction, working with nature, adding those things which had been robbed from the soil and also protecting it from soil erosion. Many farmers were contented to grow cane, a low protein feed, when their soils would no longer grow corn, but not Pasquali. He was not satisfied with less than alfalfa.

bought more livestock. He kept going, this way, until he owned and operated a square mile of farm and ranch land stocked with cattle and hogs. Actually his business had grown beyond his own imagination. His farm was paying off, and paying off well. The store was paying off, too, because the people of Coalgate were buying his quality products grown on his farm.

Few farms have more finger-tip, labor-saving devices than this one. Pasquali feeds 100 hogs in one minute. This feeding process begins in the milk house where skimmed milk, spilled from the separator into an upright pipe, is picked up by compressed air and



Farmstead as seen from the highway looking toward the southeast. A large farm pond is behind barn on the left. Terraces are visible in foreground.

Increased yield in everything was his reward. He needed more livestock to use up the feed. The livestock needed protection. The building program started, big barn and silo, a barn for the beef cattle, another for the dairy cattle, one for the hogs, and a manure pit so that everything could be held and returned to the soil.

August Pasquali never seemed to make things come out even. He had either too much livestock and bought more land or had too much land and

shoved 800 feet up the hill and poured into a square concrete tank in the center of the long hog barn. Later the grain mix is dumped in. When the swill is ready for feeding, two eight-inch gate valves are opened and the swill is allowed to spill into long hog troughs. It takes only a minute, but that is long enough to feed 100 hogs and each has a chance to get his share of the feed.

Most striking feature on the Pasquali

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Efficient Fertilizers For Potato Farms

By S. D. Gray

Washington, D. C.

THE nation's commercial potato farms are rapidly approaching 100 per cent production capacity, if measured by the number of acres utilized. Even greater capacity may be expected in 1944, if the acreage adapted to potatoes is utilized more intensively and adjusted to meet the tremendous wartime demand. There probably never has been a time when it was more important to follow the most efficient methods of production, employing to the fullest extent farm management practices which will result in maximum production with a minimum of labor.

The suggested goal for potato production in 1944 is 3,519,000 acres for the country as a whole. This represents an increase over 1943 of approximately 2 per cent.

Increased Production

In the achievement of the increased acreage and production goals that have been established in the face of a scarcity of labor, machinery, and other essentials, there will be need for clear thinking and planning. Those in authority have a big responsibility. To the layman, the mere increase in acreage presents no problem. To the man of experience, however, it becomes a matter of great concern. He knows that the large commercial growers already have under cultivation about the maximum number of acres adapted to potatoes that their farms will permit. He knows that the small growers cannot greatly expand their acreage, even if well adapted, because of prevailing restrictions on machinery and equipment that would be needed. While undoubtedly much of the acreage increase will have to come from the larger group of small operators, the desired increase in production, which after all is the true goal, must come from increased yields per acre due to the use of better seed, better cultivation and spraying, and perhaps most important of all, better fertilization.

In considering the matter of fertilization from the standpoint of increase in production, let us look at the record. Twenty-five years ago an efficient use of fertilizers on potatoes could not be fully realized because of lack of a suitable planter-distributor. The small-acreage farmers opened the rows with a one-horse plow or other tool, applied the fertilizer by hand, dragged a chain or cultivator through the furrow to mix the fertilizer, dropped the potatoes by hand, and covered with a plow or cultivator. The so-called commercial grower if he were progressive may have used the old Eureka two-row fertilizer-distributor marker which marked out the rows and applied the fertilizer. He then followed with a horse-drawn potato planter. In either case, the seed piece was in such close contact with the fertilizer that injury was frequently serious. Under such conditions, growers became indifferent to the use of fertilizer and this was reflected in low average yields as well as farm income.

With the development of the combination planter-distributor, to which the late Fred H. Bateman of the Iron

Age Equipment Company gave so much of his life, the use of commercial fertilizers for potatoes took on a new significance. The pioneering of Mr. Bateman in the perfection of the band method of applying fertilizer not only made it possible to increase potato yields by more liberal use of fertilizer, but served to stimulate enormously the growth and expansion of the industry. Today, almost every potato grower boasts of at least one modern potato planter, and no longer does he harbor that old-time fear of injury from fertilizer use. Applications of high analysis fertilizers in amounts varying from 1,000 to 2,500 pounds per acre are not uncommon in many important potato-growing areas.

Methods of Fertilizer Application

When the band method of application was first developed, potato fertilizers seldom carried more than 16 units of plant food. One of the very popular mixtures at that time was a 4-8-5, and much smaller amounts per acre were applied than today. Little by little research work at the agricultural experiment stations not only showed that larger amounts of fertilizer could be used with safety, but that potatoes definitely needed more potash than was ordinarily used. In most of the official recommendations of today, potato analyses carry from two to three times as much potash as nitrogen, and usually the phosphorus content of the mixtures is intermediate between nitrogen and potash. In areas where potatoes are grown in a grain-hay rotation, it is generally believed that potato mixtures should have about equal amounts of phosphorus and potash, especially when the rate of application is on the average less than 1,000 pounds per acre.

As larger amounts of fertilizer per acre and higher potash ratios have been established by research, some difficulties have been encountered, even where the approved band-application method has been employed. Occasionally, on soils low in organic matter or in seasons of low rainfall, during the early stages of growth fertilizer injury has been observed quite frequently. Realizing that high yields depend upon abundant fertilizer in the right ratios, yet conscious of the fact that the full benefit from its use cannot be realized when injury is being sustained, scientists have been prompted to continue their research on methods of application. The band principle having made such contributions to this field in the beginning, the first thought was to modify it in such a way as to place a part of the fertilizer somewhat deeper in one band than in the other. Results of these approaches have been extremely encouraging and it is now possible when purchasing a planter to secure fertilizer attachments designed to place part of the fertilizer in a shallow band and part several inches deeper. Commercially the attachments are called Hi-Lo.

To all intents and purposes the Hi-Lo attachment for applying fertilizer is just about perfect. It does not, however, work too well in rocky or rooty soil, and this should be kept in mind. To abridge this difficulty and at the same time avail ourselves of the obvious advantages of the Hi-Lo principle of fertilizer application, scientists have further modified their experimental plans. In this work fertilizer placement studies have been quite generally about as follows:

1. Ordinary equal depth bands two inches to each side and slightly below the level of the seed piece.
2. Hi-Lo varying the proportions of the fertilizer in each band.
3. Drilling the fertilizer deep with grain drill.
4. Broadcasting varying amounts of the total fertilizer application before plowing with balance in bands at planting time.
5. Plow-sole (furrow) application of varying amounts of the total application by using the I.H.C. plow-under attachment with the balance in bands at planting time.

Results of these approaches have been of tremendous value and interest. Briefly, it might be concluded that with ideal moisture conditions during the early growth period the equal depth band placement of fertilizer is entirely satisfactory. However, since no one can anticipate or predict ideal moisture conditions, the modified Hi-Lo band-placement method is more certain and should certainly be employed where soil conditions permit. Because Hi-Lo does not work too satisfactorily where there are many stones, roots, or coarse debris as in old tufted sods, plowing under from one-half to three-fourths of the total fertilizer with the balance in bands at planting time would seem to offer the best opportunity for increased yields under average conditions of soils and rainfall. Broadcasting or drilling the fertilizer has not been found advantageous.

Of interest perhaps at this point would be a summary of four years of fertilizer demonstrations conducted by the writer in cooperation with the Pennsylvania Cooperative Potato Growers' Association for the period between 1937-1940 and published in the January 1941 issue of "The Guide Post." This work conducted on 12 typical potato farms, representative of the important potato-growing sections of the State, is presented in condensed form in Table I.

TABLE I.—AVERAGE 4-YEAR RESULTS FOR PENNSYLVANIA POTATOES

Plot	Fertilizer*	Yield bu. per acre	Bushels increase over basic treatment
1	5–10–10........	247.80	
2	Basic treatment plus 150 lbs. 60% muriate.	285.92	38.12
3	Basic treatment plus 300 lbs. 60% muriate.	259.60	11.80
4	0–10–10**......	273.29	25.49

* Basic treatment in amount to supply 200 lbs. total plant food.

** Sufficient to raise 1:2:2 to a 1:3:3 ratio.

In 1942, fertilizer tests were conducted at the National Farm School, Doylestown, Pennsylvania, and at the Philadelphia County Prison Farm near Torresdale, Pennsylvania. In the tests at Doylestown plots 1, 2, and 3, Table II, had all fertilizer applied by the band method. On plot 4, 800 pounds of the fertilizer were broadcast and plowed down with 200 pounds in bands at planting time. On one-half of each plot 200 pounds of muriate of potash were broadcast before the ground was plowed. The results speak for the treatments involved.

The decreases in yields in plots 2 and 3 were definitely attributable to fertilizer injury, but where 800 pounds were plowed under in plot 4, with only 200 pounds in bands at planting time, injury was avoided and the yields were significantly increased. Column 5 shows that where extra potash was

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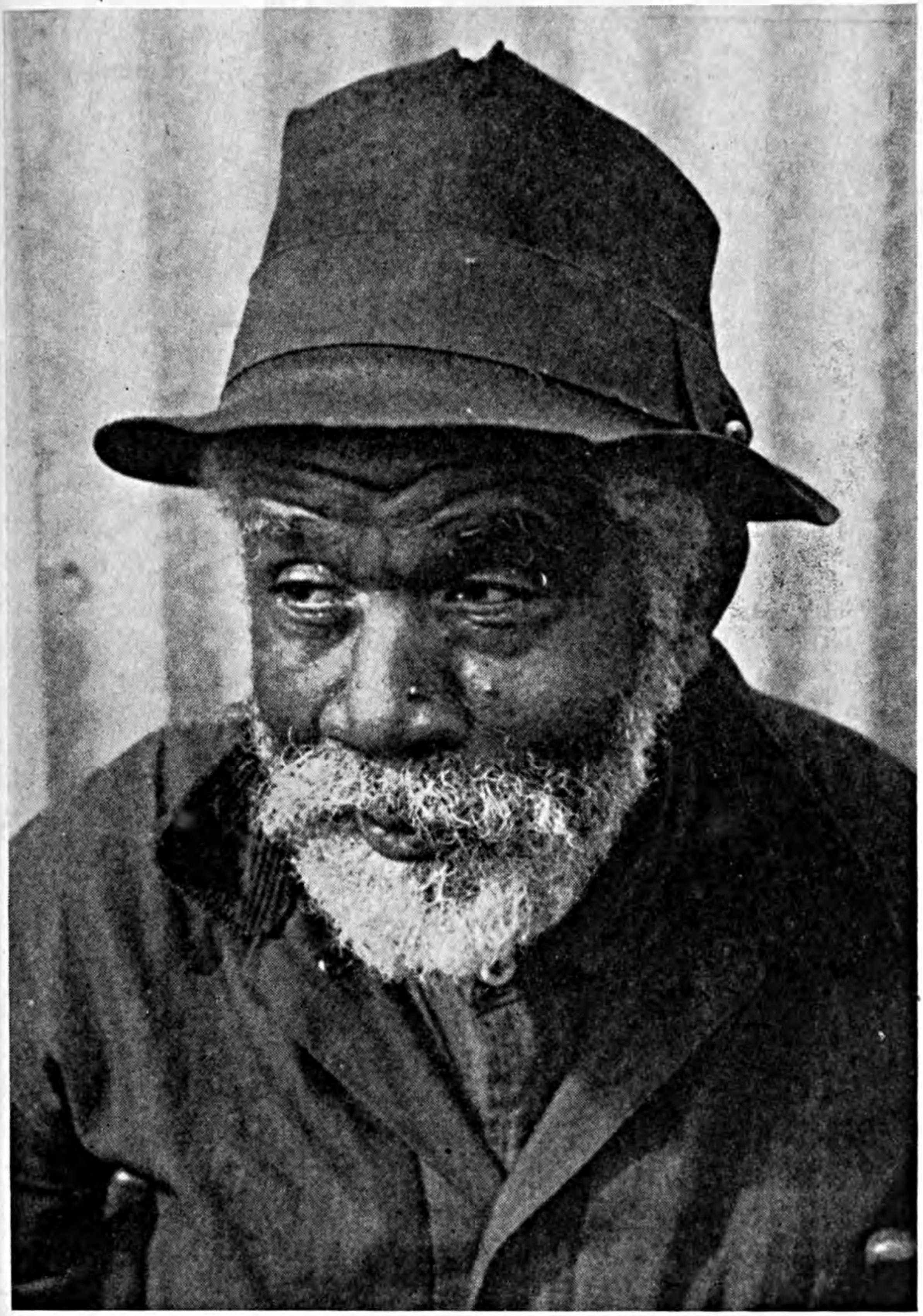
TABLE II.—1942 POTATO FERTILIZER EXPERIMENT, NATIONAL FARM SCHOOL, DOYLESTOWN, PENNSYLVANIA

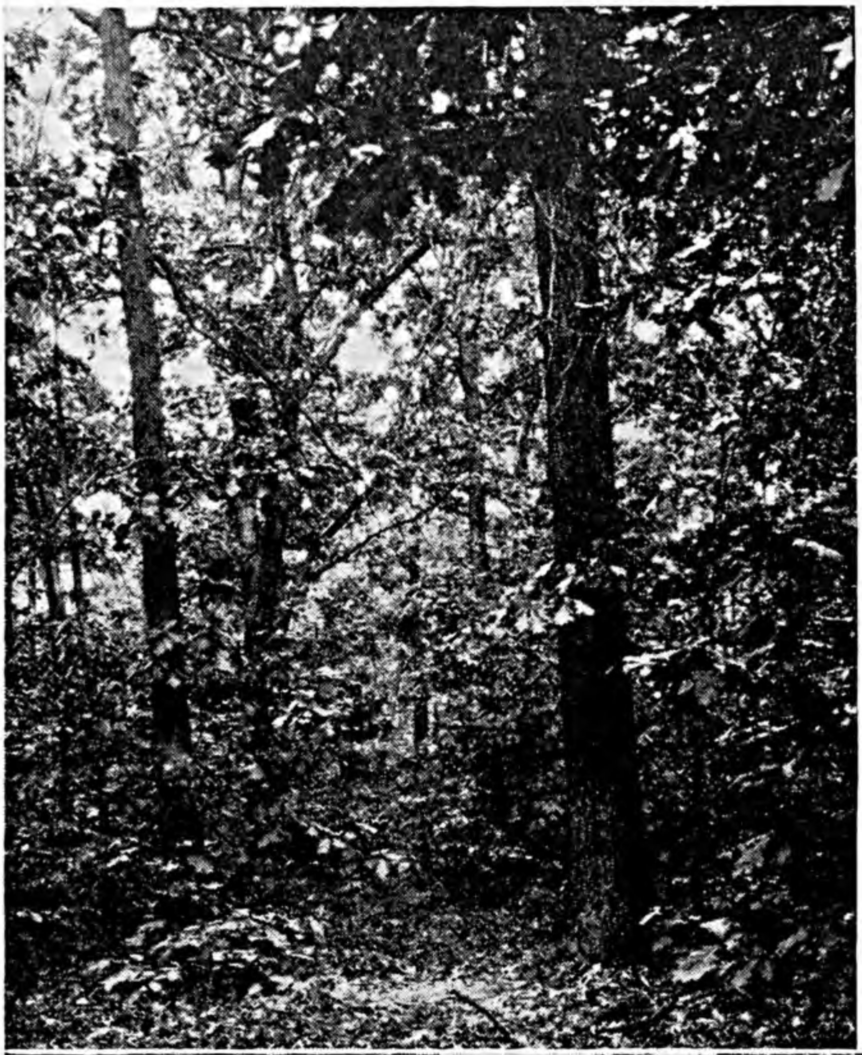
Plot	Fertilizer analyses	Rate applied	Yield—bushels per acre standard method	Yield—bushels per acre plus 200 lbs. muriate broadcast
1	4–8–8	1,000	177.8	202.2
2	4–12–12	1,000	158.5	180.4
3	4–16–16	1,000	155.8	215.9
4	4–12–12	1,000	215.9	174.9*

* This plot injured by water and so has no value.

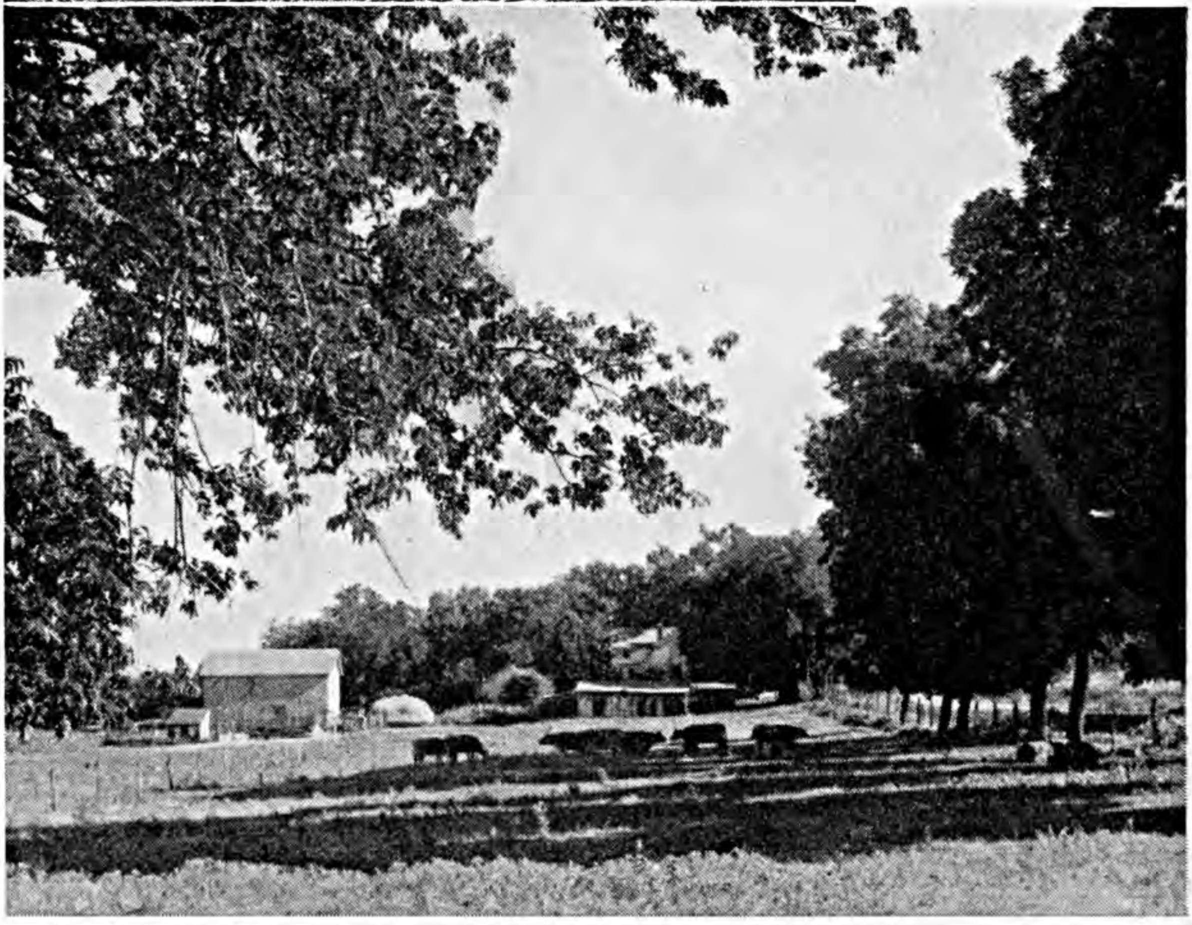
PICTORIAL



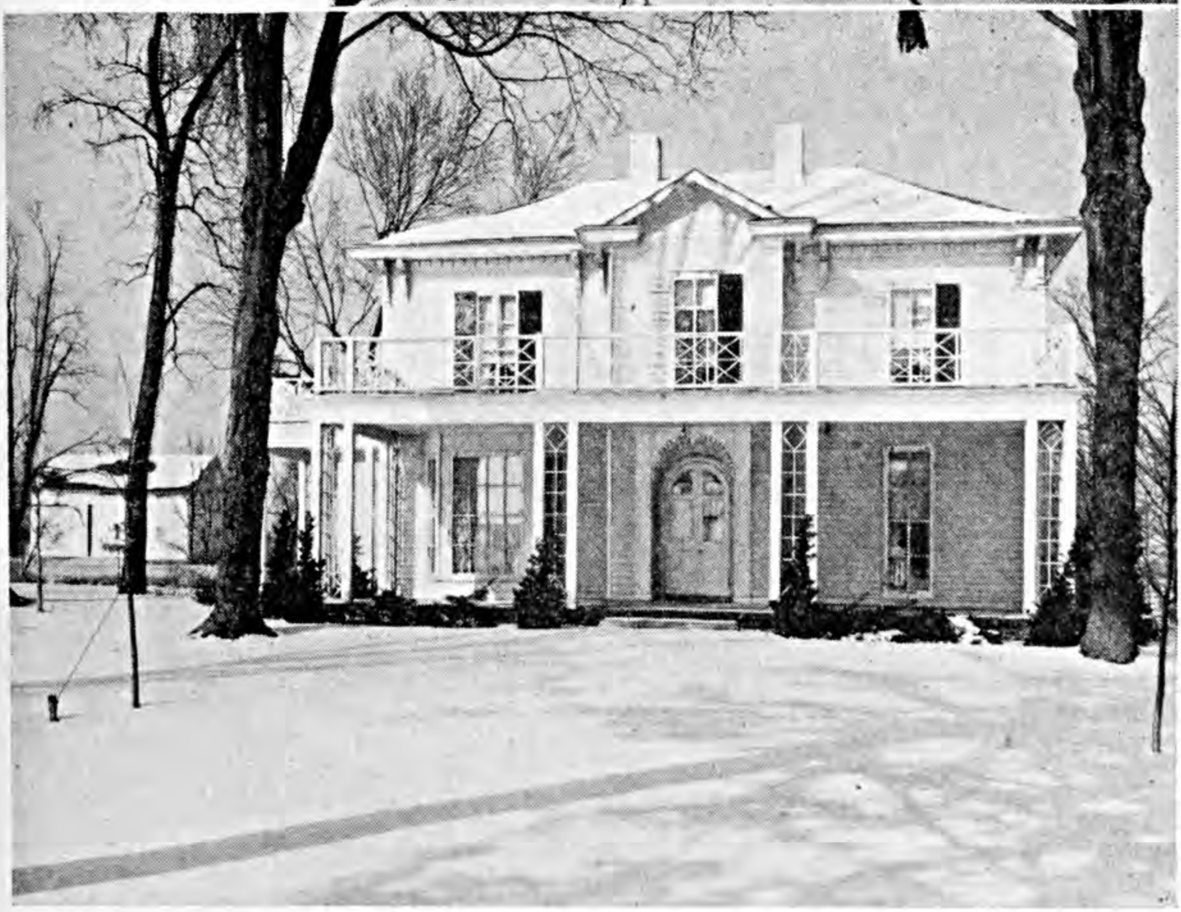
THE LOOK THAT COMES ONLY FROM EXPERIENCE

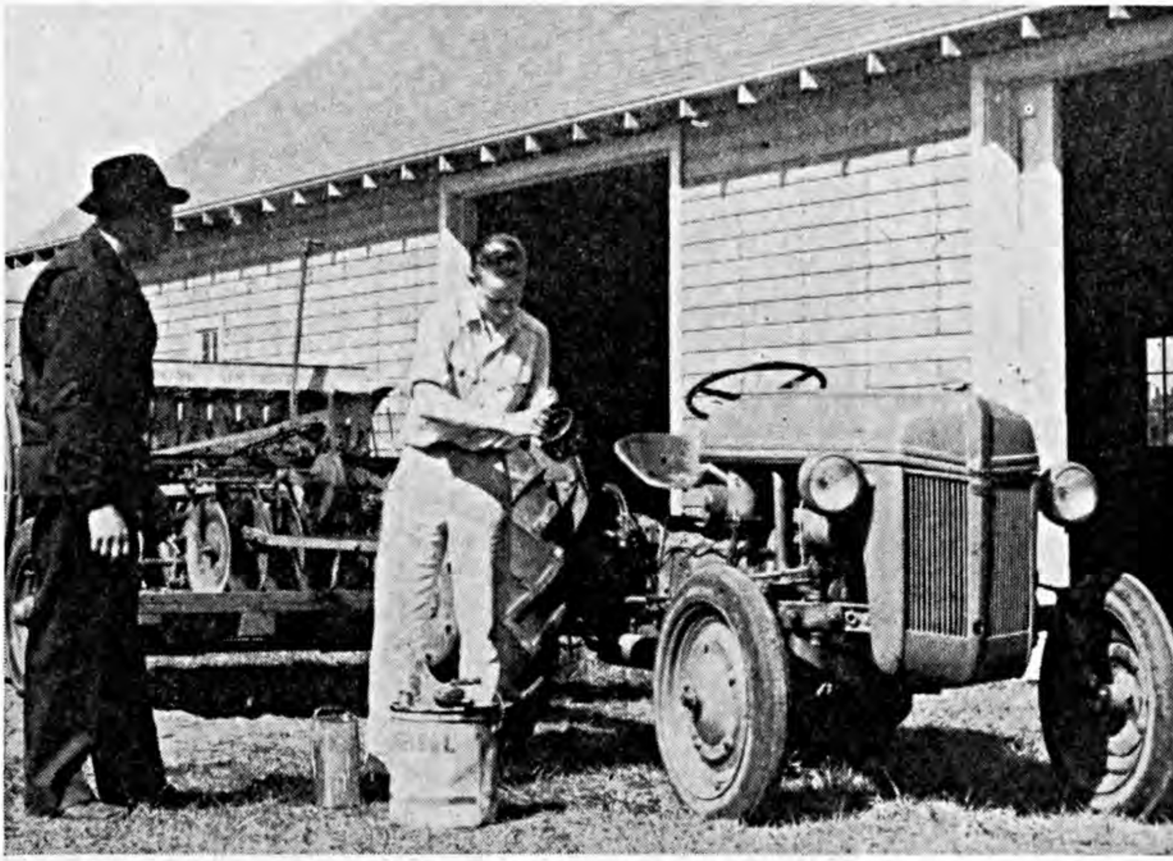


Summer



Winter





Future Farmers of Union high school, Canby, Oregon, recently made the final payment on $3802.50 worth of farm equipment, purchased during the past three years.

Above: Raymond Olson changes oil in the air cleaner on tractor before taking the machine home to use in an agriculture project. George Pope, F.F.A. advisor, checks on the job.

Below: Future Farmers watch their treasurer make out a check in payment for the Case combine harvester in the background.

The Editors Talk

American Agriculture To Get More Potash

With the approach of the planting season, concern over supplies of potash adequate to meet the huge 1944 production goals for food, feed, fibre, and oil-bearing crops has steadily increased. This concern did not arise from the possibility that any such situation as existed during World War I, when virtually no potash could be obtained and prices rose from $35 to $500 per ton, would be encountered. The American Potash Industry, developed since the last war, safeguards against a repetition of any such situation. Rather the concern stemmed from the fact that, due to Lend-Lease commitments and increased demands from the chemical industries, apparently there would be about 10% less potash than last year, available to properly balance the supplies of nitrogen and phosphoric acid which were being increased to meet the greater 1944 production goals.

The recent announcement of the War Production Board that approximately 200,000 tons additional potash salts were being allocated for fertilizer use in the United States, Puerto Rico, and Hawaii, therefore, was good news for American farmers. This Period 3 allocation is equivalent to about 100,000 tons K_2O and added to that previously allocated provides a total of 580,000 tons K_2O for American agriculture during the current crop year. This total exceeds by 25,000 tons K_2O the average of that delivered for agriculture during the preceding two crop years, the basis of allocations.

These additional supplies are the result of the cancellation of a part of Lend-Lease exports and added production through increased efficiencies on the part of the American Potash Industry. The tonnage is being delivered to the fertilizer industry for distribution to farmers.

For the greatly expanded chemical industries, there have been allocated nearly 100,000 tons K_2O, a four-fold increase over pre-war usage.

Canada is also sharing in the increased supply, being allocated a total of 39,000 tons K_2O for the year. Other exports, including Lend-Lease, have been given a total allocation of about 26,000 tons K_2O. The potash thus allocated during the 1943-1944 year exceeds 745,000 tons K_2O.

The details on the allocation are as follows:

TOTAL POTASH ALLOCATIONS 1943-44

	Short Tons K_2O
Agriculture in U. S., Puerto Rico, & Hawaii	580,027
Chemical Industries	99,723
Canada	39,000
Export	26,432
Total	745,182

BREAKDOWN OF AGRICULTURAL ALLOCATION

	Salts Tons	Equivalent K_2O Tons
60% Muriate	702,308	421,384
50% Muriate	97,334	48,667
Sulphates	141,112	51,915
Manure Salts	232,244	58,061
Total	1,172,998	580,027

These figures must have been good news also to the advisory forces who have consistently and conscientiously deprecated the lowering of potash in fertilizer formulas established and recommended after years of official research and experimental work. Even though some of the additional potash may be delivered too late for use in fertilizers that already have been mixed for early-season application, extra potash in many cases can be used as a top- or side-dressing to supplement low-potash analyses used at planting time. Thus can be brought into balance many of the mixtures which were made up under the earlier apprehensions of lower potash supplies.

Victory Gardens 1944

The first rounds in America's 1944 Victory Garden campaign have been fired. Goals have been announced; seed catalogs have been circulated; seed ordered early has been received; and fertilizers and insecticides have been assured.

Final reports on the "carry-through" by Victory Gardeners last year instill a belief that this year's goals will be met. Some 20 million gardens last year produced 8 million tons of vegetables or nearly one-half the total produced in the entire country. This year the call is for 22 million gardens—16 million urban and 6 million farm gardens. The value of the garden effort last year is valued at more than $2,000,000,000 of the Nation's food bill.

Recently announced was the fact that the civilian supply of canned fruits will be cut 43% and canned vegetables 19% during 1944. To those who met some discouragement with their gardens last year, this should give added impetus to work harder and overcome their mistakes. There is infinite satisfaction in triumph over difficulties, and as anyone with any experience knows, nothing connected with agriculture is a one-year proposition.

At its conference in Detroit, the National Victory Garden Institute adopted as its objectives for 1944:

1—22,000,000 Victory Gardens in 1944.

2—To encourage the preservation, storing, and conservation of home-grown and surplus vegetables and fruits with a goal of 26,000,000 home preserves in 1944.

3—A vegetable and fruit garden for every family that has suitable soil and a sunny site.

4—To encourage company, community, and school gardens wherever they can be successfully grown.

5—To supplement rather than to duplicate the efforts of existing agencies and organizations.

6—To act as a clearing-house for Victory Garden activities and information.

7—The encouragement of gardening as a recreation as well as a means of providing food and beauty.

That these objectives are most commendable is obvious; that they will be adopted by everyone interested in the welfare of his Nation, his community, and himself also is obvious. The Victory Garden campaign for 1944 is off to a good start.

"The production of food from the Victory Garden is not its only value. Victory Gardens save transportation; they save containers; they save manpower in many ways. All these are critical."—*Judge Marvin Jones, War Food Administrator.*

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
January	19.74	35.1	117.8	121.4	88.0	117.5	11.20	44.34	....
February	19.68	18.2	125.7	129.8	90.4	119.5	11.94	44.88	....
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.30	....
Index Numbers (1910-14 = 100)									
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
January	159	338	169	139	136	134	94	205	215
February	159	175	181	148	140	136	100	208	301
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	242	231

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
January	1.75	1.42	5.68	5.77	3.34	4.86	6.53
February	1.75	1.42	5.83	5.77	3.34	4.86	6.53
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
January	65	50	162	163	110	144	186
February	65	50	167	163	110	144	186
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14........	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922..........	.566	3.12	6.90	.632	.904	23.87	....	.508
1923..........	.550	3.08	7.50	.588	.836	23.32	....	.474
1924..........	.502	2.31	6.60	.582	.860	23.72	....	.472
1925..........	.600	2.44	6.16	.584	.860	23.72	....	.483
1926..........	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927..........	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928..........	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929..........	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930..........	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931..........	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932..........	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933..........	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934..........	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935..........	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936..........	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937..........	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938..........	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939..........	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940..........	.516	1.90	5.50	.517	.730	....	.573	....
1941..........	.547	1.94	5.64	.522	.779	25.55	.570	....
1942..........	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
January.....	.600	2.00	5.90	.535	.817	26.00	.210	....
February....	.600	2.00	5.90	.535	.817	26.00	.210	....
March......	.608	2.00	5.90	.535	.817	26.00	.210	....
April.......	.640	2.00	5.90	.535	.817	26.00	.210	....
May........	.640	2.00	5.90	.535	.817	26.00	.210	....
June........	.640	2.00	5.90	.471	.701	22.88	.176	....
July........	.640	2.00	5.90	.503	.797	26.00	.188	....
August.....	.640	2.00	5.90	.503	.797	26.00	.188	....
September..	.640	2.00	5.90	.503	.797	26.00	.188	....
October.....	.640	2.00	5.90	.535	.797	26.00	.200	....
November...	.640	2.00	5.90	.535	.797	26.00	.200	....
December...	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January.....	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922..........	106	87	141	89	95	99	....	78
1923..........	103	85	154	82	88	96	....	72
1924..........	94	64	135	82	90	98	....	72
1925..........	110	68	126	82	90	98	....	74
1926..........	112	88	114	83	90	98	82	80
1927..........	100	86	113	90	97	106	89	89
1928..........	108	86	113	94	100	109	92	92
1929..........	114	88	113	94	101	110	93	92
1930..........	101	88	113	95	102	111	94	93
1931..........	90	88	113	95	102	111	94	93
1932..........	85	88	113	95	101	111	94	90
1933..........	81	86	113	93	91	104	91	86
1934..........	91	87	110	68	79	93	74	72
1935..........	92	91	117	58	72	89	68	75
1936..........	89	51	113	65	74	95	77	85
1937..........	95	51	113	71	79	102	85	93
1938..........	92	51	113	73	81	104	87	95
1939..........	89	53	113	73	79	101	87	93
1940..........	96	53	113	72	77	....	87	....
1941..........	102	54	110	73	82	106	87	....
1942..........	112	59	129	73	85	106	84	....
1943								
January.....	112	55	121	75	86	108	85	....
February....	112	55	121	75	86	108	85	....
March......	113	55	121	75	86	108	85	....
April.......	119	55	121	75	86	108	85	....
May........	119	55	121	75	86	108	85	....
June.......	119	55	121	66	74	95	80	....
July........	119	55	121	70	84	108	82	....
August.....	119	55	121	70	84	108	82	....
September..	119	55	121	70	84	108	82	....
October.....	119	55	121	75	84	108	83	....
November...	119	55	121	75	84	108	83	....
December...	119	55	125	75	84	108	83	....
1944								
January.....	119	55	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
1943								
January	181	160	148	92	57	154	112	79
February	178	162	149	92	57	155	112	79
March	182	163	150	93	57	160	113	79
April	185	165	151	95	57	160	119	79
May	187	167	152	95	57	160	119	79
June	190	168	151	93	57	160	119	69
July	188	169	150	94	57	160	119	74
August	193	169	150	94	57	160	119	74
September	193	169	150	94	57	160	119	74
October	192	170	150	95	57	160	119	78
November	194	171	150	95	57	160	119	78
December	196	173	150	96	57	171	119	78
1944								
January	196	174	150	96	57	171	119	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

REVIEWS

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

Fertilizer

"Fifth Annual Report of the Arizona Fertilizer Control Office," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Sp. Bul., Feb. 1943.

"A Study of Ammonia and Nitrate Nitrogen for Cotton," Ga. Exp. Sta., Experiment, Ga., Bul. 229, Nov. 1943, K. T. Holley and T. G. Dulin.

"Ammonium Nitrate as a Fertilizer for Georgia Soils," Ga. Exp. Sta., Experiment, Ga., Press Bul. 531, Jan. 17, 1944, L. C. Olson.

"Fertilizers for South Georgia Field Crops in 1944," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 25, Dec. 28, 1943.

"Food Production for War, Fertilizers Help Reach War Crop Goals," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, War Cir. No. 4, H. W. E. Larson.

"Fertilizer Recommendations for Spring Planted Crops in Indiana," Purdue Univ. Agr. Exp. Sta., Lafayette, Ind., Ser. Leaf. 243, Rev., Jan. 1944.

"Inspection of Commercial Fertilizers and Agricultural Lime Products," Agr. Exp. Sta., Amherst, Mass., Bul. 118, Sept. 1943.

"Fertilizer Recommendations for 1944," Mich. State College, Ext. Div., East Lansing, Mich., E. Bul. 159 (Rev.), Jan. 1944.

"Analyses of Commercial Fertilizers, Manures and Agricultural Lime, 1942," N. J. Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Insp. Series 10, Dec. 1942, Charles S. Cathcart.

"1944 War-Time Fertilizers for Spring-Sown Crops, Permanent Pastures, and Hay Fields," Agr. Exp. Sta., Ohio State Univ., Columbus, Ohio, E. Bul. 231, Rev. Jan. 1944, Earl Jones and Robert E. Yoder.

"Consumption of Fertilizer Materials and Grades in Oklahoma," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., E. Bul. No. B-273, Nov. 1943, Horace J. Harper.

"Spreading Lime with Manure," Vt. Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Pamphlet No. 6, May 1943, A. R. Midgley and D. E. Dunklee.

"Use Phosphates to Produce More Feed," Agr. Ext. Serv., State College of Wash., Pullman, Wash., E. Cir. 65, Aug. 1943, I. M. Ingham.

"Use of Fertilizers in 1944," Ext. Serv., Univ. of Wis., Madison, Wis., Sp. Cir., Dec. 1943, Emil Truog and C. J. Chapman.

Crops

¶ The importance of the soybean crop has greatly increased under the agricultural war programs of the country. The high value of the crop for the production of edible oils and animal feed causes it to be considered of great strategic value and has led agricultural planners to call for such large increases in production that they could be met only by greatly expanding the acreage devoted to the crop, although efforts to increase yields per acre have not been neglected. Since soybeans are a vigorously growing legume, adapted to survival on soils lower in fertility than most legumes require, at one time the crop was considered a very valuable soil-conserving crop. Work by the Soil Conservation Service and other agencies later showed that this was by no means universally the case. It was found that under many conditions, soils growing legumes seemed to be subject to erosion about as bad as most cultivated crops, and in common with other legumes, their high mineral content caused them to be soil-depleting so far as the mineral nutrients, calcium, phosphorus, potassium, and magnesium, were concerned. They were soil-conserving or soil-building only so far as nitrogen was concerned, and if plowed under, they usually but not always were beneficial to the following crops. Investigations have shown how most, if not all, of the problems can be overcome, in most cases with little or no additional trouble in growing the crop and usually giving higher yields for the care and attention given to using improved methods.

¶ A useful publication that should be

read by all soybean growers in Missouri and surrounding states, if not in all soybean-producing states, was prepared by D. D. Smith, as Missouri Agricultural Experiment Station Bulletin 469, "Soybeans and Soil Conservation." Considerable space is devoted to showing methods of overcoming the erosion problem in connection with the growing of soybeans. Experiments showed that growing the crop in 8-inch rows usually reduced surface run-off of rainfall and soil erosion and increased yields, as compared to growing the crop in 42-inch rows. Even under the best of conditions, however, there still was considerable surface run-off of rainfall and erosion. Growing the crop on the contour further reduced losses and erosion, and on the average increased the yield. It was found that the place in the rotation in which the soybeans were grown had considerable influence on erosion losses. If soybeans followed corn or some other cultivated crop, it was noticed that the erosion was much more severe on the soybeans than if they followed sod or a small grain. This led to the recommendation by the author that soybeans be grown as a substitute for, and not in addition to, corn in the rotation. A very good rotation for controlling erosion was winter barley and soybeans. The winter barley can be seeded under Missouri conditions the latter part of August, and it will make sufficient growth to furnish a good cover during the winter. It is then pastured in the spring and turned under for soybeans before being plowed under in preparation for the soybean crop. This works very well when the soybeans are cut for hay, although at times when grown for grain, they are harvested too late to permit a good stand of small grain to be obtained in the fall. Rye or winter wheat, if sown early, also would be satisfactory, but when winter wheat is sown after the fly-free date, it does not make a satisfactory cover crop following soybeans.

So far as soil fertility relationships are concerned, lime has been found of great importance in growing the soybeans in Missouri. In addition to lime, phosphate and potash usually are needed for best results, 0-20-10 and 0-20-20 giving favorable and significant increases in yield. In some of the work reported, plowing under the fertilizer or placing it in bands on the plow-sole gave better results than applying it near the surface in bands alongside the seed. In other work where the soybeans were grown during a wet spring season, placing the fertilizer near the surface of the soil gave equal or slightly better results than applying it deeply. In general, however, the author appears to favor the deep placement of the fertilizer.

"Pasture Studies with Calves on Winter Forage Crops at Casa Grande, Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Mimeo. Report 47, July 1942, E. B. Stanley and Max E. Robinson.

"A Report to the Citrus Growers of Arizona on Better Navel Orange Fruiting," Agr. Exp. Sta., Tucson, Ariz., Mimeo. Report 50, Jan. 1943, Alton H. Finch.

"Field Bean Production Without Irrigation in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Bul. 482, Sept. 1943, J. F. Brandon, D. W. Robertson, A. M. Binkley, and W. A. Kreutzer.

"Pasture Investigations (Tenth Report)," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., Bul. 245, March 1943, B. A. Brown and R. I. Munsell.

"Influence of Time-of-Planting and Spacing on the Yield of Porto Rico and Triumph Sweet Potatoes," Ga. Exp. Sta., Experiment, Ga., Bul. 230, Dec. 1943, H. L. Cochran.

"Food Production for War, Field Pea Production," Ext. Serv., Univ. of Idaho, Moscow, Idaho, War Cir. No. 7, K. H. W. Klages.

"Food Production for War, Herb Crops for Idaho," Ext. Serv., Univ. of Idaho, Moscow, Idaho, War Cir. No. 11, 1943.

"Food Production for War, Commercial Corn Hybrids," Ext. Serv., Univ. of Idaho, Moscow, Idaho, War Cir. No. 14, Herman K. Schultz.

"Food Production for War, Carrot Seed Production," Ext. Serv., Univ. of Idaho, Moscow, Idaho, War Cir. No. 16, George W. Woodbury.

"Pruning Suggestions for Indiana Apple Orchards," Ext. Serv., Purdue Univ., Lafayette, Ind., E. Bul. 160 (2nd Rev.), July 1943, C. L. Burkholder and Monroe McCown.

"Strawberries for Home and Market," Ext. Serv., Purdue Univ., Lafayette, Ind., E. Bul. 174, (5th Rev.), Aug. 1943, Monroe McCown, Clarence E. Baker, J. J. Davis, R. C. Baines, and G. E. Lehker.

"The Performance of Hybrid Corn in 1943,"

Agr. Exp. Sta., Univ. of Md., College Park, Md., Mis. Publ. 19, Dec. 1943, R. G. Rothgeb.

"For a Banner Crop Grow Vicland, Tama Better Oats," Ext. Serv., Univ. Farm, St. Paul 8, Minn., E. Pamphlet 129, Dec. 1943.

"Maturity Ratings of Corn Hybrids Registered for Sale in Minnesota in 1943," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Bul. 374, Dec. 1943, R. F. Crim, H. K. Hayes, R. O. Bridgford, R. S. Dunham, R. E. Hodgson, F. R. Immer, E. H. Rinke, and Y. S. Tsiang.

"Grow More Cover Crops this Fall," Ext. Serv., Miss. State College, State College, Miss., E. Leaf. 54 (19M), July 1943, J. M. Weeks.

"Corn Tillage Studies on Rolling Putnam Silt Loam," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 475, Aug. 1943, Mack M. Jones and Robert P. Beasley.

"Annual Report of the Board of Control for the Fiscal Year Ending June 30, 1942," Agr. Exp. Sta., Univ. of Nevada, Reno, Nevada.

"Research and Farming 1942," Agr. Exp. Sta., Univ. of N. C., Raleigh, N. C.

"1942 Annual Report," Agr. Ext. Serv., N. C. State College, Raleigh, N. C.

"Weeping Love Grass in Oklahoma," Agron. Dept., Okla. A. & M. College, Stillwater, Okla., Oct. 1943, Hi W. Staten.

"High Crop Yields for War Time," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Agron. V. Cir. 7, Jan. 1944, H. E. Hendricks.

"When Should the Hay Crop Be Cut?" Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Pamphlet 7, June 1943, J. A. Newlander.

"New Rust-Resistant Pole Beans of Superior Quality," Agr. Exp. Sta., Blacksburg, Va., Bul. 350, Feb. 1943, S. A. Wingard.

"Index to Publications of the United States Department of Agriculture 1936-1940," Div. of Publ., Office of Inf., U.S.D.A., Washington, D. C., Mary A. Bradley.

"Report of the Chief of the Forest Service, 1943," U.S.D.A., Washington, D. C., Oct. 15, 1943.

"Report of Cooperative Extension Work in Agriculture and Home Economics, 1943," Ext. Serv. War Food Adm., U.S.D.A., Washington, D. C., Oct. 15, 1943.

"A Key to Pea Varieties," U.S.D.A., Washington, D. C., Cir. 676, May 1943, B. L. Wade.

"Growing Barley for Malt and Feed," U.S.D.A., Washington, D. C., F.B. 1732, Rev. Nov. 1943, H. V. Harlan and G. A. Wiebe.

"Kudzu as a Farm Crop," U.S.D.A., Washington, D. C., F.B. 1923, Oct. 1943, Roland McKee and J. L. Stephens.

"Grow Disease-Resistant Oats," U.S.D.A., Washington, D. C., F.B. 1941, Oct. 1943, T. R. Stanton and F. A. Coffman.

"Lupines, New Legumes for the South," U.S.D.A., Washington, D. C., F.B. 1946, Nov. 1943, Roland McKee and G. E. Ritchey.

"Disease-Resistant and Hardy Oats for the South," U.S.D.A., Washington, D. C., F.B. 1947, Oct. 1943, T. R. Stanton and F. A. Coffman.

"Economic Plants of Interest to the Americas, Roselle (Hibiscus sabdariffa L.) As a Fiber Crop," U.S.D.A., Washington, D. C., Dec. 1943, Julian C. Crane.

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Soils

The influence of cover crops grown on the soil and turned under as green manure on the leaching of rainfall and nutrients from a soil were investigated by H. H. Hill and reported in Technical Bulletin 83 of the Virginia Agricultural Experiment Station under the title "The Effects of Rye, Lespedeza, and Cowpeas When Used as Cover Crops and Incorporated With the Soil on the Leachings From Dunmore Silt Loam Soil." This was lysimeter work with one tank left uncropped, other tanks with rye and lespedeza turned under, rye and cowpeas turned under, rye and cowpeas grown and cut off, and rye alone as a cover crop but not turned under. The investigation was carried on for a period of eight years. The crops were fertilized with 400 lbs.

of a 4-12-4 fertilizer, and a ton of ground limestone was applied to each of the crop tanks when the experiment began. The soil with no crop at all growing on it permitted nearly 23% of the total rainfall to leach through it. Rye and lespedeza grown and turned under allowed only a little over 16% of the water to leach through, while when rye and cowpeas were grown and turned under, a little over 15% of the total rainfall leached through the soil. When rye and cowpeas were grown and removed from the soil, leaving only the stubble, about 13% of the total rainfall leached through the soil. When rye was grown as a cover crop and removed from the soil, 17% of the total rain leached through. It is obvious that the growing of a cover crop greatly conserved rainfall, but turning under the cover crop as a green manure did not seem to be as effective in reducing leaching through the soil as when the cover crop was cut off and the stubble remained.

Of the nutrients that were washed out of the soil by rain-water, much more calcium was lost from the bare soil than was lost through the cropped soils. The losses were somewhat in the same order as the leaching of the rainfall through the soil. The same was not true of magnesium, in all cases, and there appeared to be more irregularity in the leaching of magnesium from the different lysimeters, in some cases more magnesium being leached from the cropped soils than from the uncropped. In the case of sulphur, the least amount was lost from the uncropped soil, with the most being lost when the cover crop was turned under as green manure. With potassium, the greatest amount was leached from the uncropped soil, although the differences between the cropped and uncropped soils were not as great as in the case of calcium. As the experiment continued, there was a distinct tendency for the amount of potassium leached each year to become less, regardless of cropping. The leaching of nitrate from the soil was much greater from the uncropped than on the cropped tanks, with the smallest amounts leached from the tanks where the rye and cowpeas were grown and then removed. This decrease apparently was not entirely due to the reduction of total nitrogen in the soil by removing the crop, since nearly twice as much nitrate was leached where rye was grown as a cover crop, although this soil at the end of the period had the lowest total nitrogen content of any of the cropped tanks. All of the cropped tanks had more nitrogen in the soil than the uncropped.

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"Feed the Soil to Feed More People," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Leaf. 242, Oct. 1943.

"Nitrogen and Carbon Changes in Soils," Agr. Exp. Sta., Kansas A. & M., Manhattan, Kansas, T. Bul. 56, July 1943, H. E. Myers, A. L. Hallsted, J. B. Kuska, and H. J. Haas.

"Iodine in Soils, Waters, and Farm Products of Kentucky," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 447, June 1943, J. S. McHargue.

"Report of the Chief of the Soil Conservation Service, 1943," U.S.D.A., Washington, D. C., Oct. 10, 1943.

Economics

¶ A survey of agricultural practices in northern Florida as typified in Madison, and to a lesser extent in Jackson County, furnished information on time, amount of labor required, and the usual fertilizer practices followed for growing the common crops in this area. This survey was made by M. E. Brunk and J. W. Reitz and published as Bulletin 388 of the Florida Agricultural Experiment Station, entitled, "Labor and Material Requirements for Crops and Livestock, I. A General Farming Area in Florida." The data show that most of the farmers did not fertilize their corn, since the crop usually followed a well-fertilized crop. Some farmers reported good increases in yields from planting winter cover crops on land to be planted to corn. Short staple cotton was usually fertilized, the common analyses being 3-8-5, 4-8-4, 4-8-6, and 5-7-5. Peanuts harvested for nuts usually received mixtures such as 3-8-5, 0-12-4, and 2-9-4. Sugar cane growing in this section is largely a home-consumption crop with an average of only 2.3 acres per farm. Fertilization varied from nothing up to 1,000 lbs. per acre with the most prominent analyses being 4-8-6, 3-8-5, and 4-8-4. Sweet potatoes usually received at least 200 lbs. per acre of fertilizer, the most common mixture being 3-8-5. Flue-cured tobacco was the most uniformly fertilized crop covered by the survey, the usual application being 1,000 lbs. per acre of 3-8-5 or 3-8-8. Watermelons usually were fertilized with 4-8-6. A table has been drawn up based on the survey showing the distribution of labor and mule requirements for each of the crops during the year. Labor and feed requirements for livestock also were covered. The latter part of the Bulletin is devoted to suggestions for planning the farm business based on information obtained in the survey.

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"Maximum Wartime Production Capacity of Rhode Island Agriculture," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Miscl. Publ. 17, July 1943, J. L. Tennant and R. G. Wheeler.

"Forest Plantations of Wisconsin," Wis. Dept. of Agr., Madison, Wis., Bul. 232, Oct. 1942.

"Wisconsin 1840-1940 Forests and Land Use," Wis. Dept. of Agr., Madison, Wis., Bul. 229, April 1942.

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"Labor and Material Requirements of California Vegetables," Agr. Exp. Sta., Univ. of Calif., Berkeley 4, Calif., John H. MacGillivray, Arthur Shultis, A. E. Michelbacher, P. A. Minges, and L. D. Doneen.

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"Food Values on a Pound, Acre, and Man-Hour Basis for California Processed Vegetables," Agr. Exp. Sta., Berkeley 4, Calif., July 1943, John H. MacGillivray, Agnes Fay Morgan, G. C. Hanna, and Arthur Shultis.

"Connecticut Vegetable Acreages 1941-1942-1943," Dept. of Agr., State Office Bldg., Hartford, Conn., Bul. 83, Dec. 1943.

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"Peanut Production Possibilities in Georgia," Ga. Exp. Sta., Experiment, Ga., Bul. 228, Oct. 1943, W. E. Hendrix, Charles P. Butler, and Kenneth V. Goodman.

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"Farm Outlook for Indiana 1944," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Leaf. 253, Dec. 1943.

"Maine Farm Families and the War, 1941-43," Ext. Serv., Univ. of Me., Orono, Me., Me. Ext. Bul. 320, Jan. 1944, Bruce B. Miner.

"Returns from Dairy Farming in Massachusetts in 1942," Agr. Exp. Sta., Mass. State College, Amherst, Mass., FM 15, Oct. 1943, Charles R. Creek.

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Efficient Fertilizers for Potato Farms

(*From page* 26)

broadcast before plowing, yields were significantly increased on plots 1, 2, and 3 despite the injury and depressed yields resulting from band application as shown in column 4.

Results at Torresdale in 1942 with the same analyses and rate of application with total fertilizer application in bands are shown in the Table III.

TABLE III.—1942 POTATO FERTILIZER EXPERIMENT, PHILADELPHIA COUNTY PRISON FARM, TORRESDALE, PENNSYLVANIA

Plot	Fertilizer analyses	Rate applied	Yield—bushels per acre standard method
1	4–8–8........	1,000	453.7
2	4–12–12......	1,000	595.8
3	4–16–16......	1,000	497.4

Although the yields were not depressed by the band method of application as at Doylestown, this is believed to be due to the fact that the field had turned under a crop of soybeans to which 10 tons of manure had been applied before plowing. Undoubtedly, the higher nitrogen status and better organic content enhanced the values of the high phosphorus, high potash analyses.

On a timothy sod field adjacent to the above, a 4-12-12 fertilizer at the rate of 1,000 pounds per acre was applied as follows: (a) all in band, (b) three-fourths plowed down and one-fourth in band. An average of four replications showed a yield of 321.16 bushels for the band method and 374.19 bushels where three-fourths was plowed down. To determine whether additional phosphorus and potash would increase the yields, one half of each of the above plots had 500 pounds of an 0-12-12 broadcast before plowing. On the area where basic treatment was in bands no increase was recorded, in fact there was a decrease of 1.36 bushels. On the plowed-down plot, however, the extra application of 0-12-12 all plowed down gave an additional increase of 18.04 bushels, or a total increase over the all-band method of 71.07 bushels.

Further tests comparing the all-band method with plowing under of different proportions of the total fertilizer application were carried on in Pennsylvania during 1943. These tests are summarized in Table IV.

Fields A and B were located on the farm of Ed Fisher at Coudersport, Pennsylvania; Field C was at Camp Potato;

TABLE IV.—RESULTS 1943 POTATO FERTILIZER TESTS

Farm	Analyses	Amount lbs.	Method	Yield bu. per acre	Increase bu. per acre
A	6–18–18	1600	Band	196.58	
	"	1000	Band		
	"	600	Plowed Under	291.53	94.95
B	6–18–18	900	Band	234.56	
	"	300	Band		
	"	600	Plowed Under	305.45	70.89
C	4–12–12	1600	Band	283.70	
	"	800	Band		
	"	800	Plowed Under	352.60	68.90
D	4–12–12	1000	Band	121.63	
	"	500	Band		
	"	500	Plowed Under	153.00	31.37
E	4–12–12	1200	Band	209.10	
	"	300	Band		
	"	900	Plowed Under	250.10	41.00

and Fields D and E were on the Philadelphia County Prison Farm at Torresdale, Pennsylvania. Yields on all of the above farms were below average because of the late spring for the Potter County farmers and extreme drought on the farms in the southeastern part of the State.

From the results of the potato-fertilization studies summarized in this discussion, it would appear that aside from the recognized value of good seed, good spraying, and proper cultivation, the most important consideration is a fertilizer with the right ratio of nitrogen, phosphorus, and potash, provided this is applied in such a manner as to insure its most efficient utilization by the sensitive potato plants. At no time in the history of the potato industry has there been such a crying need for such efficiency.

The Use of Borax in the Legume-Livestock Program of the South

(*From page* 20)

Tennessee Valley, it appears that a sounder and more practical livestock program will be developed. He states, in part: "We have observed with considerable interest the results obtained from demonstrations involving the use of borax on alfalfa and certain other legumes. This practice has, without a doubt, proved to be practical on the soil types common in this county in our legume and livestock program, and there is every indication that such a practice will be common and widespread in the years ahead.

The effect of borax on crimson clover is noted particularly on drouthy land. Note the dense stand at left and also the size of blossoms which indicates greater seed production.

"Outstanding results have been noted in the case of alfalfa. The yield of hay has been substantially increased and the general appearance of the stand is greatly improved. This condition reflects itself particularly in lengthening the profitable life of the stand of alfalfa and certainly most farmers will agree that this factor alone is important after taking into consideration the economical production of forage together with the conservation of the soil. Recent hard rains have proved that the land should certainly be kept covered wherever practical."

T. W. Hillsman, County Agent in Madison county, reported the beneficial effect of borax when applied on crimson clover. He said that on the gray land of that county, "Crimson clover often 'fires' and finally the plants die. This did not occur when borax was used."

T. L. Mayes in Franklin county, the largest crimson clover seed-producing county in the United States, reported that borax increased the yield of seed, increased the viability, and ripened the crop about three days earlier.

G. L. Cleland, Agent in one of the Middle Tennessee bluegrass counties wrote, "It is my experience that borax increases the yield of alfalfa in this county an average of 20%, and in addition, will maintain a stand a year or two longer, which will add another valuable increase. As a result of our demonstration, there is an increased acreage of alfalfa in this county."

Stanley Ezell, Agent in Roane county, stated that, The use of borax on legumes has proved itself to be a practice that must not be omitted in the Roane County legume-livestock program. Our demonstrations show higher yields in practically every case, ranging from 20% to 80%."

J. Ben Thompson, Agent in Cheatham county, said, "I think there is a great possibility in the use of borax on alfalfa and red clover in this county. The results seem to be much greater on thinner soils." This last statement is very significant, for ability to grow alfalfa successfully on thin soils is necessary.

Another very interesting report was received from the County Agent in Wayne county, who wrote that, "Two alfalfa demonstrators using borax claimed that the hay from the land treated with borax was eaten better by the livestock to which it was fed." This sounds reasonable. The alfalfa was probably more palatable and nutritious due to the fact that the leaves were greener and were retained better during the curing process, resulting in leafier, greener hay.

These quotations from County Agents' reports give a general picture of what the Agents are thinking. During the past four years they have observed a total of over 900 demonstrations where borax has been used on alfalfa, red clover, and crimson clover. Their combined information and conclusions on any subject tested to this extent should be significant.

A number of livestock producers in Tennessee appear to be pointing the way toward more efficient livestock production, using alfalfa, not only as a source of hay, but for pasturing during emergencies when other types of pasture are not available. They have found that alfalfa properly treated, which, of course, includes the use of borax, can be grazed by all types of livestock, if judgment is used with respect to the severity of grazing. One of these farmers, Robert Bell, operates what might now be termed a dairy farm in Dyer county, which is a cotton and livestock county in West Tennessee. He seeded a 12-acre field of alfalfa in the fall of 1940 after he had limed it at the rate of three tons per acre. In the spring of 1942, he applied 100 pounds of triple superphosphate, 200 pounds muriate of potash, and 20 pounds of borax per acre. He cut this alfalfa three times in 1942 with a yield of 1,000 bales from the 12 acres, and then pastured it from the time his Korean lespedeza gave out in September until after frost, when crimson clover pasturage became available. An interesting observation was that, with the use of potash and borax as well as limestone and phosphate, he could grow alfalfa at least as successfully on his light buckshot type soil (Grenada) as he could on his well-drained brown soil (Memphis) and that these materials had increased enormously the acreage of his land adapted to alfalfa.

Another dairy farmer, Henry Clark, in East Tennessee, turns dairy cows on his alfalfa in early October and grazes off what would normally be his last cutting. This is grazed until mid-November when he turns his cows on crimson clover and small grain. This

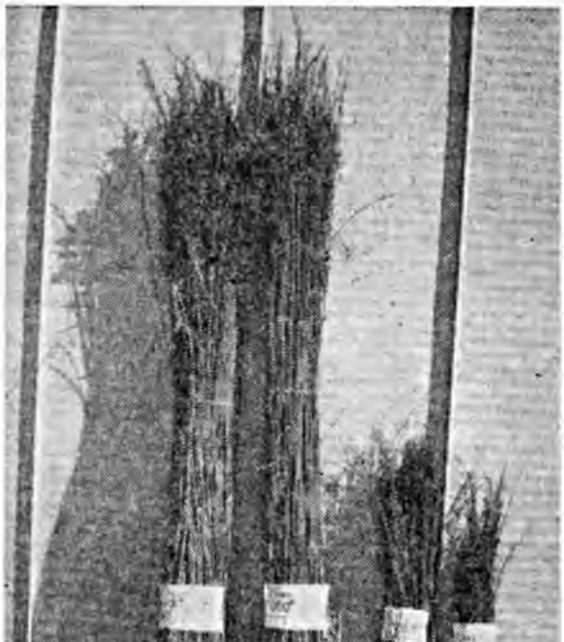
A group of agronomists and fertilizer manufacturers study the effects of potash and borax on alfalfa in Williamson county, the heart of the Tennessee bluegrass area.

provides pasture until May of the following year, when he turns his animals on bluegrass and white clover, followed by grazing lespedeza in mid-summer. Mr. Clark operates only 42 acres of tillable land and he has increased his annual income from $120 in 1932 to over $4,000 last year. His principal income is from the 10-cow herd which he is milking.

From experience, it is concluded that borax takes its place as a plant nutrient along with limestone, phosphate, and potash in developing a legume-livestock program in Tennessee. The extent to which it should be used on crops other than those mentioned remains for further research and test demonstrations on farms.

Plow-Sole Fertilizers Increase the Profits

(*From page* 12)



Bundles of hemp harvested from the Rauls plots —yield as follows:
Plow sole, 10-10-10 at 600 lbs. per acre plus 200 lbs. 3-12-12 drilled with seed = 8,174 lbs.
Plow sole, 10-10-10 at 600 lbs. per acre only = 6,830 lbs.
3-12-12 (200 lbs. drilled with seed) = 3,025 lbs.
No fertilizer = 1,344 lbs.

be available to growing crops must be in water-soluble form, and certainly we know that during periods of drouth this water-soluble plant food must be derived and brought up from the lower root-feeding zone. I am confident this method of applying fertilizer will prove practical and may be followed in general in connection with a number of crops. The crops which make their growth over a long period of time and have a high-acre value, the crops which develop an extensive and deep-feeding root system, the crops which are known to require large amounts of plant-food nutrients—these are the crops which may lend themselves best to this method of fertilizer application.

It is reasonable to expect that rather heavy applications of phosphate and potash placed on the plow sole at a depth of from 5 to 7 inches for legume crops, particularly alfalfa and clover, may prove superior to the surface or shallow placement now followed. And right here I wish to present the results of a demonstration set up on a field seeded to clover this past spring. The fertilizer, 0-20-10, was applied with an attachment on the plow in the fall of 1942 at 450 lbs. per acre. At the time of seeding in the spring of 1943, a light application, 100 lbs. of 0-20-10 per acre, was drilled in with the barley nurse crop. We were chiefly interested in the effect this heavy plow-sole application of fertilizer would have on the clover crop in 1944. However, to our surprise, the response of the barley to this plow-sole application was very striking. The results are shown in the next column.

This field was seeded to medium red clover. Just before freeze-up last fall

Soil	Treatment	How applied	Yield of barley
			Bu.
Carrington silt loam	450 lbs. 0–20–10 + 100 lbs. 0–20–10	Plow sole Drilled with seed	54.8
"	100 lbs. 0–20–10	Drilled with seed	45.2
"	No fertilizer	....	31.0

an inspection of the plot showed that the clover had made a very rank growth on the plot receiving the plow-sole treatment. There was a noticeable difference between the check plot and the plot receiving the 100-lb. application only. However, the yields of hay on these plots in 1944 will tell the final story.

Another plow-sole demonstration was set up on a field seeded to hemp in 1943. The response to treatment with 10-10-10 at 600 lbs. per acre on the plow sole was spectacular. The field selected had grown good crops of corn in 1942 and 1941. Manure was applied for both corn crops. No manure, however, was used on the hemp crop in 1943. The acre strip where the plow-sole treatment of 10-10-10 was applied was split into two sections—one-half received an additional treatment with 3-12-12 at 200 lbs. per acre, applied in contact with the seed with a fertilizer drill. Another plot received the 3-12-12 at 200 lbs. per acre only, drilled with the seed.

The 3-12-12 starter fertilizer resulted in a quick response in the early period of growth, but this plot was soon outstripped by the plow-sole fertilized plots. In fact, within three weeks' time the hemp roots had started feeding on the plow-sole fertilizer, and the rate of growth was phenomenal from that time on. The hemp on the plow-sole plots attained a height of 8 feet, was dark green in color, and very uniform. The unfertilized strip turned yellow in the early stages of growth. It became infested with weeds, and at harvest averaged only 3 feet in height. The results of this demonstration are reported in Table II.

The results of this demonstration indicate that the 200 lbs. per acre of 3-12-12, while profitable, did not supply sufficient plant food, nitrogen in particular, to make a satisfactory crop. Both of the plow-sole treated plots, 10-10-10 at 600 lbs. per acre, with and without starter fertilizer, did make a good crop. It is probable that a mixture such as the 10-6-4 would have given just as good results as the 10-10-10.

I am confident we can produce good crops of hemp on high land mineral soils of medium to even low fertility by plowing under, discing in, or applying with an attachment on the plow sole from 600 to 800 lbs. of high-nitrogen

Table II.—Fertilizer Demonstration on Hemp

Name & address of cooperator and Soil type	Treatment	How applied	Rate per Acre	Yields in pounds*	Grade	Value of increase	Cost of fertilizer	Net profit per Acre
Louis Rauls	10–10–10 +	Plow sole	600					
De Forest	3–12–12	drilled	200	8,174	1	$170.75	$18.83	$151.92
	10–10–10	Plow sole	600	6,830	1	137.15	15.00	122.15
Carrington	3–12–12	drilled	200	3,025	4	25.20	3.83	21.37
silt loam	No fertilizer			1,344	4			

* Calculated on 10 per cent moisture basis.

fertilizers such as 10-6-4 or 8-8-8, per acre, provided the soil type is suitable and rainfall adequate.

The demand for these plow-sole attachments may exceed the supply this coming year. In case attachments cannot be secured, we are suggesting to hemp and hybrid seed corn growers that they will find it profitable to disc in or plow under such mixtures as 8-8-8 or 10-6-4. Results may not be as outstanding or as satisfactory as where the fertilizer is applied in bands on the plow sole, but nevertheless may be highly profitable.

Coalgate, Okla., Farm No "Lucky Streak"

(*From page* 23)

farm is the soil, and its fine condition. In the 20-odd years that Pasquali has been practicing soil building with help from three different county agents, he has restored organic matter and given to the soils the needed minerals. By building up the organic matter he has made the soil sponge-like so it will hold more moisture and his crops will not suffer in time of drought. It is no wonder that he was able to grow grain sorghums too tall to cut with a binder in a dry year like 1943. No one else in the community has such a production record; other farmers saw their crops burn and shrivel to less than 50 per cent normal yields. Not only did August Pasquali produce enough tons of feed to fill two silos, but he also produced a more complete feed. Cattle on the Pasquali farm do not chew old bones, the tell-tale sign of mineral starvation, as they do on many eastern Oklahoma upland farms. Pasquali's cattle receive their minerals in home-grown feed, the plants having taken them from the soil. The owner gives much credit to Curtis Floyd, present county agent, for his help in the feeding and handling of his livestock. He is grateful for help from the U. S. Department of Agriculture, for without it, he thinks he may not have succeeded.

On the other hand, the Department of Agriculture has profited from the experience of successful farmers like August Pasquali. It used to be thought that terraces alone would control soil erosion. Now it's known that only a complete and coordinated conservation program, using many practices to treat the land according to its needs and adaptabilities, can stop soil losses. It's known that soil, once erosion is controlled, must have its fertility maintained with a good soil management program that includes fertilizers, barnyard manure, and legume crops. Pasquali proved that alfalfa could be grown on upland soils of eastern Oklahoma when these practices were applied, and that yields of all crops could be increased.

All the soil and water conservation knowledge that has been gathered through the years by the August Pasqualis, by the county agents, by the research stations, and by all other employees of the Department of Agriculture is now available to other farmers in nearly 1,000 farmer-organized soil conservation districts that embrace nearly 550,000,000 acres. August Pasquali's farm is within a soil conservation district—the Blue and Boggy District that covers parts of three counties draining into the Blue and Boggy Rivers. Technicians of the Soil Conservation Service—the action agency of the Department of Agriculture responsible for giving technical assistance to farmers in planning and applying complete soil conservation systems—are helping other farmers to conserve and improve their land resources, to keep them forever productive.

Some people have said that everything August Pasquali touches turns into profit, or that he has had "a lucky streak." But his farm demonstrates he has learned to live and abide by an unwritten law, "Whoever works with the Laws of Nature is successful; whoever violates her laws fails."

Where Do We Stand With Fertilizers?

(*From page* 16)

be somewhat higher relatively than they should be since in all cases, but two, the nitrogen response was segregated by difference of the PK and NPK combinations, whereas with the values for P and K, these are about equally divided between responses used singly and by segregation. Hay values were calculated at $20.00 per ton. The same yardstick may be applied to pastures. Using the data in Table V, we have constructed Table XI, which shows pretty definitely where we stand with these nutrients applied to good pasture sods.

The column headed Units per Annum may be a little misleading, in that in most instances phosphoric acid and potash were applied every third year, and the amounts listed are those that can be allocated to each year. Protein has been used as a basis for determining the value of the increase since all top-dressed plots were higher in this substance than in untreated areas. The value assumed, 15 cents per pound, is obviously too high if considered alone, but not as high as its cost in an 18 per cent dairy feed at present prices, and wherever found it is associated with other digestible nutrients.

Figures for response in hay fields will vary somewhat from those reported in Table XI, but will follow the same general pattern.

Needless to say, this article is presented to emphasize the importance of adequate fertilizers for New England agriculture. It was very fortunate indeed that there were fairly large reserve supplies of wheat and other grains stored up before war came. These reserves are now nearing exhaustion, which means that so far as New England is concerned we will be more and more dependent upon the feed we produce locally. This places additional emphasis upon fertilizers upon which we are so dependent for full crop yields.

Because we are so dependent upon them for potatoes, vegetables, and forage crops, in fact everything, practically, that we are able to produce as a contribution to the national nutrition program, it would be ideal if we had stockpiles of these important fertilizer substances built up here to draw upon in the emergency. They are just as important as wheat, rubber, or tin to this corner of the United States which contains no potash mines, no superphosphate deposits, nor nitrogen plants. In the future, this is a factor which might well be considered in any scheme for national planning.

Table XI.—Returns from Different Nutrients on Pasture

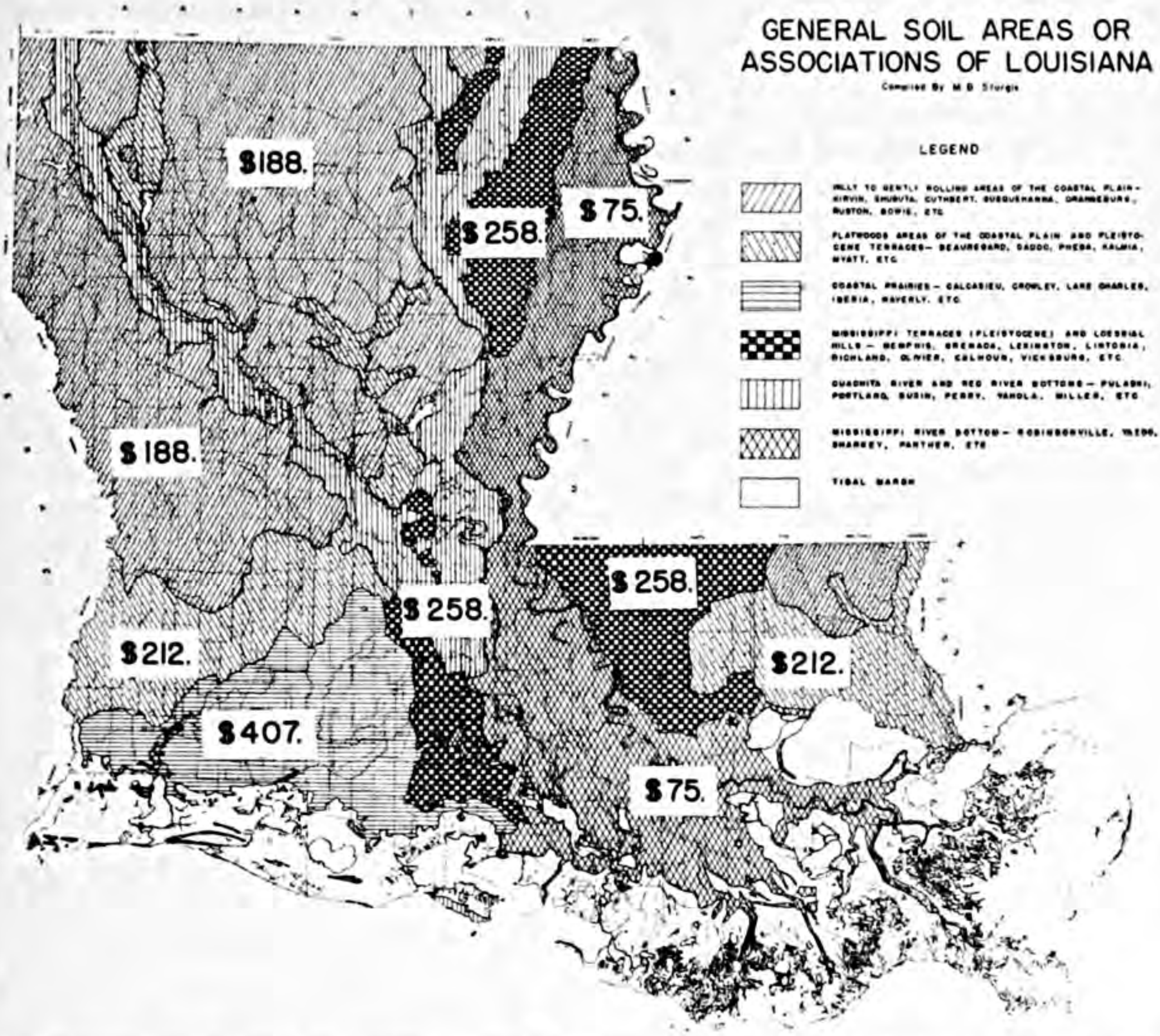
Element	Units per Annum	Gain per Unit Pounds Protein	Value of gain	Cost of fertilizer per Unit	Gain over Cost
			Dollars	*Dollars*	*Dollars*
N	2.5	60.4	9.06	2.50	6.56
P	1.67	32.4	4.86	1.40	3.46
K	1.67	36.8	5.52	.90	4.62

THE AVAILABLE POTASSIUM CONTENT AND POTASH REQUIREMENTS FOR THE GENERAL SOIL AREAS OF LOUISIANA

General Soil Areas	Tests showing no deficiency		Tests showing deficiency		Avail. K needed for normal production p. p. m.	Estimate of no. acres in cultivation 1,000 acres	K_2O recommended lbs. per acre	Net profit per ton of 60% muriate of potash for different crops dollars	K_2O needed in each area tons
	Per cent of tests	Avail. K p. p. m.	Per cent of tests	Avail. K p. p. m.					
Hilly to gently rolling areas of the Coastal Plain	27	108	73	65	80	1,850	32–40	cotton— 188.65 potatoes— 440.00 sweet potatoes— 1,107.50 tomatoes— 534.50	24,300
Flatwoods areas of the Coastal Plain and Pleistocene Terraces	20	102	80	62	80	210	32–48	cotton— 212.73 potatoes— 313.50 beans— 452.50	3,360
Coastal Prairies	35	130	65	57	100	1,320	16–48	cotton— 407.70 rice— 178.00	13,700
Mississippi Terraces and Loessial Hills	38	127	62	66	100	1,350	32–40	cotton— 258.28 sugar cane— 183.51 sweet potatoes— 777.50	15,060
Ouachita River and Red River Bottoms	46	146	54	65	100	550	32–48	cotton— 258.44	5,940
Mississippi River Bottoms	56	242	44	113	150	600	24–36	cotton— 75.00 potatoes— 507.50 sugar cane— 114.66	3,960

Potassium Content and Potash Requirement of Louisiana Soils

(*From page* 6)



The amount of money superimposed upon the various soil areas in the map represents the net profit from each ton of 60% muriate of potash used in growing cotton in that area. (See Table opposite).

that responds generally to additions of potash in this area. It will require more experimental work to definitely establish the amount of potash needed in the Mississippi bottom, particularly for cotton and sugar cane.

The data given are based on the fertilization of cash crops and show that the annual requirement of potash necessary for the establishment of well-balanced fertilizer practices in Louisiana is in excess of 60,000 tons of K_2O. When it is considered, however, that the feed, pasture, and green-manuring crop in the rotations require less fertilizer than the cash crops, the minimum potash requirement is in excess of 45,000 tons K_2O.

Mary had a little lamb,
His hair was white as heck,
And everywhere that Mary went
The poor sap signed the check.

I'm glad I am an American
I'm glad that I am free,
I wish I were a little pup,
And Hitler were a tree!

With Neck Stuck Out!

(*From page* 5)

tinct group and lived and achieved their goals and had their own ideals of national conduct vastly different from the urban population. The War Between the States was not any more North vs. South than it was a conflict of metropolitan and rural communities; and the financial struggles of the era following it were mostly fights between Granger West and Wall Street East. Some of the same foolishment persisted to a much later time and crept into the settlements which were only villages, as distinguished from the cultivated land beyond. It's true that school administration and educational changes helped to cut the core of that bad apple, but I really think this war has finally swept away most of the clutter and fog dividing the citizens of town and country. That is, except for some false leadership clamor, which infests both urban and rural life alike; and when peace comes we'll tackle that one, too.

The rude isolation of the farmstead, going it alone and resisting encroachment of any kind, has come to an end. In my youth no farm felt secure unless it had a mean and vicious dog on the premises, and the sign-manual of the genus homo on the farm was a many pronged pitchfork, useful for marauders as well as manure. No wonder city folks shrank from country contacts and ruralites never got to know anybody in town "worth knowing."

IF I give another idea I have about certain farm thought adjustments which are taking place, you won't agree with me perhaps. But I'll venture it anyhow. Here it is:

To rural-raised people "love of country" meant almost exclusively the open country, the raw outdoors, the place of universal germination, growing, flowering, and fruiting. Generations of soil-born folks felt that their environment had the finest spiritual refreshment and the noblest expression of all the natural freedoms. They thought that the best source of patriotic fervor came from wide landscapes, fresh air, and nearness to the elements. At least I know I did, away back in those barefoot days with fish pole and dog on rural rambles. We grew into it and it stuck by us. The hymn of the farmer was America the Beautiful, with stress on "spacious skies and amber waves of grain."

ALL right so far; but go with me and a visiting farm delegation down into the tenement district near a big city stockyards or perishable freight terminal. As the bus rumbles over bumpy, slippery cobblestones and folks wipe grimy factory soot off their faces, as the street narrows and dips under dark and foreboding viaducts, or turns crazy corners bordered by ash-heap playgrounds and dirty bill-boards, I see the farmers begin to count little service stars on faded dime-store emblems in dusty windows.

"Six in one block," says one. "Seven in this one, if you count two back there at the shine stand." Or, "Why, here's a house about as big as our chicken coop with three stars showing," calls another.

"What have they got down here worth fighting for?" said one of the farmers afterwards as we sat in the hotel lobby. "What can patriotism and love of the land mean to families who see so durn little of God's real country?" he concluded.

And yet, he mused, more boys per square mile and per thousand of the population have been drafted or have volunteered from the underprivileged, shut-in areas of crowded living than from the verdant rural headwaters of our country's inspiration.

But the idea of this gamble with death over such very low stakes at best, when contrasted with the sacrifices of the country boy who lived closer to the things which seem to make life desirable and replete—this brought up a tangled skein of thought, something rather disturbing to the ingrained, back-country producer.

When you knuckle down and ask yourself if it's to be a question about which boy sacrificed the most or lost the best things by entering the service, the puzzle isn't over yet. Maybe the kid who lived back of the yards in a junky alley got sort of attached to something there, something not so inspiring perhaps as the visions that were constantly before the boy from out beyond; but pretty gripping anyhow.

AFTER debating this question awhile, our tolerant rural workers will come to the foregone conclusion that probably we'd better forget what things were sacrificed for a minute and measure it on another basis. Perhaps it fits closer if we analyze it on the basis of taking up service for the country as a whole, seeing how much each can contribute to hold fast to the best and then make the best better—for everybody.

"Looking at it that way I come to believe that the lad down there in the slums and slack places deserves a mighty big hunk of praise and appreciation for soldiering and sailoring so well, with so little inspirational background," remarks the farm visitor.

This sort of inward thinking and turning of things wrong side out a little from the old ways of wearing your mental outlook, it sort of fetches you smack dab up against one of the most helpful aspects of national life. It does a lot to weave into one fabric the threads of American ideals, giving rural folks a better insight into the finished product than the kind of demonstrations we used to get from peacetime rabble-rousers.

In return for his share of what little he sacrificed in the tenements, the city boy will receive better physical training, better manual education, better discipline, and probably somewhat better nutrition.

In payment for part of his lost opportunities afield, the rural boy will be broadened and matured into a wiser and a more tolerant and progressive thinker. This adjustment may be just about as vital for a real union of good-will forces when peace returns as the improvement of the slum boy.

It's too bad we had to go to all this bother, expense, and sorrow to help our society into better alignment and give town and country the same goal. But maybe it will be worth all of the debt and worry, to see things more alike without so many fictitious barriers and stubborn prejudices.

Whisper this loud, brother: The real test of the final effects will depend more or less upon the arrangements we stay-at-home patriots make to get all these lads meshed into the gears of life again. Many of them are being discharged now and more will be back in a few months. It's a challenge.

Therefore, in terms of universal national service, let's think more about how to fit town and country veterans into the big domestic job ahead of us—and less about what law Congress may enact touching on universal service in wartime.

Farm folks don't need to fret about the latter. But it's a rural job to put a shoulder to the wheel and keep it turning at home in normal living, not thinking of what the boys sacrificed so much as planning to have them get a chance to continue their team-work begun so well abroad.

We can truly make America the Beautiful, and it need not end where the country lane meets the city street. There need be no more having our inspiration for patriotism and love of country measured in terms of local environment.

How far out is my neck, do you think?

LANGUAGE DIFFICULTY

A Frenchman, struggling with the English language, turned to an American friend for counsel:

"What," he asked, "is a polar bear?"

"Polar bear? Why he lives 'way up north."

"But what do he do?"

"Oh, he sits on a cake of ice and eats fish."

"Zat settle! I will not accept!"

"What in the world do you mean, you won't accept?"

"Ah," explained the other, "I was invited to be a polar bear at a funeral, and I will not accept."

"Please don't cry, honey," pleaded Boatswain Botsford, as he awkwardly patted his girl's shoulder. "Honest, I ain't got a girl in every port. I ain't *been* in every port."

"Would you scream if I kissed you?"

"How could I if you did it properly?"

A young man about town approaching a cigar counter behind which stood a cute young thing, said: "Do you keep stationery?" Said cute young thing: "Yes up to a certain point, then I just go all to pieces!"

HAPPY LITTLE FLEA

Here comes the happy, bounding flea;
You cannot tell the he from she;
The sexes look alike you see—
But she can tell and so can he.

"What's the cat's name?"

"Ben Hur."

"How'd you happen to choose that?"

"Well, we called him Ben till he had kittens."

HE LOOKED IT

The colored soldier had been peeling potatoes until his hands ached. Turning to a fellow K. P. he said: "What d'you suppose dat sergeant mean when he call us K. P.?"

"Ah dunno," replied his co-worker. "But from de look on his face, Ah thinks he meant 'Keep Peelin.'"

"It's nice to kiss in a shady parking place, but my boy friend doesn't stop there."

"You mean—"

"Yes, he keeps right on driving."

Johnny was not at the dinner table when his father came home, for the reason his mother had sent him upstairs to bed for swearing.

"Swearing!" bellowed the father. "I'll teach him to swear!" He dashed up the stairs and midway, stubbed his toe, stumbled and crashed his chin on the step.

When the atmosphere cleared a little, Johnny's mother said sweetly, "No more now, dear. You've given him enough for one lesson."

Mother: "I don't believe I approve of these one-piece bathing suits."

Daughter: "Oh, I think a person should wear something."

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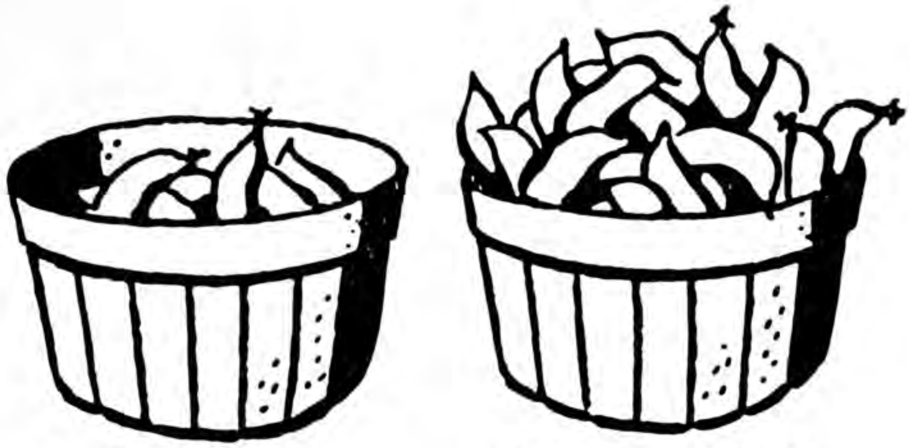

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VOLUME XXVIII NO. 3

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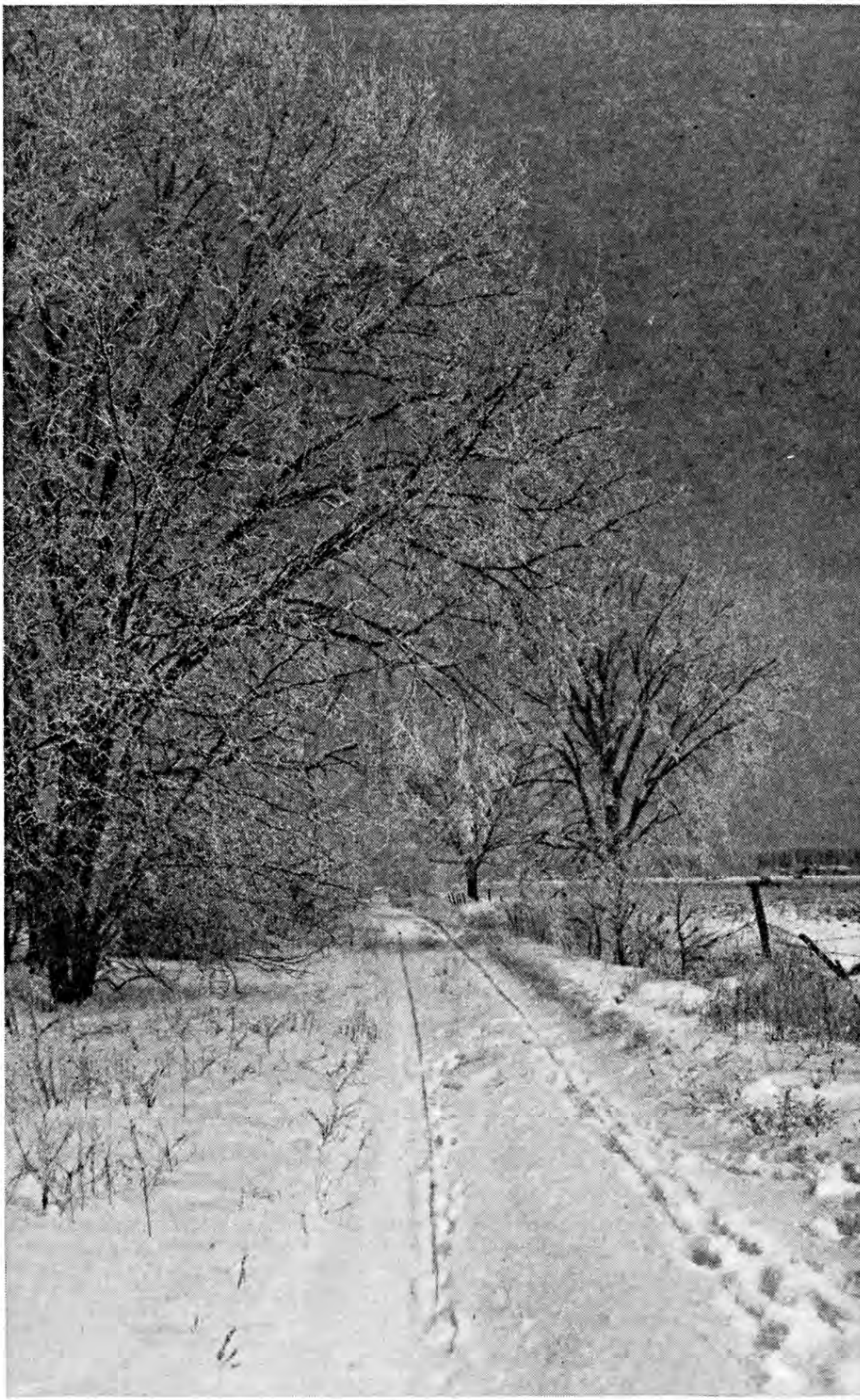

MARCH STORMS ARE APT TO BEGIN OR END IN ICE.

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VOL. XXVIII WASHINGTON, D. C., MARCH, 1944 No. 3

A "Way of Life" Based on the—

Co-op Warp and Woof

Jeff McDermid

FARM leaders up in my neck of the wilderness claim that 1944 rounds out the first century of organized cooperative associations, a movement which nobody disputes is the strongest of all factors for agricultural solidarity. You may think that the present state of the universe hardly fits into a cooperative picture, even after one hundred years of boosting for it, but maybe by another century we'll all feel more chummy than we do now.

This anniversary gives me a hunch to peek and ponder a bit into the genesis of cooperation which they celebrate, and set down a few observations of my own about it; albeit my name does not belong on any cooperative roster and I have never displayed any skill at launching cooperative programs. My place has been at the reportorial table, jotting down the wise-saws and modern instances uncorked by effervescent co-op champions.

Humanity loves anniversaries. Milestones are rallying points for further propaganda. Birthdays are convenient dates on which to measure growth and receive plaudits and presents. Encouragement in spells of stress and turmoil comes from these backward glances to feeble beginnings. Mighty forces with proud leadership also acquire a needful dose of humility sometimes by reviewing the poverty and injustice that sired their venture.

Thus it happens that co-op enthusiasts are digging into musty records and dim references to retell the story of the Society of Equitable Pioneers, formed in 1844 by Rochdale flannel weavers, led by the labor lobbyist, Charles Howarth. He banded together twenty-eight poor factory slaves of the English loom and held them in accord until nearly a year later, when they had saved one hundred and fifty dollars to open a mean little provision house on Toad Lane, the rent for which cost them one third of their hard-earned hoard.

Using the services of one Sam Ashforth as unpaid storekeeper evenings until they could overcome the competition of snugly housed rivals and maintain the loyalty of timid and complaining wives and mothers, these rugged Socialists, Chartists, Owenites, and Teetotalers wove something hard and fast into their looms without realizing its importance as a fabric for future welfare.

SAM ASHFORTH probably deserves a biography all by himself, as later on he rose to prominent place in the wholesale side of cooperative merchandising. Be that as it may, we simply have his diary to remind us that the stock of goods they displayed to customers in December 1844 consisted only of 22 pounds of butter, 50 pounds of sugar, six sacks of flour, one sack of oatmeal, and two dozen candles!

How this gawky young weaver, Sam Ashforth, has since found counterparts throughout the length and breadth of our agrarian zones, in the person of co-op produce managers, store bosses, warehousemen, and feed and fertilizer dispensers, constitutes a very long yarn, a much longer yarn indeed than those weavers ever expected to see spun out.

Anyhow, their original charter of membership shows only nine of the twenty-eight founders to be other than weavers. Jim Smithies was a bookkeeper, David Brooks a block printer, John Collier an engineer, George Healey a hatter, John Kershaw a warehouseman, John Screwcroft a hawker, James Wilkinson a shoemaker, John Garside a carpenter, and John Bent a tailor. One woman, Ann Tweedale, has her name on the books, listed only as a Socialist. That one feminine touch completes the saga, so that our dear sisters can join us in toasting the enterprise, liquidating it with whatever refreshing beverage seems most suitable to the Scotch, Welch-English heritage. Up she goes, with mud in the eye to all co-op enemies! Prosit, Skoll, and Here's How! (For the sake of the minority above, who were said to be Teetotalers, use a dash of aqua pura.)

Howarth, the chief schemer, was a warper in the big woolen mills, that is, when he was not figuring as an agitator for the ten-hour working day and the right to strike. Maybe that little slant on their John the Baptist may not sit so well with a section of the present cooperative clan, to whom a pinkish tinged labor leader smells pretty strong.

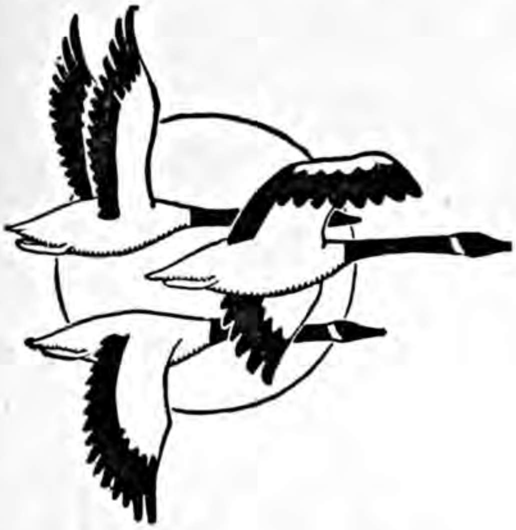
And as a matter of good truth, those who don't like "radicals" had better not poke too deeply into the germination time of English cooperation, for it reeks with radicals and swirls with malcontents. Probably there would be no chance to start any corrective movement like that without the dare-devil doggedness of such nonconformists.

But what we are concerned with in celebrating the Rochdale anniversary is the warp and woof they fixed. Others coming afterwards made the patterns and cast the threads of decorative and desirable design, as we see it in detail now. Now just what was the warp and woof, the skeleton groundwork of this rich tapestry that ornaments the modern altar of cooperation?

TO see it clearly, understand that the Rochdale boys were able to fix such a tough and ingenious warp and woof for future shuttles because of a few blunders which others had made before them.

For the Rochdale clan was not the first to want companionship in misery as a means of getting ahead. During the years preceding the experiment in Toad Lane merchandising, there were scores of so-called Friendly Societies, Penny Capitalists, and followers of William King and Robert Owen in a sort of paternalistic self-help crusade. Maybe Owen himself carried the germ of true cooperation in his attempt to socialize and uplift the working classes whom he employed, but his story does not seem to get farm leaders excited, so let's drop him.

What the Rochdale gentry did in fixing the warp and woof of the cooperative web was to insert a couple of points in their by-laws which had never appeared in the traditions of guilds and



thrift clubs and penny-pinching workmen seeking relief from grinding penury.

You don't find the fibers of their real warp and woof in the declaration of aims, such as merchandising, housing improvement, and some limited manufacturing of consumer goods. It wasn't what they intended to do in a productive way that makes history. It was how they intended to govern their society and hold it together as a trading concern that would last.

I refer to Point No. 3 and Point No. 6 in this Magna Charta of Cooperation. Here you see the warp and woof which have undergone much strain without breaking a thread or unraveling much in a whole century of progress. Any ruralite will agree that Rochdale unknowingly said a mouthful when they (or Mr. Agitator Howarth) wrote these points down by candle glow.

So all ye who revel in patronage dividends and want to reward customers and attract trade in the cooperative way, take due note of No. 3 in Rochdale's warp:

"The distribution of profits (after meeting expenses and interest charges) shall be in proportion to purchases."

Howarth and his weavers were as ignorant of making an important, world-shaking discovery as Columbus was when he landed on San Salvador, but this simple sentence did it in a nutshell. It also put the kibosh on all wordy lawyer lingo so often used to usher in some modern public policy.

Point No. 6 in the constitution was not quite so revolutionary as No. 3, but it has its modest virtues that induce me to call it the woof of the Rochdale web:

"Each member of the society shall have one vote and no more."

This survives as one of the cornerstones of cooperation, keeping it in the democratic channel free from monopoly by financial power in the hands of greedy minorities. It distinguishes stock companies from cooperatives in one sense, and has been one reason for the popularity of the movement among farmers.

BEAR in mind that I do not say that either or both of these wise and significant contributions by Rochdale pioneers has meant that all subsequent schemes and programs hatched out in the name of cooperation and bearing the above hallmarks of validity have been worthy of success and confidence.

Cooperation has had its counterfeits and mountebanks slogging along in its wake like harpies and sharks ever since Howarth's lads opened shop in Toad Lane, Lancashire. And almost worse than that, it has had hosts of failures to be blamed on indifference and neglect. Other blows at the heart of these enterprises have been struck by over-optimistic fellows with ideas that you could buy and sell things at cost and get rich quick individually and collectively at one and the same time.

Few avenues of human endeavor and ambition are left untouched by some

(*Turn to page* 50)

"Milk Flows Where Alfalfa Grows"
The lime requirement of this crop is high. Acid soils should be limed and well fertilized for abundant production.

Doubling Production By Bettering Soils

By C. J. Chapman
Soils Department, College of Agriculture, Madison, Wisconsin

MOST of us agree that there is still a great opportunity for increasing the productiveness of land now under cultivation. It has been said that the average Wisconsin dairy farmer is operating on about a 50 per cent efficiency basis. Total production of crops, as well as the livestock-carrying capacity and output of dairy products, could be increased a good 50 per cent—in fact it would be possible to double the gross returns on many farms if all of those practices of good soil, crop, and livestock management were carried out over a period of years.

If we were to take an average cross section of all the 190,000 farms in Wisconsin and compare the output of this average with production on those few farms which we consider to be models of efficiency, I think the above statements would prove to be correct. And here is the program, which, if followed out over a period of years, might make possible the doubling of the gross output and income of the average farm, and at the same time show a good profit on the practices suggested:

1. The conservation of the soil by erosion control and humus-maintenance practices.

2. The liming of every acre of acid soil on the farm, and the maintenance

of adequate lime supplies by subsequent reliming every few years.

3. The return to the soil of the plant-food nutrients contained in animal manures.

4. The regular and systematic use of commercial fertilizers on all fields and crops wherever profit can be derived from its application.

5. The providing of good pasture throughout the spring, summer, and fall months. This pasture-improvement program should include the fertilization (and renovation where practical) of both permanent and rotational pasture, and the providing of emergency pasture for mid- and late-summer grazing.

6. The growing of those crops, especially alfalfa and clover, which will produce the largest returns in crop-feed units from our cultivated fields.

A program in which all six of the above factors are put into action and carried out over a period of years will go a long way toward accomplishing the goal of 100 per cent efficient production. But I haven't mentioned the other factor, and perhaps the most important, in this program of dairy farm efficiency, and this is my trump card:

7. Feed the good crops grown on our farms to good cows.

Good Cows! And in these words I wish to convey all those principles of dairy-herd improvement and management which for a period of 50 years our colleges have so consistently preached and taught. But there is still room for improvement, even in the matter of good cows and efficient feeding practices.

The feeding of crops grown to livestock and the return of the manure produced to our soils have not maintained the productiveness of Wisconsin farm land. In fact, a careful study of the situation reveals that for years we have been "selling our farms down the river," and I am not so sure but that we have been "losing ground" faster in a livestock-dairy-farming system than is true right now in those states where most of the crops grown are sold for cash. Certainly it is true we have been burning up the humus and organic matter of our soils at a rapid rate. We have plowed and plowed to grow crop after crop of corn and grain. Our hillsides have lost both humus and the soil itself.

Manure allowed to leach away and decompose in piles back of the barn during the summer loses much of value. Better to haul and spread every day during the winter.

Many of these sloping fields have been left in a naked and half-starved condition.

Mr. Faulkner in "Plowman's Folly" must be given credit for calling our attention to the evils of over-plowing and more especially to a system of farming that has resulted in the exhaustion of the organic matter in our soils.

The statement has been made that the plant-food losses incurred in the handling of manure, produced on Wisconsin farms last year cost our farmers $100,000,000 in possible crop production. If it is true that the total value of all of the manure produced on Wisconsin farms is $100,000,000, one-third of which is lost by careless and wasteful methods of handling, and if we assume further that a dollar's worth of manure is capable of producing three dollars in crop increases, then it is true that the potential crop losses in Wisconsin last year as mentioned above did amount to the staggering total of $100,000,000.

Value of Saving Manure

We are urging farmers as never before to take better care of the manure produced on their farms. Manure now has a high value. We urge our farmers to use plenty of bedding and save the liquid manure. We point out that nearly one-half of the nitrogen and from 65 to 80 per cent of the potash are contained in the urine. We further urge farmers to haul their manure every day and spread it on their fields even during the winter months when snow covers these fields. Losses will be less where the manure is hauled and spread than where it is allowed to ferment and leach away in piles back of the barn. When fermented manure is spread in the spring or summer, we lose much of the nitrogen by evaporation in the form of ammonia.

The very fact that losses of plant food in a livestock system of farming are high and that these losses have been going on for many years is the reason why our soils are runniing so low on the reserves of available phosphorus and potash and why our crops are responding so generously to fertilizer treatment.

I have said that the dairy farmer may be losing fertility faster than the corn-grain farmer. I am sure this is true with respect to potash losses. In our modern grain, corn-clover system of farming most farmers leave straw and stalks on the ground where they are plowed under. A very high percentage of the potash is contained in the straw and fodder of these crops. Even where soybeans are grown in rotation with corn and grain and are combined in the field, the straw is left on the ground and thus most of the potash is returned to the soil. But in a livestock system of farming, most of the crops are fed and the potash is voided largely in the liquid manure. Furthermore, a high percentage of the potash contained in the straw and fodder used for bedding is in water-soluble form and subject to loss by leaching. On the average dairy farm, not more than 45 to 50 per cent of the potash contained in crops grown actually finds its way back to the cultivated fields in the manure. In fact, not more than 50 per cent of the nitrogen and phosphorus contained in these feeds gets back to our cultivated fields. We are short-changing our farms every year, even in a livestock system of farming, and this has been going on year after year for a good 50 years.

Is it any wonder then that commercial fertilizers are being used so extensively and crops responding so tremendously to their use? We have fought a battle in Wisconsin for the past 25 years in our efforts to break down the prejudice against the use of commercial fertilizers. We have battled against the forces of indifference and that feeling of self-security which our livestock farmers have grown up with. The growing of legumes and the maintenance of a fairly good level of nitrogen on some of our farms seemed to mislead us. The lodging of grain was thought to be a sign of high fertility, but gradually it has become clear that on many of these farms where lodging

Barley on the farm of Danielson Bros., Chippewa county, Wis., responded in a striking way to treatment with fertilizer. Yields were: No treatment, 22.9 bu. per acre; 0-20-0 at 200 lbs. per acre, 39.4 bu. per acre; 0-20-10 at 200 lbs. per acre, 40.2 bu. per acre.

was a problem there had developed an unbalanced condition of plant-food nutrients in the soil. Farmers now admit there must be a deficiency of certain plant-food elements.

Field demonstrations on our Wisconsin farms with phosphate and potash fertilizers, applied to the grain and legume seedings, have proven that yields, even on fields where lodging was a problem, could be increased. The grain may still lodge on many of these fertilized plots, although we have observed that where soil tests show a need for potash and potash was used, lodging was less severe. Catches of clover or alfalfa were usually better on those plots receiving the potash in addition to the phosphate.

I never tell a farmer that the use of potash in the fertilizer will prevent lodging, but I do make the statement that when potash is needed and used in the proper proportions, there will be less tendency to lodging. I have seen plots even where potash fertilizers were used "go down" worse than the unfertilized plots. The rankness and heaviness of growth in these cases overbalanced the advantage gained in the thicker cell walls in the plant tissues and the resulting stiffness of the straw.

However, there are thousands and thousands of acres of land in Wisconsin where lodging is not a problem. Our light-colored silt and clay loams, as well as sandy soils, are frequently so low in nitrogen that they do not produce enough straw. For our grain and legume seedings on such soils, we are finding it profitable to use fertilizers containing some nitrogen. In fact, the use of nitrogen in fertilizers for grain on the thinner, poorer soils will be more strongly advocated now that the cost of nitrogen is less and supplies are becoming more and more abundant. We especially recommend the use of some nitrogen in the fertilizer for our new rust and smut-resistant Vicland oats, when grown on these thinner sandy soils. This variety of oats is short-strawed and our agronomists have hesitated in recommending it on these lighter soils for this reason.

The prejudice against the use of fertilizer in Wisconsin is dying out. The tonnage of fertilizer used is increasing by leaps and bounds. In 1943 Wisconsin farmers bought and used about

175,000 tons of commercial fertilizers. Just four years previous (1939), 42,623 tons were sold.

Our state-wide program of soil testing has been an important factor in "selling" Wisconsin farmers. Records show that in the five-year period, December 1, 1938, to December 1, 1943, a total of 270,179 samples of soil were tested in our State, district, and county laboratories. The average of all the tests shows that 76 per cent of our soils are deficient in available phosphorus and 53 per cent are low in available potassium; 65 per cent of these samples are acid and the fields from which they were taken are in need of lime.

This soil-testing program has been helpful in stimulating interest in the use of fertilizers. It has given farmers a more intelligent basis on which to order the kinds of fertilizers best suited to soils and crops. I will never argue, however, that the soil test is a 100 per cent accurate means of determining the kind of fertilizer to use. But the results of our soil tests have been very helpful in the hands of our county agents, teachers of vocational agriculture, and fertilizer salesmen, as a basis for recommending fertilizers. Certainly, recommendations made on the basis of soil tests are more accurate than simply "guesses."

The thousands of demonstrations carried out all over the State have been of even greater value in "selling fertilizers" to Wisconsin farmers. Not only have these demonstrations given individual farmers a "see and believe" lesson, but these field trials carried out by county agents and teachers of vocational agriculture have likewise given "the teacher" himself first-hand information. In turn, these educational leaders have gone out in their counties and communities with enthusiasm and conviction and have talked fertilizers. The results of these field demonstrations have given all of us more confidence in our soil tests and recommendations based on soil tests. Furthermore, the yield data and pictures secured from field demonstrations have been of great help in carrying out an educational program through the media of radio, press, and platform. Each year the results of

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This picture shows the first good crop of clover hay in many years on this field. Leonard Winiecke, a "Whole Farm" T.V.A. cooperator, was well pleased with the results. Harry Noble, Portage county, Wis., agent, holds a bundle of the kind of hay this field had been growing for many years. Yields were: No treatment, 1,186 lbs. per acre; 300 lbs. of 0-20-0 per acre, 4,060 lbs. per acre; 300 lbs. of 0-20-20 per acre, 5,493 lbs. per acre.

The Response of Various Crops to Potash Fertilization in South Carolina

By W. H. Garman

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LIEBIG was probably the first to emphasize the possibility of depleting soils by cropping if the bases removed were not replaced by manure or artificial fertilizer. He recognized that one of the great benefits from fallowing was due to the weathering of "insoluble" minerals to release bases.[1]

With reference to potash he stated: "The potash contained in the soil itself is inexhaustible in comparison with the quantity removed by plants. But when we increase the crop of grass in a meadow by means of gypsum, we remove a greater quantity of potash with the hay than can under the same circumstances be restored. Hence it happens that, after the lapse of several years, the crops of grass on the meadows manured with gypsum diminish, owing to the deficiency of potash. But if the meadow be strewed from time to time with wood ashes, even with the lixiviated ashes which have been used by soap boilers, then the grass thrives luxuriantly as before. The ashes are only a means of restoring the potash."

It was an acquaintance of Liebig who gave the first detailed account of the use of potash in this country. J. Lawrence Smith,[1] while assayer for the State of South Carolina, was given permission by the cotton planters of his State to determine the cause of cotton rust. His findings were printed in 1847 in pamphlet form, under the title of "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."

In appraising the fertility level of many soils he used an extractant described as "warm muriatic" acid, and did not employ the usual method of determining total soil bases as was the practice of early workers. He checked his findings by field observations. This work was an approach to our present-day methods of soil diagnosis.

He described cotton rust as a nutritional disturbance. The ash of normal cotton plants was found to contain 24 per cent K_2O, and that of rusted plants only 15 per cent K_2O. Thus he was on the verge of discovering the cause of cotton rust as potash deficiency; however, finding more iron in the abnormal than in the normal plant, he was inclined to believe iron was the likely cause. He was thus dealing with the problem of soil acidity, and recommended top-dressing with leached wood ashes, thereby approximating present recommendations of top-dressing with potash for the correction of cotton rust and the application of lime for the correction of soil acidity.

During the ten decades which have passed since these findings were revealed, the soils of this State have been subjected to a system of almost continuous growing of clean-tilled crops. Cotton, corn, and tobacco have been the leading ones. Though erosion was noticed in the early days, little or no attention was paid to it. For many years

[1] Turrentine, J. W. Liebig and the Potash Industry. The American Fertilizer, March 15, 1941.

crops were removed and no fertilizer applied. It is not surprising, therefore, that the supply of available nutrients in many soils of the State is today quite limiting for the optimum production of nearly all crops.

Dr. H. P. Cooper, Director of the South Carolina Agricultural Experiment Station, was one of the first workers in the South to fully realize the importance of potash. As a result, considerable work was initiated in 1931 to investigate the role of potash in the nutrition of various crops. In the Forty-Seventh Annual Report of the South Carolina Experiment Station (1934) Dr. Cooper wrote: "Since corn and legume hay crops are usually not fertilized with a complete mixed fertilizer containing potash, the soils have become very low in available potash. It is a common opinion that corn and grain crops do not respond to potash fertilizers. This impression very probably results from some experimental data secured from rotation and fertilizer experiments where corn and legume hay crops are included in a rotation in which cotton is liberally fertilized with potash fertilizer. Where sufficient potash fertilizer is used for optimum results with cotton, there is sufficient available potash left in the soil for several corn and hay crops.

"Much of the potentially good corn land in the eastern part of the State has become so deficient in potash that corn is often almost a complete failure because of potash deficiency, which is often accompanied by corn root rots.

"The common field crops are affected by potash deficiency in the following order: Cotton, soybeans, cowpeas, corn, and oats. Cotton yields are the first to be seriously reduced by potash deficiency. Cotton is followed by soybeans and cowpeas. Oats are much more resistant than corn. One of the first symptoms observed in the oat crop is weak straw and serious lodging, or plants falling down before maturity.

"It is generally recognized that a heavy application of lime material may reduce the availability of the potash in the soil. This effect is often observed in the cotton crop following such crops as alfalfa where the soil is limed heavily. Where cotton follows alfalfa, it is often necessary to make a heavy application of potash fertilizer materials to the soil to prevent serious injury from potash deficiency or cotton rust.

"Where the rate of application of limestone ranges from 1,500 to 3,000 pounds, there is little danger of having serious trouble from a deficiency of available potash on the better agricultural soil types. If the soil is strongly acid, lime should be applied and in addition potash fertilizers where additional potash is necessary for a successful crop.

"Farmers should not be unduly concerned over a theoretical consideration of the effect of lime on the availability of the potash in the soil. The practical thing to do is to lime strongly acid soils and apply the fertilizers necessary in the economical production of crops."

Potash Supply Situation

Late in 1943 indications pointed to a supply of potash for agricultural use this year of less than the average amount consumed during the past two seasons. At this writing, however, it appears as though the situation has improved. More manure-salts will be available than was anticipated, and certain Lend-Lease commitments have been reduced. Thus, for the current season farmers are fairly certain that there will be sufficient potash to meet their most important agricultural needs.

It is the purpose of this discussion to review the potash experiments of South Carolina. The data used herein are largely taken from the Annual Reports of the Experiment Station.

Current market prices received for the various crops, and paid for potash, are used, rather than those of some predetermined base period. This is done because of the necessity for concern over the present welfare of agriculture. Estimated returns calculated on current prices received and paid by the farmer will exceed, in most instances, those for pre-war conditions. Nevertheless, such data will be of value in serving to emphasize to the individual farmer the importance of adequate fertilization and at the same time impress agricultural leaders with the need for maintaining fertilizer supplies.

Certain of the major crops for which sufficient data are available will be considered. In general they are the leading crops from the standpoint of farm income.

Results of only three of the numerous potash experiments with cotton will be considered. The data are summarized in Table 1.

cotton per pound of potash than the heavier Piedmont soils.

Translating the above responses to potash fertilization into returns per ton of 60 per cent muriate of potash, on the basis of current prices, the following results are obtained: In Part A, Table 1, it is seen that 30 pounds of potash produced 201 pounds more of seed cotton than 15 pounds, which amounts to 13.4 pounds of seed cotton for each pound of potash. Thus if a farmer used 30 pounds of potash per acre on Norfolk sand instead of 15 pounds, one ton of muriate would represent 16,080 pounds of seed cotton. Assuming that the seed cotton will yield 35 per cent lint

TABLE 1.—AVERAGE YIELDS OF SEED COTTON IN POUNDS PER ACRE FROM VARIOUS RATES OF POTASH FERTILIZATION

Treatment, 600 lbs. per acre	Lbs. of K_2O applied	Lbs. of seed cotton per acre	Lbs. increase for each rate	Lbs. increase per lb. of potash
Part A. Sandhill Experiment Station. Soil: Norfolk sand. Average 10 years.				
5-10-0	none	521	......	......
5-10-2.5	15	943	422	28.1
5-10-5	30	1,144	201	20.8
5-10-7.5	45	1,280	136	17.1
5-10-10	60	1,383	103	14.3
Part B. Pee Dee Experiment Station. Soil: Dunbar f. s. l. to Coxville f. s. l. Average 5 years.				
5-10-0	none	176	......	......
5-10-2.5	15	522	346	23
5-10-5	30	1,037	515	29
5-10-7.5	45	1,076	39	20
5-10-10	60	1,220	144	17
5-10-12.5	75	1,417	197	16
5-10-16.7	100	1,248	−169	11
Part C. Cooperative Experiments conducted on farms in the Piedmont. Soils: Cecil, Appling, Durham, Iredell, Alamance. Average 6 years.				
5-10-0	none	757	......	......
5-10-2.5	15	991	234	15.6
5-10-5	30	1,134	143	12.5
5-10-7.5	45	1,157	23	8.9
5-10-10	60	1,217	60	7.7
5-10-12.5	75	1,286	69	7.0

The response to potash fertilization as shown in the above table, for the various soils, is about as expected. The lighter sandy soils of the Coastal Plains gave relatively greater increases in seed

(average is actually nearer 37%) this amounts to 5,628 pounds of lint, and 10,452 pounds of cottonseed. The season price of lint of staple length of one inch or longer has been 21¢ per pound and cottonseed $52 per ton.[2] In terms of dollars these increases are equivalent to $1,182 for the lint, and $272 for the cottonseed, a total of $1,454. Deducting the current consumers' cash price, $50.85 per ton, for the muriate of potash, the balance is approximately $1,403. This means that on this soil a farmer could expect to realize this return from a ton of muriate of potash by fertilizing with 600 pounds per acre of a 5-10-15 rather than a 5-10-2.5. On a farm with 80 acres in cotton this $1,403 increase in income could be expected merely by applying 30 pounds of potash per acre instead of 15 pounds. Of course, there would be a small difference in net return due to the increased cost of harvesting and handling the larger per acre yields.

Similar calculations for the data from the Pee Dee Station, given in Part B, Table 1, which show an increase from 522 pounds of seed cotton with 15 pounds of potash to 1,037 pounds with 30 pounds of potash, an increase of 515 pounds of seed cotton, give the following results: Each pound of potash produces 34.3 pounds of seed cotton, and 1,200 pounds of potash (one ton of 60% muriate of potash) would represent a total of 41,160 pounds of seed cotton. This is equivalent to 14,406 pounds of lint and 26,754 pounds of cottonseed, with a monetary value of $3,025 and $696 respectively, or a total of $3,721. Deducting $50.85 for the cost of one ton of 60 per cent muriate of potash leaves a balance of approximately $3,670. In viewing this figure it should be kept in mind that this experiment was conducted on an unproductive site known to be especially deficient in potash.

The data in Part C, Table 1, representing the cooperative experiments conducted on Piedmont soils, show that 600 pounds of a 5-10-5 produced an average of 143 pounds of seed cotton more than 600 pounds of a 5-10-2.5. This is an increase of 9.53 pounds for each pound of potash. On this basis one ton of 60 per cent muriate of potash represents 10,978 pounds of seed cotton. This is equivalent to 3,842 pounds of lint and 7,138 pounds of cottonseed, with a monetary value of $807 and $187 respectively, or a total of $994, leaving a return of $943 after the cost of the potash is deducted.

These data show the increase in income that might be expected in cotton production on some of the major soils of this State. They are based on the increase in yields for 30 pounds of potash per acre over 15 pounds per acre. Had they been based on the difference between potash and no potash they would have been greater. Comparisons of 45 pounds with 30 pounds show considerable gains, especially on the Coastal Plain soils. Likewise, 60 pounds of potash produced very significant monetary gains over 45 pound applications on some of the lighter soils, however, they are less than for the previous comparison.

Time of Application

The experiments summarized in Parts B and C of Table 1 involved also time of application of potash to cotton as well as the rate of application. These data are omitted, but it might be pointed out that there were no significant differences in yields for the various times of application, that is, when all of the potash was applied under the crop, when all was applied as a side-dressing, or when split applications were used.

When the data of Part A, Table 1, are broken down into two five-year periods [3] an interesting observation can be made. With the two lowest rates of potash fertilization (none and 15 pounds per acre) the yields for the second period were lower than for the first period, averaging 213 and 139 pounds per acre less respectively. In

[2] Prices used are from the January 31, 1944 report, Prices Received by Farmers, U.S.D.A., Bureau of Agr. Economics, Office of Agricultural Statistician, Columbia, S. C., and are average prices for the season as reported.

[3] H. P. Cooper and W. H. Garman. Effect of applications of sodium on the composition and yield of cotton at different levels of potash fertilization. Soil Sci. Soc. of America Proc. 1942, Vol. 7: 331-338.

contrast, the yields for the 30, 45, and 60-pound rates averaged 107, 134, and 276 pounds more respectively during the second five years than during the first. From this it may safely be concluded that where ample amounts of nitrogen and phosphoric acid are applied for cotton on Norfolk sand, yields may be expected to decline with low rates of potash fertilization; whereas with 30 pounds or more per acre, the yields will be maintained, or even increased.

A large number of the experiments conducted with corn have been on farms where corn is grown in a rotation with cotton. In many such instances little response has been shown for the application of potash. This is especially true for the soils of the mountain regions. Typical results of potash experiments with corn are given in Table 2.

applications. Fields where considerable response to potash occurs are occasionally encountered.

The response of corn to potash fertilization was slight even on the sandy soils of the Coastal Plain. The average results of experiments on Norfolk, Ruston, Marlboro, and Orangeburg soils of sandy loam texture show an increase of 2.3 bushels per acre of shelled corn for the addition of 30 pounds of potash instead of 15 pounds. Though this figure is derived from a large number of separate tests, it is of minimum significance, but assuming it to be real, it would be equivalent to 0.16 bushel per pound of potash, or 9.96 pounds of shelled corn. Using the average price paid to farmers of $1.55 per bushel for corn, this increase (192 bushels) represents $298 for one ton of 60 per cent muriate of potash. After the price of the muriate of potash is deducted, a gain of $247 remains.

TABLE 2.—AVERAGE YIELDS IN BUSHELS OF SHELLED CORN PER ACRE FROM VARIOUS RATES OF POTASH FERTILIZATION

Treatment, 400 lbs. per acre	Lbs. of K_2O applied	Mountain soils. Congaree, and Toxaway. Ave. 5 yrs.	Coastal Plain soils: Norfolk, Ruston, Marlboro, and Orangeburg f. s. l. Ave. 4 yrs.	Coastal Plain soils: Norfolk sand. Ave. 3 yrs.
		Bushels of shelled corn per acre		
8-10-0	none	49.9	20.9	8.0
8-10-3.75	15	49.8	24.8	16.6
8-10-7.5	30	49.4	27.1	18.9
8-10-11.25	45	50.5	27.7	22.3
8-10-15	60	50.6	28.0	...
8-10-18.75	75	48.8	29.7	...
8-10-22.5	90	49.2	31.9	...

The above data represent the average yields of shelled corn for a large number of experiments, each figure being the result of averaging more than 80 plots for a given year. No response was obtained on the low-lying soils of the mountain region; however, this should not be taken to mean that none of the mountain soils will respond to potash

This figure is small in comparison with those from other crops, but the average yields of corn in South Carolina are so low that any such small increase in production on the soils in question would be of very great importance.

Much of the land in corn each year receives no potash because the preceding crop, often cotton, has been fertilized

TABLE 3.—AVERAGE YIELDS OF SWEET POTATOES IN BUSHELS PER ACRE FROM VARIOUS RATES OF POTASH FERTILIZATION

Treatment, 1,000 lbs. per acre	Lbs. of K_2O applied	Bushels per acre		Bushels increase per lb. of potash	
		Total	U. S. No. 1	Total	U. S. No. 1
Part A. Sandhill Experiment Station. Average 5 years.					
4-8-0	none	137	91	....	....
4-8-4	40	170	124	0.825	0.825
4-8-8	80	189	142	0.650	0.637
4-8-12	120	200	153	0.525	0.517
Part B. Pee Dee Experiment Station. Average 9 years.					
500 lbs. per acre					
3-8-0	none	152	86	....	....
3-8-3	15	162	104	0.666	1.20
3-8-6	30	176	111	0.80	0.833
3-8-9	45	179	107	0.60	0.469
3-8-12	60	186	114	0.566	0.466
3-8-15	75	179	109	0.36	0.307
Part C. Edisto Experiment Station. Average 3 years.					
1,000 lbs per acre					
3-8-0	none	203	131	....	....
3-8-4	40	212	135	0.225	0.01
3-8-12	120	242	139	0.325	0.066
3-8-16	160	232	129	0.181	none
3-8-20	200	222	122	0.095	none

with potash. From the above data for the same soils, if the yields from the 30-pound application of potash are compared with those where no potash was added, the increase is 6.2 bushels of shelled corn, or 0.207 bushel for each pound of potash. On this basis one ton of 60 per cent muriate of potash will produce 248 bushels of shelled corn, worth $384, leaving $333 after the cost of the potash is deducted. On Norfolk sand the response to the initial 15 pounds of potash amounted to 8.6 bushels, or slightly more than the yield of 8.0 bushels obtained without potash. In this case if 15 pounds of potash were used instead of no potash an increase of 0.573 bushel of shelled corn could be expected for each pound of potash, which amounts to, in terms of one ton of 60 per cent muriate of potash, 688 bushels, worth $1,066, or approximately $1,015 after the cost of the potash is deducted.

Potash experiments with sweet potatoes have been conducted at three locations on Coastal Plain soils. The results are given in Table 3.

As did cotton and corn, sweet potatoes showed more response to potash fertilization on the Norfolk sand at the Sandhill Station than at the other locations. Considering the yields of No. 1 potatoes in Part A, Table 3, it is seen that 80 pounds of potash produced 142 bushels, and 40 pounds produced 124 bushels, a difference of 18 bushels for the additional 40 pounds of potash. This amounts to a yield gain of 0.45 bushel per pound of potash. On this basis one ton of 60 per cent muriate of potash would produce 540 bushels of No. 1 sweet potatoes. In the 1943-44 season the price received by the commercial grower for No. 1 potatoes has varied from $3 to $5 per bushel. Taking the lower figure, the 540 bushels would be worth $1,620, or a net of $1,569 after the cost of the ton of muriate of potash is deducted. Thus, under these conditions one might expect to realize comparable returns by using 1,000 pounds of 4-8-8 per acre on 30 acres of sweet potatoes instead of 1,000 pounds per acre of 4-8-4 fertilizer on the same area. This takes into account only the No. 1 potatoes.

At the Pee Dee Station the only significant difference was that between the yield of No. 1 sweet potatoes from 500 pounds of 3-8-3 over 500 pounds of 3-8-0, which amounted to an average of 18 bushels annually over the nine-year period. Additional amounts of potash did not increase the yield of No. 1 potatoes. However, there were slight gains in the total yields up to the 60-pound rate of potash fertilization. If the total yields from 500 pounds per acre of 3-8-12 are compared with those from 500 pounds of 3-8-3, there is a difference of 24 bushels of sweet potatoes per acre. The additional 45 pounds of potash therefore produced 0.533 bushel per pound of potash. One ton of 60 per cent muriate of potash thus would produce an increase of 640 bushels in total yield. Assuming that the average selling price of these potatoes would be $1.80, the increase would amount to $1,152, or a gain of $1,101 after the price of the potash is subtracted. For these same treatments the yields of No. 1 potatoes differed by only 10 bushels per acre.

The results obtained at the Edisto Station are similar to the above in that there were no significant differences in the yields of No. 1 sweet potatoes. However, the total yields were increased by potash applications up to the 120-pound rate. The 1,000-pound treatment of 3-8-12 fertilizer produced 242 bushels of potatoes while the same amount of 3-8-4 produced 212 bushels, a difference of 30 bushels. The additional 80 pounds of potash, therefore, produced 0.375 bushel for each pound of potash. Calculating as before, one ton of 60 per cent muriate would result in a total increase in yield of 450 bushels of sweet potatoes, which at $1.80 per bushel would be worth $810. Deducting the cost of the potash, this represents a gain of $759. Thus on 15 acres of sweet potatoes a gain of this amount might be expected from the use of 1,000 pounds per acre of 3-8-12 fertilizer instead of the same amount of 3-8-4 per acre.

The only experimental work on the fertilization of peaches has been done at the Sandhill station on Norfolk coarse sand.[1] In this experiment the rate of fertilization was not varied, but consisted of treatments where nitrogen, phosphorus, and potassium were omitted singly. The data are given in Table 4.

The no-potassium plots (nitrogen plus phosphorus) yielded less than the nitrogen plus potassium plots every year, and especially the last four years. In 1938 these plots yielded less than the no-fertilizer treatment. The quality of the no-potash fruit was very inferior

[1] Scott, L. E. American Soc. for Horticultural Science, Proceedings, 36: 56-60 (1938).

TABLE 4.—YIELD OF PEACHES IN POUNDS PER TREE FOR DIFFERENT FERTILIZER TREATMENTS. SANDHILL STATION. AVERAGE 6 YEARS

Treatment	*Average yields, lbs. per tree	Remarks
No fertilizer	36.3	Complete treatment consisted of: 0.10 lb. NH_3, 0.05 lb. P_2O_5, and 0.05 lb. K_2O per tree per year for first 3 years, and 0.80 lb. N, 0.40 lb. P_2O_5, and 0.40 lb. K_2O per tree per year thereafter. Partial treatments used same rates.
Nitrogen (−PK)	46.8	
Nitrogen plus phosphorus (−K)	61.6	
Nitrogen plus potassium (−P)	96.1	
Complete	109.5	

* Difference of 11.6 pounds required for significance.

and many of the peaches failed to develop normally. The nitrogen plots averaged 46.8 pounds per tree, while those receiving potash in addition yielded 96.1 pounds per tree, a difference of 49.3 pounds for the 0.40 of potash. There were approximately 100 (actually 108) trees per acre, so that this increase in yield would amount to 4,930 pounds of peaches per acre as the result of applying 40 pounds of potash. Thus each pound of potash produced 123.25 pounds of peaches, or 2.465 bushels. Applying one ton of 60 per cent muriate of potash at the rate of 40 pounds of potash per acre to an orchard of 30 acres, on this basis, would result in an increase of 2,958 bushels of peaches. The price received by farmers this past year averaged $5.00 per bushel for "orchard run", including all sizes and culls. This price is abnormally high and is much out of line with the advance in prices of other farm products. For this reason a more representative figure will be used to calculate the returns due to the addition of potash in this experiment. If the crop of peaches had not been greatly reduced by late freezing last spring, the price would likely have been nearer $1.50 to $2.00 per bushel. Using the lower figure, the above increase in yield per ton of 60 per cent muriate of potash would amount to $4,437, or $4,386 after the potash was paid for. In this case the added cost for handling the larger harvest would be appreciable so that the net return would not be this large; however, it is obvious that it would still be very great. This comparison may have little significance. Here nitrogen only is compared with nitrogen plus potash. On Norfolk sand it would be most uneconomical to attempt to maintain a peach orchard without applying potash. But, the data will serve to show just what could be expected to be lost if a grower on this soil omitted potash from his peach orchard. His yields would not only be low, but the quality of fruit produced would not sell at near the market price.

Comparing the nitrogen plus phosphorus treatment with the nitrogen plus potassium there is a difference of 34.5 pounds of peaches per tree in favor of the potash treatment. This is equivalent to 69 bushels per acre from the 40 pounds of potash applied, or 1.725 bushels per pound of potash. One ton of 60 per cent muriate of potash would produce an increase in the crop of 2,070 bushels which at $1.50 per bushel would amount to a crop worth $3,105, and when the cost of the potash is deducted give a return of $3,054. Here again this would not represent actual profit due to the added cost of handling the larger yields.

Complete Fertilizer

The real effect of applying potash can perhaps be more accurately observed by comparing the complete treatment with the nitrogen plus phosphoric acid treatment. The former averaged 109.5 pounds of peaches per tree while the latter averaged only 61.6 pounds. The difference of 47.9 pounds can be ascribed as due to difference in treatment, which was 0.40 pound of potash per tree. Calculating as before, this would amount to a gain in yield of approximately 4,790 pounds of peaches per acre. This is equivalent to 95.8 bushels due to the addition of 40 pounds of potash per acre, or 2.395 bushels for each pound of potash. In this case one ton of 60 per cent muriate of potash applied at the rate of 40 pounds of potash per acre, to an orchard of 30 acres, in addition to nitrogen and phosphoric acid fertilization, would increase production by approximately 2,874 bushels. At $1.50 per bushel this would represent an increased crop worth $4,311 or $4,260 after the cost of the potash is accounted for. This is only slightly less than the calculated return of $4,386, where the potash plus nitrogen treatment was compared with nitrogen alone.

It is apparent that the effect of potash fertilization on peaches on this soil is very pronounced. Regardless of the price of peaches, an increase in production of 90 bushels or more per acre would be quite profitable if it could be obtained merely for the cost of applying 67 pounds of 60 per cent muriate of potash per acre.

In these comparisons it should be remembered that potash versus no potash data are used. Data are not available to show the response of peaches to increasing amounts of potash.

Although tobacco is neither a food nor a feed crop, it ranks high in importance. It is doubtful if the war could be conducted as efficiently if the supply of tobacco at the fighting fronts should become limited. The economy of certain sections of several Southern States is very closely related to the production of tobacco.

In South Carolina alone there are annually about 100,000 acres in flue-cured tobacco. This is approximately one-tenth of the entire acreage devoted to cotton in this State.

The data given in Table 5 illustrate typical results obtained from fertilizer experiments with tobacco.

The results of this experiment, reported in the Fifty-Fourth Annual Report of the South Carolina Experiment Station, were summarized by J. F. Bullock as follows: "Although the results obtained . . . are not entirely consistent, they seem to indicate that under the conditions of the test a considerable increase in the value of the tobacco crop may be expected from an increase in the rate of potash fertilization up to at least 120 pounds of potash per acre, provided the potash is applied in the form of sulfate. The increase in value of the crop was due partly to increase in yield and partly to improvement in quality. Where sources of potash other than the sulfate were used, approximate maximum benefit was obtained with 60 pounds of potash per acre. When only 30 pounds of potash per acre were applied, the crop showed symptoms of potash hunger. There was no significant decline in quality of the cured leaf when as much as 240 to 300 pounds of potash per acre were used, and in fact the results indicate that if the sulfate is used, beneficial results may be obtained from these high rates of fertilization."

Considering the results for the 60, 120, and 300-pound rates of potash fertilization, where sulfate of potash was used, the per acre yields and value of the crop, as shown in Table 5 are: 1,503 pounds of tobacco worth $215.24, 1,487

Table 5.—Yield of Flue-cured Tobacco in Pounds per Acre, and Corresponding Value of the Crop for Various Sources and Rates of Potash Fertilization. Pee Dee Experiment Station. Marlboro Sandy Loam. Average 5 Years

*Source of potash applied in fertilizer	**Pounds of K_2O per acre	Pounds of tobacco per acre	Value of leaf per 100 pounds	Acre value of crop
			Dollars	*Dollars*
Nitrate of potash	30	1,386	15.20	210.62
Nitrate of potash	60	1,506	15.24	229.47
Carbonate of potash	60	1,471	14.61	214.98
Sulfate of potash	60	1,503	14.32	215.24
Nitrate, 1/3; carbonate 1/2	120	1,490	15.42	231.24
Nitrate of potash	120	1,457	15.85	230.99
Sulfate of potash	120	1,487	16.56	246.28
Nitrate, 1/4; carbonate, 2/3	180	1,548	14.80	229.08
Nitrate, 1/6; carbonate, 3/4	240	1,522	16.15	245.84
Nitrate, 1/7; carbonate, 4/5	300	1,512	14.56	220.18
Sulfate of potash	300	1,666	15.72	261.89

* All plots received the following: 30 lbs. nitrogen, 80 lbs. phosphoric acid, 65 lbs. calcium oxide, 20 lbs. of chlorine, and 0.5 lb. of boron.

** Of the total quantity of potash indicated, 20 lbs. were in all cases derived from muriate of potash.

pounds worth $246.28, and 1,666 pounds worth $261.89, respectively. Though the yields did not increase consistently, as previously pointed out, there was an increase in the per acre value of the crop produced. In flue-cured tobacco production quality is one of the first objectives. The 120-pound rate of potash fertilization produced tobacco worth $31 per acre more than the 60-pound rate, while with 300 pounds the crop was worth $15.61 more per acre than where 120 pounds of potash per acre were applied. The average farmer uses about 60 pounds of potash per acre for flue-cured tobacco. According to these data, if he used 60 additional pounds he could expect to get approximately $31 per acre more for his crop. Applying one ton of 50 per cent sulfate of potash at the rate of 60 pounds of potash per acre would cover 16.7 acres. Thus, if a farmer had 16.7 acres of tobacco and applied 120 pounds of potash instead of 60 pounds per acre, he might expect to get a crop worth approximately $518 more than without the extra 60 pounds of potash per acre. After the cost of the one ton of 50 per cent sulfate of potash is deducted, this would amount to around $464. On the basis of the data in Table 5, this would represent actual gain because all of the profit would have to be considered as due to improved quality and not to increased yields.

Potash and Other Crops

Experiments involving rate of application of potash have been conducted with such additional crops as tomatoes, Irish potatoes, asparagus, beans, cabbage, oats, oat hay, and soybean hay.

The experiments with tomatoes, Irish potatoes, beans, and cabbage have been conducted in the trucking areas along the coast. Truck crops have been produced in these areas for many years and the rotation of tomatoes, cabbage, potatoes, and beans widely used. In the main trucking centers there has been little need for new land to be put into production. For years heavy applications of fertilizer have been made to these soils, most fields receiving 1,000 to 1,500 pounds of complete fertilizer in the spring and again in the fall. Experiments with these crops have been conducted on representative truck soils, and not on new untreated land, in order that growers changing from one crop to another may have some idea as to the fertilizer requirements of the crop to be grown. The response that has resulted from potash has been mainly from the lower rates of application, with depressions in yield occasionally resulting from heavy applications. However, in some of these experiments where 2,000 pounds per acre of fertilizer are used, varying in analysis from 5-7-0 to 5-7-10, and all crops in the rotation fertilized, the reduced yields at the higher potash level may not be due to an over-supply of potash but to the total salt concentration.

On such soils as these, several years may be required to deplete the potash content to the point where the yields of the no-potash plots begin to decline. But, on the soils with lighter subsoils as found in the upper Coastal Plain, yields of most crops decline rapidly when potash is omitted.

At the Sandhill Station where 2,000 pounds of fertilizer per acre were applied to asparagus, with potash varied from zero to 300 pounds per acre, the yields of the no-potash plots declined each year in relation to the potash treatments. In 1937, the last year of the experiment, the 5-7-5 yielded 3,026 pounds of asparagus and the no-potash plots 2,316 pounds. Potash also exerted an appreciable influence on the percentage of the spears grading colossal, amounting to a net gain of 12 per cent of the total yield for the 5-7-5 over the 5-7-0 fertilizer. These results are from a four-year study. A longer period undoubtedly would have resulted in greater differences.

In an experiment at the Sandhill Station with soybean hay where 400 pounds per acre of 4-8-2, 4-8-4, and 4-8-8

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Looking over the farm and getting yield data, but the farmer can give him only the prices of the past.

That Land Boom

By C. B. Sherman

U. S. Department of Agriculture, Washington, D. C.

UNRESTRAINED booms in farm-land values bode nobody permanent good. And they can and do hurt thousands in many walks of life. They hurt farm families most of all, in the long run. For what profit do better crops or bigger crops bring to the farmers who grow them if the land on which they are grown is mortgaged beyond the hilt?

Big prices for farm land may look good to farmers who would like to sell and to lenders who have put their money into farm mortgages. Speculators like them. But older farmers remember the excruciating results of the boom brought by the last war. Many farmers who had expanded their ownings for patriotic or other reasons faced bankruptcy. Farms that were apparently sold came back on the hands of previous owners who had retired or gone into other business. Huge acreages of farm lands went into the hands of non-resident corporations that did not really want them and that were thus forced to start competition with family-owned farms. Disaster was general.

Signs of a land boom are now so evident that whether one is on the way is no longer the center of discussion but rather how to prevent or control it, according to Mark Regan, the man in the U. S. Department of Agriculture who has given most study and thought to these matters. Farm-land prices are going up almost as rapidly as during World War I. High prices for farm products, unusually large farm incomes, large liquid funds at the disposal of farmers, and the buying of farm land by purchasers who are not farmers are among the obvious reasons. And there are no comparable curbing influences.

Farmers have been using much of their larger incomes to pay off their debts and many of the recent land sales have been for cash, so the total of farm-mortgage debt has been going down. But now reports are coming in showing that heavier debts are frequently being assumed when farms are bought, and this is especially true of tenants who are buying on contract or with a relatively small down payment.

If post-war prices for farm products do not drop excessively, post-war prices for land could be maintained without deplorable impacts. It may be the policy to attempt to maintain commodity prices at levels not much lower than wartime, but maintaining a given relation between prices for farm products and the general price level is particularly difficult to do, Mr. Regan points out.

It is hard to realize today, when the cry is for food and yet more food, but regardless of trade policy and work toward improved nutrition for the many, it is entirely possible that we may again face so-called agricultural surpluses.

This prospective buyer studies the farm lay-out, but what about post-war prices?

"Opinion as to the best measures for meeting these powerful influences has not fully crystalized, but there is general agreement that a boom is not wanted and the view is widespread that it should be prevented even though that may mean government action," says Mr. Regan.

"As the direction of events after the war is surrounded by uncertainties, the safer course is to control land prices now, slowing down the value of credit increases until we reach a better basis for predicting future incomes and prices. Adjustments then would be much less severe. It was about 10 years after the last war before land prices were such that they could be supported by earnings that could be reasonably expected from the land."

Effects on the war are also to be considered. The land market competes actively for the money that farmers might otherwise invest in war bonds. An excess number of land sales could interfere with achieving the food-production goals. Moreover, to prevent runaway prices of all capital assets, including farm land, is an integral part of the general program of inflation control.

But what about these measures that might be tried? Are they practicable? How would the public respond to them?

"They are practicable, I should say, and quite specific," says Mr. Regan. "The degree to which they would be acceptable to the public is still debatable."

Super-taxes on speculative gains could curb speculators and this approach is receiving increasing support as one means of curbing a land boom. Credit controls could keep mortgage loans within bounds. Taxes on land sales could hold down the number of sales and the increase in prices. Certain differentials could give preference to buyers who expect to farm the land

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Soil Tests Indicate Potash Levels

By J. Fielding Reed

North Carolina Department of Agriculture, Raleigh, North Carolina

THE results of soil analyses made by the Soil Testing Division of the North Carolina Department of Agriculture offer a good insight into the general level of "available" potassium in various parts of the State. The need for a general survey of such information has arisen in connection with the necessity for using as efficiently as possible the potash available for agricultural use.

In the course of a year many soil samples are handled by this Division. A compilation has been made of the "available" potash content of soils received during the year 1942-1943. This data has been grouped according to agricultural areas and is presented in Table 1 and Figure 1. The yield response of various crops to potash applications in these same areas is discussed in a paper by Dr. R. W. Cummings, Head of the Agronomy Department at North Carolina State College, which will appear in a later issue of this magazine.

Some mention should be made of the type of samples from which this information is drawn. A rather thorough educational program in North Carolina has done much to reduce the number of improperly sampled soils that are sent in. The samples considered in compilation of this information do not include any garden or lawn areas and do not include too many from any one farm. For the most part, these samples were taken under supervision or instruction from this office or from the office of the County Agent, Soil Conservation Service, or Vocational Teacher. It is recognized that such samples are not as representative of an area as would be the case if the area were systematically sampled for a specific study of this soil. But the information furnished by the samples gives a survey of the comparative level of "available" potash in various parts of North Carolina.

The method in use at present for the determination of "available" potassium involves extraction with 0.05 N HCl and determination of potassium directly in the extract by precipitation as the cobalti-nitrite and estimation turbidimetrically. The details are described elsewhere, and it is sufficient to say that the procedure is quite satisfactory if proper precautions of temperature control, etc., are taken. The relative terms very low, low, etc., are used because experience has shown that our farmers find such relative terms easier to understand than estimates of the parts per million or pounds per acre. Translated in terms of parts per million of the soil the figures are approximately:

	p.p.m.K
High	Above 70
Medium	30–70
Low	15–30
Very Low	0–15

These are not suggested as figures for calibration in other localities. Varying the extractant or ratio of soil to extractant should give different results. The important point is the interpreta-

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South Finds Clovers Excel in Profits

By F. J. Hurst

Administrative Ass't, Agricultural Adjustment Administration, Jackson, Mississippi

BECAUSE of their multiple value—for winter grazing, for erosion control, for soil-building, and for seed production—white clover, crimson clover, and red clover are increasing in popularity and acreage. From the brown loam sections of Mississippi and Louisiana to the fertile hills and alluvial valleys of Tennessee, Kentucky, and Virginia, these clovers are given an important place on many farms.

White clover is one of the leading pasture clovers of the South. The acreage annually seeded to this crop is increasing by leaps and bounds. It is best adapted to bottom soils, but will make a surprisingly fine growth on the better hill lands when fertilized with limestone and superphosphate or basic slag, and potash wherever needed. White clover fits ideally into the permanent pasture program because it furnishes abundant and nutritious grazing during the winter and early spring months when pasturage would otherwise be scarce on many farms.

In Claiborne, Adams, Jefferson, Warren, and other counties in the brown loam area in Mississippi and in the brown loam parishes in Louisiana, the production and harvesting of white clover seed, largely from permanent pastures, constitute an important enterprise on some farms and add to the total cash returns received from land in pasture. Claiborne county farmers alone harvested 90,000 pounds of white clover seed in 1943. Yields averaged around 100 pounds per acre, with 150-pound yields common where the clover had been fertilized. Gravity-run seed found a ready market at 50 to 65 cents a pound.

What this meant in cash income to producers is revealed by County Agent J. S. McKewen, Port Gibson, who reports that J. V. Gage harvested 6,000 pounds; Weil and Boston 25,000 pounds; Fred Wolcott 8,000 pounds; I. W. Carpenter 6,000; C. L. Nelson 3,500; D. M. Dowdell 3,000, and others from 1,000 to 2,500 pounds each.

County Agent E. L. Hobby of Jefferson county in 1943 harvested from 40 acres 4,500 pounds of cleaned white clover seed which tested 99.2 per cent pure. He reported, "Since June 10 when seed harvesting was completed on the 40 acres, we have grazed 1½ animal units per acre. With normal rainfall, these animals will continue grazing until field crops are harvested. They will then be shifted to the fields in November and December and then back to white clover until April 1 of next year. The 40-acre tract is good land and, in addition, received an application of 600 pounds of basic slag per acre last fall."

Hobby "doubts if any other crop will give so much grazing and still yield a seed crop valued at $40 per acre. After watching white clover carefully for three years, I have concluded that it is one of our most important pasture plants. It gives grazing nearly all winter and on the damper, more fertile soils provides grazing all summer."

When white clover is to be harvested for seed, animals are removed from the pasture about the middle of April to the first of May and the clover allowed to mature seed, which is usually the latter part of May and the first days of June. Harvesting the seed serves as a cultivation of the pasture which in 10 days to two weeks will again be ready for grazing.

White clover is usually harvested for seed when 75 to 80 per cent of the heads are brown in color to thoroughly ripe. Most of the seed should shell out in the palm of the hand when rubbed. A common practice is to cut the crop with a mowing machine and leave it flat in the swath. The cutter bar should be about one foot narrower than combine. Care should be taken to have the mower in good shape with new ledger plates, good guards, and sharp blades. The clover should be cut close to the ground. A mixture of grasses makes the clover easier to cut.

By the middle of the third or fourth day without rain, the clover will be crispy dry and the seed will thresh out easily. A pick-up attachment should be used for taking the clover off the ground into the combine. If rains delay threshing, the clover may have to be raked before the second growth ties it down. A side-delivery rake is best. Only what the combine can handle in one day should be raked into small windrows after the dew has dried off in the morning. The seed should not be threshed before 10 o'clock in the morning, and it is usually necessary to stop about 4 or 5 o'clock in the afternoon.

Seeding White Clover

Farmers who desire to add white clover to established permanent pasture should sow 3 to 4 pounds of seed per acre on the pasture sod in October and cover the seed by light harrowing.

As a winter cover crop, white clover may be seeded on clean, cultivated corn or çotton land without previous preparation. But if a seed crop is to be harvested, the seed should be planted on a firm, smooth seedbed, which has been prepared by plowing, disking, harrowing, and dragging until the surface soil is finely pulverized and perfectly smooth. Rain should further firm the seedbed.

At least five pounds of seed should be sown in October or early November when moisture conditions are right. A grain drill with grass-seed attachment is ideal equipment for seeding. It is not necessary to cover the seed. Where a cultipacker is used, the little furrows will hold the seed in place. If the land is smooth, a section harrow can be used to form small furrows to hold seed in place and prevent drifting by heavy rains on sloping land.

Crimson Clover as a Winter-grazing Crop

In Mississippi, crimson clover probably rates tops as a winter-grazing crop on land to which it is adapted. The amazing carrying capacity of crimson clover planted on fairly fertile soil and fertilized was demonstrated during the past season by Howard Greene of Madison county. Mr. Greene seeded 84 acres to a mixture of oats and crimson clover early in September 1942, using 1½ bushels of oats and 15 pounds of crimson clover seed per acre on well-prepared land which was fertilized with 500 pounds of basic slag per acre.

The oats and clover were ready for grazing in early October, and a total of 100 head of yearlings, 175 sheep, and 50 hogs were grazed continuously on the area until April 20, 1943, when the animals were removed and the clover allowed to seed. An average of 400 pounds of seed per acre was harvested and sold for 11½ cents a pound, or $46 per acre.

The yearlings gained an average of 100 pounds per head and increased in value from $10 to $15 per hundred pounds. On June 5, he sold 83 lambs, which averaged 83.5 pounds each, for $967. The sheep and lambs received no other feed, but were grazed on permanent pasture after they were removed from the clover. The hogs were fed corn in addition to grazing. Around $1,000 worth of hogs was sold off the clover.

D. M. Dowdle of Claiborne county grazed 34 head of mature cattle during the entire winter and up to April 21 on 13 acres of crimson clover. The clover was then allowed to seed for harvest. After the seed were combined, the land was planted to sorghum for silage which would be ready for harvest in time to again plant the land to crimson clover.

Crimson Clover Checks Erosion

If the producer does not desire to save seed, the livestock should be removed in the spring in time to permit the growth and turning under of the clover as a green-manure crop. Crimson clover covers the entire area of the surface soil, provides perfect protection against erosion, and adds large quantities of humus and nitrogen to the soil when plowed under.

Crimson clover requires more fertile soil and better preparation of the seedbed than vetch or Austrian winter peas. Its use has been retarded because of the difficulty in obtaining good stands. The seed germinates very easily, but once sprouted, the little seedlings are easily injured or killed by subsequent drying. For this reason, crimson clover should not be seeded until there is enough moisture in the soil to allow the young plants to establish a good root system. For a cover crop or for grazing, crimson clover may be sown on corn or cotton land which has just been disked.

If a seed crop is desired or if the land is covered with considerable vegetation, a good seedbed should be prepared by thorough plowing, disking, harrowing, and packing or dragging. The soil should be prepared sufficiently in advance of seeding time to permit rains to firm the seedbed. This is important.

Crimson clover should be planted at the rate of from 15 to 20 pounds of seed per acre from late August in northern latitudes to early November in the lower portion of the Cotton Belt. A grain drill with grass-seed attachment or a grass-seed drill makes ideal seeding equipment.

Soils of medium fertility are best for seed production. Fields saved for seed should be grazed until April. This makes the plants stubby and stiff, and the clover will stand up straight for harvesting. Ungrazed clover on rich land will grow so tall that the plants, when mature, will fall to the ground and, if harvesting is delayed on account of rain or for any other reason, the seed crop will be lost.

If it is impracticable to graze the clover where seed is to be saved, seed patches may be mowed early in the spring. The mowing will have the same effect as grazing and give uniform maturity and ripening of seed over the field.

Crimson clover is easily harvested for seed. Straight combining is the most popular method, but the seed is also harvested by the combine, windrow-pick-up method.

The Uses of Red Clover

The acreage of red clover is still limited, but farmers who have suitable soil and who have used this crop for grazing, for soil-building, for hay production, and as a seed crop are highly pleased with the results obtained.

Red clover requires fertile to fairly fertile, sweet, well-drained soil. On the less fertile lands, the use of limestone and superphosphate or basic slag and potash where needed pays dividends in increased growth.

Farmers in certain territories, who have soil conditions where the mixture is adapted, have found that a combination of oats and red clover is valuable for grazing, for hay, and for seed. Successful growers claim that oats and red clover will furnish more grazing for hogs from May until August than any other combination they have ever used during this season of the year.

A common practice is to plant 5 to 6 pecks of oats per acre on a well-prepared seedbed in late September or early Octo-

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Above: A 9-acre red clover pasture near Natchez, Miss., furnished continuous grazing for a flock of sheep and 30 dairy cows at night.

Below: These fine Hereford cattle are "mud" fat with no other feed than white clover pasture on a plantation near Port Gibson, Miss.

Above: The use of a cultipacker on a well-prepared seedbed will help get a better stand by holding the seed in the small furrows.

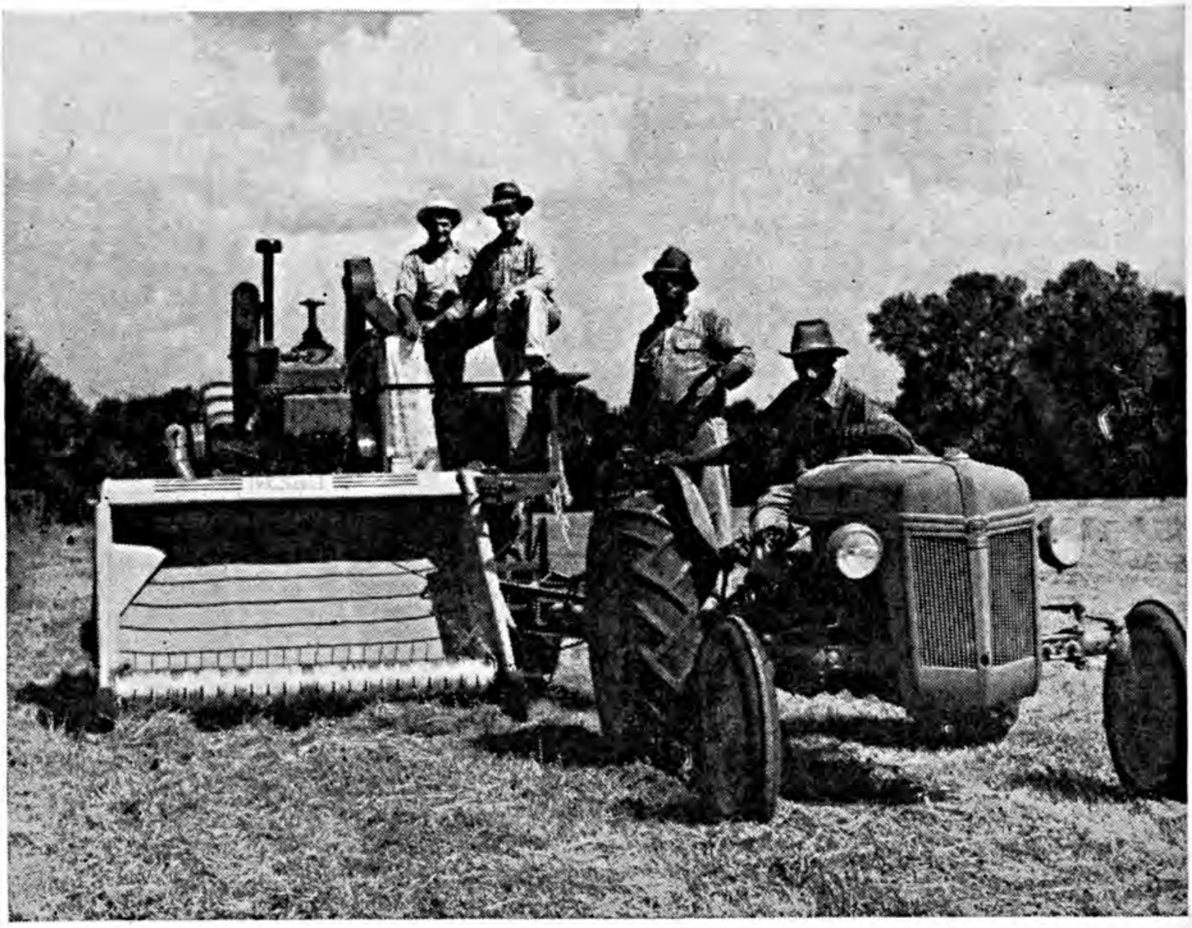
Below: A 96-acre field of white clover on April 27, 1943, which three weeks later yielded 5,700 lbs. of cleaned seed worth $3,500.

Above: A 6-year-old Dallis grass and white clover pasture in July after it had yielded a seed crop in June and then was grazed by cattle.

Below: A sample of crimson clover from a field which had furnished grazing for livestock and then produced 800 lbs. of seed per acre.

Above: This second growth red clover produced 2 tons of hay per acre in June and yielded a seed crop in August. Cattle were grazed on the clover from January to April.

Below: Harvesting white clover seed in Claiborne county, Miss., requires less labor with equipment such as this.



The Editors Talk

Agriculture Post-war

"There are good reasons for believing that many factors in the post-war period will make for the kind of agriculture our farmers, and Americans generally, want in the United States. On the other hand, it seems almost certain that other factors will make it difficult to achieve this kind of agriculture. If this is true, the obligation rests upon all of us to clarify our thinking, agree upon what we want, and set about doing the job."

The above is part of an introductory statement by Secretary of Agriculture Claude R. Wickard in the newly published report of the U. S. Department of Agriculture's Interbureau and Regional Committees on Post-war Programs. "What post-war policies for Agriculture?" the Committees asked themselves, and then proceeding on the premise that the over-all objective of government should be adequate food and fiber for all at prices fair to both consumers and producers, worked out a set of goals which the Secretary believes "might well serve as a stimulus to our thinking and a basis for discussion concerning the national agricultural policy after the war."

For the benefit of our readers, these goals are listed briefly:

1. Adequate Food and Fiber for All
2. Parity Income for Farmers
3. Parity of Public Services and Facilities for All Rural People
4. Better Marketing at Lower Cost
5. Dominance of Family Farms
6. Good Land-tenure Conditions
7. Reclamation and Cultivation of Potentially Good Land
8. Employment and Security for Part-time Farmers and for "Rural Residents"
9. Fertile Soils and Luxuriant Forests
10. High Level of Industrial Activity
11. Freer International Trade
12. By the Democratic Process.

In explanation of No. 12, the authors say, "In this attempt to put on paper what we think national agricultural policy after the war ought to be, we harbor no illusions as to how such policy will actually be made. We know it will, and believe it should, be evolved by the democratic and political process of group action, discussion, trial and error."

Space here does not permit comment on the discussion of the need for each of these goals, as contained in the Report. Nos. 7 and 9 pertain particularly to the soil, which after all is the basis of all agriculture. Under No. 7, it is pointed out that too many of our farmers are now condemned to perennial poverty by undertaking to farm soils which, under the present state of our techniques, are too poor to yield a living that will meet minimum standards. Much of this land is of such low productivity and so highly erodible that it never should have been farmed; other portions were originally productive but have been badly misused. Additional scientific attainments in cultivation and processing and the more effective use of land already in farms will help meet an increasing demand for food for the nutritional needs of our own population and the potential world-wide outlet for farm products; but it is almost certain that additional farm areas will be needed.

Fortunately, in the United States, according to the Committees, there are 30 to 40 million acres of intrinsically good land which can be made available for settlement, if the need for farm products is too large to be met satisfactorily by land already in farms. Of this total, from 10 to 20 million acres can be reclaimed in the Western States through irrigation, and another 5 million acres of fertile land in the Mississippi Delta can be made available through drainage and clearing. Approximately 15 million acres that require drainage and clearing are located at various other points over the country.

It is pointed out that as 3 million of our present 6 million farms produce about 90 per cent of our marketed farm produce, even a net addition to our agricultural plant of the total area of potentially good land would add only about 300,000 farms of average size and would increase our total output by only about 10 per cent. Such a program, however, would provide substantial settlement opportunities for some of our ex-service men, especially some of those who came from farms, and would constitute an important part of any temporary public works that might be required to assure full employment during demobilization.

Discussing conservation under No. 9, the Committees propose a country with the soil of every acre properly conserved and managed; all forest and range land so handled as to yield continuously an abundance of forest and range products and to provide adequate recreational facilities. To accomplish these objectives, all possible private action should be taken—and national, State, and local programs for soil, water, forest, range, and wildlife conservation should be expanded and put into effect as rapidly as possible. This will involve expanded research, improved management of public lands, the development of public restrictions against the misuse of privately owned lands, the active public use of lands that would otherwise be idle, and, in extreme cases, condemnation proceedings and public or private sale. It will call for the transfer to public ownership of forest lands that are submarginal for permanent private ownership, for expanding public aid to private forest owners, and for public works for the rehabilitation of depleted lands.

The Report should be carefully read and studied not only by those connected with Agriculture, but by everyone interested in the post-war welfare of this country. As Secretary Wickard hoped, it does serve as a "stimulus to our thinking." And it is time now to be putting some of our thoughts into action.

PRECIOUS soil, I say to myself, by what singular custom of law is it that thou wast made to constitute the riches of the freeholder? What should we American farmers be without the distinct possession of that soil? It feeds, it clothes us, from it we draw even a great exuberancy, our best meat, our richest drink; the very honey of our bees comes from this privileged spot. No wonder we should thus cherish its possession.—*Letters from an American Farmer, 1782.*

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910-14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920...........	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921...........	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922...........	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923...........	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924...........	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925...........	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926...........	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927...........	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928...........	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929...........	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930...........	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931...........	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932...........	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933...........	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934...........	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935...........	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936...........	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937...........	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938...........	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939...........	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940...........	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941...........	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942...........	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
February....	19.68	18.2	125.7	129.8	90.4	119.5	11.94	44.88	....
March.......	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April........	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May........	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June........	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July........	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August......	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September...	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October......	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November....	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December....	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January.....	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February....	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920...........	259	166	358	201	223	255	178	240	....
1921...........	99	187	149	136	91	135	109	103	....
1922...........	152	219	139	120	90	117	98	162	....
1923...........	215	183	121	119	124	112	103	202	....
1924...........	223	183	125	156	141	126	111	177	150
1925...........	178	161	164	196	154	172	105	162	153
1926...........	122	172	267	178	108	154	109	126	143
1927...........	128	199	190	130	122	137	101	132	121
1928...........	150	192	119	128	138	129	89	175	159
1929...........	143	179	135	135	135	117	97	162	149
1930...........	100	124	179	132	120	92	95	122	140
1931...........	61	79	104	106	77	55	82	79	117
1932...........	47	101	62	65	43	44	63	45	102
1933...........	65	124	95	68	56	66	57	57	105
1934...........	97	164	98	90	95	91	89	121	104
1935...........	94	155	71	84	119	98	89	165	126
1936...........	94	165	143	97	118	109	75	147	113
1937...........	90	191	127	105	146	122	87	140	122
1938...........	67	165	80	88	76	75	63	98	101
1939...........	70	131	98	86	73	72	58	103	109
1940...........	78	145	102	97	91	84	64	126	121
1941...........	107	184	93	108	99	95	68	162	145
1942...........	149	272	158	124	123	116	84	206	199
1943									
February....	159	175	181	148	140	136	100	208	301
March.......	161	154	208	175	146	139	103	212	302
April........	162	154	240	205	155	139	106	213	291
May........	162	362	274	257	160	140	106	214	253
June........	161	548	270	253	164	141	102	215	308
July........	158	567	240	305	167	143	100	206	315
August......	160	369	228	315	168	144	102	236	308
September...	163	358	193	264	168	148	108	240	311
October......	164	402	184	224	165	153	115	243	264
November....	156	428	191	202	162	156	121	243	254
December....	160	408	194	215	171	163	127	244	208
1944									
January.....	163	399	203	231	174	166	131	245	231
February....	161	241	200	241	174	166	133	244	204

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
February	1.75	1.42	5.83	5.77	3.34	4.86	6.53
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
February	65	50	167	163	110	144	186
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Super-phosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
February	.600	2.00	5.90	.535	.817	26.00	.210	....
March	.608	2.00	5.90	.535	.817	26.00	.210	....
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
February	112	55	121	75	86	108	85	....
March	113	55	121	75	86	108	85	....
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922........	132	149	141	116	101	145	106	85
1923........	142	152	147	114	107	144	103	79
1924........	143	152	143	103	97	125	94	79
1925........	156	157	151	112	100	131	109	80
1926........	145	155	146	119	94	135	112	86
1927........	139	153	139	116	89	150	100	94
1928........	149	155	141	121	87	177	108	97
1929........	146	153	139	114	79	146	114	97
1930........	126	145	126	105	72	131	101	99
1931........	87	124	107	83	62	83	90	99
1932........	65	107	95	71	46	48	85	99
1933........	70	109	96	70	45	71	81	95
1934........	90	123	109	72	47	90	91	72
1935........	108	125	117	70	45	97	92	63
1936........	114	124	118	73	47	107	89	69
1937........	121	130	126	81	50	129	95	75
1938........	95	122	115	78	52	101	92	77
1939........	93	121	112	79	51	119	89	77
1940........	98	122	115	80	52	114	96	77
1941........	122	130	127	86	56	130	102	77
1942........	157	152	144	93	57	161	112	77
1943								
February..	178	162	149	92	57	155	112	79
March.....	182	163	150	93	57	160	113	79
April......	185	165	151	95	57	160	119	79
May......	187	167	152	95	57	160	119	79
June......	190	168	151	93	57	160	119	69
July.......	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78
November.	194	171	150	95	57	160	119	78
December..	196	173	150	96	57	171	119	78
1944								
January....	196	174	150	96	57	171	119	78
February..	195	175	151	96	57	171	119	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

REVIEWS

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

Fertilizers

¶ The inadequacy of data on fertilizer consumption in this country is being corrected more rapidly in recent years under the impetus of wartime necessity for exact information on fertilizer usage and requirements. An excellent contribution to the subject is "Fertilizer Consumption in 1941 and Trends in Usage" by A. L. Mehring and Grace T. Vincent, U. S. Department of Agriculture Circular 689. The authors compiled their data on the basis of a questionnaire survey and by the utilization of all published figures by state, federal, and trade agencies. The data obtained for 1941 are compared with those for previous years, bringing out any interesting and significant facts. Fertilizer is now reported to be consumed in each state and the District of Columbia—only two states, South Dakota and Nevada, reporting less than 1,000 tons. The South Atlantic states are still the largest consumers of fertilizer, although their relative proportion of the total consumption for the country is much less than formerly, due to marked increases in other sections, particularly the East North Central, South Central, and Western states. About 60% of total consumption over the country is in the form of mixed fertilizer with the other 40% straight materials. This fertilizer was prepared and distributed by more than 700 companies operating about 1,000 plants. Of the mixed fertilizers, over 90% is in the form of so-called complete fertilizers, containing nitrogen, phosphate, and potash. The phosphate-potash mixtures comprised 5.7% of the total. The nitrogen-potash mixtures, while relatively small, have increased considerably within the last several years.

The survey indicated that at least 651 different grades of mixed fertilizers were sold during 1941. Probably the number was closer to 900, but even this large figure represents some improvement over previous years, when well over 1,000 grades were on the market. It may be stated that under wartime requirements, the number of grades has been drastically reduced below the number shown in this survey. The most popular grade over the country as a whole is the 2-12-6 fertilizer and it is the leading grade in the Middle Atlantic and Midwestern states. The 5-8-12 is the leading grade in New England states, with 4-8-4 the leading grade in the South. Grades which are losing in popularity are the 5-8-7 in New England, the 2-9-5 in the Middle Atlantic states, the 3-8-3 in the Southern states, and the 0-14-6 in the Midwestern states, where the 0-12-12 and 3-12-12 are gaining in popularity. There is a decided trend toward greater concentration of plant food in fertilizers, with the average in 1941 being 19.4 units of plant food compared to 17.5 in 1935, and 13.8 in 1910.

Ammonia and its salts have become the principal source of nitrogen, with a big decrease in natural organics, a moderate decrease in nitrates, and an increase in organic chemicals used in making mixed fertilizers. Superphosphate continues to be by far the most important source of phosphoric acid. Muriate of potash is the principal source of potash, with a decided trend in recent years toward the concentrated 60% grade as contrasted to the 50% grade used during the 20's and early 30's. There has been a decided drop in the lower grade potash materials such as kainite and manure salts, although this has been temporarily reversed during the last year because of war necessity. In the use of straight materials, nitrate of soda is the most popular nitrogen material, superphosphate for phosphorus, and muriate of potash for potash. The superphosphate used is much more concentrated than in past years, the lower grades having entirely disappeared from the market, and the 20% superphosphate becoming dominant over the 16% grade which was the leading one in the 20's and 30's.

Total fertilizer consumption was over 9,000,000 tons in 1941, a high record. In this, there were 454,000 tons of nitrogen, 780,000 tons of phosphoric acid, and 460,000 tons of potash, high records for each. Many other interesting data by states and trends over a period of years are given in the Bulletin.

¶ Suggestions on the use of fertilizer grades permitted to be manufactured and sold in Georgia during the current season are given in Georgia Coastal Plain Experiment Station Mimeograph Paper No. 25 entitled "Fertilizers for South Georgia Field Crops in 1944." Two hundred to 400 pounds of 0-14-10 or 2-12-6 are suggested for peanuts, with the same rate of application of 2-12-6 recommended for corn, this to be supplemented on the latter crop with 100 to 150 pounds of a nitrogen top-dresser. On cotton, 3-9-6 at 500 to 600 pounds is suggested as the best analysis available. This should be supplemented with 150 pounds per acre of 10-0-10 as a top-dresser with an extra 50 to 100 pounds of muriate of potash needed on soils that are very deficient in potash, as indicated by severe rust in the past. Attention is called to the fact that the potash supply situation improved later in the season after the lower potash grades had been drawn up, and it is suggested that extra muriate of potash as a top-dressing can be used to supplement the lower potash grades that are being sold this year.

"Fertilizer Grades and Recommendations for Alabama July 1, 1943 to June 30, 1944," Agr. Exp. Sta., Auburn, Ala.

"Conservation and Use of Poultry Manure," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Press Bul. 590, July 1943, O. K. Moore, N. R. Mehrhof and R. V. Allison.

"Effect of Plow Sole Application of Fertilizer on Maturity, Yield and Fruiting Habits of Soybeans, 1943," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Mimeo. No. 40, R. R. Mulvey.

"What About Plowing Down Fertilizers?" Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Mimeo. No. 41, Dec. 1943, George D. Scarseth and George Enfield.

"Improving Victory Garden Fertility," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Pamphlet 132, Jan. 1944, Paul M. Burson and C. O. Rost.

"The Boron Needs of New Jersey Soils," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 709, Jan. 1944, Eldrow Reeve, Arthur L. Prince, and Firman E. Bear.

"Poultry Manure," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 707, Sept. 1943, Wasley Yushok and Firman E. Bear.

"Fertilizers in the Farm Production Program," Agr. Exp. Sta., Wooster, Ohio, Agron. Mimeo. No. 91, Jan. 1944, R. E. Yoder.

"Inspection and Analysis of Commercial Fertilizers," Agr. Exp. Sta., Clemson, S. C., Bul. 348, Dec. 1943, H. J. Webb.

"Ammonium Nitrate as a Fertilizer," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. of Inf. No. 66, May 14, 1943, C. A. Mooers.

"Ammonium Nitrate," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 342, Jan. 1944, Emil Truog, C. J. Chapman, and E. J. Graul.

"Fertilizer Demonstrations on Corn and Hemp," Soils Dept., Univ. of Wis., Madison, Wis., Oct. 1943, C. J. Chapman.

"1943 Results of Fertilizer Demonstrations on Small Grain, Hay, Corn, and Hemp," Soils Dept., Univ. of Wis., Madison, Wis., Sept. 1943, C. J. Chapman.

"Granular Ammonium Nitrate," U.S.D.A., Washington, D. C., AWI-81, Jan. 1944.

Crops

¶ Investigations on the effects of variety, rotation, and fertilization on yields and effects of Fusarium wilt and nematode injury on cotton are reported by P. A. Young in Texas Agricultural Experiment Station Bulletin 627, "Cottons Resistant to Wilt and Root Knot and the Effect of Potash Fertilizer in East Texas." Symptoms and methods of identifying Fusarium wilt, rust or potash hunger, and nematode injury or root knot are described. On the soils investigated, increasing the potash content of the fertilizers in most cases increased yield and reduced wilt injury. Increasing the phosphate content had a variable effect on yield and not much influence on wilt injury. Varieties differed considerably in their wilt resistance, and those most resistant to wilt usually did not respond as much to potash fertilization as other varieties more susceptible to wilt. Growing tomatoes in rotation with cotton appeared to reduce the wilt infestation. In the case of the Mebane and Half and Half varieties, each was susceptible to wilt and root knot, but the latter disease had little effect on the wilt resistance. Three of the Dixie varieties studied were resistant to wilt but tolerant to root knot, and the latter did not greatly decrease the wilt-resisting quality. Miller's 610 and Stonewilt are wilt-resistant varieties but susceptible to root knot, and the latter greatly decreased the wilt-resisting qualities of these varieties. Coker 4-in-1 and Rhyne's Cook varieties were resistant to both wilt and root knot and the latter appeared to have little effect on the wilt-resisting qualities of these varieties. Growing nematode-resistant crops such as crotalaria spectabilis, sorghum, and velvet beans greatly reduced nematode injury. Corn, Bermuda grass, oats, some varieties of cow peas, Porto Rico sweet potatoes, peanuts, and Laredo soybeans are nematode resistant and can be grown in the rotation so as to reduce nematode injury. In addition to growing these crops in the rotation, using 300 to 400 lbs. per acre of 6-8-8 or 4-10-7 fertilizer for cotton so as to prevent serious potash deficiency and properly adapted and resistant varieties are effective ways to overcome difficulties from wilt and nematodes. On land infested with both wilt and root knot organisms, Coker 4-in-1 variety is recommended. Rhyne's Cook is also suitable, but has a shorter staple. Where only wilt is bad, Miller 610 is recommended although a number of other varieties also can be used. Where neither wilt nor root knot is bad, Stoneville 2B and Deltapine 14 are recommended.

¶ A summary of two years' work with the use of borax on alfalfa in North Carolina has been issued by J. R. Piland, C. F. Ireland, and H. M. Reisenauer in North Carolina Agricultural Experiment Station, Agronomy Department Mimeo. Report entitled, "Boron Investigations on Alfalfa." The use of borax at varying rates increased the yield of alfalfa more or less in proportion to the application, up to 26 lbs. of borax per acre, on the average of 13 tests conducted over the two-year period. Individual test data, correlated with natural boron supply in the soil, are given. The results indicate that all of the soils needed a borax application for best results on alfalfa. Not only was the yield of hay increased, but the vigor of the stand was improved, indicating prolonged life of the stand. Competing plants were crowded out by the more vigorous alfalfa growth when borax was used. In one of the tests where seed yields were obtained they also were greatly benefited by borax, since practically no seed was produced when the treatment was omitted. Based on these two years' results, the authors conclude that each dollar invested in borax returned an average profit of $14.00 under prevailing price ranges for borax and hay. In the single test on seed production, the return was much higher. On a basis of this work, it is recommended that 25 to 35 lbs. of agricultural borax per acre be applied in the fall or winter on established stands or mixed with the fertilizer at seeding time when planting new seedings of alfalfa in North Carolina.

¶ So much is heard about the ability of leguminous plants to utilize atmospheric nitrogen by means of symbiotic bacterial organisms they can harbor in their roots, the fact that such a beneficial relationship is not limited to this combination is sometimes overlooked. There is a type of fungus known as mycorrhiza that can live symbiotically on the roots of trees and other plants. Much less attention has been given to these than to the organisms in legume roots and there still are differences of opinion as to whether or not the mycorrhizae have the ability to utilize atmospheric nitrogen and even as to whether the organisms are purely parasitic, or whether there is a mutually beneficial relationship between the organisms and the plant in which they are growing. The frequency with which beneficial effects of the infestation appear to exist is good indication that, at least in some if not all cases, the mycorrhizae are beneficial. It was frequently thought that the beneficial effect might be due to the influence of the fungus on the solubility of soil nutrients rather than to any ability to utilize atmospheric nitrogen. Additional information on this is presented by A. L. McComb in Research Bulletin 314 of the Iowa Agricultural Experiment Station, entitled "Mycorrhizae and Phosphorus Nutrition in Pine Seedlings in a Prairie Soil Nursery." Results showed that the seedlings with mycorrhizae were about double in green and dry weight, had about double the phosphorus content on a percentage basis, and four times the total weight of phosphorus, as seedlings not infected with mycorrhizae. A lower percentage content of nitrogen was in the mycorrhizal seedlings, although because of the greater total weight of the plant the total weight of nitrogen was higher in these plants. The potassium content was slightly higher in the mycorrhizal plants, although probably not significantly so. The total potassium content on a weight basis in the mycorrhizal plants was more than twice that of the non-mycorrhizal plants. Studies on the root systems of the plant showed that the mycorrhizal seedlings had larger root systems and many more and larger absorbing root tips than the non-mycorrhizal seedlings. In a fertilizer experiment, the seedlings responded markedly to phosphorus fertilization, much more so than oats did on the same soil. It was observed also that mycorrhizae developed much more on soils better supplied with phosphorus. This work would indicate a very definite relationship between phosphorus nutrition and the mycorrhizae on roots of seedlings.

"Grape Varieties for Wine Production," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 356, Aug. 1943, M. A. Amerine and A. J. Winkler.

"The Blueberry," Dept. of Agr., Ottawa, Canada, Publ. 754, F. B. 120, Oct. 1943, E. L. Eaton, C. C. Eidt, A. D. Pickett, and J. F. Hockey.

"Report of the Minister of Agriculture, March 31, 1943," Ont. Dept. of Agr., Toronto, Ont.

"Report of the Addresses Delivered at the Annual Convention of the Ontario Crop Improvement Association," Ont. Dept. of Agr., Corps, Seeds and Weeds Branch, Toronto, Ont., Feb. 1943.

"Oats on Florida Farms Grow 50 Bushels to the Acre," Agr. Ext. Serv., Gainesville, Fla., Cir. 72, Sept. 1943, J. Lee Smith.

"Native Forage Plants of Cutover Forest Lands in the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Bul. 37, Aug. 1943, H. H. Biswell, W. O. Shepherd, B. L. Southwell, and T. S. Boggess, Jr.

"Tobacco Plant Production in the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 38, Nov. 1943, J. M. Carr.

"1943 Indiana Corn Performance Tests," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Agron. Mimeo. 43, Jan. 1944, S. R. Miles.

"1943 Replicated Corn Test Results and a Guide to 1944 Planting," Ext. Div., Purdue Univ., West Lafayette, Ind., K. E. Beeson.

"1943 Report of the Muscatine Island Field Station," Ext. Serv., State of Iowa, Ames, Iowa, Victor E. Hollar.

"Increase Feed Production by Better Choice of Crops," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Pamph. 133, Jan. 1944.

"Tests of Cotton Varieties in the Hill Section of Mississippi 1942," Agr. Exp. Sta., State College, Miss., Bul. 386, Feb. 1943, J. F. O'Kelly, E. B. Ferris, and T. E. Ashley.

"Annual Report of Mississippi Extension Service 1942," State College, Miss., E. Bul. 127, July 1943.

"Cultivation Studies of Certain Vegetables Grown on Peat Soils," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 795, June 1943, Robert D. Sweet.

"Sixty-Second Annual Report for the Year Ended June 30, 1943," Agr. Exp. Sta., N. Y. State, Geneva, N. Y.

"Report of the North Carolina Department of Agriculture," Raleigh, N. C., Nov. 1, 1942.

"Relation of Drouth and Grazing to North Dakota Range Lands," Agr. Exp. Sta., Fargo, N. Dak., Bul. 320, Feb. 1943, Warren Whitman, Herbert C. Hanson, and Roald Peterson.

"Chemical Composition of Oklahoma Grain Sorghums," Agr. Exp. Sta., Stillwater, Okla., Bul. No. B-274, Jan. 1944, V. G. Heller and John B. Seiglinger.

"Performance Tests of Corn Varieties and Hybrids, 1943," Agr. Exp. Sta., Stillwater, Okla., Bul. No. B-277, Jan. 1944, James S. Brooks and C. B. Cross.

"Water Requirement of Wheat at the Sherman Branch Experiment Station," Agr. Exp. Sta., Corvallis, Ore., T. Bul. 1, March 1943, David E. Stephens, Merrill M. Oveson, and George A. Mitchell.

"New Berries from Oregon's Plant Breeding Research," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 416, April 1943, George F. Waldo, Ernest H. Wiegand, and Henry Hartman.

"Science for the Farmer," Agr. Exp. Sta., State College, Pa., Bul. 446, July 1943.

"Wartime Farming in South Carolina," Clemson Agr. College, Clemson, S. C., A. R. 1942.

"Red Raspberry Culture," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. of Inf. 64, Feb. 12, 1943, Brooks D. Drain.

"Growing Garden Sage in Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. of Inf. 65, April 23, 1943, J. P. Overcash.

"Experiments on the Culture of Narcissus," Agr. Exp. Sta., Va. Poly. Inst., Blacksburg, Va., Bul. 357, Dec. 1943, A. G. Smith, Jr.

"Results of Hybrid Corn Yield Trials in West Virginia for 1943," Agr. Exp. Sta., Morgantown, W. Va., Mimeo. Cor. 49, Feb. 15, 1944, E. J. Wellhausen, J. L. Cartledge, and R. J. Friant.

"Report of the Secretary of Agriculture 1943," U.S.D.A., Washington, D. C.

"Report of the Administrator of Agricultural Research 1943," U.S.D.A., Washington, D. C.

"Reseeding to Increase the Yield of Montana Range Lands," U.S.D.A., Washington, D. C., F.B. 1924, Feb. 1943, L. R. Short.

"Range and Livestock Production Practices in the Southwest," U.S.D.A., Washington, D. C., Mis. Publ. No. 529, Nov. 1943.

"Growing Vegetables in Town and City," U.S.D.A., Washington, D. C., Mis. Publ. No. 538, Jan. 1944, Victor R. Boswell and Robert E. Wester.

"A Summary of the Literature on Milkweeds (Asclepias SPP.) and Their Utilization," U.S.D.A., Washington, D. C., Bib. Bul. No. 2, Oct. 15, 1943, A. Geraldine Whiting.

"Locating and Preparing Fields for the Cultivated Blueberry," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 473, Aug. 1943, Charles S. Beckwith.

"Pasture Grasses, Mixtures for Eastern North Dakota," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 327, June 1943, Warren Whitman, F. W. Christensen and E. A. Helgeson.

"Natural Revegetation of Abandoned Fields in Western North Dakota," Agr. Exp. Sta., Fargo, N. D., Bul. 321, June 1943, Warren C. Whitman, H. Theo. Hanson and Gordon Loder.

"Derris Culture in Puerto Rico," Puerto Aico Exp. Sta., Mayaguez, P. R., Cir. 24, Sept. 1943, Rufus H. Moore.

"Sericea—A Great Soil Improving Crop," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. of Inf. 67, July 20, 1943.

"Growing High Quality Tomatoes," Ext. Serv., Texas A. & M. College, College Station, Tex., Food Production Series No. 13, J. F. Rosborough.

"Growing High Quality Sweet Potatoes," Ext. Serv., Texas A. & M. College, College Station, Tex., Food Production Series No. 14, J. F. Rosborough.

"Harvesting Seed from Spring Pasture," Ext. Serv., Texas A. & M. College, College Station, Tex., Food Production Series No. 27, Robert R. Lancaster.

"How to Increase Cottonseed Oil Production, U. S. D. A., Washington, D. C., AWI-46, June 1943, W. H. Tharp, Jr.

"Save Weather-Damaged Soybeans," U. S. D. A., Washington, D. C., AWI-71, Sept. 1943.

Soils

¶ The late Dr. Jacob G. Lipman initiated a comprehensive study of the plant-food resources of the United States. As part of this project an all inclusive compilation of analyses of soils was undertaken with the assistance of federal agencies such as Works Progress Administration and others. A portion of this work has recently been published by the New Jersey Agricultural Experiment Station under the title of "Analyses of United States Soils, Section 2: South Atlantic States" by J. S. Joffe and Adrienne B. Conybeare of that Station. The area covered stretches from Delaware and Maryland south to Florida, and includes all the Coastal states, West Virginia, and the District of Columbia. For the most part, analyses are for total content of the elements rather than in terms of any particular solubility. The completeness of the data is limited by the published data, since original analyses were not made for this publication. It is noted that more analyses were made for phosphorus than for any other element, followed closely by potassium, with somewhat fewer determinations for nitrogen and calcium, in the order named. Analyses for elements other than the four mentioned were much fewer in number, and occurred in the following order of frequency: magnesium, iron, silicon, aluminum. The authors note that as one goes from the North to the South, the nitrogen, phosphorus, potash and calcium contents of the soil tend to decrease. The authors note also that the commonly held belief the heavier soils are higher in nutrient content than the lighter soils not only has many specific but even general exceptions. They conclude that the potassium content is more likely to be lower in the clays than in the loamy soils. The sandy soils also are lower in potassium. Thus the sandy loam and the clay and clay loams have about the same total quantity of potassium. The data are averaged in tables by states and by soil class, as well as given in detail by states.

"Soil Erosion and Land Use Survey Hope Township Project Area Durham County, Ontario," Ont. Agr. College, Guelph, Ont., Nov. 1943, N. R. Richards and F. F. Morwick.

"Soil Management Practices," Agr. Exp. Sta., State College, Miss., Bul. 381, June 1943, L. A. Davidson.

"Farm Terracing Costs," Agr. Exp. Sta., Stillwater, Okla., Bul. No. B-276, Jan. 1944, Peter Nelson and E. A. Tucker.

"Chemical Composition and Responses to Fertilization of Western Oregon Nut Orchard Soils as Indicated by Greenhouse and Field Trials," Agr. Exp. Sta., Corvallis, Ore., T. Bul. 3, July 1943, R. E. Stephenson and C. E. Schuster.

"This Land We Defend," State Soil Conserv. Com., Charleston, W. Va., First Biennial Report, Sept. 1939-Dec. 1942.

Economics

¶ An appraisal of the maximum agricultural production possible in Rhode Island and the factors that would influence the attainment of such production are given in Miscellaneous Publication 17 of the Rhode Island Agricultural Experiment Station entitled "Maximum Wartime Production Capacity of Rhode Island Agriculture" by J. L. Tennant and R. G. Wheeler in cooperation with other members of the staff of the Experiment Station. Prices for various agricultural products, labor supply, fertilizer supply, and available machinery all influence the production of the various agricultural products, favoring some and discouraging others. Under conditions of controlled prices, which to some extent are operative at present, those in charge of such control should keep a careful scrutiny over relative costs involved in growing or producing a commodity and adjust the price to be received for it, if production of the commodity is desired. The supply of labor is of great importance and the authors state that failure to control wages has made it difficult for farmers to obtain and retain trained qualified labor. Attention is called to the possibility of improving milk production by improving pasture and hay yields and quality. This will involve proper management and fertilization of pastures and meadows as well as selection of the best type of plants for seeding. There could be some increase in total acreage devoted to crops and some shifting of land from less intensive to more intensive cultivation. More machinery will be needed and larger amounts of lime and fertilizer, particularly analyses such as 4-10-10, 4-8-7, straight nitrogen fertilizers and superphosphate for use on potatoes, vegetables, fruits, corn, hay, and pasture land if maximum agricultural production is to be attained.

"Arizona Agriculture 1944," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 192, Jan. 1944, George W. Barr.

"Farm Labor Requirements in Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 387, June 1943, Paul S. McComas and Frank J. Welch.

"Consumer Demand for Apples and Oranges," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 800, Aug. 1943, W. E. Black.

"A 1944 War Production Program for Tennessee Farms," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., E. Publ. 276.

"1944 Agricultural Conservation Program Bulletin," U.S.D.A., Washington, D. C., ACP-1944, Feb. 9, 1944.

"Apples—Commercial Areas: Utilization of Production, 1934-42," U.S.D.A., Washington, D. C., February 1944.

"Pears: Utilization of Production United States Total and Selected States," U.S.D.A., Washington, D. C., February 1944.

"Wanted: 14 Million Acres More Wheat for '44," U.S.D.A., Washington, D. C., AWI60, July 1943.

"The 10th Annual Report of the Farm Credit Administration 1942," U.S.D.A., Washington, D. C., April 2, 1943.

Applied Entomology

(A Book Review)

A FOURTH edition of their popular book on practical entomology has been prepared by H. T. Fernald and Harold H. Shepard, introducing the late developments in control and nomenclature in this important field. (Applied Entomology by H. T. Fernald and Harold H. Shepard. McGraw-Hill Book Company, Inc., New York, 1942, $3.50). The fact that the book has gone through four editions within the twenty-two years since it first appeared is evidence that it has found a place for itself in literature on entomology.

The book was written as a textbook and approaches the subject from the viewpoint of teaching it to students. The general course followed is conventional, but the material is presented in a clear, straightforward, and interesting manner with comments introduced from time to time in connection with habits of certain insects, manner of spread and control of insects, and other items useful in developing interest and a broader understanding of entomology.

The opening chapter shows where insects come in the whole realm of animals, and gives particular attention to differentiating insects from other closely related groups, with which they may be easily confused. The second chapter describes the general and typical form and parts of insects, useful in recognizing or identifying the various kinds. The next chapter gives the general internal structure of insects, with particular attention to relating this to methods used in their control. The fourth chapter takes up the typical life cycles of insects and tells how they grow, information necessary for the intelligent control of them. The total damage done by insects, ways in which they are beneficial to man, natural control as it does and does not work are covered in the fifth chapter. Chapter six surveys the general field of artificial control of insects under such headings as mechanical, cultural, biological, legislative, physical, and chemical control. The next three chapters take up chemical control in detail, with a separate chapter devoted to stomach poisons, contact insecticides, and fumigants. In these chapters, the chemicals are described, their desirable and undesirable characteristics mentioned, and their general use given. The tenth chapter briefly classifies the various groups of insects, following which there is a separate chapter for each order of insects, except that the three orders of Aptergota are included in one chapter; and the comparatively new and possibly questionable order, Zoraptera, is included in the chapter with Corrodentia. This takes up 23 chapters, with the arrangement in each rather uniform. Each chapter opens with a general description of the order, the distinguishing characteristics being given in italics, and the general importance of the order is briefly appraised. Each family in the order is then taken up, giving descriptions, common names, importance, and specific control measures—if called for. The final chapter is devoted to animals other than insects, such as spiders, mites, ticks, chiggers, sowbugs, earthworms, snails, and the like. They do not technically belong in a study of entomology but to the layman they are "bugs," and the entomologist is called on for information in their control.

The book is very complete, although the authors naturally give consideration primarily to insects found in North America. They state that in discussing control methods and materials, they have confined their remarks to those that have proven effective, but they have mentioned from time to time some of the more promising controls that have not yet been fully tested. In this way, the book is up to date, but properly conservative.

It would appear as if with all the newer chemicals and other methods of control, we are just about holding our own in the continuous fight with insects. All serving in agricultural advisory capacities should stress the importance of intelligent insect control if full returns on investments in seed, fertilizers, labor, and land are to be realized. Applied Entomology can be recommended to advisers and to growers desiring information covering the entire field. While the book is presented by the authors primarily as a textbook, it certainly need not be confined to such usage. The practical approach, clear descriptions, numerous illustrations, completeness, and full index make the book excellent as a reference.

South Finds Clovers Excel in Profits

(*From page* 26)

ber. As soon as there is abundant moisture in the ground, 8 to 10 pounds of red clover seed are sown on the oats. The oats and clover will furnish an abundance of winter and spring grazing. The animals can be removed in April, a fine crop of hay cut about the first of June, and a seed crop harvested in late July or early August. If a maximum hay crop is desired, havesting should be delayed until a few dark heads appear. Where hay cutting is delayed, the clover will not yield as much seed as when it is cut earlier.

The most common method of harvesting the seed is by combining, using the windrow-pick-up method.

Soil Tests Indicate Potash Levels

(*From page* 23)

tions of these amounts as applied to expected field response. In making these interpretations the relationship between the level of potassium and that of other cations deserves consideration.

It is acknowledged that before any chemical test of a soil can be interpreted in the light of expected response to field treatment, it should be standardized or calibrated with actual field tests. Such a calibration or standardization may necessitate considerable research with various extractants and methods of determination. Certainly we have not completed the work along this line in North Carolina. But we feel that we have reached the point in our standardization with field tests where the farmer may benefit from the use of certain soil tests and from recommendations resulting from the proper interpretation of these tests.

Data presented in Table 1 and Figure 1 represent a grouping according to agricultural areas in North Carolina. The basis for division here is the rather distinct type of agriculture being practiced in each area. The division is, therefore, not based on soil differences, though to some extent the factors underlying the differentiation are tied up with differences in the make-up and character of the soils.

The figure and the data show that in all areas there is an appreciable spread in the content of "available" potassium. We might expect the areas in the eastern part of the State—in the Coastal Plain Section—to contain a larger percentage of soils that are in the low and

TABLE 1.—DISTRIBUTION BY AREAS—POTASSIUM EXTRACTED BY 0.05 N HCl

Potash Level—Percent Distribution				
Area	High	Medium	Low	Very Low
1	16	22	37	25
2	17	29	42	13
3	17	36	42	5
4	18	26	35	21
5	20	26	40	14
6	20	24	41	15
7	21	21	42	16
8	35	30	28	7

very low categories. The figures do not substantiate this. In Area 1 are the greatest number of soils that are low or very low in potassium. But Areas 5, 6, and 7, which lie largely in the Piedmont, contain just as many soils in the lower categories as do Areas 2, 3, and 4. It must be admitted that Area 5 is a rather poor division as far as soil properties are concerned, for it includes some of the heavier soils of the Piedmont as well as the very light soils of the "sandhills" area. Area 8, which represents the mountain counties, contains a higher percentage of soils that are medium or high in potassium than do the other areas. While this might be expected, it is of interest to note that in this area there are soils where potassium content is low or very low. We see then the difficulty in generalizing in a recommendation for potash applications according to areas.

The occurrence of potassium deficiencies in many areas in North Carolina is very striking. Such deficiencies might be expected in the sandier soils, particularly when one considers a cropping system including peanuts and tobacco, which remove considerable quantities of potassium from the soil, and soybeans, tobacco, and cotton, which are quite susceptible to potassium deficiencies. In many fields symptoms are very evident and can be observed from the car driving along the highway. In other fields a closer examination of the crop or a tissue test is necessary to reveal the deficiency. In still others, no plant symptoms occur.

A general recommendation for potassium is, therefore, difficult to make. Tissue tests are of help in discovering deficiencies in time for side-dressing applications or for planning for next year's crop, but we have found soil tests to be of considerable help in spotting those areas that are unusually low in "available" potassium. Here potassium must be furnished in quantities greater than normal applications would provide. Other soils analyzed for "available" potassium are found to be better supplied. Our results indicate that in the fields represented by these soils, unusually large applications of potash are not practical. Still other soils will be found to contain relatively high quantities of potassium. On these

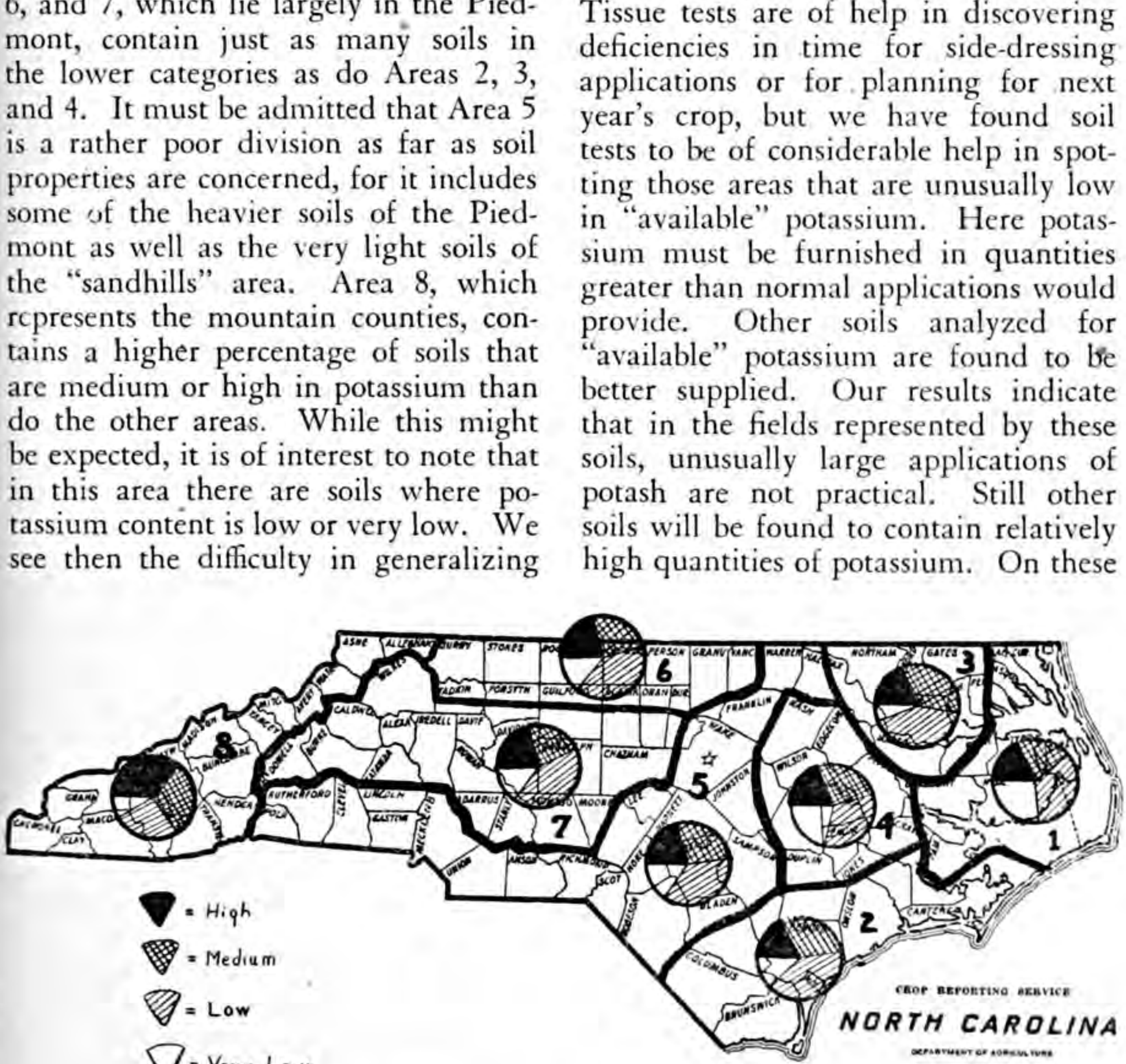


FIG. 1. LEVEL OF POTASSIUM IN NORTH CAROLINA SOILS BY AGRICULTURAL AREAS

areas, it is possible to reduce the potash application and, in the case of some crops or some rotations, to even omit potash for a few years.

In conclusion it should be emphasized that our work with soil tests for "available" potassium is still in the developmental stage. So is much of our work along agricultural lines, but this does not prevent our making the greatest practical use of what information we have on hand. We find in North Carolina that soil tests for "available" potassium can be of considerable help in determining the relative level of potassium in the soil and in arriving at practical fertilizer recommendations for a particular field.

That Land Boom

(*From page* 22)

they buy. Other suggested controls include buyers' permit and price ceilings. We are used to these terms now.

Other impacts must be considered before the all-round desirability of a measure can be determined, Mr. Regan reminds us. "Under controls, present owners of land might be able to realize less from the sale of their property, whereas those who paid higher prices in earlier years might not be able to recover their losses. Lenders who put their money into farm mortgages might think they were adversely affected. If a fairly large down payment should be generally required, tenants and young farmers might feel hard hit. Speculators certainly would object."

But many of the same individuals who would lose some of their immediate privileges and profits would probably benefit by controls, in the long run. When payments fail there are no profits, and property that comes back into unwilling hands may have deteriorated beyond the value of the payments made. Large groups on all sides of the question stand to gain from stability.

The Response of Various Crops to Potash Fertilization

(*From page* 20)

were applied as a neutral fertilizer, the average yields for four years were: 2.27, 2.35, and 2.59 tons per acre respectively. The highest potash application produced an average of 0.32 ton per acre more than the lowest. The yields for the last year of the experiment gave a difference of 0.55 ton in favor of the 32-pound potash treatment. These differences are small, and on the basis of one acre's contribution in the production of feed, appear unworthy of consideration, but any such increase would be worthwhile, and especially so if it could be obtained economically as it was in this case.

Considering the above average increase in soybean hay of 0.32 ton per acre from the use of 32 pounds of potash instead of 8 pounds, on a farm with 50 acres of this type of hay, the increase would amount to 16 tons. One ton of muriate of potash applied at the rate of 24 pounds of potash per acre would supply the additional potash to the 50 acres. Soybean hay has been selling locally for $35 per ton, and the average season price of all tame hay has been $25. The increased yield, using the latter figure, would be worth $410, leaving $359 after the cost of the potash is deducted.

Further experiments with soybean hay fertilized at the same rate, but using an acid fertilizer instead of a neutral fertilizer as above, showed yield gains for the potash treatments, but not quite so great as where the neutral fertilizer was used.

With oat hay where 0, 4, 8, and 16 pounds of potash were applied in the fertilizer, the yields averaged 0.23 ton more per acre with the highest rate than without potash over a four-year period when the fertilizer was neutral, and 0.31 ton when the fertilizer used was acid.

An experiment at the Edisto station with oats, following corn that had been fertilized with 100 pounds of potash per acre, gave no response in yield of grain to added potash.

Discussion

In South Carolina cotton and corn are the most extensively grown crops. Slightly more than 60 per cent of the fertilizer consumed within the State is used for these two crops. Approximately 2,700,000 acres were devoted to them in 1943.

Of the crops considered—cotton, corn, sweet potatoes, peaches, and tobacco—all have shown marked response to potash fertilization except corn. In many instances it was grown in a rotation. It can apparently utilize some of the potash that remains in the soil from that added for the preceding crop. However, the production of corn is more dependent upon moisture supply than upon the supply of available nutrients in the soil. That is why corn is usually grown on "bottom" lands in the Southeast. On many upland soils in the Piedmont one good crop of corn can be expected only about every four years. Regardless of the amount or kind of fertilizer used, the yields are automatically limited. For this reason this type of land often receives no fertilizer for corn, and seldom more than 200 to 300 pounds per acre. In an average season more fertilizer would not be profitable.

Of the 1,545,000 acres of corn planted in South Carolina in 1943, a relatively high proportion is suitable for other grain crops, including the grain sorghums. By devoting more land to certain of these crops, and less to corn, especially on the sites least suited for it, more pounds of dry matter for feed could be produced per acre than is the case under the present system.

Each year more acres are being devoted to the important food crop, sweet potatoes. Considerable experimental work has been done with this crop. Promising varieties are now in wide use. For best production it appears as though there is still much to be learned. Like peanuts, sweet potatoes are heavy feeders on potash. However, probably due to their feeding habits both of these crops are often able to succeed on certain soils very low in available potash, and it is only after they have been grown on the same site several times that definite response to potash fertilization may result.

The commonly grown truck crops and most of the hay crops remove relatively large amounts of potash from the soil. The soils on which truck crops are produced along the Coast have received heavy applications of complete fertilizers for many years. On such soils several years of experimentation may be required to deplete the available potash to the level that the no-potash treatments begin to decline in production to an appreciable extent. In commercial trucking areas ample fertilizer is always applied because the immediate per-acre value of the crop is high. Hay crops on the other hand have received less attention from the standpoint of fertilization because the apparent per-acre value of the crop is relatively low.

The small grains, wheat, oats, barley, and rye have, in general, played a more or less minor role in the agriculture of the Southeast. For this reason few fertilizer experiments have been devoted to them. On the average more pounds of dry matter for feed can be produced per acre in South Carolina by oats and barley than by corn. Now that desirable varieties which withstand the average winter are available, it might be well if more emphasis could be placed upon fertilizing these crops for higher yields.

Summary

For cotton, corn, sweet potatoes, peaches, and tobacco, experimental data from representative potash fertilization experiments in South Carolina are presented. The observed response to potash application is converted into its calculated equivalent in terms of monetary value. With the exception of peaches, these calculations are based on the average season price received by farmers. In 1943 the price of peaches was abnormally high in relation to that of other crops. For this reason a more representative figure was used in estimating the value of the increased production of this crop due to the addition of potash to the fertilizer.

It is, of course, realized the reported returns for cotton, corn, and sweet potatoes, based on the current average price received by farmers, exceed those for pre-war conditions. However, present conditions demand critical attention to all phases of agricultural production. Calculating response to potash fertilization in terms of 1943-1944 season prices may serve to emphasize the importance of fully utilizing existing supplies of potash. The same might be said for nitrogen and phosphoric acid.

Doubling Production By Bettering Soils

(*From page* 10)

all the individual field trials have been recorded in complete reports and these reports have been placed in the hands of our educational leaders, the fertilizer salesmen, and dealers. Many of the agronomists of the Soil Conservation Service, as well as county and community committeemen of the AAA, have cooperated in this work.

These demonstrations were carried out in a program designed to call attention to the importance of using fertilizer at the time of seeding down to clover or alfalfa. The size of the average plot varied from one-half to one acre. A large number of fertilizer combination grain drills were loaned by the implement manufacturers and used by county agents in the installation of their plots. These drills were hauled by truck, trailer, or on rubber tires from farm to farm in the various counties, and frequently as many as 20 to 30 demonstrations were installed by a county agent each year. The fertilizers needed for this extensive program were supplied by the Middle West Soil Improvement Committee and the American Potash Institute.

In addition to the type of demonstration just described, we have set up a large number of so-called "whole-farm demonstrations" in cooperation with the Tennessee Valley Authority. We are now operating in 27 counties in Wisconsin under this program. In the unit-farm demonstrational work, the plan has been to set up a fertility-and crop-management program for the entire farm and carry it out over a period of five years. The phosphate is supplied by the T.V.A. (Farmer cooperators pay the freight.) However, the individual farmer cooperator is required to purchase lime and potash as needed, and he agrees further to follow out cropping practices as recommended by the supervisor of the project. Rather liberal applications of fertilizers are made at the time of seeding down to small grain and legumes. A total of nearly 500 farmers are now cooperating in these whole-farm demonstration projects in Wisconsin. In those counties where the work was first started (now in its 5th year), we have many outstanding examples of what can be accomplished through a program of fertilization and crop management. On most of the farms crop production has been greatly increased, the quality of the feed grown has been improved, and livestock-carrying capacity is now being reflected in larger herds of better fed cows.

The sum total of all efforts in this great educational program has had its effect. The prejudice against fertilizer is disappearing. With everyone talking and telling the same story, an idea soon becomes a part of mass thinking. That is what has happened. There are now a good 5,000 active leaders telling this story of soil improvement and soil conservation in Wisconsin. And again, I give credit to the Federal Agencies, S.C.S., T.V.A., A.A.A., F.S.A., for their contribution in carrying this program of soil fertility maintenance and conservation to our farmers. Smith Hughes teachers of vocational agriculture cooperating with county agents and our state soil specialists have contributed much in this great educational program.

And what do the results of all these fertilizer demonstrations show? It is a story in actual figures which prove without doubt that fertilizers are needed and can be used with profit on a high percentage of the farms in Wisconsin. When we average up all the data, good and bad, we find that there was a sufficient increase in the yield of grain alone to more than pay for the fertilizer in 85 per cent of all the trials. We find in comparisons made between 20 per cent superphosphate and phosphate-potash mixtures that in 55 per cent of all these trials, the P-K mixtures gave the largest profit. The average of all these grain plots, where direct comparisons were made between 0-20-0 and 0-20-10, are given in Table 1.

When the residual effect of fertilizers applied at the time of seeding was checked on hay yields the year following and the value of the increases in yield of hay was added to the value of increases in grain and straw, we find that a profit has been shown in 95 per cent of all the trials. We find further that where comparisons of superphosphate and phosphate-potash mixtures were made, the largest net profit was shown in 70 per cent of the trials where both phosphate and potash were used. Table 2 gives a complete summary showing dollar per-acre values of hay, grain, and straw plus residual carry-over benefit to the hay crop.

The results of these demonstrations carried out over a period of years give us conclusive evidence that potash is needed on quite a high percentage of the soils in Wisconsin, especially where legumes are being seeded with the grain. On the silt and clay loam soils of average fertility we are now recommending from 300 to 400 pounds of 0-20-10 or 0-14-7 per acre. On the sandier soils, where seedings of alfalfa and clover are being made, we recommend up to 400 or even 500 pounds of 0-20-20 or 0-14-14 per acre.

We did find some fields where phosphate only was needed and occasional fields which were well supplied with all plant-food elements and where no fer-

TABLE 1.—AVERAGE OF 507 GRAIN DEMONSTRATIONS (11 YEARS, INCLUDING 1943) WHERE A COMPARISON OF 0–20–0 AND 0–20–10 WAS MADE

Treatment	Average rate per acre lbs.	Average yield bu.	Increase yield bu.	Average yield straw lbs.	Increase straw lbs.	Value of increase grain + straw	Cost of fertilizer	Net profit per acre*
0–20–0	200	52.6	10.3	2,562	447	$6.85	$2.55	$4.30
0–20–10	200	56.7	14.4	2,727	612	9.58	3.65	5.93
Check		42.3		2,115				

* Oats and barley figured at average value of 60c per bushel; straw, at $3 per ton.

TABLE 2.—RESIDUAL CARRY-OVER BENEFIT TO HAY CROP (11 YEARS, INCLUDING 1943) SHOWING TOTAL VALUE OF HAY, GRAIN, AND STRAW, AND PROFIT OVER COST OF FERTILIZER (119 PLOTS)

Treatment	Rate per acre lbs.	Average yield grain bu.	Value of increase grain + straw	Average yield of hay lbs.	Increase hay lbs.	Value of increase grain, straw and hay	Cost of fertilizer	Net profit per acre
0-20-0	200	51.7	$7.27	4,477	1,048	$12.51	$2.55	$9.96*
0-20-10	200	55.3	9.68	5,078	1,649	17.93	3.65	14.28
Check		40.7		3,429				

* Oats and barley figured at average value of 60c per bushel; straw, at $3 per ton. Hay figured at $10 per ton.

tilizers were needed. We urge farmers to have their soils tested, as a means of determining the fertilizer requirements of their soils.

It is my belief that the application of from 300 to 500 pounds of commercial fertilizer per acre every time we seed our fields down to clover and alfalfa will gradually build up the fertility of the farm as a whole. Large yields of grain and bigger crops of alfalfa and clover will add to the home-grown feed supply and will thus cut feed costs and increase the possible livestock-carrying capacity of the farm. We urge our farmers to take care of their stable manure and get the plant food contained in it back to their cultivated fields.

With prices for farm produce at present high levels, not only has manure a much higher value than is in ordinary times, but we will find it profitable to use commercial fertilizers at heavier rates. Let's also carry out all those other practices of good soil, crop, and livestock management for greater profit now and in the years that lie ahead.

Co-op Warp and Woof

(*From page* 5)

form of cooperative effort, with farmers in the front rank and labor next. I have been at the borning of dairy ventures of this kind, have seen credit systems set up on this principle, and been through the whole gamut of topics included in business transactions. Only a short time ago I "wrote up" the final goal of rural cooperative ardor—a funeral parlor and embalmer under contract to a cooperative society and coffins twenty dollars less than the same kind sold by frock-coated "mortuaries." Just previously my trail led to a cooperative hospital with lying-in privileges, if you had enough advance notice to join. Thus in my bailiwick the pathway of mutual sharing leads, like religion, from the cradle to the grave.

What place will organized cooperatives take in the new "world order" which it is assumed will emerge after the guns are silent? No question it seems to me presents a bigger challenge to those absorbed in building and maintaining true cooperative relations in agriculture.

Last month a prominent and successful capitalist of my town came to me with fretful and disturbing ideas, asking everyone with any remote opinions on it what the future might bring in the way of evolution in business conduct.

"Are we facing a cooperative state, a communistic commonwealth, a dose of Fascism, or a socialistic era?" was his dilemma. Naturally he thought first of the farmer cooperatives, or maybe a blend of both producer and consumer co-ops to take over the reins and hold a club over the heads of cringing capital.

FROM my long association with old-line cooperative leaders in this country, I have evolved a theory about this which may or may not begin to answer this man's fears and forebodings. Let me state, however, that I cannot vouch for the huge machinery of consumer cooperatives, both here and abroad, for the reason that they are bound by different rules and ideals than farmer groups seem to be, and they are in the majority when it comes to mass voting power. What I set down now relates solely to the farmer co-ops, but if they run true to form we don't need to vision any drastic changes over night.

Just two points in my estimation fix the attitude of agricultural co-ops toward the problem my capitalistic friend presents. See if you agree with me.

First, organized farmers and individuals making up the membership control of big and little co-ops of all kinds are deadly enemies of two things directly related to the radical movements he outlines, that is, farm thinkers oppose depriving individuals and business groups of full control of private property. No greater stronghold of private capitalism exists than among the rural class on the whole. Further, farm leaders are overwhelmingly against any movement which is dominated and motivated by political machines.

THERE we have it—rural hatred of any move to abolish property rights or inject partisan or carpetbagger control of business procedure. If you take these two points plus the natural antagonism of our farmers toward bureaucratic governmental redtape and inefficiency, believe me, you've got a bulwark of defense against encroachments and shifts of the kind feared by my inquiring friend.

Communism means the ownership and control of both producer and consumer goods by the all-powerful state. Socialism would bring in producer control at least, plus politics. Fascism stands for letting private rights in production and distribution alone as such, but would demand dictatorial dominations of the whole network by the government. In none of these waves of revolt would there be much support gained from farmers and their cooperatives.

However it strikes me that if you separate these three movements and study them over to see which presents the most likelihood of securing some organized farm support, it might be Fascism. Here the bait of letting private property alone is an advantage over the other two proposals. Fascism would not get started among farmers, but it might easily find a beginning elsewhere in capitalism, and gradually take hold by means of shrewd political maneuvers. It wouldn't be called Fascism, of course—that name is so costly to us in blood and treasure—but a snappy promotion scheme under a different brand could be foisted on us in the confusion of a postwar crisis.

I see less chance for Communism because that would get its start in consuming masses, rather than in production centers, and you don't get funds for high-power political campaigns out of consumers' units, at least the kind we have today.

BUT if we are going to rely upon the native sanity and soundness of agricultural groups to oppose half-baked or even dangerous schemes cloaked in politics, we've got to overhaul and pep up the leadership and followship of our everyday rural cooperative organizations.

Since the war there has been a tendency to let some of those intrepid groups languish and decay. The membership has been so disturbed and frustrated by the war and loss of relatives, with all old traditions torn aside, that we have seen a general weakening of reliance upon and loyalty to the original cooperatives.

Likewise a sort of intolerant spirit has crept into the directorate of many co-ops, a grave tendency to depend on lobbying and jockeying, state and federal support and financial aid, a new class-consciousness, and a wave of anti-labor feeling.

We have seen co-op leaders wax oratorical over some secondary topic with a political slant and neglect real defense of their organizations against attacks from agencies with whom they have been connected in business, or those in the same line of business.

As I see it, the future ahead of cooperatives is bound to demand the best of balanced talent and stability in their directorate. Competition is something no co-op ever found a way to overcome, and probably that's a good thing—both for themselves and their patrons. Even if private business rivals were all abolished, the cooperative would still be obliged to compete with another service or supply co-op, unless we turn it all over to state control and embrace Fascism. In meeting postwar competition only leaders of daring and imagination will win out.

Finally, the basic faith of pioneer cooperative organizers was that "cooperation is different because it is a way of life." This was based on the good old days when folks helped each other so manfully in creating vast new empires in virgin lands.

Yet if you pause long enough to think into this aspect of history, you'll admit that in reality the pioneer farmers were noted instead for rugged independence and brave self-reliance from dawn to dark. Only in cases where they could not do it all themselves did they join hands with neighbors. Mostly these were extra heavy lifting jobs, or sentimental assistance in case of illness, death, or children lost in the woods.

Our modern cooperatives are fitted to a society where no farmer could possibly be entirely self-sufficing and independent at any stage. In fact these days the farmer goes to town for most of his necessities aside from raw food. He belongs to a cooperative society, even if he shares that situation with private factories and stores. We're all more or less interdependent and we'd be sunk without the goods and services of our fellow citizens. The wilderness has gone forever. We are tied together for good. Not just farmers tied together by some mystic bond reaching back to a bygone "way of life" that has ceased to function; it includes all of us of all occupations everywhere. It isn't just a "way of life" for rural inhabitants; it's a universal dependence on cooperation for everybody.

POSSIBLY the quicker we all realize that and let it sink in, the better off we'll be to solve the tremendous problems which will perplex us all, regardless of creed or profession. Thus cooperation is indeed a way of life, a practical goal as well as a religion. What will our leaders do about it?

A customer at a roadhouse stand asked for coffee and doughnuts. He protested because his coffee was served without a saucer.

The waitress explained: "We don't hand out saucers no more. A hill-billy drifted in yesterday and drunk out o' his saucer, an' that ain't good fer trade. This here is a swell dump."

The diner was reading the latest sensation in the morning paper and looked up to talk to the waitress.

"How would you like to be buried in a snowdrift for eighteen hours with your sweetie?" he asked.

"Say if me and my sweetie was buried in a snowdrift we'd be swimming in twenty minutes."

SNAPPY STORY

"George broke up my party the other evening. He started to tell a story and I had to send him home."

"Well?"

"But all the rest followed him home to hear the end of it."

Visitor: "To what do you attribute your great age and good health?"

Oldest Inhabitant: "Well, in the first place I got a good start on most people by being born afore these here germs wuz invented."

The aviation cadet was walking with his girl friend. A plane passed high overhead. "Oh, what a pretty airplane," commented the girl friend. "What kind is it?"

The young air student looked again. "Why, that's a mail plane," he said.

The girl's eyes opened wide. "How can you tell from here?"

Kitty has a little swing,
It isn't hard to find;
For everywhere that Kitty goes
The swing is just behind.

The mountaineer walked into the doctor's office and told the doctor that he wanted him to see what he could do about patching up his son-in-law's ear—saying, "I shot a hole in it yesterday."

The doctor reprimanded him severely—the idea of shooting his son-in-law.

The mountaineer replied, "Waal you see he wasn't my son-in-law yesterday."

Some men criticize the girls who wear revealing garments—but ignore those who don't.

WE LIKE THESE CALM GALS

The demure young bride, her face reflecting winsome innocence, slowly walked down the church aisle, clinging to the arm of her father. As she reached the platform before the altar, her dainty foot brushed a potted flower, upsetting it. She looked at the spilled dirt gravely, then raised her large childlike eyes to the sedate face of the old minister. "That's a hell of a place to put a lily," she said.

"Who was that man that was kissing you in front of the Rialto building today?"

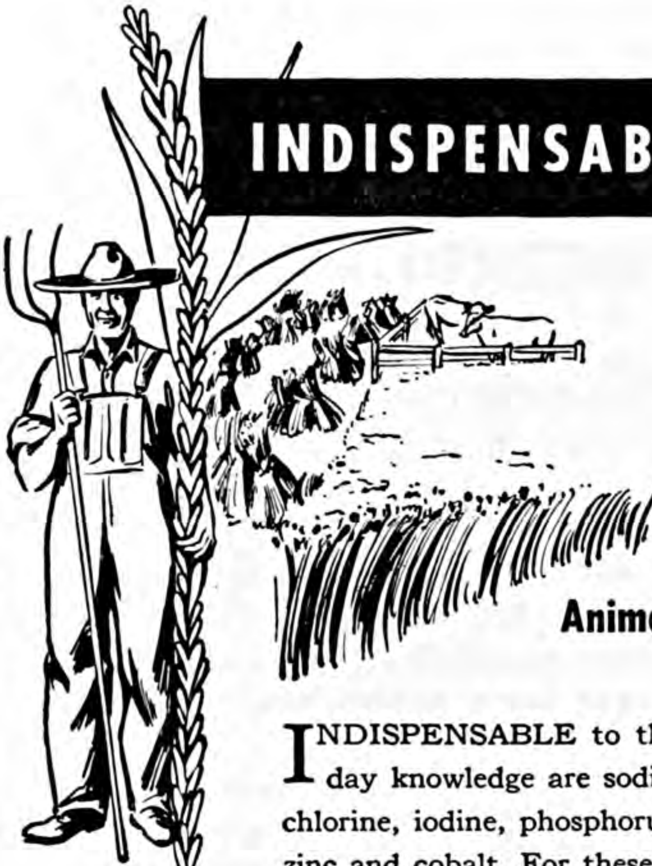
"I just couldn't place him, but he seemed to know me pretty well."

OBVIOUSLY

One of those super-intelligent seniors entered the professor's office one morning and in a very superior tone remarked:

"Last night, professor, your daughter accepted my proposal of marriage. Fully realizing the importance of the step, I have called to see you and to inquire if there is any insanity in your family."

The old professor looked up over his glasses and surveyed the young man in silence for a moment, then sadly nodding his head, remarked: "Yes, yes. There must be."



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VOLUME XXVIII NO. 4

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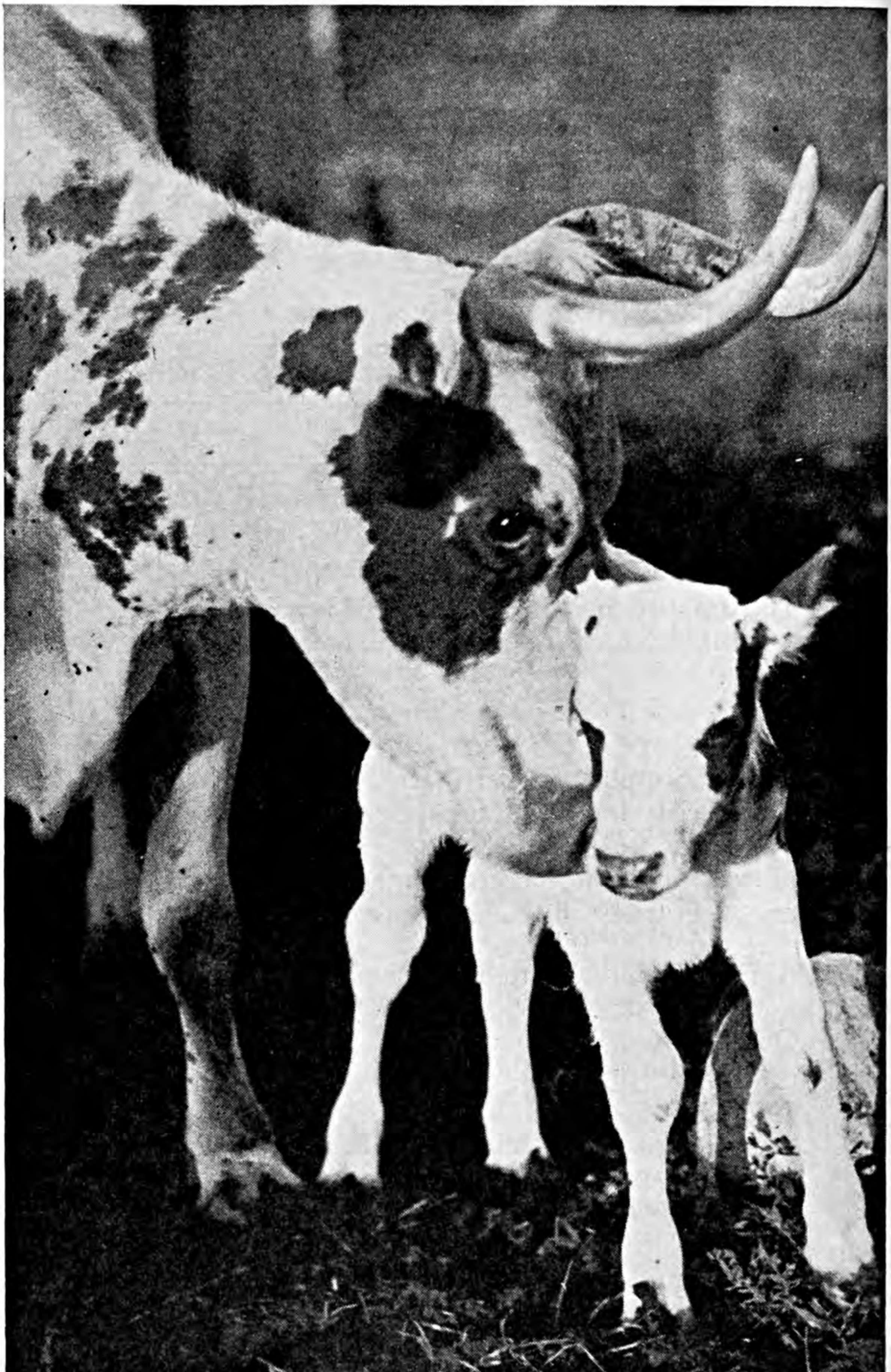

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Agriculture has its

Bottlenecking

Jeff McDermid

AMERICAN terms shift with the scenery. When I was a callow youth eager to behold everything intended to be seen or otherwise, they called me a "rubberneck." It was a term meant to discourage unseemly stretching, which was frowned upon. Today things are sort of reversed. Folks glibly use the term "bottleneck" meant to deride all things that *won't* stretch, and then exert pressure from all quarters so they will. Rubbernecking is o. k. these days, but bottlenecking is a sin against convenience, custom, and necessity.

Strange to say, the farmer's craft, so free from tippling to drown wartime sorrows, is pestered with no end of plugged bottlenecks. He who would quaff and imbibe, gurgle and smack over the delights of acquiring tools, services, and equipment at a propitious time for cash transactions finds his thirst for production stoppered and blocked by sundry corks, plugs, and frozen materials.

Verily, the frustrated farmer is now in keen personal sympathy with the motherless calf on a skimpy skim-milk diet, the bawling infant with a full milk bottle without an exit, not to mention the fox who was invited to dine at the stork's from a narrow-necked flagon.

But farmers as a class are somewhat used to bottlenecks and perhaps regard them with more philosophy than the pampered pavement population. However that may be, it will never do for the rambunctious farm leadership to sit down calmly and tolerate a whole case full of bottles without clear necks to jam up the works. Hence you are going to witness more hellzapoppin for the duration than anything the champagne class can produce. In ordinary humdrum days your farm leader will accept and tolerate the usual run of bottlenecking, treating it with that fine sense of dignity and aloofness with which drouths, floods, and hailstorms are accepted as unavoidable bottlenecks to successful harvests.

Speaking first of the climate and its twin, the weather, these are the most ancient of bucolic bottlenecks. To all those whose zeal and the zodiac are inseparable and whose wagons are more or less tied to some star or cloud, the eternal ever-present bottleneck of Boreas is real, personal, and persistent.

I KNOW of no region save California where they won't admit it pronto. Out there the oranges always flower and fruit to perfection, the alfalfa luxuriates under irrigation without recourse to rains, and chambers of commerce brag loud enough to drown out sundry skeptics hidden among the sage brush. In my state we are partners with Pluvius and put the almanac under our pillows. Every time some loquacious government authority mentions goals and food records to be busted, our neighbors shift their cuds and reach for old Doc Biggers' advance predictions. Even the college-bred plowmen don't feel like starting the mower until they call up the U. S. Weather Bureau, and then they proceed with misgivings. Our weather holds the world record for quick changes—unseemly frosts on July peat lands where tubers grow and high temperature typhoons that curl corn leaves within a week after a deluge. About all we are sure of is the time the sun rises and sets and the phases of the moon. The rest is simon-pure guess work, with the food producer holding the hazards. Crop insurance won't relieve this bottleneck much either, because cows and chickens don't care for any metallic substitute for long green fodder. Livestock don't thrive on cash indemnities.

Next to, or rather co-partner with, the weather in vexing farmers with natural bottlenecks, are the divers pests, maladies, epidemics, and ornery interlopers which insist on sucking, biting, chewing, draining, blotching, shriveling, and destroying the fine things that might take prizes at the autumn pumpkin shows.

Most of these setbacks can be traced to weather vagaries, this year's or last year's, or maybe a lack of certain nasty smelling remedies and applications, sprays, douches, and nostrums which could have been used with some success if the planter had not been so busy watching the winds and the thermometer. How can you call it neglect when a man has only 24 hours in a day, no eyes in the back of his head, and a hired man with a 1-A appetite and a 4-F work capacity?

To make a farmer hopping mad is to deprive him of necessary fighting tools, with which to combat the aforesaid obnoxious devouring enemies. Here we had for a time one of the man-made bottlenecks which proved most annoying simply because the farmer did not know whom to blame—the factory, the war, or the OPA. If you can pause and cuss at a target, it helps some on mental marksmanship.

Among bucolic bottlenecks I would surely put all manner of factors which limit farm progress and profit and which to a great degree are traceable to the sloth or stubborn indifference of the rank and file.

THEY are the kind of bottlenecks that seldom get into the campaign oratory or fill the headlines of the sensational press. I have never seen a politician or a rabid organizer get his collar wilted or his voice worn out yelping at the yokels for neglecting their duty to mankind and themselves by failure to adopt sensible modern methods.

All the yawping I have listened to was directed at forces and conditions outside the fence lines, mostly in some distant metropolis where malignant malefactors of great wealth and greed were plotting to overthrow and undermine, ravish and maim the innocent and toiling masses of the countryside.

I have never heard one of them take a swipe at inferior germ plasm, for instance, or washed-out, betrayed, and depleted land, or machinery rusting in the snow banks. No, it was only through the timid tenor of the circuit-riding extension evangelist, whose audience was usually the kind that needed no conversion or soul-saving sermons. The other kind stayed away and waited for the agitator and the technicolored thrillers. Bottlenecks lying around loose near home plate didn't count with them.

Probably inferior germ plasm of the barnyard variety has raised more sloping-rumped, nondescript, pot-bellied, razor-backed, rickety, grain-stealing soil robbers than any other form of bottleneck ever inflicted on agriculture. Right in the heaviest milk-producing states we have less than five per cent of the cows subjected to systematic testing; our breed clubs keep going in circles trading with each other and making fewer fresh recruits than the Salvation Army in Russia.

We have scads of simpletons investing in some jockey's "boarding bull" to keep him in fodder and furnishings until such time as he manages to cause the seasonal freshing of the feminine members of the herd, and then he gratefully returns the bovine behemoth to the original owner to be sold for ceiling prices in the sausage market. It's great for the wienerwurst business but tough on profitable milk production.

We have others who take kindly for awhile to the idea of using proven bulls for dam-daughter improvement purposes. But they forget or postpone paddock building, keep the old codger in the darkest den they can find in the basement, let his hoofs grow out like snowshoes, and finally have an accident or a funeral and quit trying to prove anything.

We have another half-educated and dangerous bunch who opine that this here cross-breeding of hogs is great ganders. So they get a half-breed boar and mate him successively with half-baked sows of all the colors of the rainbow, which to their thinking is surely cross-breeding, and then blame the result on Chester Bowles or Harry Hopkins.

This all goes to show something, mostly I presume that "a little learning is a dangerous thing" and what you don't do right yourself you can always blame on bureaucratic bottlenecks which an election will correct.

Having good livestock is one thing, and feeding it well is another. I want to drag in the mill feed and home-mixed ration bottleneck awhile to illustrate another mighty big point in my premise.

You know how it is, demonstrations on balanced rations have been going the rounds for over twenty years, and the state and federal governments have spent good tax money as well as special grants to keep the presses busy dishing up bulletins and yearbooks with all sorts of suggestions to fit almost every kind of farm. You

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The Importance of Potash in Maintaining Food Production in N. C.

By Ralph W. Cummings

Head, Department of Agronomy, North Carolina Agricultural Experiment Station, Raleigh, North Carolina

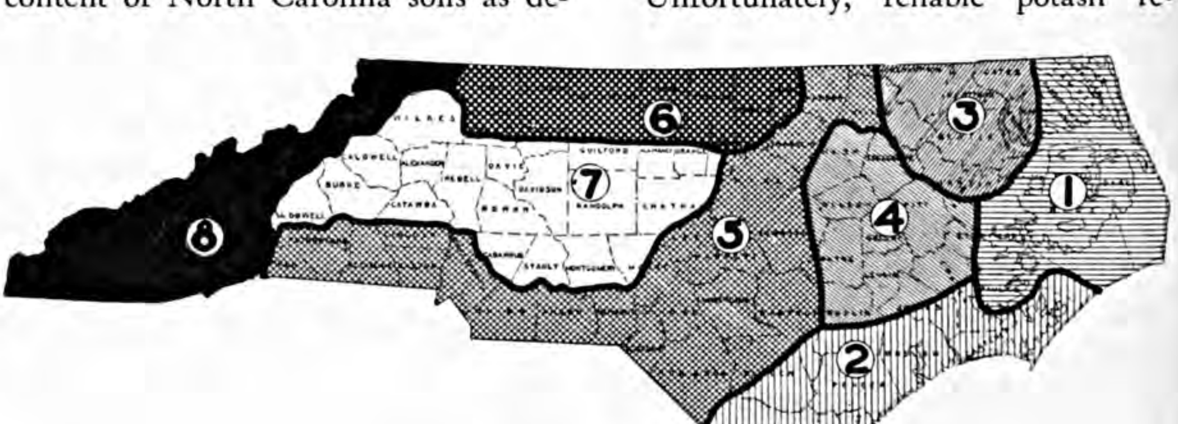
HOW much food will a ton of potash produce? And how can each ton of potash be used to produce the greatest amount of the kinds of food needed most? These are very vital questions at a time when the supplies of both food and potash are below those demanded by the consuming public. If the complete answers to these questions were available, the job of allocation of potash by government officials would be a much simpler one. Likewise, it would be much easier for government officials to decide on the relative priority to be given to expansion of facilities for refining potash salts.

Although the complete answer is not available, partial answers can be found in the data files and bulletins of the various agricultural experiment stations. Data from the North Carolina Experiment Station have been examined with this in view. The available potash content of North Carolina soils as determined on samples submitted to the Soil Testing Laboratory of the N. C. Department of Agriculture have been reported by J. F. Reed in an article in another issue of this journal. A summary of the data on crop responses follows in Table 1.

For this purpose, the State has been subdivided into eight agricultural areas as shown by the map. These areas are based on crop distribution as outlined in N. C. Agricultural Experiment Station bulletin No. 293. As indicated in this bulletin, the leading crops in each area in order of extent are:

Area No.	*Leading crops*
1	Corn, soybeans, cotton, Irish potatoes
2	Corn, cotton, vegetables, peanuts
3	Cotton, corn, peanuts, tobacco
4	Cotton, corn, tobacco
5	Cotton, corn, tobacco
6	Corn, tobacco, wheat
7	Corn, wheat, cotton
8	Corn, small grains, grasses, apples

Unfortunately, reliable potash re-



Agricultural areas of North Carolina

TABLE 1.—SUMMARY OF YIELD RESPONSE OF DIFFERENT CROPS FROM ONE TON OF K_2O IN VARIOUS AGRICULTURAL AREAS OF NORTH CAROLINA

Notes. These are taken from experimental plots and are indicative of trends. Insufficient locations are included to warrant the conclusion that they necessarily represent the areas adequately.

Agricultural area	Crop	No. of locations	Yield response to one ton K_2O
1	Irish potatoes	14	268 cwt.
	Sweet potatoes	5	873 cwt.
	Soybeans	1	455 bu.
2	Sweet potatoes	1	240 cwt.
	Soybeans	1	394 bu.
	Pastures	1	21.5 tons (dry forage)
3	Cotton	4	13,035 lbs.
	Peanuts	9*	4,500 lbs.
4	Cotton	2	11,860 lbs.
	Peanuts	9*	4,500 lbs.
	Sweet potatoes	1	696 cwt.
	Soybeans	1	117 bu.
	Pastures	1	24.1 tons (dry forage)
5	Cotton	4	4,640 lbs.
	Peanuts	9*	4,500 lbs.
6	....	..	......
7	Cotton	2	5,376 lbs.
	Sweet potatoes	2	390 cwt.
8	Pastures	2	9.6 tons (dry forage)

* No. of locations—sum of those in areas 3, 4, and 5.

sponse data are not available on all the leading crops in all areas. Experiments are under way or are being planned to fill as many as possible of the gaps. It will be noted that corn has been omitted from the table of crop response data, although this crop occupies by far the greatest acreage of any cultivated crop in the State. Very few data were available on direct responses of this crop to potash. A number of long-term experiments had been conducted on rotations including corn. In most cases, however, plots receiving no potash had been compared with those receiving small quantities of potash. Over a period of several years the potash supplies in the plots receiving none were severely depleted. It was felt that for the purpose of this study, such a comparison would give an exaggerated picture of the actual potash response.

For the relatively heavily fertilized crops, such as Irish potatoes, sweet potatoes, and cotton, data were taken only from rate of potash studies. Comparisons are made between applications of potash corresponding to experiment station recommendations and those somewhat less. In these cases no comparisons are made against plots which received no potash. This restriction on the data reported herein gives a conservative estimate of the potash responses. They are thought to indicate the amount of reduction in yield which would result from a lowering of the potash content of the fertilizer. Although the experiments were located on the important soil types of the respective agricultural areas, the number

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Left: 160 lbs. 0-20-10; yield 29.6 bu.; test weight 54.5 lbs. Right: 150 lbs. 0-20-0; yield 13.7 bu.; test weight 45 lbs. Only 10 per cent extra potash made this extreme difference in strength of straw, total yield, and test weight per bushel. Poorland Farm, Salem, Ill.

The Potash Problem In Illinois[1]

By R. H. Bray

Department of Agronomy, University of Illinois, Urbana, Illinois

THE potash problem in Illinois has been of vital concern to me for the best part of the 21 years which I have spent studying the chemistry of Illinois soils and the relation of soil chemistry to crop production in the Corn Belt.

It was back in 1930 that I first started studying the chemistry of soil potassium with respect to soil fertility. This followed hard on the heels of the soil test for phosphorus, put out in 1929, which had already proved its worth in the solution of the phosphate problem that had become critical at that time. Perhaps most of you can recall the time when we were recommending that large amounts of phosphate be applied to soils as part of our management system. The soil experiment field results had told us that some soils responded to phosphate and some did not, but they could not tell us which particular farm soils needed phosphate and which did not. As a result, many farmers were not being benefited by applying phosphates.

Studies with the soil test showed that the lack of response was not because the phosphate being used was not a satisfactory phosphate, but because the soils which did not respond already contained sufficient amounts of available forms of phosphorus. The soil test for phosphorus readily picked out, with relatively few exceptions, the soils

[1] Paper presented to the Illinois Agricultural Association, Chicago, November 18, 1943.

which did not respond and put phosphate used on a practical footing. This test represented one of the first practical applications of soil chemistry to the solution of nutrient needs which could be applied to each individual farm soil and thus give specific recommendation to each farmer.

It appeared, therefore, that the thing to do about our potash problem was to find out about the chemistry of soil potash and crop production and then design a soil test which could accomplish the same results as had been accomplished by the acidity and phosphorus tests.

Now just what is the potash problem in Illinois? The simple facts of the case in 1930 were:

1. A large number of the Illinois experiment fields were giving good responses to added potash fertilizers.
2. These responses varied widely, with no two fields giving exactly the same response.
3. There was no practical way of answering the following questions for any particular 40-acre field:
4. a. Is this field potash-deficient?
   b. How deficient is it?
   c. How much muriate of potash is needed to overcome the deficiency?
   d. Will it pay to use potash?

In other words, we knew we had potash-deficient soils; we knew that most of them were in the tight clay region in southern Illinois; and we knew that even within the tight clay region not all the soils were deficient, or at least not to the same extent. We also knew that in the dark-colored prairie soils some few were deficient and more were becoming so. We could make generalized recommendations for areas generally low in available potassium which could be considered practical because they were the best we knew how to make at that time, but we could not make a sure-fire recommendation for any specific case. The farmers requiring 100 pounds of muriate of potash and those requiring only 50 pounds, or perhaps none at all, were receiving the same recommendation.

That was our potash problem in 1930.

In attacking this problem with soil chemistry, the first thing we did was to review the attacks made in the past.

Many years ago it had been theorized (not believed) that since nearly all Illinois soils contained large amounts of total potash, the return of potash-containing materials or fertilizers would not be necessary. It was theorized that perhaps the turning under of organic matter would make the large supply of soil potash sufficiently available. It is good science to theorize, but it is poor science to believe your theory without testing it. Testing this theory on the Illinois experiment fields over a period of 20 years had completely overthrown it. This theory has been discarded.

Another Theory

Another theory we had in the past was that soil fertility varied with the soil type and that if one knew the fertility requirements of one area of a given type, these requirements would hold for other areas of that type. It was hoped that, by putting experiment fields on different soil types, one could determine the deficiencies for the type and apply the findings to all the other areas of that type.

This theory worked out only slightly better. There are certain soil types which can be designated as generally, but not always, potash-deficient. The available potash level, as well as that of other nutrients, varies greatly within the type as well as between types and there was, at that time, no way of knowing whether or not the experiment field was located on an area which contained the available nutrients in the amounts found on most of the areas of that type.

This attack, therefore, did not solve the problem of applying the experiment field results to the particular soil being

Left: 80 lbs. 0-0-60. Right: no potash. Potash-fertilized corn was normal green, while the unfertilized rows had lower leaves with brown marginal firing and yellowish streaks between veins. R. L. Murray farm, Centralia, Ill.

farmed by John Doe. This soil type is of help in generalizing for large groups of farmers. What is best for a large group as a whole may not be best for the individual whose problems are strictly his own. For the individual, the soil type cannot be considered a fertility unit to be treated alike with limestone, potash, and phosphate.

Now, let us get back to soil chemistry. In the early 1850's, Thomas Way, an English soil chemist, found that soils adsorb potassium on the surface of the clay particles.[2] This is called the replaceable or exchangeable form. By 1930 this form was considered of importance in plant feeding, but it had not been proved that it was a direct measure of the potash requirement of a soil.

Our first attack at the problem was to study the replaceable potassium in the soils of our soil experiment fields. We found that a good correlation was obtained between the amount of replaceable potassium in a soil and its need for potash. In general, soils containing less than 100 pounds per acre (2,000,000 pounds of soil) of replaceable potassium gave good responses to potash; soils testing between 100 and 150 pounds gave medium responses, mostly for corn and legumes; and soils between 150 and 200 pounds gave some response with corn but not with other crops.

In 1932, a soil test for replaceable potassium which gave the same results as the quantitative work was devised. This was adopted for extension use and was also applied to plant-tissue testing.[3]

However, it is what has been done with this test in the last year and a half that is the meat of this discussion. But before I get started on the meat course, I should rapidly mention the chemical studies of soil potash, made by the Soil Fertility Division of the Agronomy Department in the period since 1930, which help explain our new work.

We have studied the weathering of the potash minerals in the soil through all the stages of soil maturity represented in Illinois. We have found which potash minerals are of most importance. We have found that it is the weathering away of certain of these minerals which has caused our potash deficiencies. With the Geological Survey, we identified the most important potash mineral in Corn Belt soils and called it "illite", after the State of Illinois. We studied the adsorption of added potash by the colloidal clay minerals and its subsequent release to the plant when it was needed. We studied the rate of release of potash from the inside of the clay mineral to the available form; we studied the equilibrium between the replaceable potassium and the other replaceable bases and the influence of this on potassium availability. These and many other studies, includ-

[2] The Clay particles are very small, ranging from 1/25,000 of an inch down in size.

[3] See mimeo. AG 878, "Potassium, Phosphorus, and Other Tests for Illinois Soils," by R. H. Bray.

ing the analysis of the crops growing on these soils, form the background for the rest of my discussion.

Recently, I made a new study of the correlation of our potash test with crop growth. Following a method of interpretation suggested by the German scientists Mitscherlich and Baule back in the early 1920's, I soon found myself in the midst of a highly interesting set of conclusions. They were so startling that I could hardly believe them, and I spent the next six months or so trying to shoot them full of holes. Part of these conclusions could have been predicted from the work of these German scientists; others are conclusions which do not agree with their original interpretations, but which put the whole study on a highly practical basis. I found that the new conclusions were sound and that they in turn were upsetting some of our old ideas about soil fertility.

I will not attempt to give the scientific background for these conclusions. It will be published in the journals devoted to this purpose. Instead I am going to devote myself entirely to the practical use to which these conclusions can be put.

The Soil Test Value and the Per Cent Yield

Table 1, column 1, shows a set of soil-test values for available potassium.

Let us take the first value for potassium, which is 55 pounds per acre, or 55 pounds in 2,000,000 pounds of soil. In the next three columns we have the per cent yield obtainable for the major crops grown in Illinois. Corn and legumes can grow 53 per cent of a crop on a soil which contains only 55 pounds of available potassium.

Now, just what do I mean when I say that corn will produce only 53 per cent of a crop on a soil testing 55 pounds of replaceable or available potassium per acre? I mean that that land is now producing, or will produce, only 53 per cent of the crop which it could produce if adequate but economical amounts of potash were applied. I mean that the yield with adequate potash is a 100 per cent yield and that this 100 per cent yield is used as the base for all percentage calculations used in this method of soil-test interpretation.

Practically speaking, for most soils and conditions in the Corn Belt, it takes as much replaceable potassium (55 pounds) to produce a 53 per cent yield of corn on a clay pan soil, deficient in phosphorus and giving a low yield in bushels per acre, as it does to produce a 53 per cent yield on a well-drained, friable silt loam, not deficient in phosphorus and giving a relatively high yield in bushels per acre. It also takes as much replaceable potassium (236 pounds per acre) to produce a 100 per cent yield of corn on the clay pan soil as it does on the well-drained loam even though the actual 100 per cent ceiling yields may vary between the two soils by as much as 50 bushels of corn. This means that the soil requirement is not directly related to the crop requirement and that they are two distinctly different values. The soil requirement is similar for similar per cent yields as just illustrated and as shown in Table 1. However, the crop requirement in

TABLE 1.—POTASH—TABLE OF VALUES FOR THE CALCULATION OF CROP YIELDS AND CROP INCREASES.

Lbs. K/acre by test (available K)	Per cent yield*		
	Corn legumes *	Soy-beans	Wheat**
55	53	65	79
73	63	77	87
95	74	85	96
109	79	89	98
127	84	94	100
150	90	98	
182	95	100	
236	100		

$* \frac{\text{yield without added } K_2O}{\text{yield where K is not deficient}} \times 100 =$ % yield or % K sufficiency.

** Oats and other small grains probably similar to wheat.

terms of pounds per acre varies with the magnitude of the crop in bushels per acre. It is the fact that the soil requirement is similar for the same per cent yield which makes our new interpretation possible.

Now, let us get back to our first example. A 55-pound test permits a 53 per cent corn yield. This means that the use of adequate potash will almost double the yield, bringing it up to a 100 per cent yield. In our method of calculation this is a 47 per cent increase in yield, that is, the increase in yield is 47 per cent of the 100 per cent yield. If, with adequate potash, the yield is restricted to 40 bushels of corn by a shortage of other nutrients, or by the physical nature of the soil, these 40 bushels are considered a 100 per cent yield just as truly as if better conditions had permitted a yield of 80 or 100 bushels as the 100 per cent yield.

What about crops other than corn? Do they have the same potassium requirement? The answer is no, in fact they vary considerably in their soil requirement for potassium as shown in Table 1. A soil which can produce a 53 per cent crop of corn can, from the same amount of soil potassium, produce a 79 per cent crop of wheat or a 65 per cent crop of soybeans.

Again, Table 1 shows that a soil containing 109 pounds of available potassium by test can produce a 79 per cent crop of corn (or legumes), an 89 per cent crop of soybeans, or a 98 per cent crop of wheat.

Now, what are the limitations to the practical application of these facts? Will the indicated increases always be obtained? The answer is yes, provided we apply our facts in the same way in which they were obtained. These results are based on the average yields for several seasons. Legumes for supplying nitrogen were grown in the rotation and crop residues were returned. This means that, for average conditions, the amount of rainfall and the nitrates supplied by the soil and the legumes have been adequate for all increases resulting from potash additions.

On the other hand, phosphorus may or may not be deficient. This will not interfere with the potash test interpretation. If, therefore, a 70 per cent potash sufficiency exists, the average yields in the future with adequate potash use will be 100 per cent, or 30 per cent higher than they would have been without potash, although the actual yields with or without potash will be relatively lower on the phosphorus-deficient soil.

These facts were obtained on silt and clay loam soils similar in chemical nature to most of the soils of the Corn Belt. Sand soils, "slick spot" conditions, peats, mucks, and alkali spots represent further variations in soil conditions

Potash hunger manifests itself in the white fleckings on the margins of alfalfa leaves. Alfalfa is a heavy feeder on potash.

and may require a slightly different interpretation. Except for such limitations, the results are applicable generally for Corn Belt conditions.

The Potash Requirement

How about the K_2O or potash requirement for these different levels of available potash? Table 2 gives the K_2O requirements for different crops for different test values.

TABLE 2.—POTASH—TABLE OF VALUES FOR THE CALCULATION OF THE K_2O ROTATION REQUIREMENT.

Lbs. K/acre by test (available K)	K_2O Requirement** yearly			*Rotation** Corn oats clover wheat 4 years
	Corn legumes	Soybeans	Wheat (oats)	
	Lbs./A	Lbs./A	Lbs./A	Lbs./A
55	72	44	28	200
73	65	37	20	170
95	56	28	12	136
109	50	23	....	100
127	43	16	....	86
150	34	....	....	68
182	22	....	....	44
236	....	....	....	....

* The sum of the yearly requirements for each crop in a rotation equals the rotation requirement. This column illustrates a 4-year rotation of corn, oats, clover, and wheat or 72+28+72+28=200 pounds of K_2O for the 55-pound test value to be applied over a period of 4 years.

** The potash content of a fertilizer is expressed as K_2O. For example, 88 pounds of muriate of potash (KCL containing 50% K_2O) will meet the requirement for 44 pounds of K_2O.

Corn, of course, has the highest requirement for added potash, compared to beans and wheat, just as it had the highest requirement for soil potash.

For any soil-test value the requirement given for any crop is not the requirement where that crop is the only crop in rotation which is to receive potash. If you want to get the full increase for corn on the 55-pound soil, you cannot except to get it by using 72 pounds of K_2O as muriate of potash on the corn crop alone and not treat the other crops in the rotation. The way to use Table 2 is to list the crops in your rotation, after each crop put its K_2O requirement, then add the requirements together to obtain the rotation requirement (see Table 2). The prospective increase in yield given in Table 1 is dependent on using the full rotation amount consistently over a period of years. Using less than the rotation amount will, of course, be just as profitable per unit of potash used, but it will not produce the full increase in yield which could be obtained. With potash supplies limited as they are today, we will have to be satisfied with using less than the rotation requirement. Biggest returns from potash use under war conditions will come from allocating relatively more potash to the soils testing low in potash, provided such soils are otherwise capable of producing satisfactory yields.

The last column in Table 2 illustrates the full rotation amount for each test value for a four-year rotation of corn, oats, wheat, and clover.

The Practical Application

Table 1 gives the per cent yield obtainable for several soil-test values for available potassium. From these values can be calculated the actual increase in yields which may be expected from the use of adequate amounts of potash fertilizer. If, for example, you have been obtaining yields of 30 bushels of corn per acre on a soil testing 95 pounds or 74 per cent sufficient in potash, i.e., it is giving a 74 per cent yield, then the use of adequate potash will increase the yield from 30 bushels (74 per cent) to about 40 bushels (100 per cent). According to Table 2, the K_2O requirement for corn for such a test value is 56 pounds of K_2O per acre. This means that an investment in 56 pounds of K_2O per acre should increase the average yields of corn on this soil by about 10 bushels per acre. These are most of the facts necessary for the economic interpretation of the potash test. An estimate of probable crop values and the cost of the fertilizer are the additional facts necessary.

Table 3 illustrates the practical use of Tables 1 and 2. Here we have the soil-test value in column 1 and the per cent yield in column 2. Then for each soil-test value we have a series of different yield levels to fit different cases which represent the average yield of different farms in the past. Next comes the yield of corn expected when potash is used in the full amount required for a rotation, and next is the bushels increase. Last comes the K_2O requirement and the cost when applied as muriate of potash at current prices, figuring the K_2O at five cents per pound. A simple inspection should be ample to show whether or not potash use will be profitable. You do not know what corn may be worth next year, but you do have a general idea; you also know approximately what fertilizer prices will be. All that is left for you to do is pick out on this table the soil-test value for one of your own fields, select the approximate average yield in column 3 nearest to the yield which has been obtained on this field in the past, and reach your own decision as to whether or not you are interested in using potash.

I do not guarantee that you will get exactly this increase in yield for any one year, but unless the results from all 23 experiment fields in Illinois are not to be trusted, you should average approximately this increase over a period of years of consistent potash use. The yield level each year is controlled by

TABLE 3.—POTASH—TABLE OF ORIGINAL YIELDS, EXPECTED INCREASES, AND POTASH REQUIREMENTS FOR CORN ON SOILS VARYING IN AVAILABLE POTASSIUM*

Lbs. K/acre by test (available K)	Per cent yield	Farmer's average corn yield in past	Farmer's average corn yield in future	Bushels increase for potash use	K_2O requirement	Cost as KCl
					Lbs./A	
		25	47	22		
		30	57	27		
55	53	40	76	36	72	$3.60
		50	94	44		
		25	40	15		
		30	48	18		
73	63	40	63	23	65	$3.25
		60	95	35		
		25	34	9		
		30	40	10		
95	74	40	54	14	56	$2.80
		60	81	21		
		25	30	5		
		30	36	6		
127	84				43	$2.15
		50	60	10		
		70	83	13		
		25	28	3		
150	90	50	55	5	34	$1.70
		80	89	9		
		100	110	10		

* Where the full rotation requirement for K_2O is used and nitrogen is not seriously deficient.

Potash is absolutely necessary for profitable farming in most of the southern Illinois potash-deficient areas. This picture from the West Salem field tells its own story.

climate, but even the climatic effect is averaged out over a period of years.

Now you can see that we are not ignoring the other nutrient deficiencies or the physical nature of the soil type. The farmer's average yield in the past is itself both a measure and a result of these deficiencies. Also, the final yield in column 4 of Table 3 is still not necessarily the maximum yield obtainable unless the base yield you select (column 3) was obtained when all other deficiencies except potash had been corrected. It is the maximum yield obtainable by adding only potash to the soil management program already in effect. I will not show the tables for legumes, soybeans, wheat, or oats. They illustrate the same thing which this table illustrates for corn.

It has already been said that we can apply the potash test interpretation without knowing the phosphorus status of the soil. However, where phosphorus is also deficient, it is usually more practical to apply both at the same time. The potassium test is not the only test which can be interpreted in terms of per cent yield and nutrient needs. The new fluoride soil test for phosphorus (Method No. 2) published about two years ago* is also sufficiently accurate to be interpreted in exactly the same way as I have just interpreted the potassium test. The accuracy is not as high as in the case of the potassium test, which is our most accurate one, but it is still well within the practical range. As with the potassium test, the phosphorus test gives the per cent yield and the superphosphate or rock phosphate requirements.

Used along with the potassium test, a balanced fertilizer recommendation which recognizes each crop's individual need for each nutrient with respect to the soil level of these nutrients becomes possible. This does not mean that each crop in the rotation receives the same ratio fertilizer. The ratio used will depend on the relative needs of the different crops. Once the rotation requirements are known, the fertilizers can be applied according to our best knowledge of methods of fertilizer application, a subject which will not be taken up here.

Now, I should like to point out certain additional uses to which the soil-test values can be put. For example, suppose a farmer has only a limited amount of money to invest in fertilizers. Should he use adequate potash on two fields or adequate phosphate on two fields instead of applying both nutrients to one field? Should he add half the total requirement for both nutrients to two fields instead of the full amounts to one field?

Such problems are readily worked

* See mimeograph AG 1028, "Rapid Test for Measuring and Differentiating Between the Adsorbed and Acid-soluble Forms of Phosphate in Soils," by R. H. Bray.

TABLE 4.—POTASH—YIELD EXPECTATIONS AND ECONOMIC RETURNS FOR DIFFERENT METHODS OF TREATMENT ON A SOIL DEFICIENT IN BOTH P AND K BUT WHERE LEGUMES HAVE ALREADY BEEN USED.

Soil-test Values.........K test = 73 pounds
P test = low +

Crops in rotation	Past yields with no P or K	Full P and K requirement added	1/2 P and K requirement added	Full K requirement added	Full P requirement added
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Corn	33	63	53	55	38
Oats	27	39	35	33	31
Legume hay	(0.8 tons)	(1.8 tons)	(1.5 tons)	(1.3 tons)	(1.1 tons)
Wheat	17	29	25	21	24
Gross value of all increases (4 years)	None	$41.10	$27.40	$22.10	$13.80
Cost		$14.22	$ 7.11	$ 8.50	$ 5.72
Net		$26.88	$20.29	$13.60	$ 8.08

Values used—Wheat at $1.00, Oats at $0.30, Clover at $10.00, and Corn at $0.50.

out provided one has the potassium and phosphorus test values and a knowledge of the yields obtained in previous years.

Table 4 gives an example of a soil deficient in both phosphorus and potassium where legumes are grown in the rotation. The results from various treatments are calculated as shown in columns 2, 3, 4, 5, and 6. The gross value of the increases is shown and the

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Covered with "slick spots" the Newton field represents one of the poorest soils in southern Illinois. Potash increased corn yields from 29 bushels on the RLP plot to 47 bushels on the RLPK plot. (1939-42 average.)

Record Supplies of Fertilizer Materials Indicated for 1944-45*

By S. L. Clement

Deputy Chief, Fertilizer Materials Unit, War Production Board, Washington, D. C.

EVERYONE concerned with the production of food and fiber crops in 1944-45 to meet record requirements is interested in learning as early as possible the outlook for fertilizer supplies. Among the interested groups are the War Food Administration, the agronomists and other agricultural workers in the states, the members of the fertilizer industry, and the producers of farm commodities. As a guide to these groups the War Production Board has attempted to estimate the supply of each major fertilizer ingredient which will be available next year for agriculture in the United States, including Hawaii and Puerto Rico.

It should be emphasized, however, that any estimates made this far in advance, although based upon the most reliable information available, are subject to considerable error. Not only is it impossible to determine accurately what the domestic production of each material will be, but the quantities which will be imported are subject to considerable uncertainty and military requirements can only be estimated.

Potash

Potash perhaps is subject to less uncertainty than are most of the other fertilizer materials, the domestic production having become stabilized at a high level with the major producers operating 24 hours a day throughout the year. In 1943-44 the entire supply has come from domestic production and there is no assurance of any imports in 1944-45, although the possibility of obtaining shipments from Spain and Russia is being explored. In the current year out of a total production of 771,000 tons of K_2O approximately 100,000 tons were allocated to the chemical industry, a large part of the product going to meet direct or indirect military requirements. In the present estimate of supplies available for domestic fertilizer it is assumed that chemical requirements for potash will remain unchanged in 1944-45.

According to present indications United States agriculture (including Hawaii and Puerto Rico) will have available in 1944-45 approximately 700,000 tons of K_2O from primary potash salts, an increase of 96,000 tons of K_2O, or 16 per cent, over the 604,000 tons allocated in 1943-44. It appears that there will be an increase of approximately 104,500 tons of K_2O in the form of high-grade muriate, while the supplies of 50 per cent muriate and manure salts will be reduced approximately 2,500 tons and 10,000 tons, respectively, of K_2O. Sulphate of potash is expected to increase by approximately 4,000 tons of K_2O and the supply of sulphate of potash-magnesia will remain practically unchanged. Although it will vary for different salts, there will be approximately the same quantity K_2O allo-

* Estimates of supplies are based largely upon data presented at fertilizer grade conferences held within recent weeks at various points throughout the United States.

cated in Period Four (June 1, 1944, through March 31, 1945) as was allocated in Periods Two and Three combined.

This anticipated increase in the supply of potash for agriculture is based on increased production capacity, elimination of lend-lease requirements, and more efficient utilization of existing production facilities. Plant expansion by one of the producers, already authorized by the War Production Board, is expected to provide 36,000 tons of K_2O in the last three quarters of the fertilizer year; approximately 20,000 tons exported under lend-lease in the current year are expected to be available for domestic use in 1944-45; and increased efficiency of production is expected to provide an increase of approximately 40,000 tons in production.

The increased efficiency of production had become evident by the beginning of 1944 and was one of the two factors which made it possible to increase Period Three (April and May 1944) allocations above the quantity which it previously had been estimated would be available for allocation. The other factor was the fact that the United Kingdom did not require delivery of the entire 36,000 tons of K_2O originally earmarked for lend-lease. Only 20,000 tons were taken, the remaining 16,000 tons becoming available for domestic use.

In estimating the portion of the total domestic production of potash which will be available for agriculture, it is assumed that the requirements for industrial chemical uses will continue at the all-time high level reached in 1943-44, when the quantity allocated for these uses was approximately 100,000 tons of K_2O. If these requirements, a large part of which are for military purposes, should decline, the supply for agriculture will increase proportionately. It is also assumed that potash exports to countries other than the United Kingdom will be no larger than the quantities already approved.

Superphosphate

The 1943-44 superphosphate program calls for a production of 7,000,000 tons of normal superphosphate, basis 18% P_2O_5, with an annual rate of production of 8,000,000 tons by the end of June. Present indications are that the actual production will fall little, if any, short of the 7,000,000 ton goal. Production during the first eight months of the year amounted to approximately 4,494,000 tons, February production amounting to 614,115 tons. It is expected that the output will be stepped up considerably during April, May, and June, after the peak of the fertilizer mixing season has passed. If we assume an average of 620,000 tons for the five months beginning with March, the total production for the year will be approximately 7,000,000 tons.

Heretofore, shortage of sulphuric acid has been the most serious obstacle in production, but apparently labor has now become the most serious limiting factor. The movement of acid from Ordnance plants for superphosphate reached a record quantity in March, amounting to approximately 40,000 tons, basis 60° Baumé. In the Southeast there was more acid available to acidulators than they were able to use because of the lack of sufficient labor to mix and ship fertilizer and at the same time maintain full production of superphosphate plants. In view of this situation, the output of Ordnance plants in that area was curtailed somewhat in April.

In order to raise the annual production rate of superphosphate to 8,000,000 tons, it was necessary to construct some additional facilities for both superphosphate and for sulphuric acid in certain areas not adequately provided for at present. New acidulating facilities with an annual production capacity of approximately 612,000 tons of superphosphate, basis 18% P_2O_5, have been approved and construction will be completed by the end of 1944. Approxi-

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Fig. 1. An extreme case of boron deficiency. Cross hatching is evident on the leaves which were well developed when the deficiency became acute. Progressive stunting and dying of embryonic leaves resulted in the characteristic rosette in the crown.

Borax Sprayed on Beets Controls Black Spot

By J. C. Walker, W. T. Schroeder, and J. E. Kuntz

Agricultural Experiment Station, University of Wisconsin, Madison, Wisconsin

A CONSIDERABLE acreage of garden beet is grown annually in the truck crop area of eastern Racine and Kenosha Counties in southeastern Wisconsin. The best crops are produced in the old glacial-lake-bottom area between the cities of Racine and Kenosha. This soil is level in topography, well-tiled, and kept at a very high fertility level with the production of onion, cabbage, potato, tomato, beet and carrot in rotation.

In 1942 most fields in this area showed varying amounts of internal black spot in spite of the fact that liberal amounts of borax (50 lbs. per acre or more) were applied broadcast with the fertilizer before sowing. Some of the fields in question were rejected by one canning company because of black spot.

In previous reports (1, 2, 3) it has been shown that more often than not a small amount of black spot is observed when beets grown on boron-deficient soil are examined critically, even though relatively large applications of borax are applied either broadcast or in bands along the row. Mid-season spraying also has been shown to correct internal black spot when applied to beets on boron-deficient soil (2, 3).

Canning beets are sown early in the area mentioned and with favorable rainfall produce heavily. It is not uncommon, however, for a mid-season drought to occur in this region where the cool air of Lake Michigan tends to deflect thunder showers. It is during or following such a period that boron deficiency becomes acute. Whether the borax applied in the spring becomes temporarily unavailable or whether the low soil moisture inhibits adequate absorption by the roots of the growing plants is not a settled question. Nevertheless, growers of prospective large crops of beets are in constant danger of black spot ruining the crop in spite of what is generally regarded as adequate borax application just before sowing. It was therefore decided to try mid-season spraying of borax on a commercial scale to determine whether this was a worthwhile protective measure.

Borax solution was applied with a 6-row sprayer, 2 nozzles adjusted to each row; 150 gallons were applied per acre at 450 pounds pressure. Several fields were treated. Results from two of these will be given in detail.

Both fields were fall-plowed; 1,500 lbs. of 3-12-12 containing 75 lbs. of borax were applied per acre and disked into the soil thoroughly just prior to sowing. Field 1 was sown with Asgrow Canner on April 23; field 2 with Detroit Dark Red on May 1. Heavy spring rains produced an abundance of top growth. Throughout June only scattered light showers occurred and growth retardation was very severe by the end of the month. On July 5 a heavy rain fell (1.65 inches) and growth was again accelerated. At this time the crop was examined carefully for evidence of black spot and none was found. From previous observations, however, it was clear that the climatic picture was favorable to development of deficiency symptoms, since during the long dry period the borax applied in the spring had been temporarily tied up, while the recent rain by speeding up growth would be expected to increase suddenly the boron requirement of the plants.

Applications were made on July 8 at the rate of 10 and 20 pounds per acre in field 1 and at 20 pounds per acre in field 2. Three replicates of each treatment were made with untreated strips between each replicate. One month later (Aug. 7) the treated plots in field 1 were given a second spray and a new set of three replicates were treated with 20 pounds per acre for the first time on that date.

Harvest notes were taken in field 1 on Sept. 6 and 7 and in field 2 on Sept. 17. Five paired samples of 50 plants each were taken from the two center

Fig. 2. Extreme boron deficiency in beet root which results when prolonged chronic deficiency of boron has occurred. (Compare with Fig. 3)

Fig. 3. Late-season boron deficiency confined to the outer tertiary rings of the beet root. This type of symptom was the most common in the cases described in this article. Acute boron deficiency occurred after midseason when the outer rings of nearly mature beets were most active in growth. Presumably the acute deficiency was brought about by temporary locking up of boron in the soil, since 75 lbs. of borax per acre had been applied when the crop was sown.

rows of each replicate of each treatment. The roots were cut in thin slices and the percentage showing any sign of black spot (total black spot) and the percentage severely affected (severe black spot) recorded. The results are presented in table 1.

It will be seen that in the untreated checks in field 1 from 37 to 43 per cent of the plants were diseased and from 14 to 23 per cent severely so. The 10- and 20-pound treatments on July 8 and Aug. 7 reduced the severely dis-

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TABLE 1.—THE EFFECT OF MID-SEASON SPRAYING WITH BORAX ON THE OCCURRENCE OF INTERNAL BLACK SPOT IN CANNING BEETS

Field No.	Pounds of borax sprayed per acre per treatment	No. of treatments	Date of treatments	Percentage black spot	
				Total	Severe
1	10	2	July 8 and August 7	16.1*	6.1*
1	None			42.5*	23.1*
1	20	2	July 8 and August 7	8.1*	2.4*
1	None			43.5*	20.6*
1	20	1	August 7	31.2	14.8
1	None			37.1	14.0
2	20	1	July 8	2.0* 8.2*	0.4* 3.6*

* Differences between treated and corresponding check are highly significant at the 1% level.

Austrian winter peas planted in a cotton patch keeps this soil working toward the maintenance of its fertility.

A New Approach to Extension Work

By P. O. Davis

Director of Agricultural Extension Service, Alabama Polytechnic Institute, Auburn, Alabama

GO wherever you may and talk with a farmer who is improving his operations, the odds are ten to one that it won't be long until he'll soon refer to something that "my county agent told me to do." If you happen to talk with his wife, the odds are that she'll soon refer to her home demonstrtaion agent in the same way. They are more than personalities; they are symbols of better farming and better living in farm homes in Alabama, in every state.

All of this is indeed remarkable when we remind ourselves that the great county agency system of this country is just now well started on its second quarter of its first century. In fact there are now in active service county agents and home agents who were pioneers in the work.

To contact people they walked, rode horseback or in buggies, and some actually traveled on bicycles. They saw and talked with as many people as they could, probably not realizing that they were pioneering in a service for better things and bigger service to follow. They had accepted a call to carry the torch in a changed agriculture, the foundation of the old being threatened by the boll-weevil. Their assignment was to preserve and improve as much as they could of the cotton industry and, at the same time, point the way to other crops and livestock to balance and improve what was then, and is now, an unbalanced agriculture.

Those pioneer workers were poorly paid missionaries for a great cause. They had either no or poor offices, no clerical assistance, no typewriter, and little other office equipment. Their influence was little; and there were misgivings about them.

An early tool with them was the demonstration, usually a few rows of corn or some other crop to teach facts about fertilizer, varieties, etc. The picture of a good farm managed by a good farmer living in a good home had not unfolded itself to them. They were dealing with small parts of farming, not the whole. Complete, or unit, farm and home demonstrations as we now see and use them were not in their procedure. Perhaps they didn't visualize them. Our use of them is a result of growth and improvement along with enlarged responsibilities.

While the county agents were working with men and boys, the home agents were working with equal ability and diligence with women and girls. Both were giving attention to 4-H club work which, from the beginning, has been a big and important part of the Extension Service program of which county and home agents are both symbols and leaders.

Experimental information, too, was inadequate in those days. Much has been accumulated but much of the research information now in daily use was then either in the laboratory or still in the process of being perfected for practical use and better results.

Time passed, new problems arose, bigger challenges were presented, more work was expected, and the personnel expanded. In 1933 new and bigger demands were presented extension workers by new agricultural programs aimed first at relief. Extension workers had guided farmers to the production of burdensome surpluses of cotton and other products. People and institutions were hungry and bankrupt and in distress while warehouses, granaries, and storage bins were overflowing with food and fiber from American farms.

This resulted in an agricultural control program, a program to adjust pro-

Livestock that are gathering their feed by grazing are doing work that otherwise man would be required to do

duction to market needs, the agricultural adjustment program in which extension workers have had big responsibilities from the beginning. Adjustments soon became combined with prices of farm products on which our position is well known.

These additional duties for extension workers called for better offices, adequate clerical help, modern equipment, telephones, and ability to guide and manage collective programs for all the farm people of a county, of a state, and of the nation.

I am merely mentioning these as milestones in our growth and service. They have brought us to where our minimum personnel in an Alabama county now consists of a county agent, a home agent, an assistant county agent, and a secretary. In addition, there are assistant home agents in 25 counties and labor assistants in most counties. There are also those who are engaged in our cooperative program in the TVA area and our timber marketing work in cooperation with the U. S. Forestry Service. To these we add Negro county and home agents in 40 counties, plus the staff at Tuskegee Institute.

Closely cooperating with us are the AAA and the SCS workers, teachers of vocational agriculture, the State Department of Agriculture, chambers of commerce, and other business groups on both state and local levels—all working together, in the same direction, toward the same goals.

County extension workers have come out of attics and basements in courthouses. They are on the first floor and in the front rooms. Their offices are modern, their equipment generally adequate, their procedure efficient. They are leaders in the march of progress, and they are so recognized and appreciated. This is reflected by the esteem and the confidence in which they are held by the men, women, boys, and girls on the farms and the high esteem in which they are held by non-farm people, many of whom appreciate their dependence upon agriculture.

Instead of being weak voices crying in the wilderness, county extension

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Corn with and without legumes on the Tennessee Valley Substation, Belle Mina. Yields on these plots were 20 bushels per acre without legumes and 40 bushels per acre with legumes.

Our Greatest National Asset

By Marvin Jones

War Food Administrator, Washington, D. C.

ONE of the greatest contributions that this Nation has been able to make to our fighting Allies has been food. Without the food that we were able to furnish, gallant old England might not have survived during the dark days when she stood practically alone between civilization and organized destruction.

A short while ago a Russian general who fought in the Battle of Stalingrad told me that but for the food and supplies America made available for the heroic Red Army, the advance could not have been carried out as it was.

Without our rich soils that food could not have been produced.

The capital stock of a nation is its soil resources. No business can stand a continuing drain on its capital; likewise no nation can endure long excessive drains on its capital resources.

We were able to furnish this food because we had a vast, new country, rich in natural wealth.

What are soil resources? They are food and clothing locked up in nature's warehouse against the time when man, through his efforts, takes them out. Our great soil resources in this country have enabled us to develop a great race of people. History shows that the character and strength of a nation goes up and down with its soil.

In our fast development of this new country we have not always been careful in the preservation of our soil, and much of this valuable Godgiven birthright has been permitted to wash or blow away. We have cut down our timber on the watersheds and hillsides; and the rains have descended, and the floods have come and beat upon the soil, carrying it into the branches and streams and on to the sea where it is lost forever. There are only a few inches of topsoil on which we must depend not only now but so long as we remain a nation. Man's destiny is linked to the soil. From it he came and to it he must return. From it he must draw his sustenance.

We stand aghast before the spectacle of destruction in so much of the war-weary world today — the devastated fields and gutted homes, the ruins of great cities now rubble and ashes and bones. But all this wreckage, even in the scorched earth areas, can be rebuilt with time and work. North Africa is already able to produce most of its food demands. Well-directed efforts can restore production in the stricken areas. I do not minimize the destruction; but restoration can be rapid.

Most Ruinous Nation

I am here concerned with an even greater destruction, of our own fields —not by the Nazi or the Jap, but a destruction of which we ourselves have been guilty, with our eyes open, our own hands stained with the dust and mud of our eroded soil.

According to H. H. Bennett, Chief of the Soil Conservation Service, we have ruined more land in less time than any other nation in history. More than 50 million acres of land in the United States, once cultivated, no longer produce crops. That is nearly as much as our entire wheat acreage last year. And the best topsoil has been washed away from an additional crop acreage twice as large as that. Fortunately, we are learning of this danger before it is too late.

To win the war, and in the quickest possible time, is rightly our first determination now. That accomplished, our next aim is to establish a peace which will mean security, jobs and food. But we must give especial thought to the basis of all these things —our natural resources upon which they depend, and without which our victory in war would be a useless thing.

Our Hope for the Future

A master plan for the land, upon which all other plans in the last analysis depend, is the place to start. Everything we hope for after the war, if that hope is to endure, is based upon the land. History has shown that where the soil and water resources have been guarded, nations have survived. Centuries ago the Tigres and the Euphrates Valleys were productive, and excavation and other records indicate the great civilizations which developed there.

Today our Mississippi Valley, and I mean by that the whole great area between the Alleghenies and the Rockies, is the greatest potential food-producing area in the world. Properly used and preserved it can, for centuries to come, not only supply abundance for our own people, but can help supply others with its products and bring back in trade additional goods for us to use and enjoy.

This great valley is full of abundance and plenty. We have the opportunity to use these resources fully and yet preserve them—or to use them fully and waste them. There is always a conservation use and wasteful use. In the past we have exploited our good earth with a prodigal disregard of its real value to our enduring life as a nation. We have sent the export crops down to the sea in ships and the soil down to the sea in mud. When the Mississippi overflowed at its mouth, we built levees. We tried to reverse nature, and when nature rebelled, as she always does, against such treatment, we built higher levees. We wasted both soil and water. Instead of using the water to our advantage, we tried to get it into the sea as fast as we could.

We have now learned that the wise way is to go back up where the water falls as rain and work with nature instead of against her; to utilize water at the source and thus treat it as a blessing instead of a curse. Whatever system will retain that water and soil is worth any national effort, however great. Out in the dry country not a gallon of water should be permitted to reach the sea. All should be used on the land. In other areas where it is abundant, it can be channeled and utilized for power, for additional wealth.

After the war our available manpower will eagerly turn from destruction in war to construction in peace; our engineering and technical genius and skills will turn from their prodigious feats throughout the jungles and deserts of the world in making war to the constructive challenge that awaits them here.

It is not for me here to spell out the technical blueprint of how this may be done. We have, fortunately, in this country those who have proven in this war that they are able to carry out any task, however big the job may be. Once made aware of the challenge, the genius of America will meet it without any specific directions from me.

We now know better than any other people have ever known how to conserve our soil resources. Great progress has been made. The Congress, with farsighted vision, has established a Soil Conservation Service and made provisions for carrying out an extended program of preserving our greatest na-

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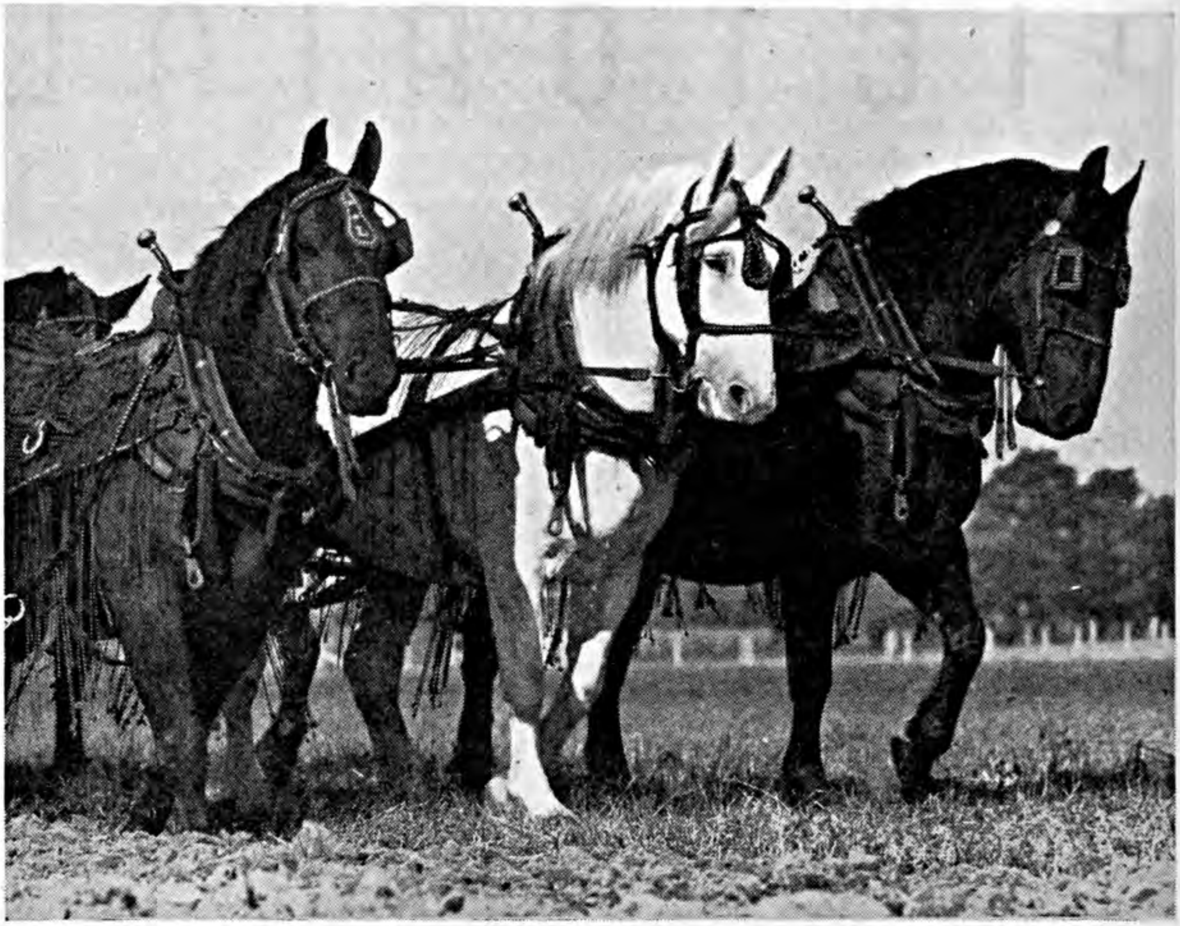
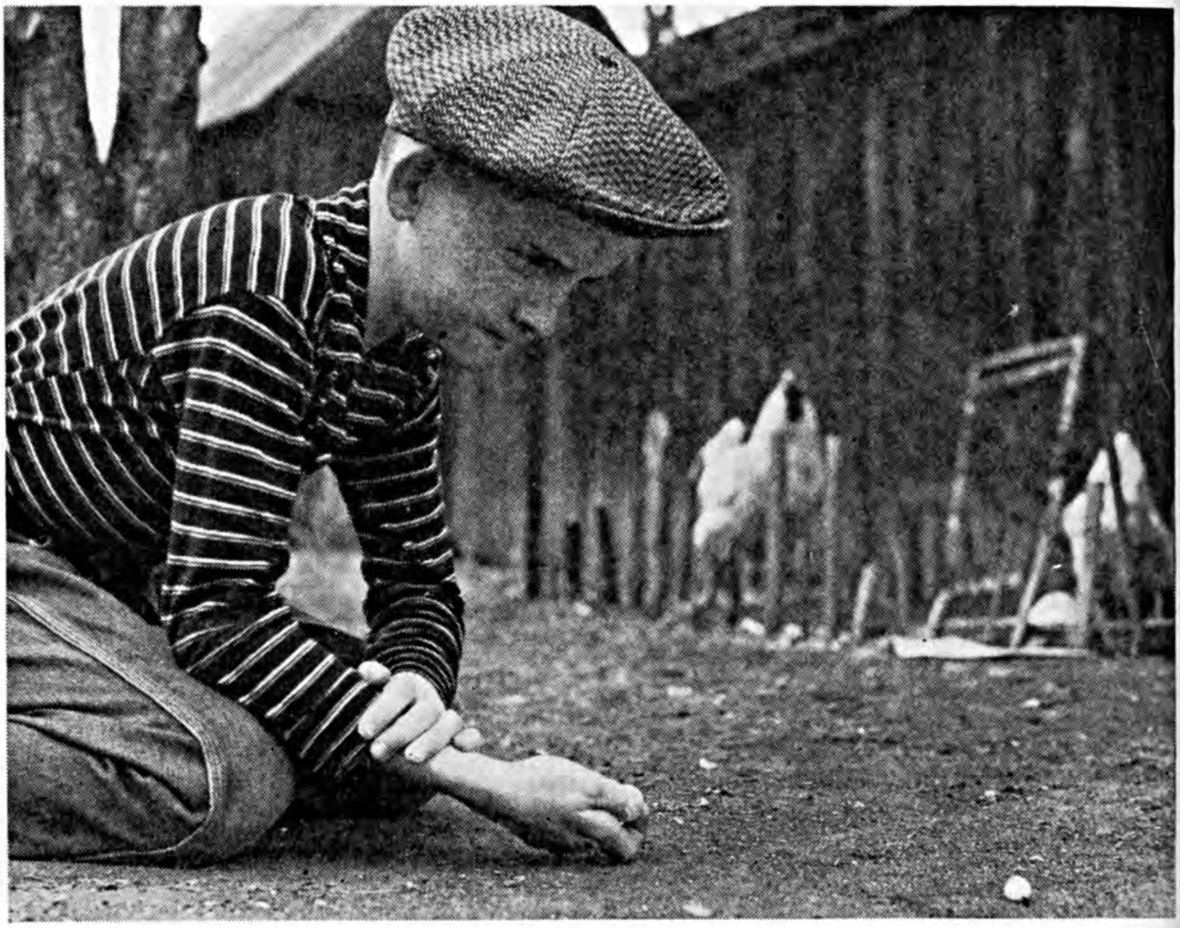
PICTORIAL

PALS!



HORSE POWER

OTHER POWER



GAMES—IN SEASON

The Editors Talk

Agriculture Post-war

Owing to the uncontrollable factors of time and seasonal requirements in the production of agricultural products, plans for agriculture must necessarily be made a considerable time in advance. It is thus necessary, even in the midst of the greatest agricultural war effort in the history of the country, to give consideration to plans for agriculture during the post-war period. A committee of scientific experts of the U. S. Department of Agriculture, calling on the vast resources of the organization they represent, has drawn up an analysis of the probable crop and livestock situation and agricultural conditions that are likely to be found as the end of the war approaches, and has sought to assay how these are likely to fit into post-war requirements. This has been published as a mimeographed pamphlet of the United States Department of Agriculture under the title "Agriculture When the War Ends." This is worthy of serious consideration by all dealing directly with agriculture, and should not be neglected by those dealing with general national problems because of the far-reaching influence of agriculture on the national economy.

When the war ends, it will find the nation's agriculture geared to a maximum effort. Whether this will result in maximum production will be dependent on such factors as weather, the condition of the agricultural plant as a whole, and labor and material supplies. If the war should be prolonged for a period of years, the general agricultural plant may have suffered serious deterioration, although at present it would appear as though the war effort has not made any great inroads. Total food requirements are likely to remain high and even to continue to increase somewhat until after a full year of harvest in the re-conquered European countries. The requirements for 1944 will range up to 150 per cent of 1943 production. If it were not for rationing and similar controls, requirements to meet demand would be even higher. Thus agriculture would appear to have an assured outlet for maximum production for the next two years at least. Increases will be desired in practically all vegetable and food crops. Maximum demands will be made on the oil crops such as soybeans, peanuts, flax-seed and cotton-seed, but continued increases in the production of these crops are being faced with difficult problems of suitable areas and labor and machinery requirements for production. The industrial crops such as cotton and tobacco present additional problems. Increased production of the longer staple cotton is desired, but milling capacities will tend to limit the amount of this crop that can be utilized and thus tend to discourage undue expansion. The demands of the food crops also will compete for land areas. The case of tobacco is even more of a problem. For the most part this crop plays only an indirect role in the war effort. With the exception of a small portion needed for the production of insecticides and similar material, the value of the crop in terms of war effort is limited to morale effects. Consumption is increasing and probably is greater than production. The competition of this crop for land areas is great in some sections, but is not serious in others where soils desirable for tobacco production are too low in fertility to be very suitable for many of the food crops. The crop does make a considerable demand on labor, materials, and equipment.

Livestock production poses many difficult problems. The livestock population at present would appear to be larger than feed production capacities under existing conditions can support for any great length of time. The question as to whether it is more efficient to produce livestock or to put more effort into the direct production of food crops which might be substituted for livestock in the overall picture of human nutrition is continually arising. There are, of course, large areas of land suitable for the production of livestock that could not be well utilized for direct food production.

Our land resources apparently have not been seriously depleted by the war. Owing to the efficient work of the Soil Conservation Service for a number of years prior to the outbreak of the war, the soils of the country were in better condition than they otherwise would have been. In spite of this excellent work, the country is not on a sustaining basis and is continually drawing on the capital or reserve fertility of its soils, although at a much slower rate than would be the case without Soil Conservation measures. If the war is continued for a number of years, this factor may become much more serious than it is at present. The Committee calls attention to the necessity for carefully appraising the adaptations of soils and using them in the most efficient manner possible. Careful farming practices, improved soil management, and the use of fertilizers, liming materials, and other soil amendments are of great value and undeniable necessities from the national viewpoint.

Attention is called by the Committee to the serious situation existing with reference to our forest resources. Insufficient concern appears to be given to maintaining these resources, and the war effort is making inroads into them to the point that the future well-being of the nation may be seriously affected.

The physical plant of agriculture, such as buildings and machinery, is being gradually depleted, although efficiency has not yet been seriously impaired. The greater availability of implements, while not sufficient to meet demand, is helping the situation to some extent. Greatly aiding in the efficiency of agricultural production are new developments in the handling and processing of food, the development of higher-yielding strains and varieties of crops, better control of insects and diseases, improved usage of fertilizer, and better livestock feeding and breeding practices.

The financial condition of agriculture is good and, in general, healthy. Agricultural indebtedness is being reduced at a rapid rate, although a tendency for a rather rapid increase in land values and accelerated change of ownership of land is causing some concern. In the post-war period, sociological as well as economic problems will have to be given careful consideration if agriculture is to be kept on an even keel.

FARMERS and the people of the country need not repeat the experiences of the 1929 crash and the depression that followed. Production is going up and we need to keep it up after the present emergency is over. Our biggest job is to distribute and consume what we are able to produce. In this field we still have much to learn. It would be suicide not to prepare for larger consumption so we can make more effective use of our productive resources. Intelligent planning and positive action now will build a stronger America.—ROY F. HENDRICKSON.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910-14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	146	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	.....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
March	.608	2.00	5.90	.535	.817	26.00	.210	....
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash in bags	Sulphate of potash magnesia	Manure salts	Kainit
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
March	113	55	121	75	86	108	85	....
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
1943								
March	182	163	150	93	57	160	113	79
April	185	165	151	95	57	160	119	79
May	187	167	152	95	57	160	119	79
June	190	168	151	93	57	160	119	69
July	188	169	150	94	57	160	119	74
August	193	169	150	94	57	160	119	74
September	193	169	150	94	57	160	119	74
October	192	170	150	95	57	160	119	78
November	194	171	150	95	57	160	119	78
December	196	173	150	96	57	171	119	78
1944								
January	196	174	150	96	57	171	119	78
February	195	175	151	96	57	171	119	78
March	196	176	151	97	57	173	119	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

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 interesting summary of data obtained by the Ohio Agricultural Experiment Station in various fertilizer experiments is given by R. E. Yoder in Fertilizers in the Farm Production Program, issued as Agronomy Mimeograph No. 91, Ohio Agricultural Experiment Station. The data were presented at a conference on land conservation and reconstruction held at the Ohio State University in January 1944. Investigations on the influence of season on response of corn to hill fertilization indicate that, when the early season is dry, hill fertilization is likely to produce injury to stand and yield if the rate of application exceeds 150 lbs. per acre. When rainfall in the early season is high, hill fertilization is highly profitable. The conclusion is drawn that, for practical purposes, hill fertilization rate is limited to about 150 lbs. per acre because of the possible danger of injury during dry seasons. A limited amount of data indicates that when corn is drilled, about double the rate of fertilizer should be applied as compared to hill-dropped corn.

Experiments on different placements of fertilizer, both at planting time and plowed down prior to planting, show that the broadcasting of phosphate-potash fertilizer is an insufficient method of placement regardless of time and depth of placement. It would appear as if all of the phosphate and potash should be placed in bands either at planting time or on the bottom of the furrow. Placing the fertilizer on the bottom of the furrow or plowing under fertilizer should be considered a supplement to and not a substitution for fertilizer applied near the seed at planting time. Applying the fertilizer on the bottom of the furrow offers an excellent and safe way of increasing the rate of application of fertilizer, although in the particular experiments reported from Ohio there were not great increases in yields from the extra fertilizer application. Relatively greater increases were obtained in some experiments reported from Indiana. The work would indicate that some phosphate and potash should be applied near the seed at planting time so as to favor early growth of the crop.

Yields of corn obtained from various rates of sulphate of ammonia applications ranging from none to 1,200 lbs. per acre show that substantial increases in yield were obtained by applications up to 400 lbs., and some increases by applications up to 800 lbs. per acre. It is brought out that when extra nitrogen is used the land should be liberally supplied with phosphate and potash so as to have a balanced fertility.

Experiments on plowing under sweet clover with lime and superphosphate showed that this program will not maintain soil fertility, with corn yields dropping off markedly and potash starvation in evidence on all the plants on those plots where no potash was added.

Results of outlying experimental fields indicate that fertilizer at the rate of 150 lbs. per acre on corn and 300 lbs. per acre of wheat is highly profitable at all locations. Phosphate-potash was better than phosphate alone, and the use of manure along with fertilizer gave big increases in yields.

Data on soybean fertilization indicate the difficulties that are being experienced in connection with the fertilization of this crop. The Experiment Station recommends that other crops in the rotation with soybeans be fertilized more heavily and residual effects be depended on to take care of the soybean crop until more is learned concerning successful fertilization of soybeans. Data are given on the approximate removal of phosphoric acid and potash in the grain by average yields of soybeans, corn, oats, and wheat. Each bushel of soybeans removes about one pound each of phosphoric acid and potash; corn, one-third of a pound of phosphoric acid and one-quarter pound of potash per bushel; oats, just a trifle less in each case; and wheat, one-half pound of phosphoric acid and one-quarter pound of potash per bushel.

¶ The report for the 1942 fertilizer inspections in Indiana, published as Circular 288, Purdue University Agricultural Experiment Station, entitled "Inspection of Commercial Fertilizers," contains the usual excellent compilation of information on fertilizer usage in Indiana for the year. Effects of wartime conditions can be noted in numerous tables. The high demand for fertilizers induced by high agricultural income and high wartime production goals is reflected by far the largest total tonnage of fertilizer ever sold in the State, well over 400,000 tons. The restrictions in nitrogen supplies caused a marked reduction in tonnage of complete fertilizers and particularly in the very popular 2-12-6 analysis. There was an even greater increase in the use of phosphate-potash mixtures such as 0-12-12, 0-20-20, 0-14-14, and 0-14-7. The calculated total consumption of nitrogen in 1942 was 3,800 tons compared to 6,523 tons the preceding year, a direct reflection of the restricted nitrogen situation in 1942. Available phosphoric acid consumption increased from 44,246 tons to 59,191 tons with corresponding increases in other forms of phosphoric acid. Potash increased from 30,575 tons in 1941 to 44,536 tons in 1942. The customary data on individual inspections also are included.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended December 31, 1943," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-75, Feb. 14, 1944.

"Analytical Tolerances for Commercial Fertilizers," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-76, Feb. 18, 1944.

"Analyses of Official Samples of Gypsum Drawn Between January 1 and February 26, 1944," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-79, March 3, 1944.

"Approximate Tonnage of Plant Food Sold in California Annually from 1937 to 1943," Bu. of Chemistry, Dept. of Agr., Sacramento, Calif., No. FM-80, March 8, 1944.

"Plant Nutrient Survey of Sugar Beets for 1943," Div. of Plant Nutrition, Univ. of Calif., Berkeley, Calif., Albert Ulrich.

"Poultry Manure," Agr. Ext. Serv., Univ. of Hawaii, Hawaii, Agr. Ext. Cir. 162, Oct. 1943.

"Preliminary Report on the Sales of Fertilizers in Canada During the Year Ended June 30, 1943," Dept. of Trade & Commerce, Dominion Bu. of Statistics, Ottawa, Can.

"Spend Money for Fertilizer Rather Than for Soil Testing," Univ. of Ill., College of Agr., Urbana, Ill., H342 (1944), Lee A. Somers.

"Restrictions and Suggestions for Wartime Fertilizer Practices," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG1197, Feb. 1944, A. L. Lang.

"Report of Analysis of Commercial Fertilizers," La. Dept. of Agr. & Immigration, Baton Rouge, La., 1942-1943.

"Commercial Feeds, Fertilizers, and Agricultural Liming Materials," Univ. of Md., College Park, Md., No. 187, Aug. 1943.

"Maryland Fertilizer Facts for 1943," Inspection & Regulatory Serv., Univ. of Md., College Park, Md., March 10, 1944.

"Fertilizer Analyses and Registrations," Div. of Feed & Fert. Control, St. Paul, Minn., Feb. 1944, H. A. Halvorson.

"Fertilizer Recommendations for Spring and Summer Crops, 1944," Univ. of Missouri, Columbia, Mo., E. Cir. 504, Jan. 1944, A. W. Klemme and O. T. Coleman.

"Fertilizer for Fish Ponds," U.S.D.A. Lincoln, Nebraska, Sept. 1943.

"Fertilizer Recommendations for 1944 Preliminary," Agron. Dept., Univ. of New Hampshire, Durham, N. H., Sept. 10, 1943.

"Survey of Sales of Agricultural Liming, 1943," Agr. Exp. Sta., New Brunswick, N. J., Feb. 21, 1944.

"Survey of Sales of Fertilizers, 1943," Agr. Exp. Sta., New Brunswick, N. J., March 9, 1944.

"Fertilize Victory Wise in 1944," Cornell Univ., Ithaca, N. Y., Bul. 497, War Emergency Bul. 16, Rev. Jan. 1944, E. L. Worthen.

"Fertilizing Potatoes in 1944," Cornell Univ., Ithaca, N. Y., Bul. 551, War Emergency Bul 58, Rev. Jan. 1944, Ora Smith.

"Fertilizing Vegetables in 1944," Cornell Univ., Ithaca, N. Y., Bul. 557, War Emergency Bul 61, Rev. Jan. 1944, G. J. Raleigh and R. D. Sweet.

"Analyses of Commercial Fertilizers," N. C. Dept. of Agr., Raleigh, N. C.

"Fertilizing Vegetable Crops in Pennsylvania," Ext. Serv., Pa. State College, State College, Pa., April 1, 1943.

"Fertilizing Farm Crops in 1944," Pa. State College, State College, Pa., C. F. Noll and J. B. R. Dickey.

"Fertilizers for Garden Vegetables," Agr. Ext. Ser., Univ. of Tenn., Nashville, Tenn., Leaflet No. 66, Feb. 1944, W. C. Pelton.

"Report of Inspection Work Commercial Fertilizers and Limes," Dept. of Agr., Charleston, W. Va., Bul.(n.s.)36, July 31, 1943.

"Tobacco Fertilizer Experiments in Vernon County," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Research Bul. 148, Nov. 1943, James Johnson and W. B. Ogden.

Crops

¶ The Victory garden campaign has brought forth publications which are not only timely but have a permanent value in any grower's library. One of these publications is "Growing Vegetables in Town and City" by Victor R. Boswell and Robert E. Webster, U. S. Department of Agriculture Miscellaneous Publication 538. This large size, 40-page publication contains a wealth of practical information on growing vegetables in small gardens. Selection of the area, care of tools (a subject usually overlooked in such publications), preparation of the soil, the use of lime, manure, and fertilizer, selecting crops, planting seed, and culture during the season are covered, in general, for all crops. The latter part of the publication is devoted to specific information on 50 different garden crops. Excellent illustrations show how to turn under organic matter, apply fertilizer, plant seed, and transplant, while a suggested lay-out for a garden and hints on what to do are also given.

"Onion Production in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 357, Sept. 1943, Glen N. Davis.

"Establishing the Young Orchard," Ont. Dept. of Agr., Statistics and Publ. Branch, Toronto, Ont., Bul. 433, March 1943, W. H. Upshall.

"Grape Growing in Colorado," Agr. Exp. Sta., Colo. State College, Fort Collins, Colo., Bul. 484, Feb. 1944, George Beach and L. R. Bryant.

"Citrus Propagation," Agr. Ext. Serv., Gainesville, Fla., Bul. 96 (Rev. Oct. 1943), May 1938, A. F. Camp.

"Producing Quantity and Quality Flue-Cured Tobacco in Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 73, Dec. 1943, J. Lee Smith.

"Producing Peanuts in Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 75, Jan. 1944, J. Lee Smith.

"Growing Corn in Florida Under War-Time Conditions," Agr. Ext. Serv., Gainesville, Fla., Cir. 76, Feb. 1944, J. Lee Smith.

"Systematic Single Cross Yield Trials," Dept. of Agron., Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., AG-1124, March 1943, C. M. Woodworth and Oren Bolin.

"1942 Experimental Hybrid Corn Trials in Illinois," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG-1128, March 1943.

"Prairie—A New Variety of Soft Red Winter Wheat for Illinois," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG-1155, June 1, 1943, O. T. Bonnett.

"Viking Soybeans," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG-1163, July 1943, C. M. Woodworth.

"Choosing Corn Hybrids for Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 492, Oct. 1943, S. R. Miles.

"Helps for the Home Garden," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., E. Bul. 238 (3rd Rev.), Jan. 1944, W. B. Ward.

"Alfalfa-Bromegrass Makes Good Pasture," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 290, Jan. 1944, J. H. Hilton, J. W. Wilbur, and G. O. Mott.

"Barley Production in Kansas," Agr. Exp. Sta., Kansas State Col., Manhattan, Kan., Bul. 318, Oct. 1943, A. F. Swanson and H. H. Laude.

"A Preliminary Report of Certain Variety, Fertilizer, and other Tests Conducted by the Crops and Soils Department of the Louisiana Experiment Station—1943," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., W. G. Taggart.

"Maine Garden Guide," Agr. Ext. Serv., Univ. of Me., Orono, Me., Cir. 190, Feb. 1944.

"Propagation of the High-Bush Blueberry by Softwood Cuttings," Agr. Exp. Sta., Mass. State Col., Amherst, Mass., Bul. 410, Nov. 1943, W. L. Doran and J. S. Bailey.

"Growing Red Raspberries for Market," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 199, (Rev.) June 1943, W. G. Brierley and J. D. Winter.

"Well-Managed Pastures," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 241, Jan.

1944, Ralph F. Crim and Paul M. Burson.

"Cotton Varieties in the Hill Section of Mississippi," Agr. Exp. Sta., Miss. State Col., State Col., Miss., Bul. 396, Jan. 1944, J. Fred O'Kelly.

"Cotton Variety Tests in the Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State Col., State College, Miss., Bul. 398, Feb. 1944, J. Winston Neely and Sidney G. Brain.

"Improve Permanent Pastures with Lespedeza, Phosphate, Lime, and Supplementary Grazing," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 285, Feb. 1944, E. Marion Brown.

"Sweetclover in Nebraska," Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb., Bul. 352, Dec. 1943, S. Garver, J. M. Slatensek, and T. A. Kiesselbach.

"Plowshares and Swords," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., 64th A. R., 1943.

"How to Recognize Some Common Alfalfa Troubles," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 616, June 1943, W. E. Colwell.

"Small Fruits for Home Use," N. C. State Col. of A. & E., Univ. of N. C., Raleigh, N. C., War Series Bul. 30, Jan. 1944.

"Official Variety Tests in North Carolina Corn Hybrids," Agr. Exp. Sta., N. C. State Col. of A. & E., Raleigh, N. C., Agron. Inf. Cir. 134, Jan. 1944, R. P. Moore and L. S. Bennett.

"Ohio Forest Plantings," Agr. Exp. Sta., Univ. of Ohio, Wooster, Ohio, Bul. 647, Jan. 1944, Robert R. Paton, Edmund Secrest, and Harold A. Ezri.

"Grow Small Fruits for Home Use," Ext. Serv., Pa. State College, State College, Pa., March 1, 1944, J. L. Mecartney.

"The Cotton Contest—1943, For Better Yield and Staple Value," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 253, Jan. 1944.

"Garden for Victory," Agr. Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Publ. 272, (Rep.), Feb. 1944.

"Available Publications of Vt. Agr. Ext. Serv. and Vt. Agr. Exp. Sta.," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Brieflet 688, Dec. 1943.

"Neighborhood Leader's Digest," Ext. Serv., Va. A. & M. College, Blacksburg, Va., March 15, 1944.

"Winter Wheat for the 1944 Crop," Agr. Exp. Sta., State Col. of Wash., Pullman, Wash., Pop. Bul. 173, Sept. 1943, E. G. Schafer, O. A. Vogel, and S. P. Swenson.

"Fifty-third Annual Report," Agr. Exp. Sta., State Col. of Wash., Pullman, Wash., Bul. 435, Dec. 1943.

"Vicland Oats," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 462, Feb. 1944, H. L. Shands and B. D. Leith.

"The Midland and Fairpeake Strawberries," U.S.D.A., Washington, D. C., Cir. 694, Jan. 1944, George M. Darrow.

"Report of the Chief of the Office of Experiment Stations, Agricultural Research Administration, 1943," U.S.D.A., Washington, D. C., September 15, 1943.

Soils

¶ An excellent publication on orchards has been prepared by E. F. Palmer and J. R. Van Haarlem of the Vineland, Ontario, Horticultural Experiment Station, entitled "Orchard Soil Management," and issued as Bulletin 437 of the Ontario Department of Agriculture. After pointing out the fundamental importance of soil fertility in orchards, a brief description of soils is given. Several sections are devoted to the important subject of organic matter in the soil, including cover crops and their growth, and the use of manure and other organic supplements. The section on plant nutrients emphasizes that balance of nutrients is very important. The primary need for nitrogen in trees and fruit trees is discussed with the warning that this nitrogen must be properly balanced with phosphorus, potassium, lime and, at times, trace elements such as magnesium, boron, manganese, zinc, iron, and copper.

The soil requirements of the various fruit trees are mentioned and systems of handling orchard soil, especially from the viewpoint of clean cultivation and cover crops, are rather fully covered. The authors are very favorably inclined toward sod culture, but warn that this needs intelligent handling, not neglect. The value and importance of mulches for increasing availability of nutrients, conserving moisture, and improving the yield are brought out. The desirability of soil testing to determine fertilizer needs and deep placement of fertilizer are discussed, and the bulletin ends with a brief description of nitrogen, phosphorus, and potassium-deficiency symptoms on fruit trees.

The authors have supplemented their own wide experience and careful investigation with quotations from numerous other sources. The subject matter is well covered without going into great detail. The publication therefore can well serve as a guide for orchardists in the management of their soils.

"Orchard Soil Management," Hort. Exp. Sta., Vineland Station, Ontario, Bul. 437, Jan. 1944, E. F. Palmer and J. R. Van Haarlem.

"Put Conservation Farming Behind War Food Production," Agr. Ext. Serv., Univ. of Florida, Gainesville, Fla., Ext. Cir. 74, Jan. 1944, K. S. McMullen.

"Soils of High-Rainfall Areas in the Hawaiian Islands," Hawaii Agr. Exp. Sta., T. Bul. No. 1, Sept. 1943, A. S. Ayres.

"Effect of Contour Farming on Soil and Surface Water Losses and on Plant Nutrient Losses from Tile Drains and from Erosion Type Lysimeters," Agron. Dept., Agr. Exp. Sta., Urbana, Ill., AG1158, June 1943, R. S. Stauffer, C. A. Van Doren.

"Effect of Crop Residues on Runoff and Erosion," Agron. Dept., Agr. Exp. Sta., Urbana, Ill., Ext. AG-1159, June 1943, C. A. Van Doren, R. S. Stauffer.

"Better Crops by Erosion Control," Agr. Ext. Serv., Rutgers Univ., N. J., Lindley G. Cook.

"The Influence of Cropping on the Nitrogen, Phosphorus, and Organic Matter of the Soil Under Irrigation Farming," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Sta. Bul. 310, Sept. 1943, J. E. Greaves and C. T. Hirst.

"Water-Application Efficiencies in Irrigation," Agr. Exp. Sta., Agr. College, Logan, Utah, Bul. 311, March 1944, Orson W. Israelsen, Wayne D. Criddle, Dean K. Fuhriman, and Vaughn E. Hansen.

"Practical Irrigation," U.S.D.A., Washington, D. C., FB1922, Jan. 1944, M. R. Lewis.

"Sagebrush Burning—Good and Bad," U.S. D.A., Washington, D. C., Farmers Bul. 1948, Jan. 1944, Joseph F. Pechanec and George Stewart.

"Protect Terrace Outlets with Grass for Food Production," U.S.D.A., Washington, D. C., AWI-79, November 1943.

Economics

¶ A survey of practices by the lima bean growers in Delaware conducted by the Delaware Agricultural Extension Service furnishes information of use and value to the growers of this crop. This survey is reported by E. P. Brasher in Delaware Mimeo. Circular 31 entitled "Lima Bean Cost and Management Study." Twenty-six growers in the State in 1943 furnished the data for this survey. The unfavorable season for this crop is reflected in the fact that the records show only three grew the crop at a profit. Yields were the lowest on record, varying from 276 to 1,279 lbs. per acre, with an average of 642 lbs. Those who harvested their beans when they graded more than 88 per cent green beans, usually realized a greater income from the crop. Investment in manure, fertilizer, and other improved cultural practices usually resulted in increased yields and income per acre. Placing the fertilizer in bands, practiced by 10 of the cooperators, resulted in an average yield of 721 lbs. per acre, while 16 operators who broadcast their fertilizer had a yield of only 593 lbs. Most of the cooperators used manure with the resulting benefit in yield. The 21 cooperators who used manure had an average yield of 670 lbs., while the 5 who did not use manure had a yield of 522 lbs. The most popular fertilizer analysis was 4-8-12, with the rate of application usually around 500 lbs. per acre. Over half of the cooperators used lime of some form.

While these results for only one year are not very encouraging, they do show that improved practices are likely to be worth while even in unfavorable years.

¶ A good way to obtain information on how to improve the farm business is to study the results obtained by various farmers, so as to see which systems are likely to produce greater profits. This has been done by K. T. Wright of the Michigan Agricultural Experiment Station, who reported his results in Special Bulletin 324 of the Station, entitled "Dollars and Sense in Farming." A survey in lower central Michigan was conducted during the period 1933 to 1938. This section of the State is devoted largely to dairying and general farming. The kind of soil on the farm had a big influence on the return from farming operations, the labor income of farms on the best soil being nearly double that on the farms located on third-class soil. The larger farms, those over 200 acres, had a larger labor income than the smaller farms, but regardless of size, the more intensively farmed enterprises had a greater income than those less intensively operated. Growing cash crops increased labor income while the farms which tended to have higher acreages in hay and pasture had a lower income. Those farms which grew more legumes had a higher income and, as was to be expected, the farms which had high yields per acre had higher income. Livestock provided a large part of the income, and those farms which had more livestock, therefore, had a larger income.

Labor efficiency was very important in determining income from the farm, the efficiency being more important on large farms than on smaller farms. A high machinery investment was profitable provided the size of the farm was such as to permit full utilization of the machinery. Good buildings when properly utilized improved farm income, although in and of themselves, they were of no particular value. Expenditures for fertilizer, good seed, and proper feed were usually very profitable. Owners usually had a higher labor income than renters. In a period of falling prices, such as occurred during the depression, the farms in all cases were not profitable and here the larger farms suffered the greatest losses, although the more efficiently operated had smaller losses than the less efficiently operated. The findings of this Bulletin are very significant, not only to Michigan farmers, but to those in other sections of the country in determining types of enterprises and management systems to be followed.

"Planning for Delaware Agriculture," Agr. Ext. Serv., Univ. of Delaware, Newark, Dela., Mimeo. Cir. 30, Jan. 1944.

"Lima Bean Cost and Management Study, Delaware—1943," Agr. Ext. Serv., Univ. of Dela., Newark, Dela., Mimeo. Cir. 31, Feb. 1944, E. P. Brasher.

"Estimated 1943 Production of 12 Crops Hawaii, Maui, and Oahu," Agr. Ext. Serv., Univ. of Hawaii, A. E. Cir. 167, March 1, 1944.

"Profitable Farm Organization in Northwestern Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 491, Feb. 1944, Lynn Robertson.

"The Outlook for Indiana Agriculture 1944," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., E. Bul. 302, Dec. 1943.

The Potash Problem in Illinois

(*From page* 16)

order of this value is also the order of the total profit per acre from fertilizer use. The complete treatment gives the most profit ($26.88) but requires the highest initial investment ($14.22). On the other hand, where only one-half the full requirements for both phosphorus and potassium are added, the gross value of the increases ($27.40) is next in order of profit, although the initial investment per acre is only one-half as much ($7.11).

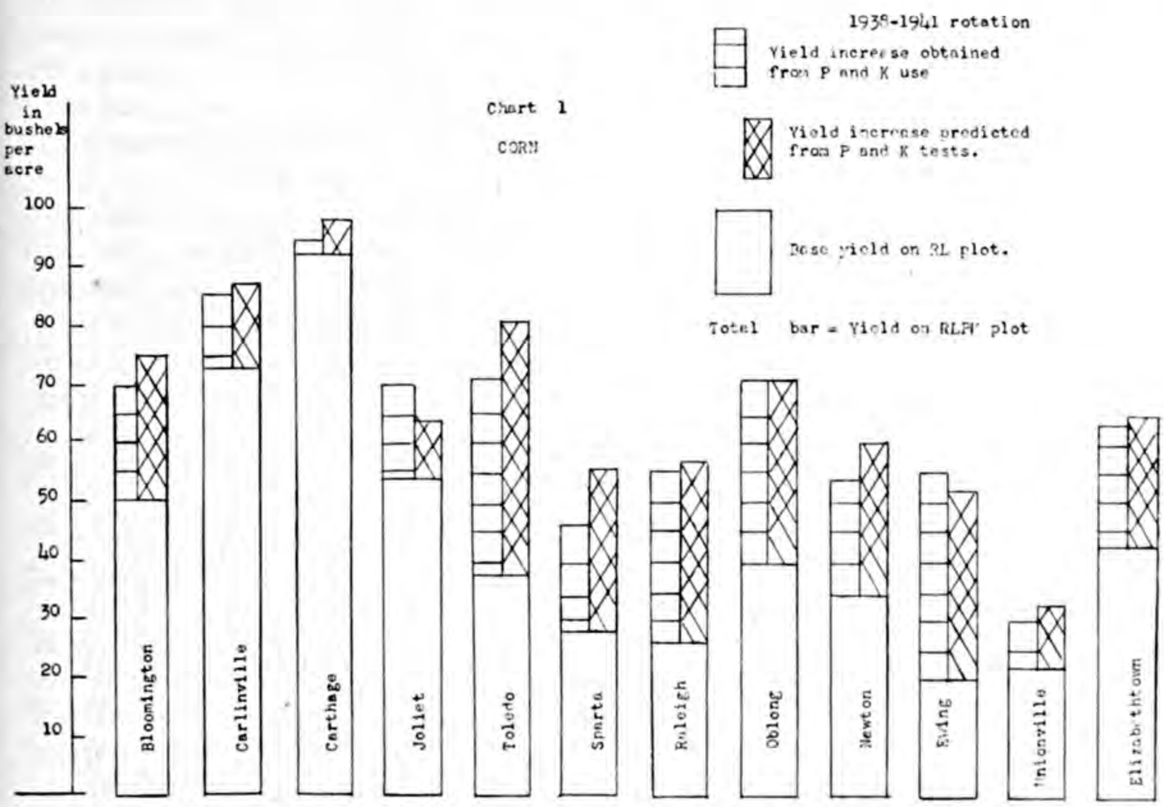
Using the full requirement for either phosphorus alone or potassium alone gives lower returns. As is well known, where two deficient nutrients are added there is a bonus for their use together. This bonus is readily calculated with the new method of soil test interpretation presented in this paper.

Now, how accurately can test predictions be calculated? Could we, by testing a soil in 1935, have predicted what the increases would be for phosphorus or potassium or for both used together for the rotation of 1938 to 1941? The proof of the pudding lies in the eating.

Chart 1 shows just such a prediction for some of the experiment fields. The tests of soil samples taken in 1935 were used as a basis for calculating what the combined increase for both phosphorus and potassium use should be, during the 1938-1941 rotation. The lower part of the bar shows the yield on the RL plot where residues, legumes, and limestone had been used. The left-hand side of the upper bar shows the increase in yield actually obtained, while the right-hand side shows the yield as calculated from the soil tests made on 1935 samples and the yield obtained on the RL plots.

A demonstration in southern Illinois, showing the need for potash fertilizers. The phosphate plot (0-20-0) yielded 33 bushels per acre; the no-fertilizer plot 22 bushels, and the phosphate and potash plot (0-8-24) yielded 55 bushels. The fertilizer was applied at the rate of 125 pounds per acre.

The agreement between the increase obtained for phosphorus and potassium use and the increase as calculated from the soil test data are certainly sufficiently good to warrant recommending this method as a practical method of soil nutrient diagnosis. For both phosphorus and potassium, it tells how deficient the soil is or the percentage deficiency; it gives the approximate fertilizer requirement; it calculates the approximate increases in yields which will be obtained in cases where past yield records are available or can be estimated; and it permits an economic interpretation of the relative use of



phosphorus or potassium or both as used at adequate or less than adequate rates.

This means that we are in reality making a synthetic experiment field especially for each farmer. The results from this synthetic field apply more closely to each farmer's soil than do any actual experiment field results because they are for a soil testing exactly the same as the farm soil tests. The accuracy of this so-called synthetic field data is only limited by the accuracy of the experiment field data themselves and the chemical test values. That they both are highly accurate is one conclusion which may be drawn from Chart 1. Without accurate work on the experiment fields and accurate work in the laboratory, such a correlation as shown on Chart 1 would have been impossible. It demonstrates the value of scientific research in the solution of practical problems.

In conclusion, we can say that farmers who are doing a good job of farming as far as rotations and other factors in soil management are concerned can find in the soil tests a ready solution to their phosphorus and potash problems.

Record Supplies of Fertilizer Materials Indicated for 1944-45

(*From page* 18)

mately 175,000 tons of this new production will be in the form of triple superphosphate. In addition, projects have been approved for the expansion of sulphuric acid facilities by acidulators having excess capacity for superphosphate production. These projects should result in increased annual production of approximately 200,000 tons of superphosphate.

While the annual rate of production probably will not reach 8,000,000 tons by July 1, 1944, that rate will be reached or exceeded when all of the authorized new facilities reach production. Taking all factors into consideration, production in 1944-45 under the most favorable conditions that could be obtained in wartime will amount to approximately 8,000,000 tons, basis 18% P_2O_5. In addition, existing facilities for production of triple superphosphate are expected to produce at least 350,000 tons basis 45% P_2O_5. Imports of ammophos from Canada in 1944-45 are expected to provide approximately 37,000 tons of P_2O_5, equivalent to 205,555 tons of normal superphosphate.

Nitrogen

The outlook today indicates that nitrogen supplies for agriculture in 1944-45 will be approximately six per cent larger than in 1943-44. Although allocations for the current fertilizer year have not been completed beyond April, it is estimated that the total will approach 675,000 tons of nitrogen, as compared with an estimated supply of approximately 716,000 tons in 1944-45.

It should be emphasized that estimates for both the current year and 1944-45 are based upon certain assumptions which may be subject to considerable error. In the first place, it is assumed that shipping space will be made available for bringing in a total of 650,000 tons of Chilean nitrate of soda by the end of June and that the same quantity will be imported in the next fertilizer year. In order to realize that tonnage in the current year, a considerable quantity must arrive in April, May, and June. Another assumption is that the supplies of nitrogen solutions will be the same next year as in the current year. Actually the amount of these materials will depend largely upon the ability of the fertilizer industry to utilize it. Larger quantities could have been delivered this season if fertilizer manufacturers could have utilized them. The estimates for ammonium phosphate are rather tentative and subject to change from time to time, largely because of shipping difficulties at the Canadian plants. A further assumption affecting several nitrogen materials is that the military rate of consumption in 1944-45 will continue at the rate estimated by military authorities for June 1944. These authorities will not estimate their requirements beyond June.

Based on such assumptions, supplies of ammonium sulphate, nitrogen solutions, Uramon, synthetic nitrate of soda, Chilean nitrate of soda, and Cyanamid are expected to remain at practically the same level as in the current season. Cal-Nitro will probably be increased by approximately 1,000 tons of nitrogen and the supply of by-product nitrate of soda is expected to reach approximately 6,700 tons of N in 1944-45. The outlook is for considerably more ammonium phosphate provided the shipping difficulties can be overcome. The tentative estimate is that the supply of 11-48 ammophos will reach 4,290 tons of nitrogen in 1944-45 as compared with 1,925 tons in the current year, with 16-20 increasing from 10,245 tons of nitrogen to approximately 14,750 tons. In organic nitrogen a 50 per cent increase is expected over the 20,000 tons of N estimated for 1943-44. The larger part of the total increase in nitrogen supply is expected in the form of ammonium nitrate, with an increase from 91,000 tons of N to approximately 144,000 tons.

In summarizing it may be said that according to present indications domestic agriculture (including Hawaii and Puerto Rico) will have available for 1944-45 approximately the following: 700,000 tons of K_2O from primary potash salts; 1,538,000 tons of P_2O_5 from superphosphate, triple-superphosphate, and ammonium phosphate; and 716,000 tons of nitrogen. As compared with 1943-44, these quantities represent an increase of approximately 16 per cent in K_2O, 17 per cent in P_2O_5, and 6 per cent in nitrogen. For the three combined, the anticipated supplies for 1944-45 are equivalent to approximately 2,955,000 tons as compared to approximately 2,597,000 tons in 1943-44, an increase of approximately 13 per cent. It should be emphasized that the above estimates do not assume any plant expansions beyond those already approved. Furthermore, it is assumed that no potash exports will be required by the United Kingdom and that total exports of this material to other countries will be no greater than the quantities already approved.

A New Approach to Extension Work

(*From page* 24)

workers are now strong voices armed with scientific facts entering vitally into the way of life and the standard of living of all the people of their respective counties. In conjunction with these are the state extension workers and the cooperating personnels. Together they make an alert and powerful team working in unison on a big job for and with a worthy people.

Results reveal that what we have done has been sound and effective. In Alabama, for example, cotton production has climbed from an average of 180 pounds per acre in pre-extension days to 283 in recent years, an increase of 57 per cent. This is remarkable in view of the fact that the pioneer county agents began work with a feeling that cotton production was doomed.

Through the spread of scientific information from our Experiment Station by the Extension Service to the farmers and their use of it, Alabama agriculture is being remade and improved in every way. If this had not been done in every state, our country would not now be in a position to fight a world war in the remarkably successful way to date and with the genuine hope of victory, perhaps in Europe in 1944.

Without the improvements, already made in farming, our food production would not be adequate for ourselves. Instead of a shortage we are now supplying ourselves and contributing large quantities to our friends and cofighters abroad. This change was not accidental. It is a result of intelligent work well done.

Unawarely, perhaps, but fortunately, American farmers have been leaders in preparing for war—the front-line people in preparedness by their acceptance and use of the continuous flow of scientific information. This has enabled fewer people on farms to feed and clothe more—to make our great country sounder at the taproot, which is agriculture.

An example of this is the fact that grain feed now required to supply our total needs of meat, milk, wool, and eggs is about half what it was before extension work began, preceded by research work. This fact is especially significant at present when our livestock and poultry industry is limited by grain feeds available; and these products are major factors in the battlelines of the world. There would be no adequate livestock industry in this country if research had not learned how to control hog cholera, Texas fever in cattle, Bang's disease, bovine tuberculosis, anthrax, blackleg, other diseases, and both internal and external parasites.

All across the board farm production has improved and increased in response to needs. In 1942 our food production hit an all-time high, to be exceeded in 1943 even with unfavorable weather in many states. The 1942 food production score was 42 per cent above the war-year of 1918. Yet our farm population in 1942 was only 21 per cent of the total against 30.5 per cent in 1918. From 1890 to 1910, before extension work was organized, the increase in food production per farm was equal to only 0.7 person; from 1920 to 1940 the increase was 5.1 persons. This is one reason why the American people now eat more and better food than at any time in the past, except for a few deficiencies due to war. In 1942, eight per cent more than during any previous year was eaten by the average civilian.

This farm progress has been focused upon the farm home, for which and around which every sound rural program must function. Unless family life is improved and the farm home is a success, extension work is for naught. Our work must reflect in the food they eat, the clothes they wear, the buildings in which they live, the ideals they acquire, the deeds they do. These achievements have been in production and are remarkable, but they are by no means all that we now hope to and must accomplish. An honest confession is that most of the job is yet to be done.

What Is Farming?

In its essence farming is land use. As land use improves, farming improves. A farmer succeeds in production in proportion to his efficiency in the use of land, which includes practical conservation. If land is not properly conserved by a farmer, he is not using it wisely and is, therefore, on the way to grief, if not already there. Efficient use of land requires efficient use of labor, equipment, capital, and livestock. Efficient use is another way of saying intelligent work, of which much more is in order.

In traveling recently over Alabama I have observed much idle land. Along with it I have observed winter idle-

Shocks of oats on the experimental farm at the Alabama Experiment Station, Auburn.

ness of labor, of livestock, of equipment, and of money invested in the land, the improvements, machinery, and other things. It is like unto an idle manufacturing plant—men, machines, and building not working, not producing, deteriorating.

Best procedure in production is efficient work all the year by all the people, all the land, and all the equipment, because work creates wealth. When land is growing legumes or small grain during winter, for example, it is working. If nothing is growing on it, idleness prevails and losses occur. Livestock that are gathering their feed by grazing are doing work that otherwise man would be required to do. Implements standing idle either in a shed or in the open are not producing.

The above is introductory to our production program now being launched in conjunction with an improved educational service on our part in the field of marketing farm products. For many years we have observed increases in the cost of distribution of farm products in relation to the cost of production—a change in the wrong direction. If we divide all of the cost of consumer goods into production and distribution, we find that distribution has grown bigger and bigger in relation to production. This means increased cost to consumers with no corresponding returns to producers. Both producer and consumer are penalized.

This handicaps farmers in two ways. First, it brings severe criticism by consumers who are not informed as to the actual facts. They attribute their higher prices to farmers. Second, it restricts the consumption of farm products; and it also increases prices which farmers must pay when they buy.

These developments have created a need for intelligent information on marketing and distribution, similar to our information on production. Unless the Extension Service meets the marketing challenge, the time will come when another agency will be created to meet it. I am certain that this would be a mistake.

Our combination service of production and marketing must be based upon the land itself, as is true of all agriculture. It becomes obvious, therefore, that the production program for any farm, or any soil division of the State, should give first consideration to the production qualities of the soil itself.

Dean M. J. Funchess and his associates in agricultural research recognized this when they established experiment stations on major soil divisions of Alabama. These stations have accumulated and promulgated much information for better production of crops and livestock on these different soils, or areas.

It now becomes our duty to adjust our extension program by areas, in cooperation with farmers themselves, for the best possible use of information already available and for other information as it becomes available. Such procedure makes an inseparable link of research and extension, which are one in service to the people of the State, especially the farm people.

The newness of this program is more a departure and expansion, an enlargement, an unfolding. At the outset extension work dealt with little jobs and individuals. Now it must deal with the entire farm operation from the beginning of production to the consumer of the product and with the total rural economy. It approaches the farm and the family as a unit, then the neighborhood, the community, the county, the State. Individual action must result in collective action by all who are concerned.

We realize that every community problem is a national problem and that there is no national problem the essence of which isn't found in every community. We realize also that farming is not a one-cylinder job but an eight- or twelve-cylinder job. Since we are concerned with the total welfare of farm people, our extension program in Alabama is being streamlined and unfolded accordingly.

Our Greatest National Asset

(*From page* 26)

tional source of wealth. Millions of acres have been scientifically protected and are now producing an average of 20 per cent more than they did before.

But I am told that about 90 per cent of the conservation job lies ahead.

Just what is there to be done? How many men and how many years will it take to do it? What will it cost? Fortunately these questions have been anticipated and studied by the Soil Conservation Service. A nation-wide survey has already been completed showing how much land needs treatment and where.

Here is some of the work that should be done. We need to build six million miles of terraces across sloping land on 95 million acres, to control water and protect the soil.

We need to drain about 30 million acres of some of our richest land, which is too wet for full production.

We need to build thousands of stock ponds for better livestock production, particularly in the West.

We need to improve our farm irrigation and water use on 12 million acres in our drier regions.

We need to plant soil-building and erosion-resistant crops on thousands of mutilated fields.

There is other soil conservation work to be done by the farmers themselves and their neighbors. For example, 120 million acres of our farm land needs to be plowed on the contour. There is a need for stripcropping on 90 million acres and for improvements of about 110 million acres of pasture. There are 40 million acres of unfavorable land now in cultivation that should be planted to grass, legumes, and trees as quickly as possible.

Fortunately farmers have become so conscious in recent years of the importance of soil conservation to their prosperity and security that they have already developed much of the machinery necessary to carry out this work. Seven years ago farmers organized their first soil conservation district. This enabled the farmers in that district to work together in a common effort to safeguard the land in that district. It worked so well that today there are nearly 1,000 of these soil conservation districts. These include about 2½ million farms and ranches that cover more than 500 million acres. In other words, the people themselves on the land are already actively on the job, so that what I have suggested is no new scheme.

With victory in war, we can look forward to an era of peace. We can, if we will, look forward as confidently to ultimate success in our efforts to prevent the loss of our natural resources. What will that success bring?

Effective Conservation

Let us use our great Mississippi Valley as an example of what we might expect in our other great watersheds on both coasts. I believe it is not too much to visualize a system of effective control over our soil and water resources.

This would include using the rainfall on the plains and hillsides where it falls, instead of letting it run off in waste.

It would include the many additional soil conservation districts that will then be joined in this common effort.

It would include an automatic form of natural crop insurance against drought; water stored in the soil during wet seasons would be available for crops in dry seasons.

It would include large dams on the rivers and thousands of small dams on tributary streams and in pastures and fields, to give us flood control.

It would include electric power generated at the dams and flowing out over the productive countryside to the millions of farm homes that need it.

It would include protecting these dams against destructive silt, to insure our hydroelectric power—increasingly important in the years ahead as we view our diminishing supplies of coal and oil reserves.

It would also include a decentralized industrial development so that the raw materials would be close to the heart of the business community.

It would include a suitable network of highways and railroads and airlines as a natural part in this development.

It would include millions of farm homes made more secure against the future.

It would mean our ability to survive, for regardless of what we do, what plans we make, or what genius we may possess, our nation must perish unless we take care of the soil.

The soil of our country is our heritage. If wisely used its value, its strength, and its productivity are ageless. In peace or in war no nation can afford to waste its substance. The children of the future have a stake in this—our greatest source of national security.

Borax Sprayed on Beets Controls Black Spot

(*From page* 21)

eased plants to 6 per cent or less. The single treatment on August 7 had no measurable effect. Unfortunately a single treatment on July 8 was not made. It is evident, however, the early treatment was the more effective one of the two. In field 2 where the percentage of diseased plants was much lower in the untreated plots the single spray of 20 lbs. per acre on July 8 was highly effective, reducing severely affected plants to less than 0.4 per cent.

It is not possible to determine from these experiments whether a mid-season spray could be used to replace entirely soil treatments before sowing. They do demonstrate, however, that a heavy spring application is not a guarantee against severe losses from black spot. They also show that a supplementary mid-season spray, applied at the proper time, did reduce black spot to a negligible figure. With a crop like canning beets, where the presence of a relatively small amount of black spot may result in rejection of the entire crop, it is the more important to have a control measure which can be relied upon to bring the product through in good condition for processing. It is hoped that further study of this method can be carried out next season.

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The Importance of Potash in Maintaining Food Production in North Carolina

(*From page 7*)

of locations reported does not give complete assurance that the data are fully representative of the areas.

The demand for soybeans for oil in the war program has recently focused attention on the fertilizer requirements of this crop. Seed yields in eastern North Carolina have been too low for sustained profitable production. Field surveys have revealed a very widespread occurrence of potash deficiency symptoms on this crop. Reliable potash response data on soybeans in this State are rather meager. Three experiments were conducted during the 1943 season, two on Portsmouth sandy loam and one on Dunbar sandy loam. Yield responses of 3.9, 7.1, and 8.2 bushels respectively were obtained from applications of 36 pounds of K_2O. Calculated to yield responses per ton of K_2O these amounted to 117, 394, and 455 bushels

Response of cotton to additional potash, Rocky Mount, N. C. Left, 24 lbs. K_2O per acre; right, 48 lbs. K_2O.

respectively. Observations to date indicate that potash is one of the greatest, if not the greatest, limiting factor in soybean production in eastern North Carolina.

The entire staff of soil fertility workers in the Department collaborated in summarizing the data on which this article is based. Special credit is due W. H. Rankin, W. W. Woodhouse, W. L. Nelson, and W. E. Colwell.

Bottlenecking

(*From page* 5)

wouldn't say that advice and those scientific hints have been any bottleneck worth mentioning.

NOW take the case of a gent I know pretty well, who has ignored the free tips on how to make his cornstalks and marsh hay palatable and nutritious with certain added supplements high in protein, minerals, and vitamins.

For years he has practiced malnutrition on his stock and thrived on it, he says. But along came the recent bottleneck in protein that everybody was squawking about. His feed dealer refused to sell him some oil meal and tankage, although I don't know yet how he ever came to inquire for it. Well, this chap suddenly got religion and tore around raving that America had gone Sovietish, that we were being regimented, stinted, and deprived terribly. He kicked up a fuss at town meeting and abused the AAA committeemen, talked about monopolies by the big millers, and wrote Marvin Jones about it.

The main thing that ailed him was that when something he never used before got scarce and they couldn't sell him any right off, he decided he wanted that more than anything in the universe. If we could fix it somehow so that protein would continue on the tight list for a few seasons, I am sure we would overcome a heap of resistance to using more efficient livestock feeding methods. Why, even the lean-landers would be trying to grow their share of protein and would find out how to use it best in winter rations. So I think a few bottlenecks properly adjusted once in awhile do more good than a surplus to dispose of at give-away prices.

The root of the trouble simply is that this country has always lived so high and had so much of everything that we don't appreciate our natural resources and our everyday opportunities until some kindly old bottlenecker comes drooping along to give us the stop signal. And how we hate him for it, brothers! We cuss him for obstructing us in the name of common welfare, and the next breath finds us praising the freedom of choice and brotherly love of a democracy like ours. We are wearing many jewels of rank inconsistency, and maybe we pay a tax on them too.

OF course, the wickedest old bottleneck we have had to pester us for many moons has been in relation to prices and production. The law of supply and demand has been invoked too soon and too often, to the detriment of protective food production.

What I mean is this: Hitherto in normal times it has been impractical for the farmers to furnish the amount of nutrition actually required to continuously supply the balanced diets we need for a strong and vigorous population. When farmers went into it in a big way with vim and skill, the result was a burdensome market situation on the one hand and thousands of underfed youngsters on the other.

Finding that repeated booms in

milk, eggs, green vegetables, and sundry other things like fruits and fats, only left the producer prostrate and surrounded by his creditors, the game was altered by the referees in 1933 and agriculture imitated big business by curbing and trimming the output to meet the current demand at what was deemed fair prices.

The trouble was that it did not cure the hunger or enhance good will by consumers, who might go without fancy manufactured gadgets longer than they could be minus menus. And there were always plenty of farmers who merely shifted their efforts from one restricted product to another, or who grassed down their land and made livestock products instead of cash crops. It was such a blamed unnatural and provoking scheme that nobody ever wants to return to that method of evening things up.

Sensibly, we need a plan worked out to stimulate enough mass earning power by using advanced plans for continued production in cities when the war ends, so that farmers may find encouragement to maintain soil fertility and extend production of the most nutrition they can make per dollar of cost. It must not be just a flash period of employment, but a steady stream involving not only refilling depleted orders but inventing new things to stimulate trade. Do we see some signs of a stronger sense of reality and progress by large groups of manufacturers, now planning for full employment for the postwar era? Just to "dam-it-all-to-hell" about past errors will not bring us into the promised land, even with political platforms.

WE cannot look for miracles or an entirely upset economy. We cannot grow good pastures without preliminary treatment any more than we can hope to do the impossible in commerce. There will be some disappointments and some unbalanced diets left, as well as a few farm failures and foreclosures, no matter how eagerly we try to puzzle it out toward universal security.

I even go so far afield as to say that maybe we don't want to bust that bottleneck entirely open anyhow, because if everybody was assured of a lifetime of easy-street living I guess there would be no incentive left for inventions or soil improvement or better livestock. Sure, it isn't nice to feel driven to duty by fear of destitution, but there must be a sane middle-ground somewhere. If a democracy can't locate it, then we are sunk to the springs in a sea of despond, because no country ridden by despots can ever hope to.

FINALLY, I can't quit without reference to the splendid way our farmers have stepped into certain bottlenecks hereabouts and started things going again. The worst one was the labor supply, and probably the most widespread, at least in the northern states. Heralds shouted "Here comes the toughest thing yet," and the country cowered in fear of what might happen to their breadbaskets. So far it hasn't materialized in the shape it was predicted, and only because it was a local issue settled in a noble local way.

Toward the end of the coming summer we are promised another astounding bottleneck, which probably can't be solved so easily by local manpower as the labor dearth was. I refer to the oft-hinted breakdown of open country transportation facilities. The jalopies are on their last legs and the motors are wheezing. Will someone have to start breaking in oxen, owing to the lack of horseflesh, just when we learned to sing Mairzy Doates? Or will the armies assign fleets of brown transport trucks to tote the provisions?

And still I refuse to get panicky. I have so much faith in the eventual brittleness of bottlenecks and the strong arm of the home-folks to break 'em.

AVAILABLE LITERATURE

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

Circulars

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

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
MM-9 Fertilizing Tomatoes in Virginia
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
G-3-42 More Legumes for Ontario Mean More Cheese for Britain
H-3-42 Legumes Are Essential to Sound Agriculture
I-8-42 High-grade Fertilizers Are More Profitable
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
Y-8-42 The Southeast Can Grow Clover and Alfalfa
Z-8-42 The One-Mule Farmer Needs a New Machine
AA-10-42 Growing Legumes for Nitrogen
DD-10-42 Clover Pastures for the Coastal Plains
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizer
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
B-1-43 Crotalaria—A Crop That Grows Like Weeds
C-1-43 Quality in Grasses for Pasture and Hay
D-1-43 For Hershey Orchards—Complete Fertilizer
E-1-43 Borax for Alfalfa in Tennessee
F-1-43 Boron Improves Canning Beets
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
K-2-43 Feeding Minerals By Way of the Soil
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
O-3-43 Indirect Nitrogen Fertilization
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
T-4-43 Fertilizing Tung Trees by Leaf Analysis
V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
HH-8-43 More Soybeans, Please!
JJ-10-43 Soil Management for Field Beans
KK-11-43 How Rotation Paid in North Carolina
LL-11-43 The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil
MM-11-43 Mississippi Farmers Improve Their Soil
NN-11-43 Maintaining Available Potassium in Soils
OO-11-43 Kudzu Conserves Southern Soils
PP-12-43 Commercial Fertilizers for Livestock Farms
QQ-12-43 Potash in War Production.
A-1-44 What's in That Fertilizer Bag?
B-1-44 Available Potash in the Surface Soils of Georgia
C-1-44 Adjustment of Agriculture to Its Environment
D-2-44 Potassium Content and Potash Requirement of Louisiana Soils
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
G-2-44 The Use of Borax in the Legume-Livestock Program of the South
H-2-44 Efficient Fertilizers for Potato Farms

THE AMERICAN POTASH INSTITUTE

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

CONCRETE-ABSTRACT

A teacher was attempting to explain to the class the difference between abstract and concrete, and was doing her best to make the explanation very simple and clear. "Now," she said, "concrete is something that you can see and abstract is something that you cannot see."

A little boy looked quite enlightened, so the teacher ventured to test her explanation. "George," she said, "give me the explanation of something concrete?"

"My pants," was George's reply.

"Correct," said the teacher. "Now give me an example of something abstract?"

"Yours," gleefully shouted George.

Nurse: "Mr. Verdome, you are the father of quadruplets."

"What! Them things that run around on four legs?"

The lady on the front row had several small packages on her lap. She was also taking notes on the lecture. A package would fall and she would pick it up and continue to write. After several such occurrences, the lecturer stopped, eyed the lady, and said, "You don't seem to have enough lap." "I have enough lap," the lady replied, "but too much of it is pushed up behind."

Teacher: "Who can tell me what agriculture is?"

Thomas: "Well, it's just about the same as farming, only in farming you really do it."

'TWAS ALWAYS SO

Mrs.: "It says here that in the Sarganlas Island they sell wives for $10. Why, I think that's awful!"

Mr.: "Yep! Guess it doesn't matter where you go, you'll still find profiteers."

Guide: "We are now passing the largest brewery in the world."

Soldier: "I'm not."

VICTORY GARDENS

When the parson called on Mandy, she proudly showed him her Victory garden.

Parson: "Mighty fine garden God and you grew this summer."

Mandy: "Dat is a nice garden, if I do say so myself. But, Parson, do you remember what dat weed patch looked like last year when God had it all to Himself?"

Little Girl: "I know something I won't tell."

Daddy: "Never mind, child. You will get over that when you are a little older."

IS THAT CLEAR?

A mother who had a daughter employed in defense work in Washington wrote to ask her just what she was doing. The reply follows:

"I work in the data-analysis group of the aptitude-test sub-unit of the worker analysis section of the division of occupational analysis and manning tables of the bureau of labor utilization of the War Manpower Commission."

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A 16mm., sound, color film depicting the early South, the results of the one-crop system, and the reclamation and conservation of Southern soils through the use of legumes and modern methods of soil management.
Running time, 28 min. (on 1200-ft. reel).

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In the Clover
Bringing Citrus Quality to Market
Machine Placement of Fertilizer
Ladino Clover Pastures
Potash from Soil to Plant
Potash Deficiency in Grapes and Prunes
New Soils from Old
Potash Production in America

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

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

For additional information write:

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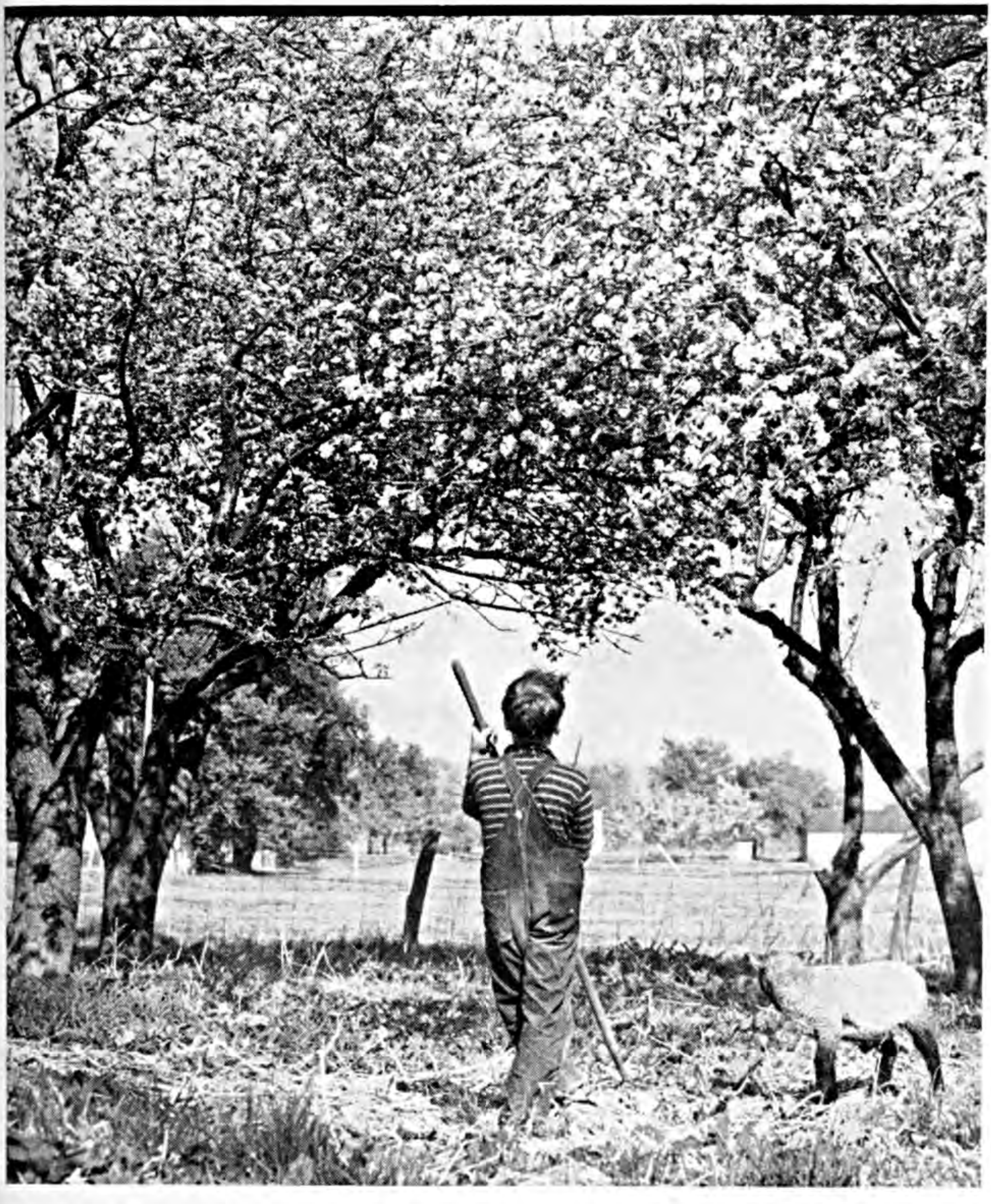

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R. H. STINCHFIELD, *Editor*

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

VOLUME XXVIII NO. 5

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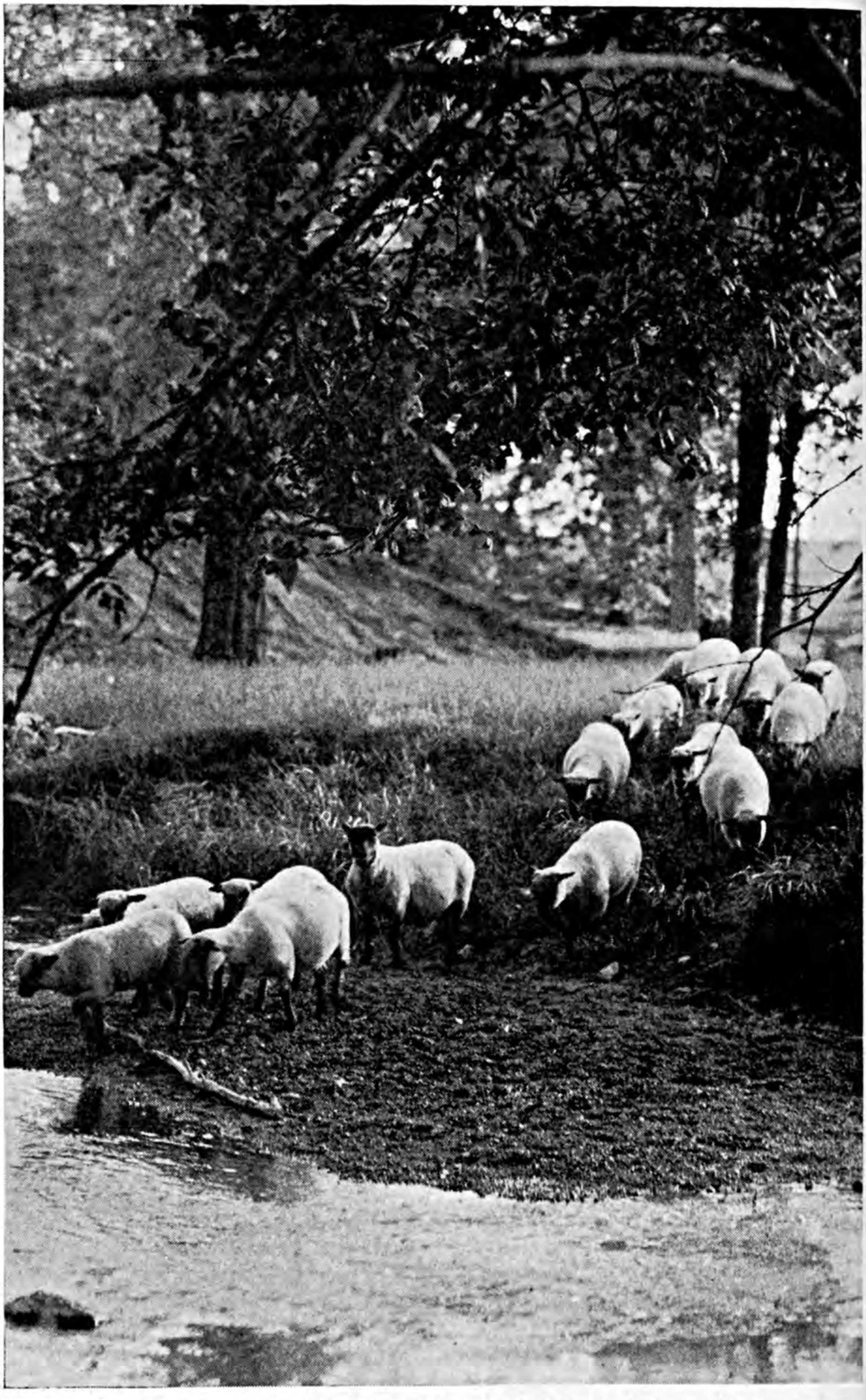

TO CLOSE SHORN SHEEP GOD GIVES WIND TO MEASURE.—*Old English Proverb.*

Better Crops with PLANT FOOD

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VOL. XXVIII WASHINGTON, D. C., MAY, 1944 No. 5

Not Progressive . . .

Just Doped!

Jeff McDermid

MY favorite bard, Bobbie Burns, once said that it would do us good to see ourselves as others see us. Hence, I come to bat this month with a text taken from that proud but deceitful publication called Das Schwarze Korps, issued regularly in Germany by the Nazi Elite Guard. Listen to their latest attempt to bolster up the fading fanatics of the Third Reich and save their kowtowing youth from the decadence of America:

"Nazi youth have nothing to fear from Russian Bolshevism, which is mere materialism, while senile England has nothing to attract the young; but Americanism must be taken seriously in our struggle for the generations of the future. for Americanism is not only comfortable but also pleasant, and has attractions that carry a drug-like effect."

I have known for a long time that the good old corner drugstore was a mecca for the spirited youth of our fair land, whose coke parties and high school chatter kept a thousand Mister Peavies busy and content. But I did not realize the portents of the general situation in America, wherein we have become addicts to Nirvana and heroin heroes. I have heard congressmen speak of the New Deal as a "shot in the arm," but I had no idea it had become habitual for us to exist in a world of fantasy and forgetfulness.

Just as DeQuincy once wrote the confessions of an opium eater, so it's time for some of us perverted patriots to lay bare our weakness for the sedatives of Yankeeland and give a true account of our struggle to overcome the temptations of a degenerate democracy. So here goes.

My first remembrance of partaking of the American dope was in sundry Fourth of July and Memorial Day celebrations, watching parades, fireworks and cannon blasting, and listening to fervid statesmen spiel. But the thing that nicked me hardest in the vulnerable veins was the attitude of Ma and Pa about such loud-mouthed anarchists as the late Emma Goldman. She flourished back in the eighteen-nineties, and perhaps in spots she was not so much different than subsequent spokesmen, but her language sounded like sedition to my family.

"IF Emma and her crowd don't like America, let 'em take the next boat and sail right back where they came from, and see if they'll get any better treatment there," was the comment always made by Pa and Ma.

So you see I got my dope habit naturally, having a couple of parents who were deep-dyed addicts to the pernicious American drug habit. But I want to show how they got that way.

One of my Grandpas came over in the steerage without a penny. The lady he later made my Grandma was also a lonely immigrant servant girl. After they were married they loped off westward seeking more dope. Life in New York city was too easy and uneventful, with only Barnum's midgets and Van Amberg's menagerie to liven things up on Sundays. Prize fighting was in its infancy and Cooperstown had not invented baseball yet. They wanted to see real hyenas, clawing catamounts, and vicious varmints, not to mention real Injuns and war-whoops.

Moreover, they craved for night life at its worst. When they got out west they got it. Grandma had to make her bed in the forest until Grandpa and the neighbors built a lean-to cabin. He worked nights to finish it, and Grandma had plenty of hectic night life bearing her children and nursing them, as well as sitting up with neighbor women in the same situation. For night club music they had the wolves and the winds, and believe me it was great dope! You can't beat it in Berlin, even now!

The tother Grandpa and Grandma found life in Vermont too tame and listless too, and their veins cried out for that strange drug which returning travelers told them was to be had by taking the Erie Canal boats out toward the Great Lakes and beyond. Here they decided to stop awhile, get a fresh fill of drugs, and bring up some kids, including my Pa.

Yes, sir, that was some powerful tonic those days. My Pa chopped rails, hoed sod corn, helped clear an eighty, went to district school about six months in ten years, enlisted in the Civil War, got wounded, slept in swamp water up to his hocks, had fever n' ague that shook his teeth loose, caught a dose of malaria and dysentery that made him feeble for years, and had a pension of fifteen bucks a month to buy dope with ever after.

As I recall it, Pa never got rid of those spells of dope. I can see him now, standing in the corner grocery with one hand in the prune box and the other raised to salute the flag, because the latter insured him a continued dose of free dope for a spree. The best way to make him hopping mad was to mention anarchists and belittlers of America. That drug sure got Pa, and no wonder it was transmitted down to me when the time came.

AS a side-light, let me say that quite some number of my Pa's old-time neighbors and pals were Germans of kultur, such as it was in those days, and strange enough they were anxious to wade through hell and high water, just like Pa was, to get a dram or two of that noxious dope retailed under the stars and stripes brand. More sauerkraut soldiers of Gen. Siegel were suckers in those days too, and so were the followers of Carl Schurz. How silly of them to prefer the cheap comforts and mirages of America to the sturdy independence of the upright old Vaterland. All those poor dopes and dupes could do was sing, "I fought mit Siegel and stand mit Schurz." Just think, they might have stayed in Prussia or Bavaria and sired some of the Elite Guard of today! Or maybe they have after all and don't know it yet.

Time and circumstances kicked my Ma around some too, but she always kept her American drug handy. In fact between shifts she managed to fill

a hefty scrapbook with lots of inspirational recipes and references to the kind of dope she used to scare off the heebie-jeebies. But with her and other women the American drug habit was mixed up somehow with religious fervor, giving Washington and Lincoln their shrines close to the family altar.

Thus I sure got it laid into me from both sides. I got plenty of needling from the family drug shelf, that slowly and surely made me a wan and hopeless devotee of this American poison, so pleasant to take and so easy to swallow!

Our folks thought this drug was dandy for every ailment of the mind and heart, and they were also simple enough to insist that the brand of dope distilled in our particular state and county was the most glorious elixir of all that witch's cauldron set simmering by the American Revolution and carried west in Conestoga wagons, canal boats, and on horseback.

I understand it's the same in other sections remote from my stamping ground. New Yorkers think no dope is as stimulating as the Borough of Manhattan brand. Others say California's Rose Balm is mighty soothing; that the District of Columbia brand packs a wallop, and that the biggest whoopee-and-holler-loud concoction is the proud boast of Texas with its Longhorn Liquid Lightning and its Oil of Omnipotence. Likewise it would be unfair to forget old Tennessee and its insidious Mountain Magic, which made such drug fiends as Davy Crockett, Andy Jackson, and Sergeant York!

In spite of my early encouragement to become an American dope addict, imbibing it in the family circle and getting it fed to me with my porridge, I've never until Pearl Harbor date taken enough of it to amount to much —compared to some other Americans. In most temperance confessions you don't find a guy apologizing for not getting loaded high enough, but that's me all over, I'm just different and want to be honest about it.

POET POPE says that a little is a dangerous thing, "drink deep or taste not the Pierian spring." There I was, right on the brink of the biggest ocean of dope you can imagine and not gulping enough of it to give me the jag required to become a "dangerous American." When I think of the gallonage of drug my kinfolk took in, my performance rates pretty meager. But during the last three years my intake has been close to the norm set by inheritance and environment. Praise be for the open jug!

It's easy to trace the effects of this awful American drug through two preceding generations of misguided citizens. When my grandparents hit the wilderness hot for more hooch to make them forget, the country was an isolated realm. What Europe or Asia or Timbuktu thought or did was of little account and nobody heard of it for ages and cared less. And our own East and West were not twain by any means.

Then along came two dope fiends,

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More About Soybean Fertilization[1]

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SOYBEANS are here to stay, and government authorities are requesting that an increased acreage be devoted to this important war crop. With the labor and machinery bottlenecks accompanying the present war, it is quite likely that farmers will be unable to greatly expand the acreage devoted to soybeans. Thus it seems that the greatest potentialities of increased production can only be obtained through maximum per-acre yields, and, obviously, maximum yields can only be obtained with adequate nutrition of the crop.

Up until a few years ago, it was believed that fertilizers could not be effectively applied to the soil the same year the soybeans were grown. However, recent experiments which include a consideration of the various factors involved, especially proper placement of the proper kinds and amounts of plant nutrients, have shown that soybeans not only respond to direct fertilization but are also very capable of utilizing plant food remaining after heavy applications made to the preceding crop.

During the past three years, agronomists at the Purdue University Agricultural Experiment Station have obtained some very interesting results from field experiments on the fertilization of soybeans. Some of these results will be discussed here.

Results of Demonstrations in 1942:

In the spring of 1942, Enfield (1)[3] laid out a series of cooperative soybean fertilizer demonstrations on Indiana farms. He broadcast and plowed under 0, 500, and 1,000 pounds of either 0-12-12, 0-10-20, or 0-8-24 per acre, depending upon the soil type involved. The increases obtained from the fertilizer varied from 4.7 to 17.8 bushels per acre over the yield of the unfertilized check plots. On one potash-deficient soil, the unfertilized beans yielded 9.9 bushels per acre, while 500 pounds of 0-8-24 broadcast and plowed under yielded 22.8 bushels and 1,000 pounds produced a yield of 27.7 bushels per acre. On another farm, the unfertilized beans averaged 18.0 bushels per acre, while 500 pounds of 0-12-12 broadcast and plowed under yielded 31.4 bushels and 1,000 pounds gave 33.4 bushels per acre.

Results at Lafayette in 1943:

At the Purdue Soils and Crops Farm at Lafayette, an experiment was conducted in 1943 to determine the effect of plow-sole applications of fertilizer on the maturity, yield, and fruiting habits of soybeans.

This experiment was conducted on a slightly acid (pH 6.4) Crosby silt loam. From 1915 to 1941, the land was in a three-year rotation of corn, wheat, and clover. During this period, all the crops were removed except the second-growth clover. No commercial fertilizers were added during this period; but manure, at the rate of six tons per acre per rotation, was compared to no manure on adjacent plots. Yield records indicate that by the end of this

[1] Journal Paper Number 163, Purdue University Agricultural Experiment Station.

[2] Technical Assistant and Associate in Crops, respectively.

[3] Figures in parentheses refer to "Literature Cited."

Fig. 1. This excellent field of Gibson soybeans, planted with only 30 lbs. of seed per acre, produced 32 bushels per acre. Louis Wagner Farm, Evansville, Indiana.

27-year period, two levels of fertility had been created.

In the spring of 1942, 400 pounds of 0-10-20 per acre were broadcast and plowed under for corn on plots representing both fertility levels. The corn on all plots was fertilized with 100 pounds of 0-12-12 per acre placed near the hill. In the spring of 1943, plow-sole applications of 400 pounds of 0-10-20 were made on other plots in the same series for the soybeans which followed the 1942 corn. The effects of the fertilizer on the maturity and yield of soybeans in 1943 are given in Table 1.

From the data in Table 1, it is seen that the 0-10-20 plowed under directly for soybeans in 1943 increased the yield 12.7 bushels (from 20.2 to 32.9) at the lower level of fertility, and 9.3 bushels (from 23.0 to 32.3) at the higher level of fertility.

The effect of the fertilizer on the

TABLE 1.—EFFECT OF 400 POUNDS 0–10–20 PER ACRE, PLOWED UNDER AT TWO FERTILITY LEVELS, ON THE YIELD AND MATURITY OF SOYBEANS IN 1943. CROSBY SILT LOAM, LAFAYETTE, INDIANA

Fertilizer plowed under for corn or soybeans	Maturity and yield of soybeans in 1943			
	On land unmanured 1915–1941		On land manured 1915–1941	
	Moisture Oct. 3 (per cent)	Yield per acre (bushels)	Moisture Oct. 3 (per cent)	Yield per acre (bushels)
None	58.6	20.2	52.6	23.0
400 lbs. 0–10–20 under for corn in 1942; residual for soybeans in 1943	31.9	25.8	16.7	29.0
400 lbs. 0–10–20 under for soybeans in 1943	12.3	32.9	12.6	32.3

maturity of the soybeans is even more striking than the effect on yield. From Table 1 we see that the 0-10-20 plowed under directly for the beans in 1943 greatly hastened maturity, as indicated by the moisture content of the beans on October 3. On the lower fertility level, the moisture content was reduced from 58.6 per cent on the unfertilized plots to 12.3 per cent on the fertilized plots; while on the high fertility level, the corresponding values were 52.6 per cent and 12.6 per cent, respectively. (See Figure 2.)

Without mineral fertilizers, plants on both previously manured and unmanured land showed severe potash-starvation symptoms during the growing season. Furthermore, by the middle of August, plants on all fertilized plots tested low for both phosphate and potash according to the Purdue plant-tissue test technique.

It was very evident before harvest time that large yield and quality differences due to treatment were to be expected. Therefore, studies were made on the pods of 60 plants selected at random from both fertilized and unfertilized plots to see how the added plant-food nutrients affected the fruiting habits of soybeans. The results of these determinations are presented in Table 2.

TABLE 2.—THE FILLING OF SOYBEAN PODS AS AFFECTED BY FERTILIZER TREATMENT. LAFAYETTE, INDIANA, 1943

Seeds in pods	Fertilizer treatment	
	None	400 lbs. 0–10–20 plowed under
None	4.3%	3.4%
One	30.5%	17.7%
Two	41.0%	34.9%
Three	24.2%	43.4%
Four	0.0%	0.6%

In Table 2, we see that the 0-10-20 fertilizer plowed under had a marked effect on the number of beans per pod. For example, 43 per cent of the pods on the fertilized plots contained three beans, while only 24 per cent of the pods from the unfertilized plots contained three beans.

Samples of the threshed beans from the two fertilizer treatments were studied for size and quality, and these results are given in Table 3.

TABLE 3.—THE FRUITING AND QUALITY OF SOYBEANS AS AFFECTED BY FERTILIZER TREATMENT. LAFAYETTE, INDIANA, 1943.

Fruiting and quality of soybeans	Fertilizer treatment		Increase for treatment (per cent)
	None	400 lbs. 0–10–20 plowed under	
Pods per plant, av.	47	57	+20
Seeds per pod, av.	1.85	2.20	+19
1,000 seed wt. gms	119	145	+22
Commercially damaged seed [1]	3.6%	0.6%	−83.3
Purple-blotched seed	13.7%	2.3%	−83.7
Germination	82.5%	93.0%	+12.7
Whole beans through 10/64 slot screen [1]	6.9%	1.7%	−75.4

[1] By weight.

From the data in Table 3, we find that the fertilizer caused a very marked increase (about 20 per cent each) in number of pods per plant, number of seeds per pod, and weight of 1,000 seeds. In addition, the fertilizer caused a decrease in commercially damaged seed and purple-blotched seed; and it increased the germination from 82 per cent in the unfertilized beans to 93 per cent in the fertilized beans.

Thus, we can conclude that the 400 pounds of 0-10-20 plowed under for soybeans on this potash-deficient soil caused a marked increase in the yield, maturity, and quality of soybean seed in 1943.

Various long-time fertility experiments in Indiana have shown that soybeans have the ability to "feed at the second table." Over a period of years, the yields have been increased on an average from 3.2 to 10.6 bushels per acre by the practice of applying 400 to 600 pounds of fertilizer to the non-legumes (corn and wheat) in the rotation along with lime, manure, and legumes (clovers).

In recent years, it has been found that soybeans respond to plant food remaining when heavy amounts of fertilizer have been plowed under for the preceding corn crop on soils of low fertility. An excellent example is furnished in Table 1 where it is seen that the fertilizer plowed under in 1942 for the preceding corn crop increased the 1943 soybean yield from 20.2 to 25.8 bushels per acre on the unmanured land, and from 23.0 to 29.0 bushels per acre on the manured land. Furthermore, this residual fertilizer greatly hastened the maturity of the beans as indicated by the moisture content on October 3. On land unmanured from 1915-1941, the unfertilized beans contained 58.6 per cent moisture on October 3 while the beans growing on plots which received 400 pounds of 0-10-20 plowed under for corn contained 31.9 per cent moisture. On land which had received manure from 1915-1941, the corresponding moisture contents were 52.6 per cent for unfertilized and 16.7 per cent for residual fertilizer applied to the preceding corn crop.

Results on Clermont silt loam:

In 1941, Harry Cook and S. R. Miles conducted a corn fertilization experiment on a Clermont silt loam soil at North Vernon, Indiana. In this experiment various corn hybrids were planted across different levels of soil fertility which were obtained by plowing under 0, 1,000 and 2,000 pounds per acre of 8-8-8 fertilizer. In the spring of 1942, after half of each plot had received three tons per acre of ground limestone, soybeans were planted to determine the residual effect of the fertilizer applied to the corn in 1941. The yields of the 1942 soybeans for the low and high fertility levels on unlimed (pH 4.8) and limed (pH 5.8) plots are given in Table 4. These yields have been reported previously (2).

Fig. 2. The effect of fertilizer on the maturity of soybeans. The plot on the left has received no manure or fertilizer since 1915. It yielded 20.2 bu. per acre in 1943, and the beans contained 58.6 per cent moisture on October 3. The plot on the right received 6 tons of manure per rotation from 1915-1941, and 400 lbs. of 0-10-20 were plowed under for the soybeans in 1943. Yield was 32.3 bu. per acre, and moisture content on October 3 was down to 12.6 per cent. Crosby silt loam soil, Lafayette, Indiana.

TABLE 4.—THE EFFECT OF LIME AND FERTILIZER ON THE YIELD OF SOYBEANS IN 1942 WHEN THE FERTILIZER WAS BROADCAST AND PLOWED UNDER FOR CORN IN 1941 ON A VERY ACID SOIL. CLERMONT SILT LOAM, NORTH VERNON, INDIANA

Treatment	Yield in bushels per acre			
	1941 corn	1942 soybeans		
		Unlimed[1]	Limed	Effect of lime
No fertilizer....	40	8.4	15.1	6.7
2,000 lbs. 8–8–8 plowed under for corn in 1941.........	81	13.6	21.2	7.6
Effect of fertilizer..........	41	5.2	6.1	

[1] Three tons of ground limestone per acre applied in spring of 1942.

In the spring of 1943, soybeans were again planted on this field to determine the two-year residual effect of the fertilizer applied to the corn in 1941. The 1943 yields from the unlimed and limed plots are given in Table 5.

TABLE 5.—THE EFFECT OF LIME AND FERTILIZER ON THE YIELD OF SOYBEANS IN 1943 WHEN THE FERTILIZER WAS PLOWED UNDER FOR CORN IN 1941. CLERMONT SILT LOAM, CLOVERDALE, INDIANA.

Treatment	Yield in bushels per acre			
	1941 corn	1943 soybeans		
		Unlimed	Limed[1]	Effect of lime
No fertilizer....	40	8.2	12.6	4.4
2,000 lbs. 8–8–8 plowed under for corn in 1941.........	81	10.4	18.1	7.7
Effect of fertilizer..........	41	2.2	5.5	

[1] Three tons of ground limestone per acre applied in the spring of 1942.

Examination of the data in Tables 4 and 5 reveals several interesting and important points in regard to fertilizing soybeans. In the first place there is a tremendous response to lime on this very acid (pH 4.8) soil. In 1942, lime gave an increase of 6.7 bushels per acre on the unfertilized plot and 7.6 bushels on the fertilized plot, while in 1943 the corresponding increases were 4.4 and 7.7 bushels per acre, respectively. Thus, it is very obvious that a farmer cannot afford to grow soybeans on this acid soil without first applying adequate amounts of lime.

In the second place, the soybeans were not only able to feed at the "second table," but they were also very capable of feeding at the "third table" as well. In 1942, the residual effect of the 2,000 pounds of 8-8-8 plowed under for the preceding corn crop caused an increase in yield of 5.2 bushels per acre on the unlimed plot and 6.1 bushels per acre on the limed plot. This marked residual effect of the fertilizer continued through the third year, for in 1943 the corresponding increases were 2.2 and 5.5 bushels per acre respectively. These increases in soybean yields were obtained in addition to a 41-bushel increase of corn yield in 1941, the year the fertilizer was applied.

Finally, it is obvious that on this acid soil which is very low in fertility, maximum yields of soybeans can only be obtained with a combination of lime and fertilizer. Neither of these two factors alone is adequate; a combination of the two is necessary to give the largest yields.

Results on Vigo Silt Loam

Another example of the response of soybeans to residual fertilizer supplied to the preceding crop is found in an experiment on a low fertility, light-colored (Vigo) silt loam soil at Cloverdale, Indiana. In 1942, O. W. Luetkemeier laid out a series of plots to compare the effects of various kinds and amounts of plow-sole fertilizers on the yield of corn (2). In the spring of 1943, these

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Borax Spray for Turnips

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The author, mixing the spray.

THE table turnip (rutabaga) is an important cash crop in western Ontario. Some idea of its extent may be gained from the fact that more than 2 million bushels of the 1942 crop were shipped to the United States market, alone.

Water-core or brown heart is one of the most troublesome diseases with which the growers have had to contend. It is difficult to give an estimate of the annual loss from this disease because the extent to which it develops fluctuates from year to year and, furthermore, growers whose turnips are severely water-cored use them as stock feed. In some years the average loss of salable turnips from this disease has been estimated as high as 20 per cent, but if one considers individual farmers who grow turnips for shipping purposes, only, the loss may be almost 100 per cent.

It is practically impossible to detect a water-cored turnip without cutting the root. Severely affected turnips may be off shape and have a rough corky to leathery skin. In the early stages of development, the disease appears as water-soaked areas in the turnip flesh; these areas may increase in size until almost the entire root is involved. Severely diseased turnips may become brown and punky inside, a condition more apt to be seen in storage than in the field in western Ontario.

Water-core is a symptom of boron deficiency. It is more prevalent in soils of neutral to alkaline reaction containing a high lime content. Whether or not the calcium in the soil reduces the availability of soil boron to the roots, or interferes with the normal function of boron within the turnip itself, is still open to question.

In some parts of Canada 10 to 30 lbs. of borax per acre, applied to the soil prior to seeding, will completely prevent water-core. This procedure has not been generally adopted in western Ontario because too many failures have been met. Some experiments carried on at the Ontario Agricultural College indicated that the amount of borax required as soil applications to prevent water-core of turnips might be so great that there would be danger of residual toxicity to at least some of the succeeding crops in the rotation series. The high calcium content of many of the soils in the turnip districts of western Ontario is a likely contributing factor to failures in the control of water-core when soil applications of borax are used.

Investigations carried on at the Ontario Agricultural College have shown that the required amounts of boron can be supplied to the turnip plant, in a practical manner, by spraying the leaves with an aqueous solution of borax. A promising spray schedule was obtained during 1941 and 1942 by means of small plot experiments. During 1942 this spray schedule was tested on block areas within several turnip fields, and practically complete control was obtained regardless of water-core incidence in unsprayed portions of the fields. In 1943 more than 250 acres of turnips in widely scattered turnip districts of western Ontario were sprayed on a commercial basis. It was difficult to obtain quantitative data on the effectiveness of the commercial spraying because many farmers left either inadequate or no checks at all. However, on seven farms involving 46 acres of turnips, adequate checks were left and these developed such a high incidence of water-core that it was obvious the entire fields would have been condemned had they not been sprayed; practically complete control was obtained by spraying. In no instance did any appreciable amount of water-core develop where the spray was applied at the proper time and in the proper manner. In general, the results were such that the turnip growers are enthusiastically accepting spraying as a practical means to control water-core.

The spray mixture is made up as follows: In 40 gallons of water dissolve 8 lbs. of borax (or saturation in cold water), stir in 2 lbs. of bentonite clay as a sticker, screen the mixture into the spray tank, then add ½ pint of Orvus paste (Procter and Gamble, Toronto) as a spreader. The amount of Orvus can be reduced in succeeding tankfuls if it tends to accumulate as a froth. About 40 gallons of spray is required per acre of turnips. The borax will dissolve more rapidly and a higher concentration of borax can be obtained by using hot water. If such is used, however, the borax should be carefully measured so that not more than 8 lbs. are dissolved in 40 gallons of water; otherwise, burning of the turnip leaves will occur. This burning will show as white, papery, irregular spots on the leaves.

Any type of sprayer can be used so long as a uniform coverage of the upper surfaces of the leaves is obtained. It is not necessary to spray the undersides of the leaves nor use high pressures. Many growers used a 40-gallon, 4-row, potato sprayer with one nozzle per row turned down on the foliage. The most efficient equipment observed was that of a tractor with a spray tank mounted on a platform over the rear axle and a 4-row boom attached behind the front wheels. No appreciable mechanical damage to foliage or roots was caused by any of the spray equipment; a rubber-tired tractor caused the least damage.

The spray can be considered as a preventive but not as a cure. Spraying was found to be useless after water-core was already present in the roots, and its effect was reduced materially if water-core were to develop shortly after spraying. It is recommended that the first spray be applied when the roots are 1 to 1½ inches in diameter but not more than 2 inches.

Many growers obtained complete control of water-core with a single spray. However, it was clearly demonstrated that in instances where a high incidence of water-core would normally occur, a second spray is required one month after the first spray. Therefore, where more than a mild occurrence of water-core is anticipated, two sprays are recommended; the first when the roots are 1 to 1½ inches in diameter but not more than 2 inches, and the second spray one month later.

The cost of materials for spraying is less than one dollar per acre per spray which is cheap insurance against such a troublesome disease. Because of war restrictions on spray equipment the growers in many turnip localities are making arrangements for custom spraying.

Assistant Agent Burnett, left, Marshall county, Tenn., tried some demonstration potash on tomatoes. Both yield and quality of the crop were greatly increased.

Southern Crops Show Need of Potash

*By H. E. Hendricks**

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IN the report of the Tennessee Experiment Station of 1884, under the discussion of the response of wheat to chemical fertilizers at the University Farm, Knoxville, it is noted: "The experiments under this section were not continued in 1884 because the expense of fertilizing with this class of agents (1879-1883) so far exceeded any increase in the yield that there was no hope of getting any results that would be of practical utility." Among the materials used were dissolved phosphate, sulphate and muriate of potash, nitrate of soda and sulphate of ammonia.

Many changes affecting the practical use of fertilizers have occurred since 1884. Fertilizers today are cheaper than they were then and the values of crop commodities are greater. The land itself has changed during this 60-year interval of cropping and the system of farming is also quite different from that in 1884. Today, therefore, the use of fertilizers for wheat in this section is generally necessary for profitable yields. In the 1941 report of the Station, it is stated: "These crops (lespedeza) remove far more of the mineral elements of plant food than was re-

* The writer is indebted to Dr. Eric Winters, Professor of Agronomy, and Dr. J. B. Washko, Associate Agronomist, U-T College of Agriculture; Dr. H. B. Mann and C. W. Summerour, American Potash Institute; N. C. Myers, Knoxville Fertilizer Company; 81 County and Assistant County Agents; and 797 farmers, who assisted in supplying and distributing material, and securing and interpreting reports.

moved under the old style farming. The poor yield of corn and other crops following the removal of lespedeza hay for a few years was found to be attributable to a lowered soil content of available potash."

There are soils in Tennessee that have been known for many years to be so deficient in available potash that potash applications for the production of almost any farm crop were recommended without question. In addition, fertilizers containing potash have been recommended on a wide grouping of soils where specialty crops such as tobacco, etc., were to be produced. However, on quite a large area of well-drained upland soils, potash deficiency has been of little concern.

In 1943, working with County Agricultural Agents, the Department of Agronomy in cooperation with the American Potash Institute undertook to explore the problem of potash deficiency in Tennessee on a wider scale than had ever before been attempted, by testing the response of some of our important field crops to potash applications.

All of the 94 County Agents in Tennessee were invited to participate in this potash test demonstration project. Of this number 81 responded and requested material to establish a total of 1,469 demonstrations divided as follows: cotton—297; corn—360; tobacco—224; alfalfa—305; and red clover—283. All of the demonstrations were one acre in size and received an application of 100 pounds muriate of potash except corn, which was two acres in size and received 50 pounds of potash per acre. This was all in addition to the regular fertilization which the cooperating farmer used over his entire acreage.

Of the 1,469 demonstrations established, reports of results were received either from County Agents, or from cooperating farmers through the Agents, on a total of 797 demonstrations, divided as follows: cotton—204; corn—233; tobacco—148; alfalfa—108; and red clover—104.

Since the alfalfa and red clover demonstrations also received applications of borax both with and without potash, and since these results have, in general, been published in another report, THE USE OF BORAX IN THE LEGUME-LIVESTOCK PROGRAM OF THE SOUTH (BETTER CROPS WITH PLANT

Hagerstown soil is usually considered fairly well supplied with available potash. The difference shown here (left) meant over 300 lbs. seed cotton at harvest.

Food, February, 1944), the discussion of results here will be confined to cotton, corn, and tobacco.

The reports of results obtained on these three crops are very interesting. It may even be said that some of the statements made accompanying the reports are entertaining. As would naturally be expected, the response reported was not entirely consistent, particularly on cotton and corn. Upon investigation, however, most of the conflicting results can be explained.

The method used in obtaining results of potash on cotton and corn was generally the harvest of four rows, both where the extra potash had been and had not been applied. In some cases, yields were calculated on an acre basis. In others, actual weights of the rows were sent in, which necessitated a percentage comparison. On tobacco, the results for the most part were, by observation, estimation of comparative yields, and a description of quality.

Nothing fundamentally new was expected from these demonstrations, yet they have contributed to a better understanding of crop response to potash material on many of our soil types and have also demonstrated how the material should be used if response is to be expected. Weather conditions in Middle and West Tennessee in 1943 were extremely dry, while in East Tennessee they were very favorable.

Summarizing all the reports received as a State pattern by crops with respect to whether profitable response was obtained, we have the following:

Crop	Per Cent Showing Profitable Response	Per Cent Showing Little or No Response	Per Cent Showing Negative Response
Cotton........	71	24	5
Corn..........	48	49	3
Tobacco......	78	22	..

The decreased yields were naturally obtained by decreased stands of corn and cotton through injury to germination, or by retarding plant emergence. This might also have been a factor in some cases where little or no response was obtained. In the majority of cases the salt was applied in the row with the seed.

The writer will attempt to give a brief, overall discussion of the observations of these demonstrations by crops, and then let a few of the County Agents and demonstrators tell their experiences in their own words.

Cotton: In most of these demonstrations, some potash was used in mixed goods applied on the entire crop. The amount usually ranged from 12 to 24 pounds K_2O. The additional 60 pounds of K_2O were naturally most beneficial on the most potash-deficient soils. Where injury to stand or emergence was not noted, the additional potash grew the cotton off faster, increased the size of the plant, prevented rust, opened the cotton earlier and more thoroughly, made it easier to pick, and gave a higher grade of cotton. Some of these are results of considerable value aside from the yield of seed cotton.

One of the demonstrators in Franklin county writes: "It was very dry. The potash cotton stayed green and opened fluffy where lots of the other dried open."

From the report of W. F. Moss, County Agent in Marshall county, comes a report that is a little confusing: "Lloyd Adams of the Farmington Community moistened his cotton seed and rolled them in the potash allowing the seed to take up all of the potash they would. The balance was put in the hopper with the seed. The total rate of application was 100 pounds per acre. From the beginning, there was a big difference. The cotton rolled in potash came up quickly and to a more uniform stand than the untreated seed. The treated area maintained a lead throughout the growing season. The treated cotton also opened better and, according to Lloyd, picked easier. The first two pickings yielded 366 pounds more seed cotton per acre than the untreated area. This increase was valued at $31.11."

Ray S. Ward, Assistant County Agent in Soil Conservation, Lincoln county, says: "Where the potash fertilizer was applied along with other fertilizer, considerable increase in yield was found when actual weights were made. The leaves remained on the plant longer, a greater per cent of the bolls matured, bolls opened better, and the cotton was easier to pick, seemed to hang out of the bolls. The entire plant showed a healthier appearance, and a smaller per cent of rust was found.

"Looking over a large field of cotton, it was very easy to tell where the potash was applied due to the bolls opening and cotton showing so much whiter."

Ward reported details on several demonstrations showing increases in the yield of seed cotton of from 400 to 600 pounds per acre.

From Lewis E. Hewgley, Assistant County Agent in Giles county, comes this report: "Good results were obtained on cotton ranging from over 200 down to approximately 100 pounds yield in seed cotton. I believe in one case we had as much difference as 275 pounds. Most farmers said that cotton opened and picked remarkably better. Rust was controlled by the application. I think we can definitely state that additional applications of potash to cotton are profitable to the average farmer in this county."

In contrast to these, Herbert L. Williams, Assistant Agent in Polk county reported numerous negative results such as the following on the farm of R. E. Firestone: "The cotton receiving the extra potash was slow coming up and getting started. It was a poor stand, although the bolls and stalks were larger. The check plot yielded 11 per cent more cotton per acre due to thicker stand."

K. B. McPherson, Assistant County Agent, says: "Several demonstrators apparently got their potash too close to cotton seed in the row at planting time. Cotton land treated was slow and irregular to germinate and early growth was retarded compared to untreated land in the same field. As the season advanced the stand and growth caught up and in a few instances passed that on plots where potash was not applied. There were four weeks of hot dry weather that caused a good many bolls not to open. There were more bolls on the fertilized cotton than on the other."

Corn: The value of the effect of potash on corn was not generally as great as on the other crops. This may have been attributable in part to an inadequate supply of other plant nutrients, particularly nitrogen. On many of the demonstrations where increases were noted, the value of the increase was barely profitable. On our more potash-deficient soils, however, located in areas in Middle and West Tennessee, the ground was not thoroughly wet after the corn was planted until harvest. In addition to increases in yield, it seemed to be general that potash applications to corn improved the quality of the grain and hastened maturity from about a week to ten days. Some of the County Agents' observations follow:

Shelby county.—From Assistant County Agent John V. Reid: "The other one (demonstrator) did not get complete data, but did get an excellent response. He used this potash on Calhoun soil which is certainly typical potash-deficient soil. Two average rows, on which potash was used, yielded 42 pounds—two average rows where potash was not used yielded 28 pounds. This showed an increase of 50 per cent by the use of potash."

From Morgan county in East Tennessee, County Agent Edwards says, "H. N. England reported a 25 per cent increase in yield of corn treated with potash and better than 20 per cent on potatoes side-dressed with potash."

Another East Tennessee County Agent, O. G. Taylor, Loudon, reports: "One demonstration of potash on corn affected the germination where it came in contact with the seed. but even then

In Sevier county, Tenn., D. B. Hendrix, County Agent, is using potash demonstrations effectively in Extension teaching. The two center rows did not receive extra potash.

the increase was six bushels over the plot that did not receive potash and had a better germination. The other two demonstrations gave an increase of 11 and 12½ bushels per acre over the untreated plots. This corn was some taller and had larger stalks and larger ears. The fourth corn demonstrator estimated no difference but he did not weigh or measure his corn."

The Agent in Dickson county, Middle Tennessee, writes: "S. B. Noland reports that the corn grown with potash supplement had a sturdier stalk and darker foliage, stayed green to maturity, was exceptionally well filled out on the tip end, and had more feed value than corn grown with no potash supplement.

"Floyd T. Gillum reports from his demonstration that the corn stayed green longer and yield was lots better than where potash was not used.

"James A. Cooksey reports that the yield on corn where potash was used showed an increase of ⅓ over that where there was no potash used."

W. O. Donnell reported to County Agent Massey in Warren county: "I did not notice any difference in the plant growth, but the ears seemed to be better matured and heavier. The season was very dry. The ground was never too wet to cultivate from the time the crop was planted until it was laid by."

Tobacco: All of the tobacco demonstrations had already received from 18 to 60 pounds K_2O per acre on the entire crop from mixed fertilizer. Nearly all of the fields also had been manured at the rate of from 10 to 20 loads per acre. The additional 60 pounds of K_2O, however, had very surprising results which were significantly consistent in the different parts of the State, on both dark-fired and burley tobacco.

By adding this extra 100 pounds of muriate of potash per acre, the yield was very profitably increased, the crop withstood the dry weather better, was prevented from wilting during hot weather, and firing of the bottom leaves was decreased, thus promoting more uniform ripening, and increasing the quality or selling price.

Excerpts from some of the tobacco reports are very interesting:

The Agent in Jackson county said: "On three of the treated plots there was quite a difference. The treated

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Two girls of the Woman's Land Army returning from a day's work.

They Who Work on These Crops

By C. B. Sherman

U. S. Department of Agriculture, Washington, D. C.

WHO is going to plant, tend, and harvest all those bigger and better crops this year? To answer that question means a quick review of how we got it done last year plus some plans for getting still more work but from less obvious sources this summer.

Fortunately a quick governmental study made in January has given us a clearer idea than we have had before of just who composed that huge farm working force last year. It answers, to a certain extent, those questions that have reverberated for months, but if we want the replies we must be reconciled to reading a good many figures, though not so many here as you would find in the published report by Louis Ducoff and Margaret Hagood. How did we manage to produce and harvest that huge total in the midst of war when both the armed services and the war industries had been draining away farm workers at a rapid rate? How many men, women, and young people were involved in this unprecedented undertaking? Who were they? Where did they come from? How was the work done?

New Totals

More than 14,500,000 different persons worked toward producing that huge food supply in 1943. Between

20 and 25 billion hours were devoted to farm work during the year. This would exceed 2 billion 10-hour days devoted to making the tremendous total of food and fiber needed for the war, says this report. Or it means that the equivalent of about 6,600,000 full man-years of work—10 hours of work every day in the year except Sundays—went into last year's farm output.

As the actual enumeration in the study covered 12 and a half million people who worked on farms last year, the rest being only closely estimated, the rounded figures quoted hereafter are based on the smaller total.

The Workers

Who were these men, women, and young people who contributed to put farm production well over the goals? How many were genuine farm people and how many were merely helping out?

Persons who were still living on farms last January—farmers, members of their families, and hired workers who live on farms—did the bulk of that farm work. In round numbers they constituted nearly 10 million, or more than 78 per cent of the workers. Naturally they worked more weeks and more hours per week than the workers who came out from cities, towns, and villages. They contributed more than 88 per cent of the total time put into agricultural work.

Young People

Young people certainly did their share. The experienced 4-H clubs and the newly organized Victory Farm Volunteers of high-school age were among them. Almost 2 million youths, 14 to 17 years old, did some farm work during the year. In round numbers 900,000 of these were farm boys, 400,000 were farm girls, and 500,000 were boys and girls who live elsewhere. (Children under 14 were not counted although they probably totaled well over a million.) As the seasons advanced, schools were generally closed, and the discussions of the subject grew prevalent, more than four times as many young people went out for some farm work as went in the first four months of the year.

Women

Women were a big part of the working force in the busy months from May through October. Nearly 3 million women who live on farms — mainly wives, daughters, and other relatives of farmers—made up nearly one-fourth of the total number who were working in agriculture during those months, and they put in about one-sixth of the total hours of farm work done in that period. For the year as a whole, farm women ranked second only to farm men in importance to farm production.

Men

Men, of course, furnished the great bulk of the work, and farm men formed the majority of the farm force in every season. They do the long steady hours of labor on which the United States depends for basic supply of food and fiber. Farm men accounted for about three-fourths of the total hours worked during 1943.

From Outside

What about all those people who were not living on farms but who helped to care for and harvest that record output? The onlookers' attention naturally turns toward them. Moreover that is a vital question to farmers, for these short-time seasonal workers who supply the extra help save the harvests. The Government study gives some answers.

For instance, during the six crucial farm months last year people from elsewhere—men, women, and youths—were nearly equal to the number of farm women who were working—there were about 2½ million of them. They made up 21 per cent of the total number that worked on the farms during this period, but they accounted for only 12 per cent of the total hours of farm work.

For the entire year, men and boys not living on farms (1,900,000 in all) averaged only 24 weeks of farm work, a little more than half the record of farm men. Their average length of work-week was 50 hours.

Women and girl workers not living on farms numbered 800,000 in all. These women had the lowest average input of time in farm work—67 ten-hour days of work during the year, spread over 16 calendar weeks.

People who had done some farm work during 1943 but were on other work by the time the study was made last January included mainly four groups: (1) those who have permanently shifted from farm work to other kinds, (2) those who live on farms, have full-time jobs elsewhere, but do some farm work after hours or on week-ends, especially in the peak seasons, (3) those who regularly work on farms in the summer but shift to some other work in the winter, and (4) towns-people who do not usually work on farms at all, but who responded to the war cries last year and helped to harvest in "twilight armies" and other special groups. Or as individuals they worked on farms during vacations or week-ends or during other "days off."

From what kind of work did most of the outside workers come—business, professional, or other labor? Here are some of the answers. More than one-third next worked in manufacturing industries (including foods), 17 per cent in wholesale and retail trade, and 11 per cent in professional and governmental service. No other major industry had as many as 10 per cent.

But about 3½ million persons who had helped on the farms were not working for pay or looking for work in January. More than 2 million of these were housewives. More than another million were youths in school. The remaining 300,000 were too old, or were not able to work, or were not working for some other reason.

Prospects for This Year

These new figures may shape some of the campaigns for farm helpers this year.

To get back into farm work the valued and experienced seasonal workers who have always been depended

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A hired girl pinchhitting for a hired man on a Cumberland County, Pa., farm.

Ladino clover in this apple orchard was fertilized with 500 lbs. of 0-12-12 per acre.

The Use of Fertilizer in Maryland

By R. P. Thomas

Soils Department, University of Maryland, College Park, Maryland

THE production of food and feed was never more urgent than now. Since Pearl Harbor this country has passed from the state of plenty, with acreage reduction to control surpluses, to unlimited production of food and feed to reduce starvation. The limitation in facilities for normal food production in many of the world's important food-growing countries is largely responsible for this change, although in many instances the distribution of food and feed in these countries is greatly reduced. It is very necessary then that some of the other countries increase their production. The geographical position of our country indicates that it should be one to make a maximum effort towards meeting this food and feed need. Maryland, as one unit of this country, should be able to do its part. This is a brief discussion of how such a demand may be met in Maryland.

In the past, this country has arisen to meet such emergency demands by increasing the acreage, although it was sometimes accomplished by growing more per acre. No doubt, along with these two methods was associated the more efficient use of labor and farm machinery. Under present conditions the shortage of both labor and farm machinery will not permit much expansion by this means. Neither will it permit very much of an acreage increase. The most feasible way then to meet this demand for more food will be by increasing the quantity grown on each acre.

Most ways of increasing acre production may be placed under two headings; namely, better management practices and better fertilizing methods. The better management practices are generally brought about by years of experience or extensive and continued educational programs. Such practices are naturally slow to develop. The limited amount of time and less semiskilled labor available make it very unlikely that much increase can result now from better management practices. The most logical means of increasing the amount of food and feed grown from each acre that can be cultivated then will probably be the use of more fertilizer of better grades.

Since food comes directly or indirectly from the soil through plants, soil has to be considered as the most important factor in food and feed production. Soils are the warehouses or storage places for plant nutrients. The plants take these nutrients through their roots from the respective warehouses, and with the power or energy from the sun, use these nutrients in the manufacture of plant material. This plant material is then used either directly or indirectly as food. These soil storehouses are no different than man-made warehouses in that they have to be restocked occasionally or they become empty. They are depleted by the growing and removal of crops, by leaching, erosion, etc.

The plant is no different than any other complex manufacturing plant in that if any particular part or material is not being supplied in the quantity needed, the whole manufacturing process is slowed down. Fertilizers are used to restock these depleted supplies in the soil. Since soils are the resulting products of many factors working singly and in all manner of combinations, it is only natural that experimental data indicate that soils differ in their residual warehouse supplies, stockpiles, or fertilizer requirements. Just as the manufacturing plants which are operated by man vary in their needs for raw products, soils differ in their supply of plant nutrients and the plant varies in its need of different kinds and amounts of fertilizer or plant nutrients. Although there are many un-

This unfertilized plot yielded only 1,513 lbs. green weight per acre.

solved nutritional problems, from the soils viewpoint much progress has been made. In general the vast amount of experimental data have indicated the best fertilizer grades to use, the better methods of applying the fertilizer, and the amounts required for maximum production under most soil conditions.

The use of fertilizer has had a gradual development. Probably the first fertilizer material used consisted almost entirely of manure and animal waste. Typical example of this was the American Indians' practice of burying fish below each hill of corn. Bones were used early as a fertilizer material. When the phosphate rock deposits were discovered they supplemented and gradually replaced the limited amounts of bone material. In general, phosphorus has been the first limiting factor in plant growth, or soon became the hardest to get from these soil warehouses. The continued use of phosphorus alone, however, did not maintain satisfactory yield. Gradually nitrogen and potash were used to supplement the phosphoric acid. The vast amount of experimental data indicates that many of our soils need nitrogen, phosphoric acid, potash, lime, and, in many instances, some of the minor elements for good yields. The recent trends, which are based on experimental results, have shown that the nitrogen and potash in the fertilizer grades are increasing at a greater rate than phosphoric acid. The limitation of either nitrogen or potash in the fertilizer mixtures, and subsequently in the soil stockpile, would naturally limit maximum production of food and feed.

Along with the depletion of the supplies within these soil warehouses by crop removal comes a disintegration and destruction of the warehouses themselves. The granular structure of our soils has decreased as the organic matter disappeared. This loss of warehouse space reduces the ability of the soil to hold plant nutrients and causes a further need for fertilizer. Along with this loss of plant-food warehouses has come a breakdown in feeder lines used to bring the materials from the warehouses to the plant root. In soil terms this loss of soil organic matter has reduced biological activity in the soil which in turn has reduced the solvent action upon both organic and inorganic

This plot, receiving 1,000 lbs. 5-10-10 fertilizer, yielded 8,168 lbs. green weight per acre.

compounds in the soil. The soils are then not able in themselves to make as much plant nutrients available or to naturally restock their warehouses. This is just another example of the greater need for fertilizer in our accelerated use of soils to meet the present emergency needs for food.

Man has tried in many ways to overcome these losses of warehouses and supply lines or decreased amount of available plant food. He has tried to maintain the organic matter level of his soil as well as use larger quantities and more concentrated fertilizers. He also has selected or retooled his crops for a better utilization of the different kinds and amounts of plant food now found in the soil through plant-breeding methods. Man has introduced, by selections and crosses, crop varieties with genetic characteristics which enable them to grow better at the changed nutritional levels. This can be illustrated by the improved varieties of all crops with hybrid corn as a specific example.

The genetic make-up of such a plant is rather specific and permits it to produce more with a limited food supply from the soil, as well as to produce much more with heavy rates of fertilization. This may be compared to the introduction of new machinery or tools in a manufacturing plant which increases the efficiency of labor. Less labor can produce more, and more labor can produce much more. Hybrid corn gives better yields than the normal corn plants with the usual rates of fertilizer and much better yield when heavy amounts of fertilizer are used. This is especially important in times of good prices and feed shortage.

Man is, also, aiding by sprays, dusts, etc., our crop plants in their fight against insects and diseases even though the root of these problems may be nutritional. Such methods should be used to the maximum now. It should be recognized, however, that these are preservation and not production methods. Any unsatisfactory nutritional factors will still have to be corrected by the farmer through proper fertilizer practices and methods.

From our experimental evidence and field observation of farmer practices, we have arrived at a list of fertilizer grades for various crops and soil conditions. It must be recognized that these

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A fertilized clover crop such as this pays dividends in increased yield of following crop.

The Seed Production of Hairy Vetch and Other Winter Cover Crops

By Roland McKee

U. S. Department of Agriculture, Washington, D. C.

THE problems involved in the production and utilization of winter cover-crop seed are many and varied. Even the term is hard to define. In its broadest sense it can mean any crop planted in the fall which serves as cover during the winter regardless of what is to be done with it ultimately. In this article, however, the meaning will be confined to fall-seeded crops planted specifically to prevent the leaching of plant nutrients, to reduce erosion, and to add organic matter to the soil, either in the form of surface mulch or as material incorporated with the soil.

In recent years the proper recognition that crops so employed improve the soil and increase crop yields without requiring the land to be out of production for a year has created a demand for seed of such crops that exceeds the available supply. This popular interest was brought about by the need and desire of farmers to meet production goals of war crops, through the efforts of agricultural extension workers, and through the war agency programs looking to greater feed and food production.

An adequate seed supply of winter cover crops has for years been a problem for farmers using such crops for soil improvement, since regions or areas needing them most for this purpose unfortunately are not adapted to seed production. As a result, a specialized seed industry developed in one part of the country to supply seed for use in other parts. This has been especially true for the vetches and field peas.

Since the use of winter cover crops for soil improvement in normal times is motivated primarily by increased cash returns, the users of such crops have always been directly concerned with the price of seed; and the decision to plant or not to plant a cover crop often hinged entirely on such price. Consequently, the maintenance of present acreage plantings of such crops for soil improvement, or increased use, will depend upon the possibility of making seed available at a reasonably low cost.

Crops Most Used

The most extensively used winter cover crops are hairy vetch, Austrian winter field peas, and crimson clover. They are not only the crops most extensively used, but they are also among the most widely adapted. Rye and ryegrass are the only other commonly used cover crops that have as wide adaptation. Common vetch, burclover, blue lupine, monantha vetch, and sour clover are also good crops for the purpose, but their adaptation is more local. Fenugreek, purple vetch, Hungarian vetch, narrowleaf vetch, horse-beans, wild winter peas, Persian clover, etc., have a more limited use. Seed of but few of these crops can be produced in the area in which they are most needed. Austrian winter field peas, for example, cannot be grown satisfactorily as a seed crop in any part of the Cotton Belt.

Hairy vetch, which runs a close second to Austrian winter field peas in extent of use as a cover crop, is not well adapted for seed production in most of the Cotton Belt. In the northern part of this region it will in most years set seed and produce fair seed crops wherever the vetch bruchid (sometimes called the vetch seed weevil) does not interfere. Unfortunately, this insect is already present in the Atlantic Coast States from New Jersey to Georgia and recently has been found in northern Alabama and Mississippi. It has not yet been reported in states adjacent to and immediately west of Mississippi, therefore this is a possible seed-producing area for the immediate future.

Since hairy vetch is the winter legume that has the virtue of succeeding best on average low-fertility soils, its production and use are advantageous for many sections. Austrian winter field peas, like hairy vetch, are better suited for low-fertility soils than most other winter cover crops, consequently also have a wide range of adaptation.

Thus, of the two winter cover crops most widely used in the South, seed of Austrian winter field peas cannot be produced at all where it is most needed on account of climatic conditions, and hairy vetch seed can be produced in only limited sections on account of climatic conditions and the destructive vetch bruchid.

Crimson clover, the third most widely adapted and used winter cover crop, usually sets seed in abundance. Unfortunately, it is more difficult to get a stand of crimson clover than it is of most any other winter cover crop. This is largely due to the fact that the seed will germinate in 24 hours, and, if dried subsequent to sprouting, will not renew growth. Thus a light shower may germinate the seed and a short subsequent dry spell kill the seedlings. Success, therefore, hinges on a thorough preparation and firming of the seedbed and planting when moisture conditions are favorable.

Other factors influencing the production of seed of these three important crops may be mentioned. The serious damage done to Austrian winter field peas in the South by several diseases has resulted in decreased plantings. This in turn has resulted in an increased demand for seed of hairy vetch or other winter legumes that may be used as a substitute. In the Pacific Northwest, where in recent years most of the hairy vetch seed has been produced, the vetch bruchid recently has gained a foothold and is gradually increasing, with prospects of greatly curtailing hairy vetch seed production in that area. Since climate and the vetch bruchid limit the areas where hairy vetch seed can be produced successfully and economically, the prospect for an increase in hairy vetch seed is anything but bright.

What is the Answer?

Is the situation hopeless or can something be done about it? It is possible to increase hairy vetch seed production in Arkansas and Oklahoma and eastern Texas, since these states seem yet to be free from the vetch bruchid. Possibly production could be increased some in the Great Lakes States, especially Michigan where limited amounts of hairy vetch seed have for years been produced. In normal times a few million pounds of hairy vetch are usually imported annually and this may again become a source of supply.

Since there are limitations to the availability of hairy vetch seed, it may be that other crops will have to be used as substitutes or alternates. On the higher fertility soils of the South it is possible to increase the use of common vetch, and in many areas the increased use of monantha vetch, spotted burclover, blue lupines, and wild winter peas is possible. Seed of all of these crops can be produced in the South, where locally adapted, and the use of home-grown seed would have the added advantage of being economical. Seed of common vetch is produced in the Pacific Northwest and is available in quantity from that Section.

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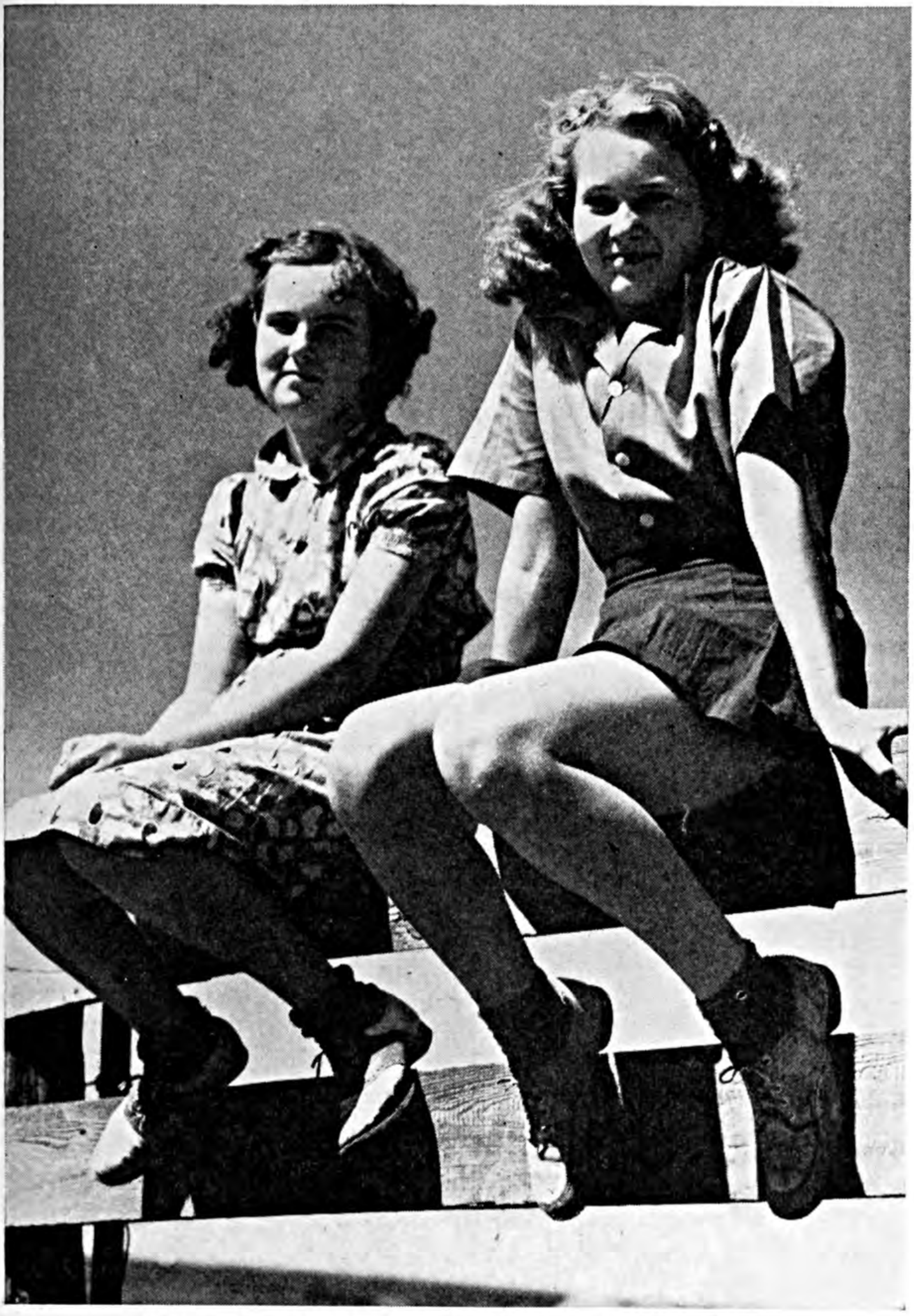
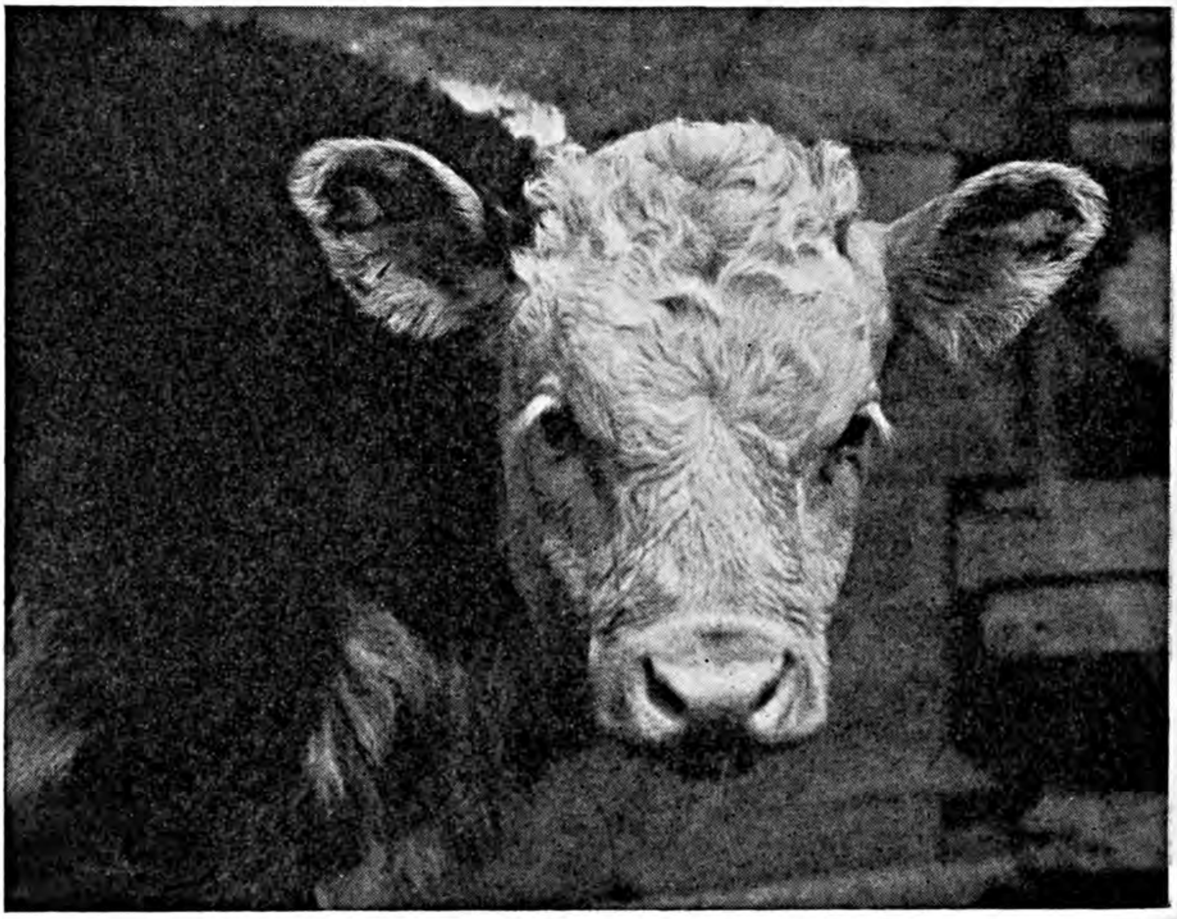
PICTORIAL

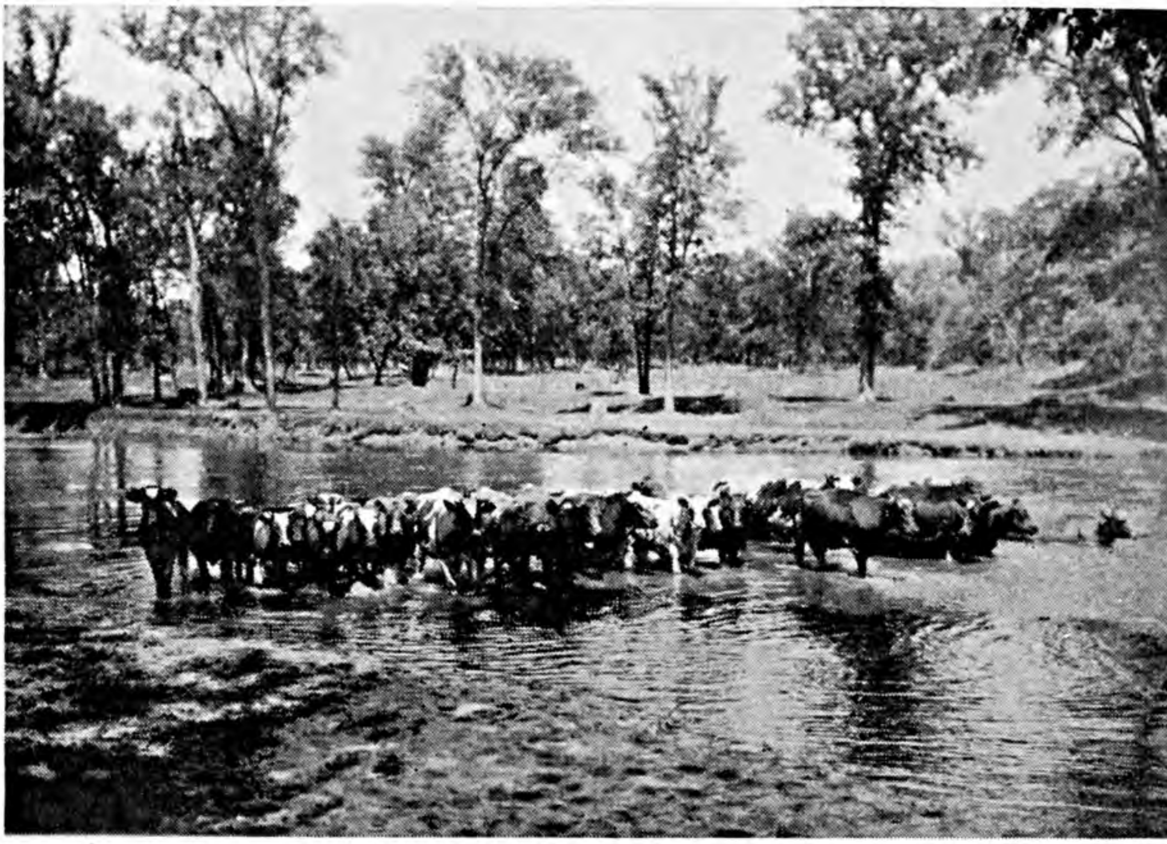


FARM GIRLS—A BRIGHT SPOT IN THE FARM LABOR PROBLEM.

SOME GOOD FARM HEADS



A LOOK AT THE FARM FRONT



Above: A good permanent pasture and stream of pure water are valuable assets to any dairyman in doing his full part in the 1944 National Milk Production Program.

Below: F. W. Tiedemann's "Pleasant Hill Farm" in Benton County, Iowa, lives up to its name. Rural landscaping has become an important project in better rural living.

The Editors Talk

A Program for the Production of Milk

An excellent program for any dairy farmer at any time is contained in the Eight-point National Milk Production Program for 1944. These eight points were worked out by the War Food Administration, the U. S. Department of Agriculture, and the State Agricultural Extension Services, in cooperation with the Dairy Industry Committee in order to help meet the high milk production goals set for 1944. They embody practices already in work on good dairy farms and their brevity, restricted to "what to do and why," should further the understanding of good dairying and prove a practical means of "fixing in mind" the fundamentals of success with the cow.

The points:

1. **Grow more legume hay, pasturage, and grain**
2. **Fertilize to increase quantity and quality of feed**
3. **Feed to avoid summer milk slump**
4. **Feed cows liberally during their dry period**
5. **Keep as many cows as feed and labor permit**
6. **Market more whole milk whenever possible**
7. **Produce good-quality milk and avoid waste**
8. **Breed for better herd replacements.**

As a sample of the "why," the publication of the program in folder form by the U. S. Department of Agriculture has this to say on Point 2:

"Much of the good pasture and hay land has been plowed up and put into grain crops. Many dairymen face a shortage of pasturage—the best feed for milk production and usually the cheapest feed.

"To get as much pasturage in 1944 as will be needed, most dairymen will find it necessary to improve the pastures they still have, and to grow some annual crop for temporary or supplemental pasture and to graze meadows.

"Very few of the dairy cows in this country have ever had all the good pasturage and good hay they could eat, day in and day out; but if pastures and hay crops were improved sufficiently to supply the necessary quantity and quality of roughage for such feeding, the use of concentrates could be reduced by one-third or more without any loss in milk production.

"Nothing excels well-rotted barnyard manure for improving pasture and hay yields. It should be used as far as it will go, and commercial fertilizers and lime should be used in the way advised by the local county agent.

"Fertilization pays on pasture and hay crops as well as on grain and row crops. Supplies of fertilizers are generally available, and applications can be made with very little labor."

Publicity given the Program has been good. It has been noted in articles in farm journals and weekly papers, in news releases from extension services, and in brief and illustrated extension circulars published by various states. Developed from the best dairy practices from all forty-eight states, the Program is designed for local adaptation, and such adaptation is seen in the publicity mentioned. For instance, Alabama's Extension circular (No. 267) gives specific instructions for achieving each point, as under Point 2 fertilizer recommendations for growing the crops mentioned under Point 1.

While necessarily organized on a long-time basis because herd improvement is never-ending, it is to be hoped that appreciable results from the Program will be realized in 1944. It is a fine piece of extension work and should be continued after the present urgency of increased milk production is lessened by the end of the war and the rehabilitation of devastated populaces.

Soil Improvement

In a recent edition of "Missouri Farm News Service," published weekly by the College of Agriculture, University of Missouri, at Columbia, Missouri, the question was asked: "To what extent is soil improvement being carried out on Missouri farms?" Dr. William A. Albrecht, Head of the Department of Soils of the University, answered the question, and while some of the details pertained only to his State, so much of Dr. Albrecht's reasoning would apply everywhere that we are prompted to repeat his answer here:

"Missouri farmers are showing their concern about the future productive capacities of their lands if the demands for limestone and all the other forms of fertilizers are any indication. Last year the demand for limestone was the highest in the history of the use of this soil treatment in the State, and fertilizer use made a similar showing.

"Unfortunately, we are not yet realizing how little fertility we are returning to our lands in the way of barnyard manure, legume green manures, limestone, and other fertilizers. Purchased fertilizers in Missouri amount to less than the equivalent of 1% of the value of the cash farm income that originates in the soil. We are running the farm plant on the belief that 1% of the income will maintain it or keep the soil factory going.

"When the ash of our common crops—the part from the soil—amounts to at least 5%, we are helping the soil by one-fifth while it is being exhausted to the extent of the other four-fifths of the crop load of fertility going out. For those crops that are more effective in animal production and in general food values, the part taken from the soil is higher and the share returned consequently so much lower.

"Such simple figures suggest that if our soils are to be productive and if we are to have crops of good service as food for animals and man from them, the fertility of the soil cannot be removed continually under intensive cultivation while we neglect our return of plant nourishment in every possible form.

"Soil maintenance for our future support calls for an investment in its upkeep in larger amounts than 1% of the farm cash return that the soil gives. The very basis of the farm business cannot be permanent with so little put back as maintenance of the very business establishment by which we live."

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920...........	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921...........	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922...........	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	...
1923...........	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924...........	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925...........	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926...........	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927...........	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928...........	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929...........	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930...........	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931...........	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932...........	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933...........	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934...........	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935...........	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936...........	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937...........	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938...........	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939...........	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940...........	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941...........	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942...........	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
April........	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May.........	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June.........	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July.........	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August.......	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September...	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October.......	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November....	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December....	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January.....	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February....	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March.......	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April........	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920...........	259	166	358	201	223	255	178	240	....
1921...........	99	187	149	136	91	135	109	103	....
1922...........	152	219	139	120	90	117	98	162	....
1923...........	215	183	121	119	124	112	103	202	....
1924...........	223	183	125	156	141	126	111	177	150
1925...........	178	161	164	196	154	172	105	162	153
1926...........	122	172	267	178	108	154	109	126	143
1927...........	128	199	190	130	122	137	101	132	121
1928...........	150	192	119	128	138	129	89	175	159
1929...........	143	179	135	135	135	117	97	162	149
1930...........	100	124	179	132	120	92	95	122	140
1931...........	61	79	104	106	77	55	82	79	117
1932...........	47	101	62	65	43	44	63	45	102
1933...........	65	124	95	68	56	66	57	57	105
1934...........	97	164	98	90	95	91	89	121	104
1935...........	94	155	71	84	119	98	89	165	126
1936...........	94	165	143	97	118	109	75	147	113
1937...........	90	191	127	105	146	122	87	140	122
1938...........	67	165	80	88	76	75	63	98	101
1939...........	70	131	98	86	73	72	58	103	109
1940...........	78	145	102	97	91	84	64	126	121
1941...........	107	184	93	108	99	95	68	162	145
1942...........	149	272	158	124	123	116	84	206	199
1943									
April........	162	154	240	205	155	139	106	213	291
May.........	162	362	274	257	160	140	106	214	253
June.........	161	548	270	253	164	141	102	215	308
July.........	158	567	240	305	167	143	100	206	315
August.......	160	369	228	315	168	144	102	236	308
September...	163	358	193	264	168	148	108	240	311
October.......	164	402	184	224	165	153	115	243	264
November....	156	428	191	202	162	156	121	243	254
December....	160	408	194	215	171	163	127	244	208
1944									
January.....	163	399	203	231	174	166	131	245	231
February....	161	241	200	241	174	166	133	244	204
March.......	161	211	197	251	176	166	134	244	191
April........	163	229	197	261	177	167	136	243	184

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11-12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16-17% ammonia, Chicago, bulk, per unit N
1910-14........	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922...........	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923...........	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924...........	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925...........	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926...........	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927...........	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928...........	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929...........	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930...........	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931...........	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932...........	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933...........	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934...........	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935...........	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936...........	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937...........	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938...........	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939..........	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940...........	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941...........	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942...........	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
April........	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May........	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June........	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July........	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August......	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September...	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October......	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November....	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December....	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January.....	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February....	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March.......	1.75	1.42	7.61	5.77	3.34	4.86	6.71
April........	1.75	1.42	7.50	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922...........	113	90	173	132	117	140	142
1923...........	112	102	177	137	140	136	147
1924...........	111	86	168	142	145	107	121
1925...........	115	87	155	151	155	117	135
1926...........	113	84	126	140	136	129	139
1927...........	112	79	145	166	143	128	162
1928...........	100	81	202	188	173	146	170
1929...........	96	72	161	142	154	137	162
1930...........	92	64	137	141	136	112	130
1931...........	88	51	89	112	109	63	70
1932...........	71	36	62	62	60	36	39
1933...........	59	39	84	81	85	97	71
1934...........	59	42	127	89	93	79	93
1935...........	57	40	131	88	87	91	104
1936...........	59	43	119	97	89	106	121
1937...........	61	46	140	132	120	120	122
1938...........	63	48	105	106	104	93	100
1939...........	63	47	115	125	102	115	111
1940...........	63	48	133	124	110	99	96
1941...........	63	49	157	151	107	112	126
1942...........	65	49	175	163	110	150	192
1943							
April........	65	50	180	163	110	144	186
May........	65	50	180	163	110	144	186
June........	65	50	180	163	110	144	186
July........	65	50	180	163	110	144	191
August......	65	50	180	163	110	144	191
September...	65	50	180	163	110	144	191
October......	65	50	180	163	110	144	191
November....	65	50	180	163	110	144	191
December....	65	50	211	163	110	144	191
1944							
January.....	65	50	211	165	110	144	191
February....	65	50	211	163	110	144	191
March.......	65	50	217	163	110	144	191
April........	65	50	214	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....
April	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....
April	119	55	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922........	132	149	141	116	101	145	106	85
1923........	142	152	147	114	107	144	103	79
1924........	143	152	143	103	97	125	94	79
1925........	156	157	151	112	100	131	109	80
1926........	145	155	146	119	94	135	112	86
1927........	139	153	139	116	89	150	100	94
1928........	149	155	141	121	87	177	108	97
1929........	146	153	139	114	79	146	114	97
1930........	126	145	126	105	72	131	101	99
1931........	87	124	107	83	62	83	90	99
1932........	65	107	95	71	46	48	85	99
1933........	70	109	96	70	45	71	81	95
1934........	90	123	109	72	47	90	91	72
1935........	108	125	117	70	45	97	92	63
1936........	114	124	118	73	47	107	89	69
1937........	121	130	126	81	50	129	95	75
1938........	95	122	115	78	52	101	92	77
1939........	93	121	112	79	51	119	89	77
1940........	98	122	115	80	52	114	96	77
1941........	122	130	127	86	56	130	102	77
1942........	157	152	144	93	57	161	112	77
1943								
April......	185	165	151	95	57	160	119	79
May......	187	167	152	95	57	160	119	79
June......	190	168	151	93	57	160	119	69
July.......	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78
November.	194	171	150	95	57	160	119	78
December..	196	173	150	96	57	171	119	78
1944								
January....	196	174	150	96	57	171	119	78
February..	195	175	151	96	57	171	119	78
March.....	196	175	151	97	57	173	119	78
April......	196	175	152	96	57	172	119	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

REVIEWS

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

Fertilizers

¶ "Fertilizing Burley Tobacco" is the title of Kentucky Extension Leaflet 63 by P. E. Karraker, R. A. Hunt, and E. J. Kinney. It is brought out that a plentiful supply of plant food is necessary if high yields of good quality burley tobacco are to be obtained, and very few soils are naturally fertile enough to supply this plant food without the addition of fertilizer. While all the nutrients are necessary for a good crop, a lack of potassium is particularly serious since it reduces the quality and often permits the development of leaf diseases. The cost of providing ample nutrients is small compared to the value of the crop.

The authors state that most of the soils outside of the Inner Bluegrass region require phosphorus, usually at the rate of about 80 lbs. of phosphoric acid per acre. Potash will be needed as a fertilizer on all except the very fertile soils or where heavy applications of manure are applied. It is stated that potassium deficiency is a common cause of poor tobacco in the State, and 40 to 75 lbs. of actual potash per acre are recommended. For applications up to 40 lbs. of potash per acre, muriate of potash is satisfactory, but on all amounts above 40 lbs. of potash, sulphate of potash should be used for the additional supply. Except on fertile soils where good legume crops are turned under or where heavy applications of manure are made, nitrogen fertilizer will be needed, usually at the rate of about 50 lbs. of nitrogen per acre. Mixed fertilizers such as 6-8-6 or 4-10-6 at about 1,000 lbs. per acre can be used to supply the nutrients required. The authors admit that the recommendations call for somewhat heavier fertilization than is commonly used in Kentucky for tobacco, but where nitrogen and potassium are needed, the small amounts of these nutrients applied in 200 to 300 lbs. of fertilizer containing 4 per cent of either are not likely to do much good, and under these conditions it really pays to use higher applications of high-analysis fertilizer. It is recommended that the fertilizer be applied in bands along the row about 3 inches deep and 3 to 4 inches from the plant. For applications of more than 800 lbs. of fertilizer per acre part of the fertilizer should be applied in bands on the bottom of the plow furrow with the remainder at planting time.

¶ Practical information on fertilizers is briefly given in Kentucky Extension Leaflet 64 entitled "How to Apply and Use Fertilizers" by P. E. Karraker. The meaning of the guaranteed analysis is given and brief comments on why nitrogen, phosphorus, and potassium are required in fertilizers, as well as what they do to the crops on which they are applied. General suggestions on the selection of the proper grade of fertilizer for various crop and soil conditions together with suggestions on methods of application are included.

"Fertilizer and Other Experiments With Pimientos," Ga. Exp. Sta., Experiment, Ga., Bul. 231, Dec. 1943, H. L. Cochran.

"Wartime Fertilizer Recommendations," Ext. Section, Agron. Dept., Iowa State College, Ames, Iowa, Agron. 4, Jan. 1944.

"Fertilizing Burley Tobacco," Univ. of Ky., Lexington, Ky., Leaf. 63, Jan. 1944, P. E.

Karraker, Russell A. Hunt, and E. J. Kinney.

"How to Buy and Use Fertilizers," Univ. of Ky., Lexington, Ky., Jan. 1944, P. E. Karraker.

"Commercial Feeds, Fertilizers and Agricultural Liming Materials," State Insp. Serv., Univ. of Md., College Park, Md., Jan. 1944—No. 189.

"Fertilizer Recommendations for 1944 Crops," Mass. State College, Amherst, Mass., Sp. Cir. 95, (Rev.), Dec. 1943, Ralph W. Donaldson.

"Fertilizers for Cabbage, Peas, and Tomatoes," Miss. State College, Agr. Exp. Sta., State College, Miss., Bul. 397, Jan. 1944, E. L. Moore and J. A. Campbell.

"The Value of Fertilizer for Oats," Miss. Agr. Exp. Sta., State College, Miss., Cir. 115, Feb. 1944, Russell Coleman and T. E. Ashley.

"Inspection of Commercial Fertilizers for 1943," Univ. of N. H., Durham, N. H., Bul. 350, Oct. 1943.

"Commercial Fertilizers for Oklahoma Crops," Okla. Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. 279, March 1944, Horace J. Harper.

"The Explosion and Fire Hazard in Handling Ammonium Nitrate as a Fertilizer," U.S.D.A., Washington, D. C., Jan. 1944, R. O. E. Davis.

Soils

¶ An interesting series of experiments studying the influence of different levels of soil acidity on the growth of vegetables is reported in Arkansas Agricultural Experiment Station Bulletin 433 entitled "Influence of Varied Soil Reactions on Growth and Yield of Vegetable Crops on Newtonia Silt Loam and Ruston Fine Sandy Loam Soils" by V. M. Watts and J. R. Cooper. In general it was found that the crops tended to make best growth at reactions near the neutral point. Crops growing on the Newtonia soil seemed to require a higher pH for optimum growth than did similar crops on the Ruston soil. The crops involved were snap beans, cantaloupes, peas, Irish potatoes, sweet potatoes, tomatoes, spinach, and watermelons. This work again shows that potatoes, which usually are grown on an acid soil, really make best growth on a neutral soil when disease conditions are not an interfering factor. Studies on the germination of the seeds of tomatoes, cantaloupes, onions, beans, peas, and spinach showed little influence in pH level on germination, but in the case of cucumbers acidity was very important, since it appeared to be associated with the development of damping-off organisms so that at pH 6 or lower germination was improved.

The nitrate nitrogen, soluble phosphorus, and potash in the sap of tomato plants growing on the Newtonia soil at the different acidity levels were determined. Nitrate appeared to increase at the higher pH values, with the optimum usually over pH 7 but under pH 8. The highest content of soluble phosphorus was usually at pH levels near or slightly below the neutral point. There did not seem to be any great influence or consistency of the effect of pH level on the potassium content of the sap.

¶ An unusual type of bulletin and one that should be very helpful locally is No. 381 of the Mississippi Agricultural Experiment Station entitled "Soil Management Practices Recommended for Tunica County," by L. A. Davidson. A generalized soil map of the County is given with descriptions of the soil groups. General discussions on drainage, erosion, organic matter, nitrogen, liming, phosphorus, and potassium in relation to the conditions existing in the County are then given. Recommended cropping systems for the various soils and brief discussions on the management of each soil type complete the Bulletin. The particular county under consideration is in the northwest corner of the State bordering the Mississippi River. On most of the soils, lime is likely to be needed and organic matter and nitrogen will have to be added. Phosphorus is likely to be deficient on the acid soils, while potassium deficiency is most likely to occur on the sandy and low terrace soils. Cotton rust frequently is found on these soils, indicating their advanced stage of potassium deficiency.

"Organic Matter in Iowa Soils," Agr. Exp. Sta., Agr. Ext. Serv., Iowa State College, Ames, Iowa, Bul. P57, Nov. 1943, A. G. Norman.

"Run-Off from Small Agricultural Areas of Dunmore Silt Loam and Related Soils in the

Limestone Valleys and Upland Section in the Southeast," Va. Agr. Exp. Sta., Blacksburg, Va., T. Bul. 90, Nov. 1943, Emanuel Azar and David W. Cardwell.

"Forest-Land Utilization in Nicholas and Webster Counties, West Virginia," W. Va. Agr. Exp. Sta., Morgantown, W. Va., Bul. 309, July 1943, E. C. Weitzell and L. F. Miller.

"The Santa Cruz Area California," U.S. D.A., Washington, D. C., Series 1935, Nov. 25, Jan. 1944, R. Earl Storie, Ralph C. Cole, Bruce C. Owen, L. F. Koehler, A. C. Anderson, W. J. Leighty, and John L. Retzer.

"The Tracy Area California," U.S.D.A., Washington, D. C., Series 1938, No. 5, Dec. 1943, Ralph C. Cole, L. F. Koehler, F. C. Eggers, and A. M. Goff.

"Physical Land Conditions on the San Mateo County Soil Conservation District California," U.S.D.A., Washington, D. C., Phys. Land Survey No. 33, 1943, Robert S. Ayers.

"The Upper Musselshell Valley Area Montana," U.S.D.A., Washington, D. C. Series 1939, No. 1, Nov. 1943, F. K. Nunns.

Crops

¶ The Canadian Department of Agriculture each year makes a survey of plant diseases reported throughout the Dominion. In the "Twenty-Second Annual Report of the Canadian Plant Disease Survey, 1942" compiled by I. L. Conners and D. B. O. Savile, in addition to the reports of occurrences of diseases caused by organisms there are numerous reports of diseases or pathological conditions due to nutrient deficiencies. These are concerned mostly with potassium, manganese, boron, and magnesium. Potash deficiency is reported as being widely observed on clover growing in Prince Edward Island, while in another case it is reported that a grower who included potassium chloride in a spray, in the belief it would be helpful in retarding ascosphore development, damaged the foliage. Manganese deficiency on oats was reported in Quebec and magnesium deficiency on beans in New Brunswick. The reports of boron deficiency are numerous, except in those places where the use of boron has become so general as to prevent the development of deficiency symptoms. The crops on which boron deficiency is reported include mangels in Ontario; beets and cabbage in Quebec; cauliflower, celery, turnips, and apples in several provinces; lettuce in Prince Edward Island, and potatoes in New Brunswick.

¶ Suggestions on the control of cracking of sweet potatoes are given by L. G. Willis in North Carolina Agricultural Experiment Station Special Circular No. 1 entitled "Apply Borax to Improve Quality of Sweet Potatoes." Difficulty has been experienced by growers in this State when the crop was grown on fertile soils, and especially those that were well limed. Professor Willis found that the use of borax prevented cracking of the root and in addition improved the general quality of the sweet potato. This improved quality was in flavor and texture. It is suggested that where cracking has been bad in the past, 10 lbs. of borax per acre be used with 15 lbs. suggested on the heavy soils. Where the trouble has not been serious in the past, 5 lbs. per acre are recommended. The possibility of obtaining beneficial results by using borax at the rate of 1 ounce per 500 square feet in the beds also is suggested. Work to date indicates that much better results are obtained if the borax is applied previous to planting rather than as a top-dressing after the crop is up. Warning is given that heavy rates of application may be detrimental.

¶ "How to Fertilize Corn Effectively in Indiana" is the title of Bulletin 482 of the Purdue University Agricultural Experiment Station. In this, G. D. Scarseth, H. L. Cook, B. A. Krantz and A. J. Ohlrogge present their findings and conclusions in a rather unusual manner. Actual case histories of experimental fields over a three-year period covering very dry years and years of ample rainfall are given, and conclusions are drawn from these various cases. The teachings are then combined to form the general conclusion.

It is pointed out that at present in Indiana, nitrogen, phosphate, and potash are the nutrients most likely to be limiting in the production of corn. Lime and magnesium are usually taken care of in liming, sulphur is usually added in abundant quantities as a component of other fertilizers, and boron is usually sufficient in the small quantities needed for corn on the acid soils in Indiana. The need for boron appears to be most noticeable on the heavily limed and alkaline soils, and the authors conclude that eventually this element also will be widely needed. In the Bulletin at hand, however, only the nitrogen, phosphorus, and potassium are considered. It is pointed out that the quantities of these nutrients required to make a 100-bushel crop would be 1,300 lbs. of a 10-10-10 fertilizer per acre, allowing for the usual fixation of about two-thirds of the phosphate added. When an ordinary application of 100 lbs. of a 3-12-12 fertilizer is given, over 90 per cent of the nutrients must come from the soil supply, if a 100-bushel crop is to be made. The authors state that therefore the ordinary fertilization can be considered only as a starter fertilizer and that if large yields are desired on ordinary soils, extra plant food will have to be applied. They also indicate that in the long run nutrients to replace those taken from the soil and not returned in the form of manure or crop residues will have to be added in fertilizers if the fertility of our soils is to be maintained.

Many interesting case histories are presented illustrating responses to applications of various combinations of plant food supplied in different ways. The importance of a proper balance of all three nutrients if maximum results are to be obtained is shown. An unbalanced fertilization not only may not give maximum yield, but may actually depress yields under some conditions by stimulating extra plant growth in the early part of the season and exhausting the available nutrients in the production of the plant so that nothing is left over for producing grain.

Extra plant food in the form of fertilizers such as 10-10-10 usually gave best results when applied in bands on the bottom of the plow-furrow. Broadcasting the fertilizer before plowing tended to mix it through the soil too much and did not permit its most effective utilization by plants. In a dry season with the fertilizer near the surface, the nutrients would tend to be above the zone of soil in which the roots could function. Surface application of fertilizer in a wet year is likely to result in stimulation of grass and weed growth which will be difficult to control if wetness prevents working of the soil. It would thus appear that deep placement of fertilizer is likely to give better results in years of unusual dryness or wetness. In years of favorable rainfall well distributed, the placement of the fertilizer is not so important. Of course, it is impossible to tell what the distribution and amount of rainfall will be when the corn is planted, so it would appear to be advisable to apply the fertilizer in bands on the bottom of the furrow. It is recommended that along with this fertilization, 100 lbs. of fertilizer at planting time be applied to give the corn a start. The omission of the starter fertilization results in a slow growth during the early part of the season. When the corn roots eventually get down to the fertilized zone, the plant will usually forge ahead quickly and largely overcome the effects of the slow start, but it usually is desirable that the rapid early growth be obtained.

The residual effects of the heavy application of fertilizers were highly beneficial on soybeans and oats.

While the heavy applications of fertilizer increased the cost of fertilization, increases in yields more than sufficient to pay for the added cost of the fertilizer were obtained and the favorable residual effects would be added to this.

The general conclusions are that in a good rotation of corn, legumes, and small grains, properly limed and with 300 to 400 lbs. of fertilizers such as 3-12-12 or 0-12-12 per acre used on the grains so that the ordinary corn yield was 70 to 80 bushels per acre, 200 lbs. of 3-12-12 fertilizer per acre in the drill or 125 lbs. per acre in the hill will be satisfactory for the corn. On soils very deficient in potash, extra potash should be applied for the small grains. If corn yields are only 50 or 60 bushels per acre, an increase of 15 to 20 bushels may be obtained by the use of about 400 lbs. of 10-10-10 per acre plowed under, in addition to the fertilization at planting time, provided other factors are not limiting the growth of the corn. On poor soils where the yield is only 30 or 40 bushels of corn per acre, 800 lbs. of a 10-10-10 fertilizer per acre in addition to the fertilization at planting time are recommended, the heavy applications being placed on the bottom of the furrow. In cases where straw or carbonaceous organic matter is turned under on soils known to be high in phosphate and potash, 300 to 400 lbs. of nitrogen fertilizers such as cyanamid or ammonium sulphate per acre should be plowed under. On black soils and those deficient in potash, 200 lbs. of muriate of potash per acre should be plowed under in addition to using the ordinary fertilization at planting time. It is pointed out by the authors that by following the above practices greatly increased yields of corn can be obtained in a much shorter period of time than is required to gradually build up the fertility of the soil by moderate applications of fertilizers in the rotation.

Numerous excellent colored illustrations throughout this Bulletin add greatly to its attractiveness and very effectively emphasize many of the facts.

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Economics

A helpful and highly practical almanac for farmers in North Carolina has been compiled by R. W. Shoffner, H. B. James and C. B. Ratchford in "North Carolina Farming Guide," issued as North Carolina Agricultural Extension Circular 263. Suggested work and plans on the farm are given for each month of the year. These are broken down into the various phases of farming operations such as field crops, fruits and vegetables, livestock, poultry, and where desirable, further subdivided by sections of the State. In addition to a great deal of helpful information and valuable suggestions and recommendations, numerous tables which cover spray schedules, units of measurement, feeding values, rates of seeding, and other similar material are included. This booklet with its timely and helpful hints and suggestions should be in the hands of every farmer of North Carolina and will also be found useful by farm advisers in other states.

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Ploughs and Politicks

(A Book Review)

AN interesting and significant contribution to colonial Americana and history of early American agriculture has been written and compiled by Carl Raymond Woodward in Ploughs and Politicks (Rutgers University Press, New Brunswick, N. J., 1941. $5.00.) The author was attempting to establish the location of the farm in Burlington County, New Jersey, which historians and biographers claimed Benjamin Franklin owned. In this search, by fortuitous circumstances, there came into Mr. Woodward's hands an old English agricultural book containing numerous references and notes on American agriculture before the Revolution. Further search showed that these notes were by Charles Read, an important local figure in the pre-Revolutionary New Jersey. They established rather definitely that the farm allocated Benjamin Franklin by historians really was that of Charles Read. Out of this old agricultural book and notes, and further search among old records, the author has fashioned this interesting book.

The first half of Ploughs and Politicks is devoted to a biography of Charles Read, while the second half is a compilation of his agricultural notes with numerous enlightening commentaries by the author. Charles Read was a remarkable character, who participated in an unusually large range of enterprises, any one of which could well have taken the entire energies and lifetime of a man. He was a merchant, farmer, ironmaster, soldier, politician, jurist, and statesman. He was no dilettante in these activities, except possibly in his soldiering. In addition to numerous minor political offices, he was Secretary of the Province, and Acting-Governor for a while, Speaker of the Assembly, Indian Commissioner, Chief Justice of the Supreme Court, and apparently the most influential and important political figure of New Jersey in the period just prior to the Revolution. He was an active and successful business man with a deep interest in agriculture. On his farm he conducted numerous experiments and made many significant observations which he carefully recorded with the thoroughness of a scientist. The end of this brilliant career was marked by failure, tragedy, and oblivion.

Mr. Woodward has arranged the agricultural notes into chapters by subject matter. The titles of the seven chapters are The Husbandry of the Soil, The Husbandry of Plants, The Husbandry of Animals, The Husbandry of Bees, Farm Structures and Farm Implements, The Husbandry of the Household, and Fisheries. Much attention was given to the use and care of manure, to liming, crop rotation, the growing of such legumes as alfalfa, clover, sainfoin and trefoil for hay and seed, buckwheat, corn, wheat, millet, rye, fruits, most of the vegetable crops we now know and many crops no longer thought of in connection with New Jersey agriculture such as rice, indigo, millet, hemp, and flax. Calculations on the production of animals, and how to care for and feed them are given. Reflecting lack of modern refrigerating appurtenances, directions are given for summer curing of meats, the conversion of milk to cheese products, and the destruction of skippers in a cheese. The chapter on bees shows the importance attached to them in colonial times. Many practical and amusing suggestions are given in the chapters on farm structures and household economy. Recipes are given for making various dishes and drinks, soaps, clothing, and the safe removal of skunks from the cellar.

The book is written in an interesting and readable style, and is well printed and bound. It can be recommended for reading on history and agriculture. It cannot help but impress the reader with the fact that our forebears knew considerable about agriculture, even subjects we are likely to pride ourselves with developing, but which perhaps we are only rediscovering or refining.

Southern Crops Show Need of Potash

(*From page* 17)

plots ripened evenly, while the untreated plots had a tendency to yellow around the edge of the leaf before the leaf ripened in the center. Two of the farmers reported that the leaves on the treated plots would not wilt down nearly so soon in the heat of the day as the untreated plots. On the farm of V. L. Anderson we could find no difference in the treated and untreated plots. However, the field has been heavily manured for five straight years. Three of the farmers using potash were sold on the results."

From the Assistant County Agent in Jefferson county comes this report: "Applications of potash made on tobacco were on land in a high state of cultivation on which stable manure had been applied and on which an application of complete fertilizer had been made. The results were particularly noticeable in the continued greenness of the lower leaves on the stalks and the uniformity in maturity of the whole plant."

The Assistant County Agent in Houston, a Middle Tennessee dark fire-cured tobacco county, writes: "Check—Poor Crop—contained very little oil and about 15 per cent of crop was left in the field as being too poor to pay the harvesting cost. Potash—Yielded 50 per cent more. All was cut and contained a normal to heavy amount of oil and was a fairly heavy bodied tobacco."

Other dark-tobacco reports indicating increased yields are numerous. T. O. Hudgens reported to J. Ben Thomson, Agent in Cheatham county: "Five average tobacco plants from treated rows weighed 55 pounds green. Five similar plants from untreated rows weighed 37½ pounds."

The Agent in Pickett, an Upper Tennessee burley tobacco county, reports: "Not so much difference in yield but withstood drought much better where potash applied. Also tended to stay green down to bottom, while ripening."

M. N. Manley, Agent in Roane

county, secured some very interesting results on nine tobacco demonstrations. He reports from 100 to 450 pounds increase in yield and stated that the portion treated with potash was "much more vigorous in growth and had larger leaves. It also cured up a lighter color and showed no disease at all."

Conclusions: These demonstrations have shown clearly that: (1) At present prices, many Tennessee farmers, and in particular tobacco growers, are not using sufficient quantities of potash for the most profitable production; (2) Soils formerly found to be well supplied with available potash for the production of our more common field crops may now be deficient, and on such soils the deficiency is related to the cropping history; (3) As potash becomes more important in the fertlizer program in Tennessee, the methods used by farmers for applying the material to crops must be improved to avoid seed injury and consequent negative results even where potash deficiency is serious.

More About Soybean Fertilization

(*From page* 10)

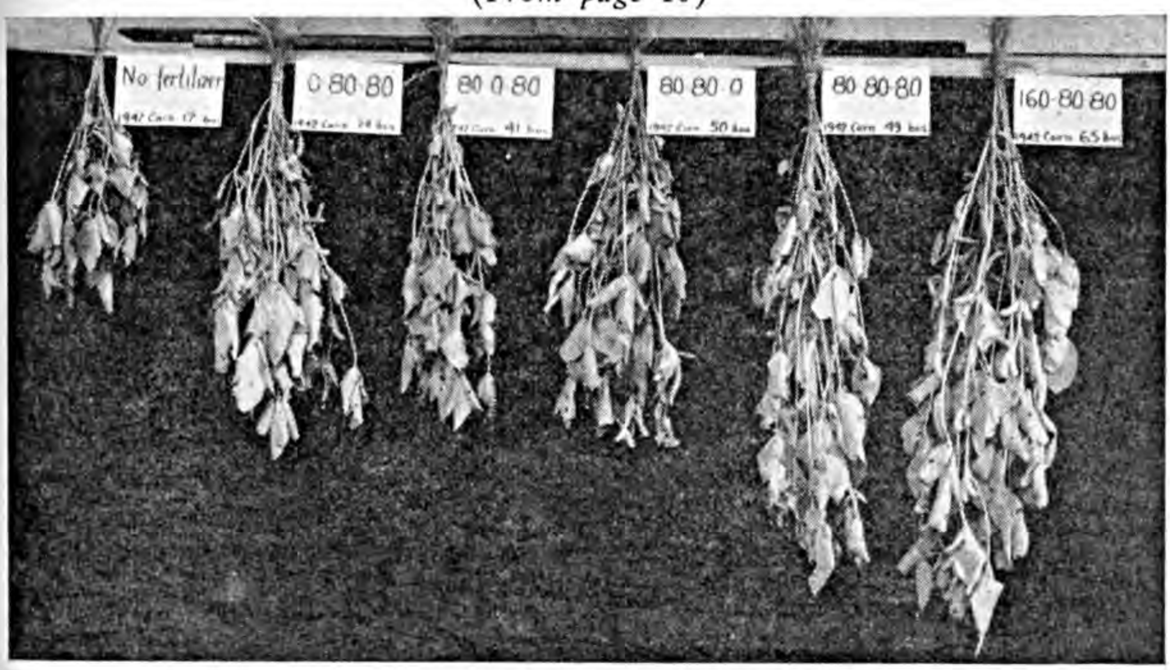

Fig. 3. The residual effect of fertilizer plowed under for the preceding corn crop on the growth of soybeans in 1943. Vigo silt loam soil, Cloverdale, Indiana. (See Table 6 for details of treatments.)

plots received three tons of ground limestone per acre and were then plowed and planted to Dunfield soybeans in order to determine the effect of the residual corn fertilizer on soybean yields.

During the 1943 growing season, considerable differences in the growth of the beans on various plots were evident. Some of these differences are seen in Figure 3 which shows 10 plants selected at random from various plots on September 11.

A comparison of the 1943 soybean yields with the 1942 corn yields and fertilizer treatments (Table 6) indicates a considerable response in bean yields to plant food left over from that applied to the preceding corn crop. The maximum yield obtained in 1943 was 22.4 bushels per acre (plot 6) where 2,000 pounds of 8-8-8 per acre were placed in the plow furrow for corn. This is almost double the yield of 11.6 bushels which was obtained on the unfertilized check plot (plot 1).

Thus, here again we have considerable evidence that soybeans are very capable of utilizing plant food remaining after heavy applications made to the preceding crop.

TABLE 6.—THE RESIDUAL EFFECT OF FERTILIZERS APPLIED TO CORN IN 1942 ON THE YIELD OF SOYBEANS IN 1943. VIGO SILT LOAM, VIRLEY GREENLEY FARM, CLOVERDALE, INDIANA.

Treatment	Pounds of N, P_2O_5 and K_2O applied on the plow sole [2]	1942 corn yields [1] (bushels per acre)	1943 soybean yields (bushels per acre)
1.........	None	17.3	11.6
2.........	0– 80– 80	13.9	15.0
3.........	40– 80– 80	34.4	19.8
4.........	80– 80– 80	45.3	16.6
5.........	160– 80– 80	63.7	20.0
6.........	160–160–160	70.3	22.4
7.........	80– 0– 80	41.4	14.0
8.........	80– 80– 0	50.5	16.2
9.........	80– 80– 80 [2]	35.4	21.0
Significant difference....		10.8	3.0

[1] Corn received a starter fertilizer of 100 pounds per acre of 3-12-12 in the row.
[2] The treatment 9 fertilizer was broadcast and plowed under for the corn.

Summary and Conclusions

From the above data, it is shown that: (1) the soybean crop can be fertilized directly, and (2) this crop has the ability to recover plant food which remains in the soil after heavy fertilization of the preceding crop, usually corn.

Therefore, our recommendations for fertilizing soybeans in Indiana include:

1. Lime all acid soils at the rate recommended for red clover. Do not attempt to grow soys on acid land without lime. Inoculate all soybean seed.
2. Where soybeans are drilled in rows for cultivation, apply 150 pounds per acre of 0-20-20 or 250 pounds 0-12-12 in the row with a divider fertilizer attachment.
3. On soils low in productivity, where corn yields average less than 40 bushels per acre, plow under 300 pounds per acre of 0-20-20 or 500 pounds of 0-12-12.
4. On potash-deficient soils, plow under 500 pounds per acre of 0-9-27 per acre.

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The Use of Fertilizer in Maryland

(*From page* 24)

fertilizer grades are averages and there may be many instances where the grade recommended is not the best one to use for a specific condition. However, for the majority of cases the grades recommended have proven to be quite satisfactory. There have been times such as in 1942 and 1943 when, because of shortages of nitrogen and potash, the most suitable grades may not have been recommended. Our present appreciation of the need for food and feed crops indicates that this may not have been the best way out of this difficulty. It appears now as if we should have insisted that all recommendations be based on experimental evidence and that more stress should have been put on maintaining production of the essential fertilizer materials. If the increased demand for feed and food is to be met, the safest course would seem to be to get on the basis of research recommendations as quickly as possible and stay on it.

Along with fertilizer grade recommendation for specific crops is given the quantity per acre to use. This was based on experimental evidence accumulated over a long period of years and for the soils best suited for the respective crops. In order to arrive at some idea regarding fertilizer use in Maryland, the average fertilizer rates per acre, as near as could be estimated, and the approximate acreage for the principal crops in Maryland were assembled, as reported here in Table 1. This table contains, also, the average yield and total production for these crops in the State. It must be recognized that the average rate per acre and the acres fertilized are largely a guess, because there is no way in which these can be accurately determined. However, the assumed rate should not be too far off because the total tonnage for the different grades obtained by these calculations is very close to that reported by the control chemist as sold.

It will be noted that the general field crops and pasture, or the crops which are used largely for animal food, have not been extensively fertilized. Animal food could be greatly increased by fertilizing more acres as well as by using more fertilizer on the acres already fertilized. The crops which produce food for man are seldom planted without fertilization, or they follow a heavily fertilized crop such as lima beans following peas. Even these crops, on the average, are not fertilized with anywhere near the maximum for the best production as indicated by experimental tests. It would seem as if the food and feed production in Maryland could be greatly increased by the use of more and better fertilizer.

In order to have an estimate of how much food production might be increased by a better use of fertilizer, the same crops as used in Table 1 are used for Table 2. In the latter table, these crops are supposedly treated with better grades and greater quantity of fertilizer. Conservative yields, as obtained from experimental tests, are used as the average yields and to indicate the total food production. In some cases the acreage figure has been changed to correspond both with the farmer's crop preference and his soil adaptation or a return to normal soil uses instead of the crop-control basis. It can be noted that the anticipated returns by such practice should produce much more food for both man and animal.

TABLE 1.—THE CROP ACREAGE, ACRES FERTILIZED, AMOUNTS OF FERTILIZER USED, AND YIELDS OF THE IMPORTANT FEED AND FOOD CROPS OF MARYLAND

Crops	State acreage	Probable acres fertilized	Probable plant food used per acre (pounds)	Average State yield in bu. or tons	Total production for the State bu. or tons
Corn	454,000	204,000	40	36.0 bu.	16,343,000
Barley	86,000	83,000	54	27.5 bu.	2,365,000
		8,000[1]	20(N)	6.0 bu.	48,000
Wheat	307,000	240,000	50	19.5 bu.	5,986,000
		10,000[1]	16(N)	5.00 bu.	50,000
Soybeans	100,000	60,000	55	15.5 bu.	1,550,000
Pasture	200,000	60,000	50	0.60 tons	120,000
Beans, lima	5,700	2,400	110	0.57 tons	3,250
Beans, snap	17,500	17,000	143	1.50 tons	26,250
Peas	15,500	15,000	120	0.60 tons	9,300
Potatoes	19,000	19,000	200	103.0 bu.	1,957,000
Sweet potatoes	8,000	8,000	270	180.0 bu.	1,440,000
Sweet corn	50,000	50,000	84	2.30 tons	115,000
Tomatoes	70,000	70,000	147	5.00 tons	350,000

[1] Spring top-dressing.

TABLE 2—THE INFLUENCE OF ADEQUATE FERTILIZATION ON THE EXPECTANCY IN CROP PRODUCTION OF THE IMPORTANT FEED AND FOOD CROPS OF MARYLAND

Crops	Acres which may be fertilized	Suggested pounds of plant food per acre	Average expected yield per acre	Probable total food production	Probable increase in food produced	
					bu. or tons	Percentage
Corn	480,000	60	42.0 bu.	20,160,000	3,817,000	23
Barley	70,000	70	32.0 bu.	2,240,000	−125,000	
	30,000[1]	20(N)	6.0 bu.	180,000	132,000	
					7,000	0.3
					55,000	2
Wheat	340,000	60	23.5 bu.	7,990,000	2,004,000	33
	160,000[1]	20(N)	5.0 bu.	800,000	800,000	
					2,804,000	47
Soybeans	100,000	77	18.0 bu.	1,800,000	250,000	16
Pasture	200,000	100	0.90 tons	180,000	60,000	50
Beans, lima	6,000	143	0.63 tons	3,790	540	17
Beans, snap	17,500	176	1.65 tons	28,875	2,625	10
Peas	15,500	160	0.70 tons	10,850	1,550	17
Potatoes	22,000	250	110.0 bu.	2,420,000	463,000	23
Sweet potatoes	9,000	288	190.0 bu.	1,710,000	270,000	19
Sweet corn	50,000	126	2.50 tons	125,000	10,000	9
Tomatoes	70,000	210	6.00 tons	420,000	70,000	20

[1] Spring top-dressing.

These heavier rates of fertilization are not believed to be impracticable, as there are many farmers who are using as much as twice the quantity of fertilizer suggested in this table for some of these crops. Of course, it must be recognized that some farmers, because of their management practices, equipment, and experience, are in better position to use heavier rates of fertilization than other farmers. Probably there are many farmers who could not and should not use the fertilizer rates suggested in Table 2. However, under the present conditions many farmers could use advantageously some fertilizer where they are using none at the present. From the food production standpoint many farmers could increase the quantity used per acre very satisfactorily. It is necessary to point out here that many farmers already fertilizing liberally should not use more fertilizer per acre than they are now using unless they modify their methods of application. If the fertilizer is applied in the row, as is usually the practice, the quantity per acre should not be increased unless by means of split applications. The results of fertilizer tests indicate that it is probably better to apply one-half to two-thirds of the fertilizer in a band on the plow sole or broadcast before plowing and plowed down, with the remainder in bands at each side of the row especially when heavier than normal rates per acre are used.

The amount of plant food given in Table 1 amounts to approximately 136,000 tons of fertilizer. The suggested tonnage as shown in Table 2 is approximately 296,000 tons. The largest increase in fertilizer usage would be for pastures, corn, and small grains or animal food. These three crops probably could use very economically for greater food production twice the amount of fertilizers now used. The man-food crops would probably respond profitably to the use of approximately 50 per cent more fertilizer. Some might question the advisability of Maryland farmers trying to use 100 per cent more fertilizer; however, it does not seem unreasonable to expect that the Maryland farmer could use 50 per cent more fertilizer under the present emergency conditions if it were available to him.

As is characteristic where prices are good, the Maryland farmer has automatically increased his fertilizer use every year since 1940. This increase has been approximately 10 per cent each year. This has no doubt accounted for the favorable production in Maryland even under some very adverse weather conditions. Unfortunately, during the last two years the farmer has not been able to obtain the fertilizer grades experimental evidence has indicated he should use, and oftentimes not the quantity he desired. It is believed that he will be able to meet his quota of food and feed production and probably increase it even with his limitation in labor and machinery if he is able to secure a sufficient quantity of the desired fertilizer grades. Experience has shown that the farmer will generally arise to the demands of the occasion if given a chance. The most feasible way for him to do his part now would seem to be through the use of more and better fertilizers, provided they are applied in such a manner as to insure their most efficient utilization by farm crops.

They Who Work on These Crops

(*From page* 20)

upon to do a large share of the harvesting may require a second consideration of what wages to offer.

Apparently even more vigorous efforts will be required to get as many as will be needed for the farm work this summer and fall, for many of the boys who helped last year will have gone into the armed services. Last year's experience provides some basis for estimating the size of the task we face and the most likely sources of the extra help.

The largest group of seasonal workers will evidently come from housewives, students, and older men who

These boys got time off from their studies to help nearby farmers plant their crops.

were not working anywhere for pay in midwinter. But many of the boys in this group will go into the armed forces instead.

Special recruiting programs may be necessary to bring out more of the women who are now doing only their housework and more school girls. These two groups probably offer the largest source of labor for fairly short periods. Victory Farm Volunteers will undoubtedly try to bring even more youths than ever before into the farm working force.

Local townspeople may form another promising group. Emphasized campaigns to enlist them for short but critical periods of the harvest in certain areas may be necessary. Men and women, boys and girls, who give their vacations and other short periods to farm work may help a lot, particularly in localities where highly perishable crops are being harvested.

Seed Production of Hairy Vetch and Other Winter Cover Crops

(*From page* 26)

In considering the possible need for winter cover crop seed, it should be pointed out that but a small fraction of the cultivated acreage in this region is planted to winter cover crops at the present time. If seed were available in greater quantity and at lower prices, the picture would doubtless change. To encourage the extended use of cover crops in the South, where winter cover crops are now most used and most needed, cheaper seed from outside sources or increased local production seems necessary.

Production of winter cover-crop seed in the South will have to be limited to the few crops that mature seed early and thus avoid unfavorably hot weather. Blue lupines, wild winter peas, crimson clover, monantha vetch, narrowleaf vetch, and spotted burclover are good bets.

Spotted burclover, wild winter peas, and narrowleaf vetch have hard seed that make it possible to volunteer these crops for several years without reseeding, thus reducing the cost of seeding. When once established, spotted burclover will volunteer four good crops from one seed crop, and wild winter peas and narrowleaf vetch can be depended upon for a similar performance. An early maturing vetch that is as yet but little known, but which should receive more consideration for use in this fashion, is the so-called big-flowered vetch, Vicia grandiflora. By taking advantage of these naturally volunteering crops and paying more attention to the harvesting and storage of seed of other winter cover crops adapted to the South, this region can in good part take care of its own winter cover crop seed needs. In the Pacific Coast States and other parts of the country where cover crops are used, no serious problems in seed production are presented.

Just Doped!

(*From page* 5)

Cyrus Field and General Dodge, the former monkeying around with an Atlantic cable system, and the latter engineering the Union Pacific. Quite by accident in their maudlin maneuvers they finished a system of overseas communication on one hand and a transportation link on the other that made a steel pathway for tired European refugees to settle the continent and get comatose on its dangerous dope.

Pioneer Americans were great talkers, especially the women, but they had to have stout lungs and masterful larynxes to get their neighbors out of bed when the house was afire. Not being able to talk any great distance cost them a lot of shoe leather and fried chicken from frequent visiting around. So as to avoid this overhead and make for quicker dating and easier gossiping, a feeble-minded dopester named Alexander Graham Bell devised a method of conveying speech and sound by electricity. Other dopes took hold afterwards and set up switchboards, loading coils, and multiple wire cables to perfect this lazy American way of scattering loose talk. Silence was at last shattered in the wilderness and the hermits had to move again—all because of the nasty habit Americans had of taking sedatives.

When my progenitors came here hunting for more morphine, the land was full of quill-pen and pencil pushers and offices were cluttered with clerks and waste paper. A merchant spent hours figuring his cost accounts and it took half a dozen good penmen to carry on his correspondence with customers. But there's always some American doper on hand to do something rash, so Chris Sholes of Milwaukee teamed up with Jim Densmore, who furnished the jack to buy him cocaine, and they launched what was called a "typewriter." This led to a brace of other nuisances hatched by other drug users, such as the check writer, calculating machine, and the addressograph. Literature, such as it is, also owes much to those early opium smokers, as each whack I give to this ancient keyboard proves.

LACK of illumination was a pest to the patriots in yonder times. No end of marauders, villains, and cutthroats roamed the countryside and milking cows and currying horses were no joke in a black, old barn. Shows were pretty feeble affairs without bright spotlights, and making change in church was darned risky in dim aisles. You'd never guess that a peanut butcher running on a slow train between Detroit and Huron could smuggle enough dope to inspire a brain storm that led to manufacture of the carbon filament and the modern Mazda. But Thomas Alva wasn't the only guy with a taste for drugs, and later on came Nikola Tesla and Charlie Steinmetz, two imported specimens with a flair for dope, who established transmitting systems with alternating current enough to save heaps of eyesight and prevent many murders.

URBAN dwellers were also having their troubles with crowded tenements and slow buses. Just as they were about ready to quit and even go to Germany in desperation, along came another chap with a hankering for bromides, named Frank J. Sprague. He dipped into his stock of smoke and drew out electric traction, geared motor suspension, and multiple unit train controls, thus making suburban homes possible and healthier kids a certainty.

News was not news in early days. It was history before most folks got wise to it. Our folks went west without much reading matter except the Bible and Doc Jaynes's pain-killing almanac. It was slow work hauling hand presses so far into the hinterlands, only to be thrown into the creek by some enraged political opponent. Finally a means was found to lower costs and print more news digests and medicine ads through the invention of a fearful looking machine which only a dope fiend could have devised. So James O. Clephane, a Washington senate stenographer, and Ottmar Mergenthaler, plain mechanic, threw together a contraption which was christened the "linotype" by Whitelaw Reid of the Tribune in 1886. Wiseacres tell me that today this machine has matrices cut in seventy languages, including Sanskrit and Hindi—possibly German too, you never can tell. Thus the effects of a strong poison spreads a lot.

Two rube inventions capped the climax of this orgy of drugging. One was uncorked by Cyrus H. McCormick, a queer blacksmith gent from Virginia, replacing the scythe and the cradle in harvesting grain; and the other madcap stunt was a cheap and rapid way to manufacture smooth and barbed wire, by Ichabod Washburn of Massachusetts and Jacob Haish of De Kalb, Illinois—both contributing to the fenced range and the full stomach. So you see the farmers and their friends were not temperate either, and they hit the hooch like Hades.

OH, you could run on with a list as full of freaks as Ringling Brothers, all the scientific and mechanical marvels which madmen under the influence of this American sedative have set loose upon a suffering world. And the worst of it is that a major share of these gadgets have been adopted and used by the Elite Guardsmen themselves.

But I don't have to go back into family history to retail the effects of this pernicious doping habit on the local scene. Even in my time (which is longer back than it is forward) I can recite some of the changes that have taken place, thanks to the prevalent custom of "taking snow."

When I was in knee pants we did not have the following "ordinary" things:

On the farms—No hay loaders, tractors, gang plows, side delivery rakes, power sprayers and cultivators, corn binders and pickers, hay balers, forage choppers, fan blowers, elevators, electric motors, automatic pumps and storage batteries, motor trucks, grain combines, soil tests, and lime and fertilizer distributors.

In the homes—No electric lights and irons, refrigerators, vacuum cleaners, mechanical washers and dish washers, linoleum, telephones, radios, pressure cookers, garbage incinerators and collectors, daily mail service, bottled pasteurized milk, frozen foods, and tropical fruits.

In the schools—No library, furnace, uniform lighting, home economics, manual arts, hot lunch, supervised teacher training, and organized recreation.

Of course, no fling into the realms of change would be complete perhaps unless one told about the revolution in church and social environment, and in the field of music, art, and literature. Here too one could demonstrate nicely that America has been a retreat and a nesting place for all kinds of "irresponsible neurotics" who like their drugs far too well. But pardon me for not encroaching upon the sacred fields of metaphysics and sociology, theology and spirituality.

I hesitate to mention any such intangible and unworldly subjects within the space allotted me, and also for quite a special reason.

The Nazi mind cannot comprehend any references to the higher strata of the heart and intellect, and it's only in matters material and mundane and "practical" that we can meet them on understandable ground.

BUT I think that America need not dodge the issue which the Elite Guards raise. Our own progress in these affairs which they envy and appreciate (by this time all too clearly and forcibly), must show them that we have not been partakers of Nirvana in vain, or opium eaters for nothing. Maybe we did indulge in an American Dream, hugging it to ourselves too long while the world lost step. But as for the drug-like effect of the era after this war is over, don't lay awake fretting over it in America. There won't be any coma then. It will be realism with a rush, and then some! Plus what we have found out about our slippery relatives in Europe! And maybe that, too, will be forgotten before it should be.

So until midsummer, sometime between hay and harvest, we bid you adieu. Meanwhile, please pass the novocaine.

AVAILABLE LITERATURE

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

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

Reprints

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N-9 Problems of Feeding Cigarleaf Tobacco
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S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
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O-3-43 Indirect Nitrogen Fertilization
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V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
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THE AMERICAN POTASH INSTITUTE

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

A Few Whinnies

SO MATTER-OF-FACT

The English are a phlegmatic race. Week-ending once with an Englishman and his wife, entirely by accident, an American happened one day on the Englishman's wife in her bath. Making a hurried retreat, the American immediately sought out his host who was reading in his room, and proffered an apology. The Englishman brought his head up from his book and regarded his guest for a minute.

"Skinny old thing, isn't she?" he remarked.

Filling out an application for dependents' aid, a soldier answered "no" to the question as to whether he had any dependents.

"You're married, aren't you?" an officer asked.

"Yessir," the soldier replied, "but she ain't dependable."

"I do not like these jackets,"
Said a Wave who was rather thin.
"But," said her friend, "you get out of them
Just exactly what you put in."

Mandy: "Ah can't come to work tomorrow, Mam. Mah little boy is sick."

Mam: "Why, Mandy, I thought you said you were an old maid."

Mandy: "Ah is, but ah ain't one of them fussy kind."

MAY LEARN HOW

"Congratulations, Old Top. Just heard about you and Alice. How long have you been engaged?"

"Two weeks."

"Have you kissed her yet?"

"No, but I think I could."

It happened in one of our larger stores during the rush hour. The elevator was jammed and the cables groaned. The elevator rose slowly, and as it neared the third floor a piercing scream caused the operator to stop the car midway. All eyes were focused on a large woman in a short, seal jacket, who wore an injured expression. A small boy, not yet of school age, stood directly behind her. "I did it," he announced truculently. "It was in my face, so I bit it."

ABBREVIATED

"And where is Cadet Smith?"

"A. W. O. L."

"What do you mean by that?"

"After women or liquor."

The father of the family is in the service and has been overseas for more than a year. His two small sons spend most of their time praying for a baby sister, and their mother can't talk them out of it.

The boys insist: "It would be such a big surprise for daddy when he comes home."

"Heredity," the little boy wrote, "means that if your father didn't have any children, and your grandfather didn't have any children, you won't have any children."

'Neath the spreading chestnut tree
The village smithy squirms;
He's been eating chestnuts
And they were full of worms!

Definition of a gentleman: A wolf with patience.

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A 16mm., sound, color film depicting the early South, the results of the one-crop system, and the reclamation and conservation of Southern soils through the use of legumes and modern methods of soil management. ***Running time, 28 min. (on 1200-ft. reel).***

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- Potash Deficiency in Grapes and Prunes
- New Soils from Old
- Potash Production in America

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

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

For additional information write:

AMERICAN POTASH INSTITUTE, INC.

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Better Crops with PLANT FOOD

June-July 1944 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

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

VOLUME XXVIII NO. 6

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

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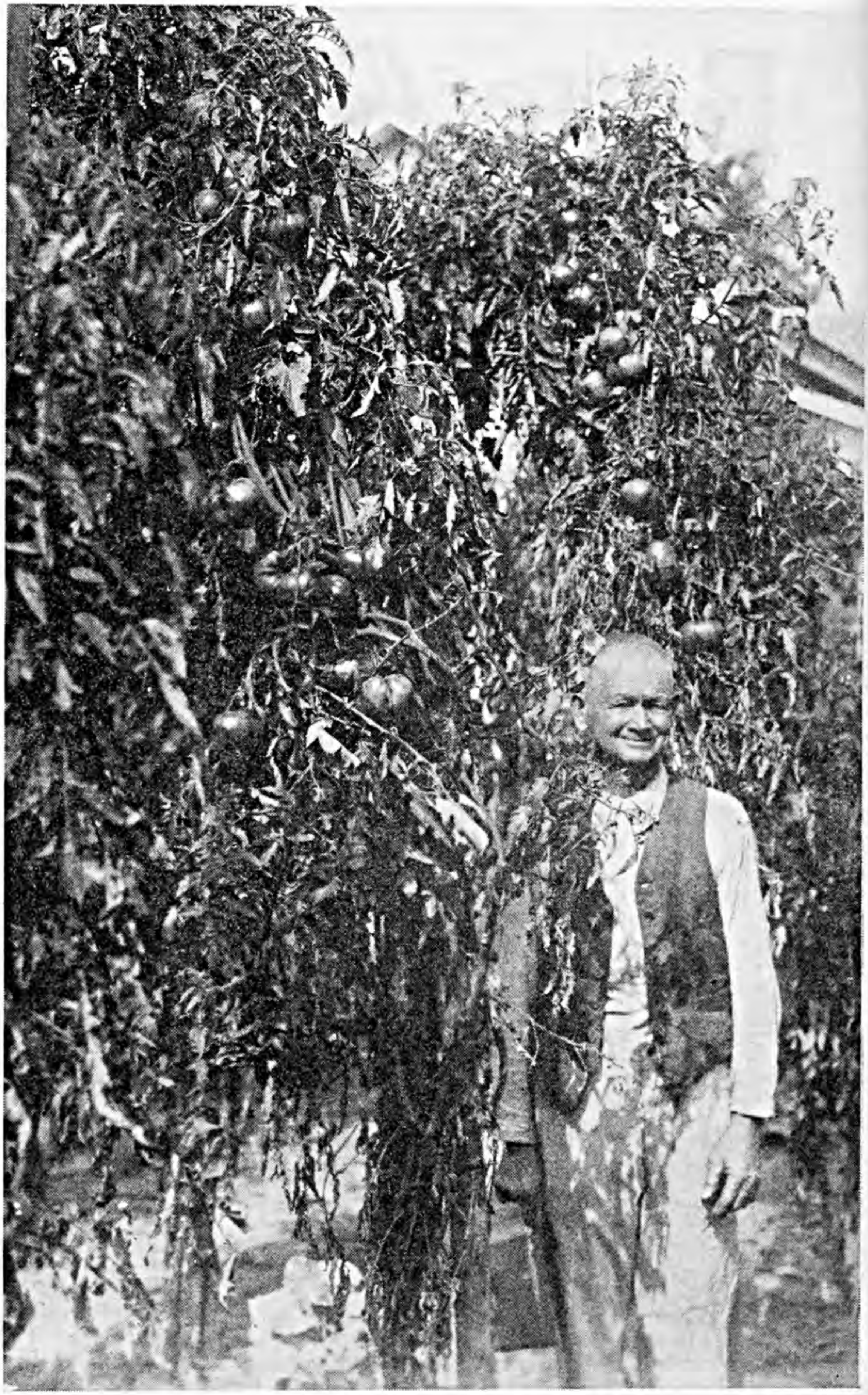

AN INSPIRATION FOR VICTORY GARDENERS.

Better Crops with PLANT FOOD

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Getting Set for—

Afterwards

Jeff McDermid

WHENEVER any of us in the family go upstairs and pass his door, we kind of halt in our tracks and almost holler out, in the old familiar lingo, "Hi there, Buddy!" But then we recollect about his being in far-off places away on the other side of that little globe he used to study in grade school and which is still standing over there on top of the set of bookshelves he made in manual arts class when Bugs Hawkins was teacher. Usually we don't spend much time in his old bedroom except when Ma is sweeping and dusting, and wiping off his long row of books, from Doc Doolittle and Huck Finn to his algebra and home radio handbook.

This spring it was pretty late in May before I got in his room to take off the three storm windows and put up the screens, so it pleased me to look out into the mulberry tree which almost taps his window sill, and find a nest of young jay birds stretching up with beady eyes and sharp beaks, all of them fluttering at a gray squirrel that was in danger of being eaten alive by the old birds on the nearest twig.

That reminded me to look for his old bird-observation notebook and feather collection, just one of a whole mess of discarded truck he put back in the closet shelf when he cleaned out the place to make room for his soldier clothes at furlough time.

Before I realized it, the time was passing too fast for me to get all my screens on, and I had burrowed into the closet and poked into a treasure chest of those no-account items which everybody should throw away but nobody does, until they get you sort of melancholy and dust-choked going through them.

Oh, of course, they're all more or less alike, these mementoes of kid days, only somewhat different than the ones we older fellows hoarded forty years ago. We didn't have those brown blouses, loose scarves, and big hats the Boy Scouts boast about; or the coils of copper wire and screws and plates and tubes for radio tinkering; and we never had such a fine array of snapshots of all the family and the pets and the neighbor kids with icecream cones; or the photos of our old Chevvy parked on Parliament Hill, Ottawa (summer of 1936), or near Bunker Hill monument and the House of Seven Gables (fall of 1937). Moreover, our kid cache held no balsa wood airplane models or mechanical drafting sets either. And jazz-record trading was unknown to us in the stamp-album days.

Browsing into this collection of stowed-away gadgets left there until his return made me kind of absent-minded and moon-eyed for a spell, and I forgot to put in screen bolts which had broken off, and I acted about as careless and dreamy as the boy used to when I set him doing some ordinary earthy job when he had just been learning to identify planes against the sky line.

SO the long and short of it was I just sat down in his old chair that Ma covered with chintz drapes, and I completely lost myself awhile, gazing out westward in the general direction of the Burma Road.

Ma was out for the afternoon working at hospital nurses' aid and bathing cranky patients, so I didn't have anyone to hold the stop-watch on me or to notice (with suspicion) how quiet I was.

Some folks can just sit, but I most always think while I'm sitting. It's a family inheritance, I guess. Thinking comes easier now when almost any old thing is apt to happen to you and yours. You won't catch any of our breed of cats mourning over spilled milk or last year's bird's nest or echoes of old serenades, however.

But a fellow meanders along in his mental processes, tuned a little unconsciously to the spot he is occupying, and weighing the consequences of this or that hazard on the troy weight scales of a feeble mind. You sort of take the past apart like an old watch-works and then see if you can use any of the assortment to patch up a plausible kind of future. All you can go by is what you have lived yourself, and that is a handicap now, because there is so much that is bound to influence public and private affairs which you never understood or took a hand in.

IN our time when we shifted gears from youth to manhood, things were relatively cut and dried for us, because the world was awful big and our spot on it wasn't connected up much with anywhere else. We could quote General George and old Ethan Allen and Davy Crockett and make out a fair rule of living without consulting any oriental oracles or continental wiseacres. If we were foolish we enjoyed it and didn't poke elbows into any quarrelsome neighbors. Maybe it was dross but some of us like to refer to it as the Golden Age, and blamed if I am not glad I was fetched up when there wasn't quite so much general hell-raising. Of course I know our indifference and ignorance was what brought out all this accumulated rash of meanness in human nature today. While we were following the motto of "live and let live," smarter nations were laying secret plots for a set of nose rings and brass collars to hog-tie us with. We should have been packing pistols instead of picking daisies.

Well, this was what began my reverie in the boy's room. I am going to keep on with my daydreams because we are all in the same boat under sealed orders amid sharks and subs. I don't aim to keep my thoughts to myself, because nothing in them will have any remote connection to army secrets and they wouldn't give the enemy anything but a good laugh.

My first postwar query sounds like this:

(1) Will the absent ones after globe-trotting and flying afar be content to come back home and sell rope, grow corn, pull teeth, and write abstracts of title?

If I can rely upon Bill Galboodle and other dads with lads in service for comparing notes, there is no doubt about the sojourners wanting to return to feather the old nest.

Here and there you'll find a rugged radical who prefers wanderlust and masculine company, bizarre adventure and shifting scenery, but mostly there is a waiting Eve on deck to greet each absent Adam, and few service men will ever surrender their hearts abroad, no matter what else they surrender.

One must allow a period of transition from mustering out to civilian pursuits, a period when the irksome duties and formal conduct of war give way to the freedom and relaxation of normal domestic life. Our boys never did quite so well at lawn mowing and spading gardens during the first few days of vacation, did they? You had to let them go fishing and swimming a while to get the fling of bare feet and unfettered existence. In the same way it isn't going to be wise for us oldsters to begin nagging the kids right away about jobs and humdrum responsibilities.

On the other hand, the solicitude and pride of parents in their returning sons are going to play a part in the outcome. I don't mean mawkish pity and coddling and mushy sentiment, which are dangerous in the extreme. I refer to the countless partnerships in trade, business, profession, and occupation which fathers and sons may continue and probably enrich and broaden because of the enforced absence.

In farming this has particular emphasis. I have seen sons discouraged and disheartened by stubborn attitudes on the part of well-meaning fathers, who refused to change crop rotations, stock management plans, and other programs of a modern kind which youth always wants to follow. Some of these barriers between old and young farmers are bound to vanish when the heroes return. The long and arduous years of hard work and little capable help have taught lessons to the dads which will induce them gladly to hand the reins over to the sons and let them make decisions.

Of course, agriculture won't begin to absorb enough of the veterans directly. We must reckon a lot on the wider use of power machinery, putting larger farms within the grasp of fewer men. But we still have our rural slums to clear, our rural roads to repair and widen and improve, our forests to manage scientifically for the soil's sake, and many other crying needs in sight to occupy the skill of hosts of country lads who cannot find a waiting plow handle.

SO the answer to myself to my first query is "Yes, they'll return and tackle the old tasks, but a whole lot depends on our attitude as well as theirs as to the final outcome."

My second projected proposition is this one:

(2) Will they be hard-boiled and worldly, and want to raise ned and squander their war bonus in riotous living and foolish extravagance?

I smile a little when I recall at this juncture how much hooch and hooray

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Fertilizer Requirements For Permanent Pastures In Alabama

By E. L. Mayton

Associate Agronomist, Alabama Agricultural Experiment Station, Auburn, Alabama

A PERMANENT pasture, in the usual sense of the term, is that area of land in a permanent sod of grass or a mixture of clovers [1] and grasses which furnishes some grazing from April to November. From one to two acres of such pasture should be provided for each animal unit.

All pastures should contain an early spring clover such as white clover, hop clover, or black medic. White clover is adapted to the productive and more moist soils in any section of the State. Hop clover is better adapted than white clover to the poorer soils, or where moisture is likely to be limited. Hop has a much shorter growing season than white; therefore, it is less desirable as a pasture plant wherever the latter can be grown. Black medic is well adapted to the lime soils of the Black Belt. It is usually present on these soils and only needs applications of mineral fertilizers to increase its growth.

Clovers are the most important part of a pasture sod because they furnish grazing earlier in the season than do the summer grasses; they are higher in protein than non-legumes, thus furnishing grazing of a better quality; and they take nitrogen from the air and release it into the soil, which increases the growth of the summer grasses. The principle of a productive pasture is the same as the production of a corn crop through the use of winter legumes.

A productive pasture must be on fairly fertile land with favorable moisture conditions. Unproductive land cannot be readily developed into productive pasture.

Since a permanent pasture should contain both clovers and grasses, the fertilizer requirements of the two must be recognized. Legume plants in general respond to lime, phosphate, and potash, while grasses respond principally to nitrogen. As has been pointed out, clover in pastures will furnish nitrogen for the production of a grass crop; hence, the major problem is to supply the fertilizers required for the successful establishment and maintenance of clovers in a pasture sod.

Experiments conducted by the Alabama Agricultural Experiment Station

TABLE 1.—THE EFFECT OF FERTILIZERS ON THE GROWTH OF PASTURE AT TENNESSEE VALLEY SUBSTATION, 1938–41

Rate per A.			Green material per A. 4-year av.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	3,940
2,000	0	0	3,989
0	600	0	4,466
0	600	75	4,884
2,000	600	0	6,457
2,000	600	75	7,622

* Superphosphate.
** Muriate of potash.

[1] In this paper the general term clovers is used to include all legume plants in a pasture sod.

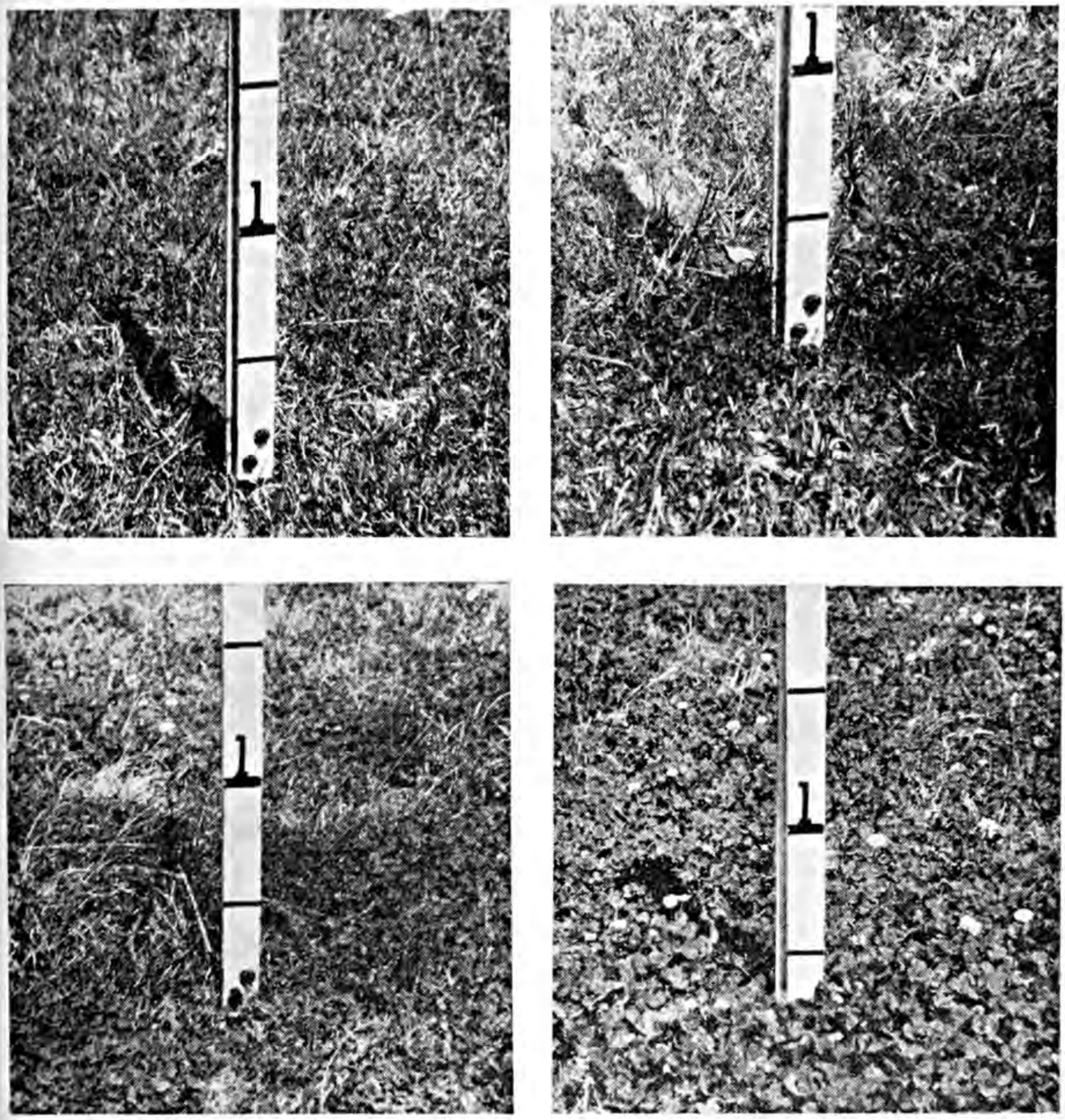

Fig. 1. The effect of fertilizer treatments on the stand and growth of white clover in a carpet grass sod: Upper left, no fertilizer; upper right, lime and potash; lower left, phosphate and potash; lower right, lime, phosphate, and potash.

in nearly all sections of the State very definitely show that lime, phosphate, and potash are necessary for the successful establishment of clover in a pasture sod. The results of some of these tests are presented. In all tests the lime applications were applied at the beginning of the experiment only. Phosphate and potash treatments were applied in the beginning and at three-year intervals thereafter.

The results in Table 1 are from an experiment on the Tennessee Valley Substation, Belle Mina, Alabama. The soil type was Decatur clay loam, which is representative of the better soils of the Tennessee and Coosa River valleys. The use of lime or phosphate alone gave very little increase in growth over the unfertilized plot; neither was there a significant increase in the amount of clover in the sod. The use of lime and phosphate increased the yield 66 per cent, and when lime, phosphate, and potash were used, the yield was almost doubled.

Table 2 is a record of the green grazing produced per acre in a test on the Sand Mountain Substation, Crossville, Alabama. The test was located on good row-crop land of that area. Fertilizer treatments in all cases increased the

TABLE 2.—THE EFFECT OF FERTILIZERS ON GROWTH OF PASTURE AT SAND MOUNTAIN SUBSTATION, 1941

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	2,400
4,000	0	0	3,400
0	600	0	4,750
4,000	600	0	5,250
4,000	600	75	5,712

* Superphosphate.
** Muriate of potash.

yield, and combinations of fertilizer materials produced more than any one material used alone. Where a lime, phosphate, and potash combination was used, a full stand of clover was obtained. However, where only lime or phosphorus, or a combination of the two was used, a full stand of this plant was not obtained.

Another experiment, located near the Tennessee line in northern Madison county, was on land representative of the so-called "Barrens" area. The soil type was Guthrie silt loam. The area was in a heavy sod of broom sedge before it was thoroughly prepared, fertilized, and seeded to pasture in the fall of 1940. The green pasturage produced the following season by some of the fertilizer treatments are given in Table 3.

TABLE 3.—THE EFFECT OF FERTILIZERS ON GROWTH OF PASTURE, NORTH MADISON COUNTY, 1941

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	3,300
4,000	0	150	4,740
4,000	900	0	7,240
4,000	900	150	11,620

* Superphosphate.
** Muriate of potash.

Lime and potash gave a slight increase in yield over the unfertilized plot. Lime and phosphate more than doubled the yield of the unfertilized plot, and the combination of lime, phosphate, and potash increased the yield three and one-half times. On the unfertilized area, almost none of the clovers and grasses seeded was established, whereas, on the lime-phosphate-potash area a good sod of clovers and grasses was established and maintained.

Six experiments were conducted in 1943 on carpet-grass lands in southeastern Alabama. In all instances the areas were fertilized and seeded in the fall of 1942. Clippings of white clover

TABLE 4.—THE EFFECT OF FERTILIZERS ON GROWTH OF PASTURE ON CARPET GRASS LAND, SOUTHEASTERN ALABAMA; AVERAGE OF SIX EXPERIMENTS, 1943

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	2,275
0	900	0	3,100
2,000	900	0	4,675
2,000	0	150	2,200
0	900	150	4,800
2,000	900	150	8,300

* Superphosphate.
** Muriate of potash.

growth from the different treatments were made in the spring and early summer of 1943; the data are presented in Table 4. These results again emphasize the necessity of supplying lime, phosphate, and potash for the establishment of white clover. When one fertilizer material is omitted, it lowers the efficiency of the other two.

While these latter experiments were conducted on sandy soils, Norfolk and similar types, in the southeastern part of the State, the results are equally applicable on the sandy soils lying north of the Black Belt, usually referred to as the Upper Coastal Plain.

TABLE 5.—THE EFFECT OF FERTILIZER TREATMENT ON PASTURE LOCATED ON RIVER TERRACE SOIL, AUTAUGA COUNTY, 1942–1943

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0.........	0	0	9,500
4,000.........	0	0	8,800
0.........	900	0	10,450
4,000.........	900	0	11,900
4,000.........	900	150	15,800

* Superphosphate.
** Muriate of potash.

An experiment was established in the fall of 1941 on a river terrace soil in central Alabama. The data presented in Table 5 are averages of the total growth for the 1942 and 1943 seasons. The clipped material from the unfertilized, lime-only, and the phosphorus-only plots was largely summer grass. The lime-phosphate plot contained some clover, while the lime-phosphate-potash plot carried a full stand of clover in the spring and early summer of both seasons.

Two experiments were conducted on the acid soils of the Black Belt in 1943; the results are given in Table 6. Here again lime, phosphate, and potash were necessary for the best establishment and growth of white clover.

Summarizing the results of all the experiments conducted, applications of lime, phosphate, and potash are necessary for successful establishment and growth of pasture clovers. The only exception to this is on the lime soils of the Black Belt, where only phosphate and potash are needed.

Applications of one ton of lime on sandy soils and two tons on heavier soils will last for at least five years.

Phosphate is the most needed element for pastures. However, it is most efficient when lime and potash are included in the application. Applications of 600 to 1,000 pounds per acre of superphosphate in the beginning will give a better stand of plants than smaller applications. The treatment may be followed with annual applica-

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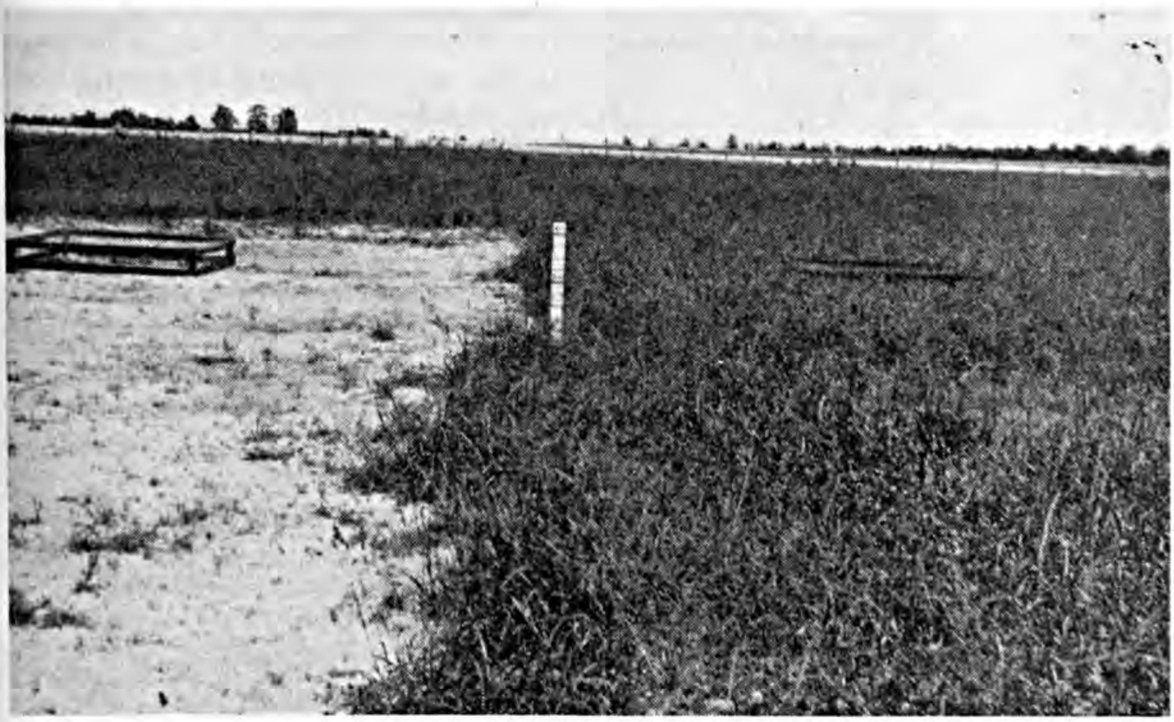

Fig. 2. The effect of fertilizer treatments on the stand and growth of pasture plants on Guthrie silt loam, Madison County, Alabama. Left, no fertilizer; right, lime, phosphate, and potash. Both plots were prepared and seeded alike.

Soil Management For Cannery Peas

By R. L. Cook

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Fertilizer in contact with the seed may delay germination and slow up early growth. Left, 4-16-8 at the rate of 300 lbs. per acre in a band beside and below the seed. Right, same fertilizer applied in direct contact with the seed, 40 days after planting.

PEAS grow best on well-drained, fertile loam, silt loam, and clay loam soils. It is desirable to have the crop mature evenly; therefore it is necessary to provide good drainage either through tile drains or a complete system of open drains or dead furrows. Uneven areas that are difficult to drain should not be planted to peas. Likewise, fields containing widely different types of soil are not suited to the production of this crop. Only on relatively uniform fields can one expect uniform maturity.

The seedbed should be firm, smooth, and moist to insure quick and uniform germination and subsequent evenness in maturity. Such a seedbed is easiest to obtain on fall-plowed land. Where peas are grown on heavy, level soils fall plowing may be recommended. Spring plowing should be as early as possible and must be followed by very thorough fitting to obtain a firm seedbed.

Soils should be kept well supplied with organic matter through the use of manures and green manures. Peas are very responsive to improved fertility. The importance of commercial fertilizer has been shown by five years of experimental work at the Michigan Experiment Station. The work was started in 1938 and has been conducted in cooperation with G. A. Cumings and staff of the Division of Agricultural Engineering, Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Department of Agriculture. The Bureau supplied a special type grain drill equipped to place the fertilizer in bands to the side of and below the seed. This drill was also used for placing fertilizer in contact with the seed or drilling it in before planting, the usual methods of application in Michigan. Studies on the effect of fertilizer analyses on the yield of the peas were included in the experiments.

Four different methods of fertilizer placement were tried:

1. Fertilizer in contact with the seed
2. Fertilizer placed in bands ½ inch

TABLE 1.—THE EFFECT OF FERTILIZER PLACEMENT ON THE YIELD AND STAND OF CANNERY PEAS ON THE VANDERMARK FARM IN 1938

Treatment*	Rate per acre	Yield—pounds per acre Stand—plants per 13 feet of row	
		Yield	Stand
"½ inch out"	300	2,060	88
"2 inches out"	300	2,285	84
Contact	300	1,096	41
No fertilizer	......	1,424	76

* 4–16–4 fertilizer used throughout the experiment. Alaska peas were planted in 7-inch drills at the rate of 4 bushels per acre. The fertilizer was placed in bands ½ inch and 2 inches to the side of the seed and 1 inch below the seed level. The data are expressed as averages of four replications that were arranged as a latin square in the field. The soil was a Brookston clay loam

to the side of and 1½ inches below the seed.

3. Fertilizer placed in bands 2 inches to the side of the 1½ inches below the seed.

4. Fertilizer drilled in deep with a grain drill before planting.

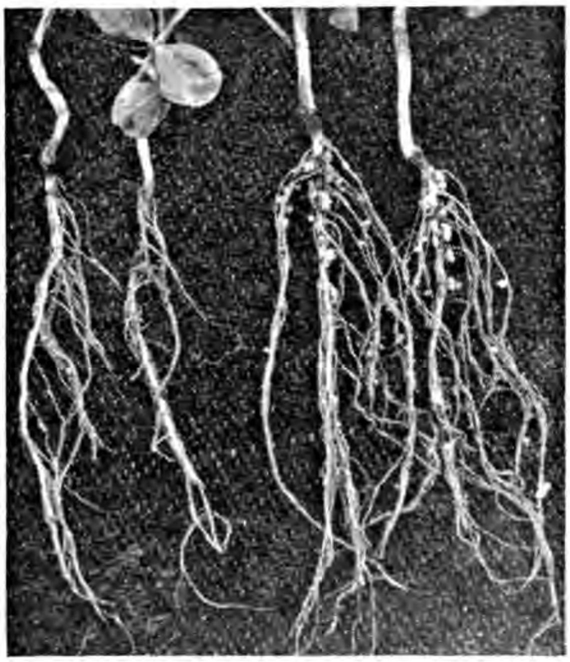
The fertilizers used in the experiments were 4-16-4, 0-20-0, 0-16-8, and 4-16-8 at the rate of 300 pounds per acre for all the mixtures and at 240 pounds per acre for the 0-20-0. The lower rate of 0-20-0 was used to obtain an amount of phosphate equivalent to that applied in the mixed fertilizers.

The rate of seeding was four bushels per acre. Early varieties were grown in 1938, 1939, and 1940 with late varieties grown in 1941, 1942, and 1943. The individual plots were large, and so the threshing was done in a commercial viner by the Clark Canning Company.

All data in the tables are expressed as averages of four or five replications and have been analyzed statistically by the analysis of variance. For all practical purposes, any treatment difference greater than 10 per cent of the average yield of the unfertilized plots can be considered significant.

The results obtained in an experiment on a Brookston clay loam soil in 1938 are recorded in Table 1. According to the data, where 4-16-4 fertilizer was placed in bands to the side and below the seed, there was a slight improvement in stand and a marked increase in yield as compared to the stand and yield on the unfertilized plots. The increases in yield amounted to 861 and 636 pounds respectively for the "2-inch out" and the "½-inch out" treatments. Where the fertilizer was placed in contact with the seed, both the stand and the yield were significantly reduced. The stand was reduced approximately 50 per cent and the yield which resulted was 328 pounds per acre less than that obtained on the unfertilized plots. The yields of the plots where the fertilizer was placed in side bands were approximately double those obtained where the fertilizer was drilled directly with the seed.

The results obtained in 1939 and 1940 are shown in Table 2. During both years, it was evident that fertilizers for cannery peas should not be placed



Fertilizer in contact with the seed may retard bacterial activity and subsequent fixation of nitrogen. Left, 4-16-8 fertilizer applied at the rate of 300 lbs. per acre in direct contact with the seed. Note very few nodules. Right, same fertilizer applied in a band beside and below the seed. Note numerous nodules.

TABLE 2.—THE EFFECT OF FERTILIZER ANALYSES AND PLACEMENT ON THE YIELD AND STAND OF CANNERY PEAS 1939 AND 1940*

Treatment		Horst farm, 1939		J. Gremel farm, 1940	
Placement	Fertilizer	Yield	Stand	Yield	Stand
½ inch out	0–20–0	1,609	293	1,780	245
½ inch out	0–16–8	2,265	285	2,000	231
½ inch out	4–16–8	2,457	280	2,060	235
2 inches out	0–20–0	1,648	273	1,540	254
2 inches out	0–16–8	1,908	287	1,980	261
2 inches out	4–16–8	2,082	277	1,960	247
Contact	0–20–0	1,475	284	1,400	233
Contact	0–16–8	1,571	255	1,600	232
Contact	4–16–8	2,140	270	1,280	184
	No fertilizer	1,905	281	1,080	248

* Yield expressed as pounds per acre and stand as plants per 40 feet of row. Surprise variety planted in 1939 and Wisconsin Early Sweet in 1940. The rates of fertilizer were 300 pounds per acre for 0–16–8 and 4–16–8 and 240 pounds per acre of 0–20–0. The soils on both farms are Brookston clay loams. Treatments were replicated four times in 1939 and five times in 1940.

in contact with the seed. If one groups all fertilizer treatments for purposes of comparison, the plots which received the fertilizer in contact with the seed yielded 1,729 pounds per acre in 1939 and 1,427 pounds in 1940. The corresponding yields for the plots where the fertilizer was placed in a side band 2 inches out from the seed were 1,879 and 1,827 pounds respectively, and where the distance out to the fertilizer was only ½ inch, the respective yields for the two years were 2,110 and 1,947 pounds. Thus it was seen that the fertilizer should not touch the seed, but that it should be as close to it as possible.

The injury to stand was less in 1939 and 1940 than in 1938. There were many plants, however, which had emerged at the time the counts were made and thus were counted as having germinated, but which were so severely injured that they never made a normal growth. In other words, the actual stand-counts shown in Table 2 understate the injury caused by the contact application of fertilizer. The severity of the injury was greatest where the fertilizer was 4-16-8 and least where it was 0-20-0.

In 1939, superphosphate alone actually reduced the yield of peas. When one considers the results from the standpoint of best method of placement ("½-inch out"), the best fertilizer that year was the 4-16-8. The increase in yield caused by the 4-16-8 over the 0-16-8 was, however, only 192 pounds per acre. While this increase would have paid for the nitrogen, the statistical analysis indicates that a difference that small may have been due to experimental error.

In 1940, when total increases in yield from fertilizer were much greater than in 1939, superphosphate was the poorest of the three fertilizers applied. Again, when one considers the "½-inch out" placement, it is noted that the increases in yield favored the 0-16-8 over the 0-20-0 by 320 pounds, but that an application of nitrogen, making the equivalent of a 4-16-8, resulted in an increase in yield of only 60 pounds. Thus it seems that the most profitable fertilizer in 1940 was the 0-16-8.

In 1941, another treatment was added to the experiment, one in which the fertilizer was drilled in 3 inches deep with a grain drill just before planting.

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Field in the Prairie that has lost all of the soil and limestone is exposed. One of the old settlers reported that this field was productive before 1860.

Knowledge of Soils Essential to South

By H. B. Vanderford

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THE cultural developments and the standards of living enjoyed by the people in an agricultural community are governed largely by the soil conditions predominating in that area. There are many economic forces that directly or indirectly influence the overall welfare of every agricultural group, but the possibilities of success or failure depend on the potentialities of the soils.

Observations and studies of soil conditions in relation to economic conditions of the people in the old Asiatic countries, as well as in our own comparatively young nation, have given credence to the old adage that "as the land is, so are the people." Theodore Roosevelt in thinking of the conditions of some of the farmers of the nation once said, "We are founded as a nation of farmers and in spite of the great growth of our industrial life, it still remains true that our whole system rests upon the farm; the strengthening of the country life is the strengthening of the nation." Many modifications and readjustments in social and economic conditions have been traced back to changes in soil conditions. Therefore, every person interested in agricultural development should acquire some knowledge of our greatest natural heritage, the soil.

As long as the farmers of this country were periodic migrators and worked on the philosophy of "wear out a farm, and move to another," very little knowledge concerning the soils was obtained. As this procedure continued, new land finally became difficult to find. Recent generations of American farmers have realized that they must remain on the same land indefinitely, and their interests in the soil and in the accumulation of useful agronomic information have increased. What one generation learned about the soil, it passed on to the next. Finally the information, gathered by the hard trial and error way, was supplemented with technical facts obtained by scientific studies. From all this knowledge it became apparent that soils could be arranged into groups for study just the same as plants and animals.

Soils are developed by nature and influenced by a number of natural forces which cause them to be extremely complicated, both physically and chemically. Since this is the case, it is understandable that soil scientists have never all agreed, and probably never will, on one definition of the term "soil." Some soil material such as sandstone or limestone is exposed to certain climatic and environmental conditions for a long period of time, and a complicated body called the soil, which has characteristics peculiar to the conditions under which it developed, results. As the conditions change, the resulting soil is modified; and subsequently this natural process gives rise to the many different soils with varying characteristics, crop adaptations, nutrient contents, etc.

From the contributions of the workers in the field of soil classification, soils are classified and identified in the field as natural bodies made up of parts, much the same as we classify animals and trees by the parts comprising the whole. The grouping and separation of the individual soils make possible a basis for accumulating valuable information that is vital to agricultural progress and development. One soil may be a good soil for the production of wheat, another good for cotton, and a third adapted for neither wheat nor cotton, but excellent for the growth of pine trees; just as some cattle are desirable for producing beef and others are suitable for the production of milk and butter. Recent experiments have shown that the supply of available nutrients in a soil not only affects the yield of crops but the percentage composition as well. Thus the health and vitality of animals are influenced by the fertility level of the soil on which they live, and everyone should be concerned with the nature of the soils that support us.

To fully appreciate the soil conditions in Mississippi, one must remember that the Gulf of Mexico once covered the entire State, along with parts of other southern states, and as far north as southern Illinois. The present Mississippi "Delta" was the center and deepest part of the old Gulf. This body of water receded, depositing marine sediments. At a later geological period when the Gulf approached its present position, Mississippi received a blanket of windblown dust which covered a large portion of the State. Hence we have three main divisions of soils in Mississippi, which are the Coastal Plain, Loessial section, and River Flood Plains or "Delta."

Coastal Plain. This is a large area covering approximately half of the State on the east from the Gulf of Mexico to the Tennessee line. The soil materials deposited in this section were sands, clays, and gravel, with the exception of the Prairie Belt. The sand and clay desposits were low in minerals and plant nutrients at the time of deposition, so naturally the soils are deficient in these materials. The excellent physical conditions of a number of the soils of the Coastal Plain cause them to be responsive to good management and fertilizer applications. The topography varies from level land to some of the steepest in the State, and accelerated soil erosion has been quite active on unprotected fields.

Prairie Belt. The prairie is a crescent-shaped and irregular area of land in the northeastern part of Mississippi and extends from central Alabama to the Tennessee line in North Mississippi. The soil material deposited in this area was soft limestone which gave rise to Prairie-like soil. In general, the soils are high in clay and the topography is gently undulating to rolling. Some of the soils are dark and resemble somewhat, in color, the soils of the midwestern prairie, while the rest developed under trees and are reddish brown and yellow. When Mississippi was first settled, the prairie was one of the most productive sections in the State and was attractive to large plantation operators. The nature of the soil and the systems by which it was managed permitted sheet erosion to take a heavy toll from the fertile land, resulting in badly dissected landscapes and many small farms.

Loessial Section. As a result of glaciation in the northern states, there was deposited over the Coastal Plain area of Mississippi a blanket of Loessial material from the River Flood Plains. The Loessial section, commonly known as the Brown Loam, extends the entire length of the State from the Tennessee line on the north to the Louisiana line on the south. The width of the area east and west varies from 30 to 60 miles. The parent material of this group of soils was made up largely of silt, which was quite fertile and high in lime. The topography varies from gently rolling to very steep and rugged. The looseness of the material on the slopes that predominate in this area causes the soils to be susceptible to severe soil erosion. The texture of the soils would fall in the silt loam class and the color is light yellow to brown. This characteristic color gave rise to the local name of the area "Brown Loam." The soils are easily worked, adapted to most any crop, and responsive to good management. The soil conditions are suitable for diversified farming, and, in some parts, the mineral content is sufficient for the production of clover and grasses required for the highest type of livestock production. In other parts, however, particularly on terrace and bottom soils, the nutrient content is low and fertilizers are required for profitable crop production.

Delta Section. The soil material found in the Delta section was brought in by the Mississippi River from the broad area of country comprising its

A Brown Loam field that has been eroded severely. Scenes like this occur frequently in this area.

A poor, eroded Coastal Plain hill producing vigorous kudzu. This is a plant well suited for eroded sandy land.

watershed. Many variations occur in the Delta soils with reference to texture, drainage, structure, etc., but in general the fertility level of the alluvial soils is higher than that which is found in the hill section. The soils are quite young and the mineral content is sufficient for all local crops. However, recent soil surveys in the Delta show that there are many soils that are developed enough to be classified as terrace or bench soils. Naturally these soils are becoming low in plant nutrients and potash and phosphorus are necessary on some of them for maximum production. There are also many soils along the eastern side of this area influenced by Brown Loam material to such a degree that they respond similarly to Loessial Bottom soils. Large tracts of rich, light alluvial soils are found in other parts, associated with tracts of heavy land locally known as "Buckshot." Since these soils were washed from the plains and slopes of the northern states, it is not surprising that nitrogen is the only nutrient that is seriously deficient. On the basis of the soil types and topography prevalent in the Delta section, the future possibilities for successful crop production seem to excel those of any other part of the State, more especially in terms of the large plantation type of operation.

Cotton is and has been the main cash crop in Mississippi for many years, just as it has been in other southern states. Long before the Civil War large plantations were established in various parts of Mississippi, but according to historical records, the majority of these large agricultural units were concentrated in the Black Prairie, Brown Loam, and Delta sections. There were only a few large plantations ever established in the Coastal Plain section and now almost all of them have disappeared. The plantation economy is still predominant in the Delta section, but is of diminishing importance in the Brown Loam and Prairie areas. The type of farming now practiced on the Coastal Plain soils is largely the small operation type of farming, with cotton and corn as the principal crops. Much of the land has been dissected by accelerated soil erosion and farmers are compelled to digress from the usual type of farming and plant critical areas to perennials crops like kudzu, sericea, and trees. These crops not only protect the soils from further erosion, but eventually provide some income for the operator. In the Prairie and Brown Loam sections, many of the large plantations have been replaced by dairying, livestock, and small farm operational units. The Delta is at present the predominant plantation area of Mississippi and may be thought of as the super-plantation section of the entire country.

The question may be asked—Why has this recession of plantations occurred from areas where they were once abundant, yet still persist in another area? Recent studies by the Agricultural Economics Department of the Mississippi Experiment Station have shown definitely that this shift from large plantations has been caused by changes in soil conditions to the extent that the producing power of the land will no longer adequately support the plantation type of farm enterprise. The Prairie section, once recognized by its broad uniform areas of land, has been severely damaged and denuded by accelerated soil erosion. There are many acres of once productive land that are now barren and limestone is exposed. These areas are said to have been productive and growing a bale of cotton per acre before 1860. The type of soil conditions now prevailing in much of the Prairie section is not suitable for plantation type of operation. Including non-prairie and badly eroded soils, the cotton production in this area on the acre basis is the lowest of any section in the State. Several large farms that have been under the supervision of one family for many years and protected from rapid erosion are still in a high state of production. The soil conditions now are more suitable for dairying and livestock production, since lime and other minerals are relatively high in the dark soils.

The Brown Loam area has suffered the same fate as the Prairie and the main reason for the disappearance of the large plantation units may also be ascribed to changes in the soil conditions brought about by progressive gully and sheet erosion. Some of the romantic traditions of the "Old South" had their origin around Natchez and many farmers in that section had incomes of from ten to twenty thousand dollars per year. Now the number of large plantations with comparable incomes are

Large, level tracts of productive soils adapted to many crops and types of farm operations are found in the Mississippi Delta.

limited and in their places are untilled areas, small operators, and cattle farms. Fortunately the depth of the soils in the Brown Loam area permits them to be reclaimed in a short time. This gives the small farmers of this section a decided advantage over those on the eroded soils of the Coastal Plain.

The Delta, with its relatively young and large tracts of productive soils, has maintained its plantations and large scale operations throughout all the social and political developments of the past three-quarters of a century. In fact, farm operations of this type have even increased since the Civil War on the alluvial soils, while such operations have declined in other sections of the State. This supports the contention that wherever the soil conditions are favorable, the large-scale operation type of farming will survive, regardless of other forces. Cotton is still the main cash crop, but large quantities of hay and feeds are also produced. No other soil area of the State approaches the Delta in natural fertility.

Need for Fertilizers

As soils develop under humid climatic conditions, there usually is a decided loss of the bases present in the soil material by the process of leaching. The organic content cannot accumulate to any great extent because high temperatures promote rapid decomposition. With this in mind, and remembering too that many soils of the southern states were developed from Coastal Plain materials which had been previously leached, it follows that large quantities of commercial fertilizers should be used to obtain economic crop production.

A survey of Mississippi shows that the use of fertilizers varies with the soil types. As was pointed out above, the greatest natural fertility levels of any soils in the State are found in the Delta, Brown Loam, and Prairie sections. Of course, since the State of Mississippi is located in a region where high temperatures prevail, all of the soils are low in nitrogen. At the present time, nitrogen is about the only fertilizer element used in the Delta section, except on the terrace soils or those that developed from material low in plant nutrients. Large quantities of nitrogen fertilizer are used on cotton, corn, and oats, all of which respond favorably. As some of the soils are cropped for a long period of time and become more developed, the use of potash and phosphorus probably will be profitable. As was stated before, some of the soils because of their environmental conditions or parent material are not only low in nitrogen but minerals as well. The grey soils along the eastern edge of the Delta and some of the terrace soils are deficient in lime, potash, and phosphate. Where these soil conditions are found, complete fertilizers are needed. There are some complete fertilizers used in the Brown Loam and Prairie sections, but not nearly as extensively as in the Coastal Plain. When the water transports the loose, wind-blown material, it seems to suffer a loss of potash. Consequently, the terrace or bench soils of the Brown Loam area respond to applications of this nutrient. Deficiency of potash in these soils gives rise to rust symptoms in cotton fields, which may be corrected by application of potash. Considerable quantities of lime, potash, and phosphate are used on pastures and legume crops grown on the highly leached soils.

The leached Coastal Plain soils which did not inherit much fertility require additional support from commercial fertilizers to produce economical crop yields. Because of the properties of the soils predominating in this section, including favorable physical conditions, the response to complete fertilizer is usually very good. However, a part of the farmer's income has to be absorbed in the cost of the fertilizer. The largest amount of complete fertilizer used in the State is in the lower Coastal Plain section. This is the natural and conse-

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Plot 24, Sanborn Field—Late July 1943. Two-year rotation of corn, wheat, with sweet clover as catch crop to be plowed under. Fifty pounds of muriate of potash per acre applied annually on the right, with both the corn and the wheat crops, but only biennially with the wheat on the left. Lime and superphosphate are applied on the entire plot. The plot had received manure, 6 tons per acre 1888 to 1913 inclusive, but no soil treatment 1914-1938.

Sweet Clover Responds To Potash Fertilizer

By Wm. A. Albrecht

Soils Department, University of Missouri, Columbia, Missouri

SOIL improvement by means of legumes is not merely a matter of distributing legume seeds and hoping that this kind of crop will build up the land. Legumes can take nitrogen from the air to add it to themselves only when they find plenty of their other fertility needs supplied by the soil. Lime has become well recognized as one need that we must satisfy by applying it to the soil. Phosphorus is also accepted widely as a soil treatment to improve legume crops. Sanborn Field,* with its carefully recorded experience, is indicating that we may well be putting potassium on the list with the lime and phosphate as an essential help to get stands of sweet clover for soil improvement.

On one of the plots where wheat had been grown for 25 years with manure applied annually, and then for the same number of years without manure, the cropping and soil treatments were changed in 1938 to a 2-year rotation of corn and wheat with sweet clover sandwiched in as a green manure crop for the corn. The soil treatment

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*This experimental field of the Missouri Agricultural Experiment Station is one of the oldest fields in the United States. It has been in service now for 55 years.

Our Fertilizers Need Magnesium

By David E. Dunklee and A. R. Midgley

Agronomy Department, Agricultural Experiment Station, Burlington, Vermont

MAGNESIUM deficiency has appeared in a number of Vermont potato fields. Its lack on several farms is known to have caused a reduction in yield to one-third of a normal crop. To one large grower it has meant the loss of at least 12,000 bushels of potatoes in a single season. For about $200 worth of magnesium, he would have saved approximately $9,000 worth of potatoes, since not only yield but quality and size would have been improved. The tops died prematurely, starting with the lower leaves, and the potatoes that grew were disappointingly small. The inclusion of magnesium in the fertilizer on this farm appears to have fully eliminated this trouble.

Cucumber leaves: (top one) plus magnesium; (lower four) no magnesium. Note the prominent green veins and the interveinal yellowing of the deficient leaves, also that the leaves are starting to die around the edges. This trouble is prevalent in Vermont gardens.

A number of other fields up to 20 acres each have shown similar symptoms, and probably other potato fields need magnesium, although they show no marked evidence of this deficiency. In order to notice a magnesium deficiency, it has to be severe enough to practically kill the vines. If the potato grower is to continue to produce crops good enough to pay for heavy expenditures of complete fertilizer, he also must have magnesium. Otherwise, a few poor years will put some growers out of business.

This plant-food deficiency has probably existed unrecognized for some years. The senior author saw a small field thus affected some 10 years ago near Brattleboro, but at that time the cause of the trouble was unknown. He also has seen a number of fields of potatoes where, despite fertilization and good care, the yield was very small. These troubles were undoubtedly due, at least in some cases, to a lack of magnesium, since the potatoes were well fed with ordinary complete fertilizer.

Magnesium is a plant food needed in addition to nitrogen, phosphorus, and potash. Special efforts have not been made to add it to most commercial fertilizers sold in the Northeast, except in Maine. Vermont is a dairy state producing large amounts of manure, often estimated to be four million tons a year. We have been depending on

Magnesium along with high-potash complete fertilizer increased yield of potatoes over 55 bu. per acre on this New Brunswick soil.

this manure to supply needed magnesium, yet it too may be deficient, since this manure mainly derived its supply from deficient soils. Superphosphate often carries some but not anywhere near enough of this plantfood. Few growers realize, however, that magnesium is needed by plants sometimes in amounts nearly as large as phosphorus. In fact, it is the basis around which plants build their green coloring matter or chlorophyl. It is as important to plants as iron in the blood is important to animals.

For the past two years small scale tests of the magnesium requirements of Vermont soils have been under way at the Vermont Agricultural Experiment Station. In pot tests with tomato plants, the addition of magnesium to other fertilizers gave an increase in yield on 15 out of 20 soils tested. Most of the increases in yield were greater than those on the soil where the grower lost 12,000 bushels of potatoes. In general, most sandy soils and some loams gave responses. We do not know enough about our clay soils to know whether they are deficient or not. Adams fine sandy loam gives us particularly severe symptoms of magnesium deficiency. Magnesium was found in greenhouse tests to be one of the elements, along with potash and phosphorus, that was lacking on a podzol soil. It is thus apt to be deficient in all podzol soils because much of their initial supply has undoubtedly been washed away by severe leaching during the process of soil formation.

In a green house test made some years ago on a soil from Bellows Falls, the yields of red clover were increased by the use of magnesium. When the test was made, the results were considered to have only local application, but clover's need for magnesium is now known to be much more widespread.

We have obtained responses in pot tests on a Vermont soil with corn, cucumbers, tomatoes, alfalfa, and garden peas, and while other crops may need it, these are the only crops tested thus far.

A year ago we ran a magnesium spray experiment, putting Epsom salts in the tank of the sprayer each time a grower sprayed his potatoes. The unsprayed vines were visibly very deficient. This grower, a generous user of commercial fertilizer, was in serious trouble on 50 out of 70 acres of potatoes. The average increase in yield from the use of magnesium in the spray was 50 bushels per acre.

A field test with and without magnesium in the fertilizer was also made with field beans. The average increase in yield in favor of the added magnesium was 305 pounds of dry beans per acre. This was on Colton fine sandy loam. The cost of Epsom salts used per acre for the beans as we fertilized them was $4.13, with a return of $15.25 if the beans were valued at five cents a pound.

This year we ran a field trial on potatoes, with and without magnesium in the complete fertilizer on a soil we thought might be deficient. The increase in yield from the use of magnesium was 29 bushels per acre, although there were few signs of deficiency symptoms during the growing season.

Potatoes were the first to show magnesium deficiency in Vermont and have shown it more plainly than other crops in the field. For this, there are several probable reasons. Land for potatoes customarily receives very little manure or lime which would supply magnesium, and it receives extra large amounts of commercial fertilizers which tend to replace magnesium from the soil reserve. Some replaced magnesium not needed by the crop is undoubtedly washed away by rain-water. Furthermore, the potato has a high requirement for magnesium and much is taken away in the crop. Growing potatoes for a number of years on the same soil, and growing them on acid loams and sandy loams where the soil supply is none too large, probably contribute to the total deficit.

Magnesium is available in several forms, some of which are more available to plants than others. Some are water-soluble and some are not. Water-soluble forms include Epsom salts ($MgSO_4 \cdot 7H_2O$), calcined kieserite ($MgSO_4$), and sulphate of potash magnesia ($MgSO_4 \cdot K_2SO_4 \cdot 6H_2O$). The more insoluble and slowly available forms include dolomitic limestone ($CaCO_3 \cdot MgCO_3$), kieserite ($MgSO_4 \cdot H_2O$), and magnesite ($MgCO_3$).

To be effective in a fertilizer on Vermont soils, we have found that most of the magnesium should be in water-soluble form, otherwise little benefit will be obtained the year it is applied. The cheapest grade of Epsom salts is suitable and costs us about $2.75 per 100 pounds. The sulphate of potash magnesia, if available, provides magnesium

Tomato seedlings: (left) plus magnesium; (right) no magnesium in the fertilizer. Without magnesium the lower leaves became yellow, shriveled, and died. Untreated plants were much smaller.

on a still cheaper basis. Last year one manufacturer put the latter form of magnesium into his fertilizer for one dollar per ton extra, to make a 3-10-10-1 fertilizer (containing one per cent of magnesium oxide). It is doubtful if magnesium under present conditions can again be provided for the very low price of one dollar per ton extra.

Epsom salts has an analysis of 16% magnesium oxide, calcined kieserite about 30% magnesium oxide, and sulphate of potash magnesia a variable analysis usually about 10% magnesium oxide. Dolomitic limestone often has an analysis of 18 to 20% magnesium oxide.

To supply the same amount of soluble magnesium contained in 150 pounds of Epsom salts, it takes 80 pounds of calcined kieserite, or 240 pounds of sulphate of potash magnesia. Of course the latter is also an important source of potash.

Dolomitic limestone can be used on acid potato soils at rates usually not greater than 1,000 pounds per acre. On some fields where potato scab is bothersome, it may not be safe to use any lime whatever. It is usually not advisable to lime a potato field above pH 5.4, some say pH 5.1, lest scab become serious.

If the use of magnesium in our fertilizer is greatly increased, we ought to be thinking where the extra supply is to be obtained. Vermont has worth consideration a source of mineral magnesium as piles of talc waste containing hundreds of tons of a mineral called magnesite already mined. More is available as a by-product of the talc industry. In its present form, the magnesite (magnesium carbonate) is not appreciably soluble in water. We have found that in its natural form it is not readily available to plants. This has been determined by pot tests in the greenhouse.

Sweet corn seedlings: (left) without; (right) with magnesium in the fertilizer. Without magnesium the leaves had a wilted appearance and a more or less purple tinge on the upper side. Lower leaves tended to die first, becoming yellow at the tip. Untreated plants were much smaller even at this early stage.

Samples of Vermont magnesite had the following analysis:

Ignition loss	45.62%
SiO_2	2.95%
Fe_2O_3	10.18%
Al_2O_3	2.69%
CaO	1.88%
MgO	37.0 %

It has been found that the availability of this magnesite to plants is considerably improved by mixing it with fertilizer for a year, but it still does not seem to be enough improved for all crops. It may be useful on acid soils like a liming material, but as yet we have no information about this. We have calcined it (heated it white hot) and apparently not improved its availability for direct application. It seems to become available to plants, however, after it is reacted with sulphuric acid. In this respect, the treatment resembles that of rock phosphate to make it available to plants. Much carbon dioxide and heat are evolved. Magnesium is converted to available magnesium sulphate. Our investigations have not proceeded far enough yet to indicate whether this magnesite can really be made into an economical fertilizer. Other sources of magnesite might be more satisfactory.

We might also expand the use of dolomitic limestone in areas where supplies will permit, because it provides a source of magnesium even though it is only slowly available to plants. Manufacturers should receive a premium for this kind of limestone to encourage them to grind it. Other manufacturers should receive a premium for magnesium-bearing fertilizers.

Dolomitic limestone is ground and available in Vermont at Plymouth and Amsden. However, most of the agricultural lime available in Vermont is of the high-calcium variety. Since our lime-grinding outfits are in the main located on high calcium lime, we will have to depend for some time primarily on sources of magnesium other than dolomitic limestone.

The experimental results obtained well justify the following recommen-

Magnesium-deficiency symptoms on potatoes. The healthy leaves are on the extreme left in both rows.

dations. Until more is learned about the need for magnesium, the Vermont Experiment Station recommends that water-soluble magnesium be included in fertilizers for potatoes and truck crops. Fertilizer manufacturers should note this fact and act accordingly, because they can provide the magnesium at time of mixing cheaper than any other way and it is best fed to plants in this way. They should use whatever source they can best obtain. The use of magnesium is insurance of good crops and no harm is known from its use at rates recommended, even though little or no response is obtained. A small excess of magnesium beyond the needs of the plant is not harmful. We believe it sound business and justified for the best use of nitrogen, phosphorus, and potash, if fertilizer companies will carry out these recommendations as far as possible.

It is recommended that farmers and gardeners purchase magnesium separate and mix it with their fertilizers if they can not buy it already mixed and included. As it is too late to have manufacturers put magnesium in all fertilizers where it is needed this year, some farmers will have to mix their own if they use it. Epsom salts or sulphate of potash magnesia are probably their best bet since it may be difficult to obtain other forms.

Tentatively, the rate of magesium application in Vermont should be 150 pounds of Epsom salts (magnesium sulphate) equivalent per acre. For potatoes, at rates that fertilizers are now used, this magnesium should go into a ton of single strength fertilizer or half a ton of double strength. In an emergency it can be used in a spray, 10 pounds of Epsom salts per 100 gallons of spray, but several sprays will be required. This is all that can be dissolved, and this may tend to plug nozzles because it washes through the strainer on the spray tank none too well.

While Epsom salts is the common form of magnesium that might be used in sprays, sulphate of potash magnesia may also be used in a similar way. However, we have no information concerning this although one large fertilizer company saved out a ton of this material for spray purposes last year.

Another measure that may be taken to increase the amount of magnesium

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Fertilizing to Make Water Go Further

By R. E. Stephenson

Soil Scientist, Oregon State College, Corvallis, Oregon

AN average of 500 pounds of water, which must be sucked from the soil by the roots of plants, is required to produce a pound of growth (dry matter). The water needs of plants vary widely, however, perhaps from half of the above figure to two or three times the amount. This variation is in part a plant characteristic, and in part due to differences in soil fertility and other conditions.

Weather in the form of precipitation is not only important for providing water but through the influence of temperature is an important factor in water usage. The U. S. Department of Agriculture in a three-year study found that during one cool season 23 per cent less water was used to make a unit of growth. As air gets warmer, more water can be held in the atmosphere; and when warm air is dry, the evaporation or transpiration from foliage is increased. The rate of transpiration is about in proportion to the saturation deficit existing in the atmosphere. Air at 70° F. that is saturated with moisture will be only 40 per cent saturated if the temperature is warmed to 100° F. The power of the dry air to pull water from the plant is more than doubled by this temperature change.

Cold air will hold but little water and exercises only a small pull on the transpiration stream even when dry. The same temperature change in warming 80° air will cause 20 times as great an increase in the moisture-holding capacity as in warming 10° below zero air. Therefore heavy precipitation occurs in hot climates. The tropical rain forests, which become an impenetrable jungle of growth, are the product of a hot climate and heavy precipitation.

Plant growth is rapid in a hot climate because temperature is an important factor that governs certain plant reactions. Growth is the result of chemical changes that are constantly occurring in the plant. Raw materials, water, carbon dioxide, and nutrients from the soil are made to combine chemically through nature's methods of forming new growth. A law of chemistry says that the rate of reaction about doubles for each 18° F. rise in temperature. This law holds for plant growth provided the necessary nutrients and moisture are present, and sunlight can act upon green foliage. Growth is more rapid with increased temperature until excessive heat or lack of moisture causes injury to the living plant tissue. The same temperature variations, however, affect the growth of different crops to a different degree, because of the variations in the optimum temperature for growth among various plants.

Nutrient Supply

Normally nature supplies the moisture, air, warmth, light, and nutrients from the soil necessary for plants to thrive. Man has a limited control over moisture through drainage, irrigation, and moisture-conserving practices. He has control if he chooses to exercise his prerogative, over the supply of nutrients, by use of fertilizers, humus renewal, and soil-conserving methods. The improvement of the nutrient supply may be practiced in any area that is suitable for crop production.

Much attention recently has been directed toward this problem. Man cannot eliminate the dry spells except where irrigation water is available, but he can eliminate nutrient deficiencies and enable the plant to use its somewhat limited supply of moisture with greater efficiency. Well-nourished plants may survive a drouth with good yields, where nutrient shortage of even one essential element if severe enough can make it impossible to produce a harvest from the best-watered soil. Moisture and nutrients therefore assume equal significance, and to the extent of his capacity, man should modify both for better yields.

The importance of fertility in efficient water usage has been illustrated many times. A study on Nebraska soils of three grades of fertility, (poor, intermediate, and fertile), showed relative corn yields of 1.0, 1.6, and 2.4, respectively. Relative water usage for a pound of growth (dry matter) was 1.0, 1.2, and 1.4 respectively, or exactly the reverse of the order for yields. When manure was used to improve the soil, yields were in the ratio 1.0, 1.1, and 1.3 for the poor, intermediate, and fertile soils, and water usage for a unit of growth became nearly identical. Thus manuring the poor soil more than tripled the yield, reduced the water required for a unit of growth by more than a third, and water usage became as efficient on the poor as on the fertile soil.

Recently the Indiana Station showed the value of proper fertilization for carrying a corn crop successfully through moderate drouth periods. Making up one nutrient deficiency may increase the yield, but largest yield naturally results when all deficiencies are corrected. In the dry year 1941 nitrogen alone on Vigo silt loam added five bushels to the harvest. Nitrogen, phosphorus, and potassium added more than 18 bushels, doubling the yield. The fertilizer supplied 72 pounds each of phosphoric acid and potash and 41 pounds of nitrogen per acre.

In areas of little rainfall, available nitrogen may be the outstanding soil deficiency. The Washington Station found that with the same moisture maintained in the soil and variable nitrates, the yield of wheat followed nitrates. With 100, 55, 46, and 28 parts per million of nitrate nitrogen in different soils, wheat yields were 45, 35, 32, and 20 bushels an acre respectively. Poor hilltop soils, depleted of humus and nitrogen, responded to nitrogen fertilizer with a 19-bushel increase, bringing the yield to 43 bushels an acre. Washington investigators found that moisture in the surface foot of soil in the fall governed the amount of nitrate to be found in the spring and the yield for the season. With 10.7 per cent moisture, there were 13.8 pounds of nitrate nitrogen an acre and a 20-bushel wheat yield. With 19 per cent moisture, there were 70.5 pounds of nitrate nitrogen and a 49-bushel yield of wheat, thus a close relationship between moisture, nitrate supply, and yield of crop.

Stored Moisture Is Vital

In a dry country or during dry periods the reserve of moisture stored in the soil becomes important. The crop must draw from stored moisture to carry through the dry period. In eastern Washington with 21 inches annual rainfall, seven feet of wet soil were considered sufficient moisture to produce 50 bushels of wheat per acre if there were no nutrient shortages, or other inhibiting factors.

Eroded soils are usually more subject to drouth injury. Humus and nitrogen are naturally found mostly in the topsoil. When the good topsoil is eroded away, the principal source of nitrogen is lost. Extensive drying of the topsoil aggravates the nitrogen shortage still further, because nitrates are not produced in dry soil and the deep soil though moist contains so little humus that nitrification cannot be appreciable.

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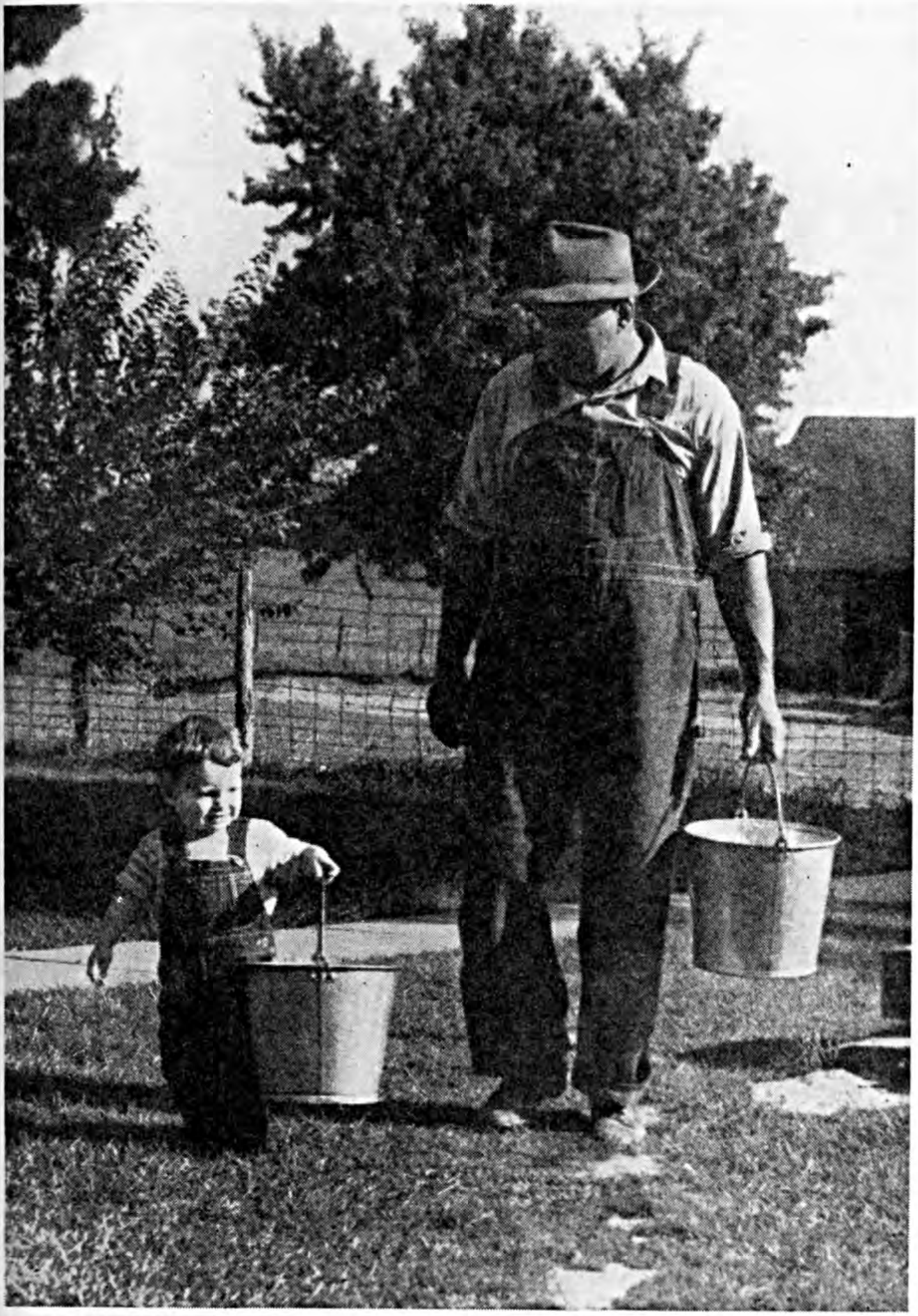
PICTORIAL



Courtesy Illinois Central

EVERYBODY WORKS DURING WARTIME

Left: Almost good enough to scare the worms.

Below: A field of onions near Hadley, Mass.

Right: A hot job in the middle of the day, but—

Below: A beautiful sight when shadows lengthen.

"CORN AND 'TATERS!"

The Editors Talk

This Still Holds True

Browsing among old publications is a delightful and satisfying hobby. Not only will it furnish amusement, but often amazement at the thought given problems which have held over to the present.

One of our readers recently sent us an item which he had found in Volume 1, N. Series of an early agricultural magazine called "The Cultivator" published in 1844 by Luther Tucker, Editor and Proprietor, Albany, New York. He thought we might be interested in presenting this 100-year-old item to our readers. We were, and here it is:

AGRICULTURAL READERS

1844

"In the early part of our experience as publisher of an agricultural paper, we found that the readers of such journals could be divided into two classes, one of which read with profit, the other with very little if any. Of course we do not include in either of these classes, those farmers who already know everything, despise all agricultural reading, and treat the idea of any improvement in husbandry with the most profound contempt. The number belonging to this class is much reduced, but specimens are occasionally met with.

"Farmer A. belongs to the class of readers that receive and peruse agricultural papers with little profit. The reason is, he does not sufficiently exercise his own judgment in reference to the details of farming. He reads a statement that such a farmer was eminently successful in the cultivation of such a crop; the growing or fattening of such or such an animal; or the management in general of a farm on the principles of rotation; and he determines at once to do the same. He does not stop to inquire whether his soil is suited to the particular crop he wishes to grow, whether it is too wet or too dry, too light or too heavy, rich or poor, but pursuing the course pointed out by the successful farmer, he miserably fails in his crop, or his animals, and frequently throws on the publication, or its correspondent, the blame which fairly belongs to himself.

"Farmer B. on the contrary, is one of a class of readers that finds a decided profit in the perusal of agricultural papers. He takes the same papers as A., but wholly escapes the mistakes into which A. is constantly falling. The reason is to be found in the fact that he exercises his judgment in managing his farm; and is fully aware that a course of husbandry that would be successful on one kind of soil, or one particular location, would be ruinous on another. Because a great crop, or fine animals, have been produced under certain circumstances, he does not go on to infer that they will be so in all, and it is in this discrimination and adaptation, that the cause of his success is found. He reads, compares, reflects, and decides whether a course is suitable for him, his soil, or circumstances before he adopts it. His agricultural reading furnishes him the means of doing this correctly, and in that he finds a great advantage.

"Agricultural publications are not intended to supersede the use of the judgment in matters of practice, among those who receive them; their great office is to enable the farmer to judge correctly as to the proper course for him to pursue; to bring to his notice all improvements in husbandry and agricultural implements, that he may choose wisely for himself; to show what has been done by others, and the way it has been done, that if in the same circumstances, and it is desirable, he may do so too; and to excite to improvement by showing it is practicable and profitable. The farmer must do as do men in other cases, obtain all the light and information possible by reading, and then reflect, reason, decide, and practice for himself."

Seeds for Victory

We are hearing much these days about "task forces." Backing up the supreme effort of our armed services, almost every industry has its task forces. One in agriculture for which zero hour is approaching is the Task Force appointed early this year by the War Food Administration to attack the legume seed shortage.

The seed shortage this past spring had reached such proportions that farmers in many sections of the country found it impossible to buy supplies for spring pasture and hay plantings. Part of the shortage resulted from the tremendous demands from England and Russia, but more important, the authorities say, has been the farmer's neglect to cut hay crops for seed. He used his second crop clovers for feed last summer rather than letting them mature for seed.

Statistics show that all big seed production years have resulted from larger than average acreages saved for seed. This means that to increase production this year, farmers must save more acreage for seed. Especially short have been red clover, alfalfa, alsike clover, and Ladino clover. With the feed situation still a critical factor in America's war food production goals, the results of the Task Force on Seed Production will be watched with much interest.

Divided Headline

Were we to open our papers some morning and see a screaming headline—"KILLED 18,000; INJURED 1,500,000"—chances are it would do more than a little to our appetite for breakfast. Yet such a startling fact escapes our notice for the reason that the headline is divided into the thousands of lesser headlines appearing in local publications throughout the country and during a year's time in the reporting of local rural accidents. The figures represent the approximate toll taken every year by accidents to farm people.

July 23-30 has been set aside as National Farm Safety Week. It is a good time to make every rural inhabitant realize the hazards which face farm people 365 days a year. Among other things, the National Safety Council suggests that farmers take steps to eliminate all possible hazards such as loose clothing whenever working around machinery, fire hazards, and obstacles which might cause a dangerous fall.

Publications are being asked to lend their aid in making rural people more accident-conscious. Undoubtedly everyone in the farm advisory groups will add his note of warning in this most commendable project.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191
April	163	229	197	261	177	167	136	243	184
May	160	358	193	269	177	167	135	243	217

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N, bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14.......	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922..........	.566	3.12	6.90	.632	.904	23.87	....	.508
1923..........	.550	3.08	7.50	.588	.836	23.32	....	.474
1924..........	.502	2.31	6.60	.582	.860	23.72	....	.472
1925..........	.600	2.44	6.16	.584	.860	23.72	....	.483
1926..........	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927..........	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928..........	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929..........	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930..........	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931..........	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932..........	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933..........	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934..........	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935..........	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936..........	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937..........	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938..........	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939..........	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940..........	.516	1.90	5.50	.517	.730	....	.573	....
1941..........	.547	1.94	5.64	.522	.779	25.55	.570	....
1942..........	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
May........	.640	2.00	5.90	.535	.817	26.00	.210	....
June........	.640	2.00	5.90	.471	.701	22.88	.176	....
July........	.640	2.00	5.90	.503	.797	26.00	.188	....
August.....	.640	2.00	5.90	.503	.797	26.00	.188	....
September..	.640	2.00	5.90	.503	.797	26.00	.188	....
October.....	.640	2.00	5.90	.535	.797	26.00	.200	....
November...	.640	2.00	5.90	.535	.797	26.00	.200	....
December...	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January.....	.640	2.00	6.10	.535	.797	26.00	.200	....
February....	.640	2.00	6.10	.535	.797	26.00	.200	....
March......	.640	2.00	6.10	.535	.797	26.00	.200	....
April........	.640	2.00	6.10	.535	.797	26.00	.200	....
May........	.640	2.00	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922..........	106	87	141	89	95	99	....	78
1923..........	103	85	154	82	88	96	....	72
1924..........	94	64	135	82	90	98	....	72
1925..........	110	68	126	82	90	98	....	74
1926..........	112	88	114	83	90	98	82	80
1927..........	100	86	113	90	97	106	89	89
1928..........	108	86	113	94	100	109	92	92
1929..........	114	88	113	94	101	110	93	92
1930..........	101	88	113	95	102	111	94	93
1931..........	90	88	113	95	102	111	94	93
1932..........	85	88	113	95	101	111	94	90
1933..........	81	86	113	93	91	104	91	86
1934..........	91	87	110	68	79	93	74	72
1935..........	92	91	117	58	72	89	68	75
1936..........	89	51	113	65	74	95	77	85
1937..........	95	51	113	71	79	102	85	93
1938..........	92	51	113	73	81	104	87	95
1939..........	89	53	113	73	79	101	87	93
1940..........	96	53	113	72	77	....	87	....
1941..........	102	54	110	73	82	106	87	....
1942..........	112	59	129	73	85	106	84	....
1943								
May........	119	55	121	75	86	108	85	....
June........	119	55	121	66	74	95	80	....
July........	119	55	121	70	84	108	82	....
August.....	119	55	121	70	84	108	82	....
September..	119	55	121	70	84	108	82	....
October.....	119	55	121	75	84	108	83	....
November...	119	55	121	75	84	108	83	....
December...	119	55	125	75	84	108	83	....
1944								
January.....	119	55	125	75	84	108	83	....
February....	119	55	125	75	84	108	83	....
March......	119	55	125	75	84	108	83	....
April.......	119	55	125	75	84	108	83	....
May........	119	55	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
1943								
May	187	167	152	95	57	160	119	79
June	190	168	151	93	57	160	119	69
July	188	169	150	94	57	160	119	74
August	193	169	150	94	57	160	119	74
September	193	169	150	94	57	160	119	74
October	192	170	150	95	57	160	119	78
November	194	171	150	95	57	160	119	78
December	196	173	150	96	57	171	119	78
1944								
January	196	174	150	96	57	171	119	78
February	195	175	151	96	57	171	119	78
March	196	175	151	97	57	173	119	78
April	196	175	152	96	57	172	119	78
May	194	175	152	97	57	175	119	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

REVIEWS

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

Fertilizers

"Revisions to a Paper Entitled 'Administration of California Laws Relating to Fertilizing Materials,'" State Dept. of Agr. Bul., Sacramento, Calif., 1941, Alvin J. Cox.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended March 31, 1944," Dept. of Agr., Sacramento 14, Calif., FM-83, May 10, 1944.

"Amount of Commercial Fertilizers Used on Various Crops in California during January-June 1943," Dept. of Agr., Sacramento 14, Calif., FM-84, May 15, 1944.

"Tonnages of Mixed Commercial Fertilizers Used in California during January-June 1943," Dept. of Agr., Sacramento 14, Calif., FM-85, May 16, 1944.

"Kinds and Amounts of Commercial Fertilizers Used in California during January-June 1943," Dept. of Agr., Sacramento 14, Calif., FM-86, May 17, 1944.

"Functional Relationships Between Boron and Various Anions in the Nutrition of the Tomato," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 395, Jan. 1944, J. R. Beckenbach.

"Fertilizing Type 62 Shade Tobacco," Ga. Coastal Plain Exp. Sta., Univ. System of Ga., Tifton, Ga., Bul. 39, Nov. 1943, J. L. LaPrade and J. M. Carr.

"Fertilizers, Fertilizer Materials and Rock Phosphate Used in Illinois during 1943," Dept. of Agron., Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., May 1944, E. E. DeTurk.

"Deep Fertilization," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Agron. Mimeo. No. 47, March 1944.

"Summary of Sugar Cane Fertilizer Tests, Seasons of 1942 and 1943," Agr. Exp. Sta., Univ. Sta., Baton Rouge, La., C. B. Gouaux, M. B. Sturgis, and R. K. Walker.

"Fertilizers for Legumes," Agr. Exp. Sta., State College, East Lansing, Mich., Sp. Bul. 328, April 1944, R. L. Cook and C. E. Millar.

"Results of Cooperative Fertilizer Experiments in Waseca County in 1943," Univ. of Minn., St. Paul, Minn., Soil Series No. 8, Feb. 1944, A. C. Caldwell and C. F. Murphy.

"Results of Cooperative Fertilizer Experiments in McLeod County in 1943," Univ. of Minn., St. Paul, Minn., Soil Series No. 9, Feb. 1944, J. M. MacGregor, C. F. Bentley, and R. E. Jacobs.

"Buying Fertilizer for Cotton in 1944," Agr. Exp. Sta., State College, State College, Miss., Cir. 116, Feb. 1944, W. B. Andrews.

"Soil Treatment to Improve Permanent Pastures," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 289, March 1944, A. W. Klemme.

"Fertilizers for New Jersey 1944," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 475, Jan. 1944.

"Commercial Fertilizers," N. M. Feed & Fertilizer Control Office, State College, N. M., R. W. Ludwick and Lewis T. Elliott.

"Use More Nitrogen to Get More Feed," Agr. Ext. Serv., State Univ., Columbus, Ohio, E. Bul. 248, Feb. 1944.

"Fertilizer Sales in Ohio in 1943," Dept. of Agron., State Univ., Columbus, Ohio.

"The Tennessee Liquid Fertilizer Distributor," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. 87, Feb. 1944, M. A. Sharp.

"Commercial Fertilizers," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 505, Aug. 1943, L. S. Walker and E. F. Boyce.

"Fertilizer Tonnage for West Virginia," Agron. & Genetics Depts., W. Va. Univ., Morgantown, W. Va.

"Tobacco Fertilizer Experiments in Dane County," Exp. Sta., Univ. of Wis., Madison, Wis., R. Bul. 149, Nov. 1943, James Johnson and W. B. Ogden.

Soils

¶ Non-technical help for those wanting to evaluate agricultural soils will be found in Publication 748 of the Canadian Department of Agriculture entitled "Guide for the Selection of Agricultural Soils," by P. C. Stobbe and A. Leahey. A map giving the general soil areas of Canada and brief descriptions of the predominant characteristics of the soils in these areas make up the first half of the Bulletin. The latter part discusses briefly such factors as soil texture, color, depth, parent material, soil structure, reaction, drainage, topography erosion, natural vegetation, and guide to present fertility.

¶ A popular pamphlet effectively emphasizing the importance of maintaining fertility of the soil if good yields are to be obtained year after year has been prepared by the Purdue University Agricultural Extension Service as Leaflet 242, entitled "Feed the Soil to Feed More People." Under the impetus of wartime food goals, American farms are being called on to produce greater quantities of foods, feeds, and fibers than ever before. These heavy productions are making heavy demands on the nutrients in the soil and unless adequate steps are taken to replace these nutrients, farms are going to be seriously depleted by the end of the war. This Circular shows how to prevent such a condition by the proper use of fertilizers throughout the rotation. As a typical rotation, it is suggested that 400 lbs. of 3-12-12 be used for wheat with the legumes subsisting on the residual effects of this fertilizer and a manure top-dressing on the wheat. Manure and fertilizer at the rate of 100 lbs. of 0-12-12 are recommended for corn, and 300 lbs. of 0-12-12 plowed under are recommended for soybeans to follow corn. This completes the rotation. A table showing the net gains or losses in nutrients with various crops is given, and a table of liming recommendations is included.

¶ The boron problem in New Jersey in light of present-day information is thoroughly covered in New Jersey Agricultural Experiment Station Bulletin 709, "The Boron Needs of New Jersey Soils," by E. Reeve, A. L. Prince, and F. E. Bear. At the outset of the work the authors knew there was some boron deficiency existing in the State, but wished to obtain as rapidly as possible some idea as to its extent and distribution. To this end they enlisted the assistance of county agents and utilized easily grown indicator crops. Turnips were selected as well suited for this purpose and small packets of turnip seed were distributed through county agents to various farmers with the request they plant the seed in some of their fields and observe the appearance of the cut roots during the season. As a result of this survey over 14 counties in the State, 42 instances where boron obviously was deficient were observed.

Laboratory and greenhouse work on samples taken from various areas in the State supplemented the survey. In the greenhouse work, the sunflower plant was used as an indicator of boron deficiency. It was determined that .35 p.p.m. of water-soluble boron or 11.2 ounces per acre to the plow depth should be present in a soil if it is to be considered adequately supplied with available boron. On the basis of this classification, 8 of the 20 important soil groups in the State were found to be deficient in boron. No correlation was found between the total and water-soluble boron in the soil.

It had been shown that there was a definite relationship between calcium and boron, an increase in calcium without a corresponding increase in boron resulting in an unbalanced nutrient condition in the plant. The addition of lime did not reduce the solubility of boron in the soil, confirming the authors' opinion that boron-calcium relationship is largely a matter of activity within the plant.

When boron is applied to the soil, part of it is fixed and part of it remains soluble, the latter, of course, being of greatest use to the crop. Heavier soils tend to fix more boron than lighter soils and it is concluded that larger applications of borax will be required to correct boron deficiency on loams than on sandy soil.

It has been well established that some plants require and will tolerate greater quantities of boron than other plants. An investigation of the boron content of 12 plants, with and without borax additions to the soil on which they were growing, disclosed that plants which have a tendency to be easily damaged by excess boron absorbed much more boron from the soil than did the plants which are not so sensitive and which have a higher boron requirements.

Studies on leaching of boron indicate that there is little danger of any toxic accumulations being built up in the soil as the result of additions of borax in fertilizer. When borax was added to the soil and water equivalent to one-quarter of the annual rainfall in New Jersey was leached through, 75 per cent of the added boron was removed from the heavy soils and 85 per cent from the lighter soils. The application was at the rate of 20 lbs. of borax per acre. This work also suggests the desirability of frequent moderate applications of borax rather than fewer heavy applications.

Investigations on the effect of green manure on soils indicate that if supplies of slightly available boron are present, the decomposition of the organic matter can utilize part of this boron and make it available for crops. This, of course, will not increase the total boron content of the soil and can have little effect on soils where the original total boron content is very low. The boron content of organic matter likely to be added to the soil is so low that the quantities required to supply an ordinary application of 10 lbs. of borax per acre would be larger than would be practical under ordinary conditions.

A number of specific cases of increased yields of crops such as carrots, spinach, red clover seed, alfalfa, and apples are given. The available boron content of numerous important soil types in the State was determined and many of them are lower in available boron than is considered necessary for good crop growth. Even some of the potato soils were found to be lower in boron than the requirement for this crop. Boron-deficiency symptoms on important crops in New Jersey and boron-toxicity symptoms on crops likely to be injured by borax are described. It is stated that some manufacturers are adding borax in all their fertilizer mixtures as an insurance factor, the rate apparently being about 5 lbs. of borax per ton of fertilizer. The authors state that the inclusion of 5 lbs. of borax per ton of fertilizer might be a very helpful way of preventing the development of boron deficiency on New Jersey soils. Where definite boron deficiency is known to exist, it is recommended for most crops that 10 lbs. per acre of borax be used on sandy soils and 20 lbs. per acre on loamy soils, with alfalfa requiring up to 30 lbs. per acre on the heavier soils. In cases of severe deficiency on crops with a high borax requirement, the applications might be doubled, in which case, care should be taken that the borax does not come in direct contact with the seed.

While this Bulletin is intended primarily for New Jersey conditions, the findings and methods of approach to the borax problem can be applied over large sections of North America.

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Economics

¶ A record of the agricultural production in Illinois for 1941 and 1942, goals for 1943, expected production in 1944, and maximum wartime agricultural production capacity are given in report AE2094 issued by the Illinois Agricultural Experiment Station entitled "An Appraisal of Maximum Wartime Production Capacity in Illinois." It was prepared by a committee of Experiment Station and U. S. Department of Agriculture members who conclude that maximum production still is required and that land must be utilized to its full capacity, even to the extent of calling on reserve fertility. It is carefully brought out, however, that such a procedure should be undertaken only with the intention of and provision for replenishing this dipping into our reserves when conditions become more favorable with respect to labor and supplies.

Total available land considered suitable for cropping already is largely taken up, so that expansion of production by means of increased acreage is limited. This means that increased production must come about largely through increased efficiency of land already in cultivation. In 1942, a little over 12.5 million acres of crop land were used for intertilled crops and the maximum considered advisable is a little under 14 million acres, the area recommended to be planted during the current year. Corn and soybeans comprise 95 per cent of this acreage. About 5.5 million acres were in grain and fiber crops, with about the same acreage recommended for this year. A little over 6 million acres were in hay and tillable pasture in 1942, and this was reduced to about 5 million acres in 1943. No further cut in this acreage is recommended owing to the requirements for feed in the livestock program. Total crop acreage is about 23.5 million acres with 1.3 million acres not utilized due to one reason or another. The 2 million acres in woodland and 4.7 million acres in permanent pasture are expected to be about the same as in the last several years.

In order to help produce the maximum crops, limestone and fertilizer should be used to the maximum extent available. It is stated that the use of commercial fertilizer has nearly doubled in the last four years, but even larger amounts could be used to advantage. About 2.5 million tons of lime are estimated as the usage in 1943, while 4 million tons should be used for maximum production. Corresponding figures for rock phosphate are 150,000 and 200,000 tons. While 25,000 tons of superphosphate are estimated as the usage in 1943, 40,000,000 tons are needed for maximum production. The use of 2-12-6 can be reduced from 14,000 to 7,000 tons, while 0-12-12 should be increased from 13,000 to 25,000 tons, 3-12-12 from 7,000 to 15,000 tons, 3-9-18 from 5,000 to 10,000 tons, 0-9-27 from 5,000 to 10,000 tons, 0-14-7 from 6,000 to 12,000 tons, 3-18-9 from 3,000 to 10,000 tons and straight muriate of potash from 1,000 to 5,000 tons. The question is raised in the text as to whether farmers would utilize all of these quantities even if they were available without the further educational efforts.

The labor problem is a difficult one, but as a whole it would appear as if there have been no serious losses in production due to shortage of labor, although the limit has nearly been reached in this respect and any further losses in agricultural labor may be more serious in their effect on production.

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Will It Rain Tomorrow?

FORECASTING the weather is one of the rural arts. Anyone who would forecast skilfully must first become alert for weather signs. Important among these signs are the direction of the wind, the kind of clouds, the speed with which smoke rises, the appearance of the sky, the behavior of animals, and changing wind directions.

Growing out of this art of weather forecasting, we have many weather proverbs and sayings that have withstood the test of time. No doubt all of these proverbs had some value in their original setting. Many which have rather wide application are worth remembering.

Probably of prime importance are those that will help us forecast tomorrow's weather. One jingle sums up

many of the signs of tomorrow's weather, all of which forecast rain:

"When the sky is red in the morning,
And there's a rainbow before noon;
When the stars are ghostly dim and dull,
And a ring forms 'round the moon;

"When the crows caw long and loudly,
And the flies stick tight and bite;
When fish jump from the water,
And sounds travel far at night;

"When you can't get salt from the shaker,
And your corns give you extra pain;
There's no need to consult an almanac,
You just know it's going to rain."

Now let's examine the weather signs listed in the jingle. A red morning sky indicates a moisture-laden atmosphere and an overcast sky, conditions which usually precede a stormy period of considerable duration.

Another way of saying this is found in the Bible:

"He answered and said unto them,
'In the morning ye say,
It will be foul weather today
For the sky is red and lowering'."

When a rainbow appears in the morning, we have the sun in the East shining through the raindrops in advance of the shower.

"Rainbow in the morning,
Shepherds take warning."

Since most showers approach from the West, a rainbow in the morning across the western sky could hardly foretell anything except an approaching storm, and one that is likely to occur within the next few minutes. Surely there is neither need nor time to consult an almanac when there is a rainbow in the West. Few signs foretell immediate rain better than a morning rainbow. •

"When the stars begin to hide,
Soon the rain will betide."

At night our first indication of moisture-laden dust particles in the atmosphere is often the gradual disappearance of the stars. The dim stars disappear entirely; the bright ones fade, become ghostly dim and dull, and look as though they were farther away.

"The bigger the ring,
The nearer the wet."

This phenomenon of the circle around the moon is caused by the re-fraction of light on the clouds through a moisture-laden upper atmosphere. An atmosphere laden with moisture and gathering clouds certainly presages rain.

The next verse of the jingle about the crows cawing, the flies biting, the fish jumping, and the sounds travelling far, as well as the first two lines of the last verse, refers no doubt to the lower pressure that accompanies a moisture-laden atmosphere. Probably "your corns do give you extra pain" when the atmospheric pressure falls suddenly, as it usually does before an approaching storm. That the flies bite and the fish jump when a storm approaches are matters of common observation.

"When the forests murmur
And the mountain roars,
Then close your windows
And shut your doors."

Without doubt, in a moisture-laden atmosphere sounds travel far and wide. Sounds seem hollow, the forests sigh and moan, and the trees murmur.

Other weather proverbs that tell much the same story are:

"A coming storm, your shooting corns presage."

"When the mists creep up the hill,
Fisherman up and try your skill;
When the mists begin to nod,
Fisherman then put by your rod."

"When the smoke goes east,
Good weather is neist;
When the smoke goes west,
Good weather is past."

"Rain long foretold, long last.
Short notice, soon past."

But the best of all the weather proverbs is the one which gives you divine protection if you would foretell the weather, and sometimes you will need this protection for the weather signs are only relative, not absolute:

"When God wills, it rains with any wind."

—L. H. Woodward, Elmira, New York.

Boron and Fertilizer for Turnips

APPRECIATING the value of good turnips as a table vegetable, I had a bushel of supposedly first-grade table turnips delivered to my home. The turnips, when cut open, showed the familiar dark brown, water-soaked areas symptomatic of boron deficiency. Some were pithy, and all were of poor quality and flavor when cooked. Those kept in storage soon began to rot.

It may be true that turnips are 90 per cent water, but I agree with the Scot who said, "Aye, not water, but turnip juice." What can be more tempting after a hard day's work than a good slice of roast beef nestling in the amber of mashed turnips?

Since I knew the grower of these turnips, I thought he might be interested in learning of their quality and that he might be induced to try out some remedial measures. He agreed to follow my advice in growing his next crop and on June 24, 1943, the field was ready to be plowed.

By means of a fertilizer attachment, 375 pounds of 2-12-10 fertilizer were placed in the furrow bottom in a band. To this had been mixed sufficient boron to provide 20 pounds per acre. The field was sown a few days later.

Owing to the lateness of the season and the subsequent unfavorable weather, growth was slow and uneven. The farmer was discouraged with the prospects of a crop and had it not been for pressure of work on other parts of his farm, would have plowed up his turnip field. Even a confirmed gambler would not have given five dollars an acre for the crop. But weather conditions finally improved and the turnips began to show signs of life. Growth was rapid and continued right up to the time the crop was harvested.

During the latter part of October yields were taken and amazing differences were found. On the area treated with fertilizer and boron, 24.1 tons per acre were harvested, while on the untreated area only 13.5 tons were harvested.

Not only was the yield almost doubled by the fertilizer-boron treatment, but the familiar water-core of the previous years was entirely absent in the boron-treated plot. On the untreated plot, it was found that 9 out of every 10 turnips cut open were affected with water-core of varying degrees of severity.

The area sown to turnips was slightly more than an acre of ground, and the owner estimated his net income at $800, as his whole crop sold at $1 per bushel. He admitted, however, that he was not selling the turnips from the untreated area locally. I secured my supply from him, and found every turnip of excellent quality.

The use of the attachment designed for placing the fertilizer in a band on the bottom of the furrow is certainly to be recommended for crops such as turnips, and it is believed that full effectiveness of the boron will be obtained by this method of application.—*W. B. George, Soils Department, Kemptville Agricultural School, Kemptville, Ontario.*

Knowledge of Soils Essential to South

(*From page* 18)

quent result of soil conditions common in this area where the soils have reached an advanced stage of development, and the large quantity of fertilizer used annually throughout the southeast is man's effort to overcome the havoc wrought during centuries of time.

Proper land-use planning in the South is a rather difficult problem because of frequent variations in the soils on individual farms. Rotations as practiced in the Corn Belt are not feasible under southern conditions because of difficulties encountered in maintaining a base number of acres in the cash crop. Most of the farms are made up of several different soils, and some lands are better adapted to one crop than to another. Because of mechanical difficulties, soil variations, etc., the farm operator must devote a part of the farm to crops like kudzu, sericea, grasses, or trees for several years and at the same time maintain the fertility of the land planted to row crops. Hence the problem of rotations and proper land use, and at the same time making a living on the farm, is a very grave one.

The Soil Conservation Service has stressed the point for several years that every acre of land on a farm should be used in some way to contribute to the income of the farmer. Wise land use and soil conservation are synonymous and much has been done along this line during recent years by the Conservation Service and cooperating agencies. Much more still remains to be done before the farmers of the South can enjoy the happy and healthy life to which they are entitled. It has been said that the Cotton Belt is the No. 1 problem area of the country. It is a problem area not altogether because of a one-crop system, freight rates, social disorders, or other man-made conditions, but primarily because of the soil conditions prevalent in this region.

In order to improve and make the most of the situation, the first prerequisite is a basic understanding of the soils and their limitations. May the day soon come when the different soils of the country will be appreciated and understood so that agricultural production may be planned according to the potentialities of the soils rather than the fancies of the people.

Our Fertilizers Need Magnesium

(*From page* 24)

received by the plants is the use of dolomitic hydrated lime in the potato spray, in place of the high calcium hydrate most commonly employed, although it may make spraying more difficult. Magnesium should not be omitted from the fertilizer even where the use of dolomitic hydrate in the spray is adopted because in severe cases, sprays do not seem to feed the plants well enough.

Magnesium can be provided for the crop over a long period of time by the use of dolomitic limestone, but it does not always provide for the immediate needs of the current crop because of its slow availability. It should be used on potato land which is acid and needs lime and as a conditioner in mixed fertilizers to decrease their acidic effect upon the soil.

When Dr. Chucka of Maine was in Vermont two years ago, he made the remark that the magnesium deficiency that he saw in Vermont potato fields was as severe as any he had ever seen in Maine. He referred in particular to Maine outbreaks in 1933. He confirmed the Vermont diagnosis of magnesium deficiency of potatoes and he also indicated that practically all of the potato fertilizers sold in Maine two years ago contained magnesium at the insistence of growers. Vermont now similarly becomes a state where growers should ask for magnesium in their fertilizers to be certain of a good crop.

Magnesium deficiency is not a new trouble. It is apparently an old trouble slowly aggravated. Some of the worst cases have occurred on long-cropped acid soils, although it is now known that some practically virgin soils need magnesium almost as badly. The proper idea in fertilizing crops is a balanced plant food. We have learned that on many of our soils the plant food is not fully balanced without this magnesium.

Last year (1943) more than 540 tons of fertilizer containing soluble magnesium were sold in Vermont through the cooperation of the Vermont Station, fertilizer companies and other agencies. Because growers reported excellent results last year and because of new evidence obtained, more than 900 tons containing magnesium will be used this year. The day may well come when nearly all of the mixed fertilizer used in Vermont will contain magnesium.

Fertilizing to Make Water Go Further

(*From page* 25)

In the corn belt eroded soil in a dry season results in "firing" or burning of the foliage, a characteristic symptom of nitrogen deficiency.

The Indiana Station prevented the firing of corn and added 28 bushels to the yield on sandy soil by plowing under fertilizer, supplying 80 pounds of nitrogen an acre. The plowing under was important because it placed the fertilizer down where the soil was moist. Fertilizer placed in the dry topsoil would have little value unless rains supplied moisture to allow plant roots to function in absorbing the nutrient. "Plowsole" application at the Indiana Station was still more effective than plowing under. This deep placement reduced fixation of phosphates and potash, as well as assured contact with moist earth. The plowsole placement of complete fertilizer sometimes added

10 or 12 bushels to the yield, compared to plowing under. An additional light application in the row helped when moisture conditions were favorable.

The importance of correcting all deficiencies is indicated by Indiana corn yields on Vigo silt loam. Fertilizer to supply 80 pounds of nitrogen broadcast and plowed under yielded 27 bushels, but 80 pounds each of nitrogen, phosphoric acid, and potash broadcast and plowed under yielded nearly 57 bushels an acre. The same fertilizer treatment using the plowsole method of application yielded 69 bushels in a year when the growing season was described as extremely drouthy. These yield responses are sufficient evidence of the importance of soil fertility in increasing the efficiency of water usage by the growing crop in dry seasons.

In another study in Washington sulfur was the limiting nutrient supplied by the soil for alfalfa production. Without treatment the yield was 1½ tons an acre, but with 200 pounds of landplaster the yield became 4½ tons an acre, with similar moisture conditions in the soil in both cases. Oregon soil deficient in boron, in greenhouse studies, refused to respond to complete fertilization including sulfur. When the boron was supplied, the yields were about tripled. Moisture was controlled so that water was not a limiting factor in either case.

When moisture is very limited, as in dry farm areas, there is a nice balance between too much and too little fertility. Wheat after alfalfa in Washington yielded 38 bushels an acre. By spreading straw on the alfalfa before plowing so that some of the excess nitrogen from the alfalfa would be used in rotting the straw, the wheat yield was boosted to 42 bushels an acre. The excessive nitrogen under the alfalfa sod made too much wheat foliage and the limited moisture was dissipated in growing foliage to the extent that the yield of grain was cut; therefore a better yield was obtained with less available nitrogen. In another study, the reverse situation was apparent. Wheat grown after wheat required 487 pounds of water to make a pound of growth, whereas wheat after clover, with more available nitrogen, required only 310 pounds of water for a pound of growth, indicating the value of improved fertility for increasing the efficiency of water usage by the crop.

The limited precipitation which may produce satisfactory harvests when the soil is of excellent quality in both physical and chemical properties is sometimes surprising. An orchard area in eastern Oregon on good soil produces four to six tons of cherries an acre, and up to seven or eight tons on the very best soils, where the precipitation for the last 20 years averages only 12.7 inches, only 2.2 inches of which falls in the six months April to September inclusive. And there is never a complete failure in spite of years like 1935 with 6.9 inches and 1939 with 6.4 inches of precipitation. These were hard years but there was a crop, and without irrigation. Only because of the excellence of the soil are the trees still alive and productive.

Water Requirement for Corn

But an adequacy of both moisture and fertility with favorable temperature conditions is necessary for maximum production. The Indiana Station estimates that 20 inches of water for the use of the crop would be sufficient to produce 100 bushels of corn an acre if all nutrient deficiencies in the soil and other inhibiting factors were eliminated. This estimate is equivalent to the production of a pound of growth (dry matter) with about 375 pounds of water, which is a reasonable figure.

The Willamette Valley in the vicinity of Corvallis has normally about 40 inches of rain. The best soils will hold nearly two inches of usable or crop water for each foot of depth. Most of the precipitation occurs outside the growing season, therefore effective soil depth has outstanding significance. Ten feet of storage depth in the soil would hold 20 inches of crop water supposedly enough for a 100-bushel corn yield could the crop send its roots into the deep soil to secure the stored moisture. But the cool climate, not ideal for corn, probably makes such a yield impossible even with adequate moisture and a fertilizer program to eliminate nutrient deficiencies. Other crops, however, that are adapted to the climate, of which the English walnut is an example, can send absorbing roots 10 feet or more into good soil for the stored moisture. Yields up to 3,000 pounds or more of excellent nuts an acre have been obtained on the best soils.

Fertilizer work on this type of crop is just beginning, but there are indications that the correction of nutrient deficiencies, boron, nitrogen, sulfur, phosphorus, potassium, or whatever they may prove to be, will contribute to a more efficient use of the limited summer moisture supply and bring increased production and profits for this and other crops.

Man can correct a water shortage by irrigation in some areas. He can modify temperature in a small way as is sometimes done in orchard heating. He may deepen the soil somewhat by drainage and improve it with crop rotations that include legumes for nitrogen and humus renewal. Anywhere that crops are grown it is possible with well-selected, properly placed fertilizers for him to correct all nutrient deficiencies. Thereby he can make a limited supply of moisture go further, or in the more favored areas enable an adequacy of both moisture and nutrients to yield the maximum harvest.

Fertilizer Requirements for Permanent Pastures in Alabama

(*From page 9*)

tions of 200 to 400 pounds per acre, or the original applications may be repeated every two to three years. If the 600-pound rate is used, it should be repeated every other year.

Potash has been found to be essential in nearly all experiments. Applications are made at the rate of 50 pounds of muriate of potash per acre annually, or multiples of this amount may be used at two- or three-year intervals. The mixture 0-14-10 may be used to supply both phosphate and potash. This material is used at a rate to supply the approximate equivalent of the recommended amounts of phosphorus and potash.

TABLE 6.—THE EFFECT OF FERTILIZER ON GROWTH OF WHITE CLOVER ON ACID BLACK BELT SOILS, 1943

Rate per A.			Green material per A.
Lime	P*	K**	
Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
0	0	0	625
0	900	0	1,157
4,000	900	0	3,157
4,000	0	150	2,563
0	900	150	2,000
4,000	900	150	5,136

* Superphosphate.
** Muriate of potash.

Soil Preparation and Seeding

Experiments to determine the amount of preparation for pastures show that some preparation is desirable. Where an area is being cleared for pasture, preparation is almost always necessary. This is done in late summer, and the fertilizer application is worked into the soil during the process of preparation. Planting is done on a firm seed bed in September or October, covering the seed lightly. A cultipacker is an ideal tool for getting a seed bed in condition and for covering seed.

The effect of soil preparation on the establishment of white clover in a carpet grass sod. Both plots received lime, phosphate, and potash treatment and same seeding. Left, thorough preparation; right, no preparation.

If clovers are to be seeded on an established grass sod, the fertilizer treatments should be broadcast and disked in during late summer or early fall. It is not necessary to destroy the sod. Dallis grass sod should not be destroyed; however, it is desirable to destroy sods of carpet grass and broom sedge.

Clovers are seeded in October after the soil has been firmed either by rain, or a roller or drag. They are covered very lightly. It should be remembered that clover seed are very small and the young plants cannot become established if covered too deeply, or if they have too much competition from other vegetation.

Sweet Clover Responds to Potash Fertilizer

(*From page* 19)

of lime was put on the entire plot. Superphosphate at the rate of 150 pounds per acre and muriate of potash at 50 pounds were applied with the drilling of the wheat. When the corn was planted, an additional 50 pounds of muriate of potash were put on only the right half of the plot. The seeding of sweet clover that follows the wheat is now demonstrating the value of this extra potash by the successful stand of this legume in contrast to its failure where this additional potassium was not applied.

The significance of the extra potassium as a soil treatment for sweet clover after its applications in only three rounds of the rotation is evident from the growth of this crop in the stubble in late July. Though there were small sweet clover plants where lime, phosphate, and lesser amounts of potassium were applied, the contrast between them and those where potassium was more generously used is so marked that one would not be encouraged to expect much green manure effect by the sweet clover for the corn next spring in that part of the plot where the smaller amount of potassium was applied.

With wheat grown on this plot for 50 years, with all the straw as a relatively concentrated carrier of potassium taken off annually, and with no manure going back to return potassium in the straw as bedding or in the animal urine, this plot has developed a distinct shortage in its potassium delivery for sweet clover in a 2-year rotation. This shortage occurs for a crop not commonly considered sensitive to potassium deficiencies when it may be seen growing on a pile of crushed limestone. The shortage in this plot, however, is so severe that the spring-seeded sweet clover was starved out by the first of August except where extra potassium was supplied.

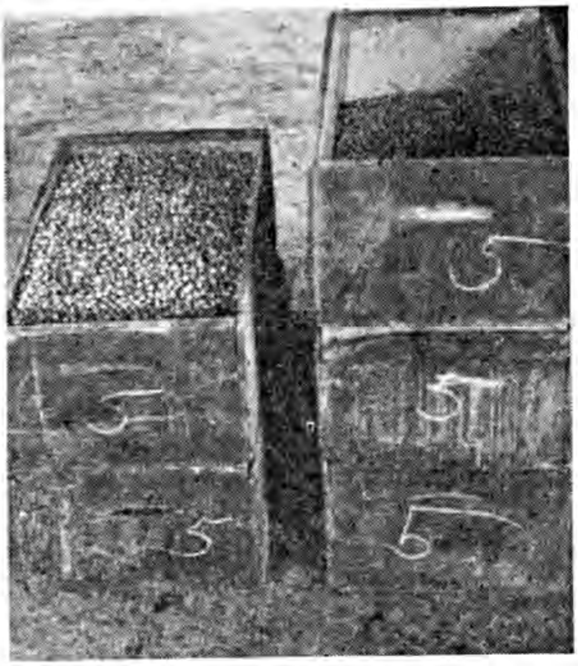
Here in this plot and its soil treatment there is evidence that our legume program, which we commonly grant needs help in the form of lime and phosphate as soil treatments, may well be looking forward to other helps such as potash fertilizer if we are to nourish these legume crops properly so they can fertilize our soils by means of the nitrogen they take from the air and by their organic matter when they are turned under as green manure.

To date no studies of the chemical composition of sweet clover in relation to soil treatment have been made, such as have been carried on with lespedeza to connect the soil treatments with the improved feeding value of the forage. When potassium now used in a more limited way is tried by more farmers, their observations on animal choices of sweet clover with different fertilizers may help to make sweet clover of better feeding value, in addition to giving it the unusual green manure value it already has.

Soil Management for Cannery Peas

(*From page* 12)

The data in Table 3 show, however, that yields where the fertilizer was so applied were lower than those obtained where the fertilizer was placed in bands



The effect of 300 lbs. of 4-16-8 applied in a band ½ inch to the side and 1½ inches below the seed in 1943.
Left—no fertilizer; 2,776 lbs. per acre.
Right—fertilized; 3,272 lbs. per acre.

½ inch to the side and 1½ inches below the seed. In agreement with previous years' results, it was found that fertilizer placed in contact with the seed injured germination and did not materially increase the yields. In fact, where 4-16-8 fertilizer was applied with the seed, the yield was less than where no fertilizer was applied.

After four years of experiments, a summary of the results led to the conclusion that fertilizer should never be placed in direct contact with the seed of canning peas but that it should be placed very close to the seed. As there seemed to be sufficient evidence for this conclusion, the work in 1942 and 1943 was limited to a comparison between the "½-inch out" band placement and the "drilled-in" placement.

Owing to extremely wet weather prevailing during the latter part of the growing season of 1942, no increase in the yield of peas was obtained from the use of fertilizer. The plants on the fertilized areas had a greater amount of vegetative growth, but lodging and rot-

TABLE 3.—THE EFFECT OF FERTILIZER ANALYSES AND PLACEMENT ON THE YIELD AND STAND OF CANNERY PEAS IN 1941, 1942, AND 1943*

Average of five replications

Treatment		H. Gremel farm			
		1941		1942	1943
Placement	Fertilizer	Yield	Stand	Yield	Yield
½ inch out	0–20–0	3,380	239	3,960	
½ inch out	0–16–8	3,660	245	4,140	
½ inch out	4–16–8	3,660	249	4,120	3,272
2 inches out	0–20–0	3,080	249		
2 inches out	0–16–8	3,560	246		
2 inches out	4–16–8	3,340	248		
Contact	0–20–0	3,260	231		
Contact	0–16–8	3,380	216		
Contact	4–16–8	2,880	195		
Drilled in	0–20–0	3,260	271	3,600	
Drilled in	0–16–8	3,480	257	4,020	
Drilled in	4–16–8	3,340	257	3,960	3,188
	No fertilizer	3,120	256	3,960	2,776

* See footnote Table 2. "Drilled in" refers to drilling the fertilizer 3 inches deep with a grain drill just before planting the peas. Varieties: Roger's Ace Surprise, 1941; Perfection, 1942; and Roger's Famous, 1943.

ting were greater on the fertilized than on the unfertilized plots.

In 1943, peas responded well to commercial fertilizer, but with a very small difference because of placement. A slightly higher yield of peas was obtained from plots receiving the band placement of fertilizer than from plots in which the fertilizer was drilled in deep before planting.

The data for the six-year period have demonstrated the need for a drill that will place the fertilizer in a band ½ inch to the side and 1½ inches or more below the seed. At the present time no such commercial drill is available. In view of the fact that experimental results from other states (New York, Minnesota, and Washington) agree with the results obtained in Michigan, a challenge is presented to the farm machinery manufacturers to supply the farmer with this type of planting equipment.

Recommendations

Fertilizers for cannery peas should not be placed in contact with the seed.

Fertilizers should be placed in bands approximately ½ inch to the side of the seed and 1½ inches, or more if possible, below the seed. However, there are now no commercial machines available to fertilize peas in this manner, and so the next best method is to drill in the fertilizer 3 inches or more deep just prior to planting. Do not disturb the fertilizer by deep tillage operations after it is drilled into the soil.

A fertilizer containing both phosphorus and potash, 0-14-7 or 0-20-10, should be applied for cannery peas. On the lighter colored soils or on non-livestock farms, or where for any other reason it is felt that nitrogen may be needed, apply a complete fertilizer such as 2-16-8, 2-12-6, or 4-16-4. The rate of application should be 300 pounds per acre.

Afterwards

(*From page* 5)

the veterans of 1914-19 stirred up at first, and some of them even kept going strong as late as the Milwaukee convention of the Legion five years ago. The snake dances on that occasion were a credit to men as far into the forties as they were; and I have seen some high old jinks going on along the home front this year, and not in regimentals either!

So I infer if there is any liquor left when the boys come back, some of us will have to keep sober for a change and let a few of the boys quench themselves. You can't alter the joy-making rules of humanity by solemn pronouncements and dire predictions. For a while there will be unconfined merriment and some clinking and splashing going on—but it won't last very long. And the percentage of those taken to the rest cure will not be as large as the number who have sacrificed a heap more than their sobriety. It calls for a nice blend of tolerance and vigilance. I don't suppose Ma and Pa ought to insist on going to the nightclubs with the boys every time either.

Since when are any of us homebodies in shape to charge the veterans with being extravagant? For four years many of us unused to big incomes have enjoyed good wages and a bonus on top of it. (Except the present white collar crowd.) The only reason we haven't bid like the devil against each other to force prices skyward is a certain unpopular limiting law. But your mud-slogging Yank and sea-going Gob have not benefited by the surge of cash business.

Naturally the few thousands he can borrow from the government on his discharge will look lofty enough after a few years of penny-ante. However, we don't need to fear an invasion of inflaters when the lads return with money burning their pants. If we keep calm during the interval and use our suds wisely on the proper kind of investments and don't buy too much land on a mortgage tied with a loose shoestring, I reckon the situation can be kept well in hand.

I am sure most farm lads upon their first night at home would rather be shown into a cozy bathroom and see Ma cook a meal over a new range and running hot and cold water on tap than to have Pa announce he has bought Binghooter's back forty with the wad he should have plugged into the existing debt.

PUT this down — that anything which has a hazardous air of speculation and risk about it will not be the proper kind of example of financing to lay before the service man with a bonus to spend. If we've been provident and careful ourselves during the big fuss, we can bank on most of the boys behaving well at the bank afterwards. The best way to prevent them from being caught with a "copper mine" is not to buy any such stock ourselves.

My third query is in this shape:

(3) Will they be crusaders, want to make the world safe for everything that is holy, and insist on adding a few more sanctimonious dictums to the Atlantic Charter?

My idea is that the average Yank is just about as much imbued with a reform spirit over there as a husky football player is in respect to tinkering with the college curriculum after winning a game. The lads went over there simply because they had to, it was our move on the grand old checkerboard, and unless we wanted to see the enemy move some men into our king row we had to do some fast work.

You won't find any Sir Lancelot romantics among the vets. (Except incidentally when obliged to tender kindnesses to the weak and unfortunate.) Maybe there were some ideologies bruited about while we were getting up steam, something to afford us a rallying cry, but we knew full well that Sherman described war exactly right and we had no illusions about one cause being all sacred and the other all evil.

I am satisfied about this too, because we are not in a mood to kid ourselves. This being the case, we are not quite so apt to be sour and disillusioned afterwards. If we were that way many of us would get cynical and bitter. We would feel that our achievement went far short of our destiny, to create a free world for the vanquished and a new deal for everybody. Not having clung to any impossible and impractical thesis of war aims, it leaves the Yanks in the role they relish best—fire-fighters and road-builders rather than metaphysical professors and theological preachers. When the fires are out and new roads built, the foreigners can plan their own future better than we can do it for them.

My final query is:

(4) Will they be shrewd and crafty about political pelf and preference for themselves and insist on giving all the good things to service personnel?

IF my boy is any index, the average service man has had little or no liking for or experience with everyday politics as it's played back home. To be sure, there will be plenty of gifted and able leaders among them who have a penchant for politics and who will delight in maneuvers and domestic campaigns.

At first the main pressure for preference to the returned veterans will be in Congress and among the civilian hero-worshippers. Of course, that won't last more than a year or so at best, and then the vets will be obliged to get well "organized" so as to get a decent hearing on anything. When uniforms are discarded and army equipment is hawked off to the slickest bidder, the glamour and salvos will die down and the only toe-hold the vets will have is some friends in office.

A bigger battle looms than this. Its problems and its reactions cut across all lines of service and non-service. I refer to the question we must settle at once—how to find leisure for all and idleness for none. Americans, after a war in which some sacrifice has come to the majority, after a decade of blue funk and depression preceding it, they will have a right to demand some leisure and no idleness and want.

I DO not think there is any other question visible now in the minds of parents and relatives, as well as in the hearts of the furloughed soldiers, which transcends this one. We are keeping that old frazzled slogan about "a world safe for democracy" among the relics of back waters. The equally puerile shibboleth "a war to end wars" is laid aside for good. But what we cling to and ask for as a modest reward for loyalty and courage is some sound scheme which will loosen the bonds of economic stagnation and give us leisure when we need it for refreshment, but not too much of it to make us weary and sore.

Along with this urge for steady employment at useful and fascinatingly modern jobs, we retain dim hopes that things will shape themselves everywhere by degrees so that it will not be necessary to load up the cannon and fire the torpedoes each time that men can't find enough work to do.

We made a lot of fun about "make work" projects, but they are a darn-sight better than "make war" projects, of which we have already seen too much. One man leaning on a crutch is worse than a dozen guys leaning on shovels. How about adopting that one for a cute little campaign emblem?

I had come to the end of my reveries just as the front door slammed on the mailman with his message from the front. It says that all was well six weeks ago. Well, all I can do now is to finish these screens, or conditions won't be so good around here six weeks hence.

OFFSHOOT

Sapphira Ann, the colored washlady, was very proud of her children, of which she had "raised eight head," as she put it, and all of them girls. When she was asked one day to give the names of her children she explained that she had chosen flower names for all of them.

Then she proceeded: "De oldest one is named Gladiola, de nex' one is Pansy, de third one is Heliotrope, de fourth one is Violet, de fifth one is Daisy, de sixth one is Petunia, de seventh one is Morning Glory an' de las' one is Artifishul."

Suspicious WAC: Look here, soldier, what's your objective?

Enamored Pfc.: In the words of Roosevelt and Churchill—unconditional surrender!

Tommy (saying his prayers sleepily) —"Now I lay me down to sleep; I pray the Lord my soul to keep . . ."

Mother (prompting)—"If . . ."

Tommy (almost asleep)—"If he hollers let him go, eeny, meeny, miny, mo!"

HOW MUCH PAINT?

"I told Tom that the average woman's clothing weighs only eight ounces."

"And what did he say?"

"He thought it was a shame that they had to wear such heavy shoes."

Consider the plight of the average girl back home. Once she used to say, "What a man!" Then it became, "What, a man?" and now it's, "What's a man?"

A bachelor may know all there is to know about women, but he won't get the truth about himself until he's married.

Burglar: "Don't be scairt, old lady, all I want is your money and . . ."

Old Maid: "Oh, go away. You're just like all the other men."

It was during a big bargain sale and tempers were rising. "If I were trying to match politeness," said the woman customer, glaring at the salesgirl, "I'd have a hard time finding it here."

"Will you kindly let me see your sample, madam?" the salesgirl replied.

Lips that touch whisky
  And lips that touch brew
Are always the first lips
  To say "I love you."

"Do you belong," asked the clerk, "to the Nazi Bund, or to any political party that plans to overthrow the government?"

"Yas'm," said the Negro.

"Which one?" asked the clerk, taken aback by the applicant's placid candor.

"The Republican," was the earnest reply.

It's hard to date women war workers. They aren't satisfied with a good time —they want time and a half.

A Southern gentleman objects to the use of "Yanks" to denote American soldiers in recent headlines. Well, there wasn't room in the line to say Damyanks.

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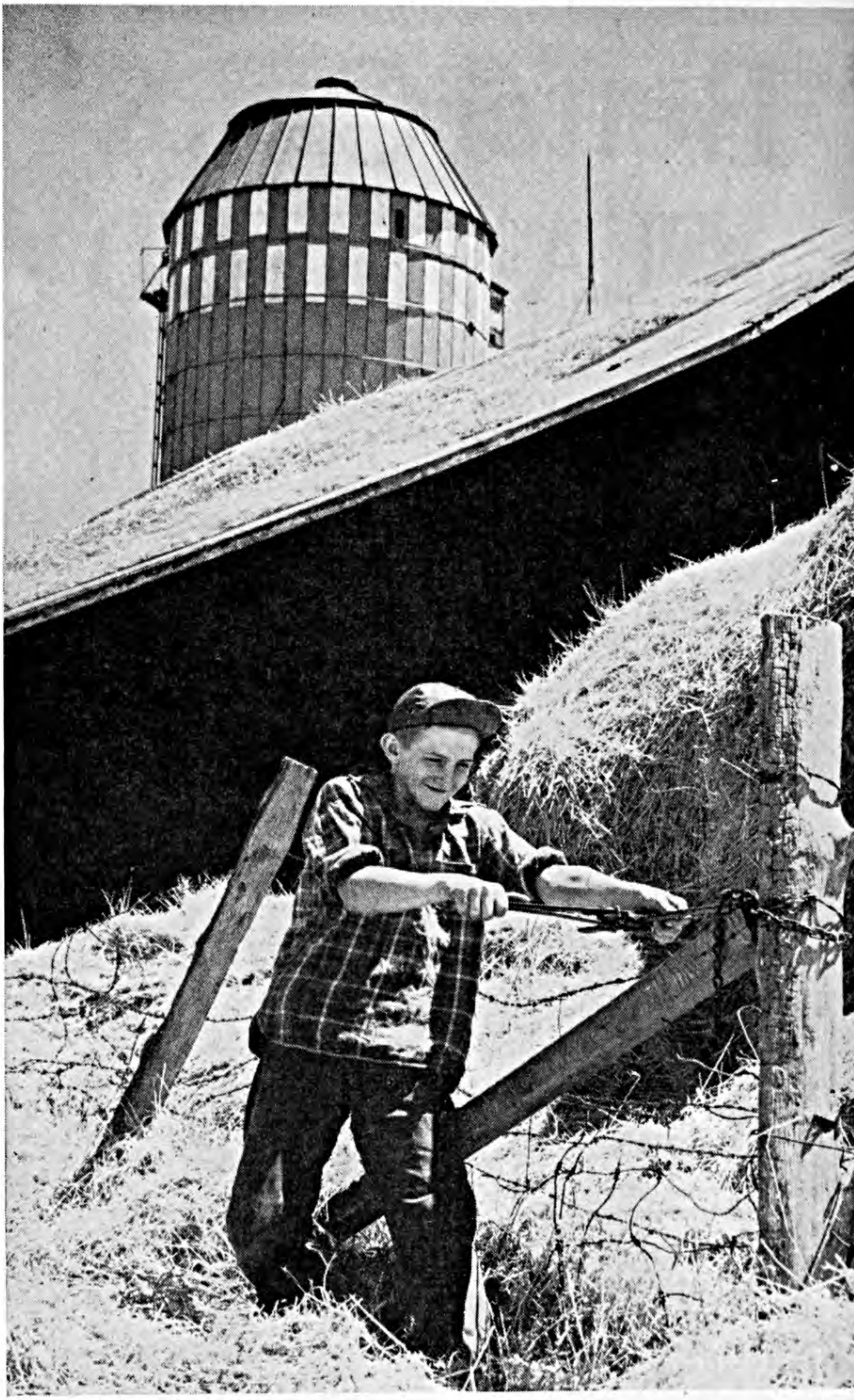

THERE USUALLY IS A REPAIR JOB AFTER THRESHERS LEAVE.

Better Crops with PLANT FOOD

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We Can't Do Business With—

BUGS

Jeff McDermid

CRAWLING recollections arise as I peruse a progress report of scientific quests for insect extinction. These wriggling memories remind me that it is quite within the span of my lifetime that economic entomology has provided mankind with something tangible in his constant itching struggle against voracious bugs and devouring worms.

If victory gardeners and all other amateur planters of esculent herbs and succulent berries had nothing more effective to ward off pests than the countryside possessed forty years ago, we would have no quarrel to pick with the WPB about the scarcity of pressure cookers or tin containers.

Indeed were we as short of insect ammunition as we found ourselves in my leg-bitten youth, it would be just as heroic and eventful to raise a mess of beans as it is to drop a brace of bombs.

With plant culture rendered more foolproof and certain, it permits our untrained operators to coax along a fair harvest so that others of bravery, ingenuity, and keen persistence may be drafted into warfare with those larger, uglier, more dangerous "insects" now due violent extermination.

Shooing at screen doors and tortured cows with paper flappers, laying sticky papers around for flies and babies to tangle with, filling poison plates with dope for invading ants, and squirting kerosene along the cracks of ancient bedsteads—these comprised our simple system of household pest control. As soon as we crossed the threshold to the outdoor jungles of teeming predatory marauders our futile barricades were abandoned, and all we could hope for there was a little help from birds and chickens.

So dependent were we upon the random notions of birds to pick up meals among our enemies that our schoolhouse debates often dragged interminably between those who wanted to kill all the crows and blackbirds on sight, and others who cried loudly for their protection because their gizzards often held carcasses of plant destroyers.

I MUST have been raised among bugs and worms, for some of my first observations concerned the antics of ants, the bumbling efforts of tumblebugs rolling along their dung balls, the creeping carpet cricket, the leaping grasshopper, the noxious smelling stinkbug under my hand, the sprawling daddy-long-legs on the door post, the fuzzy brown caterpillar at my feet, and the dainty spotted ladybug that my mother said was needed suddenly at home, owing to the fact that her domicile was afire. And sometimes when we moved to new quarters without previous fumigation and scouring, I woke up with swollen spots not caused by mosquitoes altogether.

When old enough to tackle the hoe or lead the horse afield, I became acquainted with other divisions and army corps in the insect world. Bird-pecking and finger-picking processes or maybe foot-mashing were the mainstays in our hopeless campaigns. We coaxed one particular old rooster and his harem of hens to follow our cultivator. All of these at best were but the feeble beginnings of organized economic entomology.

From notations recently seen, I am informed that the first regular systematic courses in ways to know insects and combat them were taught at Kansas State and Michigan State Agricultural Colleges back in 1867. I am not sure that folks had got along so far in their language as to dub them courses in "economic entomology"—a name that stumped me hard when I first saw it in a college catalog.

Three years after these courses were started, a modest treatise on agriculture was written by a city editor in New York City, including a nifty preface of explanation and apology for such a topic from a cave dweller in Gotham.

Its author was about as widely known then as our Mr. McCormick of the *Chicago Tribune,* and just about as unrelenting in his attitudes. In the middle of this book, which was dedicated to any man who could invent a power plow capable of turning twelve acres a day, the author inserted a chapter on insects. Now he therein invaded a field wherein he was an authority, being one of the big bug-smashers of his time. Not to keep up the suspense too long, I refer to Horace Greeley. Laying aside his faded umbrella, he divested himself of these remarks anent insects as crop pests:

"I would be far below the mark if I were to estimate the average loss of the farmers of this country from insects at one hundred million dollars per annum. In my neighborhood the peach once flourished, but does so no more, and cherries have been all but annihilated. Apples were till lately our best crop, but worms take half of them and sadly damage what they do not destroy. Plums we have ceased to grow; pears are stung or blighted; even the currant has its insect enemy.

"We must fight these paltry adversaries more effectively or allow them to drive us wholly from the field. In this I have no doubt that the best allies in this inglorious warfare are the birds. They will save us if we do not destroy them. Whenever clouds of birds shall habitually darken our fields in May and less notably through the summer months, we may reasonably hope to grow fair crops of our favorite fruits."

But at this point Editor Greeley broaches another line in pest control:

"I hold that the multiplication of insects and their devastations are largely incited by the degeneracy of our plants caused by the badness of our culture. I presume that wheat and other crops could be devastated by insects if there were no slovenly, niggard, exhausting tillage methods used. But when the fields of western New York were first tilled there were few insects; but after crops of wheat had been taken from those fields until they had been well-nigh exhausted of crop-forming elements, we began to hear of the desolation wrought by insects. I believe that we should have heard little of insects there had wheat been grown on

those farms but one year in three since their redemption from the forests.

"But whatever might have been, the Philistines are upon us, and we are doomed for at least a generation to wage a relentless war against insects, multiplied beyond reason by the neglect of our predecessors."

THAT Greeley was right in surmising that failing soils and woeful neglect of clean culture and sanitation helped to give those ancestors of our present pests a secure and threatening foothold, I need only quote from a treatise on orchard and garden insects, issued two years ago by a Midwest experiment station, which says:

"The number of insect pests will be reduced, both directly and indirectly, by good cultural practices. Insects that live in the soil, such as white grubs and wireworms, are destroyed by plowing; cutworm damage is often reduced by keeping down weeds and grass on which the moths lay their eggs; and some of the fleabeetles are partially controlled by frequent cultivation. Moreover, plants in a thrifty condition will tolerate a moderate infestation of insects without serious injury and will recover more rapidly than unthrifty plants."

As one scans the history of insect invasions and fumbling attitudes by the public toward research and appropriations to give further studies and demonstrations in economic entomology, the similarity of it to the indifference of isolationists regarding the European war menace is striking.

Few realize the uncanny and terrific adjustment and adaptability possessed by most injurious insects. They say that man has lived on this earth for 400,000 years but insects in various forms have inhabited the globe for forty million years, cunningly contriving to outwit enemies and overcome unfavorable weather and learning far more than we know about the chemical juices of plants and how to tap them with least danger to themselves.

We read about the havoc and desolation of insects in some other state or county just as we used to read about the fiends of war let loose on some distant unpronounceable village—without batting an eye or getting hot for defense. In my own locality we heard about the menacing strides of the European corn borer, but only when a group of us backyard gardeners found such worms snugly burrowed into the tassels of our favorite variety of sweet corn did we let out a yell and ask the state entomologist why in blazes science hadn't conquered the varmint yet.

So widespread and universal has been this ignorance and smugness concerning bugs and worms on fruit and vegetable that I note with alarm that only this summer congress has gotten around to an official recognition and continuing appropriation for the specific control efforts of the Bureau of Entomology.

If we think maybe we have won the world war, or see its conclusion looming across bloody fields of combat and revolution, we are far from winning,

(*Turn to page* 51)

Florida citrus groves are usually located on sandy soils such as this one in Polk County.

Florida Knows How To Fertilize Citrus

By J. Francis Cooper

Editor, Florida Agricultural Experiment Station, Gainesville, Florida

A FERTILIZATION program for Florida citrus which keeps the trees producing at maximum capacity year after year, holds expense to the minimum, and materially reduces cold damage to both trees and fruit has been evolved by the Citrus Experiment Station at Lake Alfred. It has proven its merits in both experimental tests and commercial practice.

While good wartime prices for fruit have enabled growers to make profits in spite of occasional high costs, growers are well aware of the fact that the period following the war may —and probably will—bring a different story in its train. They have not forgotten that only a few years ago they were struggling with what seemed to be an insurmountable problem of reducing costs to the point where they could still make a profit under prevailing low prices. With production in Florida now double what it was a decade ago, with yields throughout the United States almost certain to continue increasing for many years, with canning plants taking a larger and larger proportion of the crop at prices much lower than those prevailing for fresh fruit, and with uncertainty surrounding postwar demand and prices, the growers know that a proper fertilization program is their best hope for the future.

Over the past two decades citrus growers have been confronted with first one deficiency and then another, as organic fertilizers were replaced with inorganics. Research workers have tackled each deficiency in its turn and fortunately have determined the element in short supply which was causing the trouble. Copper was found to be the remedy for dieback, zinc for frenching, and magnesium for bronzing. At first, however, each element was considered more as a medicine than as a nutrient, and recommendations covered the cure but not the prevention of the trouble. Later research showed that by the time a trouble became obvious, production had already dropped at least 25 per cent.

Dr. A. F. Camp, Vice-Director in Charge of the Citrus Station, and his staff have done a fine job of correlating the work with various deficiencies, their regular fertilizer investigations, pH control studies, and even their spray schedules into a nutrition program which keeps all factors in proper balance and is giving results year after year. It works with all varieties of fruits, especially on the sandy soils on which a vast majority of Florida citrus groves are located.

The war emergency brought about a reduction in number from several hundred to 33 different fertilizer formulas in use in Florida, only a small proportion of the 33 being citrus fertilizers. It is entirely possible that the new coordinated program, which was already pretty well proved experimentally before the war started, will help to keep the number low after the war, since there will be no need for a multiplicity of fertilizer formulas to suit the fancy of each grower or a different fertilizer formula for each variety or kind of fruit.

The need for elements in addition to nitrogen, phosphorus, and potash has been evident for several years. The Citrus Station began to coordinate its program in 1936 and now has a recommendation that is meeting adequately the current needs. It can be changed, however, very easily if other deficiencies develop. The Station workers are recommending nitrogen, phosphorus pentoxide, potassium oxide, water-soluble magnesium oxide, manganese oxide, and copper oxide in the ratio of 4-6-8-(2 or 3)-1-½. It is not necessary to use that exact formula, but whatever formula is employed should follow those approximate proportions.

Most frequent difficulty encountered

A fertilizer sprayer in operation in a Florida citrus grove.

Spraying is a definite part of the nutrition program for Florida citrus in addition to controlling insects and diseases.

by growers who have attempted to follow the program has been the changing of the N-P-K ratios without changing the others to correspond, using something like an 8-12-16-3-1-½ instead of an 8-12-16-(4 or 6)-2-1. A second point of difficulty has centered around the grower's tendency to double the formula but not reduce his application by one-half, giving him a much more expensive fertilizer application.

Most Florida citrus growers fertilize their trees three times a year—about February, June, and September. Where groves are on heavier soils, however, some of them are fertilized only twice a year. Dr. Camp says the recommended formula is satisfactory for either two or three annual applications, and that it is suitable for each of the applications. However, if a grower wishes to vary the formula slightly by seasons, he can do this provided he makes sure that the total fertilizer applied for the year is in the recommended ratio of 4-6-8-(2 or 3)-1-½.

The trend toward the use of inorganic nitrates is credited with being a large factor in bringing on the very bad grove conditions which existed in Florida early in the decade beginning with 1930. The organics carried small amounts of other needed elements which the inorganics did not contain. At the Citrus Station one tier of plots which received all of their phosphate and about 65 per cent of their nitrogen from bone meal continued productive, while another tier receiving its superphosphate and either nitrate of soda or sulphate of ammonia developed the ailments common to commercial groves of 10 years ago. All of the plots were receiving what was considered a complete fertilizer.

There is as yet no conclusive evidence that inorganic nitrogen will be satisfactory over a period of years, even though magnesium, manganese, and copper are added to the fertilizer. No one knows when the reserves of some other element may be exhausted from the soil. Consequently, Dr. Camp recommends the use of from 30 to 40 per cent organic nitrates in citrus fertilizers where the organics can be obtained.

If organics cannot be obtained for all three applications, he thinks it more important to include them in the June application, which will be followed by more drastic leaching.

A 6 per cent level of phosphate set for this formula is 2 per cent lower than that of the 3-8-8 formula most widely used in the past for fertilizing citrus. The Citrus Station workers believed that with pH control, which is another necessary feature of their program, the phosphate would be more completely available than it is on very acid soils. To date they have seen no reason to change the phosphate recommendation from 6 per cent, which is lower than that used a few years ago.

That a phosphate deficiency is possible is evidenced by studies of Dr. J. R. Neller and Dr. W. T. Forsee of the Everglades Experiment Station at Belle Glade, Florida. On muck soils at Davie, fertilizer applications too low in phosphate resulted in fruit that softened prematurely and shed before becoming entirely ripe. Phosphate deficiency produced light crops of poor quality fruit, just as any other deficiency does.

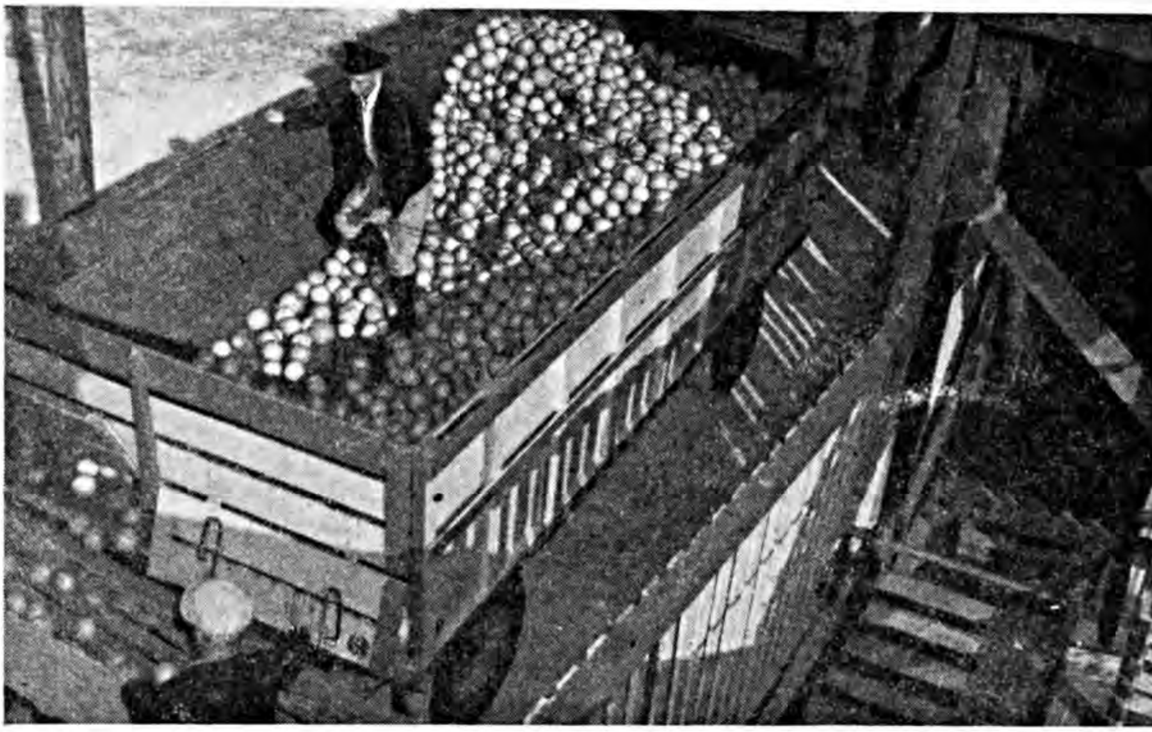
Dr. V. C. Jamison of the Citrus Station has found that superphosphate has little or no effect upon the fixation or solubility of zinc and copper in the soil. In instances where the application of reasonable amounts of superphosphate has been followed by zinc or copper deficiency, it has been found that before the phosphate had been applied fruit production was sufficiently low that the zinc and copper deficiencies were not evident. However, when the lack of phosphate has been limiting fruit production and this deficiency is removed, then either copper or zinc often becomes the limiting factor, thus giving rise to the erroneous belief that phosphate has tied up the other elements in the soil.

The 8 per cent ratio for potash was set partly because it was the percentage in standard usage, and partly because Dr. Michael Peech, formerly on the Citrus Station staff, had found that potash had not accumulated in the soils of a Station plot which had received 10 per cent potash applications for many years. Other investigators have shown a very rapid loss of potash in sandy soils, indicating that the citrus trees are largely dependent on annual applications of this element and that it would be a mistake to reduce applications too much.

Magnesium plays a particularly important role in keeping the trees bearing full crops year after year and avoiding alternation of cropping—a fair crop one year and a poor one the next. Pronounced deficiency of magnesium is evidenced in bronzing of the tree foliage, but marginal deficiencies may reduce yields without evidencing bronzing.

Dolomite is widely used in citrus groves to control pH and to furnish part of the magnesium requirements of the trees. Dr. Camp says that where the trees are in good condition and dolomite has been applied to the soil, a fertilizer containing 2 per cent of magnesium in a strictly water-soluble form, such as is contained in magnesium sulphate, is sufficient when the nitrogen level is at 4 per cent. It has been found, however, where lime or other basic materials low in magnesium are used to control pH, the magnesium ratio should be equal to the nitrogen

Virginia boys stationed at a farm labor camp at Winter Garden harvest citrus fruits, 1944. Proper citrus nutrition in this grove has increased yields.



With more fruit each year going to canning plants, economical fertilization becomes more imperative.

ratio, or 4 per cent. When magnesium-bearing materials not strictly soluble in water are used, where groves are either bronzed or in doubtful condition, and where the trees being fertilized are seedy grapefruit, it is safer to use 3 per cent magnesium, even in conjunction with dolomite.

The magnesium supply has been found to be the controlling factor in peel color.

The 1 per cent manganese included in the original master formula has been found to be sufficiently high. In fact, it has been difficult to show increased yields of fruit through the applications of manganese in the fertilizer applied to soils with a pH reading below 6.0, but fruit quality has been improved through its use. When the pH reading has been 6.0 or above, manganese has given increased yields.

Copper is recommended at ½ per cent when a copper spray is used, at 1 per cent when no copper spray is applied. However, results obtained without the spray have not been as satisfactoy as where the spray was applied, possibly due to the action of copper in the spray as both a fungicide and a nutrient. Copper in proprietary compounds is not as readily absorbed by the leaves as is that contained in bordeaux mixture.

Zinc is not recommended in fertilizers for Norfolk, Blanton, and Eustis sands since it appears to combine with organic compounds in the soil and become unavailable. Where frenching occurs, zinc sprays applied to the foliage have corrected the condition.

Control of pH has been shown to be a requisite part of this program, since a pH reading above 6.0 induces frenching or zinc deficiency, as well as manganese deficiency, while a pH reading below 5.5 is quite apt to induce bronzing or magnesium deficiency. Since maintenance of a constant pH is impossible, the Citrus Station staff recommends the application of dolomite or other basic material once a year sufficient to raise the pH to 5.5 or 6.0, and by the end of the year the pH reading probably will be down to around 5.3, giving a very good, safe range.

Framers of the program have made no attempt to specify the amounts of fertilizer which should be applied, since these will vary with age and condition of trees and other factors. However,

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Potash For War Food

By Dr. J. W. Turrentine

Washington, D. C.

SUMMARY OF SUPPLIES

1943-44 agricultural potash supply for the United States, Puerto Rico, and Hawaii was 605,000 tons K_2O, which equals 109 per cent of the base (average deliveries of 1941-42 and 1942-43).

1944-45 supplies will be 725,000 tons K_2O, 130 per cent of the base.

WITH the final clarification of the potash supply situation for the fertilizer or crop year 1943-44 embodied in War Production Board releases of recent months, showing the allocation of agricultural potash for war-food use within the continental United States, Puerto Rico, and Hawaii, interest now shifts to the question of how much potash is going to be available for next year, 1944-45. It can be confidently expected that in dealing with this question realism based on experience will control deliberations and resulting plans during 1944. Pertinent thereto is the following statement from the War Production Board:

"Everyone concerned with the production of food and fiber crops in 1944-45 to meet record requirements is interested in learning as early as possible the outlook for fertilizer supplies. Among the interested groups are the War Food Administration, the agronomists and other agricultural workers in the states, the members of the fertilizer industry, and the producers of farm commodities. As a guide to these groups the War Production Board has attempted to estimate the supply of each major fertilizer ingredient which will be available next year for agriculture in the United States, including Hawaii and Puerto Rico.

"It should be emphasized, however, that any estimates made this far in advance, although based upon the most reliable information available, are subject to considerable error. Not only is it impossible to determine accurately what the domestic production of each material will be, but the quantities which will be imported are subject to considerable uncertainty and military requirements can only be estimated.

Potash Stabilized

"Potash perhaps is subject to less uncertainty than are most of the other fertilizer materials, the domestic production having become stabilized at a high level with the major producers operating 24 hours a day throughout the year. In 1943-44 the entire supply has come from domestic production and there is no assurance of any imports in 1944-45, although the possibility of obtaining shipments from Spain and Russia is being explored. In the current year out of a total production of 771,000 tons of K_2O approximately 100,000 tons were allocated to the chemical industry, a large part of the product going to meet direct or indirect military requirements. In the present estimate of supplies available for domestic fertilizer it is assumed that chemical requirements for potash will remain unchanged in 1944-45.

"According to present indications United States agriculture (including Hawaii and Puerto Rico) will have available in 1944-45 approximately 700,000 tons of K_2O from primary potash salts, an increase of 96,000 tons of K_2O, or 16 per cent, over the 604,000 tons allocated in 1943-44. It appears that there will be an increase of approximately 104,500 tons of K_2O in the form of high-grade muriate, while the supplies of 50 per cent muriate and manure salts will be reduced approximately 2,500 tons and 10,000 tons, respectively, of K_2O. Sulphate of potash is expected to increase by approximately 4,000 tons of K_2O and the supply of sulphate of potash-magnesia will remain practically unchanged. Although it will vary for different salts, there will be approximately the same quantity K_2O allocated in Period Four (June 1, 1944, through March 31, 1945) as was allocated in Periods Two and Three combined.

"This anticipated increase in the supply of potash for agriculture is based on increased production capacity, elimination of lend-lease requirements, and more efficient utilization of existing production facilities. Plant expansion by one of the producers, already authorized by the War Production Board, is expected to provide 36,000 tons of K_2O in the last three quarters of the fertilizer year; approximately 20,000 tons exported under lend-lease in the current year are expected to be available for domestic use in 1944-45; and increased efficiency of production is expected to provide an increase of approximately 40,000 tons in production.

Increased Efficiency

"The increased efficiency of production had become evident by the beginning of 1944 and was one of the two factors which made it possible to increase Period Three (April and May 1944) allocations above the quantity which it previously had been estimated would be available for allocation. The other factor was the fact that the United Kingdom did not require delivery of the entire 36,000 tons of K_2O originally earmarked for lend-lease. Only 20,000 tons were taken, the remaining 16,000 tons becoming available for domestic use.

"In estimating the portion of the total domestic production of potash which will be available for agriculture, it is assumed that the requirements for industrial chemical uses will continue at the all-time high level reached in 1943-44, when the quantity allocated for these uses was approximately 100,000 tons of K_2O. If these requirements, a large part of which are for military purposes, should decline, the supply for agriculture will increase proportionately. It is also assumed that potash exports to countries other than the United Kingdom will be no larger than the quantities already approved."

It is recalled that early in 1943 potash was placed under allocation by the War Production Board, like most war emergency enterprises, a new experience for Government. As to potash supplies to be allocated, pretty definite information on domestic production was at hand—barring the unpredictable, but little was known of consumer demands, particularly those demands, like lend-lease exports and certain chemical and metallurgical uses intimately tied-in with the military backed by the ultimate of authority. Lend-lease commitments for export to the United Kingdom presented a major problem in estimating and apportioning requirements among those seeking supplies from American production, reaching at one time the total equivalent of 72,000 tons of 60 per cent muriate, partly as caustic potash, but principally as the agricultural grade of that highly refined salt in greatest demand. It was imperative that other sources of potash for British agriculture be drawn upon, an objective accomplished with the British return to Spain as a supplemental source of supply. In the offing, likewise, were actual and prospective demands for use in the agricultural rehabilitation of the areas rid of Axis domination by the armies of the Allied Nations. Again our domestic industry was (and still is) being viewed as the most convenient source of potash for these purposes, with quantities impossible to forecast. Fortunately, realism is prevailing and here again attention has been diverted to the Spanish exportable surplus as the more logical source, without that detriment to our own war food program so seriously threatened at one time.

From the beginning Canadian requirements have been cheerfully assumed as our obligation, on terms of exact equality with our own. But here again the forecasting of these requirements proved to be no simple matter with a 100 per cent increase since 1938, according to the official figures of the Dominion Government—an increase from 21,000 tons in that year to 40,000 tons K_2O in 1943-44.

Potash in War

In the field of chemical usage, it was promptly recognized that among the potash derivatives there were many that had important, if not essential, functions in the production of munitions and other commodities with an intimate tie-in with the prosecution of the war. There could be no question, with respect to many of them, as to their essentiality. Against the background of only 15,000 tons K_2O delivered to the chemical industries in 1938, there appeared to be no basis for apprehension that the war-time needs could not be supplied without the serious impairment of crop production; but even if apprehension had been entertained, there still existed the priorities which had to be recognized as supporting the demands. These circumstances surrounding allocations of the highly refined chemical grades of potash salts account for the fact that chemical demands reached the total of 100,000 tons K_2O equivalent, which raises the questions of possible luxury consumption in some of the many uses to which potash is now being applied in the chemical and metallurgical industries, and whether the whole situation could not now be reviewed with profit in the search for certain tonnages, insignificantly small as separate items but important in the aggregate, that could be diverted back to agricultural use with greater returns to the over-all war program. Such an increase as has occurred here could not be foretold, at least with sufficient accuracy to add value to an allocation program.

Furthermore, early in 1943 the war-food program had not won its place in the public mind as second to none in importance among war efforts. The result was, in effect, that war food was allocated what was left after prior claimants, with what appeared to be superior authority, had been satisfied. In allocating this balance to agriculture, conservativeness was in order and the major problem was equality of treatment among some 700 fertilizer mixers. The so-called Period Two allocations were made under these considerations and on this basis; at the same time it was made clear that a supplemental allocation (Period Three) would be made, an additional 10 per cent being the conservative estimate. Unfortunately, that statement was largely ignored and planning was restricted to the tonnage previously allocated. Thus resulted misinformation and confusion from a clear effort to be conservative and accurate. Now we know, belatedly to be sure but nonetheless definitely, that the potash allocated to the fertilizer industry for distribution to the farmer during 1943-44 was 605,000 tons K_2O, which is 109 per cent of the base instead of the 80 per cent widely publicized during the 1943 period of discussion and planning.

During the calendar year 1943, the potash industry made deliveries of 723,-000 tons K_2O, of which 591,000 tons K_2O were delivered for agricultural use within the continental United States. During the allocation periods of 1943-44, the War Production Board allocated 766,000 tons K_2O. Of this unprecedented total, 100,000 tons K_2O (in the form of the highest grades of salts) were allocated to the chemical industries, a more than six-fold increased consumption since 1938; 40,000 tons K_2O to Canada; 26,000 tons K_2O to exports; with the remaining 605,000 tons K_2O to the fertilizer industries of the United States, Puerto Rico, and Hawaii.

Adding to uncertainty to an even greater degree than the conservative treatment of the potash supply question was the difficulty of estimating the prospective mixed-goods tonnage output involving the appraisal of the combined effects of all the factors entering into the preparation of mixed fertilizer under war-time conditions. These were and still are many. With scarcity of labor receiving most frequent mention, other deterrents to increased production are scarcity of materials of construction and repair, of bags, and of gasoline and rubber for truck distribution. Superimposed and aggravating the more commonly encountered obstacles is the seasonal nature of the industry with many activities habitually congested within the few months of the spring planting season. These obstructive factors are now fully recognized and sincere efforts are being made by government to reduce their adverse effects on output. The fertilizer industry, accepting the challenge to its proficiency, is bending every effort to produce the maximum tonnage possible under these many handicaps. The farmer, in response to widely publicized appeal by government and industry, has been lending his aid by buying early instead of at the planting season.

The Potash Ratio

With the end of the season now past the answer shortly will be forthcoming as to how effective these efforts have been in overcoming obstacles tending to block increased output. As to mixed-goods output, the official estimate is 7¾ million tons during 1943-44.

The obstacles mentioned above give added justification, if any were needed, for the early directive issued by the War Food Administration prescribing the 18 per cent plant-food minimum for mixed goods designed to reduce the content of inert fillers using up their proportionate share of labor, bags, and transportation facilities.

With the record of 1943-44 mixed-goods output in hand, it will be possible to deal more realistically with the question of the adequacy of potash supplies for the production of recommended grades. This was not easily possible during the past year in dealing with fertilizer goals based largely on measures designed to increase output whose efficacy had not been tested. As the result, in efforts to adjust an assured potash supply to that hoped-for output of mixed goods, an average potash ratio was projected far below that of the preceding year and so far out of line with recommended ratios as to threaten the abandonment of the scientific basis of crop nutrition, evolved as the culmination of decades of research, demonstration, and farm experience.

This threat was resisted by state officials with a sense of responsibility to the farmers of their respective states and the Nation's overall war-food demands, adhering to their scientific data in advising as to the most efficient combinations of the three major plant-food elements to be applied to crops in terms of their respective requirements for maximum yields as influenced by the soil conditions on which grown, facts falling within the scope of their expert knowledge. Their position reflected the conviction that any inadequacy of supply demanded more, not less, efficiency in use and that to meet the Nation's food goals called for by the war emergency, the ultimate of agricultural science should be applied, not abandoned merely to facilitate distribution.

According to the U. S. Department of Agriculture statistics, the average percentage potash content of mixed goods for the respective years 1938 to 1942-43 were as follows:

1938	5.94% K_2O
1939	6.06
1940	6.35
1941	6.60
1942	6.85
1943	7.50

These figures show an orderly rate of increase as state recommendations find wider acceptance by farmers. However, it should be pointed out in this connection that over-emphasis on averages can also prove misleading, for after all an average is only an elementary statistical expression without any agronomic or economic significance whatever, it being common knowledge

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The Need For Borax On Fourteen Crops

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

Agricultural Experiment Station, Burlington, Vermont

Apple tree seedlings—without borax (left) were soon dead; with borax (right) were healthy.

FARMERS and vegetable growers have brought to our attention a number of crop troubles apparently nutritional in character. Since many of these troubles were suspected to be due to some phase of boron deficiency, we purposely boron-starved 14 important crops grown in the Northeast. These were grown on a very boron-deficient Vermont soil in order to more clearly recognize boron-deficiency symptoms under field conditions. The eventual objective is to find out what crops need borax and where it is needed as a farm fertilizer.

Plants starved for boron exhibit many diverse symptoms. The number of possible symptoms or phases of boron deficiency for each crop is almost unbelievable considering the small amounts of this element needed by plants. Burrell in relation to the apple describes at least five different symptoms (1) but apparently there are others.

We have obtained and corrected seven different symptoms of boron deficiency of alfalfa on a Vermont soil, namely, terminal dieback, rosetting, multiple branching, seed stripping, defective inflorescence, seedling death, and abnormal foliage coloration (4). The latter by some writers is called "yellows." Two other relatively unimportant symptoms, withered seed and root cankers, were also obtained and corrected. For alfalfa, no symptom corresponding to the "cracked stem" disease of celery has been observed, but such a symptom might exist.

We thus postulate that there can be at least all of these 10 different boron-deficiency symptoms for every kind of plant provided the proper degree of boron deficiency is attained. The extent or degree of each symptom depends on the time boron deficiency overtakes the plant and at what stage crop growth is arrested. Knowing only one symptom per plant does not seem to be the final answer. Until someone has reached into the grab-bag of nature and pulled out all symptoms, experimentally, as they occur in farm practice, we can still expect surprises. The symptoms probably express themselves more or less independently of each other or several of them at the same time, as we have found for alfalfa.

Some symptoms for each crop have economic importance, others do not, probably because they are microscopic and not easily observed. The fact remains, however, that there are still many symptoms for each crop yet to be reported, and that investigators may have missed certain prevalent symptoms which often betray the field need for boron as a fertilizer.

A five-year search has been in progress at this Station to see what diverse crop symptoms of boron deficiency could be uncovered. The writers believe that boron-fixing soils found in the podzol region offer a fertile field for further crop research since they provide suitable media for obtaining different levels of boron deficiency under field conditions. The following experiments are offered as progress in this direction.

These experiments were conducted in field pots because of difficulties previously encountered in large field trials. For two seasons before they were started, attempts had been made to produce and correct clear-cut cases of boron deficiencies in the field with 14 important crops. Although the experiments were conducted on a field where marked boron responses had been obtained with alfalfa, we had no luck in obtaining them with other crops, even though suspecting nutritional troubles were present. Difficulties encountered might have been due to either poor availability of borax, inability to control the level of the boron supply, unfavorable season, or lack of other necessary nutrients such as magnesium. At any rate, it seemed that more progress might be made on pioneer experiments if they were conducted in barrel-sized field pots, at least until the expected deficiency symptoms could be determined.

The field pots used were asphalt-painted metal ash cans, 18 inches in diameter and 2 feet deep, with holes in the bottom for drainage. The pots were sunk in the field, the top within two inches of the ground level. The possibility that plants might feed through the bottom was considered but dismissed as remote because of the character and depth of the soil employed.

These experiments were purposely to be conducted on a soil known to have a high capacity to fix boron, because it would permit growth to be

Red clover—no borax (left); with borax (right). Leaves of boron-deficient plants were lemon yellow colored, some also being streaked along the veins. With borax normal growth resulted.

arrested at many different stages, and permit the use of ordinary commercial fertilizers, even though they may carry some boron impurities. Sand cultures were purposely avoided because they would be more artificial and involve much more trouble to attain severe deficiencies.

The soil selected was a very boron-deficient podzol topsoil from Breadloaf, Vermont. When limed to neutrality it fixes considerable amounts of boron out of reach of the crop. This soil contains more than 90 per cent organic matter, and it has been found that this organic part fixes boron, apparently functioning as an organic zeolite.

The soil in all pots was limed to approximate neutrality with ordinary ground limestone, fertilized with an ordinary 8-16-16 commercial fertilizer at 1,000 pounds per acre, and epsom salt at 200 pounds to supply magnesium. The fertilizer was calculated for the full depth of soil and mixed with it. Except for boron, all pots were fertilized exactly alike.

Borax was added to every other pot at 100 pounds per acre. This rate of borax seems to be necessary to grow plants on this high-fixing soil. The other pots were left entirely without borax or, because of no growth at all, borax was later added to several at the very low rate of 2 pounds per acre in water solution. The purpose was to obtain field pots with and without borax, but otherwise generously and equally fertilized. No irrigation was provided, rainfall being the only source of water for the crops, just as in field practice in this region.

Fourteen crops were planted—red and ladino clovers, timothy, oats, turnips, beets, carrots, sweet corn, lettuce, and string beans from seed, cabbage, broccoli and tomatoes from transplants, and potatoes from tubers. To fully eliminate genetic differences between potato seed pieces used, each seed tuber was cut through the stem end into equivalent sections. Half of each tuber went to the pot fertilized with borax, half to the pot without borax. This is really a tuber unit idea, a potato cut into equal units and a unit for each fertilizer treatment.* Potato seed pieces were thus approximately the same size and shape as used in farm practice. Soil was washed from roots of transplants to eliminate a carry-over of boron from the old to the new seedbed.

A corn plant without borax produced a rudimentary ear and folded leaves while the stalk lacked tassel and silk. Leaves were streaked and had a water-soaked appearance.

Since even in these experiments it was impossible to predict and control exactly the degree of boron deficiency and the age of the plant when growth was arrested, the symptoms reported represent only a few of the possibilities. They are striking but not necessarily the only ones sought. With many crops very outstanding boron deficiencies were obtained, as well as corrected, on this Vermont soil, although the symptoms were more severe than wanted.

Potatoes (Var. Green Mountain)—An extreme response to boron was obtained in spite of any boron which might have been carried in the seed pieces. Leaves of the boron-deficient potato plants appeared markedly rolled upward and were abnormally brittle and tough. They were suggestive of the potato leaf roll virus disease except for their pale dirty green coloration.

Potatoes with borax yielded 1,296 gms. of good tubers per pot; without borax, 52 gms. of small tubers which

* Tuber unit fertilization is a very useful procedure in other potato nutritional work to equalize genetic differences in seed.

were absolutely worthless. This is a 25-fold increase in tuber yield from the use of borax on this soil. These extreme yield differences were obtained because the deficiency was very severe and because the deficient plants died when not more than nine inches high. However, the deficiency is not as extreme as it is possible to attain, because a two-year starvation with the elimination of boron from the seed piece should cause still more severe symptoms. We predict extreme variation in symptoms between the severe deficiency obtained and those which overtake the potato plant after it is older.

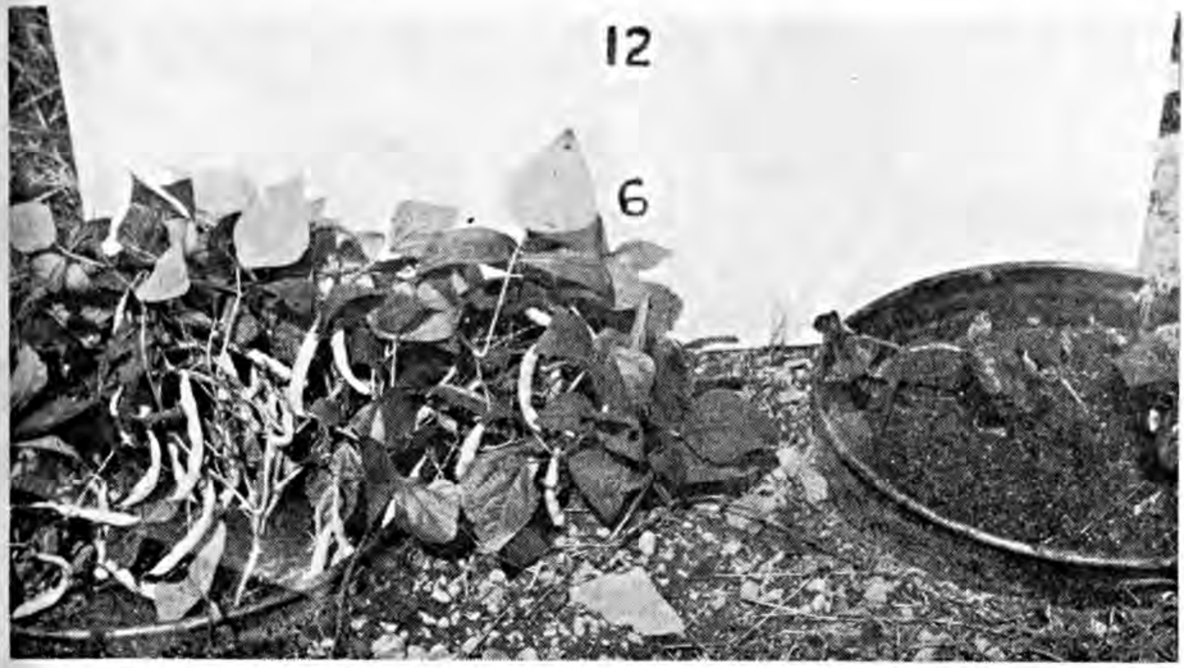
Potato plants starved for boron suffered a severe attack of early blight while right beside them those receiving boron escaped it. This happened when the deficient plants were less than eight inches high. The fungus was identified in the field by Dr. Lutman, the Station Pathologist. Leaves of deficient plants rolled upward more than normally, were plastered with brown patches of this fungus, and were a dirty pale green in color.

In contrast, plants fertilized with borax were healthy, free of early blight fungus, lived until frost time, and produced a crop of clean, healthy tubers. Severe boron starvation thus fostered a clear-cut attack of early blight while borax in the fertilizer completely corrected it. This probably will happen again if the experiment is repeated, but of course the only way to be absolutely sure is to try it another year. Heinrich has also found that boron reduced the amount of potato blight (5). In a sense, our observation is confirmed by him although it is not clear whether he refers to late or early blight.

Bordeaux spray is commonly considered the remedy for early blight. Here, however, the attack occurred on the boron-deficient plants even though they had been well and frequently sprayed with a home-made 6-6-50 bordeaux. From this one experiment it would seem that boron in the fertilizer was very helpful in preventing the early blight of the potato. It should be remembered that both boron and bordeaux are antiseptic in their action and might both function in a similar way, although it is likely that lack of boron increased plant susceptibility to blight.

Boron-deficient tubers at digging

Potatoes—no borax (left); with borax (right). Note the upward rolling of leaves and the dwarfing of plants due to lack of boron. With borax, plants were normal.



String beans—with borax (left) a prolific crop of beans was produced; without borax no beans formed.

time were more withered, rusty brown colored, and punky on the outside than potatoes that had been in the cellar for a year. The skin when cut was thick, corky, russeted, and finally cracked. Inside, the flesh was a solid rusty brown color except for a very small white area in the central part of the tuber. The vascular ring was obscured by browning. The tubers were very watery. None was larger than a golf ball. The watery internal condition indicated that the starch had not been accumulated in the tuber in the normal fashion. The brown internal color was the same shade as that causing net necrosis and stem-end browning of the potato. Further experiments are needed to determine what lesser degrees of boron deficiency look like midway between the solid browning we obtained, which severely dwarfed the tuber, and the normal white internal condition. Until proved otherwise, there is a possibility that the right degree of boron deficiency might induce symptoms similar to net necrosis or stem-end browning in the tuber. One might think that what is known about net necrosis would eliminate a nutritional explanation. Nevertheless, present information might be merely fragments of the truth.

Turnips—Rutabagas—A marked response of turnips to borax was obtained. Without it, seedlings became straw colored and died when less than two inches high. The boron-deficiency symptom obtained in this case was the death of the seedlings. With borax, normal plants were obtained and continued to grow vigorously through the season. Yields, being meaningless, were not taken. In this case the deficiency was so severe that the turnips did not grow large enough to produce the characteristic brown heart usually reported as a result of boron deficiency.

String Beans (Var. Black Wax)—String beans responded markedly to borax. Without it, they quickly grew two leaves beyond the cotyledons and thereupon were attacked by fungous diseases. Although they made some further futile attempts to grow, no blossoms formed and no fruit was set. Growth was finally arrested midway between the seedling stage and flowering. Leaves were first dirty green, tending to become yellow and brown. With borax, normal growth was obtained, fungi did not attack, and the plants flowered profusely and produced a prolific crop of beans. Failures to form flowers, pods, and seed were the deficiency symptoms most obvious in

(*Turn to page* 43)

Roscoe Fraser of Purdue and Shirley Fredericks of Lafayette comparing color on thumbnails with a ripe tomato to help determine when the tomatoes have proper color for picking.

Eliminates Guesswork From Tomato Picking

ROSCOE FRASER, Purdue University Tomato Specialist, has at last found a practical use for the brilliant red nail polish which to date has been employed solely for the glamourizing of the finger and toe nails of women.

It all came about while Fraser was dictating letters one day last spring. His secretary was having her bad moments over his dictation, and almost literally pulling her hair, which made Fraser nervous. Her brilliantly polished nails also added to his distraction, until he suddenly remembered his annual problem of teaching prospective tomato pickers to select fruit of the proper shade of red.

U. S. No. 1 tomatoes are 90% good red color, while the No. 2 grade are only 66⅔% good red. To date it has been necessary for pickers to keep in mind the desired shade of red while searching among the vines for the select color.

Fraser hit upon the idea of painting the thumb nails of the pickers with the exact desired shade of tomato-red nail polish, thus keeping constantly before their eyes the proper degree of color.

The thumbs are always in view of the picker and can be easily compared with the tomato he is about to pick. If the fruit is not the correct shade, he can pass on to the next hill. When the nails become covered with dirt, the soil is easily removed in one swipe from the hard-surfaced polish, thus insuring a uniform, unchanging color chart constantly before the eyes of the picker.

Keeping Soil Fertile In The Pecan Orchard

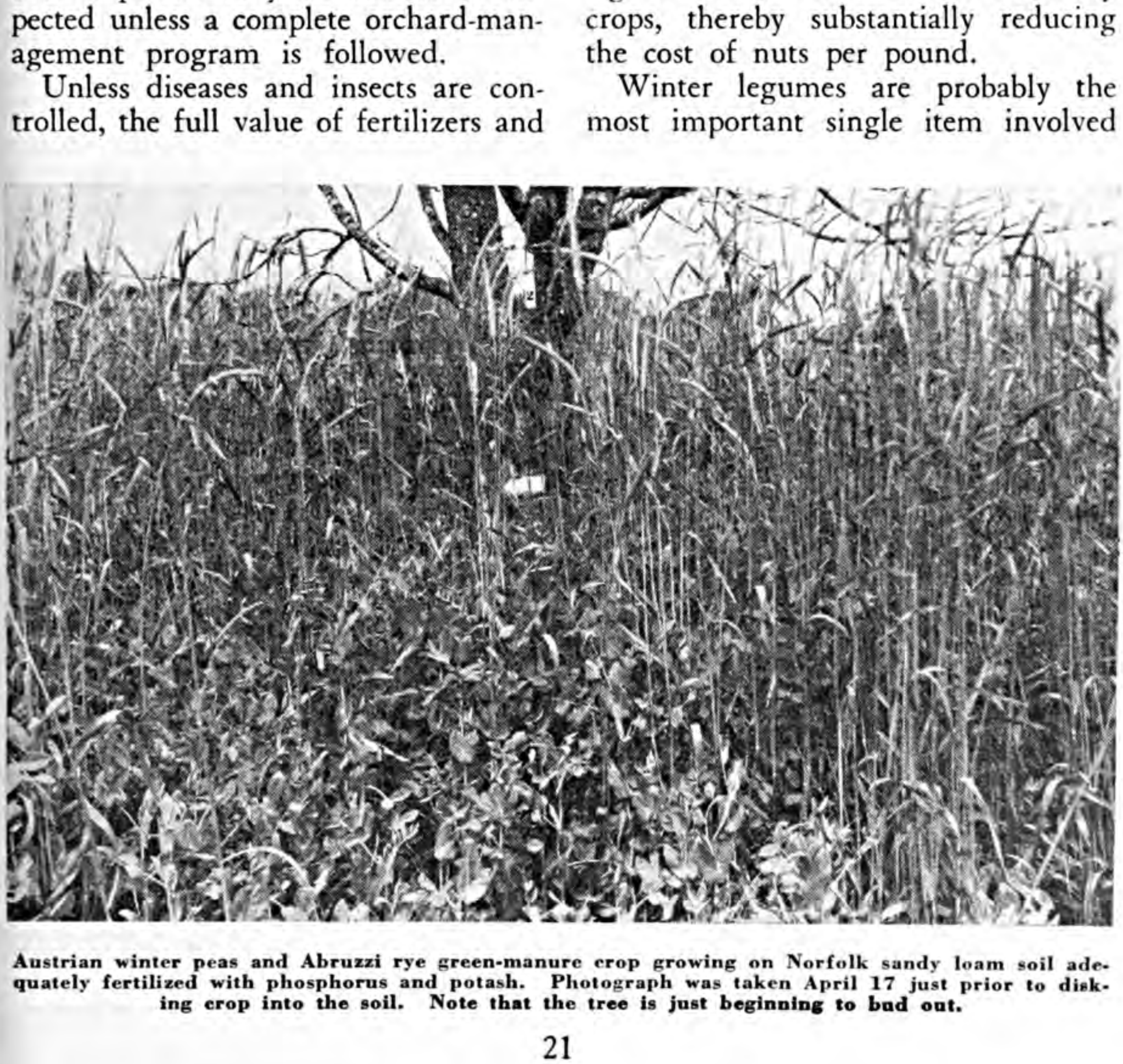
By J. H. Hunter

Associate Soil Technologist, U. S. Department of Agriculture, Albany, Georgia

THE maintenance of soil fertility in pecan orchards for the successful production of nut crops involves timely applications of the proper kinds and amounts of commercial fertilizers and the growing of suitable cover crops. It has a relation to the profitableness of the control of insects and diseases affecting the trees, as well as to that of other orchard operations. In fact, profitable production of pecans over a period of years cannot be expected unless a complete orchard-management program is followed.

Unless diseases and insects are controlled, the full value of fertilizers and green-manure crops will not be obtained; and if the orchard needs thinning or is not properly cultivated, dry weather may limit or entirely offset the beneficial effects of fertilizers and green-manure crops. Furthermore, if tree vigor is low and only light crops of nuts are set, the returns from spraying to control diseases and insects will be very small. Proper attention to the fertility of the soil usually results in vigorous trees which should set heavy crops, thereby substantially reducing the cost of nuts per pound.

Winter legumes are probably the most important single item involved



Austrian winter peas and Abruzzi rye green-manure crop growing on Norfolk sandy loam soil adequately fertilized with phosphorus and potash. Photograph was taken April 17 just prior to disking crop into the soil. Note that the tree is just beginning to bud out.

Hairy vetch and Abruzzi rye green-manure crop growing on Norfolk sandy loam soil adequately fertilized with phosphorus and potash. Photograph was taken April 3, about 2 weeks before disking crop into the soil. Note that the tree is still dormant.

in maintaining the fertility of the soil in the orchard. They are recommended in preference to summer legumes because summer crops, although valuable in improving fertility of the soil, compete with the trees for both nutrients and moisture.

It has been found, however, that the winter legumes will not make satisfactory growth on a majority of the Coastal Plain soils of the Southeast without commercial fertilizers. As a general practice, 300 to 400 pounds of superphosphate per acre, or the equivalent from other phosphate materials, and 100 pounds of muriate of potash should be broadcast annually prior to or at the time of seeding the green-manure crops. Where more convenient, a 0-14-10 fertilizer may be applied at the rate of 400 to 500 pounds per acre. If these fertilizers should fail to produce satisfactory growth of the legumes, the soil should be tested for lime requirement, and lime used only if a deficiency is indicated by the tests.

As a general thing, lime is not recommended for pecan orchard soils because overliming may upset the availability of the zinc in the soil and cause the trees to rosette. Even without the use of lime, a good soil-fertility program for pecans frequently creates a greater demand by the pecan tree for zinc than many of the soils of the Southeast will supply, and in many cases the grower should expect to use zinc sulfate to supply this need.

Experimental results as well as the experience of growers have shown that hairy vetch is the most reliable winter green-manure crop for planting in the Southeastern pecan-producing section. Austrian winter peas are planted widely but their growth is frequently reduced by diseases if planted successively. Their one advantage over hairy vetch is that they make more growth during the winter than the vetch.

As is the case with other crops, it is best to rotate, and on the heavier soil types Abruzzi rye may be used to advantage about one year in three. Data by Lewis and Hunter [1] in studies

[1] Lewis, Rulon D., and James H. Hunter. The nitrogen, organic carbon, and pH of some Southeastern Coastal Plain soils as influenced by green-manure crops. Jour. Amer. Soc. Agron., Vol. 32, No. 8, 1940.

made outside the orchard show that the nitrogen level in the soil was maintained when rye was used in rotation with vetch and Austrian peas. For a period of four years in which rye was used once, the nitrogen in Greenville sandy loam soil was increased in percentage content over that originally contained in that soil by an average of 0.02 and in Norfolk sandy loam soil it was increased by an average of 0.01. Converting these figures to pounds of nitrogen per acre of surface soil (2,000,000 pounds) gives an increase in soil nitrogen of 400 and 200 pounds per acre for the respective soils, or the equivalent of 2,000 and 1,000 pounds per acre of a fertilizer containing 20 per cent nitrogen.

Hairy vetch alone, or a mixture of 5 pounds of Abruzzi rye to 25 pounds of vetch, should be sown at the rate of 25 to 30 pounds per acre; and Austrian winter peas alone, or a mixture of 5 pounds of Abruzzi rye to 25 pounds of peas, should be sown at a rate of 35 to 40 pounds per acre. Abruzzi rye, if used alone, should be seeded at the rate of 50 to 60 pounds per acre. Ten to 15 pounds of oats may be substituted for the 5 pounds of rye in the mixtures if the seeding rate is increased accordingly. Seeding should be completed by October 15 for best results. Inoculation of seed of all legumes is necessary when planted for the first time, and inoculation of the seed each year is probably good insurance. A good seedbed is essential if good stands are to be obtained, but this will not be difficult if the soil has been properly cultivated throughout the summer.

When rye is used alone as a green-manure crop, it should be disked into the soil during the pre-blooming stage. This is important because the rye plant decreases rapidly in percentage nitrogen content from this stage to maturity and may become too low in nitrogen content for decomposition to proceed rapidly when turned into the soil. If this does happen the nutrients

(*Turn to page* 50)

Abruzzi rye green-manure crop growing on Greenville sandy loam soil following three years of winter legumes. Photograph was taken March 20 at the time of disking the crop into the soil. When rye is used alone, it should not be allowed to grow beyond the pre-blooming stage as the percentage nitrogen content of the rye plant decreases with age and may become too low for rapid decomposition.

Soil Fertility's Effect On Asparagus

By Benjamin Wolf

Soil Chemist, Seabrook Farms, Bridgeton, New Jersey

THE growing of asparagus has become an important industry for New Jersey farmers. About 22,000 acres were grown in 1943 and its value approximated $7,000,000. A good portion of this asparagus is canned. Because of the value involved, the satisfactory production of quality asparagus in the State is directly important to growers, processors, and consumers.

The G.L.F.—Seabrook Farms Raw Products Research Division—a research organization sponsored by the G.L.F., a leading farmers' cooperative in the area, and Seabrook Farms, largest vegetable farm in the world—has been studying the influence of soil fertility upon the gross dollar returns per acre of asparagus. The gross dollar returns per acre were used as an index of quantity plus quality production.

The results of the two years of study suggest the possibility of materially increasing the dollar returns by paying proper attention to the fertilizer practice. High gross dollar returns per acre, which mean high yields of good quality, are always important but are doubly so during wartime. The findings of this study are herein briefly presented so that they may be of benefit to people beyond this immediate area.

In making this study, thirty asparagus growers in 1942 and again in 1943 were selected from a list of those growers contracting their crop with Deerfield Packing Corporation, the packing division of Seabrook Farms. The growers were selected so as to give a wide variation in the average dollar returns per acre. In 1942, the gross returns per acre for the thirty growers selected ranged from $37 to $391. In 1943, twenty farmers of the original group and ten different farmers had average returns ranging from $95 to $504 per acre.

In selecting the fields for study, only beds from 5-12 years of age were considered. In this manner, low returns due to the extreme youth or old age of the bed were largely eliminated.

The soils on which the asparagus was grown were of Coastal Plain origin and belong primarily to the Sassafras series. Samples of the surface soil (0-6″) and of the subsoil (6-12″) were selected just prior to the end of the cutting season from all fields. A composite sample of five borings was used to represent an area of no more than five acres. The samples were analyzed by rapid methods which permit a fairly accurate determination of nutrients.[1]

The average results of soil tests were correlated with the average dollar returns per acre. The association of various levels of nutrients with dollar returns per acre for the two years is presented in Table I.

The association of the amounts of phosphorus and potassium in both surface and subsoil with the dollar returns per acre is most striking. Witness the 1942 returns of $225 per acre where the soluble phosphorus content of the surface soil was over 30 lbs. per acre as compared to only $125 returns for those soils having less than 15 lbs. of

[1] Wolf, B. "Rapid determination of soluble nutrients in soil and plant extracts." Ind. and Eng. Chem. Anal. Ed. Vol. 15, p. 248-251, 1943.

soluble phosphorus per acre. Also, the returns of $240 per acre when the soluble potassium was between 300-400 lbs. per acre, as compared to $170 per acre for those fields containing 100 to 200 lbs. of soluble potassium per acre. The presence of sufficient soluble phosphorus and potassium in the subsoil was even more important. The results for 1944 are essentially the same and reaffirm the findings of 1943.

The presence of sufficient calcium and magnesium was desirable, but the importance was overshadowed by the effects of phosphorus and potassium. However, there was a definite trend in favor of higher amounts of these elements. It would seem to be necessary to have not less than 500 lbs. of soluble calcium in the surface soil, and higher amounts would be an added asset.

The effects of pH and organic matter (Table II) also seem to be somewhat overshadowed by the importance of phosphorus and potassium. Again, there are definite trends in favor of higher pH values in both surface and subsoil and organic matter in the surface soil.

Attempts were made to explain the

TABLE I.—THE AVERAGE DOLLAR RETURNS PER ACRE OF ASPARAGUS AS ASSOCIATED WITH VARIOUS AMOUNTS OF DIFFERENT NUTRIENTS

Element and Location	Amount, lbs.* per acre	Dollar returns per acre	
		1942	1943
Surface phosphorus	Less than 15	125	180
	15–30	225	235
	30 or more	225	300
Subsoil phosphorus	Less than 5	115	180
	5–10	160	220
	10–15	250	265
	15 or more	280	270
Surface potassium	100–200	170	185
	200–300	225	215
	300–400	240	245
	400 or more	...	260
Subsoil potassium	Less than 50	110	140
	50–100	160	165
	100–150	220	200
	150–200	250	220
	200 or more	290	280
Surface calcium	Less than 500	...	140
	500–1,000	190	200
	1,000–1,500	225	240
	1,500 or more	...	260
Subsoil calcium	Less than 500	...	230
	500–1,000	190	240
	1,000 or more	230	250
Surface magnesium	Less than 100	205	200
	100–200	195	220
	200 or more	235	225
Subsoil magnesium	Less than 50	210	205
	50–100	205	215
	100–150	220	225
	150 or more	...	240

* Assuming 2,000,000 lbs. of soil per plowed acre. Soluble nutrients present at end of cutting season.

TABLE II.—THE ASSOCIATION OF VARIOUS LEVELS OF pH AND ORGANIC MATTER WITH DOLLAR RETURNS PER ACRE OF ASPARAGUS

Factor	Amount	Dollar return per acre	
		1942	1943
Surface pH	Less than 5.0	180	205
	5.0–5.5	230	225
	5.5–6.0	200	230
	6.0 or more	230	240
Subsoil pH	Less than 5.0	...	190
	5.0–5.5	230	220
	5.5–6.0	225	210
	6.0 or more	230	240
Surface organic matter	Less than 1%	200	180
	1.0–1.5	210	230
	1.5% or more	240	245
Subsoil organic matter	Less than 1%	190	230
	1.0–1.5	220	220
	1.5% or more	...	230

difference in amounts of phosphorus and potassium by the system of fertilization. It was difficult to obtain clear records for a number of years. However, by comparing the practices of the group having high dollar returns with those of the group having low dollar returns per acre, it was possible to evaluate fertilizer practices in keeping with these returns.

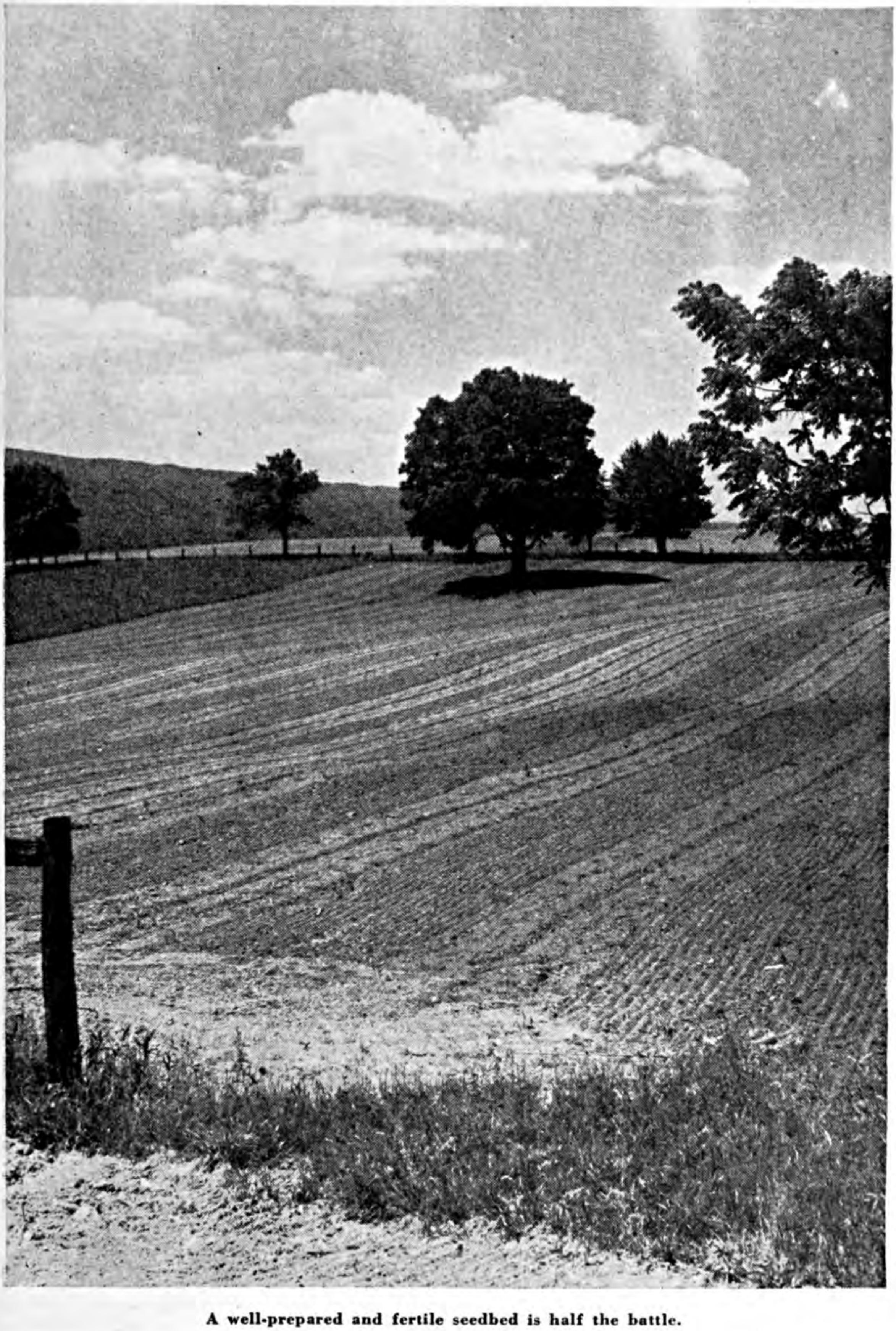
Those farmers who had planted their asparagus roots in fertile soil and had fertilized annually with approximately 2,000 lbs. of a 5-10-10 fertilizer, or something near its equivalent, had high amounts of phosphorus and potassium in both surface and subsoil and high returns per acre. Some of the growers in this group had used only 1,000 lbs. of fertilizer until actual cutting had started. The majority of those obtaining high returns had limed rather liberally and consistently to keep the pH value close to 6.0. Conversely, those obtaining low returns per acre had planted roots in rather infertile or poorly prepared soil and had skimped on the amounts of fertilizer or lime, or both.

From these studies, it would seem to be desirable to have at the end of the cutting season on an acre basis, and as represented by rapid tests, the following amounts of nutrients: At least 30 lbs. of soluble phosphorus in the surface and 15 lbs. in the subsoil, and about 400 lbs. soluble potassium in the surface and over 200 lbs. in the subsoil. It would also be desirable to have 1,500 lbs. soluble calcium in the surface and over 1,000 lbs. in the subsoil, over 200 lbs. magnesium in the surface and over 150 lbs. in the subsoil. A pH value of at least 6.0 in the surface and subsoil and an organic matter content of more than 1.5 per cent would be added assets.

Proper fertilization and liming evidently assure the presence of the necessary fertility conditions. Annual use of 2,000 lbs. of a 5-10-10 or its equivalent to plants set in fertile soil and consistent and adequate liming were satisfactory in this particular study.

The results point to the importance of sufficient nutrients in depth for asparagus. It would appear that for many soils in the Coastal Plain area normally having low concentrations of nutrients in the subsoil, a substantial improvement in the soil fertility might be made by incorporation of dolomitic limestone, phosphorus, and potash in the subsoil before planting.

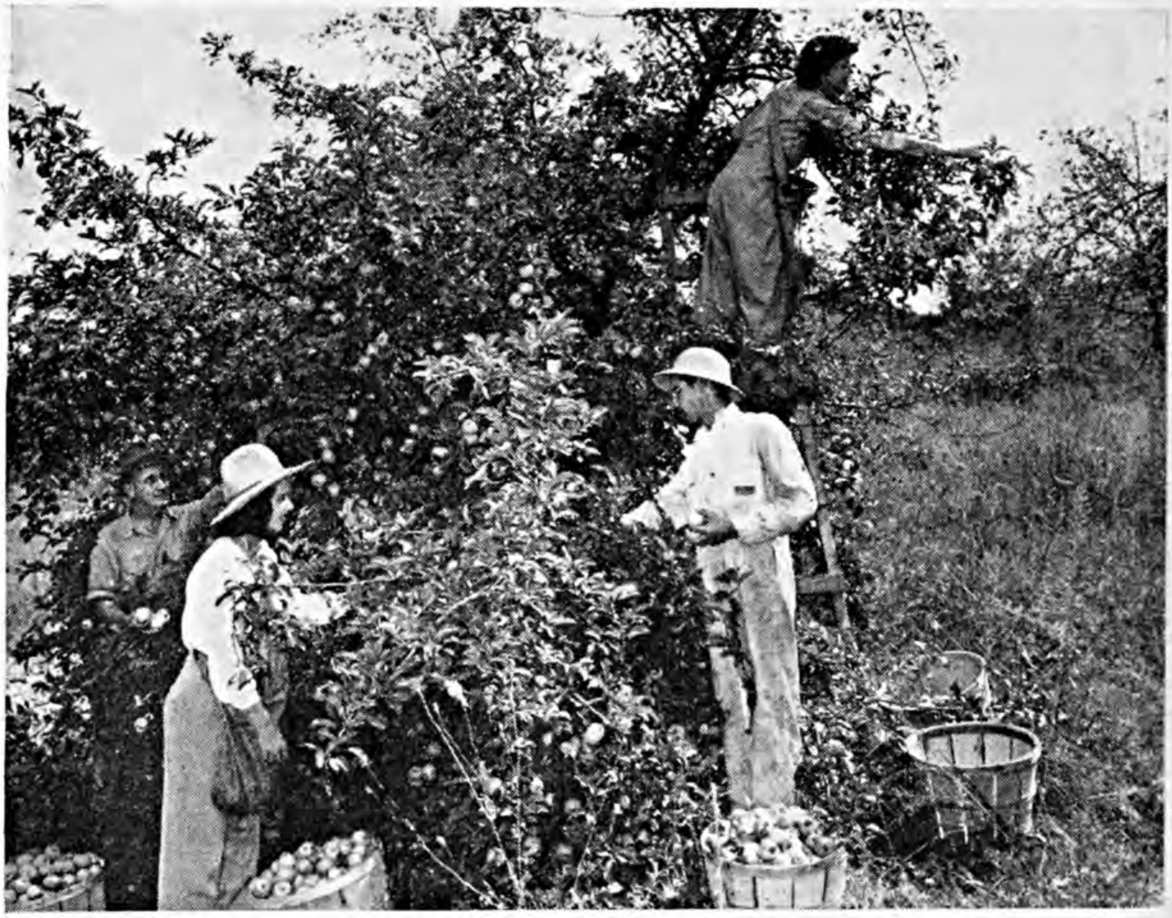
PICTORIAL



A well-prepared and fertile seedbed is half the battle.

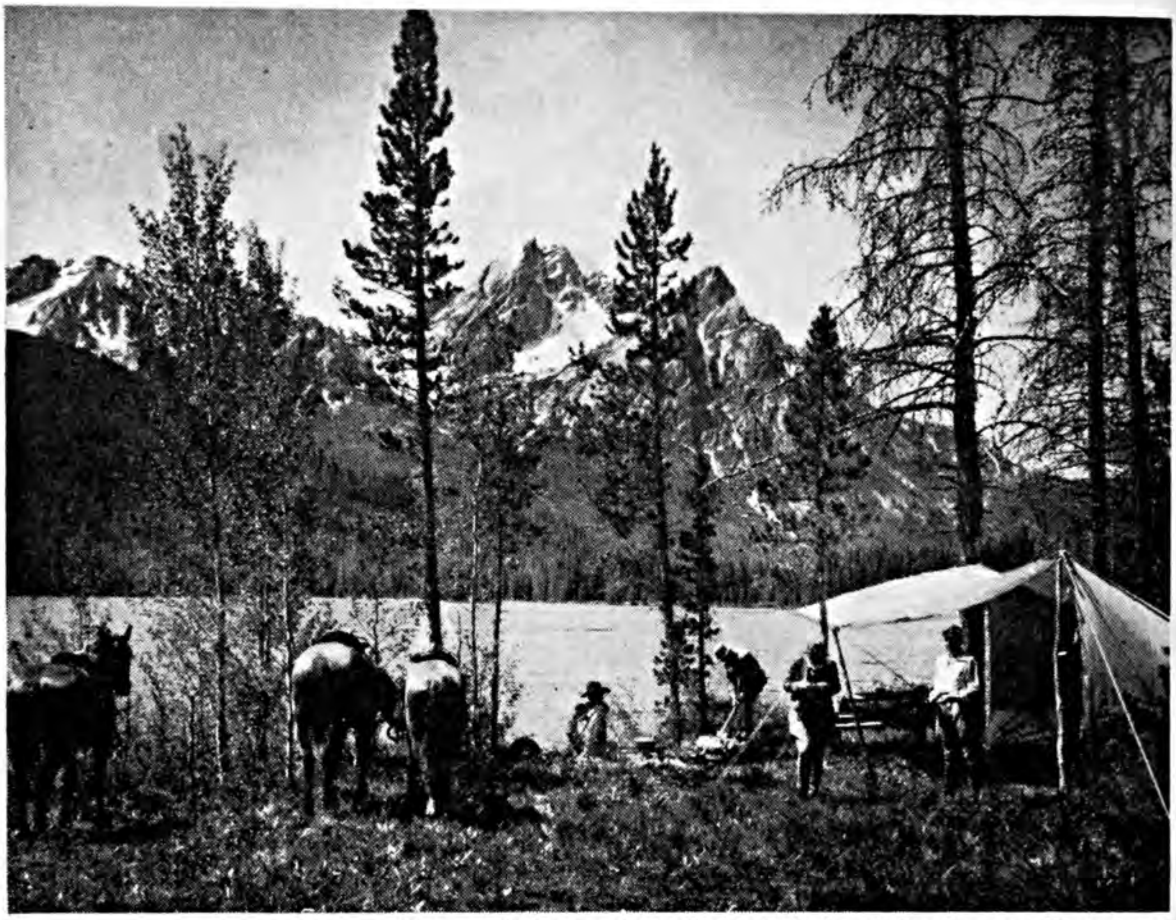
Above: Members of the U. S. Crop Corps turned out to pick tomatoes in the Shenandoah Valley.

Below: In the same Valley, apples were another crop utilizing the help of these vacationists.



Above: M. L. Wilson, Secretary Wickard, and Marvin Jones look over support of Food Program.

Below: A camp in the Shenandoah Valley where U. S. Crop Corps lived while helping farmers.



Courtesy Union Pacific Railroad Agricultural Development Department

The Vacations We Didn't Get!

The Editors Talk

Is Plowing Folly?

Who would have believed that so many people would become excited over so common an activity as plowing, regardless of what was said about it? Probably no one, including even Edward H. Faulkner, himself, when he wrote "Plowman's Folly." Plowing in one form or another is nearly as old as agriculture itself and in years past has evoked a certain amount of interest and inspiration in the minds of scientists and poets. They did not question whether or not we should plow, but concerned themselves with how to plow and the sentiments aroused by plowing. Faulkner believes, however, that we should not plow at all, ascribing many of our ills and troubles to that time-honored practice. This started no end of discussion by writers in farm magazines, daily newspapers, and technical journals and extended even to those who ride Pegasus.

We find one of the leading literary magazines of the country carrying a critique of Faulkner's teachings by one of the leading soil scientists of the country. Harper's Magazine for July 1944 has an article by Professor Emil Truog of the University of Wisconsin entitled, "Plowman's Folly Refuted." An equally interesting but more detailed discussion of the principles of plowing by Dr. W. A. Albrecht, well-known Chairman of the Soils Department of the University of Missouri, appeared in 1943 summer issues of Better Crops With Plant Food under the title of "Why Do Farmers Plow?" Many others have expressed their views on Faulkner's book specifically or on the general subject of plowing.

The Importance of Judgment

Both Professor Truog and Dr. Albrecht do not fully agree with Faulkner. Objection is made to sweeping statements based on speculation, casual observations, or sketchy trials. On the other hand, they do not entirely disagree with some of the theses of "Plowman's Folly." In common with most soil scientists, they agree that plowing can be overdone and can be harmful under certain circumstances. When properly practiced, however, it is a very useful and efficient means of effecting certain desired soil conditions preparatory to growing a crop. As Dr. Albrecht writes, "Fortunately, the plow is merely a tool in this whole matter under discussion. The concern about the practice of plowing is one that brings into question the judgment of him who is using the tool, and the purposes he has for it in relation to the soil as a national as well as an individual asset. One cannot condemn the rifle or the pistol as tools because these are now being used in war, when they can render so many more desirable services. Nor would we condemn the mechanics of the automobile when in its human destruction the fault is not one of the machine but rather one of 'the nut that holds the wheel.'"

It is pointed out that one of Faulkner's objections to the plow is the fact that it places the organic matter and plant nutrients too deeply in the soil. Professor

Truog shows that actually this is an argument for plowing. He also lists the other reasons for plowing:

"(1) Plowing, because of the special shape of the moldboard, produces a shearing action in three directions on the thick layer of soil that is lifted and turned. As a result, the turned soil layer is pulverized, and thus a more satisfactory seedbed is possible than with an implement that turns shallow layers.

"(2) Plowing also helps to improve and rejuvenate soils by bringing the deeper layers from time to time near the surface where the desirable processes of aeration, oxidation, and alternate freezing and thawing are more active.

"(3) And by plowing under organic matter it is possible to maintain an active soil layer deep enough to provide satisfactory conditions for crop plants."

Referring to Faulkner's contention that if there were no plowing, no fertilizer would be needed, Professor Truog writes, "The author of Plowman's Folly made an error when he connected nature's bountiful yields and towering trees with his no-fertilizer theory. In nature's cropping scheme, there is no removal of plant growth with accompanying soil elements, as there is in man's program of food production. Man harvests and carries away the corn and wheat, rich in fertility elements; but nature's crops are left to die, rot, and add to the fertility of the soil. This cycle is repeated year by year, and gradually insoluble soil minerals are changed over to more soluble or usable products.

"If nature's soil could, by itself, nurture a nation of 130,000,000, all soil and crop specialists would be without jobs, for all the farmers would have to do would be to sow and reap. However, the constant harvesting of crops gives us as food the nutrients which nature would normally return to the soil. Therefore, we cultivate the land and give back in the form of fertilizer the nutrients we have removed in crop form.

"Farmers now know that land which is in pasture continuously, and is never plowed, gradually deteriorates in fertility. Like all harvesting, the pasturing of cattle removes nutrients from the soil. It is not plowing, but the removal of vegetation, that causes depletion; if no vegetation is removed, the soil retains its fertility. This is the ABC of agriculture."

Plow Is Not Fertility Exploiter

On the same subject, Dr. Albrecht writes, "Plowing merely hastens many of the same processes that are occurring more slowly when 'the land is resting.' When land must be allowed to rest in order to boost its productivity back to economic levels again, this is merely proof that the fertility supply on the clay is exhausted so nearly to completion and the mineral reserve of fertility has fallen so low that the interactions between the clay and the minerals are too slow to move enough nutrients onto the clay surface to provide sufficiently for the roots during the growing season. Plowing isn't the cause of the depletion of the fertility supply. Depletion occurs because of the fertility removed within the crop hauled off. The plow is not the exploiter; rather, it is the farmer. The plow is merely the tool that facilitates his exploitation at a faster rate and over more acres than before the plow was given him. The plow has helped him to feed many of us too far removed from the land to appreciate its exploitation."

Dr. Albrecht and Professor Truog are performing a service of great value in explaining so clearly for the layman many of the controversial points raised by Faulkner. Probably agriculture is indebted to the author of "Plowman's Folly" for raising issues concerning plowing and thereby making all of us think about the subject. He has made us realize that there can be two sides to every question, even plowing. We should not go overboard one way or the other. Articles such as those of Dr. Albrecht and Professor Truog are needed to round out the picture and re-establish the equilibrium.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920...........	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921...........	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922...........	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923...........	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	...
1924...........	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925...........	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926...........	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927...........	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928...........	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929...........	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930...........	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931...........	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932...........	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933...........	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934...........	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935...........	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936...........	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937...........	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938...........	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939...........	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940...........	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941...........	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942...........	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
July..........	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August.......	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September....	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October.......	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November....	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December....	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January.....	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February....	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March.......	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April........	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May.........	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....
June.........	20.16	49.2	125.0	233.0	115.0	143.0	15.00	52.80	....
July.........	20.32	45.0	138.0	230.0	117.0	139.0	13.90	53.00	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920...........	259	166	358	201	223	255	178	240	....
1921...........	99	187	149	136	91	135	109	103	....
1922...........	152	219	139	120	90	117	98	162	....
1923...........	215	183	121	119	124	112	103	202	....
1924...........	223	183	125	156	141	126	111	177	150
1925...........	178	161	164	196	154	172	105	162	153
1926...........	122	172	267	178	108	154	109	126	143
1927...........	128	199	190	130	122	137	101	132	121
1928...........	150	192	119	128	138	129	89	175	159
1929...........	143	179	135	135	135	117	97	162	149
1930...........	100	124	179	132	120	92	95	122	140
1931...........	61	79	104	106	77	55	82	79	117
1932...........	47	101	62	65	43	44	63	45	102
1933...........	65	124	95	68	56	66	57	57	105
1934...........	97	164	98	90	95	91	89	121	104
1935...........	94	155	71	84	119	98	89	165	126
1936...........	94	165	143	97	118	109	75	147	113
1937...........	90	191	127	105	146	122	87	140	122
1938...........	67	165	80	88	76	75	63	98	101
1939...........	70	131	98	86	73	72	58	103	109
1940...........	78	145	102	97	91	84	64	126	121
1941...........	107	184	93	108	99	95	68	162	145
1942...........	149	272	158	124	123	116	84	206	199
1943									
July..........	158	567	240	305	167	143	100	206	315
August.......	160	369	228	315	168	144	102	236	308
September....	163	358	193	264	168	148	108	240	311
October.......	164	402	184	224	165	153	115	243	264
November....	156	428	191	202	162	156	121	243	254
December....	160	408	194	215	171	163	127	244	208
1944									
January.....	163	399	203	231	174	166	131	245	231
February....	161	241	200	241	174	166	133	244	204
March.......	161	211	197	251	176	166	134	244	191
April........	163	229	197	261	177	167	136	243	184
May.........	160	358	193	269	177	167	135	243	217
June.........	163	473	180	266	177	163	126	245	245
July.........	164	433	198	263	181	158	116	245	236

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11-12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate f.o.b factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f o.b. Chicago, bulk, per unit N	High grade ground blood, 16-17% ammonia, Chicago, bulk, per unit N
1910-14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....
April	.640	2.00	6.10	.535	.797	26.00	.200	....
May	.640	2.00	6.10	.535	.797	26.00	.200	....
June	.640	2.00	6.10	.471	.701	22.88	.176	....
July	.640	2.00	6.10	.503	.797	26.00	.188	....

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts	Kainit
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....
April	119	55	125	75	84	108	83	....
May	119	55	125	75	84	108	83	....
June	119	55	125	66	74	95	80	....
July	119	55	125	70	84	108	82	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922........	132	149	141	116	101	145	106	85
1923........	142	152	147	114	107	144	103	79
1924........	143	152	143	103	97	125	94	79
1925........	156	157	151	112	100	131	109	80
1926........	145	155	146	119	94	135	112	86
1927........	139	153	139	116	89	150	100	94
1928........	149	155	141	121	87	177	108	97
1929........	146	153	139	114	79	146	114	97
1930........	126	145	126	105	72	131	101	99
1931........	87	124	107	83	62	83	90	99
1932........	65	107	95	71	46	48	85	99
1933........	70	109	96	70	45	71	81	95
1934........	90	123	109	72	47	90	91	72
1935........	108	125	117	70	45	97	92	63
1936........	114	124	118	73	47	107	89	69
1937........	121	130	126	81	50	129	95	75
1938........	95	122	115	78	52	101	92	77
1939........	93	121	112	79	51	119	89	77
1940........	98	122	115	80	52	114	96	77
1941........	122	130	127	86	56	130	102	77
1942........	157	152	144	93	57	161	112	77
1943								
July.......	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78
November.	194	171	150	95	57	160	119	78
December..	196	173	150	96	57	171	119	78
1944								
January....	196	174	150	96	57	171	119	78
February..	195	175	151	96	57	171	119	78
March.....	196	175	151	97	57	173	119	78
April......	196	175	152	96	57	172	119	78
May......	194	175	152	97	57	175	119	78
June......	193	176	151	95	57	175	119	69
July.......	192	176	152	96	57	175	119	74

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

REVIEWS

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

Fertilizers

"Farm Fertility Facts for Continuous Cash Cropping," Ont. Agr. College, Guelph, Ont., N. J. Thomas.

"State Laboratory Fertilizer, Seed, and Ice Cream Report July-December, 1943," State Board of Agr., Dover, Del., Dec. 31, 1943.

"Tonnage of Different Grades of Fertilizer Sold in Delaware 1943," Agr. Exp. Sta., Dover, Del., C. E. Phillips.

"Analyses of Official Samples of Fertilizer Collected During 1943," State Board of Agr., Control Div., Topeka, Kans.

"Tonnage of Commercial Fertilizer Reported by Manufacturers As Shipped to Kansas During the Year 1943, by Counties," State Board of Agr., Control Div., Topeka, Kans., Jan. 1, 1944.

"Official Inspections 189," Agr. Exp. Sta., Orono, Me., Oct. 1943, Elmer R. Tobey.

"Tonnage of Different Grades of Fertilizer Sold in Michigan 1943," Soils Science Dept., Mich. State College, East Lansing, Mich.

"Effect of Nitrogen on Growth and Drouth Resistance of Jack Pine Seedlings," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn. T. Bul. 163, June 1943, Dwight W. Bensend.

"Nitrous Acid and the Loss of Nitrogen," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Memoir 253, Oct. 1943, J. K. Wilson.

"Fertilizer Recommendations for Vermont 1944-1945," Ext. Serv., Univ. of Vt., Burlington, Vt., June 1944.

Soils

"A Lysimeter Study of the Nitrogen Balance in Irrigated Soils," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., T. Bul. 102, May 15, 1944, H. V. Smith.

"Types and Distribution of Microorganisms in Some Florida Soils," Agr. Exp. Sta., Gainesville, Fla., Bul. 396, Jan. 1944, F. B. Smith and Owen E. Gall.

"A Laboratory Method for the Artificial Alteration of Aluminosilicates," Agr. Exp. Sta., State College Sta., Raleigh, N. C., T. Bul. 77, Dec. 1943, N. S. Hall.

"Cropping Systems and Soil Fertility," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-121, May 1944, H. J. Harper and H. F. Murphy.

"Composts for Garden Soils," Ext. Serv., Ore. State College, Corvallis, Ore., E. Cir. 415, (Rev. Cir. 387), Sept. 1943, O. T. McWhorter.

"Terracing in South Carolina," Clemson Agr. College, Clemson, S. C., Cir. 251, Jan. 1944, C. V. Phagan.

"The Care and Maintenance of Terraces," Clemson Agr. College, Clemson, S. C., Cir. 254, Feb. 1944, C. V. Phagan.

"Saving the Soil—While Increasing Crop Production," Ext. Serv., Univ. of Tenn., Knoxville, Tenn., Agron. V. Cir. 2, May 1944, H. E. Hendricks.

"How and Where to Use Lime in Western Washington," Agr. Exp. Sta., State College of Wash., Pullman, Wash., V. Cir. 16, Feb. 1944, S. C. Vandecaveye and L. E. Dunn.

"Gypsum (Land Plaster) for Peas," Agr. Exp. Sta., State College of Wash., Pullman, Wash., V. Cir. 17, Feb. 1944, C. B. Harston, Verle G. Kaiser, and Glenn M. Horner.

"Investigations in Erosion Control and the Reclamation of Eroded Land at the Palouse Conservation Experiment Station, Pullman, Wash., 1931-42," U. S. D. A., Washington, D. C., T. Bul. 860, April 1944, Glenn M. Horner, A. G. McCall, and F. G. Bell.

Crops

"Small Grain Varietal Experiments for Southern Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 191, Jan. 1944, A. T. Bartel.

"Experiments with the Transplant Onion Crop in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 682, Jan. 1944, Glen N. Davis and H. A. Jones.

"Factors Influencing the Yield, Composition, and Quality of Raisins," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 683, Jan. 1944, H. E. Jacob.

"Currants and Gooseberries," Hort. Exp. Sta., Vineland Sta., Ont., Bul. 440, April, 1944, W. J. Strong.

"Addresses, Annual Convention Ontario Crop Improvement Association," Ont. Dept. of Agr., Crops, Seeds, and Weeds Branch, Toronto, Ont.

"Addresses and Proceedings, Ontario Crop Improvement Association," Ont. Dept. of Agr., Toronto, Ont., Feb. 1944.

"Vegetables for Victory," Ext. Serv., Colo. State College, Fort Collins, Colo., Cir. WFA-G2.

"Vegetable Gardening for Victory," Ext. Serv., Univ. of Del., Dover, Del., Wartime E. Folder 5 (Rev. March 1944), Feb. 1943, E. P. Brasher.

"1943 Report Florida Agricultural Extension Service," Ext. Serv., Univ. of Fla., Gainesville, Fla.

"Sweet Potatoes—A War Food and Feed Crop," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 77, April 1944, J. Lee Smith.

"Oats on Florida Farms Grow 50 Bushels to the Acre," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 78, June 1944.

"Growing 'Manure' with Blue Lupines in Florida," Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 79, June 1944, J. Lee Smith.

"Eight Point Milk Production Program," Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., E. Cir. 319, Feb. 1944.

"Corn in Georgia," Ext. Serv., Univ. System of Ga., Athens, Ga., E. Cir. 320, March 1944, E. D. Alexander.

"Establishing the Coastal Bermuda Grass Nursery," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. 27, April 24, 1944.

"Production and Storage of Sweet Potatoes for the Seed-Piece Method of Planting," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. 28, May 1944.

"The Purdue 44 Muskmelon," Agr. Exp. Sta., Lafayette, Ind., Cir. 295, April 1944, John D. Hartman and F. C. Gaylord.

"A New Era in Oat Production," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 296, June 1944, R. R. Mulvey.

"Garden Guide," Ext. Serv., Iowa State College, Ames, Ia., Pamphlet 80, Jan. 1944.

"Potato Production in Kansas," Agr. Exp. Sta., State College, Manhattan, Kans., Bul. 322, Feb. 1944.

"Kansas Corn Tests, 1943," Agr. Exp. Sta., State College, Manhattan, Kans., Bul. 323, Jan. 1944, R. W. Jugenheimer, A. L. Clapp, C. D. Davis, and C. R. Porter.

"Studies with the Gladiolus in South Louisiana," Agr. Exp. Sta., Univ. of La., Baton Rouge, La., Bul. 372, Jan. 1944, W. D. Kimbrough.

"How Can I Get My Haying Done in Wartime," Ext. Serv., Univ. of Me., Orono, Me., 1944.

"Food and Forest Products for a Nation at War," Ext. Serv., Univ. of Me., Orono, Me., Cir. 197, April 1944.

"The Identification of Plum Varieties from Non-Bearing Trees," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 413, March 1944, Lawrence Southwick and A. P. French.

"Potatoes in Home Gardens," Ext. Serv., Mass. State College, Amherst, Mass., E. Leaf. 231, Feb. 1944, Alden P. Tuttle.

"Starting Vegetable Plants in the Home," Ext. Serv., Mass. State College, Amherst, Mass., E. Leaf. 232, Feb. 1944, Alden P. Tuttle.

"Studies of Pot-Binding of Greenhouse Plants," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., T. Bul. 191, March 1944, A. T. Knight.

"Michigan Garden Guide," Ext. Serv., Mich. State College, East Lansing, Mich., E. Bul. 258, March 1944.

"Winter Behavior of Strawberry Plants," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Bul. 375, March 1944, W. G. Brierley and R. H. Landon.

"Make Your Hay by This Yardstick," Ext. Serv., Univ. of Minn., St. Paul, Minn., E. Pamph. 136, May 1944.

"Home Orchards in Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 393 (Rev. of Bul. 350), Sept. 1943, Troy H. Jones and T. E. Ashley.

"Hybrid Corn Test, Stoneville, 1943," Agr. Exp. Sta., State College, Miss., S. Sheet 371, Feb. 1944, P. W. Gull.

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Potash for War Food

(*From page* 14)

that potash in mixed goods varies widely in line with official recommendations based on crop and soil requirements. To the same degree and for the same reason, nation-wide average ratios of the three plant-food elements —nitrogen, potassium, and phosphorus —have no agronomic significance.

Danger lies in their possible acceptance as possessing some desirable characteristics pertinent to the war-food program. To be sure, there has long persisted the need for the reduction in the number of grades and the removal of restrictions on interstate distribution. Great relief in both respects has resulted from war-agency initiation, a simplification that surely will not be abandoned when the directives imposing it are no longer in effect. To date, this simplification where made solely to eliminate grades no longer useful has still adhered to the scientific basis of crop nutrition; but it is obvious that there is a limit beyond which it cannot go without the abandonment of that basis.

The total supply of agricultural potash is allocated to the fertilizer industry for retail distribution to the farmers, either as mixed goods or as materials. In past years, it is estimated some 10 per cent of agricultural potash customarily has been retailed for use by farmers for side-dressing or home-mixing. In recent years such mixtures as 10-0-10 have grown in popularity for side-dressing, and currently it is reported that home-mixing has been largely abandoned, among other reasons due to scarcity of farm labor. There seems little doubt that because of past acute apprehension over the inadequacy of potash supplies there has been widespread reluctance to retail potash as a material, a situation plainly contrary to war agency instructions, which now may be corrected. However, based on the record as it now stands, the conclusion is obvious that if the estimated 10 per cent approximates the total of normal retail potash sales as materials, sales throughout the past winter months were much below that rate.

The question has been frequently raised—will the supplemental allocation for Period Three be delivered in time for use during the spring season? This question ignores the fact that if Period Three deliveries in one year are received too late for use in the spring of that year, they are held in storage for use in the fall and that any such tonnages thereupon become a part of the year's supply. Period Three deliveries, known in the trade as the "spot season," are thoroughly well understood as a familiar trade custom of long standing concerning which experience should provide a ready answer.

The Discount Season

The potash industry, it is recalled, operates on a daily and not a seasonal basis. Every effort is made to effect deliveries uniformly throughout the year, and the existing discount system is designed to promote that objective. An explanation of and justification for this discount system is to be found in the Department of Commerce Report, "The Potash Industry," by Willard L. Thorp and Ernest A. Tupper, pp. 87-8, stating its purpose to be: "(1) to encourage purchasers to make advance commitments, thus permitting the producers to plan their production schedules in the light of the anticipated requirements by the fertilizer industry, (2) to provide for the flow of potash in 'substantially equal monthly quantities' during the entire discount period." In effect, discounts operate as payments to purchasers for storage costs, otherwise imposing on the producers the enormous task of storing the tonnages involved in a year's output, and, what is even worse, creating a traffic congestion during the shipping season impossible to cope with.

The potash industry is confronted by war-time shipping problems strictly analogous to those facing the fertilizer industry respecting the seasonal delivery of mixed goods; for the relief of the fertilizer industry the farmers are now urged by government to accept month by month delivery. The record of potash deliveries shows that they customarily reach their maxima in December-January and their minima in April-May, with substantial improvement in recent years with respect to more uniform delivery. For example, during 1940, the spread between the maximum and minimum was 55,000 tons K_2O, while during 1943 it was reduced to 35,000 tons K_2O. Obviously, further gains yet remain to be made before maximum efficiency is attained in this particular.

The orderly furnishing of box cars on the sidings of the potash refineries is a constant problem, fortunately so far not having reached that critical stage at one time feared. From the Carlsbad, New Mexico, potash-producing center alone, there are being shipped out some 1,300,000 tons of potash salts per annum. With capacity loadings of 50 tons per car, this means 26,000 cars per annum or an average of some 2,200 cars per month. This service is provided by the Santa Fe Railroad over a spur line, which testifies to the proficiency of that company in being able to maintain a day by day traffic of such dimensions under present war conditions. A similar problem is confronted at the California production center. All of this adds up to the essentiality of a year-round, planned delivery of potash salts with the avoidance of a congested shipping season.

The Problems Ahead

Coming now to the problems that lie ahead, on the foundation of experience gained in planning for the crop year of 1943-44, it should be possible to proceed with the task for 1944-45 with full realism. The consensus of opinion appears to be that there will be no diminution of food demands. The contrary seems to be the prospect. It follows that the demands on the American farmer will pursue this trend and there is no reason to consider the possibility that he will not respond with the utmost of effort that he can bring to bear. Those suggesting increased acreages to be plowed up have been silenced by the reminder of the dust bowls following our last attempt at that procedure, futile at best with labor and farm machinery supplies inadequate to the optimum cultivation of the acreages already plowed. Labor appears a major bottleneck; in other words, the requirement is intensive cultivation of our better soils in the light of our best knowledge of scientific agriculture including the optimum use of plant-food mixtures in the most efficient ratio of one to another as demonstrated and recommended by state and federal authorities. This calls for a different approach from that of last year; namely, what is recommended—not, what can we get by with?

Since mixtures of plant-food are the farmers' preference, emphasis again will be put on what tonnage can be produced. The fertilizer year just closed will be a measure, the best measure available as based on performance resulting from an all-out effort to produce the maximum tonnage with existing plants, supplies, and labor. Is there room for improvement, pending relaxation of present restrictions on most of the elements that enter into plant operation and distribution of products?

Following the surrender of the Hitlerites we are led to believe that there will be the inauguration of the transition period with the gradual release of labor and supplies from industries more intimately related to the military. When this happens, and how quickly thereafter its effects will be registered on other business, is anybody's guess, optimism impelling the faith that it will happen not later than next winter and that thereafter the benefits will be realized in time to make themselves felt in the relaxation of present restrictions on increased production during the remaining months of 1944-45. To gauge this hoped-for expansion in terms of mixed-goods tonnage calls for extreme wisdom if we are not to be misled again into confusing the theoretical with the practical, what is needed with what can be produced.

By contrast, the figures on potash supplies released from authoritative sources are based squarely on the production records, the only realistic base. Entering therein are allowances injected in the name of conservativeness. They are assured minima, not hoped-for maxima. They have no reference to what is needed, but only to what can be produced. Such is the basis of the foregoing figures expressing the supply to be derived from five domestic producers. It is common knowledge that this represents a more than twofold increase since 1939, resulting from an expansion program promptly and courageously inaugurated by the American producers on the outbreak of European hostilities and slowed-down, but not stopped, only by government restrictions on materials of construction.

This doubling of production capacity has been privately financed, and it is clear that the motive was public service—the promotion of the war effort through providing more nearly adequate supplies of a commodity described by the military as "strategic, essential, and critical." Enhanced wartime profits are eliminated as the objective, since there has been no increase in the wholesale price of 60 per cent muriate, that preferred carrier representing 78 per cent of the total, still being quoted at the pre-war discount price of 47.1¢ per unit K_2O, and the entire output of the potash industry being sold on the wholesale basis. In relation to other wholesale prices, this price represents an index number of 66 as compared to 150 for commodities in general (basis 1910–14 = 100).

Freight charges that are absorbed by the producers have undergone an increase with enforced all-rail, due to the elimination of water, shipment. Facing the industry are the post-war hazards of potash imports with no present clue to methods, quantities, or prices. This outstanding performance in behalf of the American agricultural and chemical industries and, through them, the Nation's war effort, last year was obscured by a fictitious potash shortage, creating a false impression of failure in meeting an emergency where the facts registered a spectacular success.

Warranted Speculation

Now introducing some speculation, pretty completely excluded heretofore in this discussion of the potash supply phase of this subject, mention has been made of the possible relaxation in the stringency of labor supply following the ending of the European phase of the war and the resultant possibility of an expanded mixed-goods output during 1944-45. The same speculation applies to those sections of the chemical industry now using 100,000 tons K_2O, many of whose products have a direct tie-in with the military and for which the demand could be expected to decline with that for other military supplies to which the prospective release of labor is ascribed. While it is easy to foresee a very substantial release (now indicated by the records as already taking place) of potash from this greatly expanded chemical use, with the distinct prospect of its favorable effect on next year's supply for agricultural use, to attempt a more definite statement on time and amount again would be futile. However, the conclusion seems warranted that coincident with any release of labor permitting an expanded output of mixed goods there will be a release of potash from chemical use to agricultural use, to which may be added the observation that the chemical uses most vulnerable to this change involve some 30,000 tons K_2O in the form of high-grade muriate.

Adding the drastically-discounted speculative to the practically assured increments in supplies, there is the prospect of 750,000 tons K_2O for agricultural use during the fertilizer year, 1944-45, a figure recommended for consideration where speculation is in order. Applied to mixed goods it would provide a 7.5 per cent K_2O average for 10 million tons, 8.3 per cent for 9 million tons and 9.3 per cent for 8 million tons. If the estimated 10 per cent formerly retailed as potash materials is again offered, some 75,000 tons K_2O should be made available for direct application during 1944-45. This liberation of supplies will be welcomed particularly by the dairy and livestock interests of the South where the development and maintenance of improved pastures, dependent for their success on the liberal use of potash, is making such spectacular headway.

From the speculative viewpoint, interesting figures are being presented showing the Nation's plant-food requirements were the amounts used in agriculture ample for maximum crop production, figures easily derived and unquestioned. They are scarcely pertinent to the present discussion, however, for they are clearly beyond the realm of war-time production expansion. Confusing these optima with wartime attainable goals, a danger to be avoided, easily leads to the concept of deficits in supply, while as a matter of fact the plant-food supplies at hand may approximate war-time capacity to distribute by present methods.

Should distribution capacity prove the bottleneck due to shortages of labor, bags, and other essentials, it would be unfortunate indeed since the farmer now has the greatest purchasing power in agricultural history with fewer other commodities, to which his budget is customarily applied, available for purchase. Mehring and Shaw, of the U. S. Department of Agriculture, recently have re-examined, with elaborations, that 30-year-old economic concept of the relationship between farm income and fertilizer purchase and have found that the parallelism has continued to hold and with remarkable precision. On that basis the conclusion seems inescapable that at the present high farm-cash level, the farmer is in a position to buy his fertilizers on the basis of their plant-food content instead of their price per ton as has been his tendency in leaner years, according to a frequently expressed opinion.

The conclusion seems warranted in view of the foregoing, that the plant-food industries are now fully justified in their return to the scientific basis of potash use in crop nutrition as laid down by the agronomists, formerly observed with general adherence thereto but last year abandoned to a very considerable degree under the dual misapprehension that the potash supply would be less and the mixed goods output would be more than was actually the case. Only by so doing can the Nation's war-food program be promoted with maximum efficiency.

The Need for Borax on Fourteen Crops

(*From page* 19)

this case. These symptoms were not as severe as the death of the seedling which has been obtained in other experiments on the same soil.

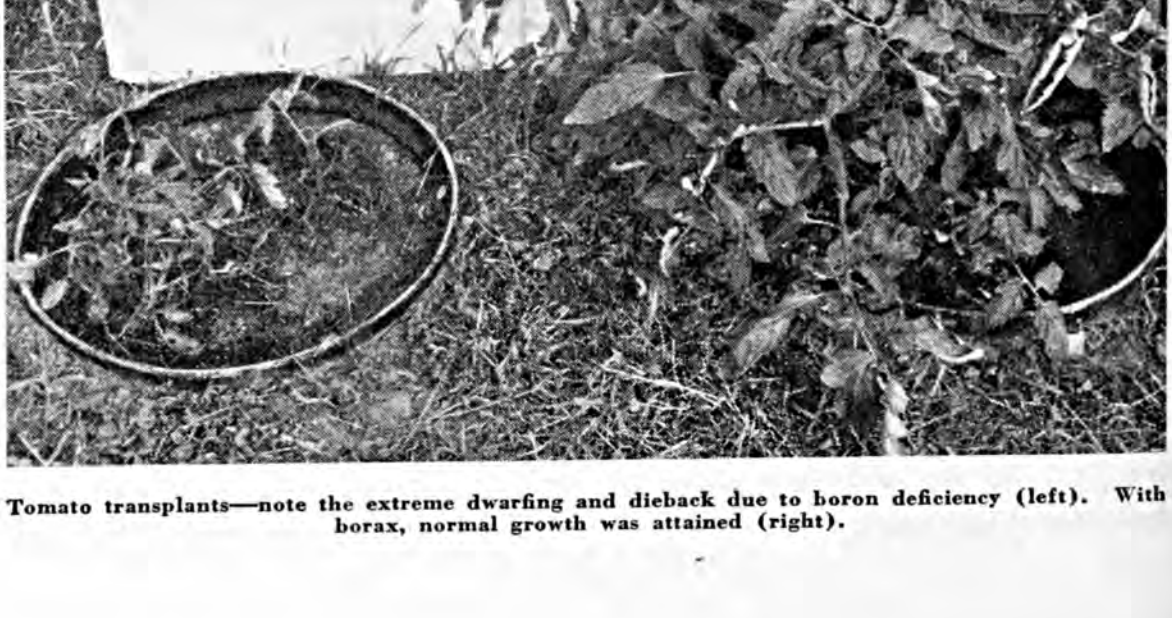
Red Clover—A marked size and stature response to boron was obtained with red clover. The actual symptoms of boron deficiency, however, were not conspicuous or outstanding. Without borax almost all of the leaves of the plant became characteristic lemon yellow colored (the same color as has been observed in boron-deficient alfalfa). Normal leaf markings were completely obscured on all leaves. Without borax some of the leaves were streaked, some had green veins with much yellow between, while others had the reverse coloring. In either case, leaf veins were more prominent than usual. Thus the yellow streaking, due to boron deficiency, was parallel to the leaf veinings. These streaking symptoms were noticeable only on close inspection, but they were better than yellowing alone as a basis for diagnosis of boron deficiency of red clover in farm fields. With borax, both the yellowing and streaking were fully corrected. The possibility that less severe boron deficiency of red clover may cause a "yellow top" condition similar to deficient alfalfa is not excluded, but in this instance all of the plant leaves were affected with "yellows." This deficiency was also more severe than that commonly reported to be responsible for lack of red clover seed.

Ladino Clover—Ladino likewise responded markedly to borax. Without it, the symptoms were much like red clover, the characteristic yellowing was observed, and normal leaf markings were obscured. Practically all leaves were affected. The deficiency was too severe for just the top leaves to be colored. Veinal and interveinal yellow streaking of a few leaves was also observed, similar to that noted with red clover, the rest of the leaf being a normal green color. Borax fully corrected these different types of leaf yellowing. Here again a "yellow top" condition was not obtained, but it seems likely that the right degree of deficiency may produce it.

Careful inspection would be required to detect signs of boron deficiency in fields of ladino and red clovers since there are other causes for legume leaves becoming a lemon yellow color. Only the interveinal and veinal yellowing would seem to serve well for diagnosis of this deficiency.

Timothy—This crop was in its first year from seeding and showed little, if any, response to borax. It was less affected by boron deficiency than any other crop grown in these experiments. However, since it is a long-lived perennial, it may later show some deficiency.

Sweet Corn (Var. Golden Bantam)—Sweet corn responded very markedly to borax. Without it, prominent symptoms were observed. Longitudinal streaks of yellow tissue in the leaves were the first and most obvious. The streaks first appeared to be water-soaked, then they bleached and died. From a distance, the symptom looked somewhat like magnesium deficiency, but on close inspection, the streaks were not continuous nor did they have regular edges. They appeared much more



Tomato transplants—note the extreme dwarfing and dieback due to boron deficiency (left). With borax, normal growth was attained (right).

crudely fashioned than magnesium deficiency streaks. Chlorophyll was completely missing in them. Similar results of boron deficiency are also mentioned by Chandler in Maine, but he did not describe them.

Deficient leaf tips tended to die and turn brown. Sometimes also the dead leaf tips coiled in a longitudinal direction into a tube the diameter of a lead pencil. The new leaves were usually first affected. The tassel in these experiments failed to form. The ear grew but produced no silk and therefore no grain, although it had husks in normal fashion. Severe deficiency symptoms thus include leaf streaks, coiled leaf tips, lack of tassel, and lack of silk and grain. With borax, normal plants developed.

Tomatoes (Var. Marglobe)—Tomatoes responded markedly to boron. Without borax, the transplants remained about as tall as when set. New growth started feebly, became dirty green or pale yellow, and died. Plants changed from a healthy green to a dirty pale green, the stalks increasing somewhat in diameter but not in length. No fruit or blossoms were produced, although the dwarf plants hung onto life most of the summer before they died.

With borax, the plants were normal, flowered, and set a prolific crop of fruit. Boron deficiency was thus clearly responsible for lack of tomato flowers and fruit. Other signs of deficiency important to the grower, such as susceptibility to disease, probably remain to be produced.

Cabbage (Var. Golden Acre)—Cabbage likewise responded markedly to borax. Without it the transplants became a stump with only a few rudimentary outside leaves having brown edges. These brown edges had a rotten appearance and the cabbage failed to head. The inner leaves which tried to grow became crude stumps of leaf petioles with dead brown edges. The growing tip became brown, rotten, and completely failed to develop. Eventually the deficient transplants died without making any appreciable growth. With borax, good heads of cabbage were formed in normal fashion. These deficiency symptoms were more severe than the internal discoloration of the cabbage head usually reported.

Broccoli—A marked response to borax was obtained with broccoli. Without it there was almost a complete lack of edible buds. Eventually the plant grew an excessive amount of leaves and finally succeeded in producing some flower stalks. However, these were abortive and no seed formed, merely naked pedicels where the seed pods should have been. No yellowing was noted although the possibility of it should not be excluded.

With borax, the growth was vigorous, flower stalks formed early without any excessive leafy growth. A good supply of edible buds was produced, and these later developed considerable seed. With borax, the broccoli grew in the normal fashion. Cauliflower shows similar field response in Scotland.

Oats—Oats responded to boron in these experiments only in terms of the yield and quality of grain. Without borax, 14 gms. of light weight grain per pot were obtained; with borax, 35 gms. of heavy grain. Borax-treated oats were almost twice as heavy per unit of volume and germinated 93 per cent compared with 51 per cent without borax. Borax seemed to have no appreciable effect on the size, color, or vigor of these oat plants until the grain came to approximately the milk stage. The deficient grain withered and aborted, while that receiving borax was well filled.

Similar observations in replicated field plots have been made once before by the writers. All evidence accumulated to date seems to show that empty heading of oats, which sometimes occurs in Vermont fields, is due in part at least to lack of boron in the fertilizer.

Lettuce (Var. Hansen)—Lettuce also responded markedly to borax. Without it, the seedlings grew about two inches high, became the characteristic yellow, or pale green, and died. No seed was produced. With borax, normal plants developed, headed in the normal fashion, flowered, and then set a good crop of seed. Borax clearly was necessary for formation of flowers and seed. Further efforts will be required to obtain symptoms of lesser deficiency arresting growth midway between the death of seedlings and flowering. Milder symptoms would be more apt to occur in ordinary gardens and appear to be causing some losses to Vermont growers.

Beets (Var. Detroit dark red)—Beets responded markedly to borax. Without it, the seedlings grew straw colored and died when less than two inches high. Death of seedlings was again the deficiency symptom obtained. With borax, plants were normal. This deficiency was much more severe than that which produces the scabby cankers and heart rot of the root commonly described in literature.

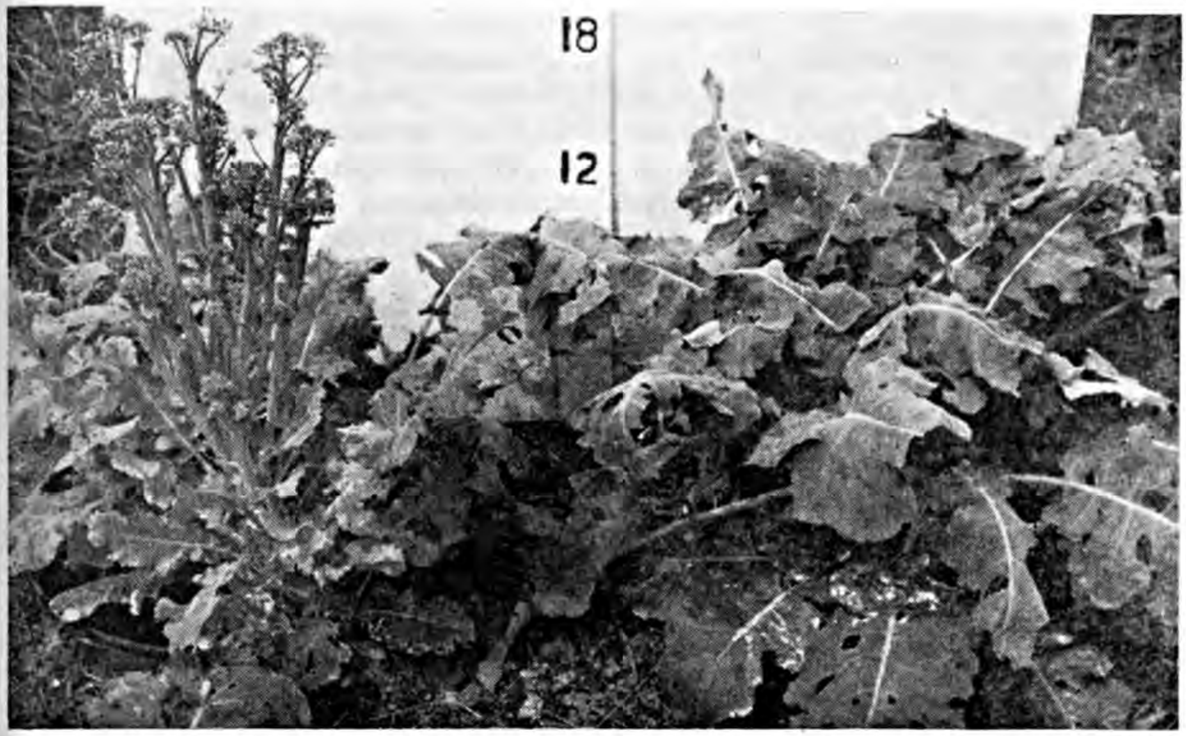
Other Nutritional Possibilities

There is a real possibility that stem-end browning, net necrosis, leaf roll, and ring-rot diseases of the potato, as well as blackening of cooked tubers, are nutritional diseases, or that susceptibility to them depends on nutritional factors. There is also a good possibility that bitter pit of apples is a nutritional disease regardless of failures to date to correct it with fertilizers. Nutritional investigations are being made at the Vermont Station to discover practical remedies for the diseases that so badly baffle potato growers. Present measures are not adequate because in spite of all that has been done to tuber-unit, index, and isolate seed potato plots, potato diseases are increasing and becoming more troublesome. In fact, in 1943 there was more net necrosis than ever before in some Vermont lots entered for certification, a 50 per cent infection in one and 15-30 per cent in others. Ring rot has invaded the Northeast before other older problems are well solved.

Potato growers need research help and need it badly. Nutritional research has an advantage over many other types because positive results once obtained can be directly put into effective field practice. Also many good crop varieties are losing ground because of diseases to which they have become susceptible. A new and resistant variety eventually is bred, in a short time likewise breaks down, and this requires more breeding. The degradation and breeding process goes on and on. The real remedy may be nutritional, the use of proper fertilizers to replace those plant-food elements lost by leaching and removed by crops from the soil. If the fertility could be replaced, much breeding work might well be avoided, and food crops with better nutritive quality could be produced. The Green Mountain potato, for example, is now going down hill fast due to susceptibility to disease.

Stem-End Browning—Chandler recently reported a brown coloration in potato tubers resulting from boron starvation in sand cultures. It was identical in appearance with the "stem-end browning" disease of the potato (2). There are many who will tend to doubt that boron is the answer to stem-end browning until it is demonstrated in field experiments. To the writers, this finding is not surprising, since they obtained the same color of browning affecting nearly all of the tuber tissues as a result of more severe boron starvation. Although our results were not the same as those of Chandler, our findings and experience tend to support him.

The work of Dennis in Scotland gives further support (3). Boron corrected a localized browning generally at the heel end of the tuber. "At the heel end" from Dennis means the same as "stem-end," as we understand it. It is highly desirable to determine whether or not stem-end browning is corrected by borax in the field. That is not likely to be as simple as it sounds because the field use of borax does not guarantee its availability to the crop



Broccoli—with borax (left), broccoli flowered profusely in normal fashion; without, it produced many leaves but failed to produce edible buds or flowers until late in fall. Buds were then abnormal and undesirable.

in the podzol soil region. Soils in some fields fix large amounts of boron out of reach of the crop, and field soils are often very spotty in their boron-fixing capacity. Hence, a number of trials on each soil would be needed with different rates and different placements of boron in the plant root zone to determine whether correction of stem-end browning could be obtained. Of course, there might also be other nutritional causes for the same sort of brown condition.

Leaf Roll and Net Necrosis— In each of the past two growing seasons an apparently non-parasitic, leaf-roll condition of the potato has been produced at the Vermont Station by extreme phosphorus starvation on a phosphorus-fixing soil and was corrected with phosphorus (6). The leaf roll resulting from extreme phosphorus starvation was indistinguishable from that present in our farm fields. Dr. Lutman, Pathologist, without knowledge of the fertilizer treatments, would have rogued out the phosphorus-starved plants as virus leaf roll had he encountered them in a farm field. Until we can learn more about it, we think that we should adopt the term, "apparently non-parasitic leaf roll" as has been suggested by Dennis. In Scotland, it is boron deficiency that sometimes produces leaf roll that is rogued out of the fields.

In the boron-deficiency experiment with potatoes described in this paper, an upward rolling of potato leaves was obtained and corrected with borax. Leaves, however, were muddy green in color, readily distinguishable from the virus leaf roll commonly prevalent in our farm fields. Our experiments, however, would not exclude the possibility of a leaf roll due to boron deficiency identical with virus leaf roll, at least in appearance.

Net necrosis tubers have repeatedly produced leaf roll plants in our experiments under ordinary field conditions, confirming again this commonly accepted fact. "Spindle sprout" potatoes also have repeatedly produced a typical virus leaf roll condition in field experiments, as some growers have come to suspect.

Further experiments are planned to try to find out if potato leaf roll, net necrosis, and stem-end browning, as they occur in the field, have nutritional aspects, boron or otherwise.

Ring Rot—Mention by Dennis in Scotland of boron-deficient potatoes with a burst surface brings to mind that we obtained some similar tubers five years ago in a pot experiment. We caused it by boron starvation on a boron-fixing soil. Tubers with similar appearing breaks or cracked surfaces are pictured in Maine Ext. Bul. 286, "Potato Ring Rot."

We do not know that there is any relation whatever between ring rot and boron deficiency. However, since rots of sugar beets, turnips, celery, and other crops are due to boron deficiency, it is interesting to compare boron deficiency and ring-rot symptoms as described by Bonds and Wyman of Maine. Some characteristics common to both are:

- Leaves rolled upward
- Leaves mottled (chlorotic)
- Leaves yellow or pale green
- More or less wilting
- Increase in dry weather
- Tops of plants injured first
- Death of whole or part of a plant
- Tuber affection without the top of the plant showing symptoms
- Tuber cracking
- Infection of vascular ring
- Bacterial and fungous invaders
- Dead areas in leaves
- Decayed tissues yellowish or brownish in color

Practically all of the symptoms of potato ring rot are very close to those known and expected in the potato from relatively severe phases of boron starvation, particularly those phases of boron deficiency corresponding to yellow top of alfalfa. Of the symptoms, only the contagious nature of ring rot would serve well to distinguish it from certain phases of boron deficiency. While the extreme similarity may be just a coincidence, experiments should be undertaken to see if boron fertilization reduces plant susceptibility to ring rot, or has any antiseptic action against the spread of potato ring rot, as it seems to have against early blight. Such experiments would seem easy; but to be conclusive, they will involve a considerable number of trials because of the possible poor plant availability of borax on soils in the podzol region.

Oats—no borax (left); with borax (right). Boron-deficient heads were empty; with borax they were well filled.

Boron deficiency may well account for one or more of our troublesome potato diseases in the field, but we still have too little evidence to be certain which one. Greater experimental effort should be made to break down the barriers between nutrition and pathology.

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Florida Knows How to Fertilize Citrus

(*From page* 10)

the Citrus Station staff has been able to increase production to the extent that they are now getting a box of fruit for each 0.2 pound of nitrogen applied, where they formerly obtained a box of fruit for each 0.5 pound of nitrogen. Thus, they have more than doubled the efficiency of their nitrogen through the addition of other elements in proper balance.

The spray schedule is necessarily an integral part of the Florida citrus production program, since many of the sprays supply nutrients as well as control diseases and insects. Where the recommended fertilizer practices are followed and the trees are thus kept thrifty, they have a dense, healthy foliage which is essential to high fruit production. But a dense foliage offers an ideal situation for the development of destructive insects, and hence insect control becomes more important than it is with trees in less thrifty condition.

The Citrus Station staff recommends a dormant spray, a post-bloom melanose spray, an oil spray, one additional sulphur spray, and possibly two, as needed.

The dormant spray, applied in January or February to all trees, whether or not the fruit has been harvested, includes 3 pounds of zinc sulphate, 2 gallons of liquid lime-sulphur (or its equivalent in dry lime-sulphur), and 8 pounds of wettable sulphur to the 100 gallons.

This spray furnishes zinc to the tree at a time when it gives better results than a post-bloom zinc spray, reduces rust mites before they can damage the young fruit, requires less material than a post-bloom spray, deposits no residue on the young leaves (which have not yet formed) to favor scale buildup, and spreads the spray schedule over a longer period, thus easing the pressure on equipment and labor.

About two weeks after the petals have fallen the copper and wettable sulphur spray is applied to control melanose and supply copper to the trees. This spray may be either 3-3-100 bordeaux plus 10 pounds of wettable sulphur, or proprietary copper plus wettable sulphur. The belief that no melanose is present is not justification for omitting this spray, since the nutrients contained have been of considerable value in maintaining production.

An oil spray is recommended between May 15 and August 1 for grapefruit and between June 1 and July 15 for oranges. If the trees are in good condition, this spray is quite essential, because scale-insects build up in trees with dense foliage.

If the first three sprays are applied properly, as a rule it will not be necessary to apply more sulphur before late summer, usually late August or early September. Examinations for rust mites should be the basis for timing this spray, as well as for determining the necessity of another sulphur spray or dust before time for the dormant spray.

This fertilizer and spray schedule has rejuvenated groves that were about to vanish from malnutrition, has increased fruit production and kept it on an even keel year after year, has aided the trees to come through cold and drouth with slight damage, and has returned increased profits to growers. In fact, it has turned widespread despair into confident hope for growers on sandy citrus soils throughout Florida.

Keeping Soil Fertile in the Pecan Orchard

(*From page* 23)

contained in the rye plant are temporarily unavailable to other plants growing in the soil, and a shortage of nitrogen may develop in the soil at a critical period in the development of the pecan trees.

Pecan trees make the heaviest demands for nutrients during the latter part of April and throughout May, when rapid shoot and leaf growth is taking place, and the green-manure crop should be worked into the soil soon enough so that the nutrients released by its decomposition will be available through this period. In most years the green-manure crop should be disked into the soil by the 15th of April. Other cultivations, usually numbering from 4 to 6, should follow at fairly regular intervals for the purpose of controlling weeds which compete with the trees for moisture and nutrients, as well as to provide a good seedbed for the following winter green-manure crop. Such cultivation is essential in order to obtain the maximum results from fertilizers and green-manure crops.

Some growers may find that this much cultivation results in too much erosion, and if this does happen measures for controlling erosion should be employed, or the cultivation modified so as to protect the surface soil. Fertility cannot be maintained if surface soil is being washed away.

Winter legumes for supplying the nitrogen requirements of the orchard have been found more economical than the use of complete fertilizers; but where the grower finds it impractical to grow the legumes, a non-acid-forming fertilizer containing 4 to 6 per cent nitrogen, 8 per cent phosphoric acid, and 4 to 8 per cent potash should be used. The 6 per cent nitrogen fertilizer should be used in orchards that do not maintain good green leaf color throughout the summer, and the higher potash fertilizer should be used on the coarser sandy types of soil.

When a complete fertilizer is used, it should be applied in late February and broadcast over the entire area extending from the trunk to 6 to 8 feet beyond the spread of the branches. The amount to use depends on the age and size of the trees. In a bearing orchard about 50 pounds per tree per year should be applied. With 10 trees to the acre this amounts to 500 pounds per acre, which is considered the minimum to be used. In some orchards the rate may be increased to 800 or 1,000 pounds per acre with profit, but much depends on local conditions and the grower must rely upon his own judgment. Fertilizers used under this method should be cultivated into the soil for maximum results.

Recommended methods for the control of disease and insects by spraying and sanitation practices, as given in U. S. Department of Agriculture Farmers' Bulletin No. 1829, fit satisfactorily into the fertility program outlined. These must be used to prevent loss of the crop set as the result of the improved fertility of the soil and the increased vigor of the trees.

Bugs

(*From page* 5)

or even getting a good start at winning, the battle with the bugs.

And I don't mean tarantulas and scorpions and centipedes and vinegarroons and like delirium tremens species of our arid Southwest; because they are only meager vanguards of a mighty host of livestock and plant devourers and bacterial disease carriers lurking in billions of grass blades and weed stems, plotting new and sudden forays. Robot torpedoes and poison gas have nothing on them to task defensive skill.

However, when we measure our own lack of foresight and aggressiveness, which is bad enough, with that of many long years and countless generations previous, there is a small ray of hope. As far as I can see there wasn't much doing between the time when Moses let loose the locusts to devastate Egypt's fields and the discovery of Paris green and London purple in the late seventies or thereabouts. And those two combat weapons were just about as effective, taking in the whole force of our enemy hordes, as a muzzle-loading rifle would be today against a Panzer division.

THE insects probably exerted no nasty baneful system of propaganda like our present enemies have done, but somehow for generations, and even centuries, they lulled us into a sense that we could find a way to "live with the pests" yet. It had become so customary to divide things with the potato bugs and the grain weevils and the codling moths that we regarded it as a kind of natural toll a fellow had to pay for being a pioneer in a free country.

Somebody sold us a new idea four years ago, which has since taken hold, and we know now that we can't do business with Hitler. But too many of us still kid ourselves into thinking that maybe we can do business without fighting the corn borer and the Jap beetle. Where is the militant author who will get us lathered up on this question like the one last winter with the book on the folly of plowing?

You can lay all your plow problems end to end from now to next time and you won't even have the preface to the volume of vexations which lurk within the predatory insect world.

TO be able to know and identify one's enemies is always a strategic method of warfare. Just as kids are taught nowadays to spot the different types and models of airplanes, even as they always knew the different models of autos before we did, so should it become the objective of our agricultural world to familiarize youth with the insects in some detail.

If progress is made in that quarter in the next generation we won't have so many specimens sent to a central laboratory when it is too late to engage in control measures against them.

As for the complexities of chemical re-agents and compounds upon the life cycle of countless marauding insects, I feel we can leave that as it is now, in the skillful hands of experiment station and commercial scientists. But public interests demand that we do not continue to leave the main job of discovering and applying the remedies and controls to the manufacturers of insecticides alone.

Much hope is pinned on DDT as a specific agent for swift and wholesale attack on the waves of insect enemies marshaled against us. Before it can be widely used by every plant grower and orchardist, however, it will take further practical trials and public demonstrations no doubt, surmising that it will be available in sufficient volume when peace comes.

Our friend, the honey-bee, as well as other insects which have some benefit to mankind, will be taken into consideration (like the French Underground) when powerful knock-out cure-alls are applied to vanquish the chief offenders. Such complications as this and the necessity of avoiding human poison in battling insects tend to slow up the work of extermination—if it is possible to use that word in reference to the teeming world of bugs and worms.

Breeding natural parasites to "sic onto" the worst invaders has been another fascinating line of study in bugology. Wasp parasites were used with much success in control of San Jose scale. In Ohio a few years past a terrific onslaught of Oriental fruit moth was frustrated temporarily, after it had damaged more than half of the peach trees, by artificial distribution of insect parasites. They tell me that the ordinary corn-stalk borer, larger than the insidious European prototype, has never got a bigger toe-hold among our corn fields because it has been kept down by several parasitic enemies.

That's why I felt like a secret service agent and an FBI man combined when I went into the fields last month with a state entomologist to scatter several thousand flies and wasps in moist nooks adjacent to the habitat of the corn borer. If these alien predators live up to the jaw-breaking Latin cognomens they bear, I expect to live to witness the redemption of acres of rich corn land from the worst threat our major crop has had in a century.

FINALLY, in the realm of defense from leaping and flying clouds of insect plagues, we have glimmerings today of a possible system of forecasting dovetailed to long-distance weather observations. I hear that England is busy at it, in between dodging robots. The good old Rothamsted outfit is tackling this scheme, probably with some help from American entomologists.

Forewarned is forearmed. The old way of forecasting insect invasions was by the usual regional grapevine system. One section was visited by certain unsavory and unwelcome pests and immediately spread the alarm to other growers of similar commercial crops elsewhere in the line of march.

Of course sometimes the bugs didn't live up to the advance billings and found it impossible to make the date expected of them in some other locality. That's the nature of insects anyway, you can't rely on them to do what you think they're going to do.

But this scientific weather hook-up to the bug behavior business appears to be pretty sound. At least it has been proven so far that the various weather factors in combination account for at least fifty per cent of the ups and downs in bug populations.

RIGHT now further study is being pressed rapidly on things like barometric pressure, air temperatures, rainfall, direction and force of winds, total solar radiation, degree of humidity, and amount of sunshine.

It stands to reason that up in our temperate zone the bugs stand a lot more punishment and meet a heap more discouragement than they do in the torrid sections. Just what things most hamper and limit them and which things in the weather series most favor them should prove to be a good key to unlock the probable future of specific species. If long range weather forecasting opens the way for concurrent advance predictions about insect invaders, we shall have one more weapon to help us meet our worst scourges.

But as I said before, we can't let the weather fool us or get us into a complacent mood, so as to halt our efforts to smash the crawlers before they hatch. He who depends on nature to take its course unaided in battling natural phenomena is just a dreamy old ostrich with his head in the sand.

For if we relax we'll be right back where we began in the days I spoke about. Who wants to return to the swatter, the rooster, and the kerosene can as the chief reliance against pugnacious bugs?

AVAILABLE LITERATURE

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

Circulars

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

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
H-3-42 Legumes Are Essential to Sound Agriculture
I-3-42 High-grade Fertilizers Are More Profitable
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
Y-8-42 The Southeast Can Grow Clover and Alfalfa
AA-10-42 Growing Legumes for Nitrogen
DD-10-42 Clover Pastures for the Coastal Plains
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizer
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
C-1-43 Quality in Grasses for Pasture and Hay
F-1-43 Boron Improves Canning Beets
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
HH-8-43 More Soybeans, Please!
JJ-10-43 Soil Management for Field Beans
MM-11-43 Mississippi Farmers Improve Their Soil
NN-11-43 Maintaining Available Potassium in Soils
OO-11-43 Kudzu Conserves Southern Soils
PP-12-43 Commercial Fertilizers for Livestock Farms
QQ-12-43 Potash in War Production.
A-1-44 What's in That Fertilizer Bag?
B-1-44 Available Potash in the Surface Soils of Georgia
C-1-44 Adjustment of Agriculture to Its Environment
D-2-44 Potassium Content and Potash Requirement of Louisiana Soils
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
G-2-44 The Use of Borax in the Legume-Livestock Program of the South
H-2-44 Efficient Fertilizers for Potato Farms
I-3-44 Doubling Production by Bettering Soils
J-3-44 The Response of Various Crops to Potash Fertilization in South Carolina
K-3-44 Soil Tests Indicate Potash Levels
L-3-44 South Finds Clovers Excel in Profits
M-4-44 The Importance of Potash in Maintaining Food Production in N. C.
N-4-44 The Potash Problem in Illinois
O-4-44 Record Supplies of Fertilizer Materials Indicated for 1944-45
P-4-44 Borax Sprayed on Beets Controls Black Spot
Q-4-44 A New Approach to Extension Work
R-5-44 More About Soybean Fertilization
S-5-44 Borax Spray for Turnips
T-5-44 Southern Crops Show Need of Potash
U-5-44 The Use of Fertilizer in Maryland
V-5-44 The Seed Production of Hairy Vetch and Other Winter Cover Crops

THE AMERICAN POTASH INSTITUTE

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

SLOWED HIM UP

The first officer called a deck hand to him and said—"Go below and break up that crap game."

The sailor disappeared below, and remained for the better part of an hour. Upon his return his superior officer demanded—"Did you succeed in breaking up the game?"

"Yes, sir," replied the gob.

"Well what in thunder took you so long?"

"Well sir," the sailor replied, "I had only two bits to start with."

Love is like an onion,
You taste it with delight
And when it's gone you wonder,
Whatever made you bite.

OBLIGING

"Can't I be squeezed in there somehow?" asked the young lady at the entrance door of the street car.

"If you get in I have one arm free," said Careless Clarence over the conductor's shoulder.

A transport had been sunk and several lifeboats were cruising about the surrounding waters picking up survivors. A completely bald-headed sailor popped up alongside one of the boats. One of the Irishmen manning the oars spotted him and, with a snort of rage, brought down his oar smack on the bald man's pate. "This is no time for fooling," he cried. "Go down and come up straight!"

A Negro woman in Mississippi the other day testifying in behalf of her husband admitted in court that he never hit a lick of work and that she had to support him. "Why do you live with such a trifling no-account husband?" she was asked. "Well, it is this way," she replied, "I makes de living and he makes de living worthwhile."

NAUGHTY! NAUGHTY!

Two babies in adjacent beds in the hospital. Said one to the other, "I'm a girl—what are you?"

"I'm a boy."

"But you look like a girl," she countered.

"I'm a boy—I'll show you when the nurse leaves."

Finally they were alone. He shyly lifted the covers. "See," he said, "blue booties."

Reporter: "I've got a perfect news story."

Editor: "How come? Man bite dog?"

Reporter: "No, a fire plug sprinkled one."

CARING FOR IT

Man: "They tell me Jones has a right good voice. Is he cultivating it?"

Friend: "I can't say about the cultivating but I know he irrigates it frequently."

"About this girl you want to marry; has she good connections?" asked a proud mother.

"Well, she never came apart when I was with her," replied the sailor.

UNTREATED SEEDS

SPERGON TREATED

Printed in U.S.A.

Better Crops *with* PLANT FOOD

October 1944 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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

VOLUME XXVIII NO. 8

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DIRECT—FROM PRODUCER TO CONSUMER.

Better Crops with PLANT FOOD

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Harking Back to—

Bovine Bazaars

Jeff McDermid

THOSE big stock shows were always held in the dog days, and believe me, my old dogs knew it every night! For my well-earned certificate of tribute, if it ever comes, there should be handed to Saint Peter the following: "To Whom It May Concern, the bearer of this gate pass is freely entitled to enter herewith and spend most of his moments recording the merits of the sacred bulls and contented cows in the temple courts of Ceres and inscribing the decisions of the judge with all the hallowed respect that his halo justifies. No permit shall be required for the bearer to lug along a kodak, but a guardian angel shall be detailed to accompany him as protection against saintly stockmen who may harpoon him with their harps for alleged distorted photos of their grand champions."

If, however, Heaven is not designed as a spot wherein one may rest and refresh himself with something more safe and satisfying than hot wieners and burnt apple pie from the North Avenue Baptist ladies' aid, then a confirmed livestock show reporter should ask for a ticket to some more exciting place, even though it also features hoofs and horns.

I guess maybe I am the only one left of a once courtly crew of enthusiastic followers of the cattle circuit who nursed bursting ambitions as well as bunions in those gaudy days of news gathering in decorated coliseums. I became imbued, or infected, as you wish, by reading the charming columns of certain scribes who preceded me, like Martin, Wing, and Guard of the old Breeders' Gazette, and inspired to film the purple bovines by scanning portfolios of pictures by Hildebrand and Strohmeyer.

Times have changed and I for one am glad they have. It strikes me we got into a sort of fashionable rut in doing our daily dozen in the wake of the dusty caravans. The worst mistake we made and lived to regret was putting so much youthful zest and wasted hours into the gathering and transcribing of solid columns of triple-decker animal names, slapping them down on paper up to the seventh place in each of two dozen classes to a breed.

I CAN see those tiresome rows of six-point yet, up and down the pages, continued drearily over to the next, and meandering boresomely onward past the ads for tractors, bag balm, and worm capsules. Probably it was good for the advertisers though, as readers quickly left the blurry mess of this cow census to revel in the display type and snappy sketches on the borders.

After a glaring day amid the ding-dong of the midway and the dung of the arena, with wilted collars, frayed tempers, and shaking shins, many of us hied to some hotel uptown for a short snort and a hurried dinner. This was just a little eye-opener, though, as the real job of the assignment beckoned us from the hall bedroom on the fifth floor back, looking out upon the grease-spotted pavement of a noisy parking lot.

After a short soak or a spattery shower in the rusty tub, we sat down in BVD abandon to peck out the dubious collection of soon-forgotten bovine names from the hastily marked margins of our hefty stock show catalogs.

Here one had to guard oneself zealously against the combined effect of the beer and the bath, so as not to give the junior champion heifer the royal purple, or list the wrong owner as winner of the most blues. If you ever stooped to mangle a typewriter at a low table or even a bedspread, using the other hand to keep a bulky catalog flat at the proper page, you'll get a bit of insight into the physical foolishness of it.

Sometimes you got the jitters when a blank unmarked page met your eye, indicating that you had been busy telling a cute story just when they led away the senior yearling bulls or ribboned the produce-of-dam class. It meant reaping the penalty of sloth, causing you to ring up another scribe in an equally close room to see if you could trade him a get-of-sire for a missing digit in your encyclopedia of nomenclature. It usually made him sore to be disturbed when he had almost finished the Holsteins without misspelling Pietertje Heilo Djerke, but he knew there was another day coming and you had to be pals or quit.

Well, anyhow, to make a long story as short as it should have been but wasn't, you peered and pecked and sweated in that cubicle until the rooster began to get uneasy on the outskirts of town. You were expected to have a neat set of typed pages ready to fling into the mail box en route to another day's tan-bark pleasures—but a bed and breakfast had to be wedged in somehow, meanwhile notwithstanding. And you had a solid, continuous six weeks of pumpkin shows to cover, without using a radiator on your typewriter.

SO much for the ordinary routine when nothing unforseen happened. But once upon a miserable time at the great Chicago International two of us working for the same rural rag were cooped up in the Atlantic hotel pushing copy in the same room. We always had brilliant "leads" to use as overtures to each breed story, in which we told the same stuff over and over about the "bloom" and "scale" and "finish" marking each entry which won judicial favor, or tieing into some judge who was snooty to the press.

After two nights of trying to outdo each other in adjectives and hyperbole, plus six-point name details, I handed the finished masterpieces to another staff man who offered to carry the precious cargo to the linotypes. Next day at noon a long distance call from him informed me that he lost his baggage on a continental express, so would we please repeat and rush it in? I draw the curtain here because we had made no carbon copies. Even in this tolerant day of free speech and nasty novels, the publishers refuse to let me tell you what we said.

That infuriated me about as much as the time this same guy came to the Minnesota state fair to "help me." He came in the front gate with a flower at his buttonhole, smiled at the clerk's stenographer, glanced at the grounds fleetingly, darted back to town in a taxi, dictated a few pages to a hotel typer, and spent the remaining blissful hours in a handy bar. He hit the front page but I furnished the reams of trailing copy that nobody read, except the chaps who accused me of putting their third-class calf into fifth-place position—and my only excuse was lack of aspirin.

"Rewards" and "awards" sound alike but they don't mean the same thing to a veteran livestock reporter. The first is something a good reporter never gets enough of from his boss or the dear public, and the second is something some guys get without earning it, especially rich gentleman farmers showing imported cows.

There never has been enough money in the livestock paper business to properly pay off the scribes who did the dirty work back when fair managers furnished no easy facilities for getting the official prize lists.

Bear in mind in those demented days before publicity departments were set up at fairs that we pencil-pushers had to cover cattle rings, sheep rings, swine rings, and goat rings, and we almost had nose-rings ourselves before the week's "bull" was put to press.

They always put the barns and arenas so far apart that a man got worn to a frazzle tramping back and forth trying to keep wise to all the goings on. The cattle show on the third day was enough to make a man wish he had a neck adjustment like a ventriloquist's dummy, free to whirl in all directions. To the north they led in the dairy breeds, to the south the beef cattle, to the east the draft horses were pawing, and over in the last crowded corner were the wobbly 4-H calves. Then half a mile across the sunlit field was the hog barn where the big pork-chasers were hurdling their snorters; to the sheep arena you had to trudge another marathon; and who would protect you in the cow circus if you left?

By getting well organized between us without playing too far toward the rival sheets, we scribblers were able to keep fairly well up with the awards books without running our socks clear off. But we used to use a knife and cut thumb-nail notches in our catalogs so we could locate the pages fast and be sure not to get the champ Hereford prize nicked onto some Jersey bull. It was a far cheaper way to get dizzy and punch-drunk than prying loose some change in a souse shop.

NATURALLY all mistakes were chalked up to the paper that printed them, even though they were often collective errors of the whole gang exchanged in the hurly-burly business of marking down awards without official reports. I am sure that some of those misprints actually meted out better bovine justice than the

(*Turn to page* 51)

A Trash Mulch Method[1] Of Reclaiming Land With Alfalfa

By H. L. Borst and R. E. Yoder[2]

TO the many Ohio farmers who are convinced that alfalfa will not grow on their unproductive, eroded hilly fields, the Soil Conservation Experiment Station and the Ohio Agricultural Experiment Station accomplishment of raising good alfalfa crops on such land is more than eye-opening news. For many a discouraged owner of hilly farm land it is the first step on the way to profitable farming, especially at a time when alfalfa and the livestock it will feed are in such demand.

It is common belief that alfalfa will succeed only on soils at fairly high levels of ferility. Prospective growers have been advised to build up their soils for a rotation or so before attempting alfalfa. They have been advised to put a little alfalfa seed in their meadow mixtures to "prepare" their soil for alfalfa. Consequently, using alfalfa seeded directlv as one step in reclaiming impoverished soils may seem revolutionary to many; in a way it is, but constructively so.

Basic requirements for alfalfa are: favorable climate, well-drained soil, nearly neutral soil reaction, an ample supply of mineral elements. Experiments in Ohio and elsewhere show that alfalfa will grow where these conditions are met. Climate is generally favorable for alfalfa anywhere in Ohio. Muskingum and related hill soils are well drained, usually overdrained rather than underdrained. Consequently, when lime and the mineral fertilizers are added in sufficient quantities, these soils make a favorable location for alfalfa.

Another important key to success with alfalfa under these conditions is to protect the land from the destructive forces of rainfall and erosion by leaving the soil covered with a blanket of organic material. Existing vegetation, which usually consists of broomsedge, poverty grass, and weeds, is converted into a surface trash mulch which promotes infiltration, decreases and controls runoff, eliminates erosion, and conserves moisture by decreasing surface evaporation. This protection cannot be provided by plowing, but it can easily be by disking the soil in the proper way while preparing the seedbed for the new seeding. Seeding the meadow directly, without the conventional small grain, eliminates competition by the so-called nurse crop.

Effectiveness of the "trash mulch" method of direct seeding of meadows in controlling soil and water losses resulting from erosion is shown in Table 1.

For six years, alfalfa-grass meadows have been established successfully without plowing on eroded, unproductive broomsedge (*Andropogon virginicus* L.) and poverty grass (*Danthonia spicata* L. Beauv.) hills at the Soil Conservation Experiment Station, Zanes-

[1] A joint contribution of the Research Division of the Soil Conservation Service and the Ohio Agricultural Experiment Station.

[2] Project Supervisor, Soil Conservation Experiment Station, Zanesville, Ohio; Chief in Agronomy, Ohio Agricultural Experiment Station, Wooster, Ohio, respectively.

TABLE 1.—EROSIONAL LOSSES FOR TWO WATERSHEDS SEEDED BY TWO DIFFERENT METHODS*

Seeding method	Size of watershed in acres	Slope of watershed in per cent	Soil and water losses†	
			Runoff in inches	Soil losses in tons per acre
Conventional—in wheat	1.69	12.7	12.18	21.3
Direct seeding—trash mulch	1.63	21.7	2.64	.1

* Results from North Appalachian Experimental Watersheds, Coshocton, Ohio. Courtesy of Soil Conservation Service.

† Annual soil and water losses for 1940, the year in which the seedings were made.

ville, Ohio. Meadows thus established have produced an average of 2.5 tons of alfalfa-grass hay per acre the year after seeding. The yields obtained are almost one ton greater than those from the average hayfield in Ohio.

Experiments aimed at establishing desirable vegetation on eroded run-down land have been carried on at the Soil Conservation Experiment Station since its establishment. Early studies supported the common belief that establishing a cover on eroded or run-down land in an effort to return it to a productive state is a slow process.

A trial seeding of alfalfa was made on a badly eroded field in the spring of 1936. About one-half the area used was bare; the rest was covered by a sparse growth of poverty grass and some briars. The area, an eroded Muskingum silt loam, had lost most of its topsoil. The soil reaction was very acid, approximately pH 5.4.

To this field, coarsely ground limestone (20 per cent through 100-mesh) was applied at a rate of 4 tons per acre. The land was disked. Twenty per cent superphosphate was put on at 400 pounds per acre. Inoculated, hardy alfalfa was sown at about 15 pounds per acre. When this was done, strips of timothy, smooth brome grass, and orchard grass were sown across the area, which was then cultipacked on the contour.

The resulting seedings were so promising that similar plantings have been made each subsequent year except 1939.

The area used in 1937 was similar to that treated in 1936. There were some bare spots, but most of the field had a fair growth of poverty grass. The land had previously received some lime,

TABLE 2.—HAY YIELDS OBTAINED FROM ALFALFA-GRASS MEADOWS SEEDED DIRECTLY ON ERODED LAND WITHOUT PLOWING

Meadow mixture seeded	Year sown	Hay yields in tons per acre			
		1939	1940	1941*	1942
Alfalfa, timothy, and orchard grass	1937	2.60	2.77	1.75	2.08
Alfalfa and timothy	1938	3.00	3.25	2.25	3.90
Alfalfa and brome grass	1940	....	....	1.90	3.35
Alfalfa and orchard grass	1940	....	....	1.75	3.00
Alfalfa and orchard grass	1941	....	....	....	1.60†

* Yields low because of low rainfall.

† One cutting only.

and a small portion of it had been seeded to orchard grass in 1933. Most of the area had been in pasture for more than 20 years. The 1938 area had been cropped last in 1931 and had received some lime previous to that date; at the time of the test it was covered with weeds, except for an occasional patch of thin bluegrass. The five areas used in 1940, 1941, and 1942 had been abandoned for more than 10 years, and none of them had ever been limed; their vegetation was similar to that of the other areas except that more broomsedge was present.

Three cuttings of hay have been made on all areas each year following the year of establishment. First cuttings each year have been mixed hay; second and third cuttings have been nearly straight alfalfa. The hay yields have equaled or exceeded those of the rotation meadows on the Soil Conservation Experiment Station except in 1941, when they were low because of scarce and poorly distributed rainfall.

In addition to the trials at Zanesville, seedings were made at the North Appalachian Experimental Watershed Project, Coshocton, Ohio, in 1940, and at the Ohio Agricultural Experiment Station, Wooster, Ohio, in 1942. Both these were successful. In 1940, several farmers near Zanesville made trial seedings of the sort discussed. Wherever made with proper care, such direct seedings have been successful.

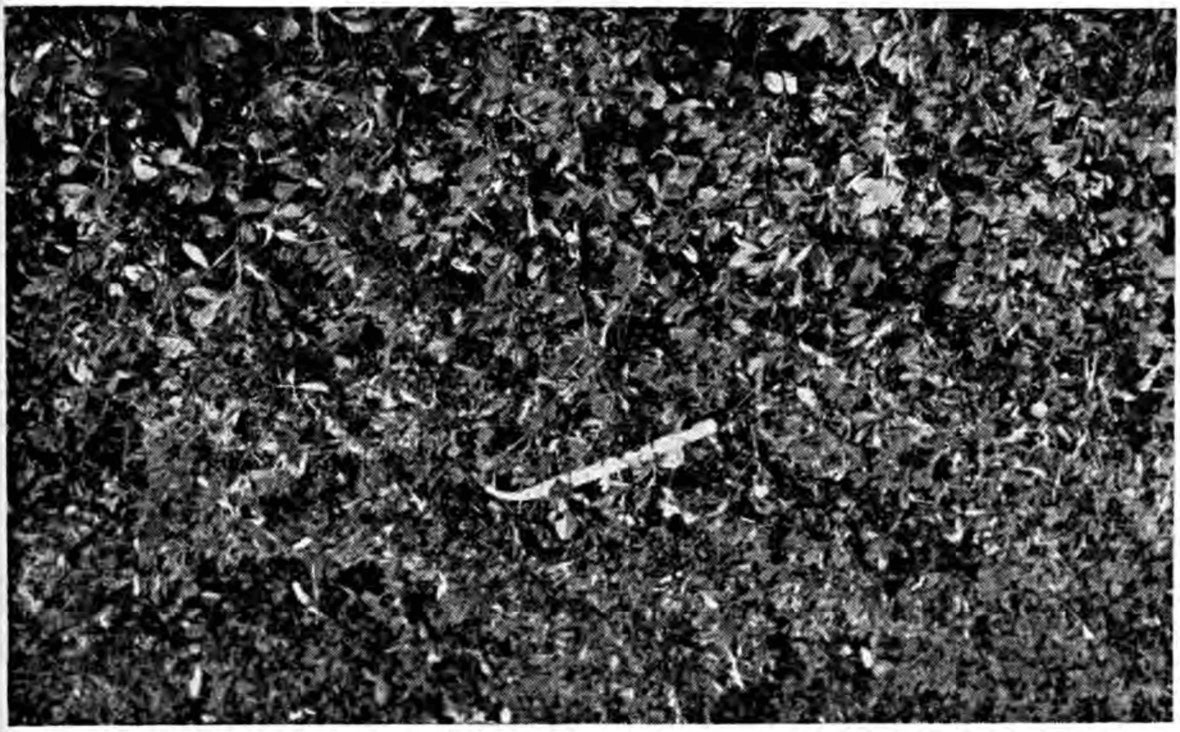
How To Do It

As a result of the experiments described, the following procedure is recommended for the direct establishment of alfalfa meadows on eroded hill lands:

This picture shows area 40-B as it appeared in April, 1940.

Apply lime, always enough to neutralize the acidity of the soil or very nearly so, any time before sowing the alfalfa; the earlier the better. Have the soil tested and take no chances. On most Muskingum soils, at least three tons per acre of "agricultural ground limestone" will be needed. If a coarser grade is used, four tons or more per acre may be advisable. Be sure to use enough lime.

Disk in late March or early April as soon as the soil can be worked. Preliminary disking can be done the preceding fall. The soil should be moist, not dry, when disked. It is better to disk the soil a little on the wet side rather than wait too long. The field should be well disked but not worked up into a fine or dusty condition. The old vegetation, which forms the important protection against the forces of erosion, should be left on or near the surface. It is usually necessary to put considerable weight (200 to 400 pounds) on the disk, particularly if the old vegetation is heavy. If the old vegetation is an extremely heavy growth of broomsedge, it may be desirable to remove enough of it so that the disk can cut through. A tractor disk does a better job than a horse-drawn implement. In fact, heavy sods cannot be cut up without tractor power. Where the old vegetation is thin, double disking (lapped one-half) twice will be sufficient. Do not try to prepare a deep seedbed. In fact, avoid doing so. Areas with a dense growth may require three and even more double diskings. As a somewhat cloddy seedbed is desired, it is not necessary to harrow except possibly with a spring-tooth, which keeps the trash mulch and clods on top of the seedbed. The final tillage operation, cultipacking, should be done on the contour.



Area 40-B in October of the same year with the cover established by trash mulch seeding.

Fertilize with 0-14-7 or 0-12-12 at a rate of 350 to 400 pounds per acre. Alfalfa requires an abundance of phosphate and potash, as well as lime. Neglecting to supply fertilizer may result in seeding failures.

The fertilizer used in most of the early trials was 4-10-6. Since the opinion was current that alfafa will thrive only on soils of good fertility, a complete fertilizer with a fair nitrogen content was applied. However, seedings made with phosphate-potash fertilizers in 1941 and 1942 appear as thrifty as those made with fertilizer containing nitrogen; so the use of nitrogen-carrying fertilizer is not recommended. The fertilizer should be drilled into the soil with a grain drill either before, or at the time, the seed is sown.

Seed with a mixture of alfalfa and grass. The following seeding mixtures (pounds per acre) are suggested:

Alfalfa 10; timothy 6
Alfalfa 10; orchard grass 5
Alfalfa 10; alsike 2; timothy 6
Alfalfa 10; ladino clover 1; timothy 6

Timothy, orchard grass, and smooth brome grass have been used along with

(*Turn to page* 49)

Fertilizer Expenditures In Relation to Farm Income

By A. L. Mehring

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THE relationship between total expenditures for fertilizers and national farm income has been investigated by Vial (9)*, Willett (10), Kriesel (5), Brodell and Cooper (1), and Mehring and Shaw (6).

Vial showed that the fertilizer consumption in a given year could be estimated with a fair degree of accuracy from the previous year's acre value of four principal crops and the two previous years' fertilizer consumption. In the other studies, a close relationship was found between expenditures for fertilizer and either gross or cash farm income. Mehring and Shaw found that farmers spent on the average 2.68 cents of each dollar of the previous year's total cash income for fertilizers and that the total cash income of the previous year was somewhat more closely related to the expenditures than either the gross income or the total cash value of crops.

In all previous studies on the subject it appeared that the farm income from the previous year and also from the present year were closely related to expenditures for fertilizers. Willet ascribed the relationship to the present year's income. Brodell and Cooper, and Mehring and Shaw apparently considered the previous year's income more important. Kriesel appears to believe that in some years one is more important and that in others the relationship is reversed. It is practically impossible from the data previously available to determine whether the size of the farm income in the past year and in the present year both influence the amount of money spent by farmers for fertilizer. If both are factors, what is the relative importance of each? It seems desirable to determine this relationship in order to be able to forecast the demand for fertilizer more accurately than has been possible in the past.

The total cash income of farmers as reported by the Bureau of Agricultural Economics (8) is given separately for the years starting with 1910 for 3 classes of income; namely, income from marketings of crops, income from marketings of livestock, and government payments.

The total farm income includes a much larger proportion of income from marketings of livestock products than from crops in some years and in others the reverse is true, but large parts of the eggs, butter, milk, and meat come from farms that use little or no fertilizer. On the other hand, most of the fertilizer is used in the sections where income from livestock products is relatively much less important. For example, in 1942 cash income from animal products and total farm income in Iowa were $1,019,585,000 and $1,289,993,000 and in North Carolina were $64,918,000 and $449,803,000. Thus, the income from animal prod-

* Numbers in parentheses refer to Literature Cited.

ucts in these two states was 79 and 14 per cent of the total, respectively.

Naturally, farmers buy as much fertilizer as they think they can afford because under certain conditions they know that it pays well to use it, so the income from the previous year should be important in deciding how much will be spent. But demand should also be influenced by prospects of a good market. If the farmer has doubts at the time of planting about being able to get a satisfactory price for his crop, he won't use as much fertilizer as when he is practically certain of a high price for whatever he can produce. Government payments should also be a factor, because the farmer knows at the time he plants his crop approximately what the payments will be. Expenditures for fertilizers were studied by statistical meth-

TABLE 1.—THE FIGURES USED IN CALCULATING THE COEFFICIENTS OF CORRELATION BETWEEN EXPENDITURES FOR FERTILIZERS AND FARM INCOME

Year	X_1 Expenditures for fertilizers (3)*	X_2 Cash income from crops and government payments in previous year (4)	X_3 Cash income from crops and government payments in the same year	X_4 Proportion of previous year's total cash income remaining after cost of production is deducted **
	million dollars	*million dollars*	*million dollars*	*Per cent*
1911	175	2950	2925	38
1912	164	2925	3111	35
1913	179	3111	3095	35
1914	201	3095	2920	35
1915	174	2920	3280	32
1916	186	3280	4043	34
1917	205	4043	5660	37
1918	309	5660	6985	43
1919	442	6985	7674	44
1920	416	7674	6654	42
1921	256	6654	4199	28
1922	225	4199	4321	16
1923	253	4321	4885	26
1924	255	4885	5415	25
1925	281	5415	5526	26
1926	268	5526	4889	32
1927	238	4889	5157	29
1928	295	5157	5044	30
1929	277	5044	5125	29
1930	276	5125	3840	31
1931	189	3840	2536	22
1932	111	2536	1997	12
1933	116	1997	2604	20
1934	157	2604	3450	30
1935	177	3450	3551	33
1936	206	3551	3938	35
1937	253	3938	4315	35
1938	226	4315	3672	33
1939	233	3672	4173	29
1940	237	4173	4236	29
1941	266	4236	5303	29
1942	328	5303	7084	36
1943	413	7084	8576	46

* See Literature Cited.

** Agricultural Statistics, 1942; Table 735 for data from which these figures were calculated for 1910 to 1939. Later data very kindly supplied by H. C. Norcross of the Bur. of Agr. Economics.

ods in relation to income from crops and other farm income in the same year, in the previous year, and on the average in both years.

The average expenditure for fertilizer per dollar of income was calculated from the income figures and the expenditures, as given in Table 1. Then the coefficient of variation was determined from the deviations of these figures from the mean for the 33 years. The coefficients obtained are given in Table 2. These coefficients show clearly that the quantity of money spent for fertilizer is highly dependent on amount of income from the past year and the present year. The relationship with the previous year's income is shown graphically in Figure 1. When expenditures from income from crops only were calculated it was apparent at once that government payments should not be left out. When they are omitted there are large deviations from the mean, all in the same direction in each of the years in which government payments

TABLE 2.—COEFFICIENTS OF VARIATION OF ANNUAL EXPENDITURES FOR FERTILIZERS FROM THE 33 YEAR MEAN, 1911-1943, PER DOLLAR OF FARM INCOME OF VARIOUS KINDS

Kind of Income	Expenditure per dollar of income		
	Previous year	Same year	Average of previous and same year
From crops only.	14.3	......	....
From crops plus gov't payments. .	10.4	14.6	9.1
Total cash income	11.9	13.5	10.2

were made. Income from government payments is related to expenditures for fertilizers in the same way as income from crops.

Expenditures for fertilizers are closely associated with total cash income during the previous year, as well as that in the same year (correla-

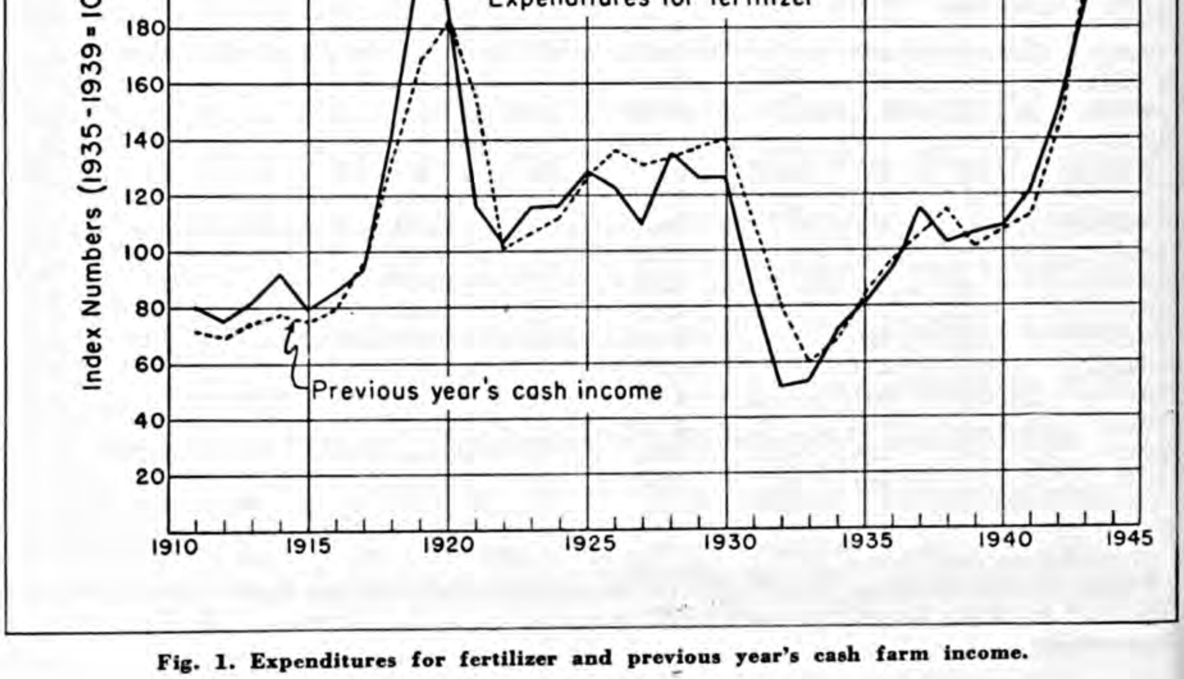

Fig. 1. Expenditures for fertilizer and previous year's cash farm income.

tion coefficients +.9209 and +.8855, respectively). But income from crops plus government payments in both years is a little more closely correlated with fertilizer purchases (+.9291 and +.9009) than is the total income. The differences, although no greater than the standard errors and therefore not significant statistically, confirm the indications of the variation coefficients that the sum of the income from crops and government payments is slightly more closely associated with expenditures for fertilizer than total income is. The income from crops plus government payments will be used, therefore, in the remainder of this study. The statistical values with the two measures of income are so nearly alike, however, that it seems that total cash income would do almost as well for estimating fertilizer demand. It also appears from the values of the correlation coefficients that either the previous or the present year's income is of about equal value for this purpose. But this latter statement is not true. It only seems to be so, because the income itself in one year is highly correlated with income in the year next to it, as will be shown more fully later. It will also be shown later that the income in the previous year is of greater value for estimating purposes than that of the present year. For best results it is necessary to consider both as factors affecting fertilizer expenditures.

It seems reasonable that the amount of money spent by farmers for fertilizers should be influenced by the quantity of money remaining after expenses of production in the preceding season had been deducted. A coefficient of variation of 104.7, however, shows that the total amount of money left over after expenses are paid is not closely related to fertilizer purchases. On the other hand, the coefficient of variation in the relationship between the proportion of the total income left over and expenditures for fertilizer is 28.5. The size of this coefficient indicates that the proportion of the previous year's income left over after all expenses of production are deducted may be another factor in determining the amount of money to be spent for fertilizer. Thus we have three factors that all appear to be affecting expenditures for fertilizers simultaneously. Other factors, such as credit, may be involved but this possibility was not investigated further.

In order to evaluate the effects of the three factors now appearing to be important in the problem, it will be necessary to calculate both multiple and partial correlation coefficients.

Correlation coefficients were calculated to show the simple degree of relationship between each set of figures in Table 2, taking every possible combination of two. The results are as follows:

	Correlation coefficients	*Standard errors*
r_{12}*.	+.9291	.0238
r_{13}.	+.9009	.0328
r_{14}.	+.5701	.1175
r_{23}.	+.8254	.0555
r_{24}.	+.4353	.1411
r_{34}.	+.5677	.1180

* r_{12} is the correlation coefficient between the X_1 and X_2 data in Table 1. r_{13} is that between the X_1 and X_3 figures and so on.

All of these coefficients are significant. The first one shows a very high degree of relationship between expenditures for fertilizers and income in the previous year. But the next coefficient also indicates a high degree of relationship with income in the same year. This is only possible if the income in one year is related to that in the next year. The coefficient r_{23} shows that they are related. High income in one year is usually followed by high income in the next and vice versa. Considerable relationship appears to exist between the proportion of money left after expenses of production are cared for, and money spent for fertilizer in the next year ($r_{14} = +.5701$). The amount of money left over is also related to the size of the income as one would naturally expect ($r_{24} = +.4353$ and $r_{34} = +.5677$). Correlation between factors that are mutually correlated to other factors gives results

TABLE 3.—EXPENDITURES FOR FERTILIZERS (X_1), FARM INCOME FROM CROPS AND GOVERNMENT PAYMENTS IN THE PREVIOUS YEAR (X_2), AND FARM INCOME IN THE SAME YEAR (X_3), BY STATES (1,000 DOLLARS)

	Massachusetts		Pennsylvania		South Carolina		Ohio		Texas		Indiana		Minnesota	
	X_1	X_2 & X_3	X_1	X_2 & X_3	X_1	X_2 & X_3	X_1	X_2 & X_3	X_1	X_2 & X_3	X_1	X_2 & X_3	X_1	X_2 & X_3
1924		35,770		104,139		123,513		130,407		684,773		108,110		
1925	2,286	36,821	9,099	110,466	26,372	131,671	11,465	125,091	4,435	570,786	8,254	108,689		
1926	2,055	35,094	9,372	116,772	26,666	98,452	10,346	132,324	3,726	493,859	8,465	117,312		
1927	2,382	34,516	10,431	100,247	18,772	120,317	10,067	126,043	2,675	584,699	8,998	98,372		103,361
1928	2,478	34,085	9,894	91,683	24,011	104,633	10,999	96,200	5,172	611,002	8,255	71,583	675	94,579
1929	2,075	34,643	9,664	93,301	22,612	115,293	10,906	98,719	7,076	516,175	9,242	81,645	581	97,794
1930	2,152	31,937	9,815	84,269	20,709	82,391	10,346	80,934	5,085	325,559	9,543	69,530	751	81,441
1931	1,863	26,339	7,491	62,628	15,097	50,894	6,898	73,732	2,281	226,767	6,073	48,339	792	47,359
1932	1,518	19,837	5,541	50,627	9,331	38,643	4,008	54,855	1,009	212,198	2,938	36,824	385	31,378
1933	1,249	23,471	5,099	56,370	10,793	58,182	4,567	72,284	857	290,639	3,010	43,833	251	53,395
1934	1,556	23,408	6,308	62,650	13,048	92,332	6,898	92,387	1,504	338,293	4,327	70,647	353	64,778
1935	1,710	25,909	7,119	68,995	13,725	92,771	8,016	103,362	1,968	327,071	5,692	77,347	390	81,367
1936	1,844	30,016	7,745	88,370	13,713	93,789	9,414	120,504	1,982	316,947	7,455	82,554	356	87,892
1937	2,190	30,278	9,621	87,965	17,938	97,402	10,346	113,547	2,884	394,199	7,537	86,239	482	113,398
1938	1,998	26,801	9,565	71,795	14,601	83,967	9,135	91,812	2,725	305,895	7,000	67,989	517	85,949
1939	1,863	31,655	9,465	82,504	15,145	99,771	9,787	115,494	3,127	340,962	6,420	87,702	502	118,379
1940	1,883	29,948	10,076	82,454	18,750	99,856	10,160	108,593	3,979	349,601	7,107	91,695	751	143,730
1941	2,017	37,188	10,896	90,795	19,206	87,602	11,558	135,148	4,304	449,014	8,562	112,015	830	131,508
1942	2,401	41,078	11,595	107,999	20,311	140,795	14,168	195,840	4,786	529,247	10,597	151,205	938	163,564
1943	2,824	54,872	12,806	131,181	26,581	166,040	16,779	201,307	5,402	639,237	11,059	173,688	1,375	195,094
r_{12}	.9211		.7708		.9004		.8989		.7913		.8602		.8707	
r_{13}	.8660		.8235		.7307		.8775		.6916		.7870		.7576	
r_{23}	.7990		.8094		.6671		.8209		.7949		.8512		.8606	
$r_{12.3}$	.7624		.3131		.8123		.6533		.5514		.5880		.6575	
$r_{13.2}$	.5559		.5338		.4015		.5581		.1687		.2047		.0331	
		*cents 6.5		cents 10.6		cents 19.2		cents 9.0		cents 0.8		cents 8.7		cents 0.7

*Average expenditure per dollar of income from crops and government payments in the previous year.

that are too high or too low, and the correlation coefficients may be entirely misleading. Tangled relationships may be untangled by means of partial correlations.

When the effects of the other two variables are accounted for by partial correlation, as shown by the value of the second-order coefficient ($r_{12.34} = +.781$*), the correlation between expenditures for fertilizer and income in the previous year is shown to be much less than indicated by the zero-order coefficient +.9291. The income in the present year appears to have still less effect on expenditures ($r_{13.24} = +.554$) than the income from the previous year when the effects of other variables are removed from it also. But the reduction of r_{12} from .9291 to .781 is slight compared to that of r_{13} from .9009 to .554 when the effect of other variables is removed. This is a highly important result, because from either charting the data or simple correlation the present year's income appeared to be almost as important as the previous year's income in determining what the farmer would spend.

The multiple correlation coefficient $R_{1.234}$ shows the effect on X_1 of X_2, X_3, and X_4 all acting together. In this case it was found that $R_{1.234} = .968$. The square of a correlation coefficient multiplied by 100 gives the percentage of the total deviations from the mean of one set of data that are associated with corresponding deviations in another set as measured by the coefficient in question. Thus it appears that 93 per cent of the fluctuations ($R_{1.234} = .968$; $.968^2 \times 100 = 93$) in expenditures for fertilizer may be accounted for by the three factors used in this study. This total is broken down as follows: 55.8 per cent ($r_{12.34} = .781$) of the deviations from the average are accounted for by similar fluctuations in farm income in the previous year, 27.9 per cent ($r_{13.24} = .554$) by fluctuations in the same year's income, and 9.3 per cent ($r_{14.23} = .305$) by changes in the proportion of the previous year's income remaining after expenses of production are deducted.

At this point it is proper to ask, "Do similar associations exist between farm income and quantities of money spent for fertilizers in the various states?" The high correlation found for the United States might be a coincidence, though the chances that it is are extremely slim. If, however, the same sort of association is found to exist in individual states, the argument that it represents a real relationship would be more convincing.

Correlation coefficients were therefore worked out for a few states scattered throughout the fertilizer-consuming part of the country, using the data given in Table 3. The farm income from crops and government payments are taken from publications of the U. S. Bureau of Agricultural Economics (8). The expenditures for fertilizers in Indiana were taken directly from Kraybill, et al. (4). The others were calculated in various ways according to the kind of necessary data readily obtainable. For example, the Texas figures were computed from the tonnages sold of each grade and the average selling price of that grade as given in the annual bulletins of the Texas Fertilizer Control. See Fraps, Ogier, and Asbury (2). Minnesota figures were obtained from the tonnages by grades of fertilizers sold and the average cost per unit of plant food in each as given by Halvorson and his coworkers (3). The Pennsylvania figures were gotten by multiplying the tonnages of nitrogen, phosphoric acid, and potash, as given in the annual Fertilizer Reports of the Pennsylvania Department of Agriculture (7), by the annual retail values of each. The data for the other states were figured from retail price lists of fertilizer companies and the total tonnages of fertilizers sold annually in those states.

The correlation coefficients are given at the bottom of Table 3. Those for Massachusetts, South Carolina, and

* The second-order coefficients given in this paper were each calculated from two different sets of first-order coefficients and the results obtained checked in each case.

Ohio are of about the same order and give the same indications as those for the United States as a whole. The association between the present year's income and amount of money spent for fertilizer in Pennsylvania, however, is higher than that with the previous year's income. This may be due to errors in the basic data or may indicate that farmers in Pennsylvania are more influenced than those of some other states by prospects than they are by the money made in the previous season when it comes to buying fertilizer. In Texas and Minnesota, where relatively little fertilizer is used, the correlations are not as close as they are in the heavier consuming regions of the East.

The percentages of the deviations in expenditures for fertilizers associated with similar deviations in farm income from crops and government payments when the correlation between income in one year and that in the previous year has been removed are as follows:

State	*Income in the Previous Year*	*Same Year*
Massachusetts	58	31
Pennsylvania	10	28
South Carolina	66	16
Ohio	43	31
Texas	30	3
Indiana	35	4
Minnesota	43	1
United States	57	41

These figures seem to indicate that in all states the amount of money received in the previous season from the sale of crops and government payments combined is an important factor in determining how much farmers will spend for fertilizers. Of the states studied it appears to be strongest in South Carolina and least important in Pennsylvania. In the Eastern states the prospects of high or low income in the same year in which the fertilizer is bought would also seem to be a factor, as indicated later by the income actually received. This seems to be of little or no consequence in the Central states.

It should be noted that accounting for the deviations from the mean associated with similar deviations in the proportion of the previous year's income left after expenses had no effect in reducing the correlation between the previous year's income and expenditures but reduced that with present year's income still further. The necessary data were not available to calculate second-order partial coefficients for the several states on the basis in which they are given for the United States.

The following equation:

$$X_1 = .03293X_2 + .01766X_3 + 1.159X_4 - 18.8435$$

gives the line of closest fit to the data. By substituting the values of X_2, X_3 and X_4 in Table 1 in this equation and solving for X_1 the calculated expenditures charted in Figure 2 are obtained. By comparing Figures 1 and 2 it will be seen that one can estimate the expenditures for fertilizers a little more accurately by means of this equation than has been done previously by taking the average expenditure of the previous year's income only. The standard error of estimate with this equation is 20.5 million dollars, whereas it was at least 42 million dollars with any method previously available.

At first thought it might seem that this equation had little value in estimating the current year's expenditures for fertilizers because the value of X_3 can never be known accurately until after the year in question is over. But past performance shows conclusively that farmers have been estimating it on the average pretty well. In the past the cash income has been only a little higher or a little lower than it was in the preceding year in most cases. Only in 1917, 1918, 1919, 1921, and 1930 was the farm income much different than might have been predicted at the beginning of the year and a study of the facts leads to the conclusion that in these years the expenditures were about what would have been predicted by the use of the

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Coker 100, strain 5, in Mr. Wadsworth's tests conducted in 1943, yielded 2,800 lbs. seed cotton; lint, 37.9%; staple, 1 3/32 inches; lint cotton per acre, 1,061 lbs.

J. B. Wadsworth— Progressive Farmer

By B. E. Grant

County Agent, Windsor, North Carolina

J. B. WADSWORTH of Woodville, Bertie County, North Carolina, is demonstrating how a farmer by hard work and careful planning can build up the fertility of his soil and grow profitable crops. He has lived in the township where he now lives all his life, except for the time he was in World War No. 1. He has been farming for himself 25 years. For the first three years, he rented land from his father and then bought the farm adjoining the one where he now lives.

When he first began farming, a bale of cotton per acre was as high as he made although he did not have any boll-weevil at that time. Through the years he has realized that in order to harvest good crops from the soil it is necessary to build up and feed the soil, instead of trying to get as much as possible from the land without putting anything back. Through a combination of both summer and winter legumes, barnyard manure, leaf mold, and the liberal use of fertilizer he now has one of the most productive farms in this vicinity.

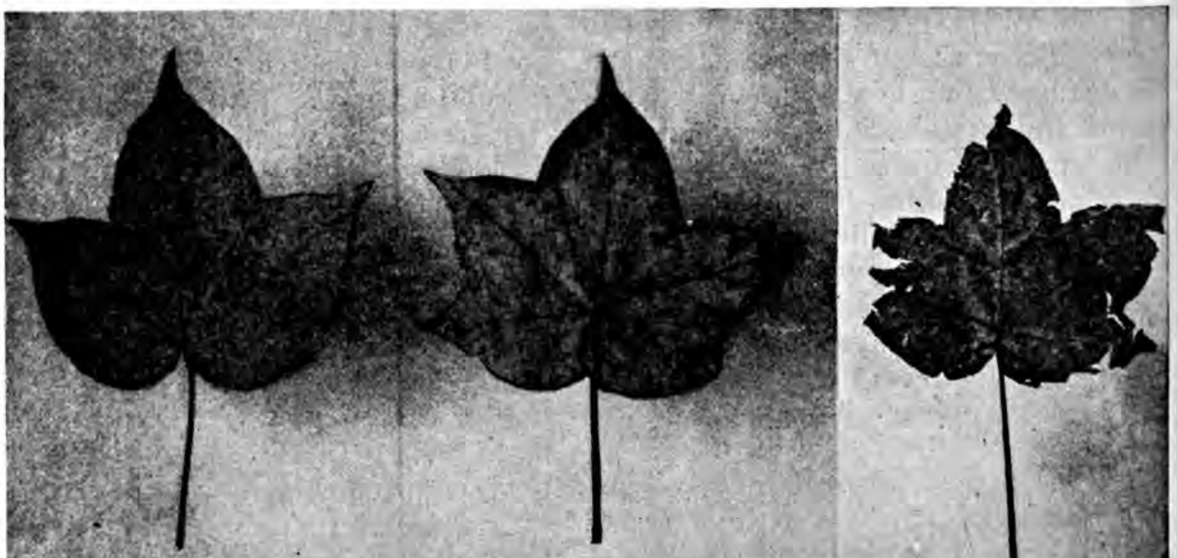
He tries to follow a three-year rotation of cotton, peanuts, corn and soybeans with a winter legume or small grain crop following the peanuts, to be turned under for corn. His farm is located in the center of the peanut section where Virginia type peanuts are grown, and where many farmers follow a two-year rotation with peanuts on the land every other year. But he has found that, over a period of years, he will not only produce as many peanuts in following a three-year rotation, but will keep up the fertility of his land better and produce a larger crop of cotton and corn.

On one 17-acre field of poor land, which he bought in 1930, he only made 180 bags of peanuts the first year. Realizing something would have to be done before this field could produce the kind of crops he wanted, he spread the peanut vines on the land as far as they would go and covered the balance of the field with woods mold and leaves. He planted the field in cotton and produced a bale per acre. Next, the field was planted in corn and soybeans and produced 40 bushels of corn per acre. Peanuts followed and produced 400 bags, an average of 23½ bags per acre. Again planted to cotton, the field produced 1½ bales per acre.

Mr. Wadsworth always tries to cover the land that was in peanuts with barnyard manure, if the peanut vines are removed from the land to be used for hay. Peanut vines are used for the main hay crop in this section. Removing both the nuts and vines from the land, makes peanuts a very exhaustive crop, particularly so if nothing is returned to the land or no winter cover crop is seeded to protect the land during the winter and add organic matter when turned under.

Where corn follows peanuts, Mr. Wadsworth plants soybeans in the corn for soil improvement. A good portion of the peanut land is seeded to vetch, winter peas, crimson clover, wheat, and rye. These crops are used for winter and early spring grazing, except part of the wheat which is harvested for a seed crop.

Peanuts, like other legumes, are heavy feeders on potash, and it is generally recognized that most of the fields in the area producing Virginia type peanuts are deficient in potash. Where cotton follows peanuts, potash hunger or cotton rust often develops in late summer if a liberal application of potash has not been made to the cotton crop. Even where rust does not appear, it is usually a good idea to add more potash than was formerly thought sufficient. Experiment station results and the experience of farmers indicate that even though peanuts need large amounts of potash it is most profitably applied to a crop such as cotton preceding peanuts in the rotation.



Potash-hunger signs in cotton: Left, normal leaf; center, margins affected; right, advanced stage, entire leaf affected.

Mr. Wadsworth fertilizes his cotton with 500 pounds of high-potash fertilizer per acre. He prefers 4-8-12 when he can get it. After the cotton has been chopped and worked out, he side-dresses it with 150 to 200 pounds of 10-0-10 per acre. He formerly used a 4-8-4 and top-dressed only with nitrate of soda, but four years ago he made two bales per acre where he fertilized part of a field with 4-8-12 and only a little more than a bale per acre from the part fertilized with 4-8-4, at the same rate per acre. The part of the crop receiving only 4 per cent potash had rust and the bolls did not develop as they did where 12 per cent potash was used. Since that time, he has been using more potash in growing cotton. The first time he made two bales of cotton per acre was when he fertilized the crop with 600 pounds of 3-8-3 and then side-dressed it with 300 pounds of 20 per cent Kainit per acre. This was a total of 78 pounds potash per acre.

In 1943, his crop was fertilized with 2-8-10 and side-dressed with 200 pounds of 10-0-10. On 40 acres he produced 71 bales which were equivalent to 75 bales averaging 500 pounds. A good portion of this crop averaged two bales per acre, but part of the crop was grown on land that he had been cultivating only a few years, which pulled the average down.

For the last four years, he has been cooperating with the County Agent in conducting a cotton variety test in which the best pedigreed and certified seed obtainable are compared side by side. From these tests he has found the strains that give best results on his farm and has made use of the information. The information has also been of great value to other farmers in the County. Based on previous variety tests, his main crop last year was planted in Coker 100, strain 3, but his crop this year was planted in Coker 100, strain 5, which is also the strain adopted by the Cotton Improvement Association in the County.

Most of Mr. Wadsworth's crops are produced by tenants. Tractors are used to prepare the land and some crops are cultivated with tractors. He uses big mules which are always fat. Both riding and walking one-row cultivators are used.

All his one-horse tenants made 10 bales of cotton, 240 or more bags of peanuts, and plenty of corn in 1943. One tenant, Leonard Williams, with two mules made 22 bales of cotton, 300 bags of peanuts, and 15 acres of corn averaging 35 bushels per acre. All of his tenants made money last year, receiving from $400 to $900 for their part of the crop above expenses, and he never has had to carry a tenant's account over from one year to the next, not even during the depression years. He has never been known to have any trouble with his tenants and has never had a tenant to leave owing him. He has the reputation of working the tenants more than the average farm does, but if one leaves, he usually wants to come back after having been away for a year. A tenant moved with him who had nothing to eat, and the reputation that he would not work. He was fed throughout the year and paid $500 at the end of the year for his part of the crop, after deducting his account. When he was paid off, this tenant said it was the first real money he had ever had.

Likes Cotton Best

A real farmer in producing all the crops which he grows, Mr. Wadsworth likes cotton better than any other crop. He grows very little tobacco and increased his cotton acreage this year. In producing his cotton crop, he is following the best recommended practices, including the use of the best adapted seed, good land built up through crop rotation, the use of manure and soil-building crops, seed treatment, adequate fertilizer, a good seedbed, boll-weevil control, good cultivation, and prompt picking of the cotton after it is open.

He began mopping cotton in 1939 with the 1-1-1 mixture and has kept it up each year since. He has made excel-

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Leslie Gilmore, Steveston, British Columbia, standing in the field which produced his record potato crop.

Producing A Record Potato Yield

By C. Tice

Field Crops Commissioner, Department of Agriculture, Victoria, British Columbia

MORE than 900 bushels of Netted Gem potatoes to the acre was the phenomenal yield officially recorded on the farm of Leslie Gilmore of Steveston, Lulu Island, British Columbia, last year. This is considered to be the highest yield per acre of potatoes obtained in Canada and is a world's record as far as the Netted Gem variety is concerned. Of the 901.3 bushels produced per acre, 883 bushels were of marketable grades.

The Netted Gem is a very popular potato in this coast Province and brings a premium on the market. It is a good yielder of excellent quality. The tubers are long to oval and elongated with shallow eyes and russet skin. The field which produced this record crop consisted of 33 acres and was entered in the crop competition held annually by the Columbia Potato Growers' Association, of which Mr. Gilmore is a member.

According to H. S. MacLeod, Federal District Certified Seed Potato Inspector for B. C. for the past ten years, potato crop competitions have been conducted annually by the Columbia Potato Growers' Association on Lulu Island at the mouth of the Fraser River. The objective of these competitions has been to increase the yield per acre, to improve the quality of the potatoes, to obtain more uniformity in type, to establish a better demand for the product, and to make the industry more profitable.

When one considers that the average yield of potatoes in B. C. is 185 bushels per acre, it is natural to ask how such a yield as Gilmore's is possible. In the first place, the soil is clay loam and is ideally suited for potato growing. It is well-drained and kept in a good state of fertility. A four-year rotation is practised; namely, potatoes, peas, hay, and pasture. Careful attention is paid to the fertility of the soil, cultural methods, and storage of the crop.

In this particular instance, the land was ploughed deeply in early January, cross-ploughed shortly before planting, and worked up to produce a mellow seed-bed. A liberal application of well-rotted barnyard manure (25 tons per acre) was disced in after the first ploughing. This was supplemented with one-half ton per acre of a 4-10-10 fertilizer, applied through the fertilizer attachment in the potato planter. The best procurable certified seed was used. The seed was cut before planting and two-ounce sets used. The date of planting was April 24 and harvesting took place on September 18. Eleven hundred pounds of seed per acre were used. The rows were 36 inches apart, and the sets were spaced 15 inches in the rows.

After the potatoes were planted, hillers were put on the back of the cultivator and the potatoes hilled up before they appeared above ground. This was followed immediately by cultivation of the bottom of the rows and then harrowing. This procedure was followed a second time just before the plants appeared, so as to keep weeds down. After the plants attained 3–4 inches growth, deep cultivation close to plants was practiced, followed by another cultivation two weeks later. The potatoes were then hilled and left until digging time. By such methods moisture was conserved to the fullest extent.

Five sprayings with a copper fungicide were made during the growing season. Fortunately, there are no potato beetles at the coast, and so it is not necessary to use an insecticide.

The peas used in the rotation on this farm are canning varieties, such as Early Surprise and Perfection, and are

Robert Bridge, Mr. Gilmore's nephew, operates a sugar beet seed planter which will plant four rows at once. At the right are Joe Maxwell, manager, and Mr. Gilmore.

Here are some of the 160 fine Holstein cows on Mr. Gilmore's farm.

grown under contract for a canning company. Needless to say, the peas help considerably in keeping up the nitrogen content of the soil. No commercial fertilizer is used for the pea crop, but a dressing of agricultural hydrated lime at the rate of 1,000 to 1,500 lbs. per acre is given just before seeding.

Mr. Gilmore finds that peas fit into his rotation very well. They are an early cash crop, and, in addition, the vines make good ensilage for dairy cows. They also make a good nurse crop for clover and grasses, as the crop is harvested during July and early August. The threshing of the peas and silo-filling are done in one operation. A good cutting of clover is obtained during September and October for late silo-filling or cutting as green feed for the dairy herd when pastures are poor.

Sugar-beet seed is another crop which is being grown on this farm. Just recently 34 acres have been seeded to this crop.

Mr. Gilmore's farm is located immediately adjacent to the south arm of the Fraser River, 12 miles from Vancouver. The average yearly rainfall in this area is 36.89 inches. The family has been farming on Lulu Island for many years. Three farms consisting of 500 acres altogether are being operated. One hundred sixty Holstein cows are milked and the milk is disposed of in nearby Vancouver. This year Mr. Gilmore has planted 65 acres of certified seed potatoes, consisting of the White Rose and Netted Gem varieties. He also has 18 acres of commercial White Rose.

In spite of his varied farming operations, Mr. Gilmore gives considerable time to the marketing of the farmers' produce. He is chairman of the B. C. Coast Vegetable Marketing Board. All potatoes grown at the coast are marketed through this Board. Fortunately, he has a competent farm manager in Joe Maxwell who has had extensive farming experience and knows "his spuds." Maxwell hails from Ireland and has been in close touch with the potato business all his life. He has both the practical and scientific knowledge which is so necessary to be a successful farmer these days.

Although the area of land under cultivation in British Columbia is rather small, compared with most other

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Fertilizing Soybeans In North Carolina

By W. E. Colwell

Agronomy Department, Agricultural Experiment Station, Raleigh, North Carolina

SOYBEANS are grown extensively on the dark, highly organic, imperfectly or poorly drained soils of the Lower Coastal Plain of North Carolina. It is common to fertilize them lightly, if at all, and to rotate with corn which is not heavily fertilized. The yields in many fields of this area are extremely low. It was under these conditions that certain experimental work was carried out in 1943, and, although the information on fertilizing soybeans is far from complete, it has seemed advisable to make available the experimental data which have a bearing on this problem.

Experiments were conducted in Pamlico and Pitt Counties on Portsmouth sandy loam and in Pender County on Dunbar silt loam. Analyses of soils from the three sites are presented in Table 1.

The field in Pamlico County had been cropped with corn for two years prior to 1943 and had been fertilized with 250 lbs. of 2-10-6 per acre in 1942 only. The results from the soybean experiment are presented in Table 2. The application of 36 lbs. K_2O per acre (side-dressed) resulted in an increase in yield of 8.2 bushels per acre. There was no further increase from the 60-lb. application. The addition of lime (1,000 lbs. dolomite in the row) was without effect. The response from phosphate was not significant. Data not reported show that borax broadcast at the rates of 5

TABLE 1.—ANALYSES OF SOILS [1] FROM EXPERIMENTAL FIELDS

Location and soil type		pH	Base Exch. Cap.	Ca		Mg		K		P	O.M.
			ME/ 100g	ME/ 100g	Lbs/A $CaCO_3$ Equivalent	ME/ 100g	Lbs/A MgO	ME. 100g	Lbs/A K_2O	Lbs/A P_2O_5	%
Pamlico County Portsmouth s. l	Surface....	5.1	7.44	2.64	2640	.48	195	.08	75	127	2.2
	Subsoil....	4.8	7.83	1.97	1970	.29	115	.06	55	trace	1.3
Pitt County Portsmouth s. l.	Surface....	4.9	9.39	2.99	2990	.43	175	.08	75	154	3.4
	Subsoil....	5.1	6.39	2.75	2750	.19	75	.08	75	trace	1.7
Pender County L. C. P. Sta.	Surface....	4.6	7.51	1.40	1400	.34	135	.06	55	140	2.6
Sunbar s. l.	Subsoil....	4.2	7.58	1.00	1000	.36	145	.08	75	trace	.4

(1) Values are averages of four check plots. Analyses made under the supervision of J. R. Piland, Associate Soil Chemist. Exchange capacity by ammonium acetate extraction, phosphorus by .002 N H_2SO_4 extraction, and O. M. by Walkley-Black method.

TABLE 2.—YIELDS AND OIL CONTENTS* OF SOYBEANS (TOKIO) GROWN ON PORTSMOUTH SANDY LOAM IN PAMLICO COUNTY

Treatment	Yield Bu/A	Oil Content %
(1) (2) (3)		
Lime—Phosphate—60 lbs. K_2O	27.8	18.0
Lime—Phosphate—36 lbs. K_2O	27.7	17.9
Lime—Phosphate— —	19.5	17.0
— —Phosphate—36 lbs. K_2O	26.0	18.0
Lime— — —36 lbs. K_2O	24.6	17.9
No fertilizer	20.7	....
Significant difference (.05)	7.3	.71

(1) Lime—1,000 lbs. dolomitic lime in the row.
(2) Phosphate—48 lbs. P_2O_5 per acre from treble superphosphate in the row.
(3) K_2O from 62% muriate of potash side-dressed before the first cultivation.
* Oil determinations made under the supervision of J. R. Piland, Associate Soil Chemist.

lbs. and 10 lbs. per acre was without effect. Similarly, 125 lbs. hydrated copper sulfate per acre broadcast before planting and 25 lbs. per acre in the row did not affect yields.

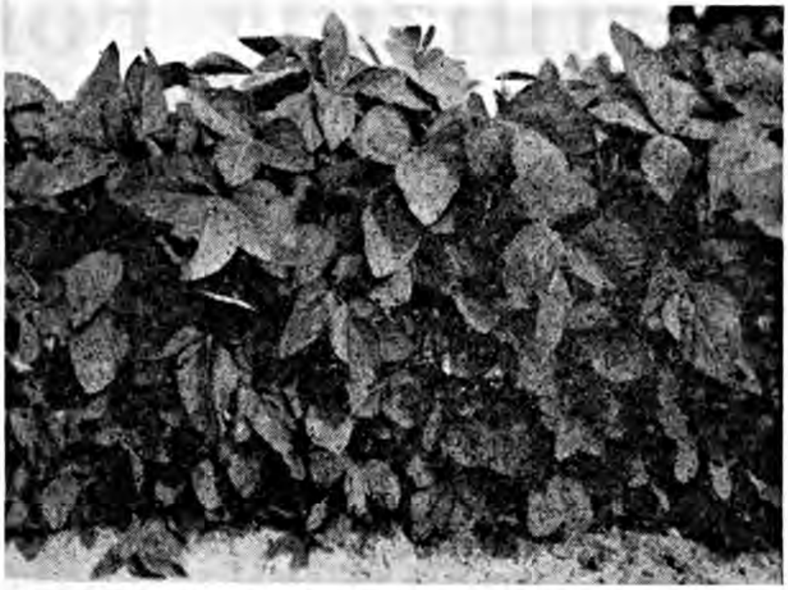
The field in Pitt County is reported to have been in corn and soybeans for at least 25 years. In 1942, it was planted to soybeans and no fertilizer was added. In 1941, it was in corn to which 75 to 100 lbs. nitrate of soda per acre were added. The results of the experiment presented in Table 3 show that as applications of potash were increased from 12 to 36 to 60 lbs. K_2O per acre on the uniformly limed plots (3,000 lbs. per acre broadcast), yields were increased progressively, but only to 11.2 bushels per acre. On all these plots, foliar symptoms of potash deficiency were present throughout the summer. It should be noted that without lime the plots receiving 36 lbs. K_2O per acre yielded slightly higher than those receiving the 60-lb. rate with lime. Furthermore, potash-deficiency symptoms were less pronounced where lime was omitted. It is apparent that on this

TABLE 3.—YIELDS AND OIL CONTENTS OF SOYBEANS (WOODS YELLOW) GROWN ON PORTSMOUTH SANDY LOAM IN PITT COUNTY

Treatment	Yield Bu/A	Oil Content %
(1) (2) (3)		
Lime—Phosphate—60 lbs. K_2O	11.2	16.0
Lime—Phosphate—36 lbs. K_2O	9.3	15.9
Lime—Phosphate—12 lbs. K_2O	6.5	15.1
Lime—Phosphate— —	5.4	14.5
— —Phosphate—36 lbs. K_2O	11.9	15.8
Lime— — —36 lbs. K_2O	9.3	16.2
Significant difference (.05)	3.0	1.1

(1) Lime—3,000 lbs. dolomitic lime per acre broadcast and plowed in just before planting.
(2) Phosphate—48 lbs. P_2O_5 per acre from treble superphosphate in the row.
(3) K_2O from 62% muriate of potash side-dressed before the first cultivation.

particular soil the additions of lime did not increase yields, but that high rates of lime accentuated potash deficiency. This is in line with other work, although it was not thought originally that lime had been added at a rate high enough to have this effect. It will be noted that the application of phosphate on this soil did not increase yields.



Adequately fertilized soybeans growing in the Coastal Plain area of North Carolina.

The third experiment was conducted at the Lower Coastal Plain Branch station on a field which had been planted to corn in 1942 and fertilized with 400 lbs. of 4-8-4 per acre. The general level of fertility was somewhat higher than that at the other two locations. The results of this experiment are presented in Table 4. It will be noted that potash was the only added fertilizer to give an increase in yield. Thirty-six pounds K_2O per acre caused an increase of 7.1 bushels per acre and there was no further increase with 60 pounds. Calcium hydroxide was without benefit although there was an early vegetative stimulation. It is interesting to note that the lime added to this soil did not induce potash deficiency as indicated by foliar symptoms or as measured by yields. The calcium level of this soil was relatively low at the outset, 1.4 M. E. per 100 grams soil, as compared to 3.0 M. E. in Pitt County experiment (Table 1).

It is apparent that potash was a major limiting factor in these fields which were selected without previous knowledge of any mineral deficiency. Foliar symptoms of potash deficiency were overcome and yields were increased by potash applications. The occurrence of potash-deficiency symptoms on soybeans in the Coastal Plain is widespread, and this fact, together with the experimental results reported above, support the con-

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TABLE 4.—YIELD OF SOYBEANS (OGDEN) ON DUNBAR SILT LOAM AT THE L. C. P. BRANCH STATION

Treatment	Yield Bu/A
(1) (2) (3)	
Lime—Phosphate—60 lbs. K_2O	29.8
Lime—Phosphate—36 lbs. K_2O	32.6
Lime—Phosphate	25.5
— —Phosphate—36 lbs. K_2O	29.3
Lime— —36 lbs. K_2O	31.2
Required for significance (.05)	6.9

(1) Lime—Hydrated lime 2,738 lbs. per acre (equivalent to 3,700 lbs. limestone) broadcast and plowed in just before planting.

(2) Phosphate—24 lbs. P_2O_5 per acre from treble superphosphate in the row.

(3) K_2O from 62% muriate of potash top-dressed before the first cultivation.

Fertilizing For Yield And Soil Improvement

By R. E. Stephenson

Soils Department, Oregon State College, Corvallis, Oregon

THE amount as well as the kind of fertilizer to use on any particular crop is critically important for producing good yields, without which the principal incentive for the use of fertilizers would be lost. One hundred bushels of corn in the entire plant contains the equivalent nitrogen, phosphorus, and potassium supplied by more than 1,500 pounds of commercial fertilizer made up from nitrate of soda, superphosphate, and muriate of potash. Land must be naturally fertile or it must be enriched by liberal fertilization, and other factors such as moisture must be right, to produce 100 bushels of corn. Use of a small amount of fertilizer under the most favorable conditions probably will not result in a 100-bushel yield on land that has a 50-bushel natural capacity. To produce the extra 50 bushels and bring the yield to 100 bushels, if such a yield is possible, the corn must be enabled in some way to obtain nutrients equivalent to more than 750 pounds of fertilizer.

Effective fertilization of corn on Vigo silt loam is indicated by results from the Indiana Experiment Station, although 100-bushel production was not attained. With 150 pounds of 2-12-6 in the row the yield was 18 bushels, showing no increase over the unfertilized corn. With an additional 500 pounds of 10-10-10 used in plow-sole application, the yield was 37 bushels an acre. Use of 1,000 pounds of 10-10-10 brought the yield to 54 bushels, and 1,500 pounds yielded nearly 70 bushels an acre. Thus, while a light application in the row had no effect, an adequate amount properly placed produced good increases of four to six bushels of corn for each 100 pounds of fertilizer.

The common rates of farm application of fertilizer, therefore, are often much too small to produce the big yields that the best soils, well fertilized and managed, are capable of producing. Corn is about average in its nutrient requirements, and other crops to produce big yields would have similar heavy demands for nutrients. Nitrogen, phosphorus, and potassium are only three of the eleven elements that crops take from the soil. Any one of the eleven essential nutrient elements coming from the soil may need supplementing before big yields can be obtained. Successful use of fertilizers depends in part upon correctly tracking down the one or more deficiencies that is limiting production.

Fertilizer Residue

Seldom, if ever, is all the nutrient supplied in fertilizer used by the immediate crop. A residue remains in the soil which will presumably have an effect upon future crops. Two-thirds or more of the phosphorus supplied in fertilizer may be fixed by the soil. If only the phosphorus needs of a 100-bushel corn crop were supplied entirely from fertilizer, 300 pounds of superphosphate per acre might suffice. Probably twice this much more must be used to satisfy soil fixation. Not fixation, however, but economic re-

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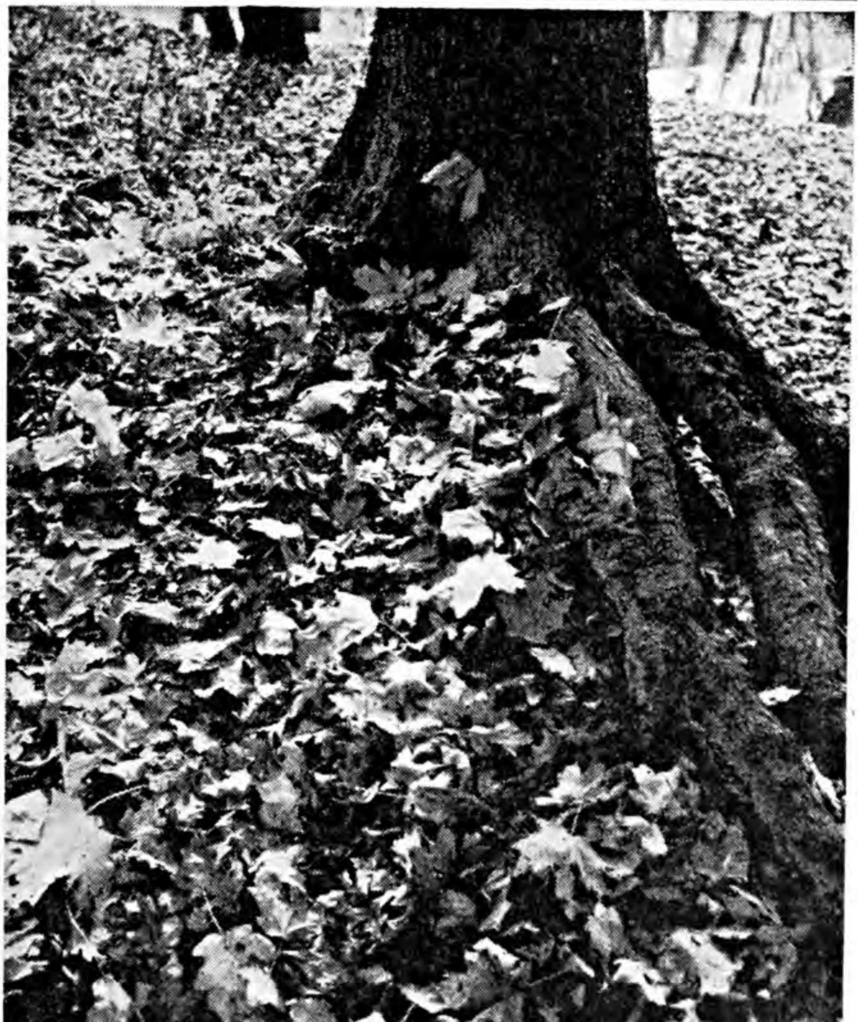
PICTORIAL

Getting ready for the judge.

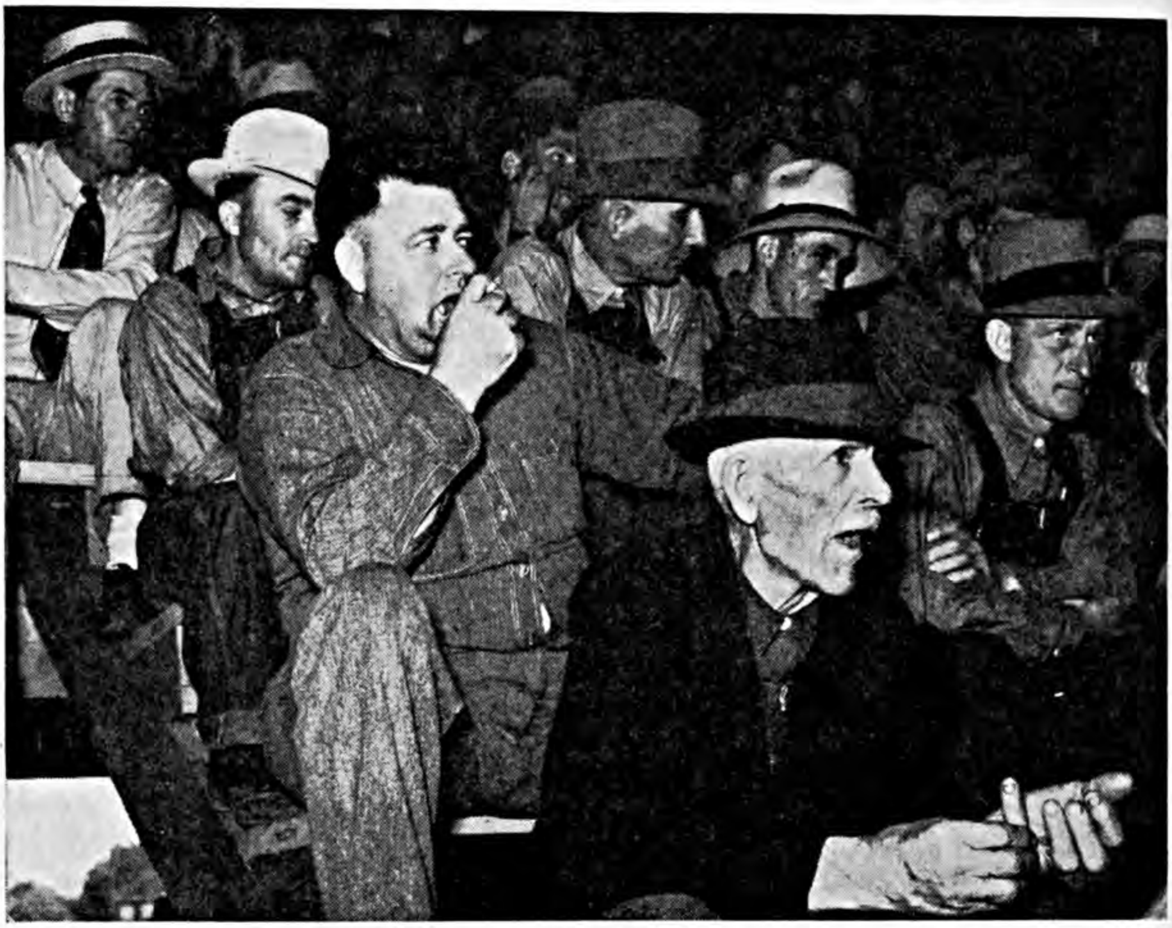
Left: Blue is a thrilling color.

Below: A test of real cooperation.

Above: Fall plowing eases spring work.



Right: Nature provides a winter cover.



Above: A farm auction provides many tense moments.

Below: Anticipating another record American crop.

The Editors Talk

Isolationism

To those who are following the magnitudinous problems of post-war planning it is obvious that isolationism is a thing of the past. No longer can a nation, an industry, or an individual find solace in the thought that his welfare must not necessarily consider the welfare of others. We are being enlightened by erudite analyses of these inter-relationships and exposed to principles from which a higher civilization should spring. We are learning to look at the other fellow's problems when looking into our own.

In the post-war planning for agriculture—in which every American farmer and agriculturist is more immediately concerned—it is no surprise, therefore, to find emphasized over and over again that a prosperous agriculture will depend upon an all-out industrial production as well. War Food Administrator Marvin Jones says it this way: "Agriculture and industry are the twin evangels of modern civilization. Neither can prosper without the other. If one languishes, sooner or later the other will feel the effect. The farmer and livestock producer furnish the raw material, and in turn, if prosperous, help furnish a wider market for the finished article. At the same time, if the factory wheels are turning, they afford a market for the products of agriculture. Labor is vitally affected by any adverse effects that touch either wing of our national effort."

Secretary of Agriculture Claude R. Wickard lists as first and most important of three conditions which must be met to assure a demand for all of our farm production on a sound and permanent basis, a full employment in this country at fair wages and salaries, so that people will have the money in their pockets to buy the farm products they want and need. That, incidentally, he says, is the reason why agriculture is so deeply interested in the non-agricultural problems of post-war planning, for full domestic employment would provide a market for most of the things our farmers will be able to produce.

But probing to the bottom of all of these analyses of inter-dependencies, we come to the one great fundamental, the basis of all well-being, the SOIL. It is encouraging to see the general recognition of this truth and the place which soil management is accorded in all post-war planning. Judge Jones has said, "But whatever is done, whatever plans we may make, or whatever genius we may possess, our nation must perish unless we take care of the soil. The soil is our natural heritage. Wisely used, its value, its life-giving strength, its productivity are ageless. The children of the future have a stake in this, our greatest natural resource. We have a right to use the soil and other natural resources. We have no right to abuse them. They can be made to grow stronger and more productive and be left to coming generations in richer and better form than when they came to us. We want to keep this nation a land of abundance and opportunity."

There is no isolationism in such thinking. A well-nourished soil produces a well-nourished people—a people eager to incorporate the principles upon which a higher world civilization must rise. To that end, the importance being given to soil conservation and management in all post-war planning is more than justified.

Soil Fertility Is A Good Investment

"Farmers who are planning to buy more land now at high prices might better heed the advice of Benjamin Franklin written many years ago in his Poor Richard's Almanac: 'A deposit of fertility in the soil bank is safest and pays the best.'" says L. B. Miller, Assistant Chief, Soil Experiment Fields, University of Illinois College of Agriculture. As Mr. Miller points out, Franklin's advice is especially appropriate now since limestone, phosphate, potash and other materials which build up the productivity of the soil are cheap in relation to the prices of crops and other farm products. He believes that those who have not already taken advantage of this opportunity to bring their soil to a high state of fertility should do so and thus accumulate a reserve to fall back upon when prices are low again.

Fortunately limestone, phosphate, and potash are lost only very slowly from the soil if a good crop rotation is used. Moderate reserves of these materials should be "stored" in the soil so there will always be plenty within easy reach of the plant roots. The best time to restock the supply is when a good bargain can be secured, is the advice of this soils specialist.

"In some localities it is very difficult to get limestone or other fertilizer materials delivered. War bonds bought now and earmarked for that purpose will assure a soil improvement program after the war and will be much safer than a speculative investment in high-priced land. The purchase of fertilizer materials or of war bonds instead of land will also help to offset the present tendency toward inflationary values of farm land," is Mr. Miller's opinion.

THERE is but one person whose welfare is as vital to the welfare of the whole country as is that of the wage worker who does manual labor, and that is the tiller of the soil,—the farmer. If there is one lesson taught by history it is that the permanent greatness of any State must ultimately depend more upon the character of its country population than upon anything else. No growth of cities, no growth of wealth, can make up for a loss in either the number or the character of the farming population. In the United States more than in almost any other country we should realize this and should prize our country population. When this Nation began its independent existence it was as a nation of farmers. The towns were small and were for the most part mere sea-coast trading and fishing ports. The chief industry of the country was agriculture and the ordinary citizen was in some way connected with it. In every great crisis of the past a peculiar dependence has had to be placed upon the farming population; and this dependence has hitherto been justified. But it cannot be justified in the future if agriculture is permitted to sink in the scale as compared with other employments.—THEODORE ROOSEVELT.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	...
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....
June	20.16	49.2	125.0	233.0	115.0	143.0	15.00	52.80	....
July	20.32	45.0	138.0	230.0	117.0	139.0	13.90	53.00	....
August	20.15	39.3	159.0	258.0	117.0	135.0	14.30	53.20	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191
April	163	229	197	261	177	167	136	243	184
May	160	358	193	269	177	167	135	243	217
June	163	473	180	266	177	163	126	245	245
July	164	433	198	263	181	158	116	245	236
August	163	378	228	295	181	153	120	246	253

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11-12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16-17% ammonia, Chicago, bulk, per unit N
1910-14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet acidulated	Tankage	High grade ground blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....
April	.640	2.00	6.10	.535	.797	26.00	.200	....
May	.640	2.00	6.10	.535	.797	26.00	.200	....
June	.640	2.00	6.10	.471	.701	22.88	.176	....
July	.640	2.00	6.10	.503	.797	26.00	.188	....
August	.640	2.00	6.10	.503	.797	26.00	.188	....

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts	Kainit
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....
April	119	55	125	75	84	108	83	....
May	119	55	125	75	84	108	83	....
June	119	55	125	66	74	95	80	....
July	119	55	125	70	84	108	82	....
August	119	55	125	70	84	108	82	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
1943								
August	193	169	150	94	57	160	119	74
September	193	169	150	94	57	160	119	74
October	192	170	150	95	57	160	119	78
November	194	171	150	95	57	160	119	78
December	196	173	150	96	57	171	119	78
1944								
January	196	174	150	96	57	171	119	78
February	195	175	151	96	57	171	119	78
March	196	175	151	97	57	173	119	78
April	196	175	152	96	57	172	119	78
May	194	175	152	97	57	175	119	78
June	193	176	151	95	57	175	119	69
July	192	176	152	96	57	175	119	74
August	193	176	151	96	57	175	119	74

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

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

"Save Barnyard Manure," Ext. Serv., Univ. of Ark., Fayetteville, Ark., Leaf. 44, (Rev. 1944), Charles F. Simmons.

"Homemade Fertilizer Spreaders," Ext. Serv., Univ. of Ark., Fayetteville, Ark., E. Plan Series No. 6, March 1944, Earle K. Rambo.

"Agricultural Gypsum in California," Dept. of Agr., Sacramento 14, Calif., FM-90, Aug. 17, 1944.

"Commercial Fertilizers Agricultural Minerals 1943," Dept. of Agr., Sacramento 14, Calif., Sp. Publ. No. 203, Alvin J. Cox.

"Annual Report for the Calendar Year 1943," Dept. of Agr., Sacramento 14, Calif., Alvin J. Cox.

"Suggested Fertilizers for 1944-45," Agron. Dept., Univ. of Conn., Storrs, Conn., July 26, 1944.

"Fertilizer, Feed, and Seed Report, January-June, 1944," State Board of Agriculture, Dover, Delaware.

"Fertilizer Materials Used in Florida for Fiscal Year July 1, 1943 Thru June 30, 1944," Fert. Statistical Div., Bureau of Inspection, Tallahassee, Fla.

"Fertilizers—What They Are and How to Use Them," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Sp. Bul. 133 (Rev.), March 1944, C. E. Millar and L. M. Turk.

"Nitrogen Fixation, Composition and Growth of Soybeans in Relation to Variable Amounts of Potassium and Calcium," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 381, April 1944, Herbert E. Hampton and W. A. Albrecht.

"1944 Fertilizer Recommendations for Wheat, Other Fall-Sown Grains, and Permanent Pastures," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, No. 257, July 1944, Earl Jones and Robert E. Yoder.

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Soils

¶ Helpful and practical information on the management of soils in lower central New York State that is applicable to wider areas of similar conditions is given by A. F. Gustafson in New York (Cornell) Agricultural Experiment Station Bulletin 789 entitled, "Soil and Field-Crop Management for the Catskill-Mohawk Area of New York." The topography is rolling to rough, and dairying is the principal type of agriculture. The general soils are described and a table gives the principal characteristics of the soil series found in the area. Many of the soils are acid and require lime for growing good crops of legumes. Most of the soils are deficient in phosphate and some are deficient in potash, especially the lighter soils that have not received heavy applications of manure. Manure should be carefully conserved and utilized, supplemented with superphosphate and with potash also on the lighter soils and others that are deficient in potash. The author brings out that if manure is not carefully handled a great deal of its value may be lost, particularly the nitrogen and potash portions.

Borax is likely to be needed in growing alfalfa, cauliflower, and possibly other crops. The use of manure from animals being fed with boron-deficient forage will not aid in overcoming boron deficiency. The author recommends that wherever boron deficiency symptoms exist, particularly a yellowing of the upper leaves of alfalfa, a trial be made by applying borax at the rate of 30 to 40 lbs. per acre on a strip two or more rods wide across the field. Overlapping half the borax-treated area, 200 lbs. per acre of muriate of potash should be applied, so that there then will be an area with borax alone, borax and potash, and potash alone. It is recommended that the applications be made either early in the spring or after the first cutting. Since potash frequently is deficient on fields growing alfalfa, both the borax and the potash should be used in the trials.

The heavy removal of potash from the soil in growing alfalfa is stressed with the statement that a three-ton crop of alfalfa contains as much potash as a 200-lb. application of 60% muriate of potash. A 10-ton application of good manure will furnish only 100 lbs. of potash or about enough to make a good 2-ton crop of alfalfa. On potash-deficient soils, therefore, this application of manure would not take care of the removal by the crop, and an extra application in the form of potash fertilizer would be necessary to maintain fertility.

Information is given on the management and fertilization of pastures. Again it is brought out that practically all areas will require phosphorus while unmanured sandy soils and perhaps some silt loams will also respond to potash. It is recommended that topdressings of lime, phosphorus, and potash be made on permanent pastures. Brief remarks on the use of forests in utilizing the soils of the area complete the bulletin.

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"Billings County North Dakota, Soil Survey," U. S. D. A., Washington, D. C., Series 1934, No. 25, June 1944, M. J. Edwards and J. K. Ableiter.

"Dry Land Rotation and Tillage Experiments at the Akron (Colorado) Field Station," U. S. D. A., Washington, D. C., Cir. 700, May 1944, J. F. Brandon and O. R. Mathews.

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Crops

¶ Results produced by different cotton varieties for 1943 and, in some cases, averages of a period of years when the crop is grown in various sections of Georgia are compared in Circular 144 of the Georgia Experiment Station, "Cotton Variety Tests in Georgia, 1938-1943," by R. P. Bledsoe, W. W. Ballard, and A. L. Smith. Over a five-year period, Coker 100, Stoneville 2B Coker 4 in 1, Deltapine, and Hibred gave good results, in the order listed. Empire varieties are now showing up favorably in many cases and Coker Wilds is giving a high return because of the present high premiums for long-staple cotton. In south Georgia, Coker 100 Wilt has given excellent results under a wide variety of conditions. On soils that are not subject to trouble from Fusarium or nematode wilts, the Stoneville 2B and Deltapine 14 varieties do very well. On soils that are troubled with root-knot and cotton wilt, the use of proper rotation and fertilization as well as suitable cotton varieties will be very helpful. One or two crops of peanuts or crotalaria with not more than two cotton crops in a three- to five-year rotation will usually reduce trouble from these diseases. Varieties such as Stone-wilt, Coker 100, Coker 4 in 1, Cook, and others are resistant to wilt. Most of the wilt-resistant varieties are likewise resistant to root-knot. Other varieties particularly resistant to root-knot are S and C2, Coker 4 in 1-6 CCS 340-7, and Wannamaker Cleveland. It is brought out by the author that in rotating cotton with peanuts, the soil may become quite deficient in potash unless care is taken to supply plenty of this nutrient. Where potash is not applied to the peanut crop, a heavier application is necessary on cotton. In 1943 much rust or potash deficiency was apparent in the cotton crop, which could have been overcome by sidedressing with potash. A total of 60 to 80 pounds K_2O may be necessary on many light Coastal Plain soils to prevent rust and give satisfactory yields.

¶ Growers of cigar-leaf tobacco will find interesting information in Bulletin 440 of the Pennsylvania Agricultural Experiment Station, "The Yield and Composition of Cigar-leaf Tobacco as Influenced by Fertilizer and Preceding Crop," by D. E. Haley, O. E. Street, M. A. Farrell, and J. J. Reid. Most of the publication is devoted to results of a nine-year experiment involving the growing of tobacco in a three-year rotation of wheat, clover, and tobacco differently fertilized. On the tobacco, the standard rate of application was 1,000 lbs. of fertilizer, with the nitrogen varying from 0 to 9 per cent, the phosphoric acid from 0 to 8 per cent, and the potash from 4 to 16 per cent. Manure was applied on some of the plots and varying rates of 6-8-12 fertilizer were used more or less as the standard. Where the fertilizer was applied broadcast, there was less variation in yield with rate of application of 6-8-12 fertilizer than when applied in the row. Highest results from the broadcast application were obtained with 1,000 lbs. per acre, while the 1,500 lb. rate with the row method of application, gave the best results, and the highest yields in the experiment.

Varying the nitrogen from 0 to 9 per cent at the rate of 1,000 lbs. of fertilizer per acre resulted in highest yields with 6 per cent or 60 lbs. of nitrogen per acre. Studies of the nitrogen content of the leaf indicate that plowing under legume stubble results in a deficiency of nitrogen during the early stages of the tobacco growth which can be overcome by nitrogen fertilization. This lack of nitrogen from the legume stubble appears to be due to competition between the organisms decomposing the residue and the tobacco plants, with the organisms winning out. The nitrogen will be released later, but it may be made available to the tobacco crop at an unfavorably late part of the season.

When the phosphoric acid in the fertilizer was varied, best results were obtained with 8 per cent content of the fertilizer, or 80 lbs. phosphoric acid per acre. Chemical analysis of the leaves showed very little variation in the phosphoric acid content.

When the potash was varied, there was some increase in yield up to 12 per cent, but the differences were not great. The authors state that better results were obtained where manure was used with the higher potash applications. Analysis of the leaves indicated that potash applications had little influence on the potash content of the leaves under the conditions of this experiment. In the discussion it is brought out that the potash content of tobacco in Lancaster County is dependent more on the soil moisture than it is on the potash applied. In years of unfavorable moisture distribution where there is a drought followed by heavy rains, however, the tobacco which receives high potash applications is much better able to withstand disease attacks, which usually follow such weather conditions, than tobacco which did not have adequate potash available.

The preceding crop in this experiment was a legume, usually clover, but in some cases, alfalfa. Other work indicated that corn was much better as a preceding crop than a legume. Data from another experiment show that, regardless of fertilization, higher yields were obtained when tobacco followed corn than when it followed legumes. The nitrogen content and, in most cases, the potassium content of the tobacco were higher following corn than following legumes, and the burning quality of the leaf usually was better. During a season of ample moisture, fresh manure was favorable, while during dry seasons, it had a decidedly unfavorable effect on the growth of tobacco.

It is brought out that cigar-leaf tobacco makes very heavy demands upon moisture and nutrient supply of the soil, so that heavy, fertile soils are needed for the crop. These soils should be kept in good tilth by the frequent supplying of organic matter in the form of manure or green manure, and the fertility must be kept at high level by the application of fertilizers. The rotation used in this experiment is not considered to be the most favorable for growing tobacco and, regardless of the fertilizer treatment, the desired levels of nitrogen and potash contents of the leaves could not be obtained. It is emphatically brought out that corn rather than legumes is the desirable crop to precede tobacco.

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Versatile Corn

WHEN corn makes headlines because of wartime restrictions on its sale, most readers think of corn as food for humans and feed for livestock—particularly pigs—or as seed for planting. But direct consumption of corn in the form of meal, grits, corn flour, and corn breakfast foods in 1943 was only about 65 million bushels out of a total production of 3,464,000,000 bushels. Feed and seed uses accounted for 3 billion bushels. A large part of the remaining 400 million bushels was required for industrial uses, many of them wartime indispensables, says the War Food Administration.

Cornstarch is the basic product for all industrial uses of corn. Cornstarch, variously treated, is going to the battlefront in explosives, penicillin, sulfa drugs, vitamin products, surgical dressings, adhesives, in textile finishes for clothing and shoes. It is used in printing inks, paper, rubber, asbestos, structural insulation board, gypsum board, including the V-boxes for overseas shipments to servicemen; also in shipping containers of all kinds and in fibrous glass cloth.

A bushel of corn will produce 33 pounds of cornstarch. And 33 pounds of starch, treated chemically, will produce 37 pounds of corn sirup or 25 pounds of dextrin. Dextrin is used in making molds for castings, wood veneer glue, labels, stamps, and envelopes. Most corn sirup products are edible—confections, bakery goods, beer, ale, jams and jellies.

Cornstarch is used for the core binder in producing copper, magnesium, aluminum, or bronze castings and forgings; also for brass, steel, and iron. It is used as a fiber in converting bauxite to alumina; and in magnesium production. These and many other industrial war uses for about 5 per cent of the corn production account for the special attention that has been devoted to the current year's corn crop.

Well Fertilized Pasture Pays In South Carolina

C. K. HUGHES of Union, S. C., has worked out a complete year-round grazing system, in which he has skillfully combined the use of recommended grazing crops so as to take complete advantage of seasonal conditions and land. Mr. Hughes has a well-fertilized, well-sodded pasture which was built new from land covered by undesirable scrub timber and brush growth. This pasture, as all permanent pasture, is at its best in May and June and the first half of July. Just at a time when it is beginning to go back because of hot, late summer conditions, he turns his cattle on a plot of pearl millet which gives this pasture relief during July and August. When the plot of pearl millet is almost grazed out, he takes his cattle entirely off the permanent pasture and gives it a fall rest so as not to eat it into the ground. The cattle are then alternately grazed upon the plot of pearl millet in the morning and upon an adjacent plot of kudzu in the afternoon. This kudzu is 3 years old and has established a very heavy growth. It is on land not suited to cultivation.

As soon as the pearl millet and residue growth of crab grass are gone, he turns that plot and plants it in a heavy seeding of oats, barley, and crimson clover. His cows then graze almost solely upon kudzu which carries them until frost. Immediately after frost, he turns the herd into a small field of corn and velvet beans which adjoins the kudzu and pearl millet plots. This corn and velvet bean grazing carries the cattle well into December when the pearl millet plot which has been seeded to oats, barley, and crimson clover should be up to grazing.

When the velvet beans and corn have been grazed out, he turns that field and plants it to a heavy seeding of oats and barley, which will be his late spring grazing plot. During January, and especially in February, March, and April, he gets very heavy grazing from the old pearl millet plot, which has been planted to grains, and the late grain grazing which followed corn and velvet beans. Between these two plots, he is able to keep his cattle off his permanent pasture until it has been firmly established in the spring and ready for heavy grazing. This system will then start all over again.

"Through heavy applications of barnyard manure and the basic mineral applications of lime, phosphorus, and potash, this system can and will be built into a very heavy-yielding grazing system which will be able to withstand more and more drought and other adverse grazing conditions," explains C. G. Cushman, dairy specialist of the Clemson College Extension Service. "We have seen no better example of a successful and skillful effort to take complete advantage of a year-around grazing program than that practiced by Mr. Hughes."—*Jack Wooten, Columbia, South Carolina.*

Fertilizing Soybeans in North Carolina

(*From page* 25)

clusion that a deficiency of potash constitutes a major problem in soybean production in this area.

Oil analyses in Tables 2 and 3 show that oil content was raised by potash applications. It was not affected by added lime or phosphate. It is not known whether this effect is a direct one, but it is interesting to note that the results are fairly consistent. The problem is being investigated further.

Soybeans are often grown in rotation with cotton and peanuts on upland soils low in organic matter. This practice has been followed experimentally at five locations. Phosphate added to peanuts ahead of soybeans was without effect on yield of soybeans which had themselves received a direct application of 24 lbs. P_2O_5 per acre. Similarily, nitrogen added to the peanuts ahead of soybeans was without effect on yield of the latter which had received a direct application of 4 lbs. nitrogen per acre. At the Upper Coastal Plain Branch Station in 1942, the application of 50 lbs. K_2O per acre to peanuts ahead of soybeans resulted in a 4-bushel-per-acre increase of soybeans which had received a direct application of 12 lbs. K_2O per acre. At the other four locations, potash added to the peanuts was without effect on the yield of beans.

The yields of cotton, which followed the soybeans, were in many cases increased by the potash added to peanuts two years previously. From this it would appear that the level of potash adequate for soybeans is below that which is adequate for cotton. In spite of this, however, the widespread occurrence of potash deficiency on soybeans on these soils indicates that a lack of potash constitutes one of the major limiting factors in soybean production of these upland soils.

Left, severe potash deficiency showing crinkling with yellowing and browning of marginal tissue, some of which is actually lost; center, less severe potash deficiency; right, healthy soybean leaf.

The available information leads to the conclusion that overcoming potash deficiency may be expected to bring about higher yields of soybeans in many fields. At the same time, the existence of other troubles for which no remedy is known at the present time is recognized. Topdressing applications of 50-100 lbs. muriate of potash prior to the first cultivation are recommended under all conditions. Depending upon previous fertilization, the application of 200 to 300 lbs. 0-10-10, or 0-12-12 (or 3-9-9 if after small grain), is recommended. A broadcast application of around 1,000 lbs. dolomitic limestone is recommended as a practical means of meeting the calcium and magnesium requirements.

Fertilizing for Yield and Soil Improvement

(*From page* 26)

turns govern the amount of fertilizer that can be used on any crop.

There is no means of avoiding some fixation. The Massachusetts Station obtained 285 bushels of potatoes with a ton of 5-0-7 fertilizer, 393 bushels with a ton of 5-8-7, and 432 bushels with a ton of 5-16-7. These data indicate not only a need for phosphorus in the fertilizer program, but that a large excess over the needs of the crop must be supplied for good production. A ton of 5-8-7 probably contained more than three times as much phosphorus as the crop used (assuming that none was contributed by the soil), and yet there was a yield increase of 39 bushels an acre when the phosphorus was doubled by using a ton of 5-16-7 fertilizer.

Making up deficiencies only seldom gives yield increases that are equivalent to the nutrient supplied in the fertilizer. At Massachusetts one ton of 5-8-0 produced 231 bushels of potatoes an acre. Probably a little more than half a pound of potash goes into the plant's nutrition for each bushel of potatoes produced. On this trial, a ton of 5-8-3 supplying 60 pounds of potash added 125 bushels to the yield, or a little more than a bushel for a half pound of potash. Larger additions of potash, however, had a lesser effect. One ton of 5-8-7 supplying 80 pounds more potash added only 37 bushels to the yield. A ton of 5-8-10 furnishing 60 pounds more potash than the previous treatment added only 25 bushels to the previous yield. Thus the yield increase dropped from two bushels to less than half a bushel of potatoes for each pound of potash as the fertilizer rate was increased, an example of the functioning of the law of diminishing returns. Presumably only a part of the potash added was utilized by the crop; a part of the excess no doubt remained in the soil to contribute to its improvement.

In contrast to phosphorus and potassium which are fixed by the soil, nitrogen cannot be long held except in combination with humus or plant materials. Most of the nitrogen applied as fertilizer is either used by the crop or soon leached and lost. Nitrogen can, however, be used in a soil-building program to grow humus materials, cover crops, and vigorous root systems which renew the soil humus.

To use nitrogen alone to grow crops that are harvested and sold may deplete the soil. Nitrogen is the growth element. The 100-bushel corn crop used nitrogen equivalent to that in 1,100 pounds of nitrate of soda. Liberal nitrogen fertilization enables the crop to remove the maximum of minerals, phosphorus and potassium, and other essential nutrients from the soil, and fertility exhaustion may be hastened as a result.

Good soils are relatively rich in available minerals. Soils of the desert, when watered, are sometimes phenomenally productive. Desert soils are unleached and are therefore rich in readily soluble minerals. Phosphatic limestone soils are usually fertile. These soils are especially rich in calcium and phosphorus, two elements that are commonly somewhat deficient in the soil and more so in the strongly leached acid soils. To bring about soil improvement, not only the nitrogen and humus must be renewed, but the mineral supply must be increased. Since it is probably impossible to correct a nutrient deficiency without at the same time leaving a residue of nutrients in the soil, fertilizing for big yields and fertilizing for soil improvement are two parts of one operation.

High-acre Returns

Fertilizing for both big yields and for soil improvement is most economically done on crops producing high-acre returns. In contrast to corn and wheat, which seldom gross more than $50 per acre, some crops may return several hundred dollars per acre. Thus hops in western Oregon, yielding a ton at 75 cents, return $1,500 per acre. A ton of fertilizer per acre on hops would be a smaller relative expense than perhaps 100 pounds of fertilizer on corn or wheat. However, the demand for nutrient may be just as great for the crop yielding a smaller return.

In western Oregon the most common nutrient deficiency is nitrogen. The soils are heavily leached by winter rains which remove the soluble nitrate and other nutrients. As warm summer weather with little or no rainfall comes, the surface soil dries and nitrification in the topsoil which contains most of the humus is stopped. Likewise the functioning of roots in the dry topsoil is stopped either by the dry condition of the soil or by deep cultivation, which destroys the roots. The crop is thereby left with only a limited supply of available nitrogen throughout most of the good growing weather.

In practice this difficulty may be partially overcome by early fertilization (February or March when possible) with nitrogen fertilizer. Next to nitrogen in importance as a deficiency are possibly phosphorus or sulfur, and frequently boron. Practically all soils and most crops respond to a nitrogen fertilizer. The response to the other nutrient elements may not be noticeable until the nitrogen deficiency has been corrected.

Garden and small fruit crops usually receive a complete fertilizer, which should supply sulfur in addition to the N-P-K as assurance against a possible shortage of sulfur. Boron in the form of borax at 30 pounds more or less an acre, according to the crop, is necessary for the production of some vegetables and other crops. Rates of use of fertilizer increase as growers gain experience and confidence in their use. The beginner not infrequently reports no returns or sometimes damage from the use of fertilizer because he fails to realize the importance of proper placement, or because too little has been used to produce an appreciable increase in yield.

For completely satisfactory use of fertilizer in western Oregon, summer irrigation is necessary. Irrigation like the use of fertilizer is extended to more acres as the users gain experience. Water and fertility are a team; a serious shortage of either may render the other of little avail, particularly for those crops grown in midsummer season when the weather is hot and transpiration is high. The very early crops grown while the soil is moist from winter rains may respond satisfactorily to fertilizer without supplemental irrigation.

Another stimulus to the use of fertilizer in western Oregon is the ever-increasing indication of fertility depletion. Where wheat, hops, grass, or some other crop has been removed from the land for half a century or more with little return of fertility, production is likely to show a decline. Then the owners become interested in crop rotations, liming for legumes, and the use of fertilizers for bigger yields and soil improvement.

Fertilizer Expenditures in Relation to Farm Income

(*From page* 16)

above equation from the facts known at the beginning of the respective years. In other words, the greater differences between the actual and calculated expenditures in these years were probably due to the inability of farmers to accurately forecast their incomes in periods of sudden change.

The preliminary estimate of 1943 income from marketings of crops is $7,903,478,000 and from government payments is $672,000,000, making a total of $8,575,558,000 ($X_2$). At the time of writing, indications were that the similar total for 1944 would be about $8,850,000,000 ($X_3$). Of the total cash income in 1943, 46 per cent remained after all expenses of production had been deducted (X_4). When these values are substituted in the equation given at the beginning of this chapter, it appears that farmers would spend in the calendar year 1944 about $438,718,595 for fertilizers, or about 6 per cent more than was spent in 1943 for the same materials. As may be seen from a comparison of Figures 1 and 2, this is a smaller figure than would be forecast by previous methods.

Summary

It was found that the income from marketings of crops plus government payments is a little more highly correlated with expenditures for fertilizer than any of the other measures of income previously studied. It was found also that 93 per cent of all the fluctuations in expenditures for fertilizers in the United States between 1911 and 1943, inclusive, which varied from a minimum of $111,000,000 in 1932 to

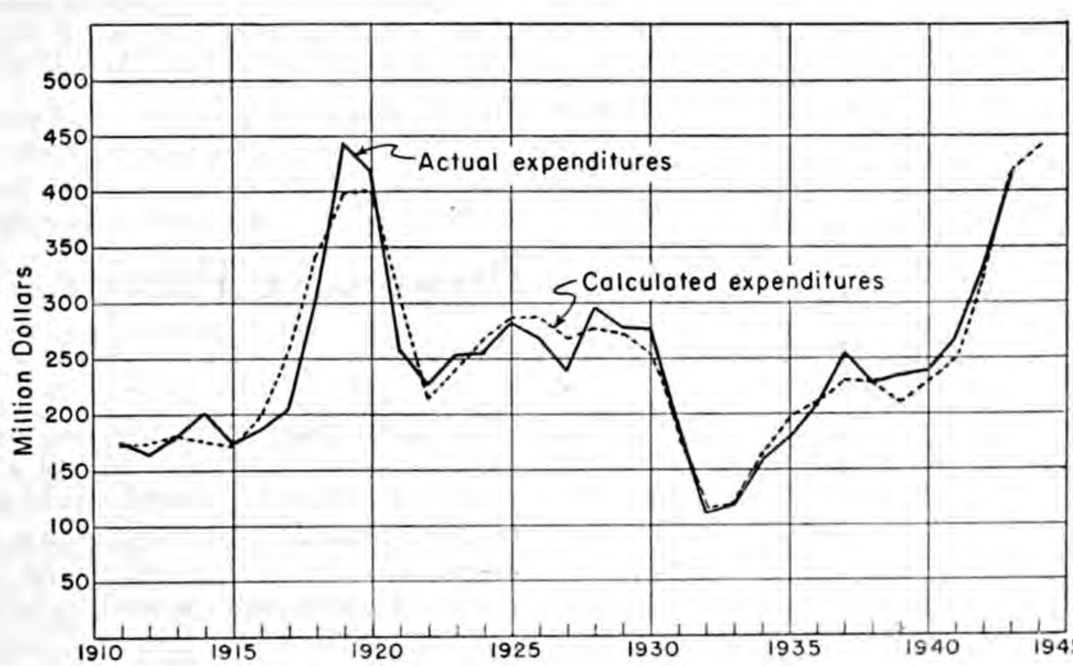

Fig. 2. Expenditures for fertilizer calculated by means of the equation $X_1 = .03293X_2 + .01766X_3 + 1.159X_4 - 18.8435$, as compared with the actual expenditures.

a maximum of $442,000,000 in 1919, are accompanied by corresponding fluctuations in three factors. These factors are: (1) cash income from marketings of crops plus government payments in the year before, (2) like income in the same year in which the fertilizer is bought, and (3) the proportion of the previous year's income remaining when all expenses of production have been deducted.

Fifty-six per cent of the deviations in expenditures for fertilizers from the average are accounted for by similar fluctuations in farm income from crops plus government payments in the previous year, 28 per cent by similar fluctuations in the same year's income, and 9 per cent by changes in the proportion of the previous year's income remaining after expenses of production are deducted. This leaves 7 per cent of the variations from the mean unexplained as probably due to other factors.

Similar indications were obtained for seven states. The previous year's income seems to be less important, however, in Pennsylvania and more so in South Carolina than average. Prospects for the present year's income appear to be of little importance in the Central states.

It appears from this study that farmers in the calendar year 1944 will spend about 439 million dollars for fertilizers, or about 6 per cent more than the 413 million spent in 1943.

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J. B. Wadsworth—Progressive Farmer

(*From page* 19)

lent crops since he began mopping, and says he is afraid not to mop. He makes four applications every seven days, starting before any squares are formed. Last year he had almost no boll-weevils until the crop was made, although weevils were worse than usual on some farms that did not follow any weevil control. He thinks the poison is effective if it can stay on the cotton as much as one or two days before it rains.

He has found that it pays to treat the seed before they are planted and does not forget an experience he had a few years ago when he planted a field early with untreated seed and got such a poor stand that he had to plant the field over. Even though the seed are treated before planting, he uses 1½ bushels per acre, for he believes in using plenty and does not want to cultivate a poor stand of any crop. He tries to get his crop planted early and by using treated seed, he, like other farmers, has found that the young plants from treated seed can stand more adverse weather in the early spring than can cotton that carries a higher per cent of diseased plants from untreated seed.

In preparing the land, he first cuts it well with the tractor disk harrow. After the fertilizer is applied, a cotton plow is run behind the sower to mix it with the soil.

He has more stalks on the land than most farmers. The usual width of cotton rows in this locality is 3½ feet, but he makes his 3 feet and leaves 2 to 3 stalks per hill, 8 inches apart. In order to get a real crop of cotton, he says you must have the plants to produce it. He cultivates the cotton shallow every week after it comes up until growth prevents further cultivation.

The yields of his other crops are also well above average. He averages 19 to 20 bags of peanuts per acre, weighing from 95 to 100 pounds per bag, and 40 bushels or more of corn per acre, in addition to having a good growth of soybeans in the corn to go back to the land for soil improvement. On one field last year he produced more than 75 bushels of corn per acre and expects to beat that record this year.

Since he uses mules weighing from 1,200 to 1,400 pounds, he cultivates his corn and peanuts, also cotton while it is small, largely with riding cultivators. He likes his riding cultivators and would rather have them than anything with which he has ever worked a crop. Many farmers still hold to the one-mule cultivation of the crop with a five-hoe cultivator or cotton plow which requires three trips to the row, where the riding cultivator cultivates the entire row at one trip.

A Trash Mulch Method of Reclaiming Land With Alfalfa

(*From page* 9)

alfalfa in these trials. Including a grass in such seedings results in better erosion control, reduces weed growth, increases the yield, helps prevent heaving, and provides a cleaner crop by supporting it above the soil. Orchard grass has proved the most easily established in these trials. Although a good grass for poor soils, orchard grass is not the ideal one to sow with alfalfa for hay, as it matures too early. Only mediocre stands of timothy have been obtained. Tests at Columbus show that additional timothy can be drilled into alfalfa seedings in September with considerable success. Since timothy is somewhat late maturing, it is apt to delay the first cutting of hay, although a new early maturing timothy, Marietta, promises to be more satisfactory. Experience at other experiment stations indicates that smooth brome grass is probably the best grass to mix with alfalfa if the meadow is to be held for more than two years and used for grazing purposes. Since satisfactory stands of brome grass have not as yet been obtained in these trials, it is not included in the recommended mixtures. In one seeding, alsike was included with the alfalfa, and it appears that this is a good combination, especially where "seep spots" occur.

Inoculate the legume seed thoroughly.

Sow the seed broadcast with any hand seeder or grain drill with a grass seed attachment. Seed and fertilizer can be applied at the same time if the seed tubes are arranged so that the seed falls back of the fertilizer tubes.

Cultipack the seedbed as the last operation before seeding. In the trials described, the areas were cultipacked after seeding, only. Since a compact seedbed is desired, cultipacking before seeding, as well as after, is recommended if time permits. Cultipacking should be done on the contour.

Clip the new meadow seeding to control weed growth. The field may look weedy and unpromising the first season. Clip off the weeds once or twice during the first summer whenever they reach a height of 8 to 10 inches; otherwise growth may become so rank that the alfalfa is choked out. This clipping should be done before mid-September if good fall growth for winter protection is desired.

In a very favorable season, considerable forage growth may be made the first season. It is better to leave this on the field. However, if any hay is made, it should be cut before September 15.

From these trials, it seems that alfalfa holds promise as a crop to utilize profitably, and at the same time rejuvenate, eroded Muskingum and related soils. Alfalfa has several characteristics which make it an exceptionally valuable soil-reclaiming crop for eroded hillsides if generous amounts of lime and fertilizer are used. Its root system goes deep for nutrients and moisture and adds many pounds of highly nitrogenous organic matter. The water-absorbing capacity of the soil is improved by this organic matter and by the openings left by decaying roots. Once established, alfalfa, unlike red clover, lives for several years, thus eliminating the necessity for frequent tillage of the soil.

Although starting alfalfa sounds expensive, it really is not. Lime is a necessity in most of eastern Ohio whether alfalfa is grown or not. The cost of the failure to use enough lime in eastern Ohio greatly exceeds the cost of the lime required to correct the situation. The fertilizer required is only a little more than should be used for wheat, a crop which returns very poor yields on such soils. The seed expense is not out of line when the long life of an alfalfa-grass meadow is considered. In favorable seasons, some hay or pasture can be had the year the seeding is made. Forage returns the year following sowing should more than cover the cost of establishing the crop. It is well to remember that a ton of good, early-cut alfalfa hay contains as much protein as a ton of bran. Areas sown in the manner described can be harvested for hay or grazed off. They should fill a real need for high-quality forage during midsummer, when permanent bluegrass pastures are apt to be short.

The "trash mulch" method of direct establishment of alfalfa-grass meadows on the "worn-out", badly eroded hill lands of eastern and southeastern Ohio possesses much promise as a means of restoring the productiveness of such lands. Farmers are urged to try the method, in a small way at first, to see how it works under their particular conditions. If there is sufficient vegetation on the ground to be converted into an effective "trash mulch", hillsides too steep for row crop cultivation can be converted immediately into high-quality forage-producing areas without creating an erosion problem.

Producing A Record Potato Yield

(*From page* 22)

provinces of Canada, a wide variety of high-quality produce is grown annually. The climate and soil conditions of the various sections of the Province vary considerably, thus allowing for the production of a variety of crops. Approximately 15,000 acres are planted each year to potatoes. During recent years there has been a considerable demand for B. C. grown certified seed potatoes in the States to the south. More than 80 carloads were shipped across the line last year. It is realized that such markets can only be maintained by exercising the greatest care in the growing and handling of the crops. Every effort is being made by both Federal and Provincial officials to see that only the best seed is produced for this export trade.

Bovine Bazaars

(*From page* 5)

cigar-biting judge handed out. But just try and tell the owner that and expect him to insert another bull sale ad with you.

I used to feel sorry for the breed clerks standing out there all day with their long ledgers with the flock of colored ribbons floating from the edges. We kept them in hot water wanting to see this or that name and checking on some animal not in the catalog. Next to the reporters, those guys had more coming to them than they ever got from the fair, which was mostly railroad money and expenses from their jobs as county agents.

I never yet felt sorry for any judge, even in the huge Holstein calf classes. Anybody with guts enough to stick out his neck to earn one hundred smackers a day won't get any sympathy from me. On the other hand it always made me boil when confirmed squawkers among the exhibitors started a whispering campaign about some judge who didn't give them the hog's share of the silk streamers. Their kine never thereafter got any of my expensive superlatives.

Speaking of exhibitors, I bet you I can tell what kind of cattle are being judged in a big expo by just looking at the ringside assembly. Your Holstein fans will be made up of dirt farmers mostly, only a mere five per cent of the crowd looking like munitions manufacturers or chain-store chiefs. Your Guernsey gallery will be mostly plow-pushers and teat-yankers, but with a mite more of the royal flush and the full house, probably fifteen per cent the velvet class.

But when you gaze over a Jersey audience you'll see special benches brought in for the day, maybe with cushions on them, on which are seated dowagers with sparklers talking to financial-looking gents who carry those sit-down canes, mute testimony to the fact that the Jersey is ace high in the Hudson valley and supreme in the Cotton Kingdom.

Over in the rampageous beef section there is no such manner of selection. Here you either have the dirt-farmer feeder and Midwest hay-tosser, or else the great, breezy, undefined brotherhood wearing wide sombreros, the ones who can't be identified until you hear them talk awhile.

IT'S a long cry indeed from these observations made in recent rings to the times when farmers sent their muley cows to the county fairs.

If you had a cow that wasn't a hooker and gave a fairly full pail of bubbly milk when she was fresh, and if she was a family pet and nobody wanted to sell her at any price, then you got the urge to tote her to Bingville for the annual livestock bazaar.

Pedigrees didn't count any more with cows than they did with the customers who paid egg money to get through the gates. A man was a man and a cow was a cow, and so what? You either liked or disliked them, and no score card was needed to list the pros and cons of it either.

They received the entries led in at the tails of country wagons, and tied them up in rows along the fence where rude shelters had been built twenty years ago and never patched up since. There wasn't any band music to liven up the cow barns and when they judged the critters on Thursday, which was Bingville Day, the oldest farmer in Whiffletree county merely walked along the line back of the bovines and squinted at them judiciously, taking a fresh chaw of Climax when he came to a right juicy-looking heifer. I've known him to hike back and switch a ribbon after he decided he'd made a mistake due to poor eyesight. Nobody yawped and abused him either and anyone who garnered a fifth prize had it framed for the what-not and bought a life membership in the fair association in gratitude.

There were a few bulls on the country circuits in those days. Folks didn't talk much about male bovines then and only about one farm in five kept them, which made lots of extra leg work for Pa when Sukie's calendar was right. So the bull classes were meager and tame indeed in my day of barefoot fence-hopping at fairs. But if they could scrape up three or four male specimens on the last day, Uncle Zeke would have them led out a ways from the fence and slap on the grand championship over all breeds, families, and tribes. No registry clubs bothered us then and a bull was just useful for mating purposes to keep the milk jug flowing free.

HOLDING consignment sales and taking pictures of the prize-taking stock were unheard of, of course. In later days we have seen too many shows that were mostly curtain raisers for subsequent sales, and I am sure that some good films of my own, and maybe Brother Guard's too, have been wasted on so-called champions posed for penny-catching purposes.

Humanity is always looking for beauty of form and perfection of ideals. The trouble in the cow show trade, as well as in many other lines of human endeavor, lies in the imperfection of our own faculties.

Nobody is able to see through the skin and hide and hair of a cow or a bull to determine what's really underneath. Our cow shows run too much to type and form and score-card regulations. Our judges get into grooves of habit and custom and read too much past show history, often timid about giving the gate to some behemoth that deserves it, except that he has had a blazing record himself on the tan bark, or else his sire or dam was called magnificent somewhere else.

Too little scientific work has been done to check up on the performance of beef bulls as begetters of economic sirloins or about the relation of butter-fat yield to level toplines or nice shoulders. Maybe the time is coming when we are going to modify our showring standards and get down to a real germ plasm system in finding successful combinations in breeding. Thus far in my own sideline observations I have seen too little stress put on proven production, even when some champion possessed it.

Yet we must credit the fanfare of the big circuit with adding a degree of glamor and attractiveness to the old job of being a herdsman. From a seedy individual with humble ambitions, the successive years of big cow shows have transformed the herd boss into a much sought man with larger horizons and, we hope, greater chance for genuine service.

I presume the fairs have done as much as that for some of the herds also, but we can get into quite a long argument over that proposition, and space forbids. Some of my neighbors who once followed the circuit now refuse to join up again, because of sundry serious maladies their cattle acquired in mingled rings. They decline to say whether any great advancement has come to their milk tonnage as a result of learning and buying in the wake of many shows.

I still wish I might find out more about the progeny of many of those champion animals I wrote about and took pictures of in past expositions. To me that would spell the final answer to the perplexity I have got into over the lack of permanent values in cattle showing.

Nevertheless each fall season whets my appetite for the friendly intercourse of modern cattle fairs, knowing as I do that they are imperfect and transitory. Life itself is, too, so maybe this fuss is foolishness. Maybe I am still justified in elbowing a millionaire aside to get a better look at a farmer's candidate for the sweepstakes, even if the critter doesn't wear a peerage pedigree.

AVAILABLE LITERATURE

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

Circulars

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

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
H-3-42 Legumes Are Essential to Sound Agriculture
I-3-42 High-grade Fertilizers Are More Profitable
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
Y-8-42 The Southeast Can Grow Clover and Alfalfa
AA-10-42 Growing Legumes for Nitrogen
DD-10-42 Clover Pastures for the Coastal Plains
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizers
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
C-1-43 Quality in Grasses for Pasture and Hay
F-1-43 Boron Improves Canning Beets
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
HH-8-43 More Soybeans, Please!
JJ-10-43 Soil Management for Field Beans
PP-12-43 Commercial Fertilizers for Livestock Farms
QQ-12-43 Potash in War Production
A-1-44 What's in That Fertilizer Bag?
B-1-44 Available Potash in the Surface Soils of Georgia
C-1-44 Adjustment of Agriculture to Its Environment
D-2-44 Potassium Content and Potash Requirement of Louisiana Soils
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
G-2-44 The Use of Borax in the Legume-Livestock Program of the South
H-2-44 Efficient Fertilizers for Potato Farms
I-3-44 Doubling Production by Bettering Soils
J-3-44 The Response of Various Crops to Potash Fertilization in South Carolina
K-3-44 Soil Tests Indicate Potash Levels
L-3-44 South Finds Clovers Excell in Profits
M-4-44 The Importance of Potash in Maintaining Food Production in N. C.
N-4-44 The Potash Problem in Illinois
O-4-44 Record Supplies of Fertilizer Materials Indicated for 1944-45
P-4-44 Borax Sprayed on Beets Controls Black Spot
Q-4-44 A New Approach to Extension Work
R-5-44 More About Soybean Fertilization
S-5-44 Borax Spray for Turnips
T-5-44 Southern Crops Show Need of Potash
U-5-44 The Use of Fertilizer in Maryland
V-5-44 The Seed Production of Hairy Vetch and Other Winter Cover Crops
W-6-44 Fertilizer Requirements for Permanent Pastures in Alabama
X-6-44 Soil Management for Cannery Peas
Y-6-44 Sweet Clover Responds to Potash Fertilizer
Z-6-44 Our Fertilizers Need Magnesium

THE AMERICAN POTASH INSTITUTE

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

HE'LL LEARN

"How come you didn't turn out?" demanded the sergeant. "Didn't you hear the bugle blow reveille?"

"Honest, sergeant, I'm afraid I'm going to be a flop as a soldier. I don't know one dern tune from another!"

At a meeting of a local council there had been some discussion regarding the type of milk which should be provided for the school children.

To conclude the debate, the chairman rose portentously to his feet.

"Gentlemen," he declared, "What this town needs is a supply of clean, fresh milk, and the council should take the bull by the horns and demand it."

"Bill shouldn't have married Irene. In six months' time she's made him a pauper."

"Wow! Is it a boy or girl?"

EDUCATED

"What do you know about love?" sez one guy to another.

"Plenty," sez the other guy, "I drove a taxicab for three years!"

And then there was the employer with a small cigar factory, who made this pathetic plea to the local draft board:

"We earnestly request that deferment be granted to John F. Dough. He is the only man left in our plant and at the present time is carrying on with 18 inexperienced girls."

There's a false and a true democracy. The false says: "I am equal to you." The true says: "You are equal to me."

Jasper—My cousin has become so fat that he can't play golf any more.

Joan—How's that?

Jasper—Well, if he puts the ball where he can hit it, he can't see it. And if he puts the ball where he can see it, he can't hit it!

Interviewer: "Have you any experience in defense work?"

Young girl applicant: "Yes; I used to go with a sailor."

A young Brooklyn soldier was on maneuvers in Oregon. Having a few minutes to himself after evening chow, he strolled out into the woods and soon came back with a handful of rattlesnake rattles.

"Where in the world did you get them?" gasped his alarmed companion.

"Off'n a woim," replied the lad from Brooklyn.

"I like the shy, demure kind," said the sailor, "you know, the ones you have to whistle at twice."

The fellow who blows his horn the loudest is likely in the biggest fog.

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Better Crops with PLANT FOOD

November 1944 | 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVIII NO. 9

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The American Potash Institute, Inc.

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THE MAGIC OF THE FIRST SNOW FALL

Better Crops with PLANT FOOD

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VOL. XXVIII WASHINGTON, D. C., NOVEMBER, 1944 No. 9

The Golden Age of . . .

GRUB

Jeff McDermid

WITHOUT casting any reflections at your wife's cooking, I would like to take you back with me to the situation around a Thanksgiving dinner table before the first world war. It would take a complete edition of Fanny Farmer (how aptly named) and a dozen of the best give-away recipe books to describe or analyze the gusty viands and tempting tid-bits which Mother and sisters spread before us. Their redolent repast to mark the climax of the season's plenty was not only a silent but steaming tribute to many diligent hours in the pantry and kitchen, but an indirect cause of genuine satisfaction to the menfolks who provided most of it in its raw state.

There were many little customs regularly followed in the thorough enjoyment of that huge family feast. Father began the ritual with his customary devotions, praising the Creator for a sort of junior partnership in successful husbandry, and winding up with thanks for health and heavy rural appetites to appreciate the largess of country abundance.

The kids had to engage in a wishing event centered on the three or more wishbones found among the ruins, the cold hard cider must be generously sampled and praised, and he who drew the stern bone of the bird was dubbed the last one over the matrimonial fence, if he were young and single.

Although warned in advance to save some cargo space for the final course, we usually were pretty well stuffed by the time the girls brought in those husky, juicy, oven-browned pies, curlicued and cross-hatched with fronds and filigree.

As we sat groaning with ultra repleteness and loose belt buckles, it was time for our parents to indulge their pet satisfaction. They had come west as children in the covered wagon and seen some rough goings-on and no little privation. They had seen families sicken and perish for want of ordinary sustenance and fully realized the triumph of those who had stuck and finally succeeded.

"Now we have a fine family gathered around us able to enjoy the fruit of our labor and the land's abundance," was their comment on this occasion. "Mark you, almost every ounce of what you have partaken today, except the sugar and the salt, has come right from this old place of ours—the homestead which your grandpa got title to by a deed signed by President Tyler. Remember in the years to come that you were raised on food grown on your own ancestral acres and that every Thanksgiving we felt just like the Puritans, except for toting guns and dodging Indians."

AND so this is where I leave the bulging board for awhile and recount again some of the ideas and ideals of that day and age of rural simplicity, contrasted somewhat to the realistic pattern of today. It was pardonable indeed for all of us to lack forward vision after indulging in all that magnificent menu, garnered with so little cash cost. It is no disparagement to our citizenry of the golden age of agriculture that we could not anticipate gradual shifts to different circumstances.

First, in those days farm folks always regarded themselves as the only original primary producers; and what is more, thought of themselves as producers only—not as consumers.

Their immediate local outlook when they went to town was likely to make them feel like the only real producers. In those times few factories existed in the small midwest countryside and neither smoke-stacks nor silos poked skyward. The town had its small bank, law office or two, a vet clinic, a blacksmith shop, and a row of stores. The clerks and members of the legal and ministerial professions, of course, looked like drones and idlers compared with the muscular and sweat-streaked ruralites. The banker was a landowner and a money-lender, which put him at once in the cream-skimming class, they said. The closest ones to be admitted to the sacred producer class were the vet and the smithy, but inasmuch as they derived their income from the surrounding farm patronage, they too were not taken seriously as bona fide original producers.

Owing to the homespun type of livelihood and the wealth and variety of food and drink to be stored away in the wake of the plow, our farm folks of those times found it easy to think they were eternal producers and had no consuming worries to fret them. If they ever thought of the store, it was usually in terms of barter and trade, and the services of the vet and the smithy were just little local conveniences of no great economic value. The government experts who figure parity and exchange value in cash or total income between the land operator and his associates of urban utility had not been born yet.

Even now much of that attitude remains in the country, the penchant for regarding the farm as the chief of all ends to production, and the farmer as one who eternally exports materials and pays the freight both ways.

This is what has made it hard sometimes to have our native farm folk realize the need for overseas trade in both directions, our position having changed from the debtor to the creditor nation. He has always figured it was the ability to produce and sell that counted, while consumption and buying of imported goods smacked of real radical departure from old patterns.

Second, in those days of the plentiful home dinners, we thought we might always rely on local, home, and country environment for our necessities and comforts.

There is little need to go into that very far, because it was so obviously the mainspring of existence in the days of yore. Men traveled little, wanted only the substance and not the cream, were content to exchange views on weather and varieties with adjacent neighbors, and asked for no innovations beyond the rude makeshifts which were the fruit of local toil and talent.

THE outside, foreign world was to them a set of bleak lands marked by varied colors in the dog-eared geography. These realms were peopled by strange and fantastic heathens, and races of polyglot tongue and mean tempers. To be "shed of" them in a hurry, after once finding out their locations, was just about the general sentiment.

When somebody ventured into a distant metropolis he was warned about gold bricks and bargain city halls, and hence cities became known as wicked deserts amid the green oases of a countrified majority. There were no labor unions then and whatever the price tag stated at the implement store represented the local margin plus the dashblasted railway tolls. So that element of the present-day grouch on labor had not reached the hinterlands. And they recalled that Cyrus H. McCormick and John Appleby, two of the potent inventors of that age, were just husky farm lads with good original ideas of country service.

And, thank heaven, the grocery stores of the times long gone were not stocked with bursting packages of crispy breakfast food, polished rice, and patent flours, so that the sugar barrel, the coffee grinder, and the tea chests were the main reservoirs of rural wants in grub.

But we have gone a long ways since then, and it is still hard to face the facts of an interlocking sort of existence between the farm and the factory, between the barnyard and the pavement. The politicians play on it more or less and seek to rouse the old prejudices and latent animosities, while honest-to-goodness city labor too seldom has a chance to chat confidentially with the farmer.

Third, folks munching around that happy board said that the forms and preferences for food would never change. After tasting the rich roasts, corn-on-cob, stuffed turkey, taters and gravy, vegetable soup, and native fruit pies garnished with natural, home-cured nippy cheddar and washed down with warm, sweet milk, is it any wonder nobody imagined a period ahead when fads, fancies, and long-distance trading would cause a wondrous array of concoctions and commodities to become standard victuals?

What would grandpa have said about dried milk, some for humans made on one kind of machine and another brand for livestock rolled off a big hot dingus in shreds and patches? What would uncle have remarked about breaking perfectly good eggs into a big copper kettle and then reducing the mess to a yellowish powder for future mixing and cooking?

Who would have visioned vitamins, in chewing gum, bread or candy, and taken out of bottles night and morning? What would the guy who soldiered at San Juan Hill have said if you told him a future war would be fought by Yanks using dried chaff to make soup of and tablets to equal a square meal?

(*Turn to page* 50)

Mississippi Crop and Pasture Production Program 1942-43

By J. M. Weeks

Agronomist, Mississippi Extension Service, State College, Mississippi

IN 1942, plans were made with specialists of the Mississippi Extension Service, county agents, and other agriculturists, for conducting organized potash demonstrations with crops and pastures. The plan called for adding potash to whatever treatments had already been used on the farms, leaving a strip of land without potash as a check plot. In most cases, the demonstration fields selected had already received an application of either lime, superphosphate, or basic slag, or a combination of lime and superphosphate. In a few cases no treatment of any kind had been given. This accounts for the fields in which potash alone was used.

The demonstration fields varied in size from 1 acre to 30 acres, and the areas treated with potash from ½ to 12 acres. Most of the potash-treated plots ranged from 2 to 10 acres. The potash materials used were muriate of potash 60% and manure salts 22%. The muriate of potash was applied at the rate of 100 pounds per acre, with a few exceptions where 200 pounds were applied. The manure salts were applied at the rate of 100 to 200 pounds, depending upon the crop and the time of application. For many of the tests, the material was applied in the fall of the year and at the time of preparing the land for seeding, while in other cases it was applied as a top-dressing or side-dressing. In the case of cotton, and certain other crops, the potash was applied in drill before bedding the land for planting. The early applications proved more profitable in practically all cases.

In general, the demonstration program proved both enlightening and profitable and convinced many farmers of the value of potash for crops and pastures. Due to reduced travel facilities, extremely dry weather in some sections, and various other causes, the records of yield were not obtained on many demonstrations, but, according to agriculturists and farmers in charge of the tests, most of the demonstrations served a useful purpose in the communities where conducted. In many cases, especially on the leguminous crops, the application of potash doubled the crop yield.

When studying the yield data following, it should be remembered that many of the records given represent only a single clipping and not the total yield for the year. If clippings had been made on pastures throughout the summer and fall, the results from potash, no doubt, would have been considerably higher, due to the effect it has in helping plants to withstand drought. Some of the cooperating farmers reported that the potash-treated pastures afforded more grazing during the summer months and remained much greener than did the checks. Many reports gave estimates on the percentage of grazing on potash-treated plots as compared with the checks. Most of these were favorable, but due to the nature of the reports, they cannot be given in a summary of this kind. This applies to crops as well as pastures. Some of the general reports will be shown further on in the discussion.

For convenience, the demonstrations

This Holmes County, Mississippi, field (Demonstration No. 26) was fertilized with superphosphate alone, for a crop of kudzu. The picture was made in August 1943. (See picture below.)

given in the appendix will be referred to by number. For example (Dem. No. 1), with Austrian winter peas, was conducted on the farm of C. V. Maxwell, Pickens, Mississippi. This field was 12 acres in size, and at the time of seeding, the entire field was treated with 500 pounds of basic slag per acre. At the same time, one-half of the field received an application of 100 pounds of muriate of potash 60% per acre in addition to the basic slag. Where basic slag alone was used, the yield of green material amounted to 7,441 pounds per acre. Where potash was added, the yield was increased to 14,247 pounds of green material per acre. In the same community, on the farm of B. E. Presley (Dem. No. 2), one-half of a large field of vetch received potash in addition to the lime and superphosphate used on the entire field. The yield here was more than doubled. Yields of this kind from potash are not unusual on this land which lies between the loessial bluffs and the Big Black River.

The most consistent yields from potash were obtained from tests with Wild Winter Peas (Lathyrus hirsutus),

This plot, in the same demonstration and photographed on the same day as above, had received 60 per cent muriate of potash in addition to the superphosphate.

known in Alabama as Caley Pea, and in Louisiana as the Singletary Pea. The results are summarized in Table 1. With this pea, it is not unusual to obtain yields of 30,000 pounds of green material per acre on reasonably good land, well fertilized. In three tests in which basic slag alone was used, the yield was 13,102 pounds of green material per acre. Where potash was added, the yield was increased to 19,818 pounds of green material. This represents an increase of 6,716 pounds per acre. Demonstration No. 8 illustrates the excellent yield that may be obtained from Wild Winter Peas when properly handled.

Demonstrations No. 2 and 11 through 20 (Table 2) are somewhat similar in that they are all forage crops to be grazed or cut for hay. They include such crops as hop clover, white clover, oats and white clover, oats and pasture mixture, red clover and oats, vetch, and mixtures of these, all grown for grazing, or for hay and seed. The results from potash in these demonstrations varied somewhat with the crops and soil, but are fairly consistent. When superphosphate, superphosphate and lime, or basic slag were used, the yield was 10,543 pounds of green forage per acre. But when potash was added, the yield was increased to 16,819 pounds of forage, an increase of 6,276 pounds of green material per acre.

TABLE 1.—WILD WINTER PEAS, FARMER'S TREATMENT WITH AND WITHOUT MURIATE OF POTASH 60%

(Demonstrations 3 to 10)

Number Cases	Treatment	Green Forage: Yield Per Acre	Green Forage: Increase Due to Potash
3	500 lbs. Basic Slag	13,102 lbs.	Check
	500 lbs. Basic Slag 100 lbs. Muriate of Potash	19,818 lbs.	6,716 lbs.
1	200 lbs. Superphosphate 500 lbs. Lime	20,908 lbs.	Check
	200 lbs. Superphosphate 500 lbs. Lime 100 lbs. Muriate of Potash	31,472 lbs.	10,564 lbs.
1	No treatment	15,681 lbs.	Check
	100 lbs. Muriate of Potash	28,749 lbs.	13,068 lbs.
3	250 lbs. Superphosphate 500 lbs. Lime*	5,953 lbs.	Check
	250 lbs. Superphosphate 500 lbs. Lime 100 lbs. Muriate of Potash	12,559 lbs.	6,606 lbs.

* No lime was used in Dem. No. 5.

Several demonstrations with alfalfa were inaugurated, but records were obtained on only three tests. The results on some of these tests included only one cutting. Differing somewhat from the other demonstrations, both potash and borax were added to the farm practice. These demonstrations are summarized in Table 3. The actual results here cannot be clearly understood or interpreted due to the arrangement of the plots and treatments. Besides, in some of the tests

TABLE 2.—FORAGE CROPS FOR HAY OR GRAZING AND PASTURES, FARMER'S TREATMENT WITH AND WITHOUT MURIATE OF POTASH 60%

(Demonstrations No. 2 and 11 to 20)

Number Cases	Treatment	Green Forage	
		Yield Per Acre	Increase Due to Potash
11	Superphosphate, Superphosphate and Lime, or Basic Slag*	10,543 lbs.	Check
	Superphosphate, Superphosphate and Lime, or Basic Slag 100 lbs. Muriate of Potash	16,819 lbs.	6,276 lbs.

* Demonstration No. 17 included in this summary was treated with potash alone.

where only one cutting was weighed, the farmers reported that later the potash showed excellent results. However, the increase from borax was very evident in all cases and became more outstanding during the dry summer months. The results on these alfalfa demonstrations will be checked again in 1944.

Field conservationists of the Soil Conservation Service, cooperating in this program, conducted a number of demonstrations with kudzu and mentioned profitable responses to potash. However, only two reports showing the actual yield were received. The results of these are summarized in Table 4. Averaging the two tests, superphosphate alone produced 10,000 pounds of material from a single cutting. When potash was added to the superphosphate, the yield was increased to 18,530 pounds, or an increase of 8,530 pounds of green material due to potash. A photograph was made later of demonstration number 26, conducted in Holmes County. At the time the photograph was made, this kudzu probably would have yielded as much as 50,000 pounds of green material to

TABLE 3.—ALFALFA, FARMER'S TREATMENT WITH AND WITHOUT POTASH AND BORAX

(Demonstrations 21, 22 & 23)

Number Cases	Treatment	Green Forage	
		Yield Per Acre	Increase Due to Potash, Borax
2	Superphosphate, or Superphosphate and Lime	19,111 lbs.	Check
	Superphosphate, or Superphosphate and Lime, Plus Potash	19,928 lbs.	817 lbs.
	Superphosphate, or Superphosphate and Lime, Plus Potash and Borax	27,113 lbs.	7,185 lbs.
1	Superphosphate and Lime	9,365 lbs.	Check
	Superphosphate, Lime, Manure Salts, and Borax	13,285 lbs.	3,920 lbs.

TABLE 4.—KUDZU, FARMER'S TREATMENT WITH AND WITHOUT POTASH*

(Demonstrations 26 & 41)

Number Cases	Treatment	Green Forage	
		Yield Per Acre	Increase Due to Potash
2	Superphosphate alone Superphosphate plus Potash	10,000 lbs. 18,530 lbs.	Check 8,530 lbs.

* Potash materials used were muriate of potash 60% and manure salts 22%.

the acre on the potash-treated plot. The check plot probably would not have made more than one-tenth this amount.

The results from potash on lespedeza were not so consistent as with some of the other crops, but this was probably due in part to the extremely dry summer and low crop yield. The farmer's treatment varied considerably, but in most cases either superphosphate, superphosphate and lime, or basic slag was used. Averaging the results from six demonstrations, summarized in Table 5, the application of potash produced an increase of 4,901 pounds of green material to the acre.

A number of very good potash demonstrations were conducted with lespedeza sericea, but the records of yield were not obtained. The only record reported on sericea came from Calhoun County, and the yield resulting from potash was good. In this

TABLE 5.—LESPEDEZA, FARMER'S TREATMENT WITH AND WITHOUT POTASH*

(Demonstrations 25, 27, 28, 29, 30 & 31)

Number Cases	Treatment	Green Forage	
		Yield Per Acre	Increase Due to Potash
6	Farmer's Treatment Farmer's Treatment plus Potash	7,731 lbs. 12,632 lbs.	Check 4,901 lbs.

* Potash materials used were muriate of potash 60% and manure salts 22%.

TABLE 6.—SOYBEANS FOR *Hay*, FARMER'S TREATMENT WITH AND WITHOUT POTASH

(Demonstrations 40, 41, 42 & 43)

Number Cases	Treatment	Green Forage	
		Yield Per Acre	Increase Due to Potash
4	Farmer's Treatment Farmer's Treatment Plus Potash	11,982 lbs. 17,423 lbs.	Check 5,441 lbs.

TABLE 7.—COTTON, FARMER'S TREATMENT WITH AND WITHOUT POTASH

(Demonstrations 34, 35, 36, 37 & 38)

Number Cases	Treatment	Lbs. Seed Cotton Per Acre	
		Yield Per Acre	Increase Due to Potash
5	30 lbs. Commercial Nitrogen, or Winter legume	940	Check
	30 lbs. Commercial Nitrogen, or Winter legume 100 lbs. Muriate of Potash	1,368	428

demonstration (No. 32) the yield of hay was doubled from the use of potash.

When potash was added to the farmer's treatment for soybeans, the yield of green forage was increased from 11,982 to 17,423 pounds. This is an average increase of 5,441 pounds of green forage per acre resulting from the potash. These demonstrations are summarized in Table 6.

In some of the counties where the use of potash for cotton was not an established practice, several potash demonstrations with cotton were conducted. These demonstrations are summarized in Table 7. In three tests, 30 pounds of nitrogen from Uramon produced 1,149 pounds of seed cotton per acre. When 100 pounds of muriate of potash were added, the seed cotton was increased to 1,525 pounds. This is an increase of 376 pounds of seed cotton per acre. In two tests where 100 pounds muriate of potash were applied to vetch and followed by cotton, the yield was increased from 675 to 1,131 pounds seed cotton.

In the five tests where 100 pounds muriate of potash were added to the farmer's treatment, the yield was increased from 940 pounds seed cotton to 1,368 pounds, or an average increase of 428 pounds seed cotton per acre.

In Table 8, all the forage crops and pasture demonstrations included in Tables 1 to 6 are averaged. In 34 tests, the farmer's treatment, usually superphosphate, superphosphate and lime, or basic slag, produced a yield of 12,437 pounds of green forage per acre. When potash was added to the farmer's treatment, the yield was increased to 19,121 pounds of green material. This summary shows an average increase of 6,684 pounds of green forage per acre resulting from the potash treatment.

In addition to the reports such as summarized above, a number of gen-

TABLE 8.—FORAGE CROPS AND PASTURES, A SUMMARY OF DEMONSTRATIONS IN TABLES 1 TO 6. THE FARMER'S TREATMENT WITH AND WITHOUT POTASH

Number Cases	Treatment	Green Forage	
		Yield Per Acre	Increase Due to Potash
34	Farmer's Treatment	12,437 lbs.	Check
	Farmer's Treatment Plus Potash	19,121 lbs.	6,684 lbs.

Demonstration No. 5 on wild winter peas was conducted on the J. M. Kimbrough farm. Plots received: Left, 250 lbs. superphosphate; center, 250 lbs. superphosphate and 100 lbs. 60 per cent muriate of potash; and right, 250 lbs. superphosphate and 300 lbs. muriate of potash.

eral reports were received. Typical of these reports are the following:

J. C. Taylor, County Agent, Decatur, Mississippi: "A. S. Burns used 1,000 pounds of your potash and 1 ton of his own. He used this potash (muriate) at the rate of 100 pounds per acre in plots, some having phosphate, some having lime, some basic slag, and some without any other fertilizer materials, and each plot where this was used was outstanding, more grazing than on any other spots compared. In fact, we feel that any farmer would be justified in adding potash to his pasture land. Another thing we checked on Mr. Burns' place was this: On cuts where he used potash, his lespedeza was greener; on cuts where no potash was used, the lespedeza had a yellowish color."

Mr. Taylor further states: "On Charles Williams' demonstration, he used 200 pounds of muriate on carpet grass and lespedeza pasture, one plot being one acre, one plot one-half acre, and the cows grazed up even on each place where he used this potash. Even though there had been lime and phosphate used on the pasture, there was a distinct line where the cows grazed the potash-treated plots, which was the most remarkable thing we observed. On his lespedeza demonstration, he had three plots. On one of these acres, 100 pounds of muriate, on one 200 pounds, on another no potash was used, but all had 500 pounds of basic slag per acre. We estimated as close as possible on his hay production and figured that where he used 200 pounds of muriate and 500 pounds basic slag, he must have made 4 to 4½ tons of some of the finest hay I have ever seen. Where he used 100 pounds muriate, the yield was 3½ tons; on the other (check), roughly, 2½ to 3 tons."

The chances are that the above estimates on hay production are a bit too high, but the comparison serves to show the results obtained from the potash.

A. G. Bennett, Assistant County Agent, Booneville, Mississippi, reports: "Potash on soybeans: Around 22 unit farmers used potash on soybeans and in practically every case we could tell quite a bit of difference, similar to the two reports that are enclosed. The potash especially paid off on the Mantachie soil. Potash on lespedeza:

There were no good check plots from potash where applied to lespedeza. In fact, in a number of cases the potash burned the lespedeza and there was no stand at all. This could be due to the dry weather as well as to being applied while the plants were wet. The potash was outstanding as a side-dressing to cotton on Paden soil. No weights were taken on this plot, but the people in the community all saw this difference and I am sure they will profit by this next year. We also had an outstanding demonstration on potash and lime applied under corn against lime by itself. No checks were made on this plot, however. The potash check plots on pasture were no good nor were any clippings made on the pasture demonstrations, due to the drought as well as over-grazing. In general, I think each unit farmer who used potash probably realizes the need of this material on most of his soils."

The potash used and referred to above by Mr. Bennett was manure salts donated for 22 Unit Farms last year. This material, if applied on lespedeza, or any other plant when wet, will kill the plants. This is probably what happened in the lespedeza tests mentioned above.

Geo. A. Mullendore, County Agent, Meadville, Mississippi, writes: "I have personally visited the farms of all the cooperators and have checked with them on their demonstrations, and do not believe that the results as shown on these forms quite represent the increase that they really received. It is interesting to note how many of their neighbors visited their farms during the season, most of whom never used potash in any form except in mixed fertilizers. As an example, one of our largest cotton farmers who generally makes 100 bales of cotton each year said: 'After seeing the results from potash I believe it is more essential than nitrogen, and I plan to use it on every acre of my crop land next year.' "

The demonstration yields referred to above were reported on a percentage increase basis, and the exact yields were not given. This accounts for the fact that they were not included in the summary. Many reports of this type were received. However, demonstrations of this type usually get the desired results in the communities where conducted.

Demonstration No. 13 was conducted on white clover pasture. The plot on the left received potash, lime, and superphosphate; on the right, lime and superphosphate only. Yield: Left, 12,196.8; Right, 8,058.6.

A group of farmers and agriculturists, during one of the tours of the demonstrations, inspect a field of wild winter peas.

Mississippi Crop and Pasture Production Program 1942-43

Name & Address of Farmer Soil	Crop	Fertilizer Treatment	Yield Per Acre Gr. Wt., Lbs.
1. C. V. Maxwell, Pickens, Miss. Terrace soil	Austrian Peas	500# Basic Slag	7,441
		500# Basic Slag 100# Muriate of Potash	14,247
2. B. E. Presley Pickens, Miss. Terrace soil	Vetch	250# Superphosphate 1000# Lime	9,256
		250# Superphosphate 1000# Lime 100# Muriate of potash	23,958
3. W. S. Pittman Winona, Miss. Terrace soil	Wild Winter Peas & Vetch	500# Basic Slag	11,107
		500# Basic Slag 100# Muriate of potash	16,226
4. H. W. Vandiver Cruger, Miss. Delta foothills	Wild Winter Peas & Vetch	No treatment	15,681
		100# Muriate of potash	28,749
5. J. M. Kimbrough Lexington, Miss. Terrace soil	Wild Winter Peas	250# Superphosphate	5,445
		250# Superphosphate 100# Muriate of potash	9,692
		250# Superphosphate 300# Muriate of potash	13,939
6. R. M. Branch Goodman, Miss. Terrace soil	Wild Winter Peas	250# Superphosphate 500# Lime	5,227
		250# Superphosphate 500# Lime 100# Muriate of potash	11,325

(*Turn to page* 45)

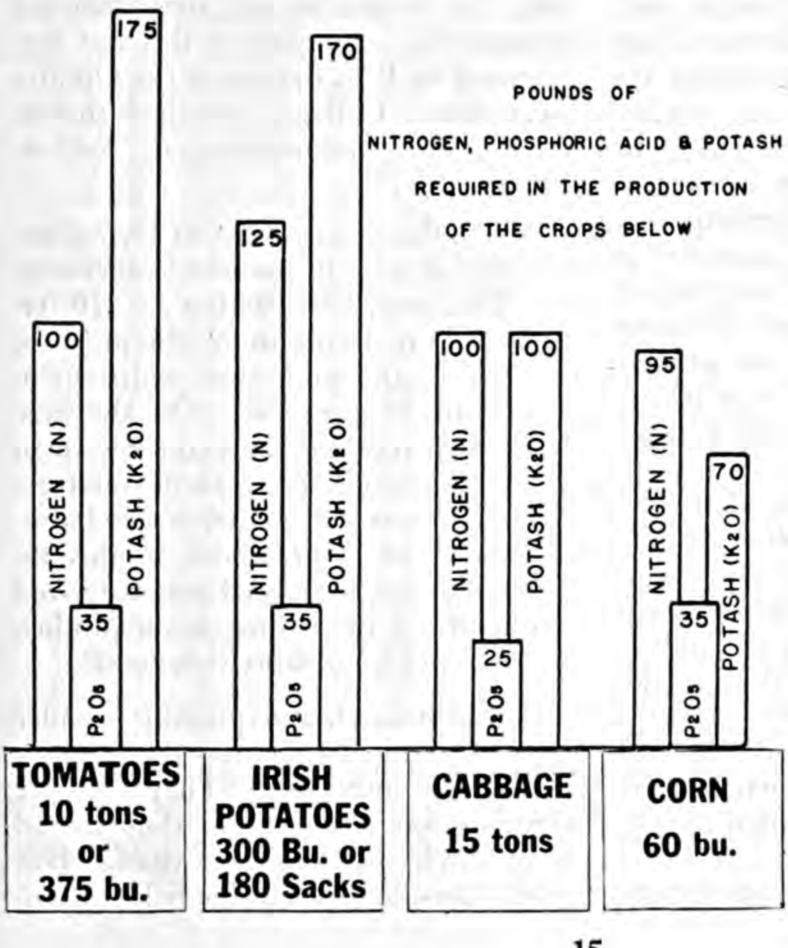
Growing Quality in Tomatoes

By E. K. Hampson
Hamilton, Ontario, Canada

A LITTLE boy when asked to define an elephant replied that he couldn't define it but he knew one when he saw it. Perhaps the term "quality" is just as difficult to define, but it is still easily recognized when encountered. Quality is usually a composite of several factors, some of which may be measured accurately by scientific devices. Others are indefinable and are not subject to scientific measurement.

But whether or not quality may be measured or defined, it is of paramount importance in the merchandising of food products. Quality must be grown. It can not be added later, as one might add seasoning to soup. A processor can not make a high-grade product from a low-grade article. It is true, of course, that by faulty processing high-quality fruit or vegetables may end up as low-grade goods.

How may high-quality tomatoes be produced? First, growers should aim at high yields per acre. Seldom, if ever, are low yields associated with high quality, and in most cases high yields and good quality are found to be complementary. Hester of New Jersey reports that of 108 growers delivering tomatoes to a large processor, 53 delivered 10 tons or more per acre. These graded an average of 74 per cent U. S. No. 1, 25 per cent U. S. No. 2, and 1 per cent culls. The remaining 55 growers delivered 5 tons or less per acre, and the average grade was 61 per cent U. S. No. 1, 36 per cent U. S. No. 2 and 3, and 3 per cent culls.



There are many factors to take into account in getting good yields. Climate, soil, cultural methods, and disease preventions are important. The following comments, however, are intended to deal particularly with the nutrition of the crop, a factor which every grower realizes is a very important one.

Briefly, the tomato crop, or any other crop for that matter, should be fed what it needs—when it needs it. The tomato is a heavy feeder. That nitrogen, phosphates, and potash are

100 lbs. 11-48-0, 37 lbs. muriate of potash. **Check Plot.** **Same as Plot 1 plus 325 lbs. muriate of potash.**
Test Conducted by Chemistry Department, Ontario Agricultural College, 1938.

needed in substantial amounts is shown by Chart 1.

There are few crops requiring greater amounts of plant food than tomatoes, if high yields are expected. This is particularly true of its nitrogen and potash needs. These two elements are somewhat opposite in their effects on quality, especially if they are out of balance. Excess nitrogen produces stalk and foliage, somewhat at the expense of well-ripened, high-quality fruit. Moreover, delayed maturity is apt to accompany too great supplies of nitrogen. On the other hand, adequate nitrogen must be provided for normal development of foliage, for it is in the leaves that the sugars and starches are metabolized.

Potash is often called the "quality" factor in fruit and vegetables. Resistance to disease, reduction in prevalence of "leather-end," more uniform shape of fruit, higher ascorbic acid content, and high yields are associated with adequate potash feeding. Tomatoes are potash-hungry plants and soils must be naturally high in potash or potash must be added if good yields of high-quality fruit are obtained.

The influence of potash on tomato quality was demonstrated on the Smart Brothers farm at Collingwood, Ontario, in 1938. Not only were yields improved by addition of potash, but of equal significance was the reduction of "leather-end," as shown in the accompanying photograph. A report of this test was prepared by R. J. Bryden of the Ontario Agricultural College, who had this to say respecting the incidence of "leather-end":

> "On this 40-acre field in 1937 there was at least 30 per cent leather-end. This year, 1938, with a 2-12-10 fertilizer replacing the 2-12-6 analysis, the leather-end was reduced to about 15 per cent. On the acre which received the extra potash in addition to the 2-12-10 mixture, there was no leather-end whatsoever. In other words, in this instance the additional potash proved its worth in assisting in the production of high-quality tomatoes."

Phosphates, while required in smaller amounts than either nitrogen or potash, are no less important. They promote vigorous root growth and thus should be in ample supply for the young plant when transplanted into the field. Phosphates in the transplanting solution, as well as fertilizers high in phosphates placed in bands near the plant, have been found very effective. Since most soils fix a portion of the phosphates into insoluble forms, more than is actually required by the plant should be applied.

The amounts of nitrogen, phosphates, and potash required in feeding the tomato crop will depend on: (a) the native fertility of the soil; (b) the amount of manure applied; (c) the quantity of residue or fertilized cover crop plowed down; and (d) the yield of tomatoes expected.

Properly conducted soil tests offer cheap and effective guidance in choosing the kind and amounts of fertilizer to employ.

When do tomato plants feed? The answer is shown in Chart 2.

Most of the nutrients are taken in by the plant during the third month of growth. At this stage the root system is well developed, both laterally and in depth. Thus, it seems reasonable that the plant food should be in the area of greatest root development. This thought has led to experiments in which the bulk of the fertilizer has been placed at greater depth than was formerly practiced. Ordinarily this deeper placement is accomplished by means of a device attached to the tractor-plow, which places the fertilizer in a band on the bottom of each furrow.

Very good results have been reported from this method of applying plant food for tomatoes, corn, and several other crops. Some of the benefits of this method of application might be enumerated:

(1) Applied in this way the fertilizer is always in a moisture area and even in dry weather the plants are able to absorb their nutrients, thus reducing drouth damage.

(2) Greater amounts of fertilizer may be employed without damage to the plants.

(3) Fixation of phosphates is reduced since there is little mixing of the soil with the phosphate materials.

(4) Both yield and quality of tomatoes have been materially enhanced over those resulting from the conventional method of fertilizer application.

Fertilizers applied in this way do not entirely take the place of shallower applications at planting time. About three-fourths of the fertilizer may be placed in the bottom of the furrow and the remainder applied in the conventional way. The surface application should be moderate in nitrogen and potash, but high in phosphate, while that placed deeper should be high in both nitrogen and potash and medium in phosphate.

In low organic soils a 10-10-10 for plowing down at rates varying from 500 to 1,000 pounds per acre has been employed to good advantage. In the higher organic soils, or where manure has been applied, an 0-10-10 or a 5-10-10, at the same rates per acre, should give good returns. These rates may

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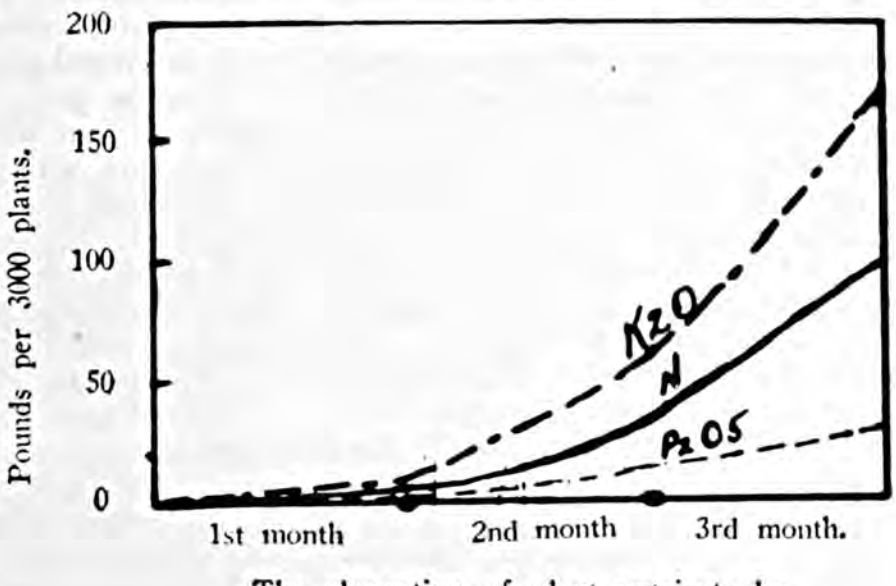


The absorption of plant nutrients by 3000 tomato plants at various growth stages.

An unusual view of Monticello on Bicentennial Day.

Thomas Jefferson Far-Sighted Farmer

By C. B. Sherman

U. S. Department of Agriculture, Washington, D. C.

TWO HUNDRED YEARS after Thomas Jefferson was born we are waking up to the truth that as a farmer he was fully a century ahead of his time. And it was as a farmer that he thought of himself; he wrote this again and again. His thoughts frequently turned to farming wherever he might be and whatever he might be doing—whether of national or of international import. In his retirement after being Secretary of State, an eminent foreigner who was traveling in this country wrote of finding Jefferson personally supervising the harvesting on his farm. "I return to farming with an ardor I scarcely knew in my youth," he wrote at that time.

Not only was Jefferson a farmer of far-seeing practices but he made suggestions, outlined plans, recommended or urged procedures and facilities to improve farms and country life which even now, in one guise or another, agricultural leaders are still trying to put over.

Beginning with his own farm, his actual practices were amazingly advanced. His experimental and inventive genius was frequently at work here. For rural communities he saw practical possibilities for rounded lives if certain feasible measures were taken. In foreign lands he was interested in plants, animals, and methods that had promise of American use. No matter how absorbed in national and world affairs and policies, he carried in the back of his mind the needs and potentialities of his farm at Monticello and American rural life in general.

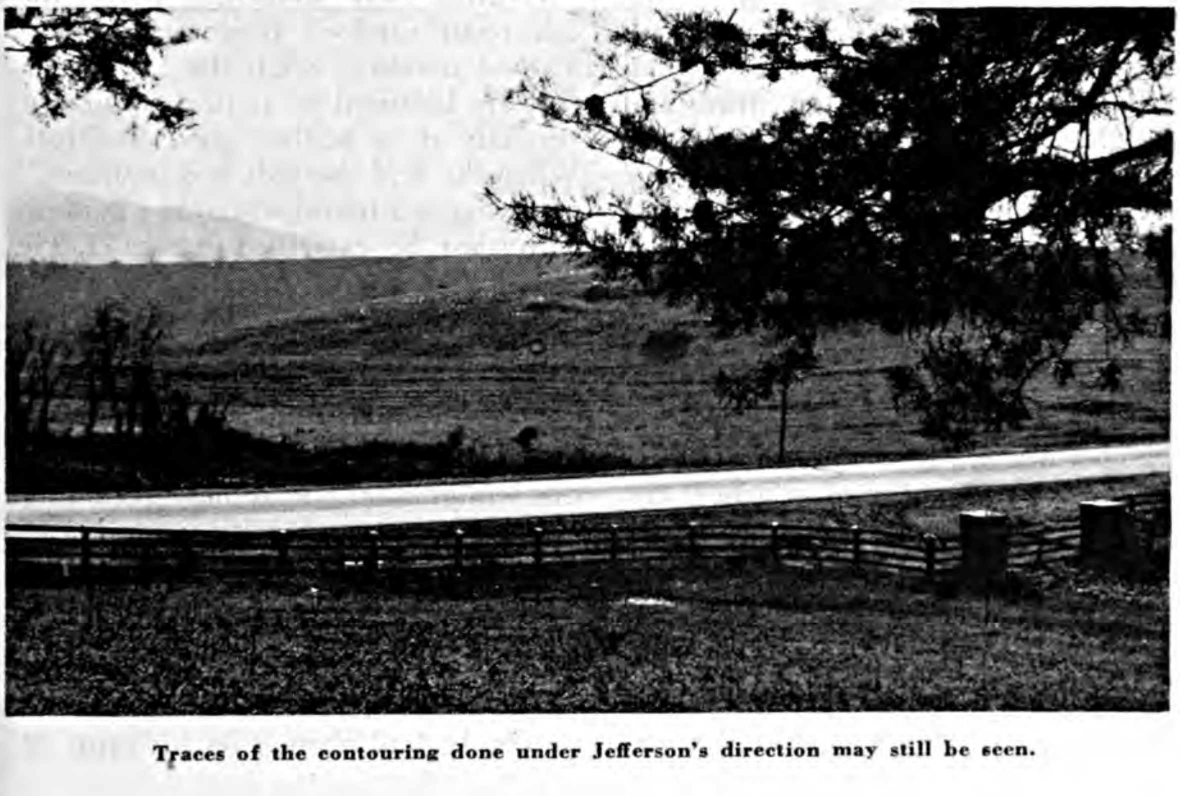
All these things are clearly demonstrated in his letters, farm and garden books, records, and papers, in his own handwriting. They have been available to scholars for a long time. When this bicentennial year is over, perhaps the gist of them will be known to all serious agricultural students and local leaders.

Fundamental to good farming, he believed, was care of the soil. He experimented with horizontal or contour plowing to keep the red soil of his Albemarle County farms in place. It was naturally given to gullying during heavy rains. In 1817 he wrote minutely of just how this kind of plowing on hillsides was done and why. But for those only generally interested: "We now plow horizontally following the curvature of the hills and hollows on dead level, however crooked the lines may be. Every furrow thus acts as a reservoir to receive and retain the waters; scarcely an ounce of soil is now carried away. . . In point of beauty nothing can exceed that of our waving lines and rows winding along the face of our hills and valleys."

No wonder the present local is called the Thomas Jefferson Soil Conservation District. Operating on democratic principles, the members formulate their own conservation ordinances that have the force and effect of law. The will of the majority of farmers in the 1940's now sets forms of land use and cultivation that are not unlike those practiced by Jefferson—but by few others—100 years ago. Remains of some of his terracing are still found even though woods have now grown over them.

Crop rotation was practiced at Monticello. After 10 years of absence in the service of his country, he returned to his beloved fields to find that "the ravages of the overseers have brought on them a degree of degradation far beyond what I had expected." He worked out and began a rotation that would take from three to six years to get completely underway. For it he divided his farm into six fields. The rotation was: first year, wheat; second year, corn, potatoes, and peas; third, rye or wheat; fourth and fifth, clover; sixth, folding and buckwheat dressings.

In easier phrase he wrote to George Washington, "Good husbandry with us consists in abandoning Indian corn and tobacco, tending small grain, some red clover following, and endeavoring to have, while the lands are at rest, a spon-



Traces of the contouring done under Jefferson's direction may still be seen.

This terracing was done on his farm during Jefferson's time.

taneous cover of white clover. I do not present this as a culture judicious in itself, but as good in comparison with what most people there pursue."

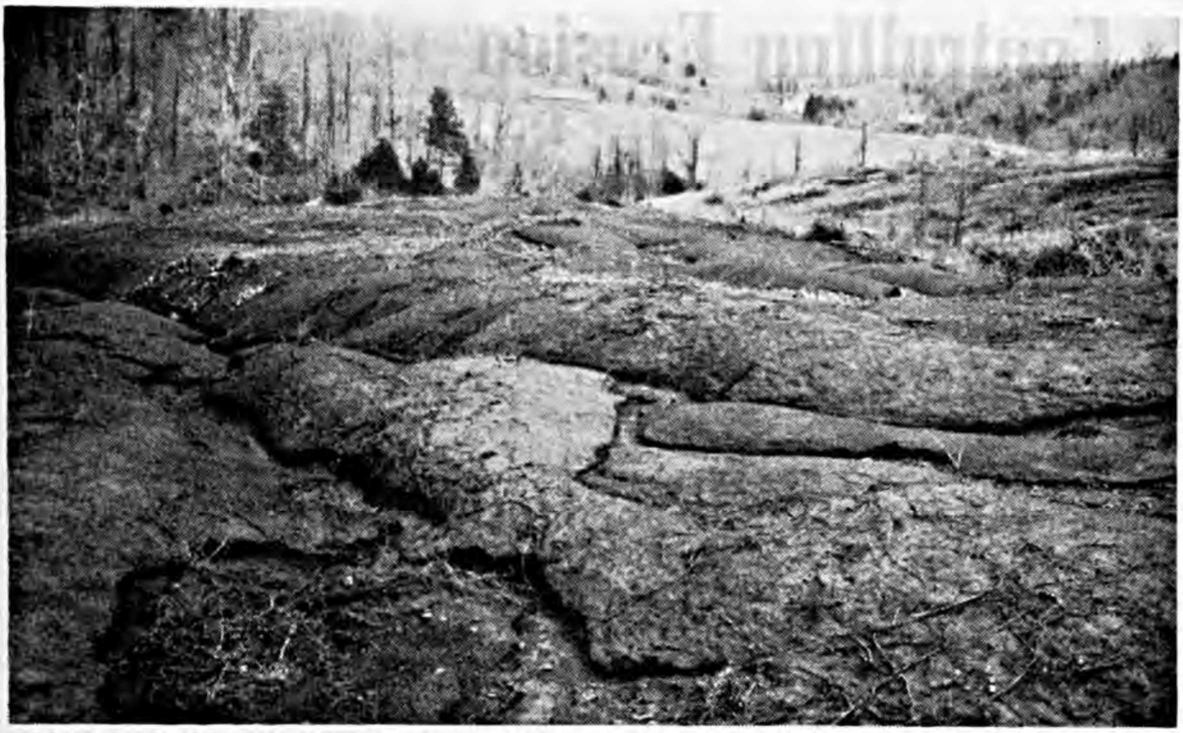
Jefferson was concerned about plant food. Dung was studied and is the subject of frequent notation. At one time he advocates "manures, plaster, green-dressings, fallows, and other means of ameliorating the soil." "Before folding, the ground should be coultered and covered with straw, then folded one week, and the straw and dung immediately turned in with the great plough." Exact notes were made as to quantity of dung to be expected under specified conditions and the best methods of storing and applying it.

"As it is not to be believed that spontaneous herbage is the only or best covering during rest, so may we expect that a substitute for it may be found which will yield profitable crops. Such perhaps are clover, peas, vetches, etc. A rotation may then be found, which by giving time for the slow influence of the atmosphere, will keep the soil in a constant signal state of fertility. But the advantage of manuring is that it will do more in one year than the atmosphere would require several years to do, and consequently enables you so much oftener to take exhausting crops from the soil."

Marl came in for its share of attention and he was especially interested in the broom which flourished at Monticello, because he believed it absorbed a fertility from the air and carried it to the soil.

Gypsum was studied: "When the calcareous earth is predominant it is a good manure, when the 2. ingredients are balanced so as to neutralize it perfectly it is neither good nor bad. When the acid abounds it is injurious." Speaking of a friend who was a gypsum enthusiast he explained it so: "1. He began poor, and has made himself tolerably rich by his farming alone. 2. The County of Loudon, in which he lives, had been so exhausted and wasted by bad husbandry that it began to depopulate . . . Binns' success has stopped that emigration. It is now becoming one of the most productive counties of the State, and the price given for the lands is multiplied manifold."

At one time or another Jefferson planted and raised all the practicable grains. In one year, according to accounts, he had planted on his farm 32



Soil in Albemarle County is given to erosion when neglected.

vegetables and 22 crops. He liked to bring in new varieties or crops, try them out, and report on them. If his location was not suitable he had them tried elsewhere—by William Drayton in South Carolina, for instance. Among the many thus experimented with were millet, upland rice, Siberian barley, and vetch. Various berries and melons were also cultivated experimentally. Useful trees were experimented with, as the cork oak and sugar maples. He tested seed for germination long before this practice was usual. His garden was one of his great delights.

When representing this country abroad he sent back seeds, cuttings, and observations on many subjects including vineyards, fruit cultivation (especially the olive), rice milling, production of silk, and manufacture of flour. He wrote that his curiosity on the fields and farms prompted the foreigners to consider him either very foolish or very wise.

He worked for the protection of the crops he planted. He brought in or developed hardy varieties to resist pests. He sowed late if that would get ahead of them. He burned stubble to destroy the Hessian fly and he urged a study of the life history of this fly the better to understand and combat it.

His observations were exact and were diligently recorded: "On an average of seven years I have found our snows amount in the whole to fifteen inches depth, and to cover the ground fifteen days; these, with the rains, give us four feet of water in the year."

Anyone who has visited Monticello is familiar with Jefferson's inventive turn of mind. Most of his inventions were of a decidedly practical nature and he took great pains to make them generally available.

In farm machinery his improvement of the moldboard plow is best known. His drawings and descriptions of the changes and his directions for building the improved plow are most explicit. He published regarding the improved moldboard in this country and in France and Great Britain, and urged further improvements. His writings had great weight. He worked in his basement shop to improve many pieces of equipment including the seed drill, the hemp brake, and the threshing machine.

Jefferson was interested in having

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Controlling Erosion In South Carolina

By Jack Wooten

Assistant Director of Information, Farm Credit Administration, Columbia, S. C.

DURING the past two years South Carolina has produced record crops. It has taken work and plenty of it to overreach its goals, but it has taken something else—care of the soil.

There are certain sections in the Palmetto State which are very hilly. The land washes easily. And when the rains come, the surface of the earth is worn away and producing soil is gone forever. At long last, rich land becomes poor and useless. If the farmer remains on this type of land, he ceases to be a farmer and becomes a man of drudgery who does well to eke out a bare living.

In many instances the farmer moves to another farm, leaving the badly eroded place to its fate—an abandoned piece of land so worthless that it becomes idle land, completely unproductive. Just as pathetic as a man with brains, talent, and personality who throws his life away by sitting around the village store, whittling on a piece of wood and letting the chips fall on the ground to be mashed in the sand or clay or raked up and burned!

Had it not been for erosion control measures practiced by the South Carolina farmers during the past decade, the record food and feed crops so essential to the war effort would never have been attained. Soldiers need much more nourishment while they are training and fighting for the freedom of the earth. Those on the home front require more meat and vegetables, too. With the increase in livestock production throughout the United States, more feed crops are necessary. These things

Dr. Bennett observes cattle grazing on a 3-year old stand of kudzu. This land was very steep, rocky, and badly eroded.

A permanent strip of lespedeza sericea along the critical portion of a cultivated field and next to the woodland edge.

simply cannot be realized on eroded land.

There has been much progress in conservation of the soil through conquering this devastating erosion. Recently, H. H. Bennett, Chief of the U. S. Soil Conservation Service, whose organization has been a Godsend to the farmers of this country, declared that the outlook for America's productive cropland is brighter today than it has been for generations. "But," he warned, "we can still lose the fight against soil erosion and exhaustion unless we apply the principles of good land use and modern agricultural methods to our farming operations."

He was speaking for South Carolina, as well as the rest of the nation. In his interview he drew a comparison between farmers who exploit and neglect their land and industrial firms which fail to keep their buildings and equipment in repair.

"Everybody knows," he said, "that a business corporation which operated haphazardly wouldn't be in business very long. The machinery would soon wear out. Soil wears out, too—the humus and the plant nutrients are exhausted by over-cropping. Erosion, as a result of improper farming methods, washes away millions of tons of top soil every year."

One trouble with South Carolina farmers years ago was that they lacked full understanding as to what their land resources were. Terracing was unknown to many of them. They did not know the meaning of crop rotations. Year after year cotton was planted on the same land. Soil-building crops (with the possible exception of cowpeas) were something they had heard about but had never planted. Kudzu, which is now recognized as one of the best perennials to stop erosion, was just a vine that was used to run up a trellis to shade the front porch or to hang unmajestically on an outhouse. They had seen volunteer common lespedeza in the pastures, but had looked on it as just another grass. All grasses were common enemies, not the friends a few soil conservation farmers considered them to be. They did not pay any attention to the control of erosion by water. It was just something that had to be. It was God's will that the rains came and washed their top soil away. It was Providence who willed that their productive land should be interspersed

These loblolly pines were planted in 1935 on steep and badly eroded land. Dr. Bennett is measuring a tree which is six inches in diameter.

with unsightly gullies—narrow ravines which remained after the good earth was gone forever.

Tractor farming was impossible under these conditions. Other farm machinery was useless. About the only thing that could be used to cultivate this badly eroded land was the plow, and on many farms even this was dangerous to both the man and his mule.

Even though this farm machinery could have been used advantageously, farmers on this eroded land could not afford to buy it. How could they when so much of their productive soil had been washed away?

But by the time World War II had started thousands of farmers in South Carolina were not handicapped by eroded soil. They had remedied the situation. They had learned how to maintain this soil. They had increased crop yields of food and other important crops. They had found out how to save themselves time, labor, and money through conservation farming.

During the last war farmers did not pay any attention to soil conservation methods. When the cry for more food reached their ears, they got out and started planting the necessary crops on just any kind of land. They cleared their woods, dug up the stumps, and unmindful of building up the soil, planted crops which yielded very little in proportion to the amount of time and money they put into cultivating the land. As a result their farms began to wash away. The trees, which had served as a bulwark for these farms from the water, were gone. Nothing was left to hold back the flow which came through and washed their land away.

Production during World War II is different. Over a period of years the erosion has been stopped. Contour and strip-crop farming have helped to improve the soil. Land has become more productive through the planting of soil-building crops. By learning what their land resources were and what was needed to be done to protect them against abuse and how to do it resulted in the record crops which have been produced since Pearl Harbor.

What are some of the things which have been done to stop this mass erosion and improve the land so that our farmers in the Palmetto State are able to do their part in producing so much food to help in the war effort, and, at the same time, keep their farms in a high state of cultivation so that they can continue to produce an abundance of food and feed in the postwar period?

You've probably heard the antiquated joke about the man biting the dog. If a dog bites a man, nobody thinks very much about it, unless the canine has hydrophobia; but if the man bites the dog, then it is news. Well, that's comparable to what really happened in Lee and Kershaw counties, South Carolina.

It all came about when many changes took place on farms in this area as a result of a soil conservation and "stop that erosion" program. Back there, not so many years ago, cotton farmers were spending money, toiling from sun to sun, and losing plenty of sleep fighting grass. And then through the efforts of the Soil Conservation Districts, these folks who had been at war with grass for a lifetime actually purchased 20 tons of grass seed. That was even more news than a man biting a dog, and it so happened that these farmers did not bite off more than they could chew!

Purchase of the grass seed was just the beginning. These same farmers—158 in number—prepared the land, limed and fertilized it well before sowing the seed.

Idle land was mentioned earlier in this article. Here is a striking example of how it was put into production to aid in the nation's Food-for-Freedom program. The seed purchased by the farmers was Dallis grass, and it was mixed with white Dutch clover and annual lespedeza before being sown for permanent pasture on low, moist land. This land, for the most part, had been idle because it would not grow ordinary crops of cotton, corn, and grain. The proof of the pudding that this practice was successful lies in the fact that at the present time cattle are grazing on these pastures—cattle that necessarily would have been placed on land suitable for food production. Meat is greatly needed during these war times, and every acre of idle land put into pastures will help tremendously in meeting this demand.

Another change on the farms in these two counties and the 44 others in South Carolina is the switch from "straight-row" to "crooked-row" farming. Here again land erosion met a powerful offense with which it could not compete. This "crooked-row" or contour farming took place on the more sloping lands after terraces had been built by the farmers on the terrace lines surveyed by the Soil Conservation Districts.

In all sections of the State two perennials are growing regularly on farms. These are kudzu and lespedeza sericea. Both of these are used for the production of hay or as a grazing crop and are also very effective in controlling erosion on steep areas. Kudzu is also a great crop for bringing marginal land into production. On the average eroded farm, with proper land preparation, fertilization, and cultivation, this takes around three years. In the case of land where the gullies are deep and wide and where the acreage seems practically hopeless, it often takes six to ten years to get it to the point where it can be used for some form of production.

The value of both kudzu and sericea

Sericea lespedeza hay is being raked after it has partially cured. Note the arrangement of permanent strips.

lespedeza was proved by observations made last June at the Southern Piedmont Experiment Station at Watkinsville, Georgia. During the month the rainfall totaled 8.59 inches on the 11 per cent slope plots on Cecil clay (red) loam, where the run-off for fourth-year kudzu amounted to only .8 per cent and soil losses none. For fourth-year sericea the run-off was 7.9 per cent and soil losses .04 tons per acre. For fourth-year volunteer Kobe lespedeza, the run-off was 11.6 per cent and soil .33 of a ton per acre. For first-year Kobe lespedeza following oats, 41.9 per cent run-off was noted and 3.01 tons of soil per acre were lost. After three years of Kobe lespedeza, stubble mulch turned under, the run-off was 43.4 per cent and soil losses were 12.9 tons per acre. It was also observed that where cotton had been planted for four years in succession, the run-off was 43.1 per cent and soil losses were 15.32 tons per acre. One can readily see from these figures how these two perennials "hold that line against erosion and soil losses."

Rotations and Cover Crops

Better rotations with full use of cover crops such as Austrian winter peas, annual lespedezas (Kobe, Korean, and common), crotalaria, oats, rye, and vetch have played a most important part in conservation farming. The plantings of these crops have not only enriched the land but have provided a real incentive for farmers to keep down erosion so that their land may be as productive as possible. The more they produce, the higher will be the income from their endeavors. Farming is hard work and the man who uses conservation measures according to the topography and soil types on his farm deserves to make a decent income.

Fertilizers for poor land, as for good land, cost money. But if soil-buiding crops are planted and advantageously supplied with lime, phosphate, and potash, they will cut down the nitrogen bill and at the same time save this necessary ingredient for abundant production for war and civilian needs.

According to R. Y. Bailey, Chief of the Regional Agronomy Division of the Soil Conservation Service, Spartanburg, South Carolina, fertilization of perennial legumes has played a very important part in their use.

"Although we have never had any very striking results from the application of lime for either sericea or kudzu, most of us feel that sufficient lime to supply calcium and to maintain a soil reaction of 5.5 or better will be beneficial. Both of these crops have responded to application of phosphate and, on many soils, potash. We usually recommend approximately 600 pounds of superphosphate per acre when sericea is planted and about the same amount as a broadcast application in the early spring of the third growing season of kudzu. Of course, we recommend liberal fertilizing of kudzu in the rows the first year. Where the row spacing that we recommend is used, 200 pounds of superphosphate or complete fertilizer and a ton or two of manure per acre give a very high concentration in the rows.

"On soils where potash is needed by cotton or other similar crops, I believe that at least 100 pounds of muriate of potash per acre should be applied along with 600 pounds of superphosphate for both sericea and kudzu.

"We do not know exactly what maintenance requirements of these crops will be. We have generally recommended that the fertilizer treatment given at planting time for sericea and that given kudzu at the beginning of the third growing season be repeated about once every three years."

In the face of necessary curtailments, farmers are being urged to carefully plan their farm programs and to seek the guidance of those who have studied proper conservation measures. Farmers who have used these practices have found from experience that soil conservation measures, properly applied, increase agricultural production and reflect themselves in a sound, productive program.

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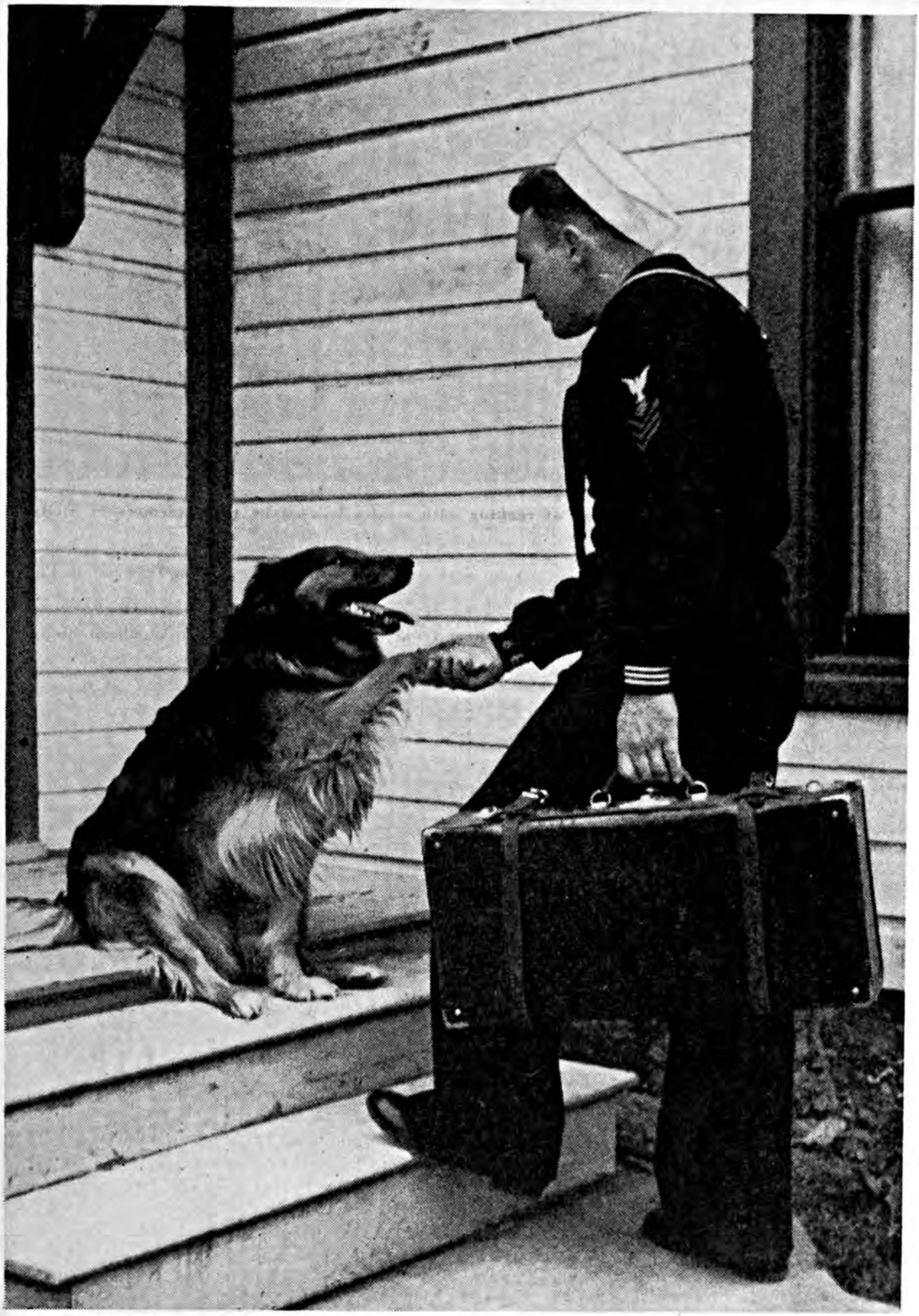
PICTORIAL

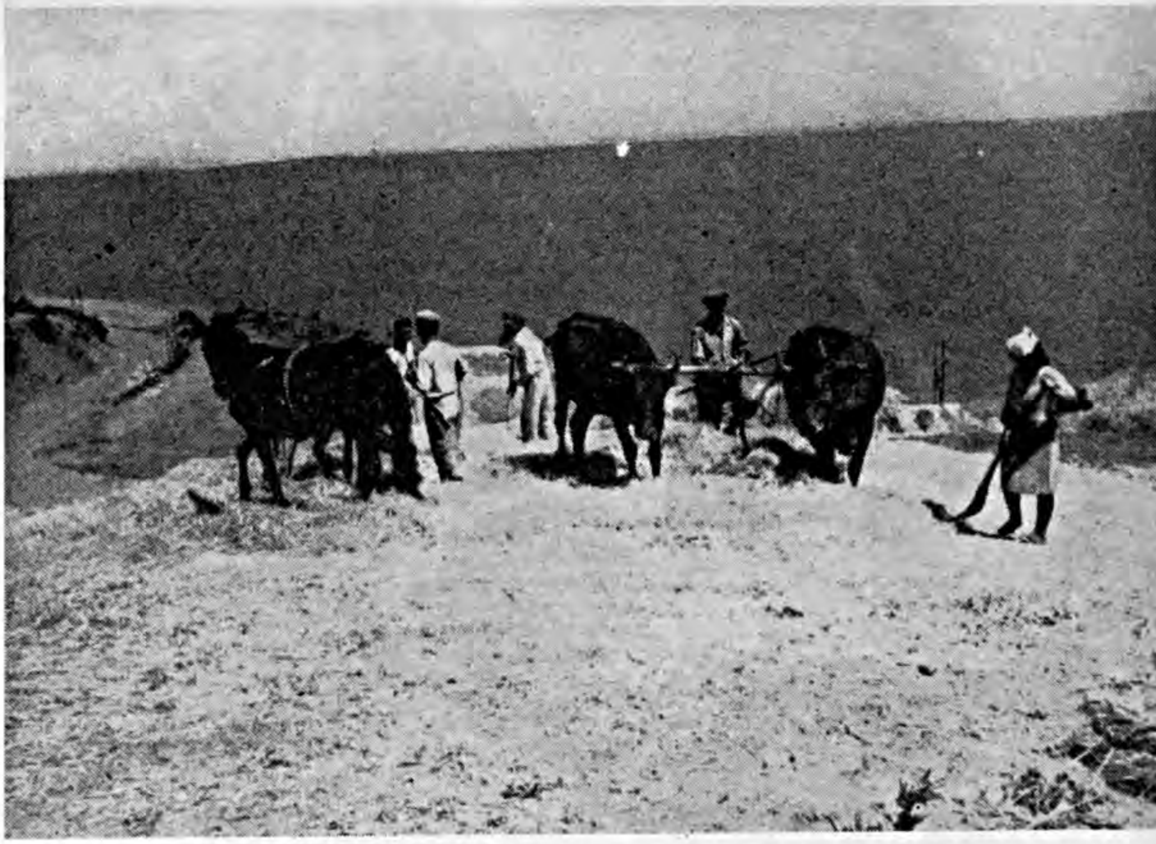


No welcome could be more sincere.

Above: The back-breaking method of reaping with sickles is used by these farmers in Sicily.

Official Office of War Information Photos

Below: Livestock are used to trample the wheat from the chaff on a farm in northern Sicily.



Above: The hand method is difficult, but it gets results. Here the farmers flail the wheat.

Official Office of War Information Photos

Below: In northwestern Sicily the faithful mule is used to carry wheat to the threshers.

Above: This Sicilian farmer was very fortunate. He had a threshing machine to help his workers.

Official Office of War Information Photos

Below: Unmindful of the loads they carry, happy Sicilians start home with the ground grain.

The Editors Talk

Thanksgiving 1944

"There is a tradition that in the planting of New England, the first settlers met with many difficulties and hardships, as is generally the case when a civilized people attempt to establish themselves in a wilderness country.

"Being piously disposed, they sought relief from heaven by laying their wants and distresses before the Lord, in frequent set days of fasting and prayer. Constant meditation and discourse on these subjects kept their minds gloomy and discontented; and like the children of Israel, there were many disposed to return to that Egypt which persecution had induced them to abandon.

"At length, when it was proposed in the assembly to proclaim another fast, a farmer of plain sense rose, and remarked, that the inconveniences they suffered, and concerning which they had so often wearied heaven with their complaints, were not so great as they might have expected, and were diminishing every day, as the colony strengthened; that the earth began to reward their labor, and to furnish liberally for their subsistence; and above all, that they were there in the full enjoyment of liberty, civil and religious.

"He, therefore, thought it would be more becoming the gratitude they owed to the Divine Being, if, instead of a fast, they should proclaim a thanksgiving. His advice was taken, and from that day to this they have, in every year, observed circumstances of public felicity sufficient to furnish employment for a Thanksgiving Day, which is therefore constantly ordered and religiously observed."

Thus wrote Benjamin Franklin more than 150 years ago. The origin and purpose of the day so ably recounted by Franklin will be a sound basis for the reflections with which we approach Thanksgiving 1944.

Thanksgiving is a personal day and as such will be celebrated by each of us in appreciation of our individual blessings. But our minds will not stop there, for no person is sufficient unto himself. Our thoughts will go on to include our home, our communities, our country, and finally the other countries of the world. There must be an added solemnity this year, but lest there be despair over some of the things which will come to mind, let us not forget to hark back to the first Thanksgiving, held by a people in the midst of infinite hardships, but with a faith in themselves and in their strength.

Let us not forget that the earth has again rewarded our labor, to furnish liberally not only for our subsistence but for the subsistence of the oppressed peoples of the world. But most of all, let us not forget that our future is still ours to plan.

"For the preservation of our way of life from the threat of destruction; for the unity of spirit which has kept our Nation strong; for our abiding faith in freedom; and for the promise of an enduring peace, we should lift up our hearts in thanksgiving," said President Roosevelt in his proclamation of Thanksgiving Day, 1944.

Dr. H. H. Zimmerley

The passing of an outstanding agricultural scientist is always a distinct loss, not only to the nation in which he lived, but to the betterment of world civilization, for the results of agricultural research are available for the benefit of all peoples. Particularly will this loss be felt in the sudden death of Dr. H. H. Zimmerley, Director of the Virginia Truck Experiment Station, Norfolk, Virginia, on October 15, 1944.

Dr. Zimmerley was internationally known for his contributions in a field of science which World War II has lifted out of a classification of general interest into one of prominence—the relationship of soils to human nutrition. This country, with its history of more than ample food supplies, was startled during the first days of selective service at the number of rejections attributed to malnutrition. Impressed upon us as never before has been the fact that physical welfare depends not only upon the kinds of food we eat, but upon the soil and husbandry utilized in the growing of such foods. In the refinements of the study of nutrition which will be emphasized in research to come, the foresighted work of Dr. Zimmerley on such problems as the influence of soil reaction on the growth and chemical composition of certain vegetable crops, the nutrition of vegetable crops, and crop breeding will prove of inestimable value.

Scientific research is one thing. Putting its findings to practical use is another. Dr. Zimmerley was widely known for his ability to adapt scientific knowledge of soils and vegetable growing to practical conditions. He probably did more to bring these two phases of our agriculture to the growers than any other man in the world. Who can place a value on this service, particularly in the light of the success with which this war's huge food production goals have been met?

Only 54 years of age, Dr. Zimmerley could ill be spared at this time. His imprint on the advancement of agriculture will prove a lasting memorial.

America

"The land of America is covered with the aftermath of the corn harvest. Shocks follow the sweep and curve of the hills, the dip of the valleys. Stalks stand like spectres upon the fields. A European, homesick for his own country, thinks of vineyards or little farms. An American, lonely in a foreign land, sees fields of corn. He sees pale rows across the earth in spring, and solid stands of corn in summer; but most of all he sees dim gold shocks upon his homeland in the fall. He sees bright little yellow pools at the foot of these shabby shocks, as solitary figures husk the corn in the first cold of winter. He sees corn-filled cribs, and ears in the shelter of barns. And seeing all these, he will hold fast to them; for he knows these will endure, when empires have fallen and the quiet of the battlefield is broken only by ghosts."

—CLARE LEIGHTON, in *Give Us This Day.* Reynal & Hitchcock.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....
June	20.16	49.2	125.0	233.0	115.0	143.0	15.00	52.80	....
July	20.32	45.0	138.0	230.0	117.0	139.0	13.90	53.00	....
August	20.15	39.3	159.0	258.0	117.0	135.0	14.30	53.20	....
September	21.02	42.9	147.0	219.0	116.0	135.0	14.70	52.30	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191
April	163	229	197	261	177	167	136	243	184
May	160	358	193	269	177	167	135	243	217
June	163	473	180	266	177	163	126	245	245
July	164	433	198	263	181	158	116	245	236
August	163	378	228	295	181	153	120	246	253
September	170	413	211	250	179	153	123	242	239

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.61	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap, dried	Fish scrap, wet	Tankage	Blood
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1937	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	217	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	......	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
1943								
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....
November	.640	2.00	5.90	.535	.797	26.00	.200	....
December	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....
April	.640	2.00	6.10	.535	.797	26.00	.200	....
May	.640	2.00	6.10	.535	.797	26.00	.200	....
June	.640	2.00	6.10	.471	.701	22.88	.176	....
July	.640	2.00	6.10	.503	.797	26.00	.188	....
August	.640	2.00	6.10	.503	.797	26.00	.188	....
September	.640	2.00	6.10	.503	.797	26.00	.188	....

Index Numbers (1910-14 = 100)

	Superphosphate	Florida	Tennessee	Muriate	Sulphate of potash	Sulphate of potash magnesia	Manure salts	Kainit
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943								
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....
November	119	55	121	75	84	108	83	....
December	119	55	125	75	84	108	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....
April	119	55	125	75	84	108	83	....
May	119	55	125	75	84	108	83	....
June	119	55	125	66	74	95	80	....
July	119	55	125	70	84	108	82	....
August	119	55	125	70	84	108	82	....
September	119	55	125	70	84	108	82	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
1943								
September	193	169	150	94	57	160	119	74
October	192	170	150	95	57	160	119	78
November	194	171	150	95	57	160	119	78
December	196	173	150	96	57	171	119	78
1944								
January	196	174	150	96	57	171	119	78
February	195	175	151	96	57	171	119	78
March	196	175	151	97	57	173	119	78
April	196	175	152	96	57	172	119	78
May	194	175	152	97	57	175	119	78
June	193	176	151	95	57	175	119	69
July	192	176	152	96	57	175	119	74
August	193	176	151	96	57	175	119	74
September	192	176	151	96	57	175	119	74

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

REVIEWS

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

Fertilizer

"Commercial Fertilizers Registrants to Date for the Fiscal Year Ending June 30, 45," Dept. of Agr., Sacramento, Calif., FM-91, Sept. 25, 1944.

"Agricultural Minerals Registrants to Date for the Fiscal Year Ending June 30, 1945," Dept. of Agr., Sacramento, Calif., FM-92, Sept. 25, 1944.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended June 30, 1944," Dept. of Agr., Sacramento, Calif., Sept. 29, 1944.

"Adjusting Plow-Under Fertilizer Attachment to Apply the Proper Amount of Fertilizer," Dept. of Agron., Purdue Univ., Lafayette, Ind., Mimeo. 55, R. R. Mulvey and A. J. Ohlrogge.

"Phosphates and Their Use," Agron. Dept., Purdue Univ., Lafayette, Ind., Agron. Mimeo 57.

"Effects of Fall Application of Nitrogen Fertilizer on the Soluble Nitrogen and Phosphate Phosphorus Content of Dormant Peach Twigs," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 457, April 1944, C. S. Waltman.

"The Value of Fertilizer for Corn," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 120, May 1944, Russell Coleman.

"Fertilizer Inspection, Analysis and Use, 1943," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 480, Aug. 1944, L. D. Haigh, W. A. Albrecht, M. F. Miller, E. W. Cown, and J. H. Long.

"Fertilizing Commercial Blueberry Fields in New Jersey," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 483, May 1944, Charles A. Doehlert.

"Tonnage Report July 1, 1943 through June 30, 1944," Dept. of Fert. Insp. & Analysis, Clemson Agr. College, Clemson, S. C., H. J. Webb.

"Some Factors Affecting the Utilization of Phosphoric Acid in Soils by Plants in Pot Experiments," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., Bul. 647, April 1944, G. S. Fraps and J. F. Fudge.

"Virginia's Field and Truck Crop Fertilizer Recommendations," Agr. Ext. Serv., Blacksburg, Va., Cir. E-341 (Rev.), Aug. 1944.

Soils

"Physical Land Conditions in Polk County, Georgia," U.S.D.A., Washington, D. C., Phys. Land Survey 34, 1944, J. H. Winsor and C. L. Veatch.

"Soil Treatments for Winter Wheat," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 503, July 1944, L. B. Miller and F. C. Bauer.

"Soil Practices for Production—Profit Conservation," Ext. Serv., Mich. State College, East Lansing, Mich., E. Folder F-57 (Rev.), June 1944, J. A. Porter and L. Braamse.

"Soil Survey—Tishomingo County, Mississippi," U.S.D.A., Washington, D. C., Series 1937, No. 10, June 1944, A. C. Orvedal and Thomas Fowlkes.

"Preparing Garden Soils," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 477, April 1944, P. P. Pirone, L. G. Schermerhorn, F. E. Bear, and C. H. Connors.

"Depth and Method of Soil Preparation and Cultivation for Corn and Cotton," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. 191, May 1944, C. A. Mooers.

Crops

¶ Results of field trials of different fertilizer treatments on four types of peanuts in North Carolina are given in North Carolina Agricultural Experiment Station Agronomy Information Circular 135 entitled "Report on Peanut Experiments Involving Variety-Fertility Combinations Conducted in 1943." This work was carried on by G. K. Middleton, E. F. Schultz, Jr., W. E. Colwell, and N. C. Brady. While the Improved Spanish type gave high yields, the seed of this is available only in small amounts, and of the ordinarily grown types, Virginia Bunch gave the highest yields. North Carolina Runner and White Spanish followed in order.

In order to get the best yields on Virginia Bunch and North Carolina Runner types, landplaster or calcium sulphate had to be applied along with muriate of potash. When landplaster was not used, the Virginia Bunch did not produce at all well. The White Spanish type yielded well with a limestone and potash combination. As a result of this work, the authors recommend that 75 lbs. of muriate of potash be applied as a top-dressing at emergence, and that 400 lbs. of landplaster per acre be applied on the foliage at the time of blooming when growing the Virginia Bunch type. When growing the Spanish type, 400 lbs. of dolomitic limestone in the row and 75 lbs. of muriate of potash at emergence are recommended.

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"Pruning the Highbush Blueberry," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., T. Bul. 192, May 1944, W. T. Brightwell and Stanley Johnston.

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"Strawberry Growing in Michigan," Ext. Div., Mich. State College, East Lansing, Mich., E. Folder F-55, April 1943.

"Soybeans for Beans," Ext. Div., Mich. State College, East Lansing, Mich., E. Fold. 59, April 1943, C. R. Megee.

"What Makes Better Alfalfa," Ext. Div., Mich. State College, East Lansing, Mich., E. Fold. 61, May 1943, S. T. Dexter.

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"Harvesting and Curing of Garlic to Prevent Decay," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., Bul. 651, July 1944, H. P. Smith, G. E. Altstatt, and M. H. Byrom.

"Emerald Sweetclover," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., June 10, 1944, 896 P. R., Earl F. Manke and W. H. Friend.

"Texas Grano Onion," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., June 30, 1944, 899 P. R., Leslie R. Hawthorn.

"Growing Grapes in Washington," Ext. Serv., State College of Wash., Pullman, Wash., E. Bul. 271, First Rev. April, 1944, John C. Snyder.

"Renovation of Established Pastures," Ext. Serv., State College of Wash., Pullman, Wash., E. Cir. 74, June 1944, I. M. Ingham and A. G. Law.

"Grasses and Clovers for Greater Production in Western Washington, Agr. Ext. Serv., State College of Wash., Pullman, Wash., Cirs. 79-83, June 1944, Alvin G. Law and I. M. Ingham.

"Kobe a Superior Lespedeza," U.S.D.A., Washington, D. C., Leaf. 240, July 1944, Roland McKee and Howard L. Hyland.

"Strawberry Culture, Eastern United States," U.S.D.A., Washington, D. C., F.B. 1028, Rev. July 1944, George M. Darrow.

"Good Pastures," U.S.D.A., Washington, D. C., F.B. 1942, (Rev.), June 1944, A. T. Semple and M. A. Hein.

"Growing the Transplant Onion Crop," U.S.D.A., Washington, D. C., F.B. 1956, July 1944, H. A. Jones, L. R. Hawthorn, and G. N. Davis.

"Cauliflower and Broccoli Varieties and Culture," U.S.D.A., Washington, D. C., F.B. 1957, 1944, Ross C. Thompson.

"A Monographic Study of Bean Diseases and Methods for Their Control," U.S.D.A., Washington, D. C., T.Bul. 868, June 1944, L. L. Harter and W. J. Zaumeyer.

Economics

¶ There is a wealth of information in "Northeast Agricultural Atlas," prepared by the Northeast Post-War Planning Committee of the U. S. Department of Agriculture. The area considered in this volume covers all of New England and the Mid-Atlantic States including Delaware and Maryland. By means of numerous maps, tables, and explanatory material, information is given on the general country, that is, whether coastal plain, hilly, or mountainous; the kinds of soil found in the various sections together with brief notes on their adaptations and fertility; crops grown; fertilizer consumed; equipment of the farm; forest and woodlot resources; health and medical facilities; marketing facilities; and soil conservation work. Much other information and many helpful statistical tables are included in this excellent reference book.

¶ The mobilization of Canadian agriculture to meet war-time requirements is set forth in "Objectives for Canadian Agriculture in 1944," prepared by the Agricultural Supplies Board of the Dominion Department of Agriculture. The performance of Canadian farmers under this program is now a matter of history, but the information contained in the publication serves as an excellent source of data on Canadian agriculture. The goals in 1944 for grains were not much higher than in the preceding year, except in the case of corn for grain, which is a comparatively small factor in the Dominion. Livestock production goals were slightly above the preceding year, while dairy goals were either the same or slightly lower. Rather large increases were planned for the oilseed crops, except for flaxseed, and large increases were desired also for field crops such as beans, peas, sugar beets, and tobacco. Particularly large increases were wanted in the leguminous forage crops grown for seed, since Canadian seed is an important factor in both Canadian and United States agriculture. In the publication, a great deal of statistical data are given on the production of crops and agricultural products in the preceding years, which not only are a handy reference, but serve to show how important is Canada in North American agriculture.

¶ A survey of practices by seed potato producers in Vermont furnishes material for Bulletin 504 of the Vermont Agricultural Experiment Station. This is entitled "The Economics of Certified Seed Potato Production II—Factors which Affect the Cost of Production" and was prepared by J. A. Hitchcock. A considerable variation in outlay for seed was found. There was a tendency for yield to increase as the seed cost per acre increased, with a slight drop in seed cost per bushel of production. Yield increased as seed rate increased, but the seed cost per bushel of yield also increased as the seeding rate increased. The amount of fertilizer used per acre tended to increase as the acreage in potatoes per farm increased. The reverse was true in the case of manure. Growers of Green Mountain potatoes tended to use more fertilizer than growers of Cobblers. As expenditure per acre for fertilizer increased, yield increased, but the fertilizer charge per bushel yield also increased. When it came to dusting, the growers of small acreages tended to make heavier applications than those of larger acreages, but the larger growers made more applications during the season, so that the total quantities used over the season were about the same. There was little apparent relationship between spraying practices and yield. On farms with very small acreage, the costs of labor per acre and per bushel were high, but as the acreage increased, the cost dropped rapidly and apparently about all of the economies of utilization of labor resources accompanying increased acreages are reached at 10 or 12 acres. The total cost per acre of producing seed potatoes broke down as follows: 17% for seed, 18% for fertilizer, 7% for spray and dusting, 28% for labor, 12% for power, and 6% each for machinery, land, and miscellaneous. The total average cost of production was $161 per acre. Total cost of production per acre was highest among the small growers, and declined rapidly as the acreage increased up to about 8 or 10 acres, after which there was no change, again indicating that about full efficiency can be obtained at this acreage. Other studies and relationships are given in this bulletin, which will be of interest to those growing potatoes. This survey was made some years ago, but the author feels that the relationships and costs involved have not materially changed and that the conclusions are valid for present conditions.

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"Riverside County Navel Orange Study," Farm Adviser P.O. Bldg., Riverside, Calif., 1943.

"Settlement Problems in Northwestern Quebec and Northeastern Ontario," Dept. of Agr., Dominion of Canada, Ottawa, Canada, Publ. 758, T.Bul. 49, Feb. 1944, A. Gosselin and G. P. Boucher.

"Florida Farm Prices," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 399, June 1944, A. H. Spurlock and C. V. Noble.

"Improving Farm Tenure in the Midwest," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 502, June 1944.

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"Area Analysis and Agricultural Adjustments for Ness County, Kansas," Agr. Exp. Sta., Kansas State College, Manhattan, Kansas, A. E. Rpt. 23, May 1944, W. H. Pine, M. L. Otto, and H. E. Myers.

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"Effects of War on Farm Population in Kentucky," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 456, April 1944, Howard W. Beers.

"Agricultural Production and Types of Farming in Minnesota," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Supl. to Bul. 347, Rev. June 1944, Selmer A. Engene and George A. Pond.

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"Association of Crops with Soils and Other Factors, Jefferson County, Tennessee," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., R. R. Ser. Mon. 169, May 25, 1944, H. J. Bonser.

"Proposed Changes in Postwar Agricultural College Curricula," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., R. R. Ser. Mon. 170, May 31, 1944, C. E. Allred and H. J. Bonser.

"The Food Supply of Texas Rural Families," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., Bul. 642, Oct. 1943, Jessie Whitacre.

"A Summary and Appraisal of Texas Real Property Tax Laws," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., Bul. 645, Jan. 1944, W. R. Parks, L. P. Gabbard, and H. C. Bradshaw.

"Significance of the Patronage Dividend as Applied by Cooperative Cotton Gin Associations," Agr. Exp. Sta., A. & M. College of

Tex., College Station, Tex., Bul. 649, May 1944, W. E. Paulson and R. T. Baggett.

"Purchasing in Texas Counties," Agr. Exp. Sta., A. & M. College of Tex., College Station, Tex., Bul. 653, July 1944, H. C. Bradshaw and E. J. Hervey.

"Shall I Be a Farmer?" U. S. D. A., Washington, D. C., AWI-105, July 1944, P. V. Maris.

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RAYMOND MIZELLE of Woodard, Bertie County, North Carolina, produced 7 bales of cotton on 4.2 acres of land in 1943, the best crop he ever made, according to County Agent B. E. Grant in a report to the North Carolina State College Extension Service. On one plot of two acres, he made four bales.

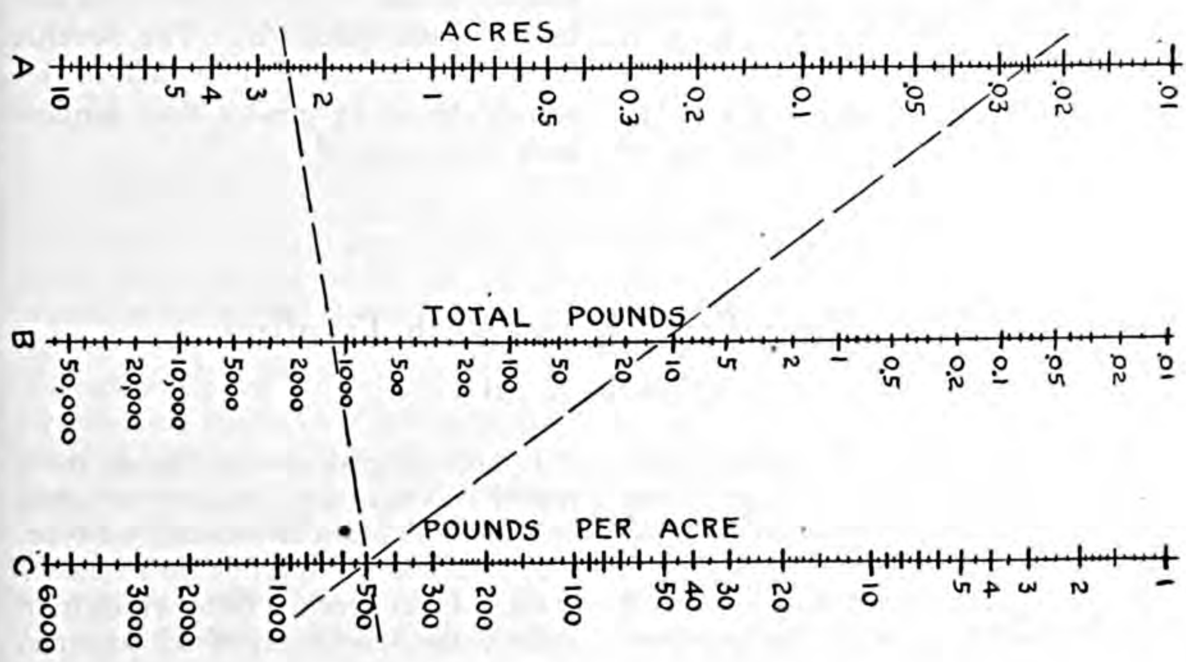
Mr. Mizelle planted Coker 100 No. 5 seed, which had been treated. He used 500 pounds of 3-8-5 fertilizer per acre and top-dressed with 100 pounds of nitrate of soda and 100 pounds of muriate of potash per acre. Mr. Grant reported that the extra potash paid well because one could easily see where it was left off.

Mr. Mizelle makes it a practice to plant crotalaria in all his corn for soil building, and last year the crotalaria made excellent growth. He says that his best yields of peanuts come on land which has previously been in corn and crotalaria.—*N. C. Agricultural Extension Service.*

How Many Pounds Per Acre

NO doubt every reader frequently has occasion to compute "pounds per acre" problems. This chart will prove to be a great help in making such computations. The chart gives the total number of pounds of anything to be used on any plot of ground without any "longhand" figuring whatever.

For example, let us suppose that you want to apply 500 pounds per acre.



Let us also suppose that the plot is very small—only .025 acre. How many pounds should be used?

Run a straight line through the .025, column A, and the 500, column C, and the intersection with column B gives the answer as 12.5 pounds. One of the dotted lines drawn across the chart shows how it is done.

The other dotted line across the chart shows that if there are 2.5 acres, and that if you are told to apply 500 pounds per acre, the answer is 1,250 pounds.

The range of the chart is from .01 acre to 10 acres, and one pound per acre to 6,000 pounds per acre. However, by keeping tab on the ciphers this chart is easily applicable to any number of acres and any number of pounds per acre. Thus if the plot is 25 acres,—12,500 pounds will be required: 250 acres,—125,000 pounds, etc. With the aid of this chart you will be able to quickly do problems that might produce headaches and consume much time when performed by the old long-hand method.

W. F. SCHAPHORST,
Newark, New Jersey.

Fertilizer Use To Continue

An expansion of fertilizer production is to be anticipated in the years after the war, in the opinion of Dr. R. O. E. Davis, in charge of fertilizer research in the U. S. Department of Agriculture. The increased uses of fertilizer that have been a necessary feature of wartime agriculture will be carried over, at least in part, to the post-war period. He estimates that the plant food in the fertilizers used this year will total about 650,000 tons of nitrogen, 1,380,000 tons of phosphoric acid, and 610,000 tons of potash, representing increases of about 43 per cent, 38 per cent, and 33 per cent for these three principal plant foods as compared with 1941.

Plans are already under way, says Dr. Davis, which look to increased use of fertilizers in helping to meet food and clothing needs of the world at peace. The activities of the Department in wartime, he says, have actually been a speeding up of its peacetime program. Progress in fertilizer research has introduced new materials, new methods, and new practices in soil treatment and crop production that have meant millions of dollars annually to farmers both in war and in peace.

After the war, in the opinion of Dr. Davis, farmers will have better opportunities to use improved fertilizers and to use them efficiently. The benefits from the accumulated results of research should be greater than farmers have ever enjoyed.

Controlling Erosion in South Carolina

(*From page* 26)

What practices can be applied with minimum assistance and at the same time increase the production of food and feed?

Ernest Carnes, South Carolina's Soil Conservationist, answers the question:

1. Seed lespedeza (we have mentioned its importance before) or crotalaria or small grain on suitable soil type.

2. Establish an appropriate livestock-grazing system for the farm which may include the renovation of all pastures,

the planting of a sufficient amount of annuals or perennials for temporary annual grazing.

3. Use every idle acre on the farm for the production of needed food or feed crops. Idle or slacker acres only help the Axis.

4. Plant draws or other areas of the farm to perennial crops of lespedeza sericea, kudzu for water disposal and hay crops.

5. Plan for the production, harvesting, and care of legumes and other seed for the farm.

6. To partially offset the fertilizer shortage, take special care of all farm manures and construct synthetic compost heaps where materials are available.

There are 21 soil conservation districts in the State, embracing all of the 46 counties. South Carolina is the second state in the United States to reach this goal, districts having been organized in all the counties in Alabama some time ago.

On October 31, 1943, district conservation farm plans had been written for 9,568 farms in the State, covering a total of 1,648,403 acres and signifying a determined effort on the part of South Carolina farmers to keep the topsoil in their fields where it belongs instead of letting it wash away.

Here are some of the highlights of the progress made:

Trees have been set out on 21,291 acres. Farmers themselves bought and planted 9,153,961 trees; the districts furnished 15,908,798. More than 21,000 acres of permanent pasture have been improved by reseeding and fertilizing; 18,965 acres of kudzu set out; approved rotations have been established on 217,556 acres of cultivated land; grass for permanent hay has been planted on 7,070 acres, and grassed meadow strips for hay and to serve as terrace outlet channels have been established on 12,145 acres. These practices have been further augmented by 154,755 acres of terracing.

These figures, covering 8,251 farms, are from the December 31, 1942, report. Since that time a great deal that does not show in the foregoing figures has been accomplished, but the reports for 1943 will not be available for some time.

By the end of June 30, 1943, 92,689 acres of idle land had been transferred to profitable farming use. Of this amount 29,147 acres were returned to cultivation, 23,347 acres to permanent pasture, 24,972 acres to woodland, and vegetation attractive to wildlife was planted on 3,820 acres.

Growing Quality in Tomatoes

(*From page* 17)

seem high to those growers who have been using 250 to 500 pounds per acre and getting 5-ton or 6-ton yields, but where 10 to 12 tons or 15 tons are expected, much higher amounts of plant food must be used.

Deep application may be made by broadcasting these fertilizers and then plowing, but this is not considered to be so effective as the furrow placement.

It is well known by tomato growers that fertilizers will not take the place of organic matter in the soil. They are not intended to be a substitute for good cultural practices, or for applications of manure, or the plowing down of cover crops. They find their greatest usefulness and give the highest returns when used on soils of adequate organic content. It can be said with equal truth that manure and cover crops alone seldom produce high-quality tomatoes. Fertilizers with manure, not instead of manure, should be the practice.

It is also good practice to fertilize all cover crops. The advantages are twofold: first, a greater growth of cover

This tractor attachment places the fertilizer on the bottom of the furrow.

crop will be obtained; and second, the vegetation itself will be higher in nutrient materials for use by the succeeding crop. The latter point is given emphasis in results reported from the Newman Fertility Field, where W. B. George of the Kemptville Agricultural School reports that well-fertilized hay plants contained 2.3 per cent phosphoric acid, while the poorly fertilized plants contained only 0.9 per cent. The same may be said of manure. All farmyard manure is not of equal value in nutrients. Its value will depend not only on its care and handling, but on the mineral constituents of the forage from which it was produced.

In the interests of greater profit to the grower and to achieve a reputation for high-quality tomato products, yields per acre should be substantially increased. This is not difficult to accomplish. A study of soil needs, as indicated by soil tests, a knowledge of plant-food requirements, and the use of modern technique in applying the right sort of fertilizers at the right time—these, along with retention of organic matter and employment of good cultural methods, will increase yields, improve quality, and enhance the profits.

Thomas Jefferson, Far-Sighted Farmer

(*From page* 21)

these improved machines not only do better farming but make possible the wiser use of labor. He worked toward the use of less labor through the application of mechanical principles, and the improvement of plants and livestock. He also worked toward arrangements that would bring continuity in the use of labor and avoid the peaks that are still plaguing us today.

His interest in the improvement in livestock was centered primarily in sheep. He was among the first in this country to have a Merino ram and worked constantly to improve his flock. He proposed to furnish Marino rams to other counties and outlined a plan for improvement throughout the counties of the State that has been called the precursor of modern cooperative breeding circuits.

Jefferson's suggestions for the improvement of rural life were practical though far ahead of his time. He helped to organize the Albemarle County Agricultural Society in 1817 and made outlines for its study and work. He urged the forming of other agricultural societies as centers for activity and information. He had an amazing agricultural library of his own at Monticello—probably the best in existence. It included contributions in Latin, Greek, French, and Italian. In 1809 he outlined a plan for a small circulating library, such as he believed should operate in every county: "I have often thought that nothing could do more extensive good at small expense." He believed ardently in thorough-going correspondence to promote and exchange agricultural and farming knowledge. His correspondence of this sort with friends and strangers both in this country and Europe is among the real wonders. He urged the teaching of agriculture in the institutions of higher learning, and made specific recommendations at the Univeristy of Virginia. His recommendations have been called the forerunners of the Land Grant College Act which was signed some 60 years later. He was the scientist in agriculture. ."Agriculture," he stated, "is a science of the very first order."

To cover all of Jefferson's firsts, all his advanced farmer enthusiasms, all his contributions to agriculture could fill a volume. His philosophies relating to country life and agrarianism could fill another. To the study of these phases of his life alone certain men have given months if not years. Most of us must be content with the bare outlines, the simplest facts, and the gist of his beliefs in regard to these matters that lay so close to his heart: "Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous, and they are tied to their country, and wedded to its liberty and interests by the most lasting bonds."

It has been said that to Jefferson all life was education. That he was abreast of the latest developments in practically every field of knowledge. That his was one of the most remarkably diversified minds this country has ever known. That in agriculture he was eminent not only as a farmer but as an agricultural statesman. And finally, that many have loved the land but no one has done more for it.

Mississippi Crop and Pasture Production Program, 1942-43

(*From page* 14)

Name & Address of Farmer Soil	Crop	Fertilizer Treatment	Yield Per Acre Gr. Wt., Lbs.
7. R. M. Branch Goodman, Miss. Terrace soil	Wild Winter Peas	250# Superphosphate 500# Lime 250# Superphosphate 500# Lime 100# Muriate of potash	7,187 16,661
8. C. S. Hamer Kilmichael, Miss. Hill land	Wild Winter Peas	500# Basic slag 500# Basic slag 100# Muriate of potash	16,988 28,636
9. Scott Wafford Mantee, Miss. Bottom land	Wild Winter Peas	500# Basic slag 500# Basic slag 100# Muriate of potash	11,211 14,592
10. J. E. Scarbrough Cumberland, Miss. Branch bottom	Wild Winter Peas	200# Superphosphate 500# Lime 200# Superphosphate 500# Lime 100# Muriate of potash	20,908 31,472
11. Thompson & Carroll Lexington, Miss. Hill land	Pasture, Hop Clover & Other Clover	250# Superphosphate 250# Superphosphate 100# Muriate of potash	11,761 14,697
12. Thompson & Carroll Lexington, Miss. Terrace soil	Hop & White Clovers Seed Field	250# Superphosphate 250# Superphosphate 100# Muriate of potash	8,712 13,721

Name & Address of Farmer Soil	Crop	Fertilizer Treatment	Yield Per Acre Gr. Wt., Lbs.
13. H. P. Watson Lexington, Miss. Terrace soil	White Clover Pasture	250# Superphosphate 500# Lime 250# Superphosphate 500# Lime 100# Muriate of potash	8,058 12,196
14. B. E. Presley Pickens, Miss. Terrace soil All clover died on check plot.	Oats & White Clover	250# Superphosphate 1000# Lime 250# Superphosphate 1000# Lime 100# Muriate of potash	11,761 26,136
15. B. E. Presley Pickens, Miss. Terrace soil	Oats & Pasture Mixture	250# Superphosphate 1000# Lime 250# Superphosphate 1000# Lime 100# Muriate of potash	13,068 24,829
16. H. W. Vandiver Cruger, Miss. Delta foothills	White Clover	250# Superphosphate 500# Lime 250# Superphosphate 500# Lime 100# Muriate of potash	6,425 10,454
17. G. E. Bobb Vicksburg, Miss. Delta foothills	White Clover	No Treatment 100# Muriate of potash	10,345 11,979
18. W. H. Simpson Winona, Miss. Branch Bottom	Red Clover & Oats	600# Basic slag 600# Basic slag 100# Muriate of potash	7,949 14,483
19. W. S. Pittman Winona, Miss. Terrace soil	Red Clover & Oats	500# Basic Slag 500# Basic Slag 100# Muriate of potash	18,401 23,522
20. J. E. Scarbrough Cumberland, Miss. Branch bottom Seed crop on potash plot estimated 100% better than check.	White Clover	200# Superphosphate 500# Lime 200# Superphosphate 500# Lime 100# Muriate of potash	10,236 9,038
21. M. M. McKinnon Coldwater, Miss. Bottom land	Alfalfa 1 cutting	250# Superphosphate 500# Lime 250# Superphosphate 500# Lime; 30# borax 100# Muriate of potash	9,365 13,285
22. Part-time Farm State College, Miss. Bottom Land Alfalfa seeded fall 1942	Alfalfa 3 cuttings	200# T. Superphosphate 200# T. Superphosphate 200# Muriate of potash 200# T. Superphosphate 200# Muriate of potash 30# Borax	29,185 30,056 40,942
23. Rex Reed Tupelo, Miss. Bottom land	Alfalfa 1 cutting	200# T. Superphosphate 200# T. Superphosphate 200# Muriate of potash 200# T. Superphosphate 200# Muriate of Potash 30# Borax	9,038 9,801 13,285

Name & Address of Farmer Soil	Crop	Fertilizer Treatment	Yield Per Acre Gr. Wt., Lbs.
24. W. A. Evans Muldon, Miss. Prairie land (1-acre plots, treated 3 years) Wild barley on plot 5	Pasture Hop Clover, Black Medic & Grasses	No Treatment 200# Superphosphate 100# Muriate of potash 200# Superphosphate 100# Muriate of potash 200# Superphosphate 100# Muriate of potash	12,954 13,612 14,697 14,697 10,345
25. Thompson & Carroll Lexington, Miss. Terrace soil	Dallas grass & Lespedeza	250# Superphosphate 250# Superphosphate 100# Muriate of potash	12,196 24,393
26. K. H. Diggs Lexington, Miss. Hill land	Kudzu	250# Superphosphate 250# Superphosphate 100# Muriate of potash	5,000 20,000
27. R. L. Fulcher Louisville, Miss. Terrace soil	Tenn. 76 Lespedeza	No Treatment 100# Muriate of potash	8,167 10,998
28. S. L. Bennett Louisville, Miss. Bottom land	Kobe Lespedeza	No treatment 100# Muriate of potash	8,058 17,859
29. Brooks Watkins Vardaman, Miss. Terrace soil	Common Lespedeza	500# Lime 500# Lime; 200# Manure salts 2000# Lime 2000# Lime; 200# Manure salts No treatment (check) 200# Manure salts 100# T. Superphosphate 100# T. Superphosphate 200# Manure Salts 100# T. Superphosphate 2000# Lime 100# T. Superphosphate 2000# Lime; 200# Manure salts	4,791 6,534 3,702 6,307 2,395 5,445 4,573 4,791 3,920 5,880
30. C. N. Wagner Calhoun City, Miss. Hill land	Common Lespedeza	400# Basic Slag 400# Basic Slag 200# Manure Salts	2,831 5,009
31. Jerome West Calhoun City, Miss. Terrace soil	Common Lespedeza	500# Lime 500# Lime; 200# Manure salts 2000# Lime 2000# Lime; 200# Manure salts No Treatment 200# Manure Salts 100# T. Superphosphate 100# T. Superphosphate 200# Manure Salts 500# Lime; 100# T. Superphosphate 500# Lime 200# Manure Salts	7,296 11,325 7,296 10,563 10,563 7,296 8,712 14,048 10,563 12,741
32. J. T. & W. D. Clark R 1, Foxworth, Miss. Sandy soil	Lespedeza Hay	No Treatment 75# Muriate of Potash	1,080 Hay 2,000 Hay

Name & Address of Farmer Soil	Crop	Fertilizer Treatment	Yield Per Acre Gr. Wt., Lbs.
33. Brooks Watkins Vardaman, Miss. Hill land	Lespedeza Sericea	100# T. Superphosphate 500# Lime	20,000
		100# T. Superphosphate 500# Lime; 200# Manure Salts	40,000
34. Henry Henderson Holmes County, Miss.	Cotton	30# Nitrogen (Uramon)	1372 S. Cotton
		30# Nitrogen (Uramon) 100# Muriate of Potash	1666 " "
35. Howard Webster Holmes County, Miss.	Cotton	30# Nitrogen (Uramon)	1127 " "
		30# Nitrogen (Uramon) 100# Muriate of potash	1470 " "
36. H. W. Vandiver Cruger, Miss. Delta foothills	Cotton	30# Nitrogen (Uramon)	950 " "
		30# Nitrogen (Uramon) 100# Muriate of potash	1440 " "
37. B. N. Simrall Redwood, Miss.	Cotton Delfos 651 (Wilt Resistant)	Vetch No fertilizer	804 " "
		Vetch 100# Muriate of potash	1208 " "
38. B. N. Simrall Redwood, Miss.	Cotton Delfos 531-C	Vetch No fertilizer	446 " "
		Vetch 100# Muriate of potash	1054 " "
39. S. G. Summers Nesbitt, Miss.	Cowpeas	500# Lime	10,800
		2000# Lime	14,100
		100# T. Superphosphate	7,500
		100# T. Superphosphate 500# Lime	10,300
		No Treatment (Check)	4,500
		100# Manure salts	8,700
		500# Lime; 100# Manure salts	8,800
		100# T. Superphosphate 100# Manure Salts	9,000
		100# T. Superphosphate 500# Lime 100# Manure Salts	9,200
40. H. C. Marion Mooreville, Miss. Hill land	Soybeans	500# Lime	8,712
		500# Lime; 167# Manure salts	9,583
		2000# Lime	11,458
		2000# Lime; 167# Manure salts	12,197
		No Treatment (Check)	5,227
		167# Manure Salts	6,010
		100# T. Superphosphate	10,692
		100# T. Superphosphate 167# Manure Salts	12,197
		500# Lime 100# T. Superphosphate	15,260
		500# Lime 100# T. Superphosphate 167# Manure Salts	17,424
		2000# Lime; 100# T. Super.	10,420
		2000# Lime; 100# T. Super. 167# Manure Salts	11,326

Name & Address of Farmer Soil	Crop	Fertilizer Treatment	Yield Per Acre Gr. Wt., Lbs.
41. J. C. Burt Hattiesburg, Miss. Terrace soil	Soybeans For seed	500# Lime	36 Bu.
		500# Lime; 100# Manure salts	40 Bu.
		2000# Lime	35 Bu.
		2000# Lime; 100# M. Salts	38 Bu.
		No Treatment (Check)	32 Bu.
		100# Manure Salts	35 Bu.
		100# T. Superphosphate	40 Bu.
		100# T. Superphosphate 100# Manure Salts	45 Bu.
		100# T. Superphosphate 500# Lime	45 Bu.
		100# T. Superphosphate 500# Lime; 100# Manure salts	50 Bu.
		100# T. Superphosphate 2000# Lime	50 Bu.
		100# T. Superphosphate 2000# Lime; 100# M. salts	58 Bu.
42. J. C. Copeland Booneville, Miss. Terrace soil	Soybeans For Hay	500# Lime	10,454
		500# Lime; 200# Manure salts	17,946
		2000# Lime	10,018
		2000# Lime; 200# Manure salts	16,552
		No Treatment (Check)	9,060
		200# Manure Salts	20,908
		100# T. Superphosphate	9,583
		100# T. Superphosphate 200# Manure Salts	20,473
		100# T. Superphosphate 500# Lime	13,068
		500# Lime; 200# Manure salts	16,552
43. H. C. Shirley Marietta, Miss. Bottom land	Soybeans For Hay	No Treatment	17,424
		200# Manure Salts	23,522
44. F. C. Carlisle New Albany, Miss. Hill land	Kudzu	No Treatment (Check)	8,276
		100# Manure Salts	12,705
		100# T. Superphosphate	15,246
		100# T. Superphosphate 100# Manure salts	17,061
45. Fred Getwan Brookhaven, Miss. Bottom land	Soybeans For Hay	No Treatment	5,663
		200# Manure Salts	8,276
46. Roy Pearce Dorsey, Miss. Terrace soil	Corn	No Treatment	16 Bu.
		100# Manure Salts	25 Bu.
47. J. T. & W. D. Clark R 1, Foxworth, Miss.	Corn	No Treatment	15 Bu.
		75# Muriate of potash	20 Bu.
		100# Muriate of potash	24 Bu.

ENOUGH TROUBLE

Mr. White—Allow me to present my wife to you.

Mr. Green—Thanks, but I have one!

ARMY FUN

Sarge—I was almost killed twice in a jeep.

Pvt.—Once would have been enough!

GRUB

(*From page* 5)

Who in tarnation could have foreseen the battle royal to ensue between cow milkers and soybean and cotton crushers over a spread for toast and pancakes? And how about the array of frozen lockers and southern produce sold daily to hungry people a thousand miles away? Yes, and how about dried turkey and fruit pastes and process cheese, and citrus groves catering to the breakfast menus of everyday folks up on our northland farms?

Verily, the man who raises the raw food nowadays has so little to say about its destiny and what happens to it en route to the esophagi of consumers that we marvel at the consequences. The old theatrical call, Quo Vadis—whither goest thou, is a plain description of the situation as far as the humble food producer is concerned.

The old idea was that if we had minerals enough in the soil all would be well; but now everybody from the cook to the calf wants to know the percentage of minerals in the grub. The onward rush of science has wiped old, simple notions off the map.

Fourth, satisfied old-timers around that groaning larder would have scoffed at anyone who hinted that maybe sooner or later the power of the land to make food naturally by its own processes would peter out.

Of course, here and there, in remote spots on very lean and sandy land the farmers got disgusted and quit. But when you recall that this Thanksgiving table I mention was heaped with goodies gleaned from a No. 1 black upland prairie soil, the case is different.

When tinges of yellow appeared in corn blade and the roots withered, when grain did not fill out well, when clover thinned and died, and when livestock fared badly on certain kinds of roughage—it was always the season, the phase of the moon, or the time and rate of seeding that got the blame.

When little rivulets trickled down easy slopes and gradually plowed furrows and then gashes and finally gullies—this was just tough luck and common to country experience. Nothing ailed the birthright, which was the fair land that Grandpa took up from Tyler. To be a good steward was just working hard from morn to eve and raising enough kids to save expensive hired help.

Few talked about the sacredness of the family-sized farm when the soil was new and rich. Their idea of a grub-stake was the farm-sized family!

BUT right now in the county, where we ate that hefty meal of victuals, there is more commercial fertilizer and ground limestone used annually than the whole state used before. In this aspect of things we have improved indeed.

Fifth, as we scooped in that volume of viands it never occurred to us that some day there would be too many folks around the farm to make it pay.

Sometimes I think we don't know it yet, when I hear the hectic reformers advocating a general exodus of the returning war veterans to agricultural holdings on easy federal loans.

Probably this question raises more hell and darnation than any single moot topic you can fetch up by hand. Farm engineers in conventions predict marvelous mechanical inventions that outdo the hitherto wondrous strides taken in unbending weary backs. One-man farming with complete tractor outfits from seeder to combine, plus nifty automatic chore-boys around the stable and feed-lot, electricity and its modern cousin, electronics, all presage the shift in our agricultural enterprise.

Technology has its benefits, and carries no less its threats, to former rural methods and motives. Larger farms run with less man and woman power are in the offing. Or else, we must learn how to clip coupons on the farms and become a leisure class more than hitherto. The main trouble will be to convince farm folks that culture and rest are as essential to goldliness and godliness as the sixteen-hour day. Can you vision a farm Thanksgiving with ersatz victuals and only a family of two or three to partake? In that instance, who will be left to brag about Tyler and the original deed?

I maintain we must keep some farms running to raise healthy youngsters on, but it looks like a section of land will be the minimum.

SIXTH, if the table chatter drifted over to mortgages and chattels, our early Thanksgiving diners would have paused long enough in their munching to refer the inquiry to a provident neighbor with cash to lend. In other words, back there the supply of home capital, private, or public in banks, would have taken ample care of the local needs.

About twenty years ago a study in one county out my way showed that ninety per cent of the mortgages were held locally, and payment was prompt, interest not high. Is there any need to plunge further into comparisons, to show how far the loan system has drifted from that epoch to now, when the government, insurance concerns, city banks, and distant investors hold most of the gilt-edge paper covering active farms?

In the other days, a farmer hung his head in shame if he could not pay off his obligations. In later times, we have seen rural organizations pray hard for more chances to get farmers into debt, on easy terms for lifetime periods. This has been caused somewhat by the commercial spirit of agriculture as it runs today, changing farms into modern business ventures, and with less emphasis upon the sentimental side of human life.

Today many farmers are movers and shifters, tramps and drifters. Much of the old permanence and gritty home tradition has vanished. It's only the high dollar and the quick profit that hitches them to the plow handles. And, by and large, who is there to blame agriculture for this alone? If it is necessary thus to keep step with progress, let's be constructive about the present rather than critical of what's gone.

And finally, take the sixth comparison. Those old gormandizers around the festive board would have vouched to a man that a youngster could get all the training he would ever need to succeed in farming by staying at home and watching Pa and the neighbors.

What could be more natural than this assumption, or religion, if you prefer? Every man-jack of the crew chewing lustily there had acquired his success the hard, homespun way, without much recourse to anything save the calendar and the climate. A few farm papers were taken and thoroughly read, but most of them consisted of printed personal experiences tossed back and forth, interlarded with poems and home sentiment. Laboratories and colleges were just getting a meager start, and few heeded them. No commercial companies maintained research workers to find out why their products did not pan out well.

IF you go today and join a festive harvest assembly out in the country it's ten to one that every group will include several college short-course men, a whole mess of Future Farmers, and no end of ambitious 4-H devotees. Each day brings radio teaching and precept; each mail brings educational literature beyond the hope of the recipients to digest.

Yet all this change and progress in rural scenery has not gone far enough to banish from your mind and appetite the heady aroma of that glorious meal. Here at least one element of the old spirit stays put. So drag up a chair, stranger, and put your brogans under our mahogany. As long as we have good stomachs and normal appetites, agriculture is paramount forever! Let's quit talking and tackle the turkey!

TOUGH ON THE SCOTCH COLONEL

The Colonel of a Scotch regiment who was disliked by his men wanted to locate a sniper. He called for Sandy, the crack shot of the regiment, and said: "Sandy, there's a sniper over there. He's been shootin' at us all day. The fir-rst time, he knocked the hat off me and the second time he knocked the cigarette oot of ma mouth. Go over and get him. I think he's in yon clump of bushes."

Sandy went toward the spot and found a German hidden in a small tree. Sandy shook the tree and down fell the German, who threw up his hands and cried, "Kamrad, Mercy!"

Sandy looked at him disgustedly and said: "Mer-r-cy? Ye'll get nae mer-r-cy from me! Ye missed the colonel twice!"

Then there is the sailor who treated all his girls with wine. He wanted a little port in every sweetheart.

UNPALATABLE

"Brother Johnson," asked a wide-awake Negro divine in the South, "can you-all tell me why the lions didn't eat de Prophet Daniel?"

"No, pahson; why was it?"

"Because de most of him was backbone and de rest was grit."

Young and inexperienced father, gazing at triplets the nurse had just brought out: "We'll take the one in the middle."

"What's the matter, Mary?"

"I've got rheumatism in my muscles."

"You ought to visit a masseur."

"What's that?"

"A man who pinches you all over."

"Oh, you mean a marine!"

Chaplain: "Son, are you following the Ten Commandments?"

Seaman: "I don't know, Sir. It's all I can do to keep up with the station notices and memos."

SHAME ON GRANDMA

Grandmother was a diabetic patient, and rather given to "cheating" on her strict diet. After one violation she was sent to the hospital, where the only available room was in the maternity ward. Granddaughter was just outside the door when some visitors went past.

"What are you doing here, little girl?"

"I'm visiting my grandmother," she replied.

"Your grandmother!" exclaimed one. "What's *she* doing in here?"

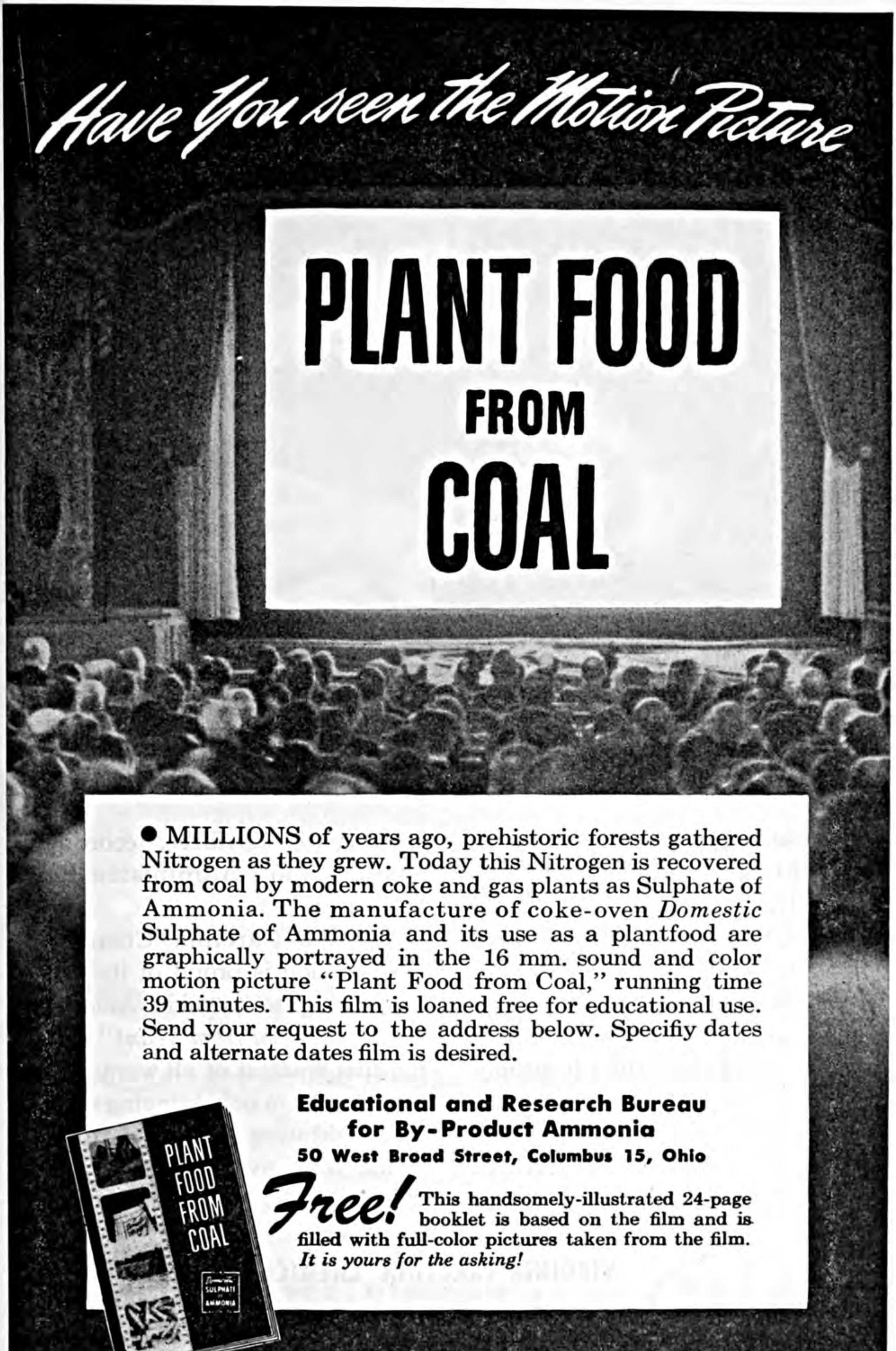
"Oh," said the little girl brightly, "she's been cheating again!"

Father: "Do you suppose our son gets his intelligence from me?"

Mother: "He must. I've still got mine."

"Cheer up, John. A woman's 'no' often means 'yes.'"

"How about her 'phooey!'?"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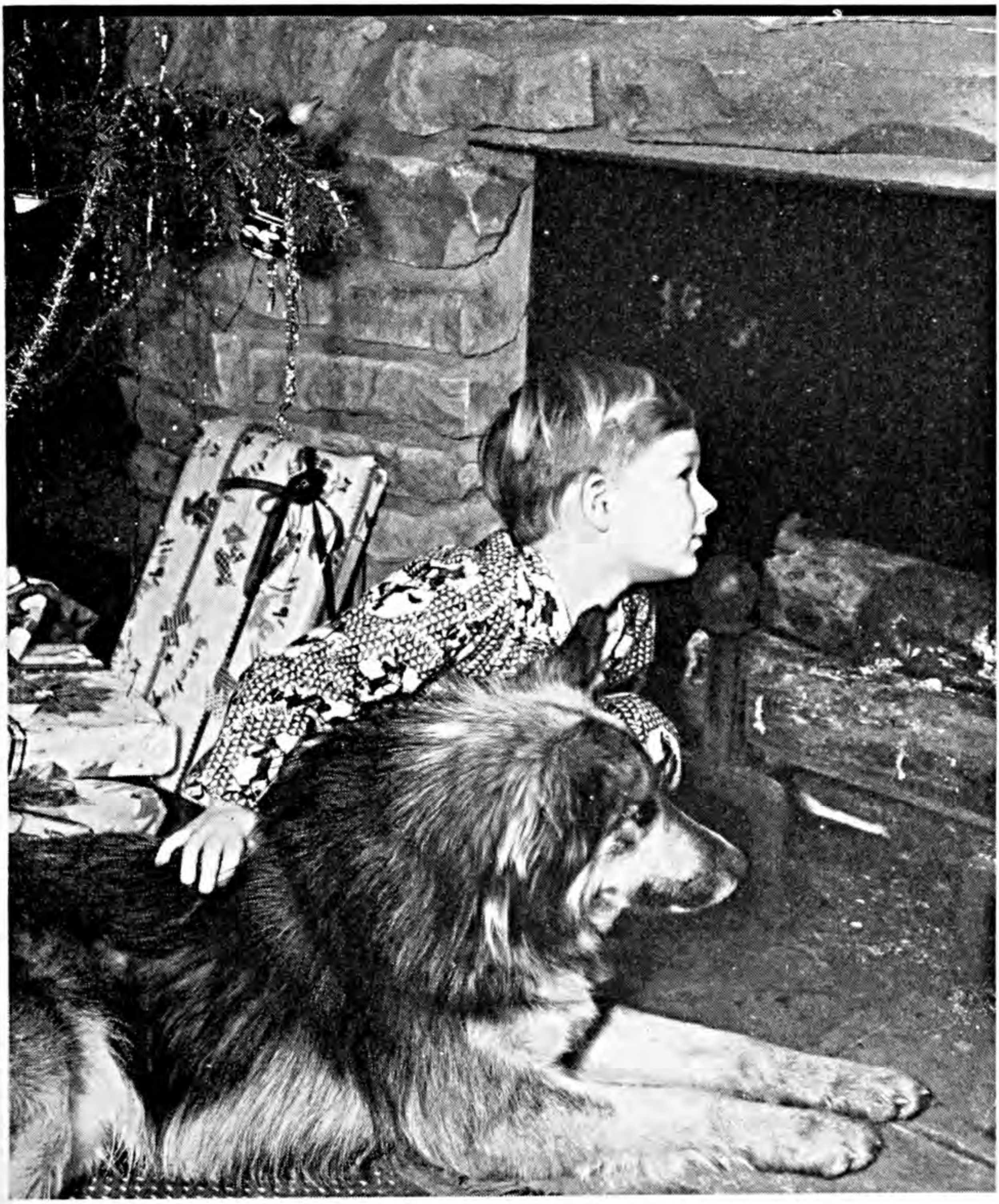

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*
Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXVIII NO. 10

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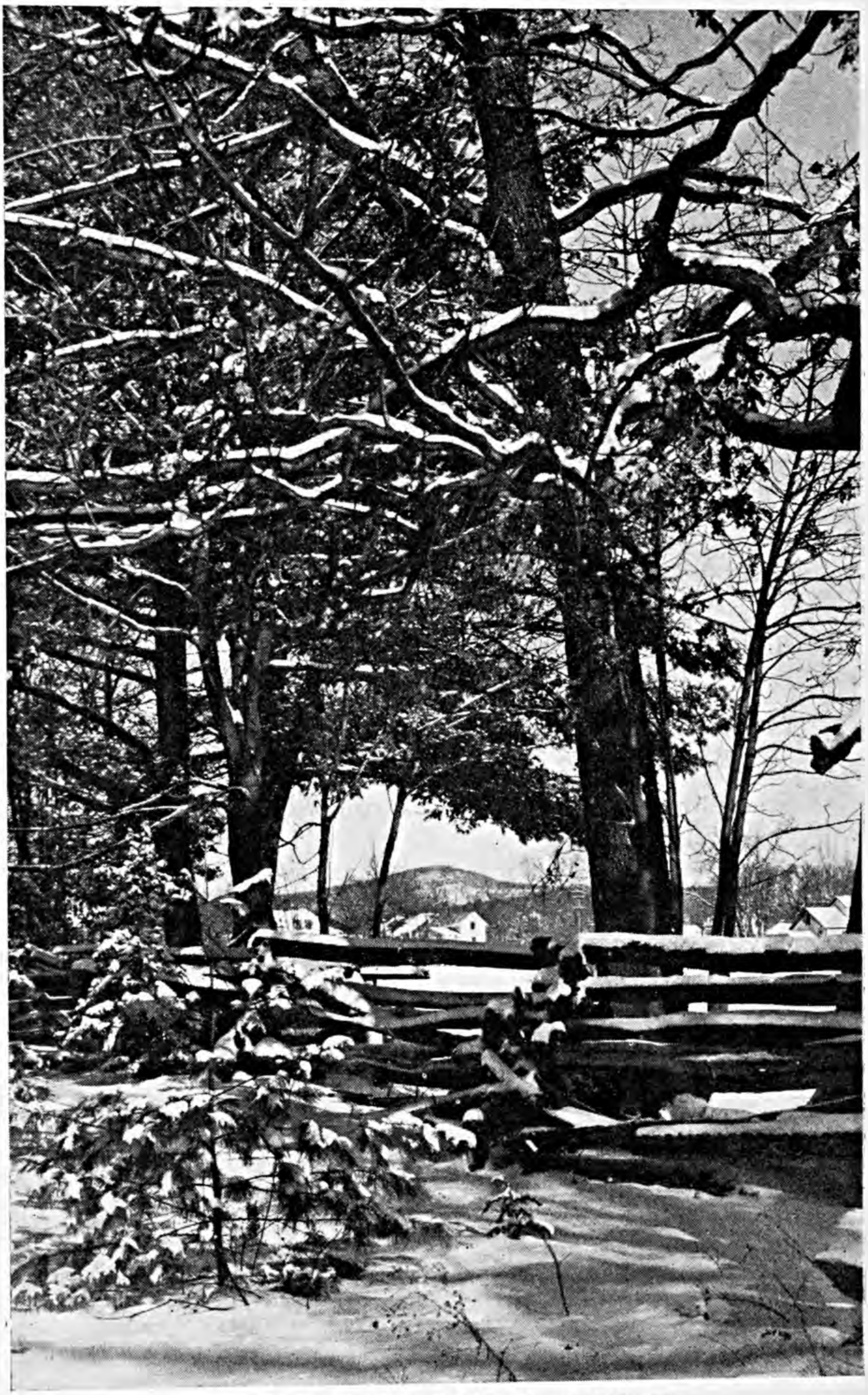

"AND ON EARTH PEACE, GOOD WILL TOWARD MEN!"

Better Crops with PLANT FOOD

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VOL. XXVIII WASHINGTON, D. C., DECEMBER, 1944 No. 10

Anticipating . . .

Anti-Acre Aches

Jeff McDermid

WHEN we are under the mellow influence of Christmas it's time to watch out for benevolent blundering, a good time to see that our sentiment doesn't run away with our sense, or that we don't try to pay taxes with tinsel and thus invite aching acres in 1950 by beckoning all the boys back to hustle for happiness on the old homestead.

We all must admit to a certain carefree mental jag at holiday time, a tendency to let the programs of the year ahead glimmer away in a wave of generosity, and to take all things at their outward face value, like Santa Claus' whiskers. It's a fine old American trait, but the trouble is we often let it fool us all the rest of the year, and overlook the fact that a Christian can also be careful, considerate, and cautious.

This is especially apt to happen when we have an empty chair or two in the circle, and the absent ones are delving in unaccustomed industry or facing danger in unknown lands. In our anxiety to have them back among us in old haunts and following old habits, we like fairy tales better than facts.

From time immemorial the good earth and its husbandry have been the refuge for the "forgotten man." It has been the place of last resort, the wondrous rainbow's end in a deluge, the retiring spot for the escapist and the incompetent, and the promising shelter for victims of economic unrest.

Because so much of the best and soundest aspects of living have sprung from close communion with nature and under the vine and figtree of the family-sized farm, we allow ourselves to get maudlin and lush with starry-eyed faith in the soil as a sure-fire cure for what ails us in a world out of joint.

Ergo, we say to ourselves, if a food or a medicine is so helpful, let's all gather around and take more of it!

This attitude has been traditional in American thinking and disregards the gradual way in which general opportunity on the farm has been hedged in and circumscribed by the growth and spread of technical progress and mechanical ingenuity in the old art of filling the human belly.

YOUR standard Christmas card depicting human cheer and comfort and content has been decorated with ruddy rural doorways, jolly family reunions, cozy hearthstones, laden larders, and gravy galore—always the horn of plenty, but never the horn of dilemma. When all else fizzled out, the farm was functioning, the goose hung high, the calf was milk-fat, and the poor prodigal was once more the home-bound hero.

Anybody who dared to intimate that maybe the farmer should be licensed to practice on his ability and his equipment and soil resources, just like the dentist or the veterinarian, was never popular as a rural prophet. No siree! Let the freedom of our national life be reflected and upheld by giving everybody a chance to push the plow, yank the teat, and slop the hog. Training and education and basic soil culture were things to be sought after all the hopes and joys and jags of bucolic blessedness were realized. The guy with a hoe had as much right to dig for dollars in the dirt as the man with the pickax to crack the rocks for gold. The only thing that's wrong nowadays is that hoes and pickaxes are so darn far behind as modern tools of achievement!

That kind of mechanical effort belonged to the dead days of yore when it took eight families tilling the farm to keep themselves and only two families in town eating three squares daily. Of course, if we grab hold of that temporarily silly notion so current these days that the destiny of American farms is to keep on shipping provisions to Europe, Asia, and the Isles of the Sea, then maybe we'd go right back to those good old days awhile and keep the balance of our manpower busy in the furrow. But anybody who has ordinary hoss sense can figure out that by 1950 we will be in a normal state again in regard to foreign demand and the home-grown surplus, unless old Hitler and Hirohito hold out longer than we think.

Then by gravy, there's still another poser for you. Back when the walking plow and the pitchfork ruled our farms, the boys and girls somehow never had the strange yen for fancy luxuries and slap-dab fixings in the home and on the ranch like most of them insist on buying now. That means either fetching the kids all home to take a chance on being bereft of the gadgets they want to make life cozy, or else letting them go mail-order haywire and trust city industry to pay their help so they can eat twice as much as they want to, so the farm folks can pay the freight both ways. In either case you've got to have livestock to make manure or else buy mixed minerals galore, and it hurts both ways if you haven't got a good market handy.

But I don't want to forget our "forgotten man" I mentioned a bit ago. He's being forgot so much it's no wonder I almost missed him in branching off a little in my essay. So bend closer to the mazda and follow along in this mess until you begin to see what I am aiming at. We mustn't allow him to sneak back on the farm to starve while we indulge in rhetoric.

TWO cases that prove nothing for future results come to my attention, but both are typical of what may be expected as fast as the soldiers and sailors return to old communities. Each carries its own question mark, insofar as depending on agriculture for a haven after war's shattering abuse.

First, take the boy, Darrell, who worked out on farms more or less before his enlistment in the marines. He was in the thick of the New Georgia Island campaign, where he suffered brain concussion from a Jap shell explosion. Upon his discharge the home doctor recommended the farm as a place to recuperate and be free from loud noise and confusion. His mustering-out pay was all the cash assets Darrell had and local finance concerns were unable to get him located on a farm. Thereupon through the FSA agency he rented a 70-acre place and with a loan of $2,500 got 15 cows, a team with harness, feed and seed, and some tools.

His father and mother came to live with him last spring. He got a late start but planted about 10 acres of corn, 18 acres of oats, and 6 acres of potatoes for a cash crop. He has had a slight setback with malaria fever, but fresh country living is more likely to curb that than a confining job in town, he says. He gets his $50 monthly pension money and with this he hopes to tide himself along until health returns and a normal season comes. He leans toward pure-bred cattle and says he wants blue ribbons on them to match his service ribbons in the war. Well, let's hope he will and trust to nature and weather and government price supports, as well as more loans, probably, to pull him along.

The second case is unlike the first because this time an elderly couple born in Poland are alone on the 80-acre place with only 40 acres cleared, and with five boys and two girls in the active services. The Missus says she is just a thankful old lady working hard and praying for the time when her family will all be together again. This no doubt means having them all try to get a start on the home farm or on some adjacent place. She gets $20 a month from each of the five boys, which she mostly invests in war bonds. Although the boys told her to use the cash for fixing up the farm house and getting conveniences they long desired, she prefers to put it away in a snug place and have it ready to give some of the boys for future farming operations. Only two of her sons had been injured in battle up to last reports. She trusts that the rest will come through healthy and strong so they can bend their energy to the plow handles.

Here we have a family that managed to clear only 40 acres of land in more than 20 years, partly due to depression prices, partly to poor yields. The background of experience and manual skill and progress these lads have had at home is not stimulating in many ways toward future success in agriculture. Most of them took winter jobs in the logging and pulpwood industry before the war, and three of them have a high school education. What would a jury recommend for these returning soldiers? Put them all back in agriculture or encourage them to divide their interests?

IT'S true that the zones from whence these cases come are not the best developed farming sections of my state. This may have a bearing on the issue, but even in the well-settled, century-old agricultural regions the cards will be stacked just as bad owing to the fact that the older areas usually have

(*Turn to page* 49)

J. D. Warner in a field of blue lupine at the North Florida Agricultural Experiment Station, Quincy, Florida. Photographed Feb. 23, 1944.

Blue Lupine Is A Valuable Legume

By R. Y. Bailey

Chief, Regional Agronomy Division, Soil Conservation Service, Spartanburg, S. C.

FROM a 2-pound packet in the fall of 1935 to more than 4 million pounds of seed harvested in the spring of 1943 is the remarkable record of blue lupine. This bushy annual promises to be the answer to the search for a winter legume that will produce good crops of seed in the lower South.

Although lupines have been grown in several of the European countries since ancient time, they have only recently come into prominence in the South. Roland McKee of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, sent the 2-pound packet of seed to the North Florida Agricultural Experiment Station at Quincy.

In commenting on the blue lupine planting at Quincy Mr. McKee said: "The testing of lupines that led up to this planting began in connection with our cooperative work with the Florida and Georgia Experiment Stations in 1930 when plantings were made at Gainesville, Florida, and Tifton, Georgia. In 1931 plantings were also made in connection with cooperative work with North Carolina and South Carolina Experiment Stations.

"These tests, together with plantings in subsequent years, indicated the possibilities of lupines in the South and made it clear that special inoculation is required in getting lupines started. The seed sent to Quincy in 1935 was a part of this general program. Special work was also started in 1935 in Louisiana in cooperation with the Louisiana Experiment Station, with very promising results as indicated by the Louisiana State Experiment Station Annual Report for 1941-1942, issued June 30, 1943."

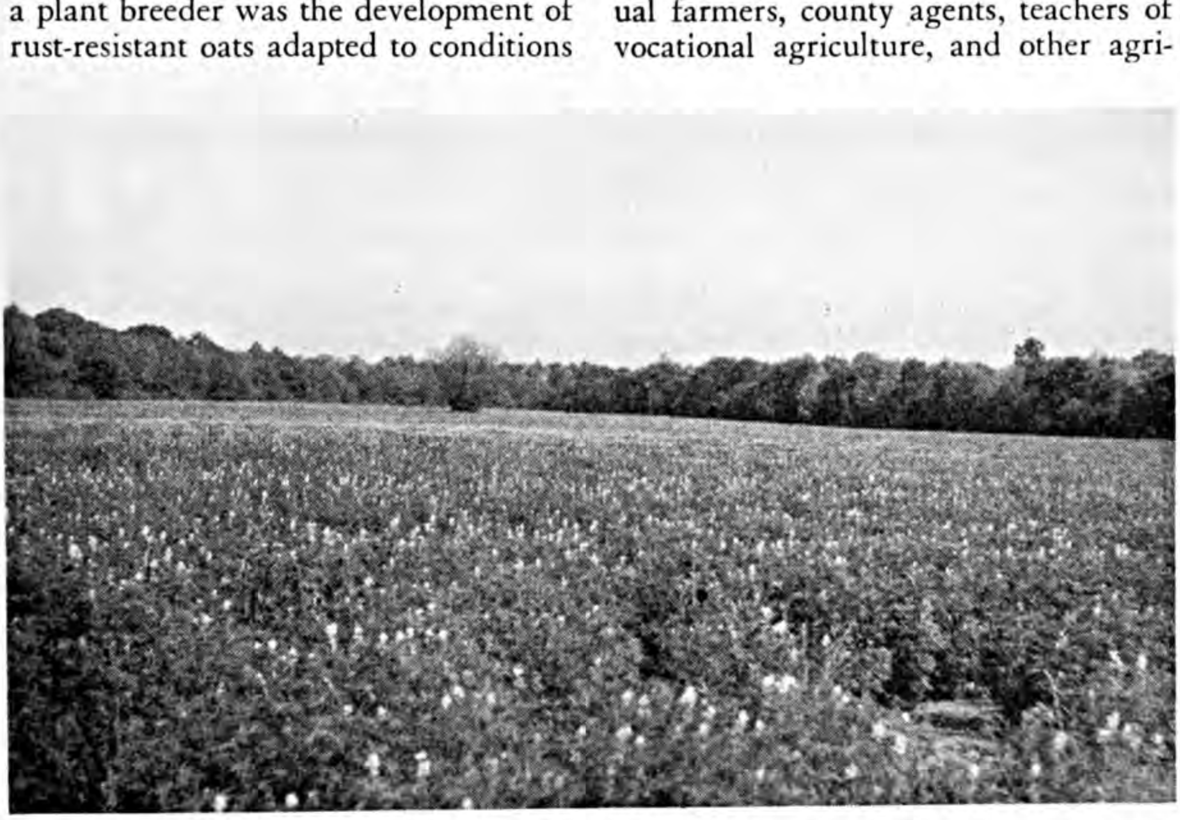
Various lupines had been tested at several of the other Southern experiment stations at intervals over a period of 30 or more years. Most of this earlier work was at stations considerably north of Quincy, Florida, and, because of less favorable climatic conditions, results were so disappointing that most agronomists had about written the lupines off as cover crops for the South.

Fortunately, the soil and climatic conditions at Quincy were favorable for blue lupine and it made vigorous early-season growth and produced such heavy yields of seed that it attracted the attention of all who saw it.

It also was fortunate that J. D. Warner was agronomist at the Quincy Station when the lupine seed was sent there. He recognized the possibilities of this legume as a cover crop for the lower South. Warner has done outstanding work as a plant breeder and as a tester of newly introduced grasses and legumes. Notable among his accomplishments as a plant breeder was the development of rust-resistant oats adapted to conditions in the deep South. His work with pastures and grazing crops also has been outstanding.

Seed produced from the planting made at Quincy in the fall of 1935 was harvested in the spring of 1936 and planted for increase that fall. In the fall of 1938, small quantities were released for trial plantings on farms. A small quantity of seed was sold to the Soil Conservation Service for the demonstration area at Greenville, Alabama. Again in the fall of 1939, Warner let the Soil Conservation Service have a few hundred pounds for trial plantings at the land utilization project, Munson, Florida, and in CCC camp work areas in southern Georgia, Alabama, and Mississippi. Plantings in Florida, Alabama, and Georgia gave promising results, and larger quantities of seed were planted in the fall of 1940. Because of an unusually severe winter in the 1939-40 season, lupine did not succeed in south Mississippi. A few plantings made in the fall of 1942 were more successful, and seed was harvested from small patches in 1943.

Warner also released seed to individual farmers, county agents, teachers of vocational agriculture, and other agri-



A general view of a 70-acre field of blue lupine grown for seed production in Huston County, Alabama. The acre rate of seeding was 50 lbs. Photographed April 16, 1942.

Blue lupine at Blakely, Georgia, was sown immediately after runner peanuts were harvested, September 4, 1943, and covered with a section harrow. The field was heavily gleaned by hogs. Photographed Feb. 24, 1944.

cultural workers. From the seed produced at the Quincy Station and distributed for trial plantings, blue lupine rapidly developed into a winter green-manure crop of importance. Farmers in Florida, Georgia, and Alabama harvested between 4 and 5 million pounds of seed in the spring of 1943. This seed had a cash value of more than $325,000.

In addition to its excellent seeding habits, blue lupine grows off more rapidly and is ready to turn under earlier than other winter legumes. When planted by the middle of October, lupine usually makes sufficient growth to turn under so that the crop that follows it can be planted by the middle of March. Green-weight yields of above 10,000 pounds per acre by the middle of February are not unusual. Elijah Cook, a north Florida farmer whose address is Falco, Alabama, had 19,000 pounds of green lupine per acre on February 2, 1943, from a planting made September 1, 1942.

Blue lupine has grown well on most of the soils found in northern Florida and southern Alabama and Georgia. It also has grown well on the light sandy soils in the citrus-producing section of Florida. When seeded just before irrigation water was applied in citrus groves in the fall, lupine has made excellent early growth and promises to be a valuable orchard cover crop in irrigated orange groves. Like most other legumes, lupine has grown most satisfactorily on well-drained, fertile soils. In some instances, it has appeared that damping-off of the young plants was more severe on light sandy land than on heavier soils.

Cold damage was more severe in December 1943 on flat than on sloping land. Air drainage probably was a factor in freeze injury on the fields that were low and practically level.

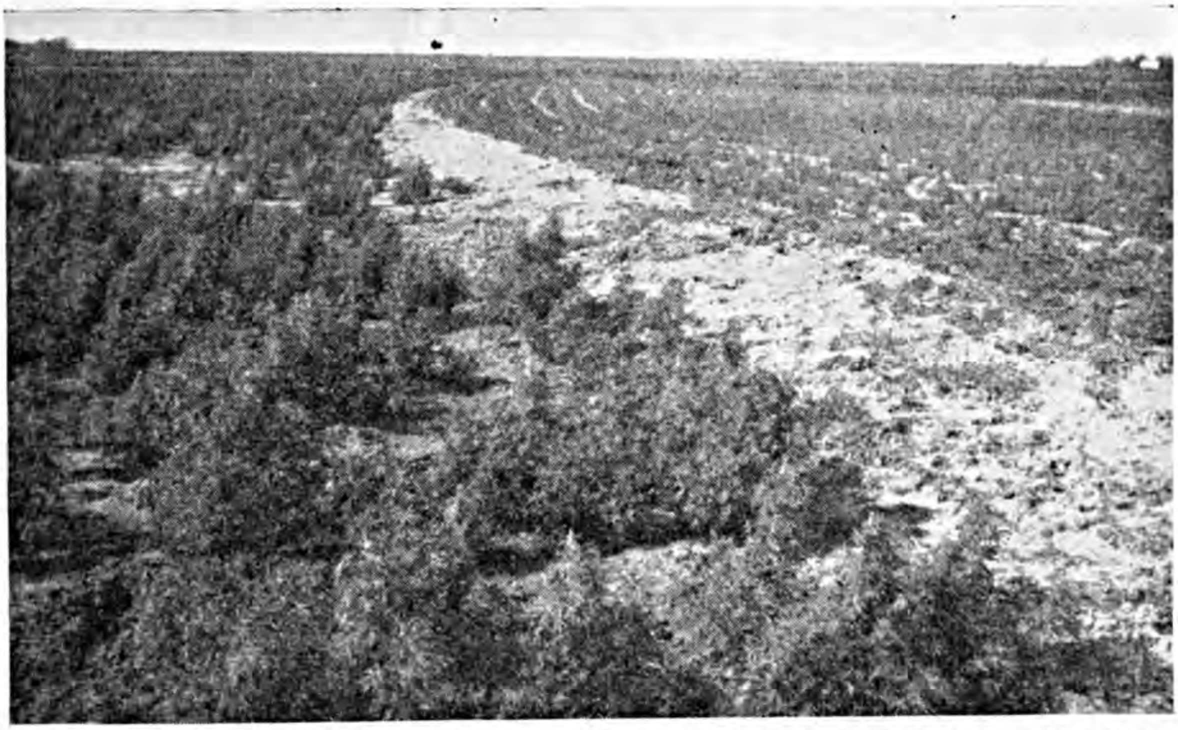
Experience to date indicates that best results may be expected with blue lupine when it is planted early, September 1 to October 15. A few August plantings have been seen where plants survived the high temperatures of late August and early September, but, so far, these earlier plantings have not given as good results as those made from September 15 to October 15. Plants from seedings made in September have sometimes been so far advanced in growth that they were severely damaged by freezes in January or February. Where this has occurred, however, the plants usually have made sufficient growth for a satisfactory green-manure crop. September plantings usually get sufficient rain to bring the plants up before the dry weather that often occurs in October and November.

Farmers sometimes plant blue lupine as late as the first to the middle of December and make moderately good crops of seed. Most of them prefer earlier planting, particularly when the crop is to be turned under as green manure. The young plants from late seedings often are severely damaged by cold, grow off late in the spring, and make smaller yields of seed than those planted earlier.

Blue lupine plants have shown remarkable ability to withstand extended periods of hot, dry weather in the fall. The small plants wilt during the day and look as if they are dead, but revive at night. Survival of plants during the severe drought in October and November 1943 was considerably better than that of Austrian winter peas under similar conditions.

There is considerable difference of opinion about the rate of seeding blue lupine. When planted early, 50 pounds of seed per acre usually gives a fair stand that covers the ground well late in the spring and makes a large crop of seed. Farmers who grow and harvest their own seed often sow 75 to 100 pounds per acre. The heavier rate gives a thicker stand and earlier ground cover. Also, where drought, disease, or worms reduce stands, a thick seeding is more likely to have enough plants survive for a fair stand than will a thin seeding.

Most farmers and agricultural workers who have had experience with blue lupine agree that shallow covering of the seed is essential in getting stands. Most experienced growers recommend covering seed from ½ to 1½ inches deep. In connection with depth of covering J. D. Warner says, "Lupine certainly should not be covered more than 2 inches deep and ½ inch seems to be plenty." Most of the farmers who have expressed an opinion about covering have emphasized the importance of very shallow covering. On light sandy soils in central Florida, covering of 1½ to 2 inches gave bettter stands in 1943 than shallower covering.



Left, blue lupine in Dale County, Alabama, sown broadcast Sept. 10, 1943, before runner peanuts were dug; right, lupine drilled Dec. 1, 1944, after peanuts were dug. Green weight on Feb. 24, 1944—left, 6,000 lbs.; right, 3,000 lbs. per acre. The rate of seeding was 50 lbs. per acre and the field was gleaned by hogs after peanuts were dug. Photographed Feb. 25, 1944.

Blue lupine seed has been planted broadcast and with various kinds of drills. Satisfactory stands have resulted from both methods. J. D. Warner followed his grain drill with a cultipacker in 1943 and is sure that stands were improved by cultipacking.

Like other legumes, lupine requires inoculation when grown for the first time. Most farmers inoculate the seed each year with a special lupine culture, even when planting on land where lupine has grown before. The small acre cost of inoculation is considered by most growers to be cheap insurance. A few farmers have planted lupine on land where it has grown before and omitted the inoculation with satisfactory results.

Maxwell Strom, chairman of the board of supervisors of the Gadsden Soil Conservation District in Gadsden County, Florida, has grown blue lupine since 1938. When asked about inoculation Mr. Strom said, "I had a terrace interval in lupine in 1940 that I left to mature seed. After I gathered the seed, the land was idle the rest of the summer. That fall, for my own information, I sowed lupine on this terrace interval without inoculation. Just above the terrace, where no lupine had been grown previously, I inoculated the seed. If there was any difference in the growth or the number of nodules produced, the lupine that followed lupine and was not inoculated was better than that artificially inoculated, but planted on land where lupine had not grown before.

"I used soil from a field that had previously grown lupine to inoculate seed in 1941. I had just as good luck with it as I did with seed where I used artificial inoculation."

The extent to which the bacteria in commercial inoculant survived several weeks of dry, hot weather when seed was sown in dry soil in the fall of 1943 was a surprise to most who observed it. In several cases, lupine seed sown when peanuts were dug lay in the dry soil 2 to 5 weeks before there was enough rain for germination, but in January 1944 the plants appeared to be fairly well inoculated, except where seed was not well covered.

Fertilizer requirements of blue lupine are, so far as is known, about the same as for vetch and Austrian winter peas. J. D. Warner warns against drilling lupine seed and fertilizer down the same drill spout. He has found that the seed often is injured by direct contact with phosphate. Roots of young seedlings also have been injured by concentration of fertilizer in drill furrows. Warner says, "It is all right to broadcast the seed and phosphate separately and then disk them in together, but there is too much concentration of phosphate on the seed when they are drilled together."

A Good Seed Producer

Blue lupine usually matures seed by the first to the middle of May. Yields of seed have varied, but this legume has been a consistent seed producer. Yields of 1,000 to 1,500 pounds of seed per acre are quite common. M. L. Pierce, Uriah, Alabama, harvested 28,000 pounds of seed from 20 acres in 1943. Grady Baggett, Baker, Florida, harvested 2,185 pounds of seed from one acre in 1943.

Larger yields of seed usually are made on early than on late plantings. J. D. Warner says, "Yields of lupine seed vary with planting dates and weather conditions. My December plantings average 1,000 pounds of seed while those made the middle of October average 1,300 to 1,400 pounds per acre." Farther north earlier planting is even more important than it is at the Quincy Station.

Most of the lupine seed is harvested with combines. Farmers who grow small patches for seed sometimes harvest by pulling the plants when the seed is ripe and flailing the plants against woven wire stretched over a wagon bed. The seed shatter and fall through the wire into the wagon bed. Lupine seed shatters if not harvested soon after it is ripe. Some years the

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Leaf Analysis — A Guide to Better Crops

By M. E. McCollam

San Jose, California

The taking of proper samples of leaves in the field is important as the first step in leaf analysis.

PLANTS grow upon the soil and derive an important part of their nutrition from the mineral elements which are available to them from the soil. We know that all soils contain more or less of the minerals essential as plant foods. We do not always know why a plant grows well, or grows poorly on a soil. There are outside factors such as diseases, insects, and climate, and soil factors such as soil moisture, soil structure, and the level of soil fertility itself, which govern how a plant grows.

In trying to arrive at the causes for crop behavior concerned with soil fertility, it seems quite logical to analyze by chemical means a part of the plant itself to see how much of the essential mineral elements the plant has been able to get from the soil. If we are familiar with the quantities of these elements found in good plants and the quantities found in deficient plants, we can interpret many crop troubles by making such chemical analyses.

In choosing a part of the plant to analyze, the leaf is usually considered best because it is such a vital part of the plant in its nutritional processes. It is in the leaf that the plant foods are gathered and combined for redistribution throughout the plant. The leaf is the breathing and manufacturing organ of the plant.

If the plant cannot get enough of any one of the essential mineral elements from the soil, life processes are crippled and crop production suffers. Leaf analysis and its proper interpretation, therefore, reveal shortages of essential plant food, and are a most direct guide to better fertilizer practices and better crops.

In taking samples of leaves, it is important to take leaves from the same relative location on the plant, so that all samples will be comparable. For instance it has been determined on fruit trees that a leaf from the lower portion of the current year's new growth is most suitable for analysis. In the case of orange trees, which are classed as evergreens, a leaf from the spring cycle of growth is taken. To be more sure of this location on the orange tree, a leaf just behind a small green fruit is selected for sampling. With grapes, a recently matured leaf some distance away from the tip of the new cane is taken. The leaf selected for leaf sampling of sugar beets is midway between the old outer leaves and the small, immature leaves in the center. In other words, it is an active, recently matured leaf. So with other crops, it is desirable to choose the best leaf location for the sample to be analyzed. In some cases the entire leaf is analyzed, and in other cases only the leaf stem or leaf stalk is kept for analysis.

It is desirable in a thorough study to take several leaf samples during the season, in order to determine how well the plant is being supplied with mineral nutrients during its growth and when shortages begin to appear. However, it has been found that one leaf sample taken at the proper time of year and analyzed may give a good indication of the mineral nutrient status of the crop, and may be used to interpret its present condition and final yield. Such a leaf sample should be taken after the early growth period and well before the harvest period. As an example, leaf samples from fruit trees in California taken in late June or early July have been found to be quite indicative of the nutrient condition in the trees. Should such a leaf sample taken in mid-season show a low value, this is significant in indicating that the plant has too little of the nutrient in question to insure maximum crop production. Should the sample show a high value, it would indicate an amount of the nutrient sufficient to carry through for a good crop yield.

If leaf samples are taken too early in the season, all analytical results for nitrogen, phosphorus, and potash may show high values. If taken too late in the season, all values are apt to be low.

The chemical analysis of plant tissue, whether it be the laboratory analysis of leaves or rapid chemical tests on plant tissue which can be performed in the field, has found widespread usefulness.

It has been successfully used as a means of surveying fertilizer needs of entire districts or individual farms with respect to a wide variety of crops. It is at the same time a guide for the grower to use in arriving at more intelligent fertilizer use and a valuable aid to the research worker in locating field experiments and interpreting the results.

In making leaf surveys of large crop areas, it has been the practice to take the leaf samples extensively at first, then pick out localities within the area which show a number of low analyses for one or more of the plant foods. The next step is more intensive leaf sampling within these certain areas to localize the deficient areas.

Such a survey was recently made in an important grape district in California. In considering the potash content of the leaf samples taken, the results of the first extensive sampling within the district revealed an area giving a number of low potash values. In sampling this area more intensively it was found that 60 per cent of the leaf samples taken were in the low range for potash.

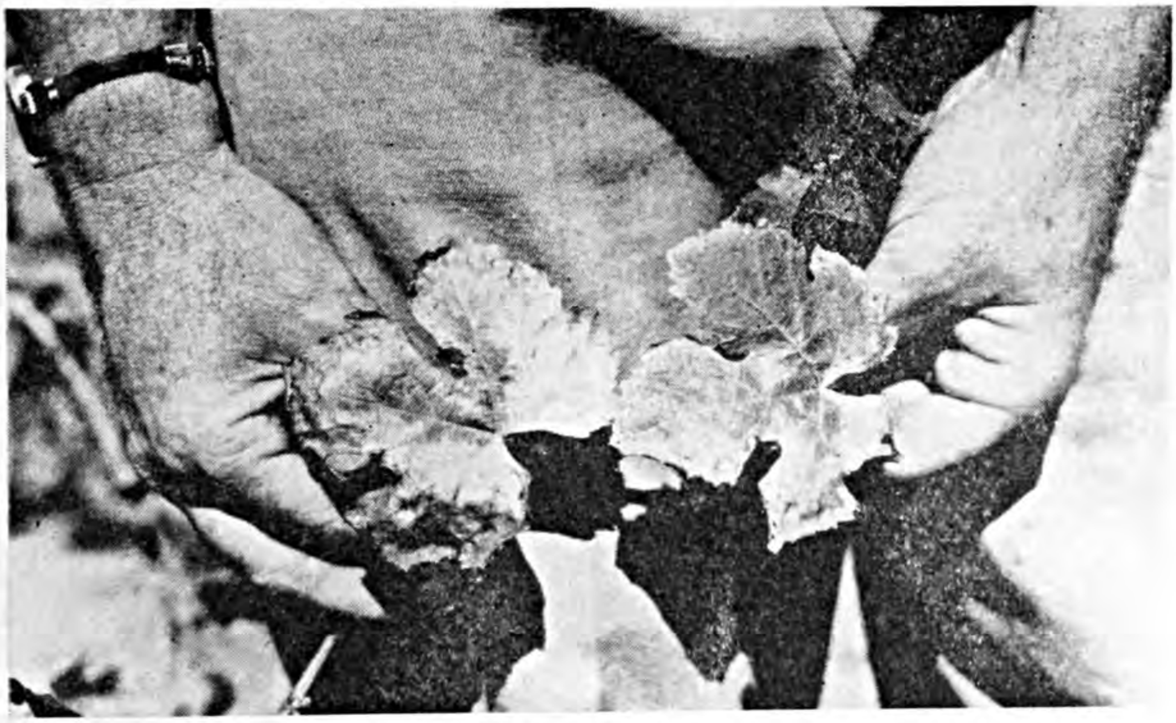
The Fertilizer Program

Leaf surveys of individual farms, especially where rather large acreages are involved, have proven of great value in interpreting crop behavior and in making more effective use of fertilizers. The procedure here is to map the acreage and the location of each leaf sample taken. The results of the chemical analyses are then filled in on the map with different colors for nitrogen, phosphorus, and potash. A fertilizer program can be adopted on the basis of the leaf survey map. Subsequent leaf surveys are helpful in confirming the effectiveness of the fertilizer and indicating changes which should be made in the fertilizer program.

The successful use of leaf analyses by California Packing Corporation on a large peach orchard in California is described in brief by P. D. Caldis, A. R. Brown, and R. T. Marks of that organization. "The yield of cling peaches depends on the ability of the tree to size a crop, regulated by thinning. To determine the causes of partial inability on a 3,000-acre ranch near Merced, California, leaf analysis was resorted to. Comparative analyses,

Normal leaves such as this one contain more than 1.5 per cent potassium.

yearly since 1937, of leaves of peach trees from various blocks of the Merced and neighboring orchards, have revealed the K_2O content of the Merced ranch ranging between 0.87 and 2.73 per cent, while well yielding and sizing orchards in neighboring counties but different soil types analyzed 2.72 and 5.19 per cent. No symptoms of potash deficiency could be observed and in many respects the trees, fertilized adequately with nitrogen, appear normal. Applications of potash and phosphorus either alone or in combinations, yearly, at 900 pounds per acre each, have not shown response, until single applications of 4000 pounds of potassium sulfate per acre were made. Without fur-



Leaves such as these containing less than 0.5 per cent potassium are starved for potash.

Leaf analysis can be used as a guide to prevent trees getting into this condition. The prune trees above are severely damaged by die-back due to potash deficiency.

ther applications, the K_2O content was increased gradually to 2.53 per cent from 0.87 per cent at the end of the fourth year since application; the mean diameter of the fruit was increased by 2 mm., while the yield of No. 1 fruit was increased by 4.8 tons. A potash survey of the ranch was carried out by means of leaf analysis and the deficient areas treated in 1942."

Experiences with leaf analysis on fruit trees in the Eastern United States have been quite favorable, according to Drs. Cullinan and Batjer of the U. S. Department of Agriculture. They state, "It is believed that the results obtained with leaf analyses justify their further use with fruit trees as an index of the adequacy of available nutrients in the soil and as an aid in diagnosing abnormal growth responses that may be caused by mineral deficiencies."

Leaf analysis is being used extensively by Dr. O. Lilleland and Mr. J. G. Brown of the University of California in studying nutrient disturbances in prune, peach, and almond orchards. In much of this work the results of leaf analysis have correlated with such symptoms as leaf scorch and die-back of the trees, and failure of the fruit of peach trees to reach satisfactory size.

Extensive studies with leaf analysis of grapes, clover, and sugar beets have been made by Dr. A. Ulrich of the University of California. The responses obtained in fertilizer experiments on grapes have correlated with leaf analysis results. He concludes that after reliable critical levels for the mineral nutrients have been established for a crop, leaf analysis can be used to arrive at fertilizer recommendations.

Much valuable information on the fertilizer requirements of Ladino clover has been obtained through leaf analysis, both in field experiments with fertilizers and more extended leaf surveys.

Recently the beet sugar industry has been collecting leaf samples from many sugar beet fields during the growing season. The Plant Nutrition Laboratory at the University of California is analyzing these leaf samples. Through such a cooperative effort much information on the nutrient status of sugar beets in California will be gained and will lead to more effective fertilizer use.

Leaf analysis has been applied to the tomato crop in California in surveying

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Stumbling Blocks to Responses From Plow-Down Fertilizers

By D. F. Beard

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WHERE nutrients are the principal limiting factors in crop production, heavy applications of complete fertilizers plowed under have given substantial yield increases. Under such conditions in the Corn Belt, no other method of applying 500 to 1,000 pounds of 8-8-8 or similar grade per acre has proved as satisfactory under a variety of conditions for corn and some other row crops. Since most improved farm practices are accepted first by the more enterprising farmers on the better land, the natural question is "What results can be expected on more productive land?" Speculation also arises as to whether nitrogen plowed under coupled with higher rates of phosphorus and potash in the planter row would produce the same results as 8-8-8 fertilizer put under, or, would phosphorus and potash plowed under at heavy rates meet the needs on fertile land without additional nitrogen?

Eight farm comparisons were set up in Ohio in 1943 on lands ranging in productivity from very poor to very good. Unfortunately, excess water early in the season and extreme variation in stands of plants between treatments eliminated four of the eight. The remaining four were on better-than-average land and were harvested, although hail damaged one of these.

Combinations of fertilizer nutrients were used rather than grades as listed.

Left: AxTr over 10-10-0 treatment; right: Ohio W36 across same treatment. Broken plants in AxTr were 66.7 per cent of total compared with 4.7 per cent for Ohio W36. Although stalk breakage was greater with 10-10-0 than with 10-10-10, in the case of most hybrids, the behavior of individual hybrids varied in this regard. See Table 4.

TABLE 1.

Acre yields in bushels of shelled corn at 15½% H_2O content are given in body of table.
Per cent broken stalks in parentheses ( ).
Previous crop: Corn-stalks left on ground.
Manure applied: 10–12 loads of strawy shed manure just prior to plowing.
Row fertilizer: 200 pounds of 2–12–6 per acre.
Date planted: May 6, 1943. This was early for the area. Corn-borer infestation was heavy and damage severe on Iowa 939 and U. S. 13 under NP treatment. Average stand of plants 10,500 per acre. (Weight of ears per plant .44 pound.)

Hybrid	Plow-down treatment					
	800 lbs. 10–10–0	800 lbs. 0–10–10	800 lbs. 10–10–10	800 lbs. 10–10–20	Nothing plowed down	Average
U. S. 13	63.0 (7.5)	64.0 (11.4)	78.9 (6.5)	83.4 (9.0)	60.1 (7.0)	69.9 (8.3)
Iowa 939	54.3 (17.0)	58.8 (7.8)	72.5 (12.6)	60.0 (11.0)	48.7 (7.9)	58.9 (11.3)
Ind. 608C	62.9 (5.6)	47.3 (4.5)	71.3 (1.9)	78.5 (3.5)	41.2 (5.9)	60.2 (4.3)
Ohio W36	76.0 (10.6)	69.0 (6.4)	84.4 (1.9)	76.1 (1.0)	58.3 (2.0)	72.8 (4.4)
Average	64.1 (10.2)	59.8 (7.5)	76.8 (5.7)	74.5 (6.1)	52.1 (5.7)	
Gain in yield	12.0	7.7	24.7	22.4		

However, uniform rates per acre in terms of the grades shown are given for ease of comparison.

800 lbs. of 10-10- 0 plowed under
800 lbs. of 0-10-10 plowed under
800 lbs. of 10-10-10 plowed under
800 lbs. of 10-10-20 plowed under

Across these parallel treatments four corn hybrids were planted. Two of the hybrids were as early as any recommended for the area—Iowa 939 and Ohio W36; one was intermediate in maturity—Indiana 608C or AxTr; the other was U. S. 13 which is the latest recommended in the areas where the comparisons were made.

All of the fertilizer plowed under was applied with a grain drill before plowing. Placement on the furrow bottom in bands was desired but impossible because of lack of equipment. The regular fertilizer application to which the farmers were accustomed was made in the row or hill when the corn was planted.

On a field of Fincastle silt loam in Preble County the earliest planting was made. The corn was planted May 6 by which time less than 25 per cent of the corn in the area had been planted. Results given in Table 1 indicate clearly the inferiority of the treatments not containing all three of the elements nitrogen, phosphorus, and potash.

Corn-borer damage was greater in these early planted comparisons than in those planted late in May or June. Yields were reduced at least 10 to 15 bushels to the acre because of borer injury. Greatest damage occurred on the treated strip which received no potash. Stalk breakage also averaged most on the 10-10-0 strip. Just prior to tasseling, corn on all nitrogen-treated strips stood 18 to 20 inches taller than where the heavy nitrogen application was omitted. Yield responses were less, therefore, due to corn-borer damage than could have been expected in the absence of borer under similar conditions. Placing the nitrogen on the furrow bottom does not stimulate early growth to the extent observed here—a possible advantage to be noted where corn borer is present. No advantage for double potash (10-10-20) over 10-10-10 was observed in these comparisons either in leaf blight control or yield. The need for a balance between nitrogen and potash (compare the 10-10-0 and 0-10-10 strips with the 10-10-10) at these rates of application is probably the most significant observation to be made, especially in view of the fact that the cornstalks from the previous crop were left on the field and a manure application of 10-12 loads per acre accompanied the various fertilizer treatments.

A similar set of comparisons was duplicated on a Miami silty clay loam in the same county. Here a mixed legume grass sod, rather than corn, preceded the corn crop. Planting was done June 4, nearly a month later than on the first farm, and corn-borer damage proved negligible. Gains for all plow-down treatments were small but probably significant. Since these gains were essentially the same for all treatments, phosphorus (being common to all) was undoubtedly responsible for them. See Table 2.

The most interesting observation to be made from these comparisons is the high ear weight, or production per plant of .70 pound of dry ear corn. In a 21-year experiment at the Ohio Agricultural Experiment Station, highest corn yields were obtained with a stand of plants averaging 14,220 per acre and an average ear weight of .46 pound. In the same experiment, and in the better seasons, an ear weight of .71 pound was obtained and a yield of 63.3 bushels with 7,110 plants per acre compared with .51 pound ears and a yield of 89.9 bushels with 17,775 plants per acre. Each .01 pound in ear size above the optimum .51 pound cost one bushel per acre in grain yield in this experiment.

Obviously, the .70 pound "show" ears produced in the comparisons reported in Table 2 were made at a severe yield loss. Fertility was not seriously limiting, but too few plants per acre were.

Table 2.

Acre yields in bushels of shelled corn at 15½ per cent H_2O content are given in body of table.

Previous crop: Alfalfa-clover-timothy.

Manure applied: 10 loads per acre.

Row fertilizer: 100 pounds of 0–20–0 per acre.

Date planted: June 4, 1943. Average stand 8,620 plants per acre, or about ⅔ that desired. Being drilled in 40″ rows this gave only one plant every 18″. Very few broken stalks were found, and so relative amounts were not determined. (Weight of ears per plant .70 pound.)

Hybrid	Plow-down treatment				
	800 lbs. 10–10–0	800 lbs. 0–10–10	800 lbs. 10–10–10	800 lbs. 10–10–20	Nothing plowed down
U. S. 13	97.2	85.2	91.0	94.8	87.7
Ohio W36	85.8	87.6	89.3	86.6	76.6
Ind. 608C	83.0	87.1	84.2	82.9	76.3
Iowa 939	83.5	85.1	81.0	93.8	81.6
Average	87.4	86.3	86.4	89.5	80.6
Gain in yield	6.8	5.7	5.8	8.9	

TABLE 3.

Acre yields in bushels of shelled corn at 15½ per cent H_2O content are given in the body of the table, the per cent broken stalks in ( ).
Previous crop: Clover-timothy.
Manure applied: 12 loads of stable manure per acre.
Row fertilizer: 240 pounds of 3–18–9 per acre.
Date planted: June 4, 1943. Average stand 9,300 plants per acre, or about ¾ that desired. This gave only one plant every 17″ in 40″ rows. Hail severely damaged the crop at earing time and no doubt reduced yields considerably. (Weight of ears per plant .54 pounds.)

Hybrid	Plow-down treatment				
	800 lbs. 10–10–0	800 lbs. 0–10–10	800 lbs. 10–10–10	800 lbs. 10–10–20	Nothing plowed down
U. S. 13	85.7	81.4	79.8	75.5	77.6
Ohio W36	74.7	67.6	72.1	74.1	61.6
Ind. 608C	68.3	70.6	67.3	65.9	61.7
Iowa 939	69.8	74.1	73.5	77.5	66.5
Average	74.6	73.2	73.1	73.3	66.6
Gain in yield	8.0	6.6	6.5	6.7	

Results on Miami silt loam on another farm, Table 3, followed a similar pattern. In spite of hail damage, yields were good and ear weights were above optimum for highest acre yields.

Planting rates were stepped up on a fertile river bottom field in Fairfield County and yields of the better hybrids exceeded 100 bushels per acre. Even here, however, it is questionable that a sufficient number of plants per acre occupied that land. While the average weight of ears per plant was .51 pound for this entire area, it averaged .63 and .56 pound, respectively, for the two highest yielding hybrids. It should be

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Comparative yields obtained with four hybrids in Preble County comparisons showing gain for 800 lbs. per acre of 10-10-10 plowed under. Left: Yield of 76.80 bushels from 10-10-10 treatment; right: Yield of 52.1 bushels with row fertilizer only. See Table 1.

Lime Is the Key to Potash Efficiency

By S. S. Obenshain and P. T. Gish

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THE oft-repeated saying of Professor T. B. Hutcheson of the Virginia Agricultural Experiment Station that "the only thing a farmer has to sell is plant food" leads to the conclusion that the most efficient user of plant food should be the most successful farmer. While passing through the early years of the war food production program when there was so much discussion about a scarcity of potash, the natural thing to do was to search for more efficient ways of using potash. A study of experimental data in Virginia indicates that in practically every case, consistently greater yields from the use of potash alone and in combination with nitrogen and phosphoric acid have been obtained when the soil was adequately limed. The most striking of such data are taken from an experiment carried on at Staunton, Virginia, on a soil mapped as Berks silt loam. Soils of this and closely related series are among the most extensive soils in the limestone valley of Virginia and extend through West Virginia and Maryland into Pennsylvania. Similar results can be expected on many of the other soils of the Southeast, but the degree of response will vary.

The experiment described herein was carried on in a three-year rotation of corn, wheat, and red clover, each crop being grown every year in adjacent series of plots. The results are given in Table 1. Each of the plots on which various combinations of nitrogen, phosphoric acid, and potash were used was divided into two sub-plots, one of which

TABLE 1—THE EFFECT OF NITROGEN, PHOSPHORIC ACID, AND POTASH WITH AND WITHOUT LIME ON THE YIELD OF CORN, WHEAT, AND RED CLOVER ON BERKS SILT LOAM. 1935-1940.

Fertilizer Treatment [1]	Corn average yield bushel per acre		Wheat average yield bushel per acre		Clover average yield pounds per acre	
	Unlimed	Limed	Unlimed	Limed	Unlimed	Limed
O	11.57	21.14	5.67	13.14	604	1,379
P	20.63	27.44	13.73	21.64	1,050	2,279
P–K	25.64	40.79	14.03	24.21	1,187	2,569
N–P	23.60	29.19	15.38	21.72	1,210	2,408
N–P–K	30.60	47.14	16.78	24.31	1,477	2,989
N–P–2K	36.31	48.56	19.24	25.80	1,822	3,263
N–P–3K	38.40	48.81	20.26	27.16	1,750	3,348
N–2P–K	36.44	46.45	20.28	27.82	1,777	3,218
N–2P–2K	37.62	50.44	21.55	27.76	1,783	3,365
N–K	17.46	37.65	8.96	16.65	1,035	2,382
2N–2K	21.16	43.45	9.22	20.81	1,198	2,702

[1] O–No treatment; N–20 lbs. of nitrogen per acre annually; P–32 lbs. P_2O_5 per acre annually; K–20 lbs. K_2O per acre annually.

The corn on the right received potash in addition to the lime, nitrogen, and phosphoric acid used on both plots. Note lodged stalks, left, in contrast to erect ones, right. For the six years, left yielded 29.19 bushels per acre per year; right, 47.14. At $1.00 per bushel, this means approximately $18.00 for the grain alone, resulting from less than $1.00 worth of potash. With present corn prices and the feed available in the fodder, this difference would be far more striking.

received lime while the other remained unlimed. Yields were therefore taken on each sub-plot. The rate of liming was two tons of ground limestone every six years of the experiment, but the limed sub-plots had received two tons of lime every three years previous to the experiment. The pH of the limed sub-plots varied from 6.5 to 7.8, while that of the unlimed varied from 4.4 to 5.8. The nitrogen was applied as urea, the phosphoric acid as 16 per cent superphosphate, and the potash as muriate of potash.

Since the farmer is more interested in the economy of the use of fertilizer and lime than in the actual increase in bushels and tons, calculations were made to determine the increased values of the crops produced when lime and various fertilizer materials were used. These calculations are based on prices assumed to be about average for the period of the experiment, prices decidedly different from those at present. A similar interpretation can be worked out for any specific price relationship by changing the values for both the crops harvested and the fertilizer used. As the prices for crops increase in relation to the prices of fertilizer and lime, the value of crop over cost of treatment will increase, and the reverse is also true. At present price levels, the returns would be much more favorable than is indicated by these interpretations, since the farm prices of the crops grown are practically double those used in these calculations, while the cost of the fertilizer and lime has advanced less than 25 per cent.

The values used for the financial interpretation were as follows: corn $0.75 per bushel, wheat $1.00 per bushel, clover hay $15.00 per ton, nitrogen $1.50 per unit, phosphoric acid $1.00 per unit, potash $0.80 per unit, and lime $3.00 per ton of ground limestone. This evaluation does not take into consideration the added production of straw or corn stover, nor does it consider the increased value of the crops produced with added fertilizer and lime. There the difference would be more striking than indicated in the discussion. This is particularly true with hay, since the plots receiving lime gave good quality clover hay in comparison to much less hay of a very inferior quality where lime was not used.

The results given in Table 1 are strong evidence in favor of the use of fertilizers, since the largest yields came from the heaviest application of a complete fertilizer; but even stronger is the evidence that for greater yields and for greater profits these fertilizers cannot be used without lime.

In the case of the corn yields, the phosphoric acid alone gave an increase of approximately 9 bushels per acre. Potash in addition to phosphoric acid gave an increase of approximately 5 bushels on the unlimed plots, and 13 bushels where lime also was used. The nitrogen used in addition to the phosphoric acid was not as effective as the potash in increasing the yield of corn, but the greatest yields were obtained from the use of a complete fertilizer. This increase was also sufficient to give a good profit after paying the added cost of the fertilizer. The addition of potash to the nitrogen and phosphoric acid on the unlimed plots gave an increase of approximately 7 bushels of corn per acre. Where lime was used, the increase was approximately 18 bushels per acre. For the 11 treatments, the average increase per acre for the limed half of each treatment over the unlimed half was 13 bushels. The highest yield on the unlimed series of plots was from the N-P-3K treatment, which also gave the greatest value of crop over cost of treatment. However, by the addition of about $1.00 worth of lime, the value of the crop was increased by approximately $7.75.

In the case of wheat, phosphoric acid increased the yield over check by approximately 8 bushels. The addition of potash increased the yield over the phosphoric acid by only .3 of a bushel per acre. However, the addition of lime to the P-K treatment gave an increase of over 10 bushels of wheat. As with corn, the greatest yields of wheat both on the limed and unlimed half came from a complete fertilizer. On the unlimed half of the plots, this difference was more than enough to pay for the extra cost of fertilizer. On the limed half, only the N-2P-K treatment gave an increase over the P-K treatment large enough to pay for the extra cost of fertilizer based on the average values given below. For the 11 treatments,

The wheat, right, received phosphoric acid in addition to the lime, nitrogen, and potash used on both. Yield, left, for the six years was 16.65 bushels per acre per year; right, 24.31. At $1.50 per bushel, this means approximately $12.00 in return for about $2.00 worth of phosphoric acid.

The clover, right, received lime in addition to nitrogen, phosphoric acid, and potash used on both. For the six years, it averaged 2,989 lbs. of excellent clover hay annually, in contrast to 1,477 lbs. of poor quality hay, left. At $20.00 per ton, this means approximately $15.00 in return for $1.00 worth of lime.

the limed half yielded approximately 7¾ bushels per acre more than the unlimed half. At present prices, this would give well over 1,000 per cent on investment.

The clover hay on the unlimed half of the plot gave the greatest yield from the N-P-2K treatment and from the N-2P-2K on the limed half. Based on the figures given above, the N-P-2K gave the greatest return over cost of treatment, with the limed half giving approximately $10.00 worth of hay for $1.00 investment in lime. The 11 treatments gave an average yield of 1,354 pounds of hay per acre on the unlimed half; the limed half gave 2,718 pounds, or just over twice as much. It is also interesting to note that for each treatment the limed half gave a yield approximately twice that of the unlimed half. The above interpretation of results does not give due credit to the use of fertilizer and lime at present for two reasons. First, the price of hay is approximately double that used for the above calculations and also due to the fact that the quality of the hay is much better on the fertilized and limed plots. (See Fig. 2.)

The only treatment which did not give sufficient increase in yield to pay for the cost of fertilizer, based on the above values, was 2N.2K where used on wheat and hay. However, the use of lime in addition to the 2N.2K gave approximately $10.00 increase in value above the cost of the lime. The complete fertilizer gave best returns in yields, and also in value over cost of fertilizer in practically all cases. Next to the complete fertilizer came the P-K treatment.

The yields also showed that nitrogen in the fertilizer was relatively more effective in increasing yields on the unlimed plots than on the limed plots. This would be expected, since the clover which grew much more luxuriantly on the limed plots was effective in supplying a portion of the nitrogen needs of the corn and wheat. It is also equally evident that the increase in yield caused by potash in addition to the nitrogen and phosphorus was far greater where lime was used.

With apologies to Kipling, there are several "ifs" to the maximum returns from the use of lime. In the first place,

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It's in the farmer's hands—this business of soil management. The productivity and physical condition of his soil depend on the crops grown, the cultivation practiced, and the fertility and organic matter returned to the land.

Fitting Practices To Soil Conditions

By Harry H. Gardner

Chief, Regional Agronomy Division, Soil Conservation Service, Milwaukee, Wis.

ONCE again the soil is being subjected to an outpouring of words relative to its care and management. This deluge is more than a seasonal controversy; it has to do with "washing out" an age-old practice—plowing. It would be folly to attempt to stop the verbal flood, but a review of certain facts should help guide the run-off into proper channels.

From the facts obtained by experimentation and experience, some soil management recommendations have stood the test of time. But, based on the lack of information or the prevalence of misinformation, others have been merely passing fads.

American agriculture has established three cardinal points about soils: (1) They differ; (2) they must be managed differently to maintain high productivity; and (3) they require different measures and practices to control erosion.

Soils vary because of the parent material from which they were formed, the vegetation under which they developed, and the climate (temperatures and the amount and intensity of rainfall) under which they matured.

These factors account for the great soil regions and the specialized crop areas such as the Corn Belt, the Cotton Belt, and the three major wheat areas—soft red winter, hard red spring, and soft white winter. They account for the different tillage methods and crop rotations in general use.

In the Upper Mississippi Valley where the rainfall is above 30 inches a year, where grass-legume meadows are used in the rotation, where crop yields and plant-food requirements are high, and where the conditions for biological activities are favorable only a relatively small part of the year, plowing is necessary.

In the Corn Belt with its high rainfall, efforts are directed toward high-acre yields of corn. For a time after the virgin sod was broken, it seemed that corn could be grown year after year with satisfactory results. But after a few years of continuous corn, yields began to drop (in spite of improved varieties and strains) and the soil became sticky and harder to plow. The enormous reserve of organic matter accumulated through the ages by the decomposition of native grasses was being exhausted rapidly.

Where rotations including small grain and meadow were used, corn yields were higher and the soil was in better physical condition.

Further investigations have shown that there are many differences in soils in the Corn Belt. Some soils need only one year of meadow in the rotation to maintain a high yield of corn and proper soil tilth, while other soils need two, three, or even four years of meadow. Organic matter from the tons of roots per acre that penetrate the soil to depths of 2, 4, 6, 10 feet, and deeper, and from the crop residues (cornstalks, straw, and animal manure) make the difference. But, it also was discovered that too much organic matter or poorly activated organic matter may be even worse than the lack of organic matter.

Grass-legume meadows were found to be better than either grass or legume alone. Micoorganisms which decompose the raw organic matter need nitrogen to build their bodies and carbon for energy. A mixture of the quickly decomposable residues high in nitrogen and the more slowly decomposable grass roots and highly carbonaceous residues provides this source of food and energy and gives best results. But, bacteria can't live on carbon and nitrogen alone.

Experimentation has proved that decomposition of organic matter is stimulated and plant nutrients released quickly where grass-legume meadows are killed by plowing, the inverted sod tilled to prepare a firm seedbed, and the soil cultivated to keep it thoroughly aerated. Given optimum air, moisture, and temperature condi-

To plow or not to plow is a question to be answered on the basis of conditions of soil, climate, and vegetation. In the humid Corn Belt, plowing under a meadow crop promotes decomposition of organic matter and kills the plants that otherwise would interfere with a cultivated crop.

Grain can be drilled in standing corn in the fall without any other seedbed preparation. If sown broadcast in the spring, disking will cover the seed and chop the cornstalks to provide a good mulch.

tions, the microorganisms in the soil decompose raw organic matter, freeing nitrates, carbon dioxide, and other nutrients.

Carbon dioxide is given off as decomposition of the organic matter progresses, but nitrates are liberated only after the peak decomposition has passed. While decomposition is in progress, the micoorganisms in the soil and the crop growing on the soil compete for available nitrates. This situation makes it desirable to have the decomposition of organic matter in the soil take place rapidly while the plants are small and before the nitrate requirement of the growing crop is large. Nearly all of the raw organic matter, accumulated during other years of the crop rotation, is decomposed in one year where there is sufficient nitrogen and air for the microorganisms.

As soon as nitrates accumulate in the soil as a by-product of decomposition, they should be utilized by a growing crop. The best crop to capitalize on such a situation is corn. It is planted in May after decomposition has started. The soil is aerated by cultivation. The nitrogen needs of the crop are small, until midsummer after decomposition is at its height. The total requirement for the crop is large.

This program—the accumulation of organic matter by a grass-legume crop, activating it by plowing it under where air, temperature, and moisture conditions are optimum for decomposition, and quickly removing the available plant food with a high value per acre crop—has stood the test for some time.

As long as the potential supply of calcium, phosphate, potash, magnesium, and other minerals remained high, this program left nothing to be desired. But high crop yields gradually reduced the mineral supply until it appeared that organic matter was losing its power to produce. Soil scientists, by prying into the soil's mineral condition with chemical tests, discovered that the supply of available plant foods was becoming exhausted. Supplying active organic matter without maintaining the essential minerals, is exploitative farming.

At first the solution to this problem seemed simple—lime for legumes, a little fertilizer in the hill or row for corn, and under certain conditions a more substantial application with the grain and meadow seeding increased yields. But these results were short-lived. Such relatively small amounts of fertilizer placed so near the surface of the soil were only a starter. This practice actually reduced the potential supply of available plant foods faster than when no fertilizer was used at all. In field trials larger amounts, placed deeper where more of the roots of crop plants feed, gave better results.

Now, experimental data in some places where moisture is adequate indicate that fertilizer can be applied successfully with attachments for the moldboard plow. Applications of from 500 to 7,200 pounds per acre of a fertilizer having a 1-1-1 ratio placed in the bottom of the furrow when meadow sod is turned over are being used for corn.

Conservation Practices Necessary

The activated organic matter and mineral replacement program has worked perfectly where erosion has not been excessive. Fortunately, soil and water conservation practices can be used without interfering with the production program. By terracing to reduce the length of slopes, by strip-cropping with alternate meadows to keep water from concentrating, by tilling on the contour to prevent rapid run-off, and by maintaining grassed waterways to carry excess water, soil and water losses are reduced to a minimum and crop yields are increased. Where such conservation practices are not applicable, others may have to be used to control erosion.

In the Corn Belt, sub-surface tillage machines have not given satisfactory results, possibly because the soils are never dry enough when the operations can be performed. The blade cuts through the soggy soil, doing very little or no injury to the roots of weeds and without loosing it sufficiently to promote conditions favorable to the decomposition of organic matter. Where the soil is dry, the blade shatters the soil and does a thorough job of cultivation.

On some high-producing land where most of the topsoil remains, two crops of corn may be grown in succession. When this is done, however, a legume cover and green manure crop should be planted in the first year of corn either during or immediately after the last cultivation. When plowed under the following spring, this crop furnishes the nitrogen needed for rapid decomposition of cornstalks. On most land, crop rotations include only one crop of corn followed by small grain and a seeding of grasses and legumes for meadow. The cornstalks in the field provide winter protection to the soil and hold drifting snow. (Where the corn is cut, a winter cover crop is essential.)

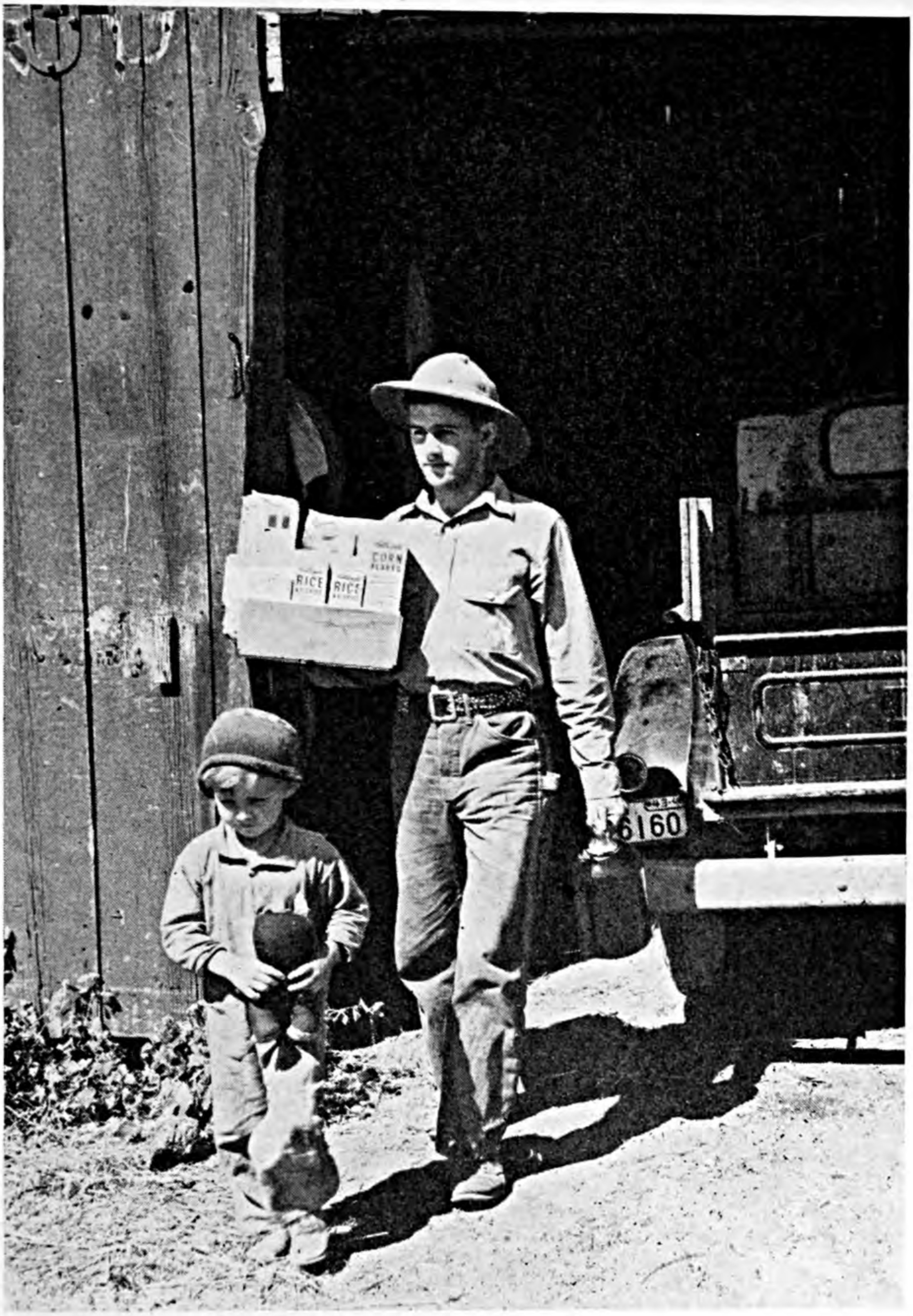
In the Corn Belt, oats usually follow corn in the rotation. They are sown broadcast very early in the spring and the land disked to cover the oats and to chop the cornstalks. Thus all of the raw organic matter is left on or near the surface where decomposition takes place more slowly. The old crop residue left on the surface decomposes, the grasses make a dense network of fibrous roots, especially in the surface soil, and the top roots of the legumes penetrate to great depth, creating a sod condition similar to nature's method of building soil.

When the oat crop is harvested with a combine, the straw is scattered on the new meadow seedings. When harvested with a binder, the straw is used for livestock bedding and returned to the field in the manure before plowing for corn. Following the oat crop no mechanical soil preparation of any kind is done.

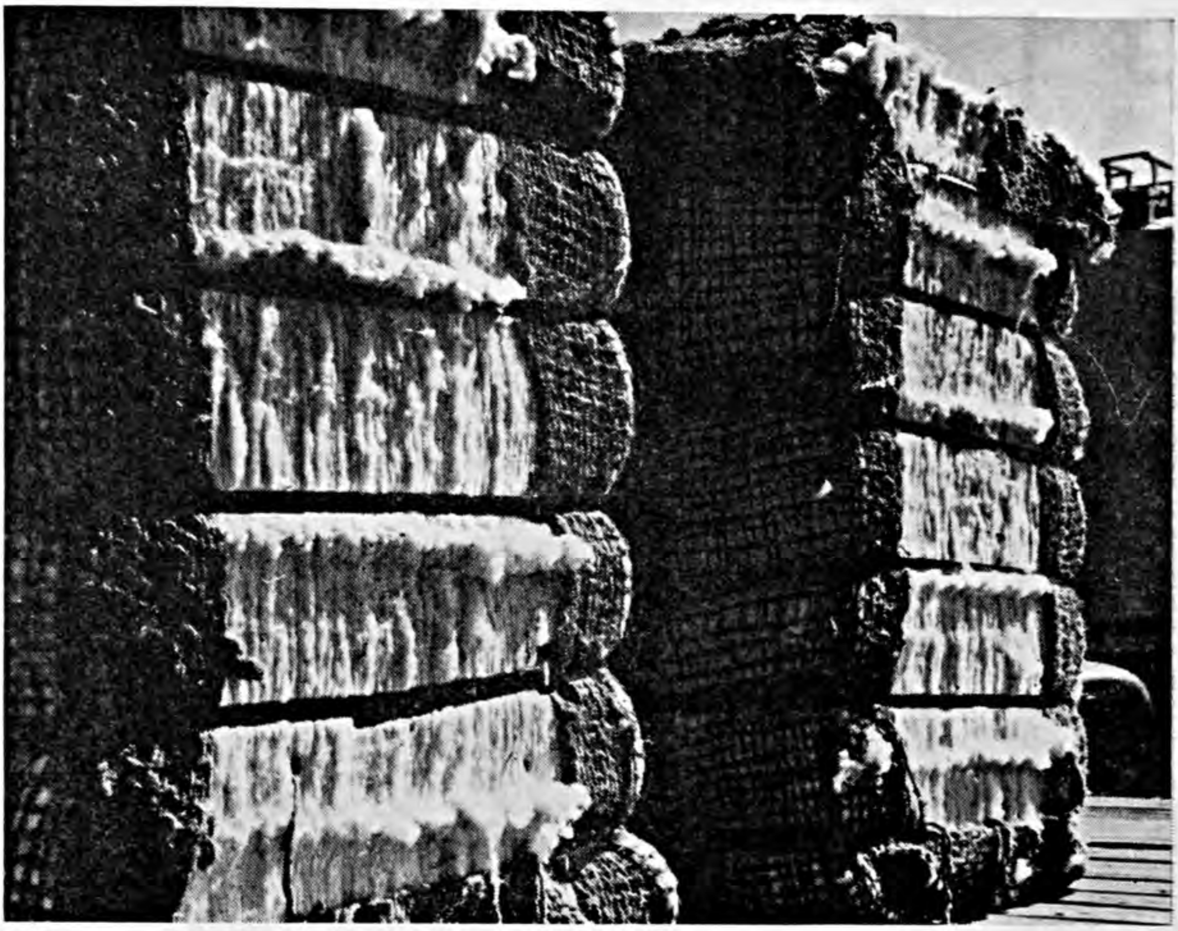
Under such a program, high crop yields have been maintained. Corn and oat yields of 100 bushels and hay yields of two, three, or four tons per acre are not uncommon on land that has been farmed from 50 to 100 years. Compare these yields with what nature did under virgin soil conditions or what she is doing now in fence rows or along right-of-ways that have never

(*Turn to page* 44)

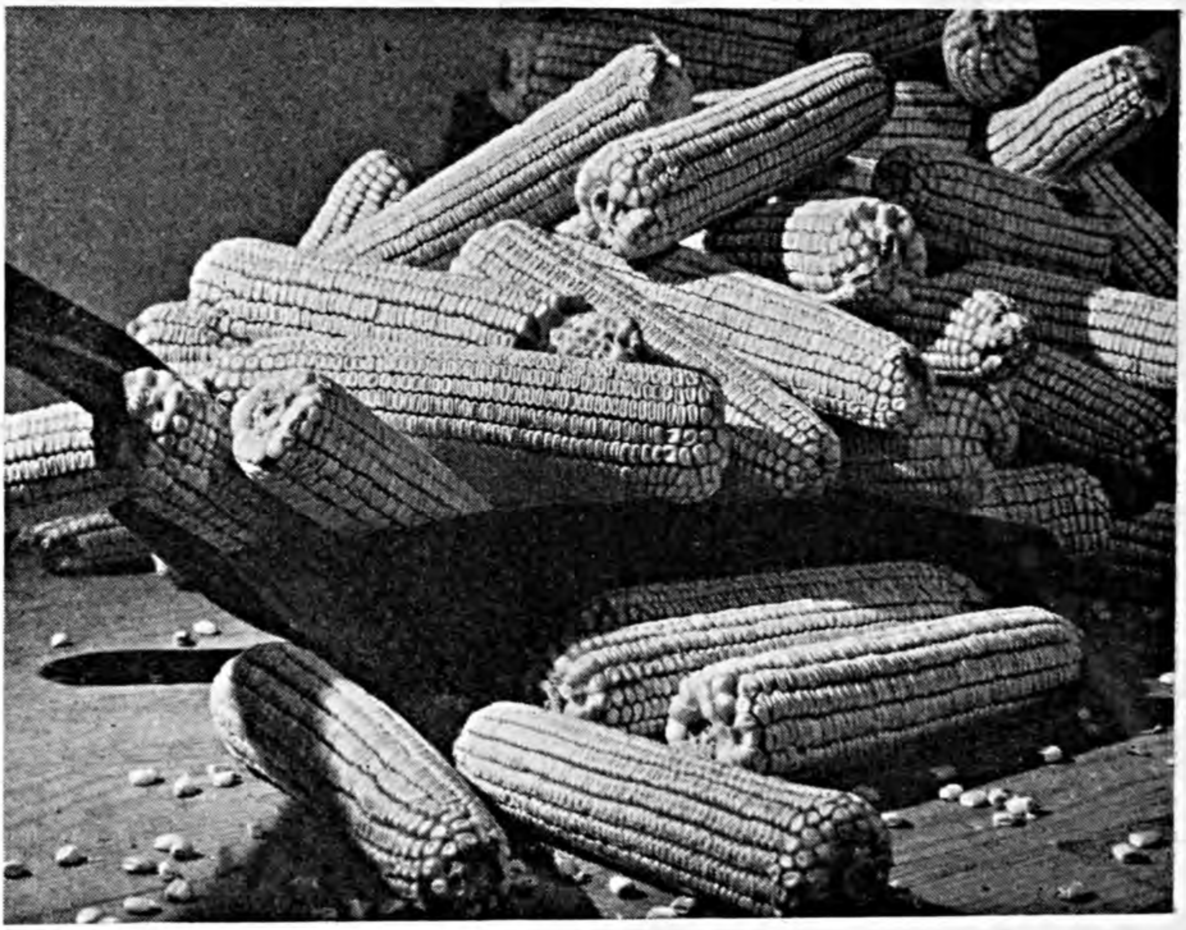
PICTORIAL

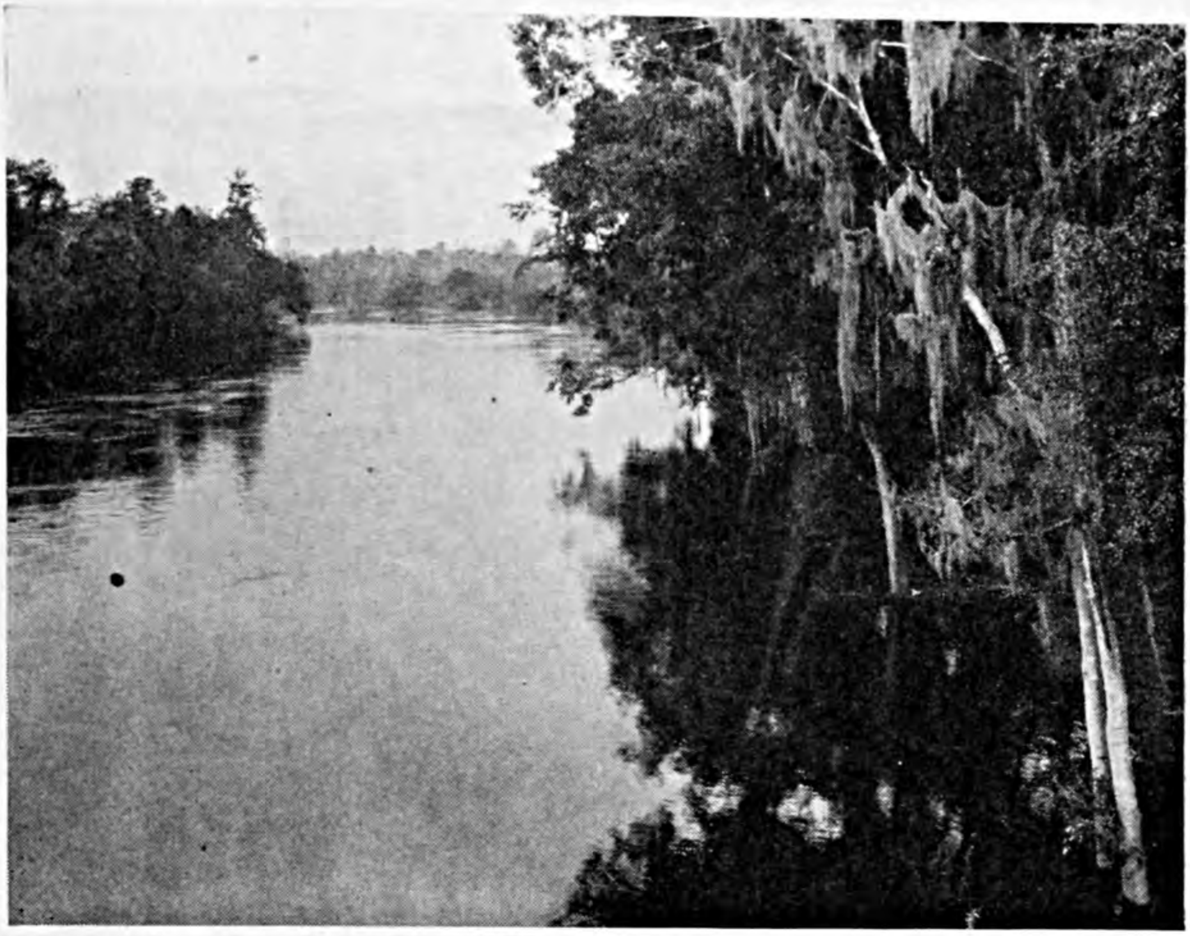


Back from a Saturday Afternoon in Town.



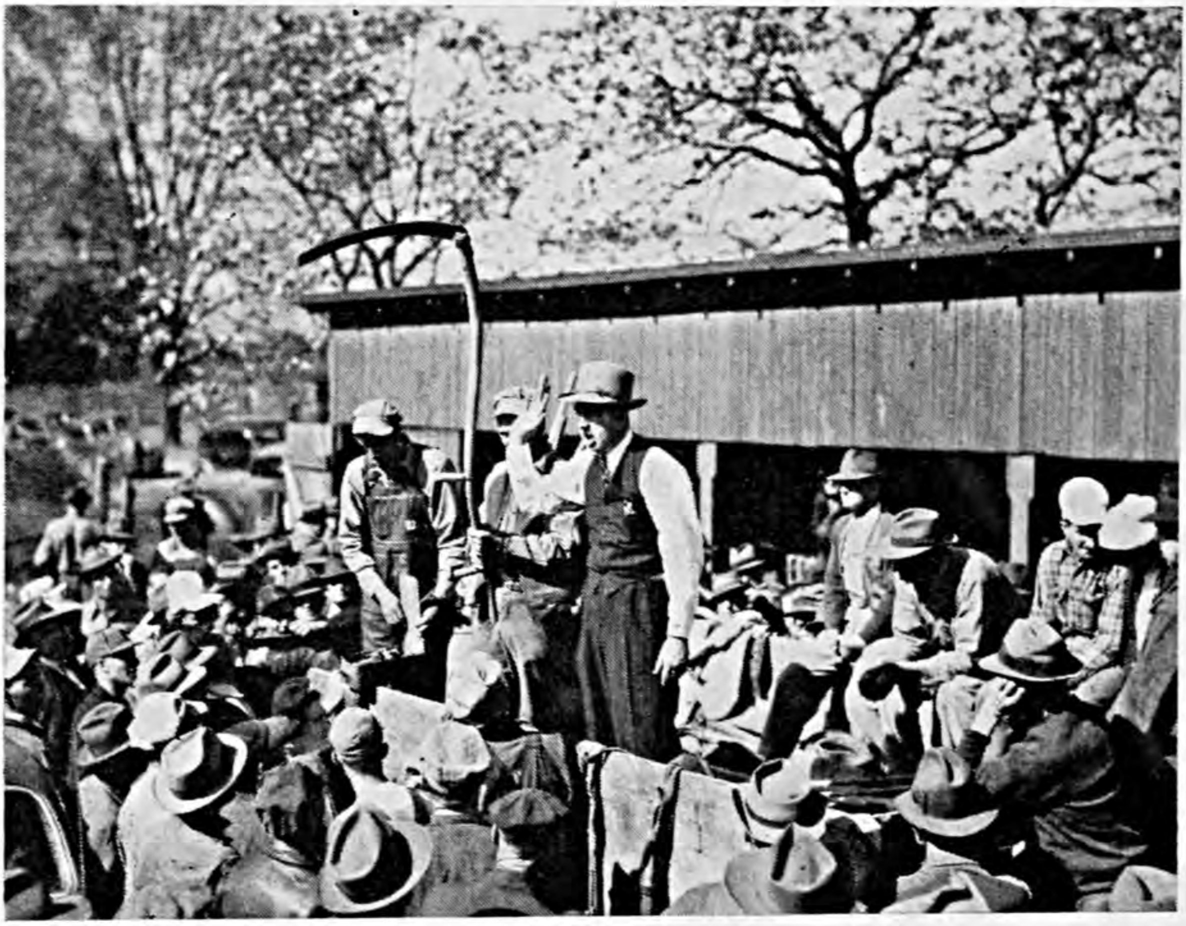
THE MAJOR CROPS ARE MOVING TO MARKET.





RIVERS IN DECEMBER—SOUTH AND NORTH.

Above: Flocks like these help to keep American traditions alive.
Below: Staging and seating are impromptu at farm auctions.



The Editors Talk

Charles Bernard Lipman

1883 - 1944

Biographical sketches of eminent men chronicle the achievements by which eminence is attained, omitting perforce the traits of mind and soul, the virtues which inspired those achievements. These can be contributed only by friends and admirers. The biographies of Dean Lipman, while establishing his eminence as a scientist and educator, disclose a career of the sort that arouses the admiration of every American, a career beginning when an immigrant boy was brought to this country by his parents from Moscow and ending as Dean of the Graduate Department of one of America's greatest universities, the University of California. Such a career once again epitomizes America as the land of opportunity; but of equal significance in this instance it shows an intellectual and spiritual capacity to make the most of that opportunity; and in delineating a life of public service, it reveals a deep sense of gratitude for that opportunity.

While these biographies make clear an ever-mounting succession of achievements in scientific researches in the agricultural field, and in education, they reveal much that is more accurately indicative of the spirit of Dean Lipman. In addition to being an ardent worker in education and research, his proven interest in the well-being of his fellow man, of high and low estate, and of his community caused him to be sought after for prominent service on such boards and in such associations as the Educational Advisory Board of the John Simon Guggenheim Memorial Foundation, the Belgian American Educational Foundation, the James D. Phelan Fellowships in Literature and Art, the Board of Directors of International House of Berkeley, the Committee of the Sixth Pacific Science Congress, the California Chapter of the American-Scandinavian Foundation, and the State Department Commission on the Adjustment of Foreign Students, not to mention membership in a long list of scientific societies, honorary fraternities, and social clubs.

But still this record fails to reveal one of his outstanding characteristics, the warm-hearted friendship which he unfailingly offered to all those who came within his wide circle of associates. Conspicuous was his charitable attitude toward human frailties, looking for and finding and pointing out the good in everyone, but at the same time intolerant of intellectual dishonesty and of injustice. Against such he stood as an immovable rock, and by that token his own sense of honesty and justice was universally recognized by all who came to know him. It was these rules of life that won for him the host of friends and admirers who now cherish his memory as a precious legacy.

Hoarding?—No, Common Sense

Is a farmer going home with a truckload of fertilizers these days a hoarder? No, he is just using common sense. Furthermore, he is complying with the Government's suggestion to "Buy Fertilizer Early" and in reality is helping the Nation's war effort.

In normal times, approximately 85 per cent of the fertilizer used during a year is delivered during the first six months of the year, the other 15 per cent going to farms during the last six months. Last year the appeal to purchase early brought sales for the last six months of the year up to 30 per cent. It is hoped that this percentage is being materially increased during the last half of this year.

The reasons for early purchase would be obvious if one considered only the labor problems involved. With the greatest demand for fertilizer in the Country's history, expected to exceed next year by a considerable margin the record 1943-44 consumption of approximately 12,000,000 tons, there will be greater demands on the already short labor supply in manufacturing plants, in transportation, and on farms. It is easy to see the advantage in providing this inadequate labor supply with a longer period over which to get the plant food where it will be available for opportune application.

But to be added to the labor situation are three others which assume real importance as factors behind the Government's request to spread the buying period: inadequate equipment in fertilizer manufacturing plants for meeting heavy seasonal demands, lack of storage space, and greatly reduced transportation facilities. The latter is becoming more acute than ever before with trucks and tires wearing out and deliveries becoming increasingly uncertain.

There has been and continues to be on the part of many farmers a reluctance to store fertilizer even though they have the necessary space and during the press of spring work could well afford the avoidance of last-minute rush and worry over fertilizer deliveries. J. C. Lowery, Extension Agronomist, Alabama Polytechnic Institute, recently offered several worth-while suggestions to help overcome this reluctance. He says:

1. Store fertilizer in any dry building with flooring above the ground, but never on the earth itself.
2. Keep broken bags separate from the main pile. Loose fertilizer is likely to absorb too much moisture and damage the good bags.
3. Make separate stacks of mixed fertilizer, superphosphate, ammonium nitrate, and each other type of material. This makes it easier to clean up any spilled fertilizer and keep it separate.
4. Keep sodium nitrate and ammonium nitrate away from hay, feeds, and organic meals to prevent fire. Dispose of empty bags from which sodium nitrate and ammonium nitrate are emptied.
5. Stack bags close together to reduce circulation of air from which fertilizer absorbs moisture.
6. Keep farm animals away from the storage pile. Sodium nitrate and ammonium nitrate may be injurious when eaten by farm animals.
7. If fertilizer cakes hard enough so that ordinary handling does not break it, drop the bag on each edge and both sides from waist-height.

No records on the amount of next year's fertilizer that has moved to farm storage are available at this time. It is estimated that at least 4,500,000 tons, or 1,000,000 more than were handled last year, will have to be delivered by January 1 if needs of 1945 cropping are to be met. Anything which the official agricultural forces can do to encourage farmers to buy and store their fertilizer early will be a definite aid in meeting next year's crop goals.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910-14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943									
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....
November	19.40	44.5	133.0	177.0	105.0	137.0	14.50	52.50	....
December	19.85	42.4	135.0	188.0	111.0	143.0	15.20	52.60	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....
June	20.16	49.2	125.0	233.0	115.0	143.0	15.00	52.80	....
July	20.32	45.0	138.0	230.0	117.0	139.0	13.90	53.00	....
August	20.15	39.3	159.0	258.0	117.0	135.0	14.30	53.20	....
September	21.02	42.9	147.0	219.0	116.0	135.0	14.70	52.30	....
October	21.25	41.2	142.0	185.0	113.0	142.0	15.20	52.70	....

Index Numbers (1910-14 = 100)

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943									
October	164	402	184	224	165	153	115	243	264
November	156	428	191	202	162	156	121	243	254
December	160	408	194	215	171	163	127	244	208
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191
April	163	229	197	261	177	167	136	243	184
May	160	358	193	269	177	167	135	243	217
June	163	473	180	266	177	163	126	245	245
July	164	433	198	263	181	158	116	245	236
August	163	378	228	295	181	153	120	246	253
September	170	413	211	250	179	153	123	242	239
October	171	396	204	211	174	161	127	244	192

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943							
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71
November	1.75	1.42	6.29	5.77	3.34	4.86	6.71
December	1.75	1.42	7.39	5.77	3.34	4.86	6.71
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.40	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943							
October	65	50	180	163	110	144	191
November	65	50	180	163	110	144	191
December	65	50	211	163	110	144	191
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	211	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Super-phosphate Balti-more, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14........	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922...........	.566	3.12	6.90	.632	.904	23.87	....	.508
1923...........	.550	3.08	7.50	.588	.836	23.32	....	.474
1924...........	.502	2.31	6.60	.582	.860	23.72	....	.472
1925...........	.600	2.44	6.16	.584	.860	23.72	....	.483
1926...........	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927...........	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928...........	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929...........	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930...........	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931...........	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932...........	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933...........	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934...........	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935...........	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936...........	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937...........	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938...........	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939...........	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940...........	.516	1.90	5.50	.517	.730	......	.573	....
1941...........	.547	1.94	5.64	.522	.780	25.55	.570	....
1942...........	.600	2.13	6.29	.522	.810	25.74	.205	....
1943								
October.....	.640	2.00	5.90	.535	.797	26.00	.200	....
November...	.640	2.00	5.90	.535	.797	26.00	.200	....
December...	.640	2.00	6.10	.535	.797	26.00	.200	....
1944								
January.....	.640	2.00	6.10	.535	.797	26.00	.200	....
February....	.640	2.00	6.10	.535	.797	26.00	.200	....
March.......	.640	2.00	6.10	.535	.797	26.00	.200	....
April........	.640	2.00	6.10	.535	.797	26.00	.200	....
May.........	.640	2.00	6.10	.535	.797	26.00	.200	....
June.........	.640	2.00	6.10	.471	.701	22.88	.176	....
July.........	.646	2.16	6.10	.503	.749	24.44	.188	....
August......	.650	2.20	6.10	.503	.749	24.44	.188	....
September..	.650	2.20	6.10	.503	.749	24.44	.188	....
October.....	.650	2.20	6.10	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922...........	106	87	141	89	95	99	....	78
1923...........	103	85	154	82	88	96	....	72
1924...........	94	64	135	82	90	98	....	72
1925...........	110	68	126	82	90	98	....	74
1926...........	112	88	114	83	90	98	82	80
1927...........	100	86	113	90	97	106	89	89
1928...........	108	86	113	94	100	109	92	92
1929...........	114	88	113	94	101	110	93	92
1930...........	101	88	113	95	102	111	94	93
1931...........	90	88	113	95	102	111	94	93
1932...........	85	88	113	95	101	111	94	90
1933...........	81	86	113	93	91	104	91	86
1934...........	91	87	110	68	79	93	74	72
1935...........	92	91	117	58	72	89	68	75
1936...........	89	51	113	65	74	95	77	85
1937...........	95	51	113	71	79	102	85	93
1938...........	92	51	113	73	81	104	87	95
1939...........	89	53	113	73	79	101	87	93
1940...........	96	53	113	72	77	....	87	....
1941...........	102	54	110	73	82	106	87	....
1942...........	112	59	129	73	85	106	84	....
1943								
October.....	119	55	121	75	84	108	83	....
November...	119	55	121	75	84	108	83	....
December...	119	55	125	75	84	108	83	....
1944								
January.....	119	55	125	75	84	108	83	....
February....	119	55	125	75	84	108	83	....
March.......	119	55	125	75	84	108	83	....
April........	119	55	125	75	84	108	83	....
May.........	119	55	125	75	84	108	83	....
June.........	119	55	125	66	74	95	80	....
July.........	121	60	125	70	79	101	82	....
August......	121	61	125	70	79	101	82	....
September..	121	61	125	70	79	101	82	....
October.....	121	61	125	75	84	108	83	....

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922	132	149	141	116	101	145	106	85
1923	142	152	147	114	107	144	103	79
1924	143	152	143	103	97	125	94	79
1925	156	157	151	112	100	131	109	80
1926	145	155	146	119	94	135	112	86
1927	139	153	139	116	89	150	100	94
1928	149	155	141	121	87	177	108	97
1929	146	153	139	114	79	146	114	97
1930	126	145	126	105	72	131	101	99
1931	87	124	107	83	62	83	90	99
1932	65	107	95	71	46	48	85	99
1933	70	109	96	70	45	71	81	95
1934	90	123	109	72	47	90	91	72
1935	108	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	121	130	126	81	50	129	95	75
1938	95	122	115	78	52	101	92	77
1939	93	121	112	79	51	119	89	77
1940	98	122	115	80	52	114	96	77
1941	122	130	127	86	56	130	102	77
1942	157	152	144	93	57	161	112	77
1943								
October	192	170	150	95	57	160	119	78
November	194	171	150	95	57	160	119	78
December	196	173	150	96	57	171	119	78
1944								
January	196	174	150	96	57	171	119	78
February	195	175	151	96	57	171	119	78
March	196	175	151	96	57	171	119	78
April	196	175	152	96	57	172	119	78
May	194	175	152	97	57	175	119	78
June	193	176	151	95	57	175	119	69
July	192	176	152	96	57	175	121	74
August	193	176	151	96	57	175	121	74
September	192	176	151	96	57	175	121	74
October	194	176	152	97	57	175	121	78

* U. S. D. A. figures.

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

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

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

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

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

"Soil Fertilizers, Their Application and Function on Soils in Alaska," Matanuska Exp. Sta., Palmer, Alaska, Cir. 5, April 1944, Don L. Irwin.

"Sixth Annual Report of the Arizona Fertilizer Control Office," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Sp. Bul., Jan. 1944.

"Amount of Commercial Fertilizers Used on Various Crops in California During July-December, 1943," Dept. of Agr., Sacramento 14, Calif., FM-95, Nov. 1, 1944.

"Tonnages of Mixed Commercial Fertilizers Used in California During July-December, 1943," Dept. of Agr., Sacramento 14, Calif., FM-96, Nov. 2, 1944.

"Kinds and Amounts of Commercial Fertilizers Used in California During July-December, 1943," Dept. of Agr., Sacramento 14, Calif., FM-97, Nov. 3, 1944.

"Fertilizer Recommendations 1945, Maritime Provinces of Canada," Maritime Fert. Council, Moncton, N. S., Canada, J. E. McIntyre.

"Fertilizing to Increase the Yield and Longevity of Alfalfa in Georgia," Ga. Exp. Sta., Experiment, Ga., Press Bul. 540, Oct. 5, 1944, L. C. Olson.

"Fertilizer Now for More Feed in Forty-Five," Dept. of Agr., Univ. of Me., Orono, Me., E. Cir. 204, Sept. 1944.

"Tonnage of Different Grades of Fertilizer Sold in Michigan Jan. 1 to June 30, 1944," Soils Sci. Dept., Mich. State College, East Lansing, Mich.

"Fertilizers for Young Tung Trees," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 314, May 1944, S. R. Greer.

"Fertilizers for Fall Sown Crops," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 510, Aug. 1944, Arnold W. Klemme.

"Better Wartime Use of Farm Manure," College of Agr., Cornell Univ., Ithaca, N. Y., Bul. 639, March 1944, A. F. Gustafson.

"Poultry Manures," College of Agr., Cornell Univ., Ithaca, N. Y., Bul. 641, March 1944, A. F. Gustafson and L. E Weaver.

"Farm Manure," College of Agr., Cornell Univ., Ithaca, N. Y., Bul. 642, March 1944, A. F. Gustafson.

"Fertilizer Sales in Ohio Jan. 1 to June 30, 1944," Dept. of Agron., State Univ., Columbus, Ohio.

"Inspection of Fertilizers," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Cont. 658, March 1944, E. J. Deszyck and J. J. Havern.

"The Effects of Maturity, Nitrogen Fertilization, Storage and Cooking, on the Ascorbic Acid Content of Two Varieties of Turnip Greens," Agr. Exp. Sta., Baton Rouge, La., Southern Coop. Ser. Bul. 1, Nov. 1943.

"Ammonium Nitrate vs. Sodium Nitrate as Fertilizer for Cotton," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. of Inf. 71, Feb. 8, 1944, C. A. Mooers.

"Fert. Tonnage Sales Report for Washington for July 1, 1941 to June 30, 1942," Agr. Exp. Sta., State College of Wash., Pullman, Wash. Mimeo. Cir. 10, July 1943, S. C. Vandecaveye.

"Drillability of Various Types of Ammonium Nitrate Fertilizers," Agr. Res. Adm., U. S. D. A., Beltsville, Md., Res. Rpt. 25, Sept. 1944, C. W. Whittaker, F. O. Lundstrom, J. Y. Yee, L. G. Schoenleber and G. A. Cumings.

Soils

"Soil Improvement in Alabama," Ext. Serv., Ala. Polytechnic Inst., Auburn, Ala., Cir. 290, June 1944, J. C. Lowery and W. W. Cotney.

"Soil Building and Pasture Practices for Alaska," Matanuska Exp. Sta., Palmer, Alaska, Cir. 4, April 1944, Don L. Irwin.

"The Control of Soil Erosion in New York," College of Agr., Cornell Univ., Ithaca, N. Y., Bul. 438, June 1940 (Rev. June 1944), A. F. Gustafson.

"Investigations in Erosion Control and Reclamation of Eroded Land at the Central Piedmont Conservation Experiment Station, Statesville, N. C., 1930-40," U. S. D. A., Washington, D. C., T. Bul. 873, Aug. 1944, T. L. Copley, L. A. Forrest, A. G. McCall, and F. G. Bell.

"Land Settlement," Library, U. S. D. A., Washington, D. C., Library List 9, June 1944, Annie M. Hannay.

"Physical Land Conditions in Muskingum and Guernsey Counties, Ohio," U. S. D. A., Washington, D. C., Phys. Land Survey 32, 1944, C. L. Whiteford, A. H. Paschall, and E. C. Sease.

Crops

¶ Five-acre cotton contests have been conducted in South Carolina for 16 years and the results in 1943 are published in Clemson Agricultural College Circular 253 entitled "The Cotton Contest—1943." The State winner this year was W. G. Smith of Johnston in Edgefield county with the yield of 5,980 lbs. of lint. Mr. Smith used Coker 100 Wilt Resistant, Strain 2, and had a staple length of 1-1/16 inches. The circular points out that during the 16 years of these cotton contests, more than 12,000 five-acre fields have been entered. The steady improvement in the staple length of the lint is shown over this period with 97.7 per cent of the crop in South Carolina now running 15/16 inch or longer, compared to 53.3 per cent of the state in 1930. In this respect, South Carolina has the best record of the four southeastern states. In 1943, 90.5 per cent of the crop was one inch or longer, and again was better than the other states in this territory.

The practices followed by farmers in obtaining these record yields of high quality cotton are summarized, and recommendations based on the experience of these outstanding growers are drawn up. There is a definite tendency for rows to be narrow and spacing closer than in past years, and, the improved varieties are used in practically all cases. It has been found that the improved variety seed should be of known origin and not more than two years removed from the breeder. The seed should be treated to prevent diseases, and land should be carefully and thoroughly prepared with a firm seed bed.

Side-placement of the fertilizer in bands is desirable, but if this is not possible, it should be applied and bedded down 10 days before planting. In general, 400 to 800 lbs. of fertilizer per acre should be used, the amounts and analysis adapted to the conditions prevailing on each individual farm. It is stated that on the average a 4-8-6 fertilizer was used at planting time, supplemented with side-dressings so as to bring total plant food used to a 1-1-1 ratio. Nitrogen top-dressing at chopping time is usually necessary, and if rust has appeared on the previous crop, 50 to 100 lbs. muriate of potash or the equivalent should be used at chopping-out time. If legumes are turned under for cotton, nitrogen in the fertilizer can be reduced, and it is suggested that mixed fertilizers should be non-acid forming. On highly acid soil, lime should be used. Planting should be as early as possible, after danger from cold weather is past. Boll weevil should be controlled by appropriate applications of poison mixture, and harvesting should be done only when the cotton is thoroughly dry. The cotton should be ginned where equipment is in good condition and where care is taken to keep the seeds free from contamination. The experiences of these successful cotton growers can well be used for a guide for all growers in this section.

¶ Alfalfa is one of our most important forage crops from the viewpoint of quality, and in many parts of the country is rapidly becoming a most important crop from the viewpoint of acreage. At times, growers are discouraged due to unsatisfactory growth of the crop. In order to help correct this situation W. E. Colwell has compiled information on diseases that may adversely affect alfalfa, and makes suggestions on how to correct them. These are contained in Cornell Extension Bulletin 616 entitled "How to Recognize Some Common Alfalfa Troubles." In this publication, leaf spot, bacterial wilt, potash deficiency, boron deficiency, leafhopper injury, and snout-beetle injury are considered. Two color plates and excellent black and white photographs are of great value and assistance in recognizing and identifying the various troubles described. These are of great benefit, since some of the difficulties encountered on alfalfa are a little hard to distinguish at first glance. With the descriptions and illustrations given by Dr. Colwell, a careful observer should be able to form a pretty good idea as to what is wrong with his alfalfa, provided it is one of the troubles covered in this publication. Leaf spot is a very serious trouble, but there is no practical control of it. It often can be reduced by early cutting. Bacterial wilt is devastating when it develops. The control usually recognized as helpful is to have a shorter rotation whereby alfalfa is not kept on the same field for such a long period of years, and to keep the field out of alfalfa at least two years between crops. Potash deficiency is due to an insufficient supply of available potash in the soil, and the characteristic symptoms are described and illustrated. This can be prevented or overcome by the use of 300 to 400 lbs. of muriate of potash per acre applied in the fall or early spring. It is stated that when seeding alfalfa on soils known to be deficient in potash, applications of 150 to 300 lbs. of muriate of potash per acre should be made at seeding time. Owing to the depletion of potash supplies in the soil caused by heavy crop removals of alfalfa, more attention has to be given to maintaining a sufficient supply of this nutrient in the soil.

Boron deficiency is due to a lack of sufficient available boron in the plant. When describing the typical signs of boron deficiency, the author is careful to distinguish between these and leafhopper injury, since the two are easily confused. In order to correct boron deficiency, it is recommended that about 30 lbs. of borax per acre be applied at any time during the year when the growth is short. Following the initial application, 10 lbs. per acre may be applied each year, in order to prevent the development of deficiency after it is once corrected. Leafhopper injury is best combated by cutting the crop early. Snout-beetle injury is localized and is usually taken care of by poison bait. This bulletin is of use and value to all alfalfa growers, since the troubles described are by no means confined to New York State.

¶ Another publication on alfalfa is Circular 560 of the Illinois Agricultural Extension Service. This was prepared by W. L. Burlison, D. Heusinkveld, and O. H. Sears. The publication's title is "How to Get Good Yields of Alfalfa." The use of alfalfa as a hay crop and as a pasture, the latter case preferably in mixtures with a grass, is described. The conditions necessary for getting a good crop are a soil with good drainage, a soil that is not acid, or one that has had the acid corrected by the use of lime, sufficient plant nutrients supplied by manure, phosphate, and potash, and proper inoculation of the seed, if it is not known that the soil already is inoculated with nitrogen-fixing organisms. It is brought out that phosphates increase alfalfa yields on many Illinois soils, while lack of potash is a limiting factor over wide areas in the southern third of the State, and in more areas over the other two-thirds of the State. These deficiencies can be corrected by the use of appropriate phosphate and potash fertilizers. Adapted varieties should be used, a well-prepared seedbed should be provided, and cutting should be made at the proper time and not too late in the season. Alfalfa diseases and insect pests are briefly considered. This publication is a good popular guide for growing alfalfa in the Midwest.

¶ Another legume that is valuable and popular, although more restricted in the areas in which it can be grown, is lespedeza. In order to give popular and practical information on growing this crop, the Illinois Extension Service has issued Circular 561 entitled "Lespedeza: Its Place in Illinois Agriculture." This was written by O. H. Sears and W. L. Burlison. While lespedeza will grow almost anywhere in Illinois, in the northern part of the State the late varieties will not reseeed. This property of reseeding itself is one of the valuable characteristics of lespedeza, and therefore varieties should be selected that will be sure to set seed in the area in which they are grown. While there are several lespedezas, two of the annual species are most commonly grown. One of these includes Tennessee 76 and Kobe lespedeza, while Korean, Harbin, and Early Korean belong to the other.

Lespedeza sericea is a perennial lespedeza and is becoming increasingly popular. Lespedeza is ordinarily used in Illinois as a pasture crop. It will grow on soils that are not adapted to growing alfalfa and the clovers, which has led many farmers to grow lespedeza on poorer soil without proper fertilization. This results in the soil being depleted even further of nutrients and in the production of low yields of poor quality forage. When used either for pasture or hay, soil acidity should be corrected by the use of limestone, and phosphate and potash should be applied to meet any deficiencies in the soil and to replace nutrients removed in the crop. It is brought out by the authors that there may not be as much response to fertilizers by lespedeza as by alfalfa and clover. There are soils, however, where applications of phosphate and potash are needed for maximum yields. Inoculation should be provided unless it is certain that the nitrogen-fixing organisms are present in the soil. Information on seeding, harvesting, and the few diseases and pests of lespedeza is briefly given.

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Leaf Analysis—A Guide to Better Crops

(*From page* 14)

the fertilizer needs of tomato districts and in arriving at more effective fertilizer programs on individual plantings.

In the Eastern states chemical analysis of plant tissues has been extensively used as a guide in fertilizing the tomato crop for high yields and better quality.

Considering the wide use already found for it, and the rapidity with which it is being applied to various crops, leaf analysis is certain to furnish the grower a most valuable aid in solving plant nutrition problems and making fertilizer expenditures more effective.

Leaf analysis as a guide to the effective application of fertilizer means higher yields and better quality.

Stumbling Blocks to Responses from Plow-Down Fertilizers

(*From page* 18)

noted (see Table 4) that whereas fertilizer treatments influenced yield a maximum of 6.2 bushels per acre, choice of hybrid, or germplasm, accounted for a range in yield of 57.6 bushels per acre.

Corn leaf blight was present by early August and spread rapidly from the lower leaves upward. By mid-August the top leaves of AxTr, the most susceptible hybrid, were carrying large leaf blight lesions. By early September most of the AxTr plants had been killed. The other hybrids also carried the infection but were apparently affected very little by it. Though the heavier potash treatment failed to improve the yield of AxTr significantly more than the other hybrids, stalk rot and stalk breakage averaged considerably less on the 10-10-20 strip than on the 10-10-0 strip.

The average percentage of broken stalks for the two locations where counts were made are given by treatment in the following table:

Treatment	*Per cent broken stalks*
10-10-0	17.2
0-10-10	11.2
10-10-10	11.4
10-10-20	8.5

From these limited observations it would be unsafe to conclude anything definite or to make sweeping generalizations on the basis of the results obtained. Possible explanations for sub-optimum corn yields with heavy rates of fertilization are suggested. They are:

1. Lack of full acre stands of the crop plants. Uniform stands are too often mistaken for "full" stands. Actual counts showed that only 2/3 to 3/4 enough corn plants occupied the land on these Ohio farms applying fertilizer at heavy rates. The "test" for a "full" stand of corn is an ear-weight of 0.5 pound—not more.
2. Disease or insect damage. Yields can be so reduced under heavy insect or disease damage that the effects of good nutrient supply may be nullified.
3. Germplasm. Irrespective of its ability to tolerate insects or diseases, the potential capacity of a crop strain to produce will eventually, if not immediately, influence the amount of nutrients needed.
4. Competition by weeds. Nutrients and moisture consumed by weeds don't feed the crop. Deep placement of nutrients, especially nitrogen, will encourage weed growth less and make weed control easier. A full stand of the crop plants also reduces the opportunity for weed growth.
5. Lack of "balance" among the nu-

TABLE 4.

Acre yields in bushels of shelled corn at 15½ per cent H_2O content are given in the body of the table, the per cent broken stalks in ( ).

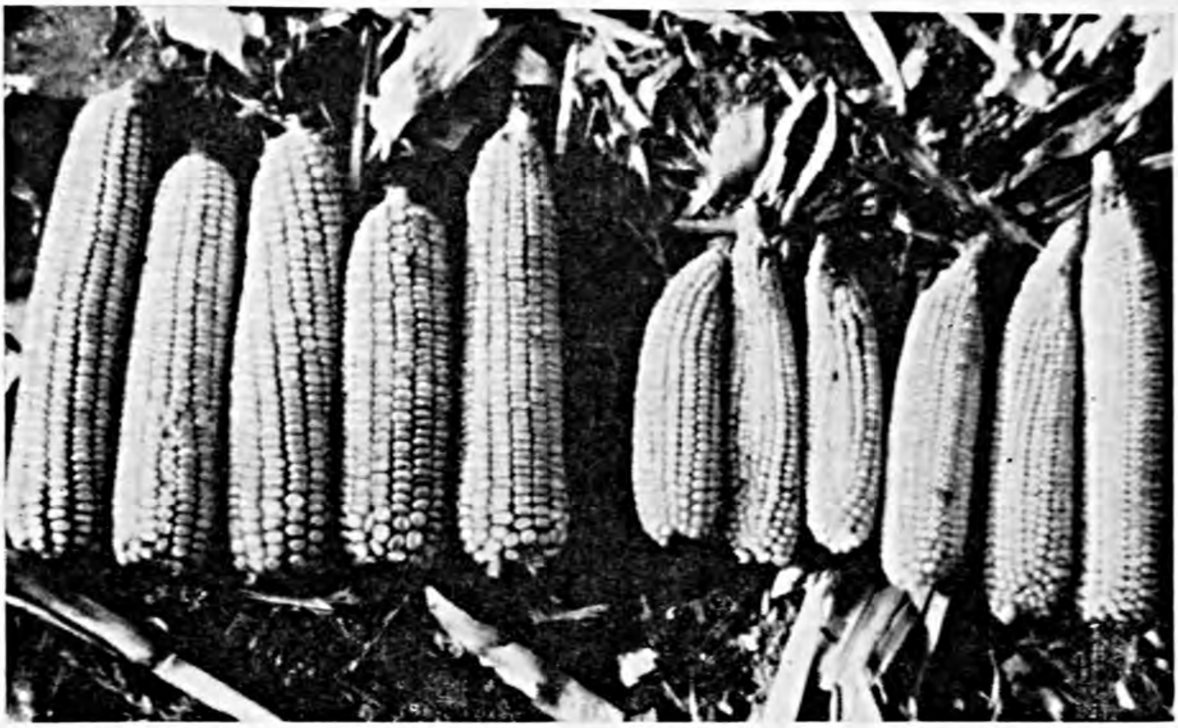
Previous crop: Sweet clover-red clover pasture which carried one animal unit per acre in 1942.

Manure applied: None in addition to that produced on pasture.

Row fertilizer: 150 pounds of 0–12–12 per acre.

Date planted: May 29, 1943. This was slightly later than normal for the area. Blight severely damaged the AxTr. Average stand per acre 13,100 plants. (Weight of ears per plant .51 pound.)

Hybrid	Plow-down treatment					
	800 lbs. 10–10–0	800 lbs. 0–10–10	800 lbs. 10–10–10	800 lbs. 10–10–20	Nothing plowed down	Average
U. S. 13	120.8 (3.8)	121.2 (5.4)	119.3 (.9)	117.5 (.9)	115.0 (1.8)	118.8 (2.6)
Ohio W36	105.3 (4.7)	110.2 (5.4)	105.9 (4.5)	105.1 (0.0)	99.8 (4.8)	105.3 (3.9)
AxTr	57.7 (66.7)	57.6 (33.7)	69.0 (47.3)	64.7 (39.2)	57.2 (7.1)	61.2 (38.8)
Iowa 939	93.8 (21.5)	98.8 (14.7)	96.4 (15.5)	97.3 (2.9)	94.1 (7.5)	96.1 (12.4)
Average	94.4 (24.2)	97.0 (14.8)	97.7 (17.1)	96.2 (10.8)	91.5 (5.3)	
Gain in yield	2.9	5.5	6.2	4.7		



Left: Ears as harvested from Ohio W36, one of the blight-tolerant hybrids used in these comparisons. Right: Representative ears of AxTr showing the influence of serious leaf blight injury.

trients supplied. (One pill may be beneficial but half a box of the same may be detrimental.) With heavy rates of added nutrients via the fertilizer bag, the grades customarily used in small amounts may not only fail to give expected yield increases, but may actually destroy a needed nutritional balance to the extent that enough harm is done to completely wipe out a fertilizer response.

Fitting Practices to Soil Conditions

(*From page* 26)

Seeding legumes in grain requires no special seedbed preparation.

been plowed. Man not only has learned how to improve on nature's plan, but also how to maintain this improvement.

A decline in crop yields can be attributed to poor soil management practices such as using too many row crops or not enough meadow crops in the rotations, burning crop residues, failing to supply lime and other mineral plant foods, faulty seedbed preparation, excessive soil and water losses, and other factors.

While a three-phase program (active organic matter, mineral replacement, and erosion control) works satisfactorily in the Corn Belt, it may not work successfully in other areas.

Since problems and conditions in the various soil regions are different, management of the soil and erosion-control methods must be different. Measures and practices which are applicable under one set of conditions may not be applicable under another. More research is needed for the improvement of tillage implements, for the production of new crop strains and varieties, and for the development of better cultural methods.

Sweeping recommendations lead to misunderstanding and embarrassment. It is only by thorough study of facts, careful experimentation, and actual experience that our system of agriculture has developed and will be made to endure permanently.

Blue Lupine Is a Valuable Legume

(*From page* 10)

seed seem to shatter worse than others, probably due to atmospheric conditions more than anything else. This tendency to shatter limits the acreage that can be harvested with one combine. Farmers who grow large acreages for seed usually plant at several dates, thereby extending the harvesting period for a few days.

Mr. Warner gives a timely warning about the handling of seed after harvesting. He says, "In gathering lupine seed care should be taken to have as few green seed as possible. If there are any green seed when harvested, it is important to spread them not more than 8 to 10 inches deep and stir them every day for 3 or 4 days. Without further stirring seed may be left 10 days or 2 weeks to dry more thoroughly before sacking or placing in large piles. It is important that seed be spread on dry floors that will not "sweat" and keep the seed moist. Where green seed are present, they should not be carried over night in the sacks."

Mr. Warner's warning about drying seed is extremely important. In several cases growers who harvested large quantities failed to spread the seed for drying. When ready to market, germination tests showed the seed to be practically worthless. It is best to play safe and spread seed within a few hours after harvest.

The question often is asked about the northern limits of blue lupine. Although this is not known exactly, experience to date indicates that U. S. Highway 80 in Georgia and Alabama is near the northern limit of its climatic range. So little success has been had with lupine in Mississippi, however, that no statement can be made about its climatic range there.

Lupine seedlings in their earlier stages of growth have suffered varying degrees of damage from disease, particularly damping-off. In most instances the damage has been light enough that sufficient plants for a fair stand survived. Studies of various seed treatments for disease control on lupines are being conducted by the Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Florida and Georgia Agricultural Experiment Stations.

Disease damage does not seem to be intensified where lupine is planted several successive years on the same land. D. L. Henderson, Pinckard, Alabama, planted the fifth successive crop of lupine on a field of sandy soil in the fall of 1943. When examined in January 1944, lupine plants in this field showed no more evidence of disease than those in other fields where lupine was growing for the first time.

There has been considerable damage to stands by rabbits in small seed patches. Rabbits cut the lupine plants off at the ground, eat the stems, and leave the foliage on the ground. Rabbit damage is not important where several acres are planted to lupine.

Blue lupine is classed as a toxic plant, but is not highly palatable and no record is known of livestock being poisoned as a result of eating the green foliage. One case was reported of a goat getting into a barn and eating enough seed from a bag to cause death. Several cases have been observed where cattle grazed the green plants where other green feed was not available. The animals did not show any ill effects from eating the lupine.

Providing some kind of winter cover for land following the harvesting of peanuts is a serious soil conservation problem that has been intensified by the war. Blue lupine that was planted in the fall of 1942 showed much promise as a cover crop for peanut land. It has remarkable ability to grow under the adverse conditions of fall drought and of hogs gleaning the peanuts that remain in the ground when runner peanuts are dug.

Satisfactory stands usually have resulted where lupine seed was sown just ahead of the peanut digging plow in September or early October. Inoculation of plants was sometimes "spotty," where light digging plows failed to cover lupine seed completely. Where the plants got a fair start while peanuts were stacked in the field, the hogs did not destroy the plants when they were turned in to glean the fields after peanuts were picked. If allowed to develop deep roots before hogs are turned in, the lupine plants can take a surprising amount of punishment. Where hogs were turned in soon after planting, severe damage to stands often resulted.

Based on its performance the past two years, blue lupine promises to be the best winter legume for planting after harvested peanuts. Farmers in the Wiregrass Soil Conservation District in

Threshing lupine seed by hand.

F. P. May, Quincy, Florida, is turning blue lupine for corn, Feb. 23, 1944.

southeast Alabama were so favorably impressed with lupine planted after peanuts in 1942 that they planted an extensive acreage when they harvested peanuts in 1943. Luckily the largest peanut acreage is in the section where blue lupine has made satisfactory growth.

Most of the blue lupine grown in the Southeast has been harvested for seed. Enough of it has been turned under for succeeding crops, however, to show that yields of other crops following lupine compared favorably with those after other winter legumes.

As an example of the yields following lupines, F. P. May, Quincy, Fla., said, "I had a sandy field known as the old Smith field that had been making 5 to 8 bushels of corn per acre. In the fall of 1940, I sowed 40 pounds of lupine seed per acre and turned it under the latter part of the following March and planted corn. In 1941, my corn yield was about 14 bushels per acre. Each fall since then I have sown this field to blue lupine and followed the lupine with corn. In 1942 my yield was 36, and in 1943, 45 bushels of corn per acre. I did not use any more fertilizer for the corn than I did back in 1940.

"I save my own lupine seed. The first year we gathered seed by hand and since then we have used a combine. This spring we saved about 12,000 pounds from 14 acres. Due to extended dry weather in the fall of 1943 we did not get to plant as early as usual, so we planted 80 pounds of seed per acre where we had been planting 40 pounds. We planted 120 acres this year."

The consistently large yields of blue lupine seed have suggested the possibility of industrial uses of the seed in the future. Since the seed of the strain of blue lupine being grown in the South contains a poisonous alkaloid, it has no possibilities as a feed for livestock. There may be other industrial possibilities and it is hoped that these will be investigated.

The recent development of non-alkaloid strains of blue lupine reported in Farmers' Bulletin 1946, Lupines, New Legumes for the South, suggests several possibilities. If alkaloid-free lupines are palatable and have growth and seeding habits comparable to the strain of blue lupine now being grown in the South, they may become important sources of both forage and concentrates for livestock feeding.

It may be well to consider, however, that the development of such strains may have certain disadvantages. Unpalatability of the present strain of blue lupine gives this plant a distinctly practicable advantage as a soil-conserving crop. It makes sufficient growth for early turning under, even when livestock are in the fields during the winter, whereas, the palatable legumes often are grazed so closely that they make little growth before livestock are removed and spring plowing begins. This advantage has been particularly apparent where blue lupine and several other winter legumes and small grains have been planted on different parts of the same fields as ground covers following the harvesting of peanuts.

Blue lupine has been used successfully in conditioning land for pastures in northern Florida. Bermuda grass has grown vigorously following lupine that was harvested for seed. The residue from the combine has furnished both mulch and nitrogen, which benefited the grass.

Blue lupine has been grown with sufficient success in Florida and southern Georgia and Alabama that it can no longer be considered as a "morning glory." It has a future in this section and promises to be a major contribution to the agriculture of the peanut belt of the deep South.

Lime Is the Key to Potash Efficiency

(*From page* 22)

lime must be used with fertilizers and not in place of them. In the case of nitrogen, liming frequently lessens the need for its application in the form of commercial fertilizer. Lime improves the condition of the soil, allowing legumes and microorganisms to take from the air a large part of the nitrogen needed for production of the crops. Such is not the case with phosphoric acid and potash, which can come only from the fertilizer material added and from the supply in the soil. With an increased yield, the amount of phosphoric acid and potash removed from the soil increases proportionately. If this added amount removed by the increase in crop yield is not compensated for by increased applications to the soil, a depletion of the reserve supply in the

Many plants show easily recognized signs of plant-food starvation. White clover indicates an acute lack of potash by white spotting around the leaf edges. Similar symptoms of potash deficiency are common to practically all members of the clover family.

soil takes place. Such a depletion of the reserve can be excused only in cases where phosphoric acid or potash cannot be obtained in adequate amounts, or where their price relationships are such that the increased value of the crops will not pay for the fertilizer added. If the reserves of phosphoric acid and potash are depleted when they are scarce or when the price relationship is unfavorable, then these reserves should be built up when they are plentiful and when price relationships are favorable.

Another one of the "ifs" in regard to the use of lime is that the effect of the lime on corn and small grain, grown in a rotation such as the one described here, is largely an indirect effect. In other words, the lime applied to the soil causes a great increase in the yield of clover. The benefit to the soil of the extra clover stubble and refuse added to the soil where the clover yields are great is responsible for the greater part of the increase in corn and wheat. Such increases are just as real as if they were direct, but one should recognize that such increases in the yields of wheat and corn from the use of lime would not be expected to occur where the lime was added for the first time just before the corn or wheat was seeded.

A very important rule in regard to liming is to lime according to the needs of the soil and the crop. No two soils have the identical lime requirement, nor do any two crops, so in the process of liming, both should be considered if lime is to play its part.

Anti-Acre Aches

(*From page* 5)

more modern implements and better soils. Hence, fewer men per hundred acres can be expected to earn a safe livelihood where mechanical power and soil resources are greater. To the north in the cut-over meager spots of slow development, the handicaps are mostly that the land has been officially zoned and the better part of it is more profitable for hunting, fishing, and summer resorting than for agriculture.

Much of this northern country of all the Lake States region experienced panic, distress, and tax delinquency in the period following World War No. 1. One of the best informed extension men who knows this whole territory of zoned lands like a book is definitely opposed to allowing sentiment to cloud our vision in respect to encouraging wholesale farm settlement in this last area of raw country.

He agrees that some soldiers and defense workers will choose to carve out farms and live in the midst of wild life like the old pioneers, while others will seek its climate to escape from industrial living conditions.

These adventurers would be in the minority out of any large body of veterans, he thinks. To those others who seek a steady and reasonable return from farming as the main endeavor of their lives, this man urges a close scrutiny of roads, markets, soil types, degree of stoniness, drainage, frost hazards, and the cost of land-clearing and the tools and equipment needed to wrestle with the devil among the stumps.

But, he warns, just about the time when a beginner has spent his wad in this manner his danger is greatest. Just as he has become ready with his tools and fences and raw land, maybe some of it on borrowed capital, the bottom may drop out of farm prices and his hopes will be sunk.

His best advice on the whole seems to be that the best opportunity for returning war workers of all kinds is to invest in developed or partly developed farms in the older areas of the state where the years of costly pioneering and exploitation have passed. Yet as I remarked before, it is in these more settled sections that the land will support fewer operators without creating a burdensome surplus.

So far we haven't seen much evidence of all the various public and private loan agencies getting together for a talkfest and a little agreement between them on certain sane rules which could reasonably be adopted to stave off future acre aches.

Some critics of the government loan systems point out that they have been apt to act on the baling-out theory, the relief angle or the coddling attitude toward clients. On the other hand, private loan agencies have not always given full opportunity to the borrower, leaning towards the lender in administrative details, and have palmed off a lot of poor soil on good men and likewise good soil on inexperienced men.

One governing clause of a federal loan agency which bears attention these days reads: "No loan shall be made for acquiring any farm unless it is of such size as will be sufficient to constitute an efficient farm-managerial unit, and to enable a diligent farm family to carry on successful farming thereon."

HERE we have a sort of floor to keep the farm in mind from being too small and a ceiling to prevent it from being too large. In regard to oversized acreages, the idea is that no unit should be sold without reference to the ability of the man's family to work it well without many outside labor bills, or the requirement of a tenant to supplement the labor of the owner.

Long-time earning capacity on the basis of general average, long-range prices for farm products, plus enough modern equipment and power to enable the operator to keep step with the times and not become a helpless hillbilly, are added thoughts in any careful defense against acre aches.

In regard to reasonable standards of living, to which returning war workers and veterans are entitled, some old ideas held vainly by grasping landlord and capitalist must be ventilated. The standards long considered good enough no longer meet the modern demand. Access to ozone and early rising to see the dewy grass reflect the shining sun are not quite enough compensation these days for a life of toil and uncertainty. Youth has come up from childhood in an environment different from that of your hard-fisted old landlord. Likewise some of the heroes will be rather inclined to want a little luxury by the fireside to help pay off the hardships of war. And why not?

IN the same way farm operating costs are higher and more variable than they were in other times. Something on depreciation has to be reckoned, of course, and we always have taxes and insurance to settle out of the milk checks, as well as a snug sum ready to handle the loan on farmstead and chattels.

But when it comes to measuring this business by that old yardstick of the family-sized farm, we often learn to our dismay that the yardstick is rubber. It stretches and contracts. A guy buys a farm and has two kids under twelve. Ten years more and that farm may be too small, or if he is left alone with Ma, it may be too large—whatever he thought it was to begin with. In desperation he sells a chunk of it and divides the acreage. Now neither portion is suitable for a so-called family unit. So maybe he sells his part next year to the same man, who also buys another piece of a neighbor. This leaves the second party with more land than he can work with on the family-sized model.

To get out from under, the second man disposes of the farm for an inflated price instead of on its real earning capacity. The one who takes the bait had it measured up to his family all right, but how to make a good living and pay off the inflated valuation remains a mystery to him until all his sons are gone and they sell him out at auction. So there you are, folks!

I am aware that the term "family-sized" farm, so often used to decorate long-winded resolutions in stuffy halls where rural groups gather for indoor sport, is one that was coined to fight against the encroachments of the corporation.

IT really doesn't mean an awful lot simmered down to ordinary rural community experience, because the family out there has shrunk so fast that nobody ever builds those three-holers anymore. If your present fenced-in borders take in too much territory to handle easily, you can hire somebody's boy awhile. If the boy is not available you can "seed her down," and quit milking. If the contrary happens and the family is too big to fit the farm, why my neighbor needs a good hired man, so let's accommodate him.

Nothing whatever seems to be gained in such a region of restricted infant appearances by merely buying or selling off chunks of land. Besides it's a mess of bother just to match up the men and the manor, so as to retain the family-sized model. So we have to go slow in advocating use of this highly-prized recipe for success in our campaign to satisfy the land-hungry heroes. Still more unfortunate is its use in an unwelcome depression. That's when the trek back to the land begins with all the ardor of the Cherokee strip affair—and how in tunkins can you shift original family-sized units around over night to meet such an emergency or judge how long the old-home-week celebration will last?

To sum it all up, it seems to me we should set us up another alphabetical agency. Let's call it SSA, meaning by this, Selective Settlement Authority. Probably we should appoint the main squeezes of the existing federal loan agencies to its board of directors and policy makers. Or maybe just try it out awhile in some state willing to be a guinea pig. Take some state with plenty of husky, ambitious lads fresh from rigorous outdoor pursuits in pursuit of the Japs, and with ample land left for younger men to tackle. It won't be hard to find such a state because they reckon now that over a third of the operating farmers are at least sixty years old and getting older. No use sending explorers away to locate claims in some God-forsaken wilderness, just in the hopes that Europe will be anxious to buy everything we can coax out of the ground.

But even in these tamer regions of established settlement which have been exposed to the vagaries of agricultural progress for a century, you'll need a true guide and index, a soil auger and a Scotch pocketbook. You'll need some advice from our SSA boys just as much as though you tried to farm Coney Island.

BUT to get back to what I intended to say, to stick to my text as it were, I am going to be awful hard to convince when they start claiming that every lad who says he was raised on a farm is entitled to go back to one, loan or nothing.

Don't forget we need somebody to stay in town and show those half-baked apprentices how to run machinery, and nobody can beat a farm boy at that business. And while he is there, no doubt he will raise as big or bigger a family as he would have if he stuck to the farm, and that means customers. Paying customers too, not exchange help customers like we have in the country!

Meanwhile we can forget this whole thing long enough to go and eat a genuine family-sized dinner, which I shall do at Christmas in my usual hefty style, pausing once more after many similar holidays to extend you one and all my heartfelt greetings.

DAD KNOWS

Smith—"What would you say is the most effective factor for redistributing wealth?"

Jones—"From my own experience, I'd say, wives, daughters, and sons!"

Rose's are red,
Violet's are blue,
Lily's are white—
I know. I saw them on the washline.

A mother received a letter from her son who is in the navy.

"Dear Ma: I joined the navy because I admired the way the ships was kept so clean and tidy. But I never knew until this week who keeps them so clean and tidy.—Love, Junior."

GOB HUMOR

Girl: "I'm afraid dad always turns out the lights at 12 o'clock."

Gob: "What a good sport he must be!"

Jeanie—"Why did you quit teaching school to join the chorus?"

Queenie—"Well, I think there's more money in showing figures to the older boys."

LOST

Mother (to young son)—"Whose little boy are you?"

Son (disgustedly)—"Gosh! don't tell me you don't know."

Famous Last Words: "Well, if he won't dim his, I won't dim mine."

A colored maid was asked if she was going to hang up any mistletoe this Christmas. "Not me," she replied, "deed I isn't. I got too much pride to advertise for de ordinary cou'tesies a lady have a right to expect."

Americans are different from all other races about drinking. The English prefer ale, the French wine, the Germans beer, the Irish whiskey, but the American has no choice as he drinks the whole darned business, whichever he can get to first.

Women snore, too.

SETTLED

Old Maid: "I can't decide between the divan and the arm chair."

Clerk: "Lady, you can't make a mistake on a nice comfortable chair like this."

Old Maid: "O. K., I'll take the divan."

"Sit down in front!"

"I don't bend that way."

ACTIVITY—FOR LIFE

If you have any idle time on your hands, take up pipe-smoking and you'll never have another idle moment, what with cleaning, filling, lighting, packing, loosening, relighting, tamping, puffing, cleaning, filling, etc., etc.

A Short Story, entitled "Three Generations." Grandfather had a farm. Father had a garden. Son had a can opener.

AVAILABLE LITERATURE

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

Circulars

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

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
B-1-42 Growing Ladino Clover in the Northeast
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
S-6-42 A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa
DD-10-42 Clover Pastures for the Coastal Plains
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizers
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
C-1-43 Quality in Grasses for Pasture and Hay
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
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QQ-12-43 Potash in War Production
A-1-44 What's in That Fertilizer Bag?
B-1-44 Available Potash in the Surface Soils of Georgia
C-1-44 Adjustment of Agriculture to Its Environment
D-2-44 Potassium Content and Potash Requirement of Louisiana Soils
E-2-44 Plow-Sole Fertilizers Increase the Profits
F-2-44 Where Do We Stand With Fertilizers?
G-2-44 The Use of Borax in the Legume-Livestock Program of the South
H-2-44 Efficient Fertilizers for Potato Farms
I-3-44 Doubling Production by Bettering Soils
J-3-44 The Response of Various Crops to Potash Fertilization in South Carolina
K-3-44 Soil Tests Indicate Potash Levels
L-3-44 South Finds Clovers Excell in Profits
M-4-44 The Importance of Potash in Maintaining Food Production in N. C.
N-4-44 The Potash Problem in Illinois
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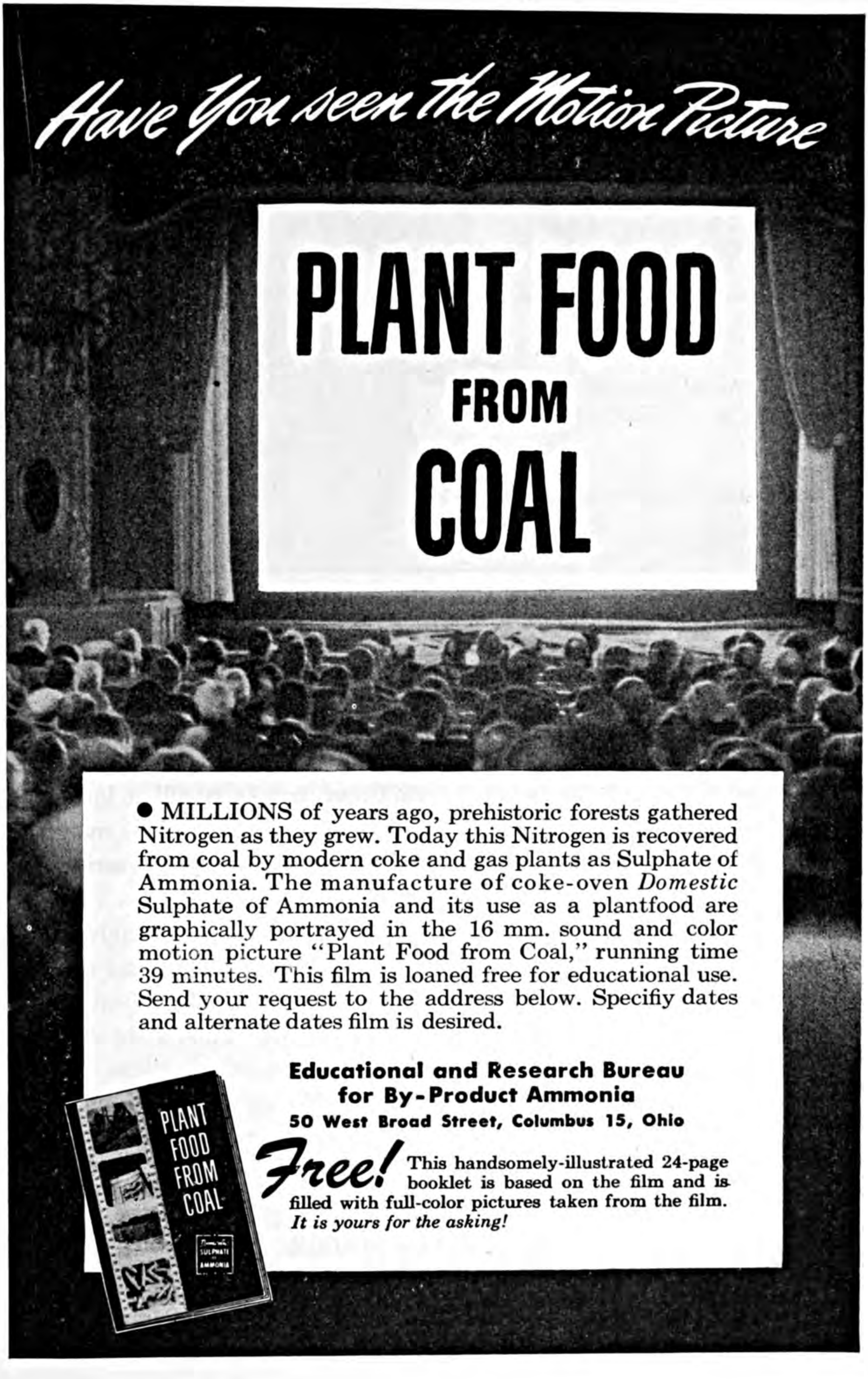
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THIS FARMER is ready to grow Victory Crops. He has bought all of his 1945 fertilizers. They are stored on his farm under shelter in a dry place. When he is ready to plant his seed, he will have his fertilizers on hand.

Farmers who delay too long in placing their orders may find themselves waiting for fertilizer at planting time. Under war conditions, the fertilizer industry simply cannot get a lot of extra labor and a lot of extra freight cars and trucks to fill a lot of last-minute orders. Too many late orders may result in a serious fertilizer shortage.

Fertilizers must start to move to farms early this month and continue to move steadily throughout the season. This is the only way the greatest fertilizer demand in history can be supplied, with a war shortage of labor and transportation.

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