BETTER CROPS V

The Pocket Bo

TABLE OF CONTENTS

JANUARY 1942

FEBRUARY 1942

MARCH 1942

APRIL 1942

MAY 1942

TH PLANT FOOD

f Agriculture

January 1942 to December 1942

JUNE-JULY 1942

AUGUST-SEPTEMBER 1942

OCTOBER 1942

NOVEMBER 1942

DECEMBER 1942

Better Crops with PLANT FOOD

January 1942 10 Cents

The Pocket Book of Agriculture

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

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Tree (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)

Reprints

B-8 Commercial Fertilizers in Grape Growing
C-8 Peanuts Win Their Sit-down Strike
K-8 Safeguard Fertility of Orchard Soils
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
GG-8 Soil and Fertilizer Needs of Apple Orchards
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
NN-8 Does Weather Affect Tomato Yields?
A-9 Shallow Soil Orchards Respond to Potash
N-9 Problems of Feeding Cigarleaf Tobacco
R-9 Fertilizer Freight Costs
T-9 Fertilizing Potatoes in New England
X-9 Hershey Farms Find Potash Profitable
CC-9 Minor Element Fertilization of Horticultural Crops
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
NN-9 Grass Is a Crop, Treat It as Such
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
B-2-40 Pasture Problems Still Unsolved
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
K-4-40 British Columbia Uses Boron for Fruit
M-4-40 Ladino Clover "Sells" Itself
N-4-40 How Shall We Fertilize Vegetable Crops?
O-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
Z-8-40 Permanent Pasture Treatments Compared
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podzols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
KK-12-40 Better Pastures for Better Livestock
LL-12-40 Tripping Alfalfa
A-1-41 Better Pastures in North Alabama
B-1-41 Our Defense Against Soil Fertility Losses
C-1-41 Further Shifts in Grassland Farming?
D-1-41 How, Where, When Apply Fertilizers?
E-2-41 Use Boron and Potash for Better Alfalfa
F-2-41 Meeting Fertility Needs in Wood County, Wisconsin
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
J-3-41 Soil, The Substance of Things Hoped For
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
M-4-41 Available Potassium in Alabama Soils
N-5-41 Soil Productivity in the Southeast
O-5-41 Synthetic Wood Ashes Require Boron
P-6-41 The Making of Better Pastures
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
T-6-41 The Concept of Available Nutrients in the Soil
U-8-41 The Effect of Borax on Spinach and Sugar Beets
V-8-41 Organic Matter Conceptions and Misconceptions
W-8-41 Cotton and Corn Response to Potash in South Carolina
X-8-41 Better Pastures for North Mississippi
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
AA-9-41 The Newer Ideas About Fertilizing Orchards
BB-11-41 Why Soybeans Should Be Fertilized
CC-11-41 There's Enough Potash for National Defense
DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
EE-11-41 Cane Fruit Responds to High Potash
FF-12-41 A Five-year Program for Corn—Livestock
GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
JJ-12-41 Potash Demonstrations on Statewide Basis
How to Determine Fertilizer Needs of Soils

THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON, D. C.

Better Crops with PLANT FOOD

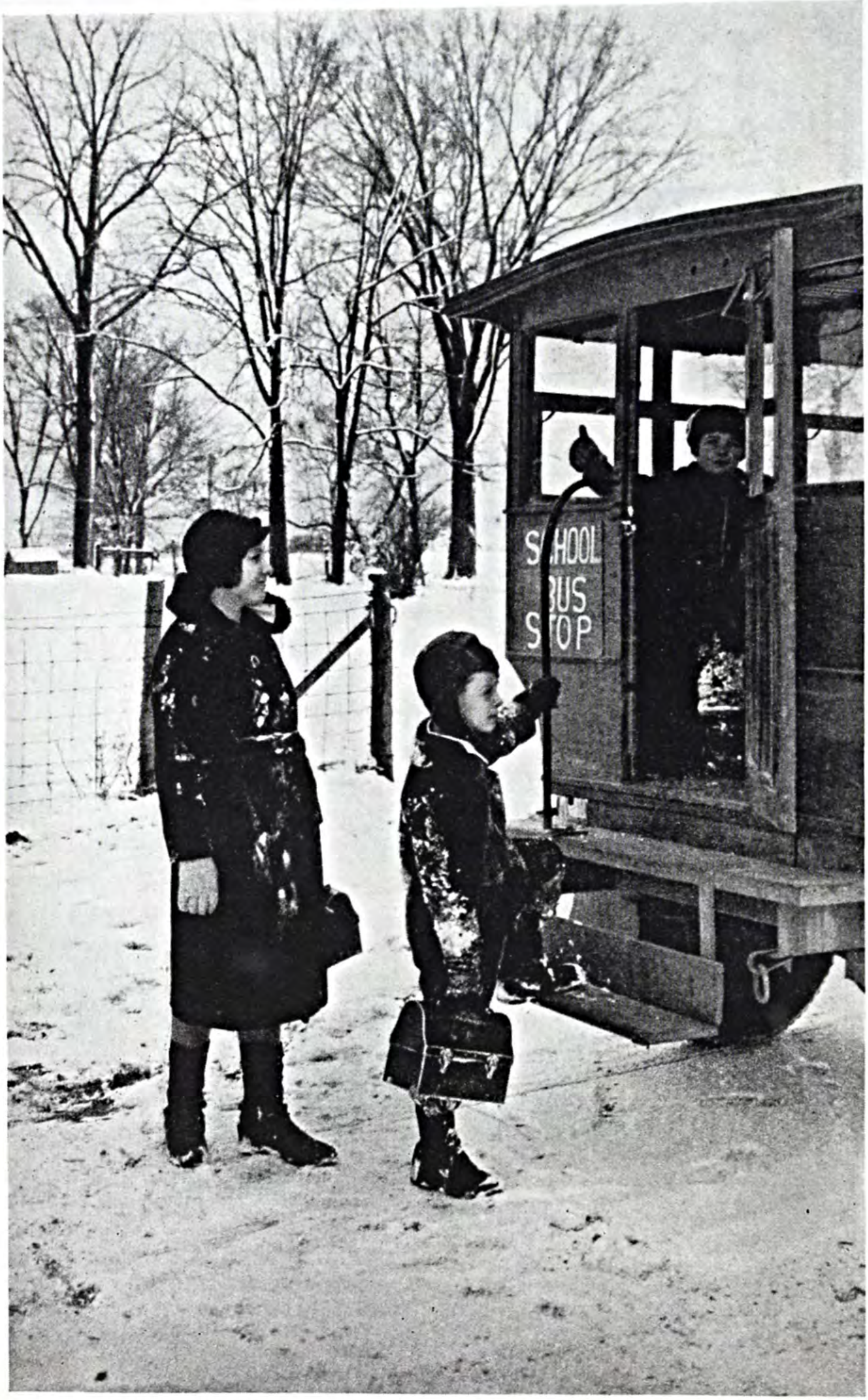
The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI NUMBER 1

TABLE OF CONTENTS, JANUARY 1942



WINTER DOES NOT HOLD THE DISCOMFORT FOR RURAL SCHOOL CHILDREN THAT IT DID IN THE "GOOD OLD DAYS."

Better Crops with Plant Food

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

Vol. XXVI WASHINGTON, D. C., JANUARY 1942 No. 1

Our farmers dig in . . . . .

As the Plot Thickens

Jeff McDermid

WITH the entrance of the villain Mars to disquiet us in our darkened domestic theater, the drama of farm production is playing to larger audiences than ever before in its long "barn-storming" career in the American scene. Hence as the plot thickens and the hisses begin and we shuffle about a bit uncomfortably, we regard the farmer as one of our dependable heroes of this democratic cast, perhaps second only to our firearms and plane industry. As patrons of the living stage today, we are all either stagehands, ushers, stars, or hams. So we begin by looking over the imposing program while the curtain rises, and trace some of the lines and cues of the farmer from overture to crisis.

Before going into the history of the farmer as a real Thespian on our stage, we must realize that he comes before us in his critical hour of artistry somewhat handicapped. That is, his financial resources have been none too effulgent and his rewards have not made him independent. And today as he waits for his springtime cue, he is harassed by lack of steel to fit into plowshares and harvesters and his supply of adequate reliable labor is short and getting shorter under duress of military and industrial demand.

Yet having acknowledged his present inadequacy through no fault of his own on the whole, we may trace his progress across the stage of American drama. Like his brother farmer-tragedian, Junius Brutus Booth of Maryland, Agricola of America has had his ups and downs during a notable career of satisfying the "inner man."

Casual citizens have regarded the

agricultural scene as so pastoral, peaceful, and benign as to give the sense of lost motion, arrested development maybe but anyhow, a degree of unchanging serenity. Students of the economic and geographic alterations through our first century know far better. They proclaim that agriculture has been somewhat of a shifter, albeit not shiftless, and peradventure a drifter to ports of destiny unknown.

During our first hundred years we have witnessed at least four major shifting and adjusting movements across the pages of farm history. Slow and indeed unconsciously made at times, they have nevertheless altered the life and goals of farming beyond anything we youngsters dreamed about in the brave days of old.

OUTLINE them first. We have had shifting of crops from east to west. We have experienced shifts from a pioneer farm-home economy to centralized services and commercial agriculture. We have gone through more recent adjustments by government aid and advice, which a few have called "regimentation"—(but we "ain't seen nothin' yet"). And lastly, on the eve of our serious tragedy we enter an era of world influences in crops and trade, which means good-bye to provincialism and line-fence limitations.

Other changes of great moment could be included had we time or space to discuss them properly. They would take in the technological emancipation of the farm worker by machinery and the scientific contribution of white-collar farmers to soils, fertilizers, rotations, and animal husbandry. Yet these are more or less deliberate paths taken to cut costs and expand manpower, while the first list names things that sort of "snuck" up and took us unawares.

Sectionalism was rampant in the first years of farming. It was sectional thought and habit, geared however to the necessities of the times and changing with them. As Milton Eisenhower points out, "Our first job was to conquer the continent and we did so, boldly and effectively. We did it by process of trial and error. The New Englander, fresh from the humid fields of Britain, first tried self-sufficient farming. As cities provided markets, he shifted to wheat and livestock. Soon competition from western New York and Ohio caused the New Englander to shift to pasture and sheep. Free lands of the West caused new competition, and he changed to hay and cheese. The North Central States won that battle and so the New Englander turned to fluid milk and vegetables."

WESTWARD the farm flow migrated, from a land of high humidity and relatively low fertility to a region of increasing fertility but decreasing annual rainfall. Still men grew basic crops and improved their yield, as the westward flow continued. In 1849 New York led in wheat, in 1859 Illinois led, in 1899 Minnesota forged ahead, and in 1919 Kansas topped the list. Everybody knows how the cotton empire expanded westward from a fringe of sea-island cotton colonies along the Atlantic to the great plains of Texas, where it remains supreme today. Men elbowed their way out of old environment to swing their scythes and scour the plows in new territories—which of course can never be repeated with such epic fervor.

What changes we make today must be done by science and group acceptance, not by the old adventurous spirit of conquest on overland trails. The romance may be gone but we have the reality and sometimes that's a challenge to us all.

Previous to the first world war considerably more butter was produced on the farm than in factories. "Butter money" was pin money for thousands of farm women, some of whom also made small cheeses. Today three times the amount of so-called "dairy butter" comes from the commercial plants, and in the heavy milk states farm butter is practically non-existent.

Along with this shift in butter output from isolated single enterprises to central plants came the shift from farm-skimming of milk to the delivery of whole milk for separation in factories. Right now a heavy shift in this line is going on under wartime stimulus, making it hard for some of the creameries to keep patrons on the cream basis.

Formerly the task of hauling milk and cream to dairy plants was the job of the producer or his neighbor, but the motor age plus good roads and factory competition made of this hauling item another commercial venture, so that a major share of the raw material is now toted to vats and churns by custom truckers.

Similarly, the transporting of livestock to market was once the sole interest of the farmer, who received orders from a stock buyer and delivered the loads in person. This also is mostly history, and truckers handle a considerable part of the sheep, hogs, and cattle sent to terminals.

Then, too, the old biddy hen and the housewife ruled the spring hatching job in former times, but today a vast majority of the baby chicks arrive on the farm in fiberboard boxes fresh from some trustworthy commercial hatchery. No guessing on sex either as cockerels or pullets are delivered on order just like the fuel oil and cooking gas.

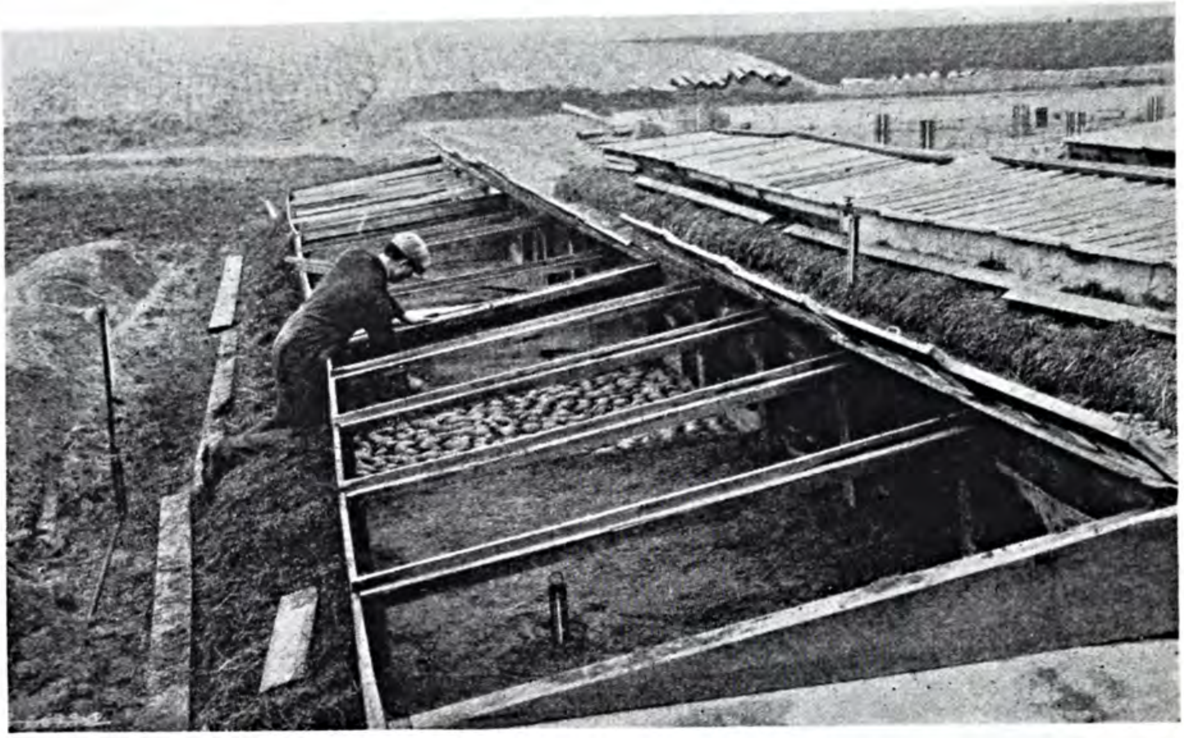
Even the conservative cattle breeder has yielded to the modern shifting idea and saves wear and tear on temper and old bulls by joining an artificial insemination ring. Here also he gets germ plasm by fast express and does not have to fear the results of busted fences, mixed herds, and ruined pedigrees.

The hybridizer with his strange equipment and crossing plots has shifted the emphasis in the Midwest from wind-pollinated varieties of corn to those of line-bred strength which must be renewed each year.

In this category naturally belongs the shift from hand labor to machinery. Corn harvesting which used to take 10 men can now be done with 3 or 4, using modern outfits. It used to take 50 or 60 men to do the work that 5 operators can perform with a tractor gang plow. Four men with a milking machine can empty as many cows in the same time as a dozen men before. An ordinary mower can be operated by one man to do the work of six or seven bended backs half a century ago.

Men of middle age today have lived right through all of these shifts from a farm-home economy to a streamlined or centralized semicommercial mode of agriculture. While sometimes one hears it claimed that seeking more leisure was the thing that prompted all this shifting, the best reason probably lies in the saving of drudgery and the doing away with so many folks to feed. Ma always stood behind Pa in these shifts because it meant thrift and convenience for her in household duties. Maybe she

(*Turn to page* 45)



Placing sweet potatoes in plant bed.

Growing Sweet Potatoes in Georgia

By Jack Wooten

Agricultural Extension Service, Athens, Georgia

FOR some time the State of Georgia has led in the total production of sweet potatoes but for years most of the output has been used for local consumption and feed for hogs and other livestock. Very little attention has been given to the matter of growing and marketing the crop for commercial purposes until more recently.

Practically all of Georgia is well adapted to the production of sweet potatoes, and farmers in the State are awakening to the fact that the crop can be increased to good advantage. With cotton acreage being curtailed and with the boll-weevil still cutting deeply into the yields each year (despite every effort to control the pest), farmers are looking to other sources for cash income and many are beginning to realize that sweet potatoes fill the bill.

In an effort to improve the quality of potatoes and at the same time create a demand on the markets, specialists of the Georgia Agricultural Extension Service are now laying particular emphasis on practices that will give the farmers higher yields, higher quality, and better keeping qualities.

In the first place, one thing that has a tremendous influence on all three of these points is good seed selected for profitable yields and marketable quality potatoes.

"Seed should be of a type that has been proven as to uniformity in size and shape and also as to a deep yellow color of skin and flesh," says Elmo Ragsdale, the Extension Horticulturist. "The slight additional cost of selected seed will be many times repaid in the percentage of No. 1 potatoes that will be produced."

Mr. Ragsdale and the county agents are pointing out that the seed stock should be free from disease and should be certified. Farmers are taking this advice and are getting results. The agricultural experts are also advising farmers that the best way to be sure of good and disease-free land is to plant on land that has not been previously planted to sweet potatoes in five years or more.

"Seed stock should be stored in houses that have not had any diseased potatoes stored in them or the houses should be thoroughly disinfected before any storing is done," Mr. Ragsdale declared. "The size of the seed stock is not so important. The smaller size potatoes—about 1½ inches thick—usually produce more plants per bushel. It is also important to know that the smaller potatoes are selected from high-producing hills."

Just as cotton has its boll-weevils so do sweet potatoes have their sweet potato weevils. This insect is probably the worst pest the sweet potato crop in Georgia has. It made its appearance along the Georgia coast about 1933 and has been found in several points in the State since that time. Precautions recommended by the Extention Service to keep the crop free from disease include careful handling, the use of clean seed, and proper methods of treating the seed and soils in the plant bed.

Successful sweet potato growers in the State are also paying considerable attention to treating the seed. Among these methods are:

1. Soaking all seed potatoes for 10 minutes in corrosive sublimate solution, using 3 ounces corrosive sublimate to each 22½ gallons of water. A 50-gallon barrel is used. By this method a sack of potatoes may be treated at one time. Because the solution is weakened by the potatoes being soaked in it, one-half ounce of sublimate is added after each treatment and the water level brought back up to the 22½ gallon mark. This solution is good for only 5 to 6 treatments.

2. Seed potatoes are also being treated with new improved semesan bel., the seed potatoes being dipped for 1 minute in a solution of 1 pound to 7½ gallons of water.

3. Farmers have also found it profitable, when the sweet potato drawers have been pulled from the draw bed, to dip the roots and lower part of the stem in either a 1 pound copper sulphate, 1 pound lime and 2½ gallons of water solution, or a 1 ounce semesan and 3 gallons of water solution.

Attention Given Varieties

Considerable attention is also being given to the proper varieties of sweet potatoes. The Porto Rico has proven itself to be the most important variety in Georgia since it has been found well adapted to the soil and climatic conditions. Other varieties grown in a limited way are Nancy Hall, Dooly, and Pumpkin Yam. The Big-Stem Jersey has been grown for some time in a limited way for shipment to eastern and northern markets, but is not planted now as extensively as it was at one time.

Besides being assured of good seed and proper treatment of the seed, Georgia farmers using sweet potatoes as a cash crop are practicing proper bedding methods. The simplest and most inexpensive means of bedding the potatoes is the use of an ordinary bed constructed of boards with the dirt banked around the outside of the boards and covered with an inexpensive cloth such as unbleached sheeting. Electric or flue-heated beds are growing in popularity in Georgia. These require more water and when plants begin to show through the surface of the soil one inch of clean sand or a mixture of equal parts of sand and sawdust is used on top of the bed so as to develop a better root system on the plants.

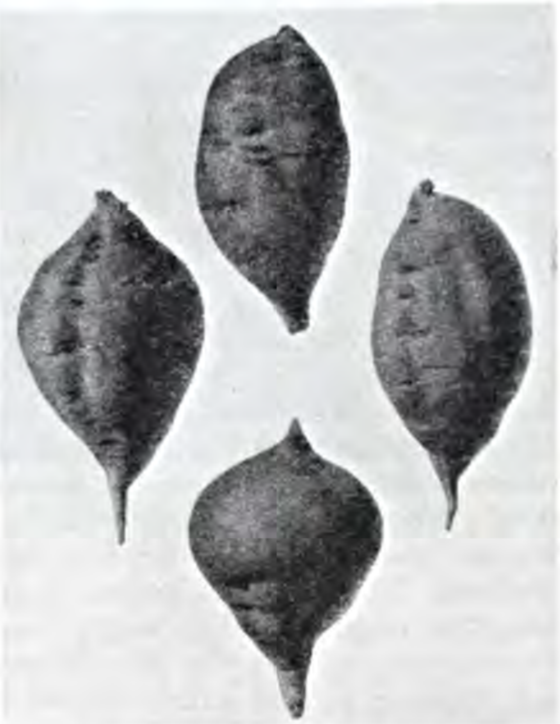
Another type of bed being used is a simple dirt bed constructed without manure. Various types of flue beds are also being utilized to some extent. The two most common types of beds are the ditch type and the hollow tile type. (Details on growing plants can be obtained from the Georgia Agricultural Extension Service Bulletin 482, "Growing and Marketing Georgia Sweet Potatoes.")

The use of commercial fertilizer is also playing an important part in successful sweet potato production in Georgia. According to Horticulturist Ragsdale, the amount of fertilizer needed to produce a good crop depends to some extent on the fertility and previous treatment of the soil. He has told farmers, however, that sweet potatoes, like other root crops, require an abundance of potash. The amount of fertilizer usually found most practical is from 600 to 800 pounds per acre. A complete fertilizer analyzing about 4 per cent nitrogen, 8 or 9 per cent phosphoric acid and 10 to 12 per cent potash gives good results. The nitrogen, according to Mr. Ragsdale, should be applied if possible about a week before the plants are set. It is better to apply it in bands about six inches apart and set the plants between the fertilizer bands.

"The question arises many times as to the advisability of using stable manure on sweet potatoes," the Extension Horticulturist said. "The use of manure is not generally recommended on the sweet potato crop but if applied to some other crop preceding sweet potatoes, it is usually very beneficial and does not give any harmful results. If heavy applications of stable manure have not been used on crops preceding sweet potatoes, it may be necessary to reduce the percentage of nitrogen in the fertilizer to some extent as it is not desirable to stimulate heavy vine growth."

Lime is not usually needed to produce a good crop of sweet potatoes but if the soil to be used is below the average in acidity, an application of lime may be found beneficial and, if possible, it should be applied several months before the crop is planted. Sweet potatoes will thrive best on soil with a pH ranging from 5.5 to 6.5.

Georgia farmers making the most money out of sweet potatoes are grow-



Porto Rico sweet potatoes—the most important variety in Georgia.

ing them on the lighter types of soil, since smooth potatoes may be produced on such soil. However, good crops are being made on some of the heavier soil types where plenty of vegetable matter has been added to these soils through the use of cover crops. Lespedeza and similar crops turned under aid in putting the heavier soils in good condition for a crop of sweet potatoes.

Speaking of cultivation of sweet potatoes, Mr. Ragsdale said: "Land should be well prepared for the crop. Plowing does not need to be done as deeply as for some other crops but a good job of harrowing should be done, leaving the soil in a well-pulverized condition. After fertilization, the land should be ridged over the fertilizer and allowed to settle for a short while before planting is done. Most growers like to smooth off the top of the ridges just before planting. This is a good practice, since it will destroy germinating grass and weed seeds and make dropping and setting the slips more easily done.

"Smoothing the ridges may be done by the use of a board attached to cultivator feet or to an ordinary plow stock. The boards should be long enough to smooth two rows at a time. Transplanting to the field may begin in south Georgia about the middle of March, in middle Georgia about the first of April, and in north Georgia from April 15 to May 1. It will require from 175 to 190 days to produce a maximum yield of No. 1 potatoes."

Harvesting Recommendations

Sweet potatoes are usually harvested in Georgia in late summer for the early market but sometimes are allowed to remain in the field until just before frost. On potatoes that are stored, best results have been obtained by waiting until they are well matured before being dug, but it is best, if possible, to dig them before frost. It has also been found that it is much better if the crop can be taken out of the ground during fair, warm weather. However, the potatoes should not be allowed to lie exposed to the sun for more than 30 minutes and should not be left in the field overnight. Mr. Ragsdale is advising that if frost should injure the vines before digging, it is best to remove these vines at once and dig the crop as soon as possible.

As has been pointed out, from a market standpoint, the weakest point in Georgia's sweet potato industry is the lack of quality in potatoes produced for commercial market. Although there are certain individual growers who are doing a good job of producing high quality sweet potatoes, when the entire crop is considered there has been a very definite lack of quality. This is gradually being corrected, however, and Georgia growers are benefiting from the experience of sweet potato producers in other states such as Louisiana and South Carolina by taking more pains in connection with the production and marketing of quality potatoes which are uniform in color, shape, and size, and as nearly free of disease as possible.

Proper grading and packing are two phases of the industry in which Georgia farmers have greatly improved during the past few years. Some people have the idea that this product should be graded and packaged to fit just one particular market. This is an erroneous

(*Turn to page* 44)

Sweet potatoes should never be left exposed to the sun for more than 30 minutes.

A large amount of kudzu was cut from this South Carolina field. Note how the leaves cling to the vines in the haystacks.

Kudzu—A Mender Of Tattered Lands

By Wellington Brink

Soil Conservation Service, Washington, D. C.

KUDZU came out of Japan and somehow got onto porches in Alabama. Down there for many years they called this legume "porch vine." It flowered prettily and was lavish with shade. Once in a while, whether by chance or by design, the vine would get a toe hold in a deep gully and do a spectacular job of roping it down, checking its further progress.

In 1923 Claude C. Hamilton, for instance, obtained from Alabama a single kudzu crown which he replanted near a wide and deep gully on the old family farm nine miles northeast of Forrest City, Arkansas. The gully was near his house, just across the road from his large peach and apple orchard. In 10 years or less the vine had spread until it lined the gully and covered its bed to a distance of 100 feet. It climbed trees and threatened to kill them, but the road grader kept the kudzu cut back and the peach trees remained safe.

That is one of the misapprehensions which for years held back the popularity of kudzu—the fear that the plant, once started, would "take" the fields, that it could not be kept within prescribed bounds. Actually, the vine is an obedient child, amenable to forms of discipline easily exercised by the farmer. Fire and the plow are effective exterminators of would-be runaway runners, but the simplest way to discourage kudzu's greedy ambitions is to deliver it over to a few hogs or cows. All livestock love the stems and foliage, and a hungry porker will follow down a lush vine, consuming every morsel as he goes, even rooting out the crowns as he comes to them.

Thanks to the vision and enthusiasm of R. Y. Bailey, to the new surge for soil conservation, and to the effort to put agriculture's house in order for defense, the Nation, and particularly the South, is rapidly becoming cognizant of this once obscure but lately acclaimed mender of tattered lands. I have it on Bailey's authority that approximately 200,000 acres of kudzu have been established in the South, if we include last spring's planting. But there are at least 10,000,000 other acres that ought to have the soil protection that kudzu, used in rotation, can give them.

Bailey, colorful philosopher-technician of the Soil Conservation Service, who is in charge of the Service's agronomic work in seven Southeastern States, is the man who, more than any other, discovered, developed, and defined the place of kudzu in Southern agriculture. His trained eye and his gift for phrases combined to put what he called "critical slopes" in direct opposition to the magic-worker, kudzu. Early in January 1937 Bailey wrote a memorandum, the fame of which has steadily soared as kudzu's long fingers have inched out across thousands upon thousands of wasting acres. He knew that terraces could never be relied upon to check erosion on the steeper lands. And it is on the more sharply angled segments of Southern farms that soil losses from beating rains create a control problem at its baffling worst.

Bailey's observations led to this conclusion: "The critical slopes present one of the most difficult problems in the control of erosion. . . . The soil washing from such areas during heavy rains silts and clogs up terrace channels below, causing breaks in the terrace ridges. Gullies started in the steeper portions of a slope usually extend to the area below, thus causing considerable damage to land on which erosion could be controlled if the steep area above was brought under control. The material from these slopes may be deposited on lowlands, rendering them useless."

Having thus established the premise, Bailey extended his reasoning thus: "Any practical solution of the problem of controlling erosion on critical slopes within a cultivated field should greatly simplify the problem of controlling the remainder of the field. . . . Permanent vegetation seems the answer. . . . The vegetation should be some kind of forage crops rather than trees. . . ."

Kudzu, naturally. Bailey had learned to know his kudzu as a father knows his child. For years he had been riding down the corridors and tramping the aisles of a vast outdoor laboratory. He knew this laboratory—the great Southeast—its plants, its terrain, its soils, its people, its economy. Well he knew the serious crisis that was mounting as erosion bit away at the South's basic resource of farm fertility. And he chose kudzu as best fitted to hold back the destruction and to begin the work of rehabilitation.

Campaigning Brings Results

Several years ago I made a trip with Dick Bailey through parts of Alabama and Georgia. At intervals Bailey would bring his car to a lunging halt. His practiced eye had discerned some good example of "critical slope." He must deliver a minute-long illustrated lecture on kudzu's potentialities. I am sure that the teacher's role must have been an old one to Bailey by that time and that I was but one of many pupils before and after. Even then, as a result of his quiet campaigning, others were beginning to talk of erosion control in terms of critical slopes and kudzu. Experimental starts were soon to be made. Shortly a farmer demand for kudzu seed, crowns, and seedlings was born. Japanese growers began to discover an increased market in the States. Soil Conservation Service nurseries were assuming an added propagation program.

In 1939 a total of 15,000,000 seedlings for transplanting were produced in these nurseries. The next fiscal year, 26,000,000 seedlings were sent out by the nurseries. Production in 1941 numbered 30,000,000. And during the 12 months beginning the first of July the output is expected to jump to at least 40,000,000.

Before proceeding further, let's pause for a brief appraisal of the personality and the character of our subject, *Puerària thunbergiàna.* The plant is perennial—survives from year to year. It is leguminous, which means that it is a bearer on its roots of those soil-enriching nodules which are miniature nitrogen-producing factories. The large, fleshy roots sometimes assume the most curious shapes; they are said to yield starch of excellent quality, and the main branches often measure four to five feet.

From a well-established root the vines often grow 40 to 60 feet in a single season, producing a profusion of very large leaves. Although the full possibilities of by-products have not been explored, it is known that from the tough fiber of the inner bark can be made a cloth in which are combined fineness and remarkable strength. The stems are slender, hairy, twining. The flowers are pea shaped, purple in color,

One of the deep gullies on the Beeland estate farm near Greenville, Alabama, is completely covered with kudzu planted 12 years ago. The kudzu in this 300-foot gully is sufficient to furnish grazing for a cow.

occurring in axillary spikes late in the growing period. The pod is large and flat; the vine hardy, extremely rapid in growth. In certain situations, kudzu has a high rating for ornament and shade. Propagation is by crowns, by seedlings, or by cuttings. In the North the plant dies to the ground in the winter; in the South the top becomes woody. Set the crowns around the rim of a gully, behind check dams, at intervals over a sharp slope, and chances are that in one season the vines will grow over the afflicted areas, affix themselves to the pitted faces of the slopes and the scourged water channels, and effect a healing or at least a control of the process of erosion.

All-around Wonder-worker

Because of kudzu's promise as an all-around wonder-worker (it not only stops abruptly rain-wrought ruination of agricultural lands, but also can be fed and grazed and cut for hay during its work of building back), Dick Bailey is searching all production possibilities. Southern farming needs kudzu and more kudzu, needs it quickly and in quantity. For that reason Bailey is beginning to encourage the production of seedlings by farm boys and girls who can grow the plants in good garden soil much as they grow beans or carrots. And although kudzu is a shy bearer of seed, there's a worth-while job and a fairly profitable one waiting for American youth who will locate favorable areas and undertake the collection of seed.

But while Bailey and his co-workers are concerned with the problem of obtaining planting materials, they are equally intent on assuring the complete success of stands. No use spoiling a good thing by giving it a poor trial.

Kudzu, to do a first class job, must get off to a proper start. Moreover, it suffers from the Topsy-like sort of care that leaves it up to the plant to "just grow." Planted right, fed amply, groomed well by clean cultivation along the rows, kudzu will thrive and more than pay for itself. The rule is to nourish the crop in proportion to the use that is made of it; kudzu given two cuttings in a season demands more fertilization than that which is cut but once.

I've been thumbing through Bailey's "Kudzu for Erosion Control in the Southeast," issued in 1939 as Farmers' Bulletin No. 1840. The section on "fertilizer treatment" gives us in a short page and a half some excellent suggestions for stimulating the establishment of kudzu and for its development as a paying crop.

Trials on various soils of the Southeast have shown conclusively that manure and phosphate stimulate the growth of kudzu and produce a stand more quickly. Experiments have not been conducted to show the potash requirement of kudzu, but it is highly probable that on soils deficient in this element application of some form of potash fertilizer would also be beneficial.

With this bulletin as a starter, Bailey proceeds to refine and perfect many ideas of practical value. He emphasizes the importance of care in the handling of seedlings intended for planting; advises plowing deep enough to get at least six inches of fleshy root with each crown.

The rows should be prepared 12 to 18 feet apart by breaking a strip approximately 5 feet wide along each row. A deep furrow is laid off. Two to three tons of manure, if available, and several hundred pounds of suitable fertilizer are applied in the furrow. There are six furrows to the row, to form a broad flat bed. These are prepared as early in the fall as possible to allow settling. Plant roots are not brought into direct contact with manure. The manure and fertilizer are often distributed on the surface and worked into the soil after the plants are set. Bailey says that kudzu may be set on every fourth and fifth cotton row without preparation, provided fertilizer is applied and thorough cultivation given after planting. On steep, terraced areas, plants may be set five feet apart on the terraces, row crops being grown in the intervals between terraces for two or three years.

In gullies or rough areas where horse-drawn equipment cannot be used in preparing the soil, Bailey suggests that hills be prepared 20 feet apart each way. Each hill should be 18 inches square, 15 inches deep. Manure and superphosphate should be applied and mixed

(*Turn to page* 38)

Kudzu cutting demonstration on a farm in Richland County, South Carolina. The kudzu was planted eight years ago and was not cut until last year. A vine attachment on the mower was used.

Canadian Muck Lands Can Grow Vegetables

By F. S. Browne

Central Experimental Farm, Ottawa, Ontario, Canada

THE muck lands of Quebec and Ontario are extensive and represent a huge reserve of potential agricultural wealth. At present, only a small fraction of these great areas is utilized for crop production, and of this small fraction, only a relatively small part is worked intensively. Should the need arise for large quantities of food, particularly vegetables, these thousands of idle acres could, with proper handling, supply an enormous demand.

Regardless of origin, the muck soils of these regions can be separated into two groups, those in which the soil is alkaline and those in which it is acid. In general, the acid mucks are of greater value as they respond more quickly to treatment, and in them, there is usually less loss of plant-food elements by fixation.

From the standpoint of agricultural value, muck or organic soils may be graded according to the degree of decomposition of the surface layer. This ranges from raw peat to well-decomposed muck. The greater the degree of decomposition and depth to which it has extended, the greater the value of the soil. In the profile of a first class muck soil the well-decomposed layer should extend 12 or 14 inches below the surface. This should gradually blend into a layer where decomposition is much less complete and the general texture is coarse, loose, and open. This layer may extend to a considerable depth, but all of the better organic soils are finally underlaid with clay, marl, or rock.

Probably the most important factor in muck land crop production is water control. Undrained mucks are usually too wet for successful crop production, and when drained, dry out too fast. Owing to the high absorption capacity of muck soil, which will usually absorb more than its own weight of water, ordinary summer rains are absorbed and held in the top inch or two where few if any plant roots are situated. Furthermore, a muck soil is much less compact than mineral soil and permits a much freer movement of air through it. Evaporation from the top layer is more rapid and the surface is soon dry after rain.

Irrigation by Seepage

By taking advantage of the coarse, open nature of the layer of soil below the well-decomposed and somewhat more compact top soil, very satisfactory irrigation can be effected by seepage. The drainage ditches can be filled to near the bottom of the well-decomposed layer and water will seep laterally through the coarser second layer for distances up to 200 to 300 feet. Water for plant requirements is drawn from this saturated layer by capillary attraction into the well-decomposed surface layer. The amount thus moved can be regulated by raising or lowering the water level in the ditches.

The means of obtaining water for irrigation of muck developments will vary with conditions. In many situations advantage may be taken of small streams or springs, the water from which may be held back, after the spring run-off, and diverted into ditches where it can be held to the desired level by dams. On other situations water may be held in ponds or lakes, on higher levels, and released into the ditches as required. Under some conditions fairly effective irrigation may be obtained by holding part of spring run-off water in ditches which may be added to from time to time by heavy rains.

At the Dominion Experimental Sub-station at Ste. Clothilde, Quebec, which is primarily a muck land development, a very efficient and practical irrigation system is in use. At this site the cultivated areas are situated about 1,200 feet from a permanent source of water, a large creek, and the water in the creek is normally 4½ feet below the level of the surrounding muck land areas. The water, therefore, is pumped by a high-speed centrifugal pump through a 4-inch fiber pipe-line, of the type used for encasing electric lines underground, to ditches in the cultivated areas. From there it is carried by lateral seepage under the growing crops. In the spring during the run-off period, or after excessive precipitation, the dams may be opened and the same ditches used for the removal of surplus water. With this set-up the cost of moving water into the ditches has been as low as 52 cents per acre inch.

The light, portable pumping outfit used for irrigation at the Dominion Experimental Sub-station, Ste. Clothilde, Quebec. With this outfit water is raised 4½ feet for 52¢ per acre inch.

The amount of irrigation water necessary as a supplement to precipitation has varied but little at Ste. Clothilde during the past four years, since only very heavy summer rains provide sufficient moisture to reach plant roots. In general, it would seem that approximately one-half inch per week is sufficient for such crops as potatoes, cabbage, and onions. Spinach and carrots apparently need somewhat less, and celery up to three-quarters of an inch, especially during August and early September. With the celery crop, however, the water supply must be constant and uniform, as it has been observed that sudden changes in soil moisture may induce blackheart.

Since all muck or peat soils are of organic origin, they normally contain large amounts of nitrogen but are deficient in many of the mineral elements necessary for plant nutrition. In the soil at Ste. Clothilde, which is similar to that of large areas in Quebec and Ontario, there is a very marked deficiency of potash. This is so pronounced that some crops can not be grown without it. There is also a deficiency of phosphorus, and trace elements such as boron, copper, and manganese must be added for certain crops.

These findings were indicated in a series of preliminary experiments conducted in 1936, the results of which form the basis of more extensive trials with the principal vegetable crops. Although space is not available for the setting down of much of the detail of such work, a brief review of some of the more important results should prove of value.

One of the crops which has received a great deal of attention is celery. This is primarily a muck land crop, and the large areas of this type of soil near Ste. Clothilde are conveniently situated for marketing the product. With the first fertilizer trials it was clearly indicated that potash was of extreme importance for celery on this soil type. Also, due to the highly organic nature of the soil, some of the potash in the initial application was fixed and rendered unavailable early in the season.

With this information, an experiment in which a 2-8-16 was applied at rates of 1,000 and 2,000 pounds per acre in two series, one with the potash in the muriate form and in the other as sulphate of potash, was conducted for two years. Supplementary summer side applications of 100 and 200 pounds per acre of both muriate and sulphate of potash were also included in comparison with initial applications. The experiment was conducted in quadruplicate each year.

The results (Table 1) indicate clearly that fairly large quantities of potash were essential in the fertilizer applications for the production of celery; also that muriate of potash was superior to sulphate of potash for this crop, due probably to the high sulphur content of these soils. Summer side-applications of potash, although of some apparent value in this experiment, have not proved necessary in subsequent trials.

In the years 1938, '39, and '40, similar experiments were conducted with phosphorus and nitrogen levels. It was found that with potash at 16 per cent, no added response was obtained by increasing phosphorus over 8 per cent or nitrogen over 2 per cent. Applications containing less nitrogen and phosphorus in relation to potash depressed yields. Accordingly, the formula of 2-8-16 with the potash in the muriate form is recommended for the celery crop on muck soil in this region.

TABLE 1. RESPONSE OF CELERY TO APPLICATIONS OF POTASH AT STE. CLOTHILDE, QUEBEC, 1937 AND 1938.

Initial application of 2–8–16	Source of potash	Supplementary application	Mean yields per acre
lb.		*lb.*	*Tons*
1,000	Sulphate	0	12.23
1,000	Muriate	0	16.01
2,000	Sulphate	0	15.28
2,000	Muriate	0	22.35
1,000	Sulphate	100	13.26
1,000	Muriate	100	18.75
2,000	Sulphate	100	14.98
2,000	Muriate	100	23.99
1,000	Sulphate	200	13.49
1,000	Muriate	200	18.52
2,000	Sulphate	200	16.23
2,000	Muriate	200	25.21

Difference required to be significant 1.02 tons per acre ($P = .05$).

Trials of minor elements over a period

(*Turn to page* 42)

A good crop of late celery, fertilized with 1,500 lbs. of 2-8-16 per acre, at the Dominion Experimental Sub-station, Ste. Clothilde, Quebec.

Growing Ladino Clover in the Northeast

By S. D. Gray

Washington, D. C.

FOR many years Northeastern agriculture has been handicapped because of the lack of a reasonably permanent hay-type legume. Ladino, a comparatively new grassland crop, now appears destined to place the agriculture of this region on a par with that of alfalfa-growing regions farther west.

Ladino is a triple-purpose crop, excellent for pasture, hay, and silage. It is permanent on well-adapted soils under favorable conditions of fertility and management. It is a promising legume for Northeastern livestock farms.

Ladino is a giant type of white clover in contrast to the smaller types such as common white Dutch, English wild white, and native wild white clovers. It was introduced into this country from northern Italy around 1890. The first official experiments with this crop are recorded in Bulletin 98 (1894) from the North Carolina Agricultural Experiment Station. Seed, from which our first commercial seed supply was developed, were imported in 1903 and used chiefly on irrigated land in southern Idaho. Oregon, Washington, and more recently California have further developed the crop and supply seed which today provide for the rapidly increasing acreage.

Since 1928 when John Ellis of Lee, Massachusetts, made the first field planting of Ladino clover in the Northeast, the acreage of this crop has increased from 4 acres to an estimated 100,000 acres in the 13 Northeastern States. A recent survey of the agronomists in this area indicates that this acreage may be greatly increased and that within a reasonable time it may even exceed a million acres. In Maryland alone it is estimated that the present acreage of somewhere around 1,000 may be profitably expanded up to 20,000 to 25,000 for straight seeding and possibly 60,000 additional acres to thicken stands of pasture and pasture-legume mixtures.

Like the wild white and white Dutch clovers, Ladino spreads by means of runners which take root at the joints to form new plants. It is distinguished from ordinary white clover by having much larger leaflets and taller stems. Owing to its more erect growth it is able to compete with tall-growing grasses and legumes. It is not so well adapted to closely grazed pasture sods as the smaller types, but with favorable management and liberal fertilization will persist over a period of years. It is a true perennial and should prove a boon to grassland farming in the Northeast.

Leads in Palatability

As a pasture plant Ladino appears to be at the top among the legumes in palatability for both dairy animals and chickens. Successful grazing of this crop requires rotational management, pasturing fairly heavily then removing the stock when there are several inches of the top still remaining. This is to permit a full measure of recovery. It is important to let the plant go into winter with at least five or six inches of top growth. A light application of from five to six tons of well-rotted manure applied in late fall or early winter has been found very helpful in preventing winter-killing.

Ladino makes an excellent hay that is relished by all classes of livestock. In harvesting for hay, care must be exercised in handling to prevent shattering of the leaves. The crop should be mowed when about one-tenth of the flower heads have turned brown. The first cutting, which is ready about June 1, has a moisture content often as high as 80 per cent. For this reason and because of the possibility of unfavorable weather, this early crop might well go into the silo. The experience of most growers is that in ensiling, from 60 to 80 pounds of molasses per ton of silage should be used to best preserve this feed and to increase its palatability.

Ladino clover is a high producer and a heavy feeder. It is a good crop to be grown on good land. It thrives best on the moist, lowland areas of the farm, those normally too wet for corn or alfalfa yet sufficiently well-drained to prevent standing water. While recommendations for fertilization vary in the different states, it is generally agreed that to produce the maximum yields the soil should be limed to around pH 6.0 and liberally supplied with phosphorus and potash.

Preparation of Soil

In the preparation of soils for Ladino the same seeding practices used in the seeding of ordinary clover-grass mixtures are followed. Most agronomists recommend the plowing down of from 8 to 10 tons of manure. If seeded in a grass mixture, a complete fertilizer is usually recommended. Where seeded in pure stands or in a legume mixture, a phosphorus-potash analysis is believed best. Analyses recommended and chiefly used in the New England States are 4-16-20 and 0-20-20. Grades in similar ratios are quite generally recommended in the Middle Atlantic States. In New Jersey, for example, the recommendations call for the use of from 400 to 500 pounds per acre of a 5-10-10 fertilizer for Ladino grass seedings, and where seeded with alfalfa or red clover mixture 800 pounds of an 0-12-12. The University of Maryland Agricultural Experiment Station suggests from 300 up to 800 pounds per acre of an 0-14-6 or 0-12-12, depending upon the natural fertility of the soil and whether or not manure has been plowed down. The higher potash analysis is to be preferred on the poorer or lighter textured soils where little or no manure is used.

The most satisfactory time of seeding Ladino is in the spring with a companion crop of oats, and it should be planted as soon as the ground can be worked. Successful seedings, however, have been made in August and early September without a companion crop and also in March or April on stands of fall-sown grains or timothy. Whatever the method of seeding, the companion crop should be pastured early or made into silage. As Ladino seeds are small in size, best results follow shallow seeding. It is a common practice to broadcast on top of the ground and to press the seed into the soil lightly by use of a roller. Ordinarily, from one to two pounds of seed added to a seeding mixture of grasses and other legumes are recommended. Even for the seeding of pure stands of Ladino very satisfactory results may be expected from the use of from two to four pounds per acre provided a nurse crop is used to control the weeds. Once started, the vigorous spreading habit of Ladino soon completely covers the surface.

A small acreage of Ladino pasturage on every dairy farm to supply most of the grazing is a capital investment. Where there is some supplemental grazing from old pastures, from one-fourth to one-half acre of Ladino pasture may be ample. However, as the carrying capacity of the clover may vary considerably with the season, age of the stand, or fertility conditions, dairymen might well figure on one acre for each cow for a grazing period of 160 days. Early grazing should begin when the plants are from three to four inches high. Quite frequently as many as 8 or 10 cows per acre at weekly in-

(*Turn to page* 38)

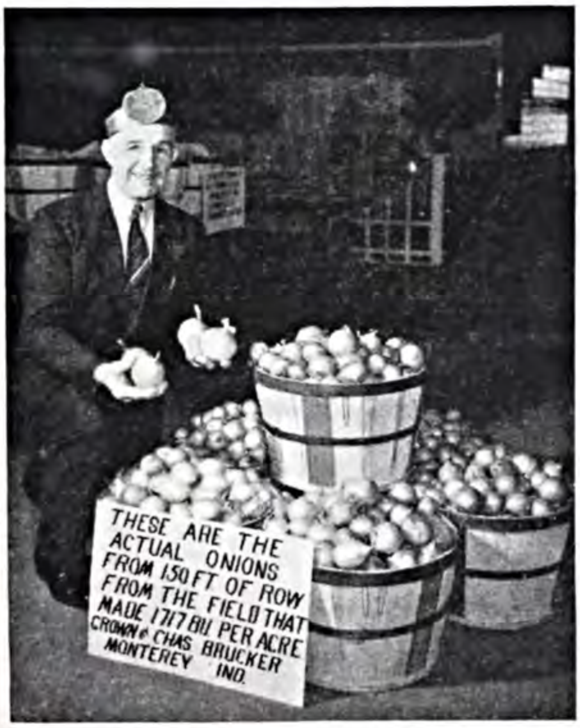
Charles Brucker Is New Onion King

By Roscoe Fraser

Agricultural Extension Service, Purdue University, Lafayette, Indiana

INDIANA recently crowned a new onion king—Charles Brucker, of Monterey, Pulaski County — a king, who, when he bought his 100-acre "most-swamp" farm at public auction 17 years ago, thought his biggest crops would be cattails and bullfrogs. Little did he dream he would some day produce 1,716.91 bushels of Sweet Spanish Onions on one acre of that very bog. He was nearly as surprised as other people when he did that very thing this year, although he had set out to try to break last year's record of 1,625 bushels per acre.

When record yields like these are becoming so common in this country, it is difficult for us to imagine an onion shortage in England. We read that at a recent charity bazaar in London, a basket containing a dozen large onions sold for $20. At that rate, if Mr. Brucker had in London, the six bushels of onions dug from one 150-foot row in his field, he would almost be in the plutocrat class. To have 1,716.91 bushels would probably make him one of the most sought-after men in all England.



Charles Brucker with part of his record-breaking yield of onions.

Onions in our own country are so common that we seldom think of their nutritive value. They are exceptionally rich in vitamin C, the complete lack of which inevitably causes scurvy. Added to a basic diet believed to be complete except for a deficiency of the pellagra-preventative factor, green onions prevented pellagra. It is estimated Americans consume more than a billion pounds of onions a year; while in China, onions are the second most widely used food, rice rating first place.

Nowhere are better onions grown than on Indiana's 300,000 acres of muck land. Mr. Brucker is one of Indiana's progressive muck farmers, and grows fine onions. Shortly after he had bought his farm, he attended a farm bureau meeting where the principal speaker talked about muck soil and its possibilities. At the close of the meeting, Mr. Brucker talked with the speaker, whose name he has long since forgotten. The speaker had but recently returned from a study of similar soils in Germany, and he advised Mr. Brucker that the muck in the neighborhood of his farm was probably the best muck in the United States.

As an experiment, Mr. Brucker put

(*Turn to page* 37)

Higher Analysis Fertilizers as Related to The Victory Program

By A. L. Mehring

U. S. Department of Agriculture, Washington, D. C.

IN THE manufacture of fertilizers, formulas are used providing for one ton of a definite grade. The total weight of the various materials required to supply the necessary quantities of the three primary plant foods, nitrogen, phosphoric acid, and potash, in grades customarily demanded will usually be less than a ton. The custom, therefore, is to add other material not containing any appreciable quantities of these three plant foods in order to bring the weight of the mixture to exactly one ton.

For many years the average plant-food content of the materials available for making mixed fertilizers has been increasing, and in the past few years at a very rapid rate. The average total plant-food content of the mixed fertilizers made from these materials has been increasing also but at a much slower rate. As a result more and more of the material containing none of the primary plant foods has been added in order to produce the old-fashioned, low-analysis grades of mixed fertilizer still demanded by many farmers.

When a material added to a fertilizer does not materially increase its efficiency in promoting crop growth it is known as filler. Thus enough limestone added to a mixture to neutralize its physiological acidity would not be filler if the fertilizer was intended for a highly acid soil. However, many of the soils in the West and some in the East contain enough calcium and are improved for certain crops by the use of physiologically acid fertilizers. In such cases limestone in any quantity would be a filler.

Filler is usually ordinary sand, but many materials have been used, including limestone, spent fuller's earth, rock salt, coal ashes, grit removed in the preparation of refined chalk, peanut hulls, spent foundry sand, sawdust, etc.

The exact quantity of filler used in making commercial fertilizers is unknown. Mehring[1] has estimated the quantities consumed in certain years as follows:

Year	Short tons	Per cent of total fertilizer consumption
1880	5,000	0.7
1890	50,000	2.9
1900	112,000	3.5
1910	258,000	4.6
1920	635,000	8.8
1930	730,000	8.7
1937	510,000	6.1

It will be observed that very little filler was used in 1880 but that the quantity increased until sometime between 1920 and 1930 and since then appears to have decreased. The reason for the decrease is that in 1928 dolomite

[1] *The Magnesium Content of Fertilizers 1850 to 1937, A. L. Mehring, 1939 Yearbook of Commercial Fertilizer 32-41.*

began to be added in rapidly increasing quantities and this has not been considered as filler in the above figures.

The purpose of this article is to give some later figures on the use of filler and to emphasize the importance at this time of getting rid of as much of it as possible.

The 1939 census of manufactures gives the tonnages of the various materials used in making mixed fertilizers as reported by the industry. It also

TABLE 1.—TONNAGE AND PLANT-FOOD CONTENT OF MATERIALS USED TO MAKE MIXED FERTILIZERS IN 1939.

	Short tons material	Analysis	Short tons		
			Nitrogen	Available phosphoric Acid	Potash
Ammonium sulphate	339,590	20.7	70,295		
Sodium nitrate	87,793	16.0	14,047		
Anhydrous ammonia	13,047	82.0	10,698		
Aqua ammonia	77,289	20.6	15,922		
Cyanamid	34,779	22.0	7,651		
Urea	16,305	42.0	6,848		
Ammonium phosphate	27,356	13.0–35.0	3,556	9,575	
Cal-Nitro	45,145	18.0	8,126		
Other inorganic nitrogenous materials	69,476	33.0	22,927		
Cottonseed meal	75,903	6.5–2.6–1.8	4,934	1,973	1,366
Other seed meals	10,462	7.0–2.0–2.0	732	209	209
Tankage, process	92,638	8.4–0.6	7,782	556	
Tankage, animal	53,951	7.5–10.4	4,046	5,611	
Tankage, garbage	31,091	3.0–3.0–1.1	933	933	342
Fish scrap	39,067	8.8–7.5	3,438	2,930	
Milorganite	40,000	6.0–2.7–0.6	2,400	1,080	240
Guano	27,063	7.0–9.0–2.5	1,894	2,436	677
Tobacco stems	50,000	2.0–0.7–6.1	1,000	350	3,050
Sewage sludge	17,300	4.5–2.3–0.5	779	398	87
Castor pomace	50,000	5.1–1.8–1.1	2,550	900	550
Cocoa by-products	25,000	3.5–1.5–2.5	875	375	625
Bone meal	15,775	3.2–24.8	505	3,912	
Double super	90,000	45.0		40,500	
Run-of-pile super	2,103,312	19.5		427,696	
Muriate of potash	424,532	58.5			248,351
Sulphate of potash	56,389	49.5			27,913
Manure salts	23,910	26.0			6,217
Kainit	19,434	20.0			3,887
Sulphate of potash-magnesia	12,000	26.0			3,120
Nitrate of soda-potash	50,000	14.5–15	7,250		7,500
Cotton hull ashes, wood ashes, etc.	4,066	5 to 6		203	244
Phosphate rock	30,994	4		1,240	
All other materials containing plant food	268,959				
Total	4,322,626		199,188	500,877	304,378
Average composition without filler			4.61	11.59	7.04
Total mixed fertilizers made	5,321,823				
Average composition with filler			3.74	9.41	5.72
Average as reported by census			3.44	9.23	5.64

gives the tonnages of mixed fertilizers made and the average grades reported. Table 1 gives those figures, supplemented by some additional data obtained from other official sources. Most, if not all, of the 268,959 tons of "all other materials containing plant food" as shown in the table consisted of peat, peanut hulls, open-hearth basic slag, dried manure, vegetable meal, manganese sulphate, copper sulphate, and other such materials containing little or no available nitrogen, phosphoric acid, or potash.

The manufacturers were required to report to the Census Bureau the tonnages of materials containing plant food consumed, but did not have to report materials such as sand, limestone, dolomite, etc. Of the difference of approximately 1,000,000 tons between the tonnage of mixed goods made and the total of the tonnages of materials containing plant food used in making them, about 300,000 tons consisted of liming materials such as limestone, dolomite, etc. Therefore, about 700,000 tons must have been sand and similar inert material.

Filler and the Farmer

The cost of manufacturing and distributing mixed fertilizers exclusive of the cost of the raw materials is about $11.00 a ton, and that has to be paid by the farmer even if the product he buys is nearly all sand. When used, the cost of the filler material also is added to the $11.00 that must be paid by the farmer.

M. H. Lockwood of the Eastern States Farmers' Exchange made a careful study of the costs of delivering plant food to the farmer. He found that for every dollar paid by the farmer for 3-6-6 fertilizer 48 cents went for the purchase of materials and filler and 52 cents for the cost of manufacture, bags, and distribution. The cost of the materials required to make the equivalent quantity of 4-8-8 was 42 cents and the total of other costs was 39 cents, making a total of 81 cents or a saving of 19% to the farmer over what he would pay for the same plant food in a 3-6-6 grade. When the same plant-food materials were used to make a 5-10-10 grade, the cost of materials was 39 cents and other costs 32 cents, making a total of 71 cents, or 29% less than in the 3-6-6 grade. Further slight savings in the total cost per unit of plant food can be made by using more concentrated materials and raising the grade to a maximum of 9-18-18, but above 5-10-10 the materials required may even cost a few cents more. The savings are made on the freight, bags, and labor.

In general, it may be said that with conditions as they are today mixed fertilizers cannot be economically prepared with less than 20% total plant food, and even some grades containing 20% nitrogen, phosphoric acid, and potash, when prepared in the best manner possible with the most economic materials, require some filler in the formula. The following formula, which was used to produce non-acid 2-8-10 fertilizer by a well-known company in Baltimore in 1941, is an example:

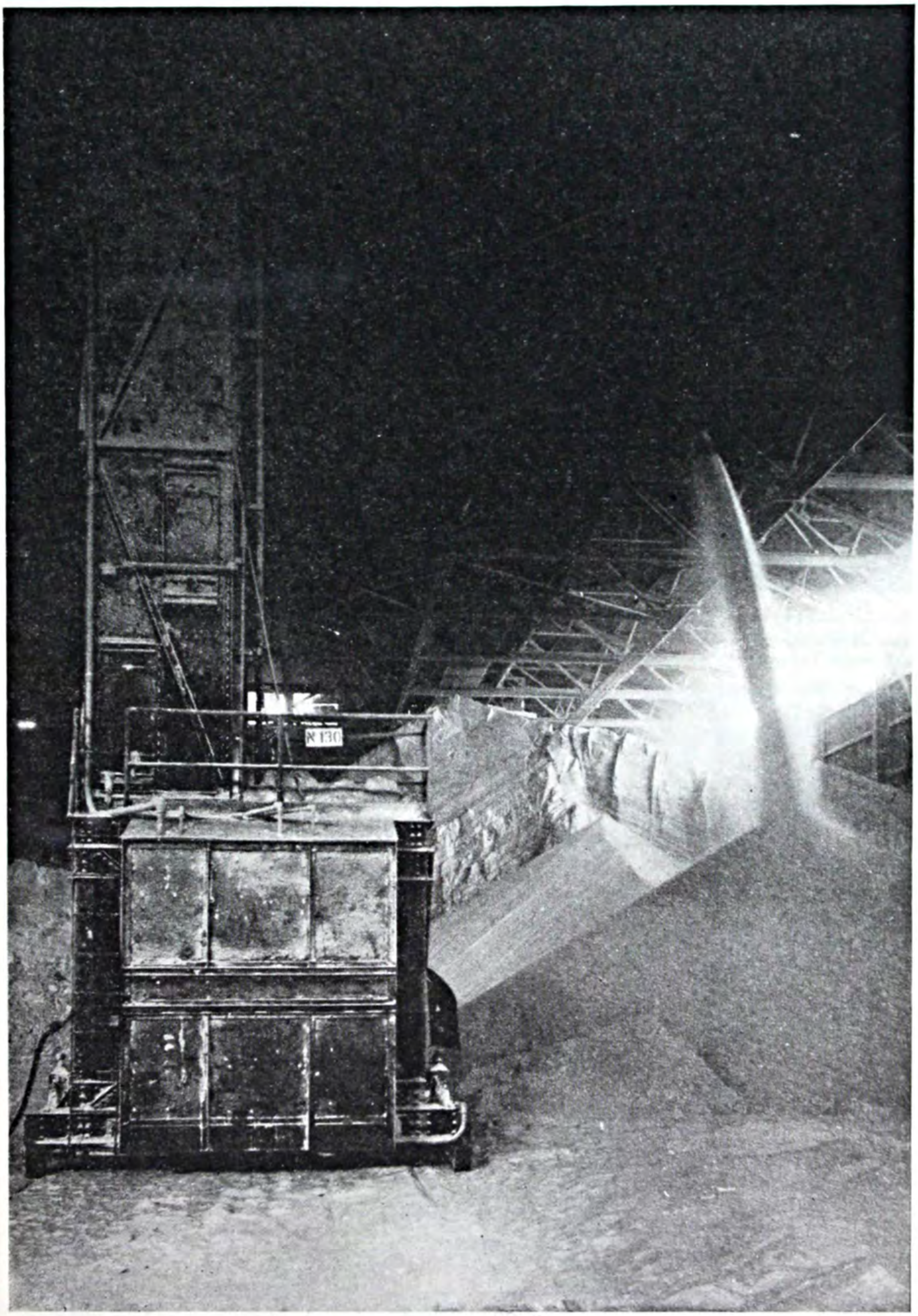
Ammoniating liquor	100 lbs.
Nitrate of soda	10 "
Superphosphate	833 "
Tobacco stems	100 "
Muriate of potash	327 "
Dolomite	100 "
Minor element material	5 "
Sand	525 "
Total	2,000 lbs.

It was shown by Mehring[2] that the average grade of superphosphate sold in the United States increased from 11% in 1880 to 18% in 1937, but that in some states almost all farmers were buying 20% superphosphate while in others 16% was almost always demanded. With present improved methods and quality of rock many manufacturers make run-of-pile superphosphate containing 20% or more available phosphoric oxide (P_2O_5) di-

(*Turn to page* 40)

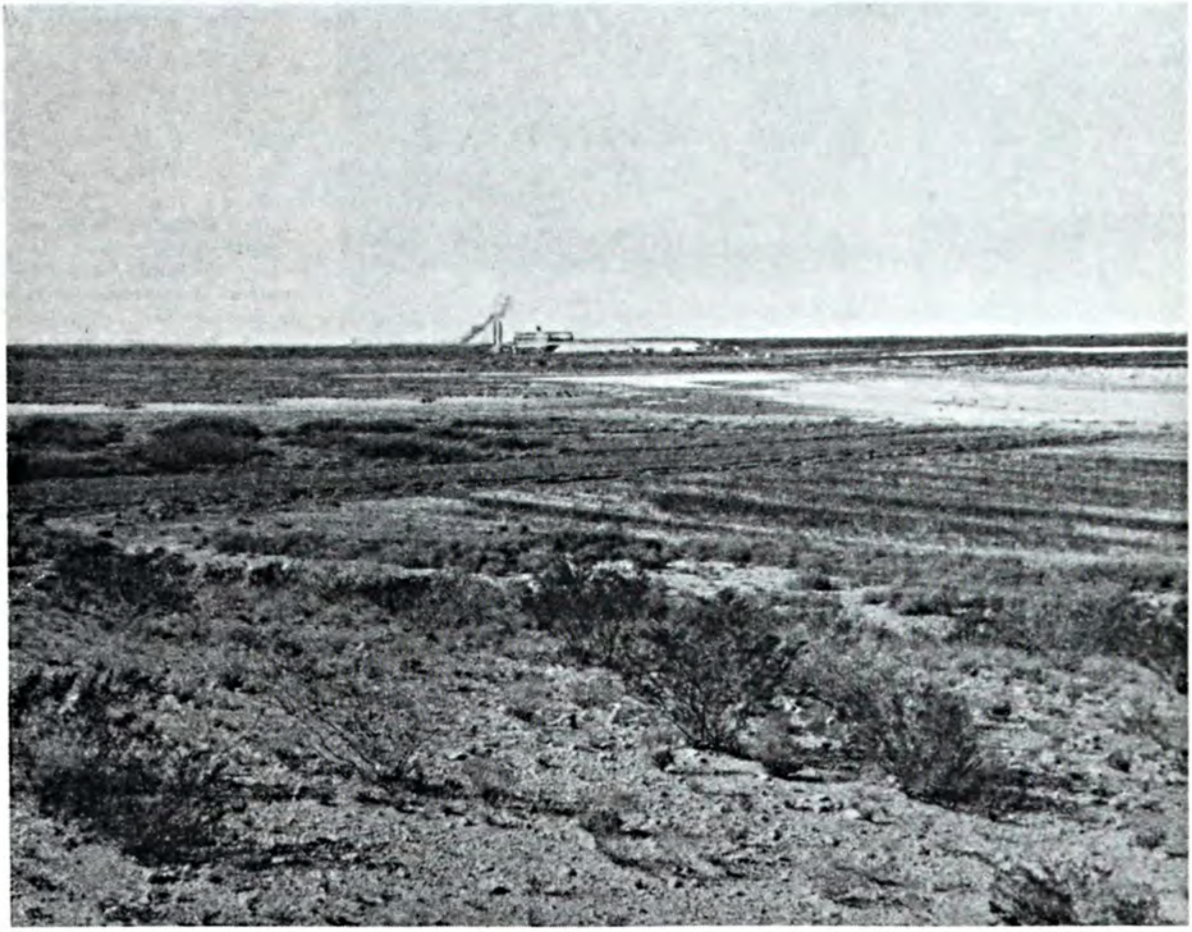
[2] Grades of Superphosphate Sold to Farmers in the U. S., A. L. Mehring, Fertilizer Review 14, No. 1, 3 and 12-13, 1939.

PICTORIAL

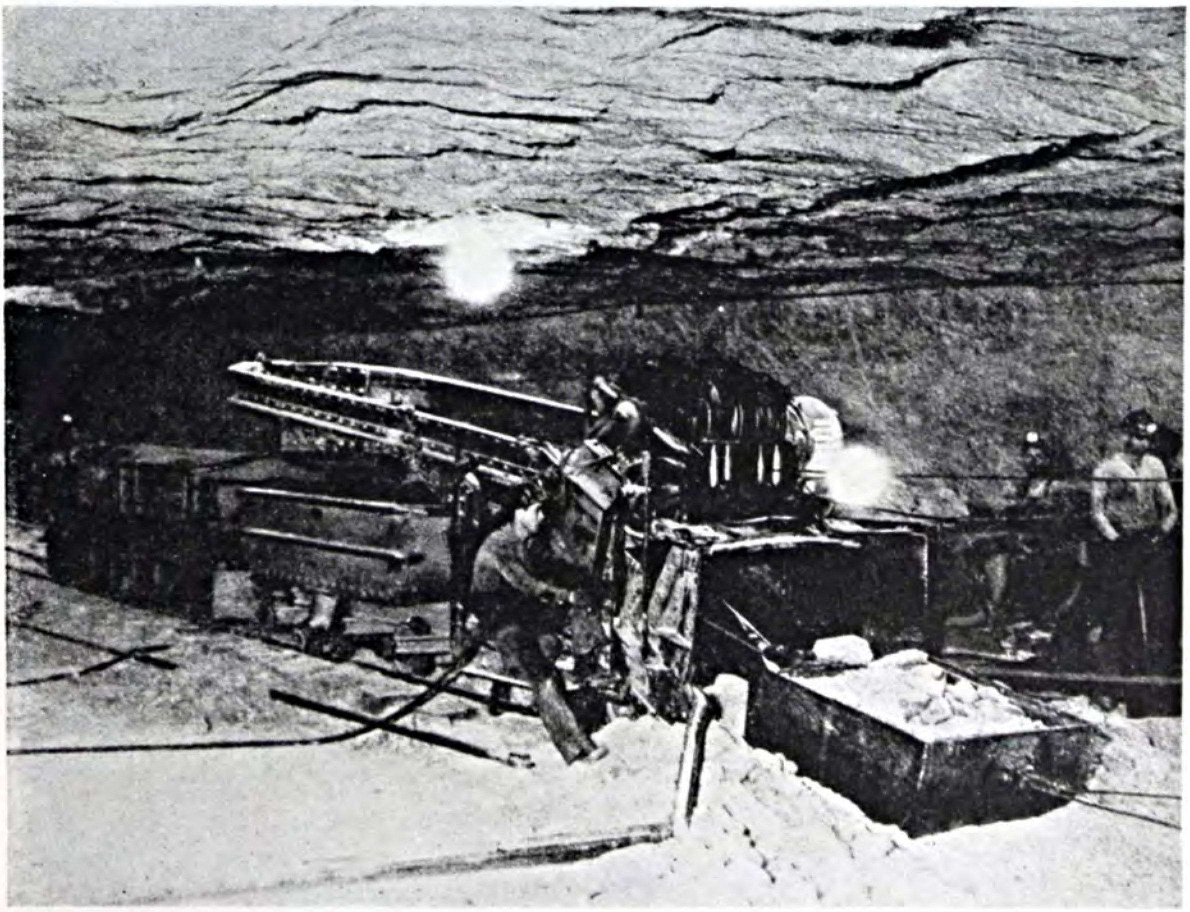


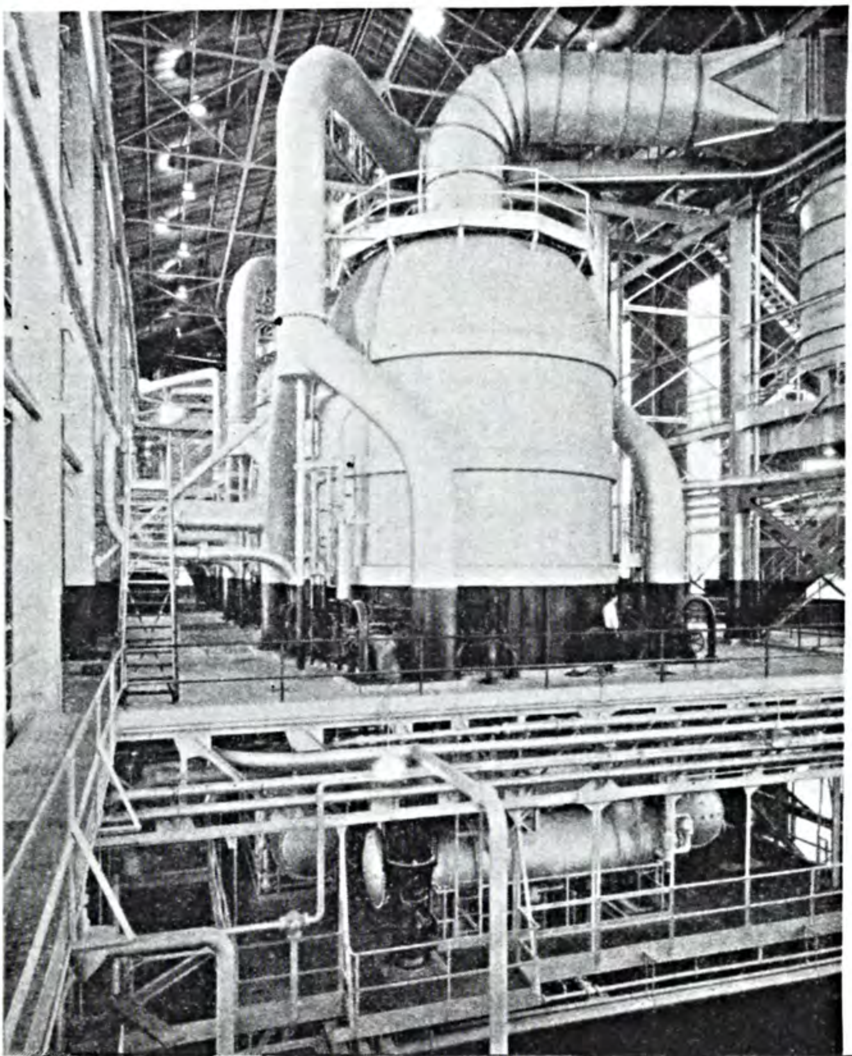
In this issue of Better Crops, the American Potash Institute is announcing for free distribution a new, educational motion picture on Potash Production in America. The scene above shows refined potash being stored at one of the producing plants.

One of the major producers extracts its potash from the brine of a partially dried up lake in California (above). The brine, under the heavy salt-crust surface of the lake (below), is pumped to the evaporators and refineries of this plant.



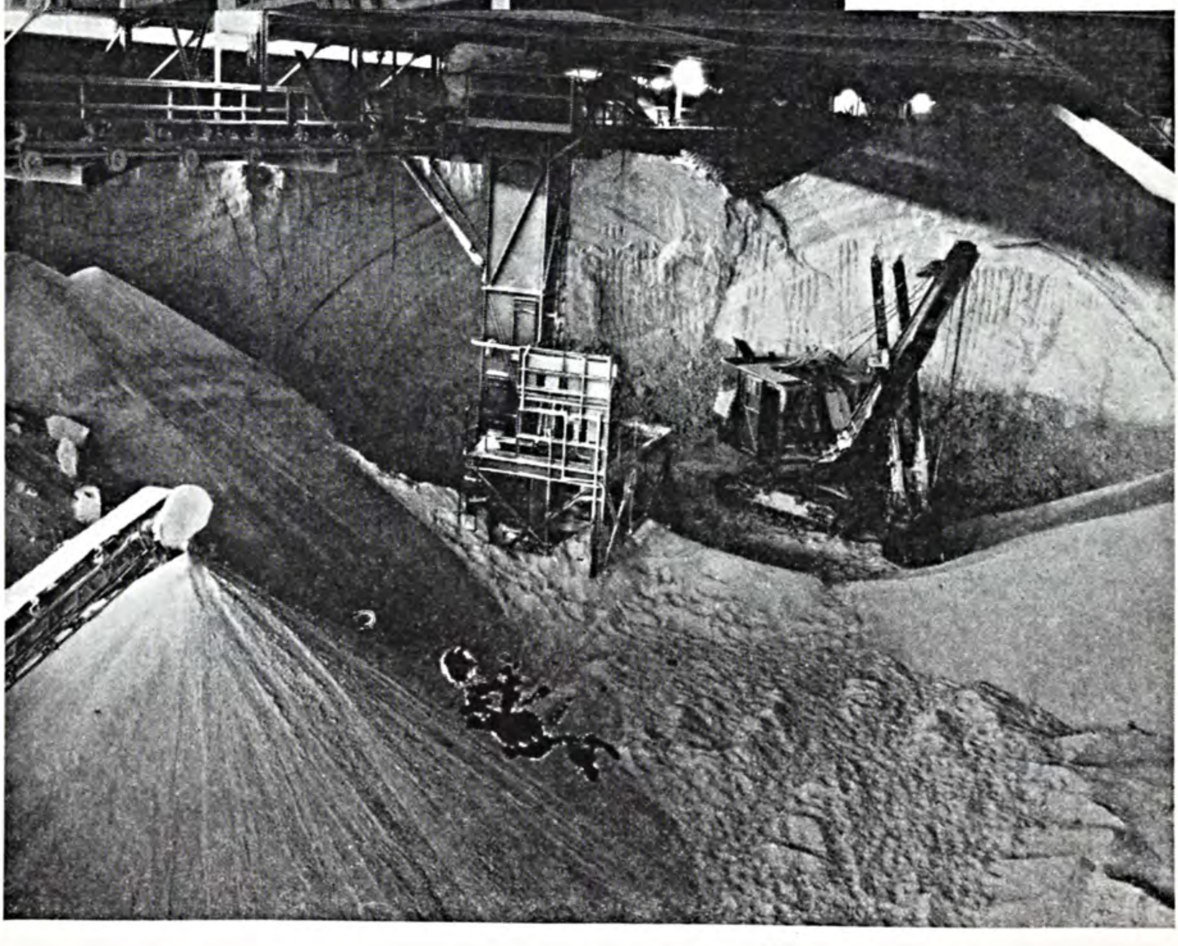
The plants of the other important potash producers are located on the desert (above) near Carlsbad, New Mexico. Here potash is mined from deposits about 1,000 feet underground with the most modern mining equipment (below).





Left: Refining processes employ the most efficient methods of purification to produce the concentration of potash salts required for the making of high-grade chemicals and fertilizers.

Below: To insure supplies during the peak demand periods, stockpiles of potash are accumulated during the "off" seasons. This highly developed industry is now meeting America's need for this essential element.



The Editors Talk

High Analysis Fertilizers and the Victory Program

In emergencies, corners are cut and the most direct route to effective action is taken. One such corner in the manufacture and use of fertilizers is the elimination of unnecessary filler, now receiving special emphasis by the Government's Fertilizer Industry Defense Committee.

Reasons for higher analysis fertilizers are easily seen: for the farmer, more plant food for his money, less labor in handling, and a saving in time of applying; for the manufacturer, a saving in bags, labor, and wear and tear on the machinery; for the Government, more freight car space for other uses and a more economic production of vital foodstuffs.

In this issue we are pleased to present to our readers an article by A. L. Mehring of the Division of Soil and Fertilizer Investigations, U. S. Department of Agriculture, on "Higher Analysis Fertilizers as Related to the Victory Program." Mr. Mehring points out the practical economies of eliminating filler, what may be expected in the manufacture of higher analysis fertilizers, and the publicity and cooperation necessary in bringing about their use by farmers loath to change long-established practices. With statistics he outlines the progress made and well defines the goal.

The movement, of course, is being supported by the fertilizer industry and the educational groups. In subsequent issues, we plan to present articles from these two viewpoints to tie in with that of a Government official as expressed by Mr. Mehring.

Potash Production in America

The story of the development of a potash industry in America capable of meeting the agricultural and chemical needs of this continent for potash has been told often in scientific circles. What potash is, what it looks like, and its use are well known by the agricultural advisory groups. Yet a surprising number of other people have no conception of this essential plant-food element or of its preparation for commercial use.

In response to innumerable requests for such information, the American Potash Institute has prepared a motion picture in color to show the location of potash deposits in this country and the mining and refining processes necessary to convert the potash in these deposits into products which can be used by the agricultural and chemical industries.

The film is entirely of an educational nature and has been designed for the use of county agents, vocational teachers, other advisory groups, and members of the fertilizer trade for showings before audiences interested in the subject. It is now available for free distribution and will be found listed among other films on the back cover of this issue where instructions for requesting its loan are given.

Looking Forward

We have been actively involved in the second great world war for a little over a month, and have been so concerned with increasing on short notice the production of those military items which a peaceful nation admittedly could not be expected to have on hand, that many of us have overlooked one of the greatest assets which the United States and her Allies possess—American Agriculture. As this war proceeds, it is becoming more apparent that the military value of a balanced and abundant agricultural production cannot be underestimated.

In spite of the fact that American farmers have just completed a record year, agricultural production to satisfy the needs of America and her Allies must be stepped up in 1942. The production goals which were announced in September of 1941 are being studied and revised upward in line with the latest information on these needs. But it should be emphasized that 1942 will be unlike the years immediately following the entrance of the United States into the first world war. Farmers are not being asked to increase their total output without due regard to a balanced production of the foods needed for greatest war effort.

Dietetic and medical research have made great strides in the past few years with respect to diseases and physical deficiencies due to an inadequate diet. Much of these data have been utilized and translated into the 1942 agricultural Food for Victory program. The result has been a request for increased production of such foods as pork products, eggs, dairy products, fruits, fats and oils, and canned vegetables. At the same time production of some crops such as wheat, cotton, and tobacco is being held static or actually reduced.

Agricultural prices have advanced actually and relatively since the beginning of 1941 and are now about 99% of parity and, according to the Bureau of Agricultural Economics, are expected to average about 25% above 1941 and about 5% above the present January level. However, according to Secretary of Agriculture Wickard, "There is little excuse for any substantial increase in the price of agricultural commodities at this time and we will do everything in our power to check speculative increases." In other words, there is little reason for a demand and supply situation in food products to contribute to the inflationary trend which is bound to accompany our participation in the war. The increases in agricultural prices which have occurred to date and which are expected in the future are only sufficient to insure the farmer his fair share of our total national income which in 1942 is expected to be about 10 billion dollars greater than 1941.

Incomes of industrial workers are expected to average 15% greater than in 1941. This is nearly double total industrial wages at the beginning of the war. It is, of course, recognized that there will be increased taxes and purchases of Defense Bonds tending to drain off a part of this expanded purchasing power, but the experts do not believe that these two factors will be of sufficient influence to reduce the demand for farm products. The actual money income available for the purchase of consumer goods may not be much, if any, greater than in 1941, but it should be remembered that the diversion of factory capacities to the production of military articles is reducing the quantities of civilian goods available for purchase and leaving the income which might have been expended on such goods available for the purchase of food products. Thus it is expected that the demand for agricultural products in 1942 will be greater than in 1941.

Increased Government purchases of farm products for shipment to our Allies and for other purposes and the substitution of domestic products for some of those which were formerly imported will also add to the total demand. With favorable weather the American farmer should be able to meet these increased demands and collect in 1942 an income about 2 billion dollars greater than that he received in 1941.

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 importance of the fertility conditions on not only the growth but the type of plant produced by soybeans has been strikingly shown by C. E. Ferguson and W. A. Albrecht in Missouri Agricultural Experiment Station Research Bulletin 330 entitled "Nitrogen Fixation and Soil Fertility Exhaustion by Soybeans Under Different Levels of Potassium." They grew the soybeans under carefully and cleverly controlled conditions with constant supplies of phosphorus, calcium, and magnesium but varying supplies of potassium, with barium added inversely proportionate to the potassium to balance this effect.

Some of the plants were inoculated. On these, when potassium was added in increasing amounts, growth of the plants increased, nodulation of the roots was greater, nitrogen fixation was increased, protein production was higher, and carbohydrate production was higher. When potassium was entirely omitted, there was practically no nitrogen fixed by the nodules. While increasing potassium increased the nitrogen fixed, it decreased the percentage content of nitrogen, indicating that the potassium influenced the carbohydrate production even more than it influenced protein production. The actual percentage of starch, however, was not increased regularly by potash although the total amount of starch produced was increased. The potassium did not affect the calcium percentage markedly although it increased the total amount of calcium taken in by the plant. In general the magnesium was reduced both proportionally and in total amount by increasing the potassium. Increasing the potassium usually increased the amount of phosphorus taken in but did not change the percentage content very much. A very noticeable effect of this potassium was to increase the efficiency of the foraging power of the plants for phosphorus since with increasing potassium the proportionate amount of total phosphorus utilized in the plant was markedly increased.

When the plants were not inoculated, they behaved much differently. Increasing the potassium increased the growth up to the second increment, but the last increment caused a decrease under the second increment. The potassium content was increased while the nitrogen content was decreased by adding the potassium. Since the plants had no access to any outside sources of nitrogen, the only source was that contained in the seed. It is interesting and important to note that the plants contained less total nitrogen than was contained in the original seed. Thus the seed actually lost some of its nitrogen to the soil. Increasing the potash increased the carbohydrate production very greatly in these uninoculated soybean plants, in marked contrast to the condition existing when the plant was inoculated. About the same relationship for calcium, phosphorus, and magnesium existed in the inoculated and uninoculated plants.

In order to study the effects of soil depletion on the behavior of the plant, second and third crops of soybeans were grown on the soil which had grown the inoculated plants. These succeeding crops likewise were inoculated but no additional nutrients were added. With the exception of the soil which had received the highest potash application there was a negative potash absorption by the plants grown after the initial crop, i. e., the plants did not contain as much potassium as did the original seed, indicating that the first crop had greatly depleted the potassium supply in the soil. There was practically no nitrogen fixation; in fact, in the case of the plants grown on the soil which did not receive any potassium at any time there was a negative fixation, i.e., the seed gave up some of its nitrogen to the soil. There was also a negative phosphorus absorption, showing that the seeds gave up phosphorus to the soil. In the case of calcium and magnesium, there never was any negative absorption.

When the third crop of soybeans was grown on the same soil there was again a negative absorption of potassium but oddly enough not always as much as in the case of the second crop since in effect the seed of the second crop fertilized the soil and the residual effects of this were observed in the third crop. The same general relationships, however, held in the case of both residual crops. The plants growing on these depleted soils did not fix much if any nitrogen and in some cases had a negative fixation. Protein production was therefore correspondingly reduced. Carbohydrate production was not reduced to anywhere near the same extent as protein formation with the result that the plants were very high in carbohydrate in proportion to their protein, thus approaching the same condition as in the case of the uninoculated plants. The authors stressed the importance of this, bringing out that uninoculated plants or plants growing on soils low in fertility actually behave like non-leguminous plants rather than leguminous plants, and they therefore do not possess the highly desirable feeding properties associated with well-grown leguminous plants.

The plants under all conditions appeared to have an efficient foraging capacity for magnesium and even when the soil was very low in magnesium, seemed to be able to get all they required. This condition in all probability would not go on indefinitely.

These interesting investigations are of great significance in view of the fact that soybeans are frequently recommended as a leguminous crop to be grown on soils of low fertility. This work shows that while the soybeans might grow fairly well on such soil, the quality of the crop is seriously impaired and the plants produced may actually possess few of the desirable characteristics associated with legumes. The growing of soybeans on depleted soils therefore must be recognized as a makeshift arrangement and steps should be taken to build up the fertility of the soil rather than indefinitely try to grow legumes on the depleted soil.

¶ There probably is no crop on which there is a greater diversity of opinion as to proper fertilization than peanuts. Judged by ordinary standards, the crop may react very peculiarly and quite inconsistently to various treatments. With large acreages of this crop already grown throughout the South and even greater acreages called for in connection with the war program, any work that helps clarify the problem of the fertilization of peanuts is an important contribution. North Carolina Experiment Station Bulletin 330, "Soil Fertility Studies With Peanuts," by E. R. Collins and H. D. Morris, certainly falls in this category.

Much needed complete data on the chemical composition of the plant when growing under present-day farming conditions show the large amounts of foods that are contained in this crop. As it is usually handled, nearly everything that is produced is taken off the land. While the nitrogen contained in the plant comes largely from the air, due to the fact that peanuts are a legume, the phosphoric acid, potash, calcium, and magnesium contained in the crop are a net loss to the soil except as replaced by lime and fertilizer treatments. The authors show that a good crop will remove the equivalent of 175 pounds of an 0-8-12 fertilizer in the nuts alone and 300 pounds of an 0-8-34 in the nuts and hay together. On the basis of experiments and numerous field tests with different lime and fertilizer treatments the authors recommend several forms of treatment. One involves the use of 400 pounds dolomitic limestone in the row with a side-dressing of 50 to 100 pounds muriate of potash as the peanuts come through the ground; or a potash-lime mixture applied in the row at planting time or as a side-dressing when the peanuts come through the ground. The former treatment is preferable.

Many growers feel that gypsum is very beneficial and the authors found this to be substantiated in many, but by no means all, cases. They recommend that gypsum be used only on acid soils or on light, sandy soils, or where it is known to give a response. They point out that gypsum alone has been uneconomical in about 44 per cent of the tests made. This would indicate that usually gypsum should be used along with other treatments. Mixed fertilizer also can be used. Analyses such as 0-8-8, 0-8-16, or 3-12-6 are adapted to soils deficient in phosphate, with or without additional applications of limestone or gypsum as needed.

¶ The rapid increase in alfalfa acreage in recent years has been accompanied by new problems in obtaining and maintaining good stands and yields. One of these problems is the yellowing of alfalfa leaves called "alfalfa yellows." This has been observed in many parts of the country. Widespread trouble of this nature in western Washington led to an extensive investigation of the problem by the Experiment Station, the results of which have been published as Bulletin 396, "Boron Deficiency of Alfalfa in Western Washington," by K. Baur, G. A. Huber, and L. C. Wheeting.

Alfalfa yellows is not an entirely new disease and for many years it was ascribed almost entirely to damage caused by leafhoppers. More recent investigations have indicated that two or three factors may cause alfalfa yellows, in many places the most important being deficiency of boron. Alfalfa yellows due to boron deficiency usually is accompanied with a shortening between the branches, particularly at the growing tip of the plant, while with leafhopper injury this characteristic stunting of growth will not be an accompanying result. Numerous field and greenhouse experiments by the authors have shown that applications of boron in the form of ordinary borax or boric acid will correct the yellows due to boron deficiency. The rate of application will be dependent on the extent of the deficiency and the kind of soil, but usually where the trouble shows up at all seriously 30 to 40 pounds on light soils and 50 to 60 pounds of borax per acre on the heavy soils will be needed. Growers are warned against using more than the maximum amounts recommended. The cost of the material is very low and returns may be very high, with increased yields sometimes double and more over areas not treated with borax.

The authors also briefly describe a method they have used with considerable success in determining in the greenhouse whether the soil is deficient in boron. They developed a technique of growing sunflowers in soils in the greenhouse and recording the time required for boron deficiency to be observed on the plants. The length of time before boron-deficiency symptoms developed on the sunflowers was then correlated with field response to boron, and in this way a rather accurate estimate of the available boron supply in the soil could be obtained. The correlation has not yet been fully worked out, but it has been observed that when boron deficiency does not develop in the sunflower, or develops only in the late period of growth, there is little likelihood that plants in the field growing on the same soil will respond to boron applications. The authors have included a good color plate showing boron deficiency on alfalfa, and they also briefly describe the conditions under which boron deficiency is more likely to develop.

¶ Since Rhode Island soils usually are deficient in potash, the Experiment Station there has devoted considerable attention to the problem of potash fertilization. Some of these experiments have been going on for 30 years and are probably the oldest in the country devoted exclusively to this nutrient. Recent data not previously published have been compiled, summarized, and interpreted in Rhode Island Agricultural Experiment Station Bulletin 280, "Field Experiments with Potash Fertilizers," by T. E. Odland and T. R. Cox. The experiment is laid out in a way to compare various forms of potash fertilizers, three different rates of application, all with uniform nitrogen and phosphorus application, and also high potash applications with low nitrogen or low phosphorus applications. Representative vegetable and field crops were grown.

Only a few of the outstanding items out of the many data in this bulletin can be mentioned here. The response to potash was by no means the same in going from a very low to a medium application as it was in going from a medium level to a high level of potash fertilization. Parsnips responded the most in going from a very low to a medium level of fertilization, followed in order by corn, cabbage, onions, mangels, potatoes, tomatoes, hay, carrots, and oats. In going from a medium level to a high level of potash fertilization the order of response was as follows: mangels, cabbage, tomatoes, parsnips, potatoes, hay, onions, carrots, oats, and corn.

The relative position of corn in the two lists is particularly noteworthy. It was one of the most responsive crops in going from a low to a medium fertilization but the least responsive going from medium to a high level. This would indicate that corn while having a great need for potash does not respond to more than medium applications, while crops like parsnips, tomatoes, cabbage, and mangels respond to high potash applications. The position of hay is somewhat misleading since the figures represent an average of several years with a grass and legume mixture and several years with a grass mixture. The grass-legume mixture responded much more to potash application than the straight grass mixture; in fact, in the grass-legume mixture the amount of legumes present was largely proportionate to the amount of potash applied.

Crops from three levels of potash fertilization were analyzed for their potash content and it was observed that the potash content increased as the application increased, although not by any means always in the same proportion. In going from the low to the high potash application the potash content in cabbage, for example, increased more than fivefold, while in the case of squash it increased less than twofold. It was observed that the yield did not always increase in proportion to the increase in potash content, indicating that in some cases at least the plant was able to obtain more potash than it could utilize due to other factors limiting the growth. In the case of potatoes, tests were made on the cooking quality of the tubers from the variously fertilized plots and it was found that those from the high potash plots were consistently more mealy than those from the low potash plots.

The potash materials compared were muriate of potash, sulphate of potash, kainit, and sulphate of potash magnesia. Considering the results as a whole, no one carrier appeared to be markedly superior to the other carriers. For this reason the authors suggest that the cost per unit of potash should be the governing factor in deciding which form should be used on the crops in question.

"Fertilizers Used in Alabama, Season of 1941," St. Dept. of Agr. and Inds., Montgomery, Ala.

"Men—Land—Phosphate," Agr. Ext. Serv., Auburn, Ala., Cir. 220, Jan. 1941, Charles S. Davis.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended September 30, 1941," St. Dept. of Agr., Sacramento, Calif., Anns. FM-34, Nov. 21, 1941.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Lafayette, Ind., Cir. 265, May 1941.

"Report of Analysis of Commercial Fertilizers," St. Dept. of Agr. and Imm., Baton Rouge, La., Fert. Rpt., Season 1940-1941.

"Nitrogen Fixation and Soil Fertility Exhaustion by Soybeans Under Different Levels of Potassium," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 330, May 1941, Carl E. Ferguson and Wm. A. Albrecht.

"Fertilizer Investigations in Montana in 1940," Agr. Exp. Sta., Bozeman, Mont., Bul. 395, Aug. 1941, A. H. Post.

"Fertilizers and Field Crops. I, II, and III," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 748, Bul. 749, and Bul. 750, Mar. 1941, E. L. Worthen.

"Report of Analyses of Commercial Fertilizers Sold in New York State, July 1, 1939, to June 30, 1940," Dept. of Agr. and Mkts., Albany, N. Y., Bul. 332, Part I, Jan. 1941.

"Report of Analyses of Samples of Lime Materials Used for Agricultural Purposes Sold in New York State, July 1, 1931, to June 30, 1940," Dept. of Agr. and Mkts., Albany, N. Y., Bul. 332, Part II, Mar. 1941.

"Inspection and Analysis of Commercial Fertilizers," Agr. Exp. Sta., Clemson, S. C., Bul. 336, Nov. 1941, B. D. Cloaninger.

"Commercial Fertilizers in 1940-41," Agr. Exp. Sta., College Station, Tex., Bul. 607, Sept. 1941, G. S. Fraps, T. L. Ogier, and S. E. Asbury.

"Rules and Regulations Pertaining to the Sale of Commercial Fertilizer," St. Dept. of Agr., Charleston, W. Va., Bul. (n.s.) 22, July 1, 1941.

Soils

¶ Because of the proximity to New York City the agriculture on Long Island is usually rather intensive, being devoted largely to potatoes and other vegetable crops. However, a certain proportion of the Island is devoted to forage crops, including pastures, either to furnish feed for livestock on the Island or to provide cover on land not planted to vegetables. General recommendations for the growing and fertilization of these crops other than vegetables are given in Cornell University Agricultural Experiment Station Bulletin 755, "Soil and Pasture Management for Long Island, New York," by A. F. Gustafson and D. B. Johnstone-Wallace.

Brief descriptions of the principal soil types and complete chemical analyses of them are given. These indicate that most of the soils are of only moderate to low natural fertility. Lime is needed on many of the soils if the acidity is to be kept within the range favorable for growing legume crops. Phosphorus is usually needed on all soils, and potash fertilizers also for most crops on all but the heaviest and most fertile soils.

For alfalfa, potash and phosphate are recommended, 600 to 800 pounds per acre of superphosphate at planting time, with 400 pounds per acre as a top-dresser on alternate years on heavy soils and 300 pounds every year on sandy soil after the stand is 3 years old; 200 pounds muriate of potash at seeding time except on the very heavy soils, with a top-dressing of 100 pounds of muriate every two years on heavy soils and every year on light soils after the second year of cutting. If heavy applications of manure or fertilizer have been made to the soil immediately preceding alfalfa, no fertilizer is needed at planting time, but top-dressings should be made. Boron and other trace elements may be needed for alfalfa and other legumes, particularly if no manure is used. Nitrogen should not be applied except on light soils to start the crop.

For corn 200 to 300 pounds per acre of fertilizer in a 1-2-1 ratio are recommended except where it follows a heavy manure or a good legume sod turned under, in which case only superphosphate is recommended.

For pastures 600 to 800 pounds of superphosphate every 3 or 4 years on all soils and 100 pounds of muriate of potash on all light soils and on some of the heavy soils are recommended. Fall application every 3 or 4 years is suggested for all fertilizer treatments except nitrogen, whereas 100 to 200 pounds per acre of a quickly acting nitrogen fertilizer should be applied each spring. It is recommended, however, that the nitrogen application be confined to small intensive pastures with the main pastures obtaining their nitrogen by favoring legumes in the pasture sod, through proper fertilization with phosphate, and potash, and the application of lime to correct soil acidity.

Other information on the fertilization of forage crops, grass mixtures for hay and different types of pastures, and the prevention of soil blowing are given in this useful bulletin.

"Simple Practices in Conservation," Agr. Ext. Serv., Amherst, Mass., Sp. Cir. 73, Sept. 1940, A. B. Beaumont.

"Some Causes of Infertility in Montana Soils," Agr. Exp. Sta., Bozeman, Mont., Cir. 164, Nov. 1941, Edmund Burke and H. E. Morris.

"Effect of Soil Moisture and Fertilizer Placement on Vitality of the Potato Seed Piece," Agr. Exp. Sta., Durham, N. H., Cir. 59, Apr. 1941, Stuart Dunn.

"Soils in Relation to Fruit-growing in New York. Part XV. Seasonal and Soil Influences on Oxygen and Carbon-dioxide Levels of New York Orchard Soils," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 763, June 1941, Damon Boynton.

"Contour Strip Cropping Saves Both Soil and Water," U.S.D.A., Washington, D. C., Cons. Folder 1.

"Protected Waterways in Cultivated Fields," U.S.D.A., Washington, D. C., Cons. Folder 2.

"Wildlife and Soil Conservation Go Hand in Hand," U.S.D.A., Washington, D. C., Cons. Folder 3.

"Range Improvement by Proper Stocking," U.S.D.A., Washington, D. C., Cons. Folder 4.

"Strip Cropping for Control of Wind Erosion," U.S.D.A., Washington, D. C., Cons. Folder 5.

"Save Soil, Moisture With Contour Tillage," U.S.D.A., Washington, D. C., Cons. Folder 6.

"1942 Agricultural Conservation Program Bulletin," U.S.D.A., Washington, D. C., ACP-1942, Oct. 31, 1941.

"Soil Survey, Greenbrier County, West Virginia," U.S.D.A., Washington, D. C., Series 1937, No. 3, Sept. 1941, A. J. Vessel, M. E. Swann, and H. M. Fridley.

"The Cotton-and-Tobacco South," U.S.D.A., Washington, D. C., Misc. Pub. 474, Oct. 1941.

Crops

¶ Those interested in growing the intriguing group of plants called "gourds" for useful or ornamental purposes will welcome Minnesota Agricultural Experiment Station Bulletin 356, "Gourds—Uses, Culture, Identification," by A. E. Hutchins and L. Sando. The publication covers very well the subjects indicated in the title.

¶ The importance of pastures as a forage-producing part of the farm has long been stressed, and with the emphasis being placed on dairy and beef production by the defense program even greater utilization of pastures has to be made. Two excellent bulletins on this subject have recently been issued by the Virginia Experiment Station. Bulletin 330, "Lime and Fertilizers Improve Pastures," by W. R. Perkins, A. L. Grizzard, and T. B. Hutcheson summarizes a series of experiments and tests carried out in southwest Virginia. Lime and different combinations of nitrogen, phosphoric acid, and potash were applied over a period of years. Yields of herbage and botanical composition of the sod were recorded. It was found that lime and a complete fertilizer were most effective in building up a pasture. After the initial building up stage was completed, which usually resulted in the establishment of legumes in the pasture, then nitrogen could be omitted from the fertilizer, and only lime, phosphate, and potash used. On the soil studied, phosphate was usually the first limiting factor; and until legumes were introduced, nitrogen was usually the second limiting factor. Potash would give substantial increases in yield and improvement in the botanical composition of the pasture when applied in addition to the lime, nitrogen, and phosphate. As was to be expected, potash increased the proportion of legumes in the pastures in most cases.

In Bulletin 333, "Experiments and Observations on Pasture Management in Appomattox County," by T. B. Hutcheson, there is a broader discussion of other factors, along with fertilizers, that are important in building up and maintaining pastures. Various seed mixtures of grasses and legumes were tried, different types of renovation measures were compared, and the effects of treatments on the gain in weight of cattle pasturing were recorded. The author brings out that in some cases the proper renovation of a pasture will cost more than the original value of the land but after building up the pasture its return will amply repay the investment. On the soils in this county also lime and phosphate were the first limiting elements, and in the early stages of renovation nitrogen was a limiting factor, but best results were obtained only when potash was used in addition to these.

After the first stages of renovation were completed the most economical treatments appeared to be lime, phosphate, and potash, since these nutrients favored the establishment of legumes, which could supply nitrogen, in the pasture.

Both of these bulletins contain a lot of sound practical information and advice on the profitable and efficient management of pastures, applicable not only to Virginia but other states with similar climatic conditions.

"Report of the Minister of Agriculture for the Dominion of Canada for the Year Ended March 31, 1941," Dom. Dept. of Agr., Ottawa, Ont., Canada.

"Report of the Minister of Agriculture, Province of Ontario, for the Year Ending March 31, 1941," Ont. Dept. of Agr., Toronto, Ont., Canada.

"Fifty-third Annual Report for the Year 1940-41," Agr. Exp. Sta., Experiment, Ga.

"Better Methods of Pimiento Production," Agr. Exp. Sta., Experiment, Ga., Bul. 218, Oct. 1941, H. L. Cochran.

"Suggestions for Establishing Improved Pastures in the Coastal Plain of Georgia," Agr. Exp. Sta., Tifton, Ga., Mimeog. Paper 1, June 10, 1941.

"Suggestions for the Commercial Production of Tomato Plants in South Georgia for Sale in the Eastern and Mid-western Canning Areas," Agr. Exp. Sta., Tifton, Ga., Mimeog. Paper 3, Aug. 15, 1941.

"Suggestions for Commercial Onion Production," Agr. Exp. Sta., Tifton, Ga., Mimeog. Paper 4, Sept. 15, 1941.

"Permanent Pastures—the Establishment of Bahia Grass from Seed," Agr. Exp. Sta., Tifton, Ga., Mimeog. Paper 6, Oct. 1, 1941.

"Results of Bindweed Control Experiments at the Fort Hays Branch Station, Hays, Kansas, 1935 to 1940," Agr. Exp. Sta., Manhattan, Kans., Bul. 296, June 1941, F. L. Timmons.

"Tame Pastures in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 206, June 1941, Kling L. Anderson.

"Re-establishing Native Grasses by the Hay Method," Agr. Exp. Sta., Manhattan, Kans., Cir. 208, Oct. 1941, Leon E. Wenger.

"Report of Progress for Year Ending June 30, 1940," Agr. Exp. Sta., Orono, Maine, Bul. 400, June 1940.

"Annual Report for the Fiscal Year Ending November 30, 1940," Agr. Exp. Sta., Amherst, Mass., Bul. 378, Feb. 1941.

"Agricultural Research in New Hampshire—Annual Report for 1940," Agr. Exp. Sta., Durham, N. H., Bul. 330, May 1941.

"High Quality Roughage Arms Dairymen for National Defense," Agr. Exp. Sta., New Brunswick, N. J.

"Farm Defense Program and the New Jersey Vegetable Grower," Agr. Exp. Sta., New Brunswick, N. J.

"Woody Plants for Shady Places," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 465, June 1941, R. W. Curtis and J. F. Cornman.

"Lily Forcing," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 467, Aug. 1941, Kenneth Post.

"Sixteenth Annual Report for the Fiscal Year Ended June 30, 1941, with Meteorological Records for 1883 to 1940, Inclusive," Agr. Exp. Sta., Geneva, N. Y., P. J. Parrott.

"Grass," Agr. Exp. Sta., Fargo, N. Dak., Bul. 300, June 1941.

"Fifty-fourth Annual Report, 1940-1941," Agr. Exp. Sta., Burlington, Vt., Bul. 475, Aug. 1941, J. L. Hills.

"Grass Waterways Control and Prevent Gullies," Agr. Ext. Serv., Madison, Wis., Cir. 320, Aug. 1941, O. R. Zeasman.

"Climate and Man," U.S.D.A., Washington, D. C., 1941 Yearbook of Agr.

"New Hampshire Farm Handbook, 1941," U.S.D.A., Washington, D. C.

"Rice Varieties and Their Comparative Yields in the United States," U.S.D.A., Washington, D. C., Cir. 612, Sept. 1941.

"Avocado Production in the United States," U.S.D.A., Washington, D. C., Cir. 620, Sept. 1941, H. P. Traub, C. S. Pomeroy, T. R. Robinson, and W. W. Aldrich.

"The Work of The United States Cotton Ginning Laboratory," U.S.D.A., Washington, D. C., Misc. Pub. 445.

"Cotton from Boll to Bale," U.S.D.A., Washington, D. C., Leaf. 211, Oct. 1941, F. L. Gerdes, W. J. Martin, and C. A. Bennett.

"Medicinal Plants—Analysis and Summary of Information on the Crop Possibilities of Medicinal Plants of Essential Significance," U.S.D.A., Washington, D. C., June 1941, D. M. Crooks and A. F. Sievers.

"Condiment Plants—Analysis and Summary of Information on the Crop Possibilities of Condiment Plants that May Be Grown in the United States," U.S.D.A., Washington, D. C., July 1941, D. M. Crooks and A. F. Sievers.

"Descriptions of Types of Principal American Varieties of Onions," U.S.D.A., Washington, D. C., Misc. Pub. 435, Sept. 1941.

Economics

¶ In these times of rising taxes and governmental costs, studies relating to taxation are particularly interesting. Section 6 of Part 2, "Income Parity for Agriculture" deals with the subject of farm property taxes. The report was prepared by Donald Jackson and Gerhard J. Isaac of the Bureau of Agricultural Economics. The report was also prepared and issued as a regular research report of the Bureau of Agricultural Economics.

When it passed the Soil Conservation and Domestic Allotment Act in February 1936, Congress presented the problem of estimating income parity for farmers for it was definitely stated in that Act that it was the intent and purpose to reestablish the ratio between the purchasing power of the net income per person on farms and the income per person not on farms that prevailed during the 5-year period, August 1909 to July 1914 inclusive, as determined from statistics available in the U. S. Department of Agriculture. In 1938 the Agricultural Adjustment Act changed the definition of parity to read as follows:

"Parity, as applied to income, shall be that per capita net income of individuals on farms from farming operations that bears the per capita net income of individuals not on farms the same relation as prevailed during the period from August 1909 to July 1914."

In the latter definition, the purchasing power requirement was omitted and income was limited to income received from farm operations. The project of developing income parity estimates was begun in 1936 as a cooperative enterprise of the AAA with the Bureau of Home Economics and the Bureau of Agricultural Economics participating. The results of the study are being made available in a series of preliminary reports under the general heading "Income Parity for Agriculture."

Farm taxes enter into parity determinations under two different categories. First, as they relate to the price index and second as they relate to the income parity relationship. The report deals with both points of view.

The taxes paid per acre of land in the United States have increased considerably since 1910 and are now about 190% of the base period. The actual amount per acre paid was estimated to be 13¢ in 1890, 19¢ in 1910, 51¢ in 1920, and 39¢ in 1939. The change in amount per $100 valuation has been from 47¢ in 1910 to 79¢ in 1920, $1.30 in 1930, and $1.16 in 1939. The average total farm property taxes paid 1909-1913 amounted to $212,752,000 as contrasted to $547,020,000 in 1920, $637,611,000 in 1930, and to $460,450,000 in 1939. In 1939 the total farm tax bill was less than in 1930 or 1920 but was more than twice the annual average between 1909 and 1913. The trend was upward to about 1929 when the peak of $641,119,000 was reached. From that time the total farm tax bill has declined to a low point of $420,086,000 in 1934 and to its present level of $460,450,000.

The increase in farm taxes per acre between 1900 and 1920 was 7% per year. It was 2% per year from 1920 to 1929 in spite of the fact that there was not a corresponding slackening in the growth of Government service nor decrease in the per unit prices and wages paid by Government offices. It is believed that the abruptness in the change of the rate of tax increase is accounted for by the increasing importance of three other major sources of revenue, other state and local taxes, federal grants, and borrowing. The report deals in detail with the method of computing the farm tax series, adequacy of the sample, reasons for selection of base period, weights, and relation between Government services and income.

"Economic Considerations in Planning for Soil Conservation on Tobacco-combination Farms," Agr. Exp. Sta., Storrs, Conn., Mar. 1941, James W. Bottomley.

"Illinois Crop and Livestock Statistics. Annual Summary, Crops 1940 and Livestock 1941," St. Dept. of Agr., Springfield, Ill., Cir. 442.

"An Examination of the Accuracy of Lattice and Lattice Square Experiments on Corn," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 289, Aug. 1941, W. G. Cochran.

"Planning the Farm Business in the Bluestem Belt of Kansas," Agr. Exp. Sta., Manhattan, Kans., Bul. 294, Mar. 1941, Raymond J. Doll.

"Market Quality of Kansas Potatoes as Determined by Federal Inspection," Agr. Exp.

Sta., Manhattan, Kans., Bul. 298, Nov. 1941, Franklin L. Parsons.

"Farm Organization and Costs and Returns in Producing Potatoes on Farms in the St. John River Area of Aroostook County, Maine, 1937," Agr. Exp. Sta., Orono, Maine, Bul. 406, July 1941, William E. Schrumpf.

"Trends in Market Prices for Montana Farm and Ranch Products," Agr. Exp. Sta., Bozeman, Mont., Bul. 394, Aug. 1941, Harold G. Halcrow and Jay G. Diamond.

"Costs and Returns for the Cabbage Enterprise, 1938 and 1939," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 759, June 1941, R. W. Hoecker.

"Prices of Apple Varieties as a Factor in Variety Selection," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 761, June 1941, M. D. Woodin.

"Some Successful Systems of Renting Land in Tennessee," Agr. Ext. Serv., Knoxville, Tenn., Ext. Pub. 254, Oct. 1941, H. C. Holmes.

"A Study of Farm Organization by Type of Farm in Sanpete and Sevier Counties," Agr. Exp. Sta., Logan, Utah, Bul. 300, Nov. 1941, W. P. Thomas, G. T. Blanch, and Edith Hayball.

"Report of the President of the Commodity Credit Corporation, 1941," U.S.D.A., Washington, D. C.

"Marketing Peanuts and Peanut Products," U.S.D.A., Washington, D. C., Misc. Pub. 416, Sept. 1941, Harold J. Clay.

"Income Parity for Agriculture. Part II—Expenses of Agricultural Production; Section 6—Farm Property Taxes," U.S.D.A., Washington, D. C., Nov. 1941, Donald Jackson and Gerhard J. Isaac.

Charles Brucker Is New Onion King

(*From page* 19)

out a few potatoes and onions. Those first years he thought 300 bushels of onions per acre was a pretty good yield. A representative of a fertilizer company worked with him, putting out all kinds of experimental plots. Yields increased until by 1939 he raised 1,280 bushels per acre, setting a new State record for Southport Yellow Globes.

Most years Mr. Brucker usually plants about eight acres in onions, but due to labor shortage, little itinerant labor being used in his vicinity, and to one of his sons going to camp, he planted only 1½ acres this year. He had out about 30 acres of potatoes, cabbage, and carrots, and sold his vegetables right at the farm. On the rest of his 250 acres he grew feed for his dairy herd and beef cattle.

The onion field was plowed April 2 and 3, nine inches deep, an eight-inch green rye crop being plowed under. The field was then double disked four times, floated and planked before planting. An 0-8-24 fertilizer at the rate of 1,200 pounds per acre was drilled in with a wheat drill just before the ground was floated, or leveled. Sweet Spanish seed, four pounds per acre, was planted April 17, three-fourths of an inch deep, in rows 12 inches apart. The onions were hand weeded twice and gone over with a mulcher.

In 1940 potatoes were grown in this field. They were fertilized with 1,000 pounds of 0-8-24, and produced a yield of about 400 bushels per acre.

The onions were pulled and put in windrows August 19 and 20, and topped August 26 to 30. Weeding, pulling, and topping were all done by neighbor boys.

Mr. Brucker spoke of a demonstration he saw on Bill Gehring's farm a few years ago where potatoes were dug with a one-row potato digger, and a small hand-turned grader was demonstrated. Now the commercial growers use two-row diggers and large power graders. Most growers also mechanically wash or brush their potatoes.

"And I remember telling my wife after seeing 400 bushels of potatoes dug from one acre at Whit Gast's that if they increased production on this ground much more, the stuff couldn't stay in the ground. There wouldn't be room for all of it. Now nothing would surprise me. This dirt is the finest in the world and I, for one, shall keep trying to increase production per acre and improve quality. The Northern Indiana Muck Area is truly the garden spot of the world."

Growing Ladino Clover in the Northeast

(*From page* 18)

tervals may be necessary at this season of the year to make the most economical use of the herbage. The use of portable electric fences for dividing the Ladino pasture has been found to be an essential part of the management program. This or some other system of dividing the field will be found to be necessary in order to prevent excessive grazing and to insure maximum utilization of the feed produced.

Young Ladino clover is laxative and animals may lose flesh when grazing on it unless they are gradually accustomed to it. To guard against this, as well as against a bloat which may result if animals stuff themselves on clover, they should be pretty well filled up on hay before being turned out and for the first few weeks of grazing allowed to graze only about 15 minutes at any one time. The time of grazing may be lengthened gradually and alternated wherever possible between Ladino and permanent grass pasture. Such a grazing program insures a high level of milk production, reduces the need for concentrates, and keeps the cost of production of milk at a minimum No dairy farmer in the Northeast can afford to ignore the possibilities of Ladino clover.

Kudzu—A Mender of Tattered Lands

(*From page* 13)

with the soil. Two seedlings go into each hill after rains have fallen sufficiently to settle the soil.

Bailey's plan calls for spacing of plants in rows to give 500 per acre. He has an arithmetical trick by which he divides 88 by the row width to arrive at the right spacing within rows. Where hay production is desired, Bailey's tip is to broadcast 400 to 600 pounds of superphosphate per acre (or its equivalent in basic slag), and disk the field just before growth begins the second or third season.

Kudzu willingly and capably repairs the hurts of stricken agriculture wherever they are found. It makes no distinction of race or creed when rescue and rehabilitation are the stakes. Down at Camp Hill, Alabama, there was an earnest, hard-working colored farmer of the old school. He had a mule. The mule got along rather badly until he and his colored owner, John Wooddy, found out what kudzu could do for them. The story, to my mind, is the more dramatic and illuminating because it can be given here exactly as told by Wooddy and taken down verbatim by a stenographer. And I mean verbatim.

I never had no mule when I fust moved here. I got the mule a few days after I moved, along the last of March. The mule was dead po'. I met Mr. Judge Johnson in front of his house when I was going on to town to have her shod and he said, "What I had?" I said, "A mule," and he just laughed. When I passed on by his store he told me to come by a minute and I went on in the store and he told me to be particular and I asked, "What?" He said, "They are right in behin' you and if you don't mind they are going to catch you," and I sed, "I ain't done nothing to catch me for." And I sed, "Who, Mr. Johnson?" and he sed, "A crowd of buzzards."

I come on down the road to Mr. Earnest Mooney's and him and his wife and his chillun, they all come out to the road looking at the mule. Mrs. Mooney, she sed I mought git home with her but told me I had better be particlar crossing the bridge down there as the buzzards mought catch me as they roosted down the creek.

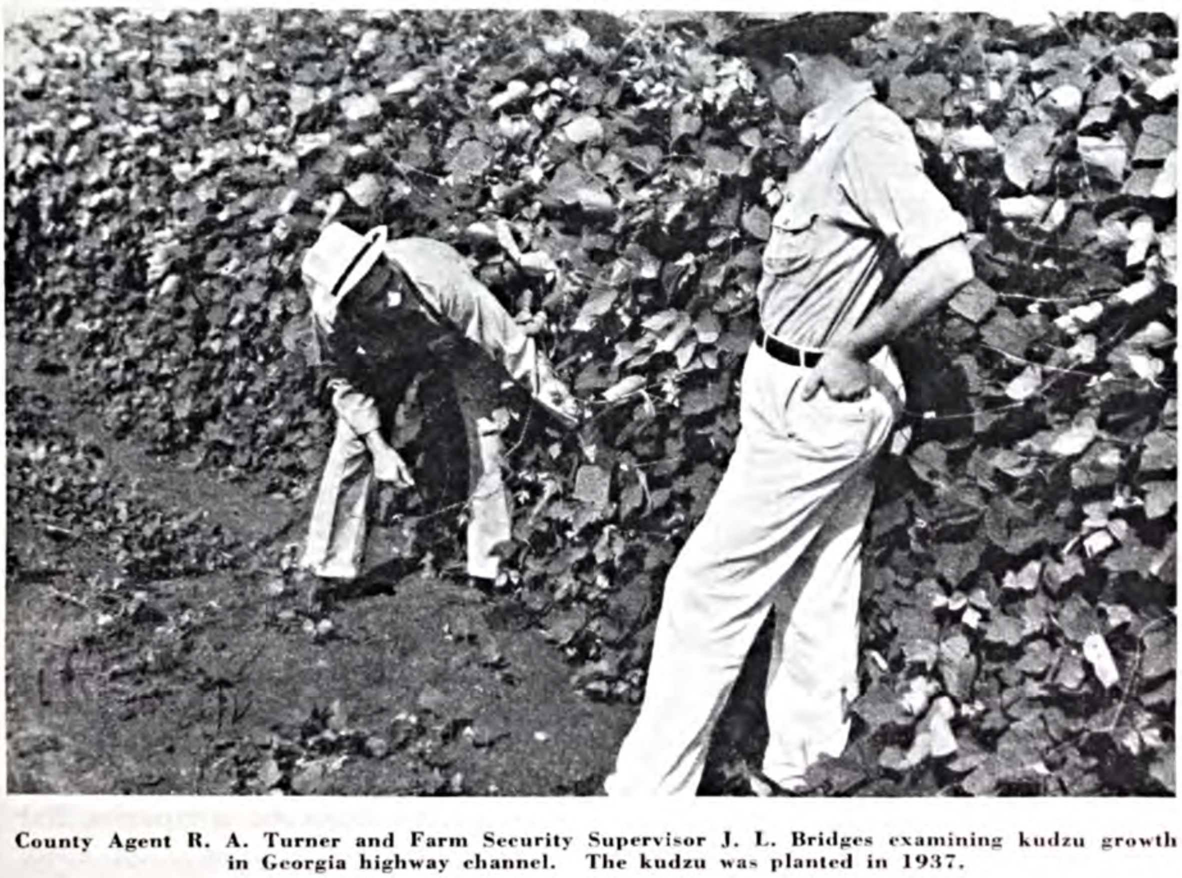
My brother-in-law asked me if that was what I was going to farm with and I told him, "Yer." He sed I had better just as well go somewhere and try to git a job cause that mule will be dead 'fore Satday night. I come on home and my wife, she sed, "You ain't no better off, you had a steer last year and nothing to eat and this year, you have something to eat and nothing to plow."

When I fust got the mule she got down and we would have to help her up. When I was feeding her, some would say not to feed her too much it mought kill her. I didn't see her git no better 'till I fust started to cutting kudzu and feeding it to the cow. On the 15th day of April was the fust day I started feeding the mule on kudzu. It was not over four or five days after that before she got where she could git up and down by herself and has been picking up ever since. If you feed her sweet feed and kudzu, she will eat the kudzu 'fore she will the sweet feed. They say she has picked up 200 pounds, so they tell me, I don't know. Mr. Judge Johnson sed for me to bring her to town he wanted to weigh her. Sed he didn't believe she was alive. He don't believe I made my crop with the mule but I did not have no help 'cept with her.

Mr. Frank Wrenn told my dad-in-law that he ought to see my crop. He sed he never seen nobody or no horse doctor take care of a mule and brought the mule out any better than I did. Sed he ought to come and see my crop and the mule.

It has been three weeks ago I passed Mrs. Mooney's again and she was a-coming from the cowpen and she stopped me and looked at the mule and sed, "Don't you tell me that that is the hide and cocklebur that you carried on by here about two or three months ago." I told her, yes mam that she was.

I had a milk cow when I come over here. The calf was 'bout eight months old. She was dry, only give about one pint of milk a day. I told my wife I believed the cow would come back to



County Agent R. A. Turner and Farm Security Supervisor J. L. Bridges examining kudzu growth in Georgia highway channel. The kudzu was planted in 1937.

her milk if she had something to eat. She sed, "No, she never would come back to her milk until she found another calf." After we went to feeding her on the kudzu, in about two weeks she picked up somewhere along about one gallon of milk a day and my wife sed she believed she would come back to her milk if we just increased the kudzu with her and we did and it come on up to two gallons a day.

When you come in from the pasture with the cow and have a pile of kudzu and she gits a sight of it, she kicks up her heels and runs to it. I feed her on kudzu twice a day. She is in the lot now and if you will carry her some kudzu, she will come and meet you.

I have a sow that brought pigs 'bout first of May. She ain't had a mouthful of nothing to eat 'cept kudzu vines and the slop from the kitchen. The pigs they be seven weeks old today. I have been feeding the sow on kudzu ever since before the pigs was born and have been feeding her on it ever since. The pigs are pretty. Course the sow is sorta off but I have seed sows that was fed grain that was in worser shape than she is.

Higher Analysis Fertilizers as Related to The Victory Program

(*From page* 22)

rectly, but none, insofar as could be learned by asking most of the manufacturers, makes run-of-pile superphosphate containing less than 18.5% available P_2O_5, and the average is above 19.5%. In order to make one ton of 16% superphosphate from run-of-pile superphosphate, 200 to 400 pounds of sand or other material must be added to 1,600 to 1,800 pounds of run-of-pile material. Thus a unit of available P_2O_5 in 16% superphosphate always costs the farmer more than in 20% material. For example, at the average retail delivered prices quoted in the Eastern States in the present season a unit of P_2O_5 in 16% superphosphate costs from 6 to 15, with an average of 11, cents more than in 20% goods. Ordinarily, the only differences between eight 200-pound bags of 20% and 10 bags of 16% superphosphate are that the farmer has to pay about $1.75 more for the latter and then he has to struggle with the two extra bags. When he gets through he will have no more crop, but he will have two extra second-hand burlap sacks. Pretty expensive sacks!

Most of the muriate of potash formerly imported from Europe was 50% grade, and farmers became accustomed to using this grade. On the other hand, all American companies for the most part produce 60% or higher analysis material in their refining processes. Nevertheless, many farmers and fertilizer manufacturers still order 50% material. In the past season 42,000 tons, or 15% of the muriate delivered by American producers to fertilizer manufacturers, were 50% grade, which under American conditions, usually is prepared by diluting 60% goods with filler. The bulk of that sold to farmers, however, is still the 50% grade, which indicates that a lot of dilution also occurs in the hands of distributors, who are not altogether to blame for it.

Very little 14 to 20% potash salts has been imported since 1938 and not one ton in 1941, although nearly all of our potash was in this form until the beginning of the first World War. The old-fashioned kainit contained large proportions of magnesium and sulphates, but the kainit imported from Europe in recent years was mainly a mixture of muriate and common salt. None of the domestic companies has ever produced real kainit. In 1940, 98.8% of the potash delivered to customers by members of the American Potash Institute was in the form of salts containing 50% or more potash, and the remaining 1.2% of deliveries were 25 or 30% manure salts. There was not a ton of 14 or 20% salt sold by producers, but the state tonnage reports show that large quantities of something claimed to be kainit is still being sold to farmers. At the time of writing, state tonnage reports had been received from only three states for the season ending June 30, 1941. These three showed sales of 15,190 tons of 14 and 20% kainit. In 1939, however, these states used more than half of the total consumption of kainit and only a little larger tonnage than in 1941.

At prices quoted during the present season, a unit of potash costs the farmer on a delivered basis approximately as follows:

	Retail price per ton	Cost per unit
20% kainit.......	$31.50	$1.58
50% muriate......	45.00	.90
60% muriate......	48.00	.80

The only thing a farmer gets nowadays in three tons of 20% kainit that he does not get in one ton of 60% muriate is, ordinarily, two tons of sand, common salt, or salt cake. The latter two in many soils will do more harm than good.

Filler and Defense

In normal times it may be true that if a farmer wants to buy an uneconomic grade of fertilizer, the manufacturer should make it for him, but if in war times such a policy materially injures our defense efforts, it is no longer true. The dilution of high-analysis materials to make lower analysis grades or mixtures not only unnecessarily adds to the price the farmer must pay, but uses up a lot of transportation facilities, labor, and bags, all of which are needed in winning the war.

Normally, a very important part of our domestic freight is hauled by coastwise and intercoastal ships. Many of these ships have been diverted to war use, and more could be used with great benefit if they could be spared from normal traffic. This diversion of ships, added to the greatly increased need for transportation due to war work, has begun to place a strain on our rail and truck transportation also. It is, therefore, becoming increasingly important to economize in transportation in every legitimate way.

It is not feasible to prohibit entirely the use of filler because some filler is desirable to adjust formulas, inasmuch as state laws require grades to be stated in whole numbers, and for other reasons. Nevertheless, a half million tons of unnecessary filler could be eliminated with real benefit to agriculture, the fertilizer industry, and the defense of our country.

The average mixed fertilizer moves about 100 miles. It requires the equivalent of 20,000 box cars moving 100 miles to haul the half million tons of unnecessary filler in mixed fertilizers. It requires roughly 500 cars to move the filler in 50% muriate from the refineries to fertilizer factories about 2,000 miles away. This is equivalent to 10,000 cars moving 100 miles. It also requires the equivalent of another 1,000 cars moving 100 miles to haul the filler in 16% superphosphate that could be eliminated if all of this grade was replaced with 18% superphosphate. So, adding these three items together we have a possible saving in transportation equivalent to a 100-mile movement of 31,000 cars.

It requires a lot of power and labor to provide the kiln-dried sand used as fertilizer filler, not to mention the additional labor required to handle the extra bulk of fertilizer produced.

It required the labor of 18,744 wage earners to produce 8,000,000 tons of fertilizers in 1939. It is rather difficult to determine how much of this labor could be saved by providing the same amount of plant food in 7,500,000 tons, but it would probably be of the order of the full working time of 1,000 men.

Two years ago a 200-pound burlap sack cost about 8 cents, and now it costs 19 cents at wholesale. Since all of our burlap and jute comes from India, it is questionable whether any more burlap can be imported for the duration of the war. The supply of burlap has been tight for some time, and many fertilizer manufacturers have already shifted to cotton or paper bags. We have plenty of certain kinds of pulp, but a very strong paper is required for fertilizer bags and a large part of the kind of pulp required for such paper was formerly imported from Norway, Sweden, and Finland. The number of spindles available is not sufficient to make all the extra cotton bags that will apparently be needed. It is therefore necessary to economize on bags. One half million tons of filler require an annual supply of five million 200-pound bags.

To sum up, the elimination of the annual consumption of 500,000 tons of unnecessary filler will not only save the farmer about $5,000,000 a year but a lot of unnecessary labor as well. What is more important now, however, is that such a change would ease the strain on our transportation and bagging industries and strengthen our war effort.

It will require a lot of publicity and cooperation to bring about this desirable objective. In fact, many people feel that, due to the natural resistance of human beings to change of any kind, it can only be accomplished by legislation. Nevertheless, every year large numbers of farmers shift to higher analysis grades of fertilizer. It is felt that much good can be accomplished at this time if everyone who understands the situation will do what he can to explain it to farmers who do not understand. Farmers should be discouraged from buying kainit, 50% muriate of potash, or grades of superphosphate or mixed fertilizers containing less than 18 or 20% plant food. Instead, they should buy lesser quantities of 18 or 20% superphosphate, 60% muriate, or mixed fertilizers containing 20% or more plant food. In so doing they will not only help themselves but the country as well. Fertilizer manufacturers can cooperate by pointing out in their price lists and advertisements the savings to be made by using higher analysis grades and by discouraging the sale of uneconomic grades.

Canadian Muck Lands Can Grow Vegetables

(*From page* 16)

of four years indicated that occasional applications of borax up to 25 pounds per acre are necessary. The quality of crop can also be improved by applications of manganese sulphate up to 50 pounds per acre.

Although, in this region, muck land potatoes are believed to be of inferior quality, experiments at Ste. Clothilde have definitely shown that with the use of high-potash fertilizers, potatoes of excellent quality can be grown on this type of soil. An experiment was conducted from 1937 to 1940 in which varying amounts of 0-8-16, 2-8-16, 0-8-24, and 2-8-24 were used with this crop. With all four formulas satisfactory yields of good quality were obtained, the only significant difference being that 24 per cent of potash without nitrogen depressed yields.

Substantial differences were obtained with different amounts of fertilizer, although the most economical application appeared to be from 1,000 to 1,500 pounds per acre. The formula now recommended for this crop is 2-8-16, although on muck that has been worked and fertilized for several years the nitrogen may be omitted and an 0-8-16 used to advantage.

Onions have proved a very successful crop at Ste. Clothilde, although almost complete crop failure may result without correct fertilizer applications. Unlike celery and potatoes, onions on

Potatoes on muck soils need potash—(left), fertilized with nitrogen and phosphorus (right), with nitrogen and potash.

this soil require relatively large amounts of phosphorus. A 2-16-8 or 2-16-16 appears to give the best results. Copper is also necessary for the development of good skin quality, and yearly applications of about 50 pounds per acre of copper sulphate are advisable, particularly where heavy applications of other fertilizers are used.

Almost phenomenal yields of spinach have been obtained on these soils, in some instances running to over 16 tons per acre. With this crop a 2-8-16 fertilizer has given the most satisfactory results, and the most practical application is about 1,000 pounds per acre.

Similar results have been obtained with lettuce and carrots. With both, boron appears to be necessary and should be applied in moderate amounts whenever the characteristic boron-deficiency signs appear.

Considerable difficulty has been experienced in preventing cabbages from producing heads too large for market requirements. Although many fertilizer mixtures have been tried and numerous varieties and strains of cabbage grown, it is still a problem. Tremendous yields of this crop can be obtained with the use of a 2-8-16 or an 0-8-16 mixture, but the heads are invariably too large if permitted to grow until mature and firm. The use of smaller applications, close planting, and withholding of water have been tried with only partial success. To date small, firm heads of cabbage have not been produced in quantity at Ste. Clothilde.

In addition to the foregoing, experimental work is now under way with a great variety of vegetable crops including melons, tomatoes, peas, beans, asparagus, and mint. With all of these the basic fertilizer would appear to be a 2-8-16. This can be modified to meet the requirements of specific crops, such as tomatoes and beans, which require additional phosphorus, and melons which respond to applications of available nitrogen during the early stages of growth.

In the method of applying fertilizer, it has been found that broadcast applications are in general superior to row placement. This is apparently due to the rather loose texture of the soil which permits easy penetration by plant roots, resulting in wider spread root systems than on mineral soil. The concentration of fertilizers near the row is therefore unnecessary; in fact, with heavy applications it appears to be harmful. Also, owing to the loose texture of soil which is usually quite dry to a depth of two or three inches and is seldom wet through by rains, fertilizers must be worked in so that they will be placed below this dry layer in the moist soil where plant roots are located; otherwise, much of the application may remain above the reach of plant roots during a large part of the growing season.

Snap beans on muck land respond to potash. Nitrogen and phosphorus (left); Nitrogen, phosphorus, and potash (right).

A very simple and effective method of placing fertilizer at the desired depth is by the use of an ordinary grain drill. The fertilizer can be placed in the seed box of the drill, adjustments made for the amount to use, and the drills set at the required depth and drilled below the surface in strips six or seven inches apart. Harrowing and crop cultivation break up these strips and insure a good distribution in the soil. Where controlled irrigation is practiced, the fertilizer can be set in at the depth where it is practical to maintain moisture. This normally is two to three inches. On imperfectly irrigated or dry muck, the fertilizer must be drilled somewhat deeper, although in no case would it appear desirable to place it deeper than four or five inches.—*Contribution No. 589 from the Division of Horticulture, Dominion Experimental Farms System.*

Growing Sweet Potatoes in Georgia

(*From page* 9)

conception, as markets vary in their requirements. It is important, therefore, for farmers to know where their sweet potatoes are destined to go and to grade them according to these particular market requirements. Explaining this situation, L. E. Farmer, Extension Marketing Specialist, declared:

"As an example of fitting the pack to the market, let's assume that the normal market outlet for sweet potatoes is one that does not use a fancy grade and pack and will not pay a premium for this type of pack. It would be foolish to spend time or money putting up a fancy package for this particular buyer. However, if on the other hand the outlet is in some of the larger northern or eastern markets which demand a fancy pack and are willing to pay the premium price for them, the growers would be justified in spending time and money in putting up a fancy grade and pack."

Most of the successful Georgia growers are doing as much grading as possible in the field at harvest time. This is requiring supervision of someone familiar with market grades of sweet potatoes working closely with the field crew. County agents and vocational teachers in the Empire State are doing a great deal towards assisting growers in this work.

This field grading is not usually sufficiently well done to eliminate the necessity for regrading at the storage house or packing sheds. Therefore, farmers selling to commercial markets are regrading and are paying particular attention to packing. Some of the producers in putting up fancy packs are requiring their labor to wear cotton gloves. By giving the potatoes a twist this removes dirt and also prevents fingernail injury.

A number of curing and storing houses are being installed in Georgia. Where very large quantities are to be stored, the curing house has been found to be the most satisfactory method. There are four general types of these houses now being used: 1. Government type house built according to plans furnished by the U. S. Department of Agriculture and heated by stoves; 2. The forced air type which gives a fairly uniform temperature throughout the house and reduces to a minimum the possibility of overheating; 3. The flue under the floor type—a plan consisting of a slatted floor with flues running under the floor; and 4. The electrically heated type which is growing in popularity every year.

As the Plot Thickens

(*From page* 5)

has carried it too far, though, when she beckons for the bread truck.

Then in 1933 certain facts and conditions had to be faced which caused a national farm adjustment the like of which men had never experienced. This act in the tragic opera started with our change to a creditor nation without altering our customary role as a debtor nation toward the rest of the commercial world. Accompanied by a severe depression that sent many native sons back from city employment to a refuge on the land, it quickened the pace to despair and dismay for farmers producing crops and livestock products no longer exportable.

It was then that we had bumper crops along with bread lines, plenty mated with poverty and soils becoming depleted and eroded. Folks were dried out by drought, washed out by flood, blown out by winds, and forced out by mortgage holders. No westward expansion saved the day because that door was closed, and we had to study ways to live with each other in tolerance and makeshift economy until such time as normalcy returned. The only solution was to seek an agency to act as a referee, some force to assume a share of the load, a leadership that possessed courage, conviction, and patience. Because no party could do it or no sect or bloc could afford relief, the answer lay in the government itself.

Hence agriculture sought adjustment in laws and volunteer compliance with them through those who saw that farmers had to hang together or else hang separately. Out of it came numerous worthy and helpful action remedies to tackle the grave threats which gnawed at the root of agriculture in every state and every county, including excessive tenancy, submarginal land use, needless surplus, and breaking morale and finance.

The greatest thing which came out of it was the opening of farmers' eyes to the fact that they were no longer sectional or even national in their long-time outlook, but that the country had grown up overnight and had to partake in the economic diet of the whole world, whether we liked the dish or not. Old musty outmoded aspects of hillbilly style, so long held up as the horizon of each rural community, were torn aside and we glimpsed the vast stretches of human competition that faced the commercialized farmer.

This ushered us right smack into the sphere we now occupy. Leaders of the AAA and associated agencies plead long with our provincial-minded, leisurely thinking ruralities to point out the place we had to take in an orbit of international proportions. Thanks to good educational leaders and teachers and aroused farm organizations, we were able to convince our new generation of farm youth that America had indeed found its place in the sun—sometimes an uncomfortably hot one.

THIS later drama was lightened by little acts of comedy and sarcasm to relieve the tension. We all had our flings at bureaucrats and dictators in the dirt-farm scene, some of which would make a roaring farce set to lilting, tantalizing music. We exposed a score or more of fakirs and charlatans and gave them the "hook" as they abandoned the boards in shame. It was a burlesque in spots too, and somewhat of a circus and a sideshow as well while the worst of it lasted. But when we had calmed down and surveyed the whole period of transition from individualism to coordinated effort, the results showed us that after all the democratic way is best, including the catcalls and the criticism. That proved once more that no matter how much we slam each other, we can unite finally to weld strong links in a solid chain of national power. We like to squabble before we shoot.

As the lights darken before the deciding act of the drama, we of the farm ranks are thrown together as never before. Much effort and speech-making were expended in early days of AAA turmoil to show the North and the South, the East and the West that its best destiny demanded firm allegiance and joint action. But it was hard to break through the crust of jealousy and old tradition sometimes, and it takes a crisis like the one we engage in now to cement the rural citizens of America into one unyielding foundation for future service.

Old sore spots left by internal competition and state-line bickering over economic development are being erased for the time being. It leaves our farm leaders free to wrestle with ignorance and inertia wherever found, and to forget all moss-grown tirades intended to stir up sectional strife.

Matters of price and parity and "ceilings" of course are another thing, usually a problem wherein agriculture must prove its case before the public in a decent, lawful, and republican way. Only blockheads will adhere to the old blocs while the Nation expects duty and production first and foremost. Trades and swaps in legislative halls to get temporary advantage for sectional groups seem to me to be out of place in an emergency.

However, this does not signify that during the impending crisis we of agricultural outlook can safely store away our dreams and hopes entirely—dreams and hopes that look toward obtaining the full fruits of the democratic way of life for a larger portion of the folks who farm. If we abandon those ideals and goals even during the "duration," we shall find it harder to remember them and apply them when the sun shines again.

EVERY reader can fill out a better list of these purposeful and desirable ideals than I can hope to do, but let's start anyhow.

Under the harsh hand of war it behooves us to guard against any tendency to magnify price or income or temporary gain at the cost of our basic soil resources. Thus far in the national farm program we have stressed concerted action for soil maintenance in every field of farming and in all areas. Let's not abandon that principle one iota, for to do so would be losing our birthright after launching an attempt to keep it.

Next we must take care of the reasonable needs of our relatively arid agricultural and grazing regions for artificial water supplies, reservoirs, dams, and irrigation projects. Here much intelligent progress has been made and vast sums spent by public and private initiative. These too need to be safeguarded.

Invention, pioneering in mechanics and electricity, studies in labor-saving, and ingenious discoveries and methods—all help keep this country's scale of agriculture above par and enable us to produce food and feed and fiber without reliance upon some distant land. Agriculture will keep this country from actual food rationing during the present strife by its skill and abundant output. Some day we may raise all the rubber and the hemp we need besides, and add to our store of vitamins through culture of a variety of sub-tropical fruits and vegetables not now deemed within our scope. As I vision the future, we are going to open up a larger field for talent in agriculture and allied branches than in any century which America has benefited by its productive power.

As RAPIDLY as we accomplish this we are going to stand firmly for a wider diffusion of knowledge on diets and nutrition, and ask that economic policies be shaped so that the largess of our horn of plenty will be more evenly and fairly distributed to hungry human beings within our own and other nations.

And it will not be enough just to fill their bellies. We will need to launch in every nook and cranny of this broad land programs which will inspire and invigorate the minds and energies of countless persons. We will see that they have proper social and recreational facilities and know how to use them sanely and morally. We will encourage large-scale farm organizations more than in the past, perhaps with less needless rivalry between them and with fewer grandstand artists and more active membership. We are going to imitate the good old Grange by encouraging more young folks to become active participants in organization among farmers. We will then have fewer graybeards and tired old war-horses doing all the talking, voting, and parading, unaided, as they are too often now, by the strong arm and the bright eye of youth.

Moreover and meanwhile, if we do all these things and forget to polish up the rural pulpit and plunk in more pennies for a good parson so that the white steeples may rise as a mark of decency and faith in our wide countryside—if we fall down on this main assignment, we miss the spark plug of democracy, the nub of what we are battling for with fervor. I have never been a psalm-singer or a goody-goody, and my church attendance record is not of the best; but it has always seemed to me that America has so much in the open country that is noble and inspiring that it would be easy and natural to worship together there always. And what remains out there that needs correction and improvement and cleansing would benefit a heap by more Christian organizations as a vital force in rural life. I like to see a country landscape dotted with silos and windmills, but it seems even nicer when it produces a white spire or two amid the pines and the prairies.

WHEN we have rung down the curtain on the last act of the present drama we can be sure that Agricola of America will emerge as a player of first rank indeed. He has the training, the physique, and the endurance and balance sufficient to last through to the end. We are betting on him and his relatives and associates. They have a plan for this war and a plan for what is to follow it, when victory is ours.

It isn't any of your "five-year" plans or "super-race" programs or made-to-order systems. It will hinge on the tradition on which we have built the best in American agriculture, mainly on work, sacrifice, cooperation, education, decency, and thrift. If that won't mesh the gears into a forward movement, then my New Year guess is as weak as my resolutions. And until those happy times arrive, here's to you and yours for 1942.

VARIETY

"And what kind of pie have you?" inquired the diners who had stopped at the eating house in a country town.

"We got three kinds," the waitress replied. "We got open-top, lattice-top, and kivered pie—but it's all apple."

A negro father placed his sixteenth child to sleep in the old shaky cradle. Looking up, the mother said: "Sam, do you know that cradle am gettin' mighty old and weak?" "Yes, yes, it sho am," said Sam, "and I is goin' to get a new one right away. One dat will last for years and years."

Teacher: "Now children, what great woman's letters reflect the suffering and misery of her time?"

Chorus: "Lydia Pinkham's."

"Does it make any difference on which side of you I sit?" she asked.

"Not a bit," he replied. "I'm ambidextrous."

Returning from leave, a young army officer was about to take his place in an airliner when a girl ran up and asked the passengers if any of them would be kind enough to sell her a seat, explaining that her mother was dangerously ill and the liner was full.

The gallant young officer gave up his seat and wired his commanding officer: "Gave berth to girl. Returning by next plane."

Shortly afterward came the reply: "Congratulations. Your next confinement will be in barracks."

Which reminds us to ask, "what did the calf say to the cow?"

"Shoot the udder to me, mudder."

And a little later he mumbled, "And de udder udder to me brudder, mudder."

"My mother always told me to say no to everything," she said.

"Well do you mind if I hold your hand?"

"No."

"Do you mind if I put my arms around you?"

"N-o-no."

He sighed deeply. "Sweetheart, we're going to have lots of fun," he said, "if you're on the level about this."

Traveler: "What have you in the shape of automobile tires?"

Miss C., clerk: "Funeral wreaths, life preservers, invalid cushions, and doughnuts."

Poem of the Month: Jack had money; Jill had nil. Jill married Jack, so Jack had Jill. Jill went to Reno; now she's back. Jack has nothing, but Jill has jack.

An old negro mammy who was visiting in Tipton, Georgia, discovered that smallpox was prevalent in the neighborhood, and rushed to the health doctor to be vaccinated.

"Where are you from?" asked the doctor.

"I'se from Johnsville."

"Well, you'll have to be vaccinated in your own precinct."

"Lawd a-mercy," replied the woman, "dat's funny. De rest of 'em has been vaccinated in the ahm."

Printed in U. S. A.

Better Crops with PLANT FOOD

February 1942 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

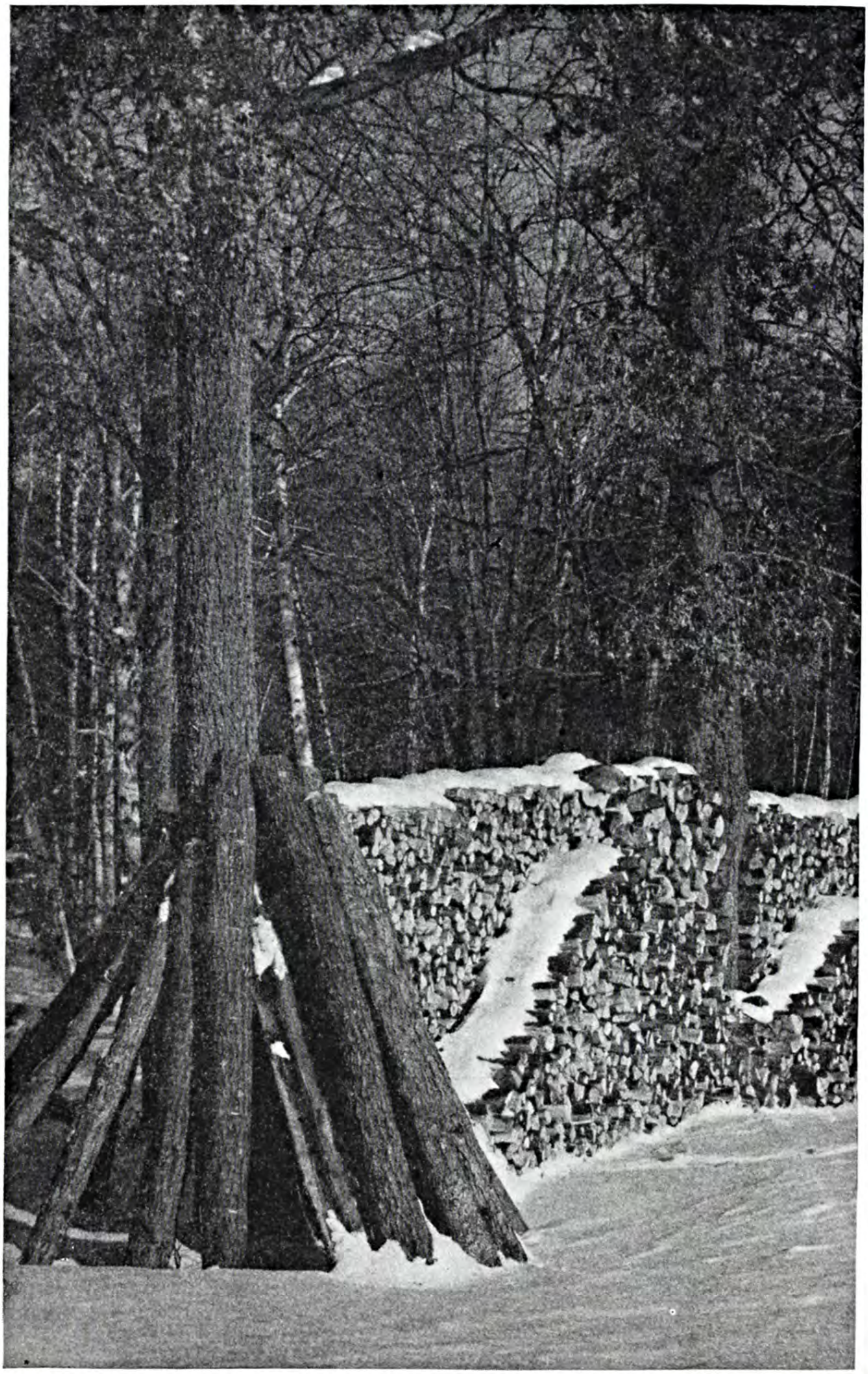
The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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

VOLUME XXVI NUMBER 2

Table of Contents, February 1942



THE WOODPILE—A NECESSARY FARM "STOCKPILE."

Better Crops with PLANT FOOD

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

Vol. XXVI WASHINGTON, D. C., FEBRUARY 1942 No. 2

Civilians, too, will do a . . .

Squads Right!

Jeff McDermid

INSTEAD of talking about Youth at the Crossroads, we now shrink from the truth that Youth is on the Firing Line. Out our way, as in hundreds of other American communities, folks who have ambled along in the family way for a generation are brought up squarely to face what for them is a new set of conditions—yet by no means a new situation in our historical background.

Last week a third contingent of draftees shouldered their rucksacks and departed this life as we know it in our bailiwick. I looked them over down at the depot and shook hands with a dozen lads who have arrived at "man's estate" only to find it heavily mortgaged. A number of these boys are leaving with reluctance and some inner resentment at an apparent bungle in society, which they naturally infer is none of their making but plenty of their business hereafter.

Among them were recruits who were thrust into my small orbit as follows: One boy with a loud whistle who delivered my daily paper at a penny profit per; one youth with more vigor than veracity whom I tried to teach in Sunday school; one with five years' record as an unremitting snow shoveler and lawn grass mower in our block; another who delivered our modest but often bulky groceries at the back door and nibbled a few dozen of Mother's cookies betimes; and three or four more who bobbed up week-end evenings to escort my daughters to sundry simple sociables, and who were verified beforehand as sober lads and careful drivers. Not being the sire of sons, I am unable to point to rich acquaintanceship with boy scout hikes and important conferences at night over the mysteries of radio sets, airplane models, scroll-saw jobs, and bench work; or boast the degree of allegiance to the lodge of boyhood vouchsafed to men who have had the direct training of masculine minds.

While lacking this contact, I feel that as long as the world depends on the harmony of the sexes to keep it going, I may rightfully discern some personal interest in the departure of those kids who persisted so long in attendance upon my daughters, and those others who probably waited upon somebody else's girls just as solicitously. Though I didn't have a hand in showing any of them the way to wind a reel or saw a plank or row a boat, I figured in their world finally when they sought and found romance and feminine companionship. And so this gives me a license to prattle on about their affairs, which have now become our major concern and which mean so much more to us neighbors than as though these boys had just finished college and wandered off to their first jobs away from home.

IN that case they would have been lost to us except for filtered messages of promotion or failure or being home on a short vacation to get married or something. What they did would have been but a passing item of casual interest under the old civilian routine. But since they are now signed up for more glory than they ever wished for in summer daydreams and smaller pay than they got when they worked for me, I notice a great difference in our regard for their future welfare.

No, I don't mean they are going to be made into knights overnight by some sergeant, or that they will relish the drumbeat of martial fervor. They are going to be too darn close to realities to catch the spirit that the rest of us will assume toward them, out here waiting by ourselves alone—shoveling our walks and running errands and cutting our grass and thinking how much better and faster they did it.

It's we who will be the ones to cry, "They're in the Army Now," and publish their pictures and praise them and feel sorry for any Japs or any others who start knocking off chips from broad Yankee shoulders like theirs! It'll be a lot like rooting for the old high school team after all, won't it? Sure, all except the catch in your voice.

If we live in good old Dixie, we'll begin to compare this and that fellow who left our town with such manly defenders of state rights as Robert E. Lee, Stonewall Jackson, or that daring and spectacular hero, Jeb Stewart. If we have been nursed in northern brands of the same strain of native valor, we will sing their praises in terms of the best of our ancient colonels who refrained from vandalism and accepted victory modestly at last.

AND together we will all join in cooperative tribute to American tradition and focus our hopes on the chance that our departed lads may be led by just as inspiring and devoted men as roving Robert Rogers, crafty General Marion, the Swamp Fox, and that old ironsides of "Jehoshaphat and the Continental Congress," Ethan Allen of Ticonderoga. It will warm the cockles of stay-at-home hearts to imagine them in barracks or behind barricades, stemming right up from the seeds of glory as America planted them long before Japan was "civilized."

Or we can refresh our boyhood memories on the doings of Teddy Roosevelt and the Rough Riders, Funston and the defeat of Aguinaldo, recalling the outbound trainloads with broad brown hats and leather leggings who left our towns in 1898, victory bound like hell bent for election. Moreover some of us can bring it down to a nearer day, when the first infant bawls of these new heroes were mixed with the din of the armistice of 1918, and the world was made safe for democracy "over there."

This teaches us that we hanker for a little sacrificial stimulation about so often in our mundane lives. We get to plodding along keeping store and dictating letters and selling washing machines and listening to dull sermons and reading tiresome essays. We take everybody as "automatic Americans," as natural legatees of that which is calm

and peaceful and standpat, and maybe just a bit shabby and grubby too. We try to think up new plays and novels and make them stinky in spots so they will be read widely and profitably. We go in for fads and repeat trite sayings and turn on the radio for jazz and go to bed too late. We talk about stamina and reserve power and heroism as something we found in the new historical set we bought for Christmas, not anything which fits into the present rushing world of come-hither and go-yonder. Ah, no, my friends of easier days, it won't do to "tell this to the Marines!" It's far too prosaic and common to fit into Wake Island! We've got to foster something better before they come back, and I don't mean maybe.

We've got to assume a share of the deprivation and bereavement ourselves. And that means whether we have sons bearing arms and flying planes or not. It signifies being hard-headed and realistic for many of us who have been soft-minded to an extent that is alarming. We must hitch up our braces and prove to the deluded, despotic countries abroad that democratic nations know how to live up to their historic inheritance.

To begin with, we've got to distinguish in our minds from now on the real difference between bereavement and deprivation. Plenty of us have it all solidified together and don't know one from t'other.

I MEET fellows every day who have no relatives in the war but who feverishly seize each evening's paper to see what the war board has done to them in the past twenty-four hours. I am one of those behindhand guys who fail to keep track of all the industrial rules and regulations about sugar and tires and metals and motors. I confess to a woeful indifference to what mileage lies ahead for me in my buzz-buggy; although I am not going to change my methods of driving or my care of the car simply because I've always let folks whizz past me and kept a watchful eye on the mechanism anyhow. I haven't tried to interview any tire bootleggers or bothered the ration board.

Yet lots of men in my neighborhood have become geared so tight to the motor age that they seem bewildered and agitated beyond measure. They hate to think of changing cars at lonely junctions again and spending time in hotels with those old red railway guide books or bus folders. For them this is real bereavement, a tragedy and a personal affront. So they haunt the ration boards and snoop around second-hand tire shops, becoming easy marks for countless rackets afloat. In these days, all this looking around high and low surely means "rubbering" if it ever did; and restless hours abed call for a change in terms from "nightmare" to "night-tire."

I know it's hard on the traveling salesmen and I fully sympathize with them. But in my youth the erstwhile jolly, philandering drummers were "faster" in spots than the boys with bags are today, and had more time to tell funny stories and make life worth while en route.

Denial of rapid locomotion, hither

(*Turn to page* 46)

Boron Deficiency On Long Island

By R. H. White-Stevens

Long Island Vegetable Research Farm, Riverhead, New York

THE soils of Long Island cannot be considered as possessing a natural fertility comparable with that found in many other vegetable-growing regions of the United States. However, the combined advantages of a favorable climate, the proximity of the New York City markets, and excellent transportation facilities have resulted in vegetable growers on the Island employing cultural practices which have led to the maintenance of high levels of production in all the major crops grown. Potatoes frequently yield 300 to 400 bushels of U. S. Grade 1 per acre, cauliflower 400 crates per acre, lima beans 350 hampers (30 pounds each) per acre, and brussel sprouts 6,000 quarts per acre. Some 25 other crops are grown, all producing yields comparable with those obtained on the best vegetable soils in the country.

Of the many cultural factors which go to produce a successful crop on Long Island, the one which receives the most attention is the fertilizer program. The comparatively rapid leaching of nitrogen and the excessive fixation of phosphorus have led to the use of large amounts of complete fertilizers. Applications of commercial fertilizers of such analyses as 4-8-4, 4-8-7, and 5-10-5 made at rates of from 1,500 to 2,000 pounds per acre per crop are considered standard practice. Organic matter is usually maintained by the use of green manures because the increasing dearth of farm livestock has raised the cost of manure to a prohibitive degree.

Thus the only source of external plant nutrients is the fertilizer applied. The bulk of this fertilizer is composed of mineral components, and with the improvements in the manufacture and purification of mineral fertilizers such as nitrate of soda, phosphates, and potash salts, the inclusion of incidental elements has been reduced. It is true that some organic sources, particularly of nitrogen, contain various supplementary elements, but these sources, such as fish scrap, castor pomace, cottonseed meal, and tankage, are too costly to be employed as a sole source of nitrogen and are consequently used in comparatively small quantities, largely as conditioners.

These fertilizer practices have tended to induce associated minor element problems, the chief of which, on Long Island, appears to be boron deficiency. It would be both unfair and untrue to assign the recent increase in boron deficiency on Long Island soils solely to the fertilizers employed, as several factors, discussed later, are equally if not more responsible. Nevertheless, the constant withdrawal and leaching of boron from the soil and the incomplete return in the fertilizers applied have not tended to correct the deficiency.

Symptoms

The first requirement for the practical control of a boron deficiency is the recognition of the symptoms of the deficiency on the crop in question. Essential though it is, it is not as easy as it might appear. Boron deficiency may frequently be effecting a distinct curb upon the growth of a crop as expressed in ultimate yields, and yet it may not be reflected in the appearance of the plants. On Long Island this has been observed frequently. Obviously, when a visible symptom appears on the plant it indicates that the deficiency has attained a degree where it not only reduces growth but actually commences to kill the plant. Even at this stage accurate diagnosis is not always simple because another essential element may have become deficient simultaneously, and the symptoms of the two deficiencies collectively may be quite different from those of either deficiency alone. Nevertheless, there are certain rather characteristic symptoms of boron deficiency, which when known, are fairly easy to recognize and provide a significant clue to diagnosis. For simplicity we may consider these by plant organs.

Fig. 1. The effect of boron deficiency on the growing point of cauliflower early in the life of the plant.

Growing points.

Growth slows down as the deficiency develops, and the growing points of the plant begin to suffer. At first growth may continue slowly, weakly, and unevenly, with the resulting leaves becoming curled, gnarled, lopsided, and distinctly impaired as food-manufacturing centers. Eventually, if the deficiency persists, the growing points simply wither and die (See Fig. 1).

Stems.

The stem tissue breaks down, particularly those regions involved in translocating to the rest of the plant foodstuffs manufactured in the foliage (e.g. sugars, elementary proteins, etc.). This tissue literally becomes plugged with gummy materials, the identity of which is unknown, and the resulting upheaval created in the surrounding tissue frequently causes the stem or leaf petioles to split and crack. This symptom is often seen by the grower in rutabaga, cauliflower, and celery plants suffering from boron deficiency in the field (See Figs. 2 and 3).

Leaves.

The foliage is also affected, the young growing leaves as described above, and the older foliage first by purpling, followed by a border yellowing and gradual withering and die-back. These leaves being the regions where foodstuffs, sugars and starches, are chiefly manufactured tend to become stiff, thick, and very brittle owing to excessive accumulation of these substances (See Fig. 4).

Roots.

Roots show variable effects but usually tend to throw excessive branch roots. This condition arises as the result of degeneration and death of the absorptive tips of the roots.

Large storage roots, such as those of rutabagas and beets, develop various internal symptoms which become visible externally only in very severe cases, the development of water-soaked, blackened, or pithy regions being the most frequent (See Figs. 5 and 6). These symptoms are of extreme economic significance as they affect the market value of the crop. The grower can readily harvest such roots and ship them to market in good faith, only to receive severe criticism or have goods condemned as poor in quality and unsalable. In some cases it has been found that flavor and storage and shipping stability may be distinctly below the required level without there being any visible symptoms at time of harvest.

Fruits.

Reproductive tissues, though not commonly affected in vegetables, may also suffer various types of breakdown, either dropping prematurely or withering on the plant and ultimately rotting from secondary decay.

It is unusual to observe all these symptoms arising on the same plant simultaneously since under field conditions boron deficiency may occur at different times with varying intensity and from a variety of causes. In general it develops either during the major growth period of the plant or just before maturity. It must be remembered, however, that the visible symptoms are but the end point of a severe upheaval in the normal functioning of the plant, and when they do make their appearance the plant has been suffering for some time. It is this fact which accounts for the reduced quality found in crops grown at a level of boron nutrition below normal requirement, yet at one high enough to prevent the incidence of apparent symptoms.

On Long Island the chief factors which cause boron deficiency are heavy consumption of boron by crop growth, failure to return to the soil an adequate supply in the fertilizers applied, and leaching of the natural borates by rain and melting snow.

The consumption of boron varies enormously with the type of crop. Thus root crops tend to consume relatively large amounts of boron, but even among root crops there are variable requirements. Beets and rutabagas appear to be gross consumers, while carrots are injured quite easily by excess applications of boron. The cruciferous family appears to require comparatively large quantities of borax and shows wide limits of tolerance. Many of the legume family and the solanaceous family, on the other hand, are quite sensitive to boron. Leafy crops such as spinach, lettuce, and endive have small requirements and yet are still fairly tolerant to boron. Celery has a fairly

Fig. 2. Cracked petiole in rutabaga, indicating an advanced stage of boron deficiency.

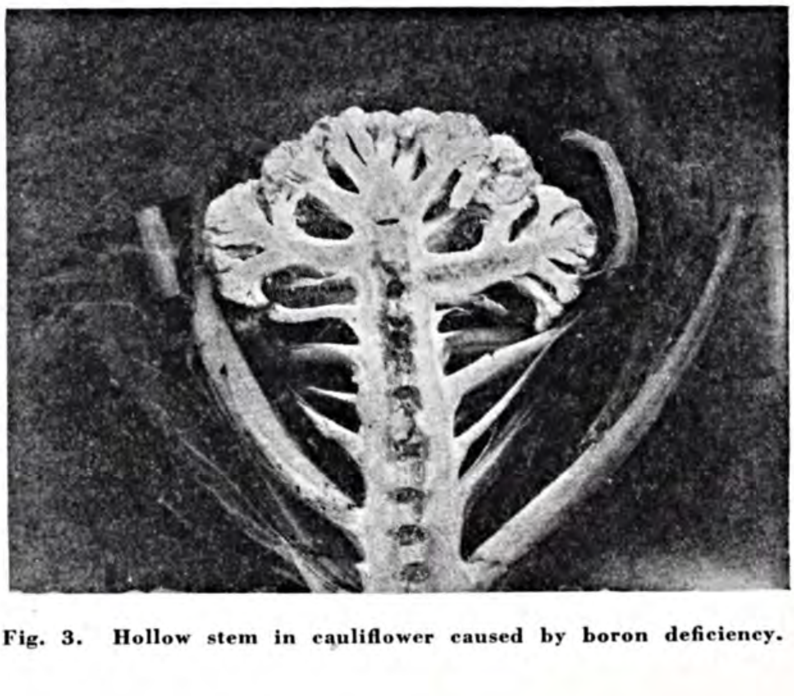


Fig. 3. Hollow stem in cauliflower caused by boron deficiency.

high boron requirement, and suffers inordinately if it is deficient.

The data presented in the subsequent tables give an idea of the extremely variable tolerance and requirements of some of the more important vegetable crops grown on Long Island.

As has been mentioned previously, the bulk of the fertilizer used on Long Island vegetable farms is composed of comparatively well-processed mineral salts in which boron, as a contaminant, is very low. Apart from the failure to replenish boron as it is consumed by plant growth, there is the added factor of stimulation in boron requirement induced by the major mineral fertilizers. Nitrogen and phosphorus, for example, will tend to increase the boron requirement of plants due to their stimulating effect upon growth. It has been found that the degree of boron deficiency developing in a crop grown on a boron-deficient soil is in direct proportion to the rate and amount of growth attained by the crop. In specific tests with beets and rutabagas, the correlation was found to surpass significance at odds of 999:1. Potash also will tend to increase boron deficiency on soils low in available quantities of the latter element even under conditions where increased potash has no effect upon yield. The exact nature of this interrelation between potash and boron is not clear as yet.

Fig. 4. Boron deficiency on rutabaga foliage. The older foliage becomes thick, purpled, and eventually yellow and dead at the edges.

The question of leaching of available borates from the soil is a significant one on Long Island for two reasons. First, the soils are characteristically acid, having a natural soil reaction highly buffered in the region of pH 4.8 — 5.4. This condition renders the natural borates soluble, and consequently subject to leaching. Second, the high sand and gravel content of the surface soils, combined with low clay and organic matter contents and an extremely porous subsoil, permits even moderate rains to effect distinctly heavy leaching. The application of lime to such soils tends to reduce the loss of boron from leaching in wet seasons, but amplifies the deficiency by reducing the available boron in dry years.

It is of interest in this regard to note the difference in the incidence of boron

(*Turn to page* 42)

The Jachim Brothers of Wheatfield, Indiana, with an exhibit of the crops which won for them the title, "Champion Muck Crop Farmers for 1941."

Cooperation

By Roscoe Fraser

Agricultural Extension Service, Purdue University, Lafayette, Indiana

NO better example of the statement, "In union there is strength," can be found than in the Jachim family of Wheatfield, Jasper County, Indiana. This family of 6 young men and women, ranging in ages from 20 to 40, by sticking together and working as one unit accomplished more last year than many people do in a lifetime. One member of this family has just been crowned Indiana's Potato King, and the entire family shared honors in winning the much coveted title of Champion Muck Crop Farmers.

Several years ago, when medals were first given in the muck area for high yields of onions and potatoes, the mother of this fine family remarked how nice it would be if someday they might win a medal. The remark was apparently forgotten, yet when they were told of the honors they had won their first expressed thought was "Gosh, wouldn't Mom and Dad be proud?"

In this group there is no claiming of individual credit. They work together in perfect harmony. After their father's death they held a conference to decide what they should do. Since the death of their mother some years before, the girls had done the housekeeping. The boys had done the actual farming for many years as their father was an invalid. So they decided they would try to carry on as they had been doing. There is no grasping for authority, and there are no quarrels or arguments.

They have a very good system for avoiding quarrels that might be well used by more pugnacious people. Every problem is discussed by the family as a whole. Each expresses an opinion, without arguing, and when the decision is made the plan is put into action as the majority wished it.

Louis, the eldest brother, works in Chicago but spends every week end and holiday at the farm. He takes an active part in all the planning and managing, but Joe, Frank, and Ed do the actual farming of the 520 acres. Joe, who is married and has a small son, lives on the farm, but in a house about 200 feet distant from the others. Frances and Agnes share the house and garden work, with Agnes doing the secretarial work, too. A more cooperative family would be hard to find.

The Jachims were all born on an 80-acre, mostly-sand farm in Starke County, Indiana, where the land runs from the very poorest to the very best in the entire State. The small patch of muck they had was not enough to keep them all busy, so one or two of the boys usually found time to work for a neighbor, Bill Gehring.

"It was like going to school to work for Bill," they said. And it is doubtful if they could have found a more able teacher, for Bill Gehring ranks as one of the most progressive and successful of muck farmers. Fired by Bill's successes, they decided to branch out for themselves. Three years ago they bought 240 acres of muck land near Wheatfield. Since then they have purchased another 280 acres, increasing their present acreage to 520. At the present time they do not intend to buy more land. Their idea is to possess, not be possessed by, the land.

In 1941 the boys tried onion raising for the first time. That they were apt pupils and hard workers is proven by the fact that Frank produced more yellow globe onions on one acre than anyone else in the state last year, 1,248.5 bushels; Joe produced 1,230.39 and Ed 1,201.74 bushels—a total of 3,680.63 bushels on three acres. On 50 acres they grew a total of 68,750 bushels. These yields put them all in the 1,000-Bushel Onion Club and entitled each of them to a gold medal given by the Northern Indiana Muck Crop Growers Association and the Purdue Horticultural Extension Department.

The onion fields were plowed 8 to 10 inches deep November 1 to 10. They were double disked twice, harrowed twice, and rolled with a 36-inch concrete roller twice last spring. They were then floated, or leveled, three times. Onion seed, 4½ pounds per acre, was planted 1 inch deep and in 16-inch rows April 25 to 29. Fertilizers, 1,950 pounds of 3-12-15 and 100 pounds of copper sulphate per acre, were applied with a grain drill, going over the ground twice. The fields were hand-weeded twice, wheel-hoed twice, and plowed twice with a small garden tractor. The onions were pulled and topped September 15 to 20.

In 1940 this ground was in potatoes which had been fertilized with 1,500 pounds of 3-9-18 per acre, producing 500 bushels per acre. Soybeans were grown here in 1939 but were not harvested due to wet weather. For several years before this nothing but wild hay and weeds grew on this ground.

Corn Yields Outstanding

In the 5-Acre Muck Grown Corn Club, the Jachims were beat by only four-tenths of a bushel. They produced 137.9 bushels, while the winners, Surma Brothers of North Judson, grew 138.3 bushels per acre on their 5 acres.

Eighty-five acres were plowed for corn May 10 to 15. The field was then double disked once, harrowed twice, rolled twice, and floated once. The corn was planted with a regular Iron Age potato planter, putting a corn box on the planter instead of a potato hopper and using the fertilizer attachment that puts the fertilizer deep down in the soil. Hybrid corn, fertilized with 250 pounds of 2-8-16 per acre, was planted May 27 in 34-inch rows with 6 inches between kernels. The field was weeded twice and gone over with a two-row tractor cultivator once. In both 1939 and 1940 potatoes were

(*Turn to page* 41)

Fertilizing for More and Better Vegetables

By H. D. Brown

College of Agriculture, Columbus, Ohio

IN spite of assurances that our fertilizer supply will be adequate for all needs, the present emergency calls for a reexamination of these needs in the light of new demands, new emergencies, and old emergencies only recently recognized.

During World War I, vegetable gardening activities were accelerated primarily because they furnished additional food. Now there is an added motive. The present demand arises from the knowledge that these vegetables are essential for proper nutrition. They are the protective foods essential for health. But all vegetables are not equally healthful. Some varieties of carrots, for example, contain more Vitamin A than others. Fertilizer treatments alter the mineral and vitamin content of many vegetables. Minerals such as calcium, phosphorus, magnesium, iron, and many others are necessary for animals as well as plants. The present demand is for vegetables grown and fertilized so that they provide a maximum of vitamins and minerals for health.

There are many new emergencies. The need for food is not the least of the needs of our allies in this present struggle. Canned vegetables and vegetable concentrates will probably be our contribution to this need. Here again the need for effective and adequate fertilization is essential in order to increase yields to such a point as will make the crops profitable at the higher wage levels. In this and all other similar efforts we must be especially careful not to plow up city lots and other submarginal lands and make the same mistakes that were made during the last World War.

Throughout all these efforts we must not lose sight of the fact that we in America have dissipated the natural fertility of our soils more rapidly than any other nation and the time is near at hand when we will be compelled to do something about it. This perhaps is a poor time to try to build up the fertility of the soil, but we had better lay aside some cash for future use in the hope that there will be an adequate supply of fertilizer available at reasonable prices.

From the foregoing it is probably evident that there are at least two different procedures followed in fertilizing vegetables. In general these methods can be designated as (1) intensive and (2) extensive.

Intensive gardeners apply large amounts of commercial fertilizers and organic matter. Soils cultivated by this group, which includes market gardeners and our most successful potato growers, receive annual applications of from 750 to 2,500 pounds of a complete fertilizer per acre. Market gardeners commonly apply in addition approximately 15 tons of manure per acre annually. Of course applications vary widely in different sections, but a surprisingly effective treatment for these intensively cultivated soils consists of 1,000-1,500 pounds of a complete fertilizer per acre plus 15 tons of manure. Soluble nitrogenous fertilizers are used as side-dressings when needed, and they are commonly needed for leafy vegetables. Potato growers generally secure the organic matter supply by plowing under green manure crops primarily because it is cheaper than manure and also because manure encourages scab in some instances. The potato growers make a little more effective use of the commercial fertilizer by applying practically all of it in bands along the sides of the rows.

High-quality Vegetables Grown

Vegetables grown on these highly fertile soils are generally of the highest quality. The necessary minerals are present, and the gardeners who are intelligent enough to provide proper food also provide adequate moisture and other requirements which frequently necessitate the use of specialized equipment of various kinds. Their soils are now more fertile than they were 100 or more years ago. These soils, perhaps less than 2,000,000 acres in all, represent the notable exception to the outrageous depletion of our natural resources of soil fertility in the United States. On these soils it is not so important to wrangle over fertilizer analyses. Enough is applied for the needs of all crops and the omission of an application for an entire year, although not advisable, would probably not greatly reduce the yield.

The other type of vegetable gardening—the extensive type—makes use of poorer soils where more exacting fertilizer practices must be followed for success and where, unfortunately, vegetable production is only a side line and the farmer finds it difficult to master the details essential for success. This is the type of gardening that will probably net the greatest increase in acreage during the present emergency, for canning tomatoes and peas are commonly grown by this type of culture and they represent two vegetables in great demand by our and allied armies.

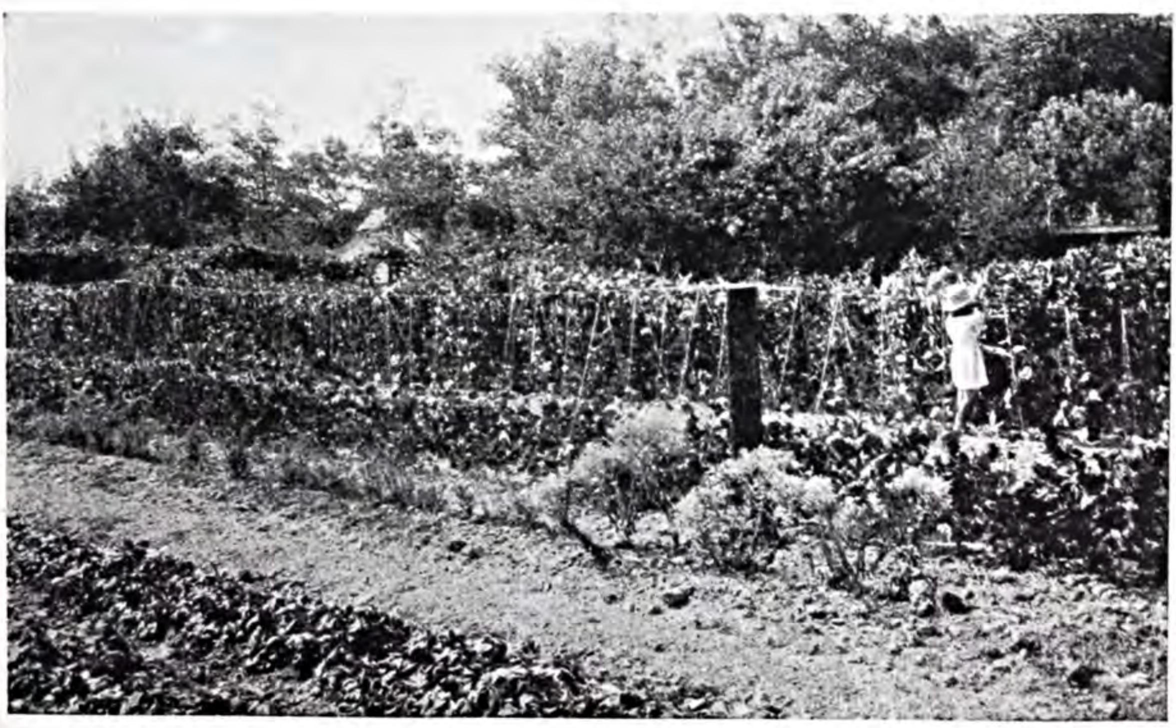
A few rules may be helpful in arriving at a useful fertilizer program.

(1) Acid silt loam soils usually need additional phosphorus for vegetables.

(2) Sandy soils usually need both nitrogen and potash applications before they will produce profitable crops of vegetables.

(3) Muck soils and dark soils usually contain inadequate amounts of potash for successful vegetable culture.

(4) Leafy vegetables, especially spin-



A well-kept garden is a source of many dollars worth of products which may be easily grown on the farm.

ach, require large and constantly available supplies of nitrogen.

(5) Root crops require especially adequate supplies of potash.

(6) Fruitful crops, tomatoes for example, generally require a liberal amount of phosphorus.

(7) Fertilizer applied in bands at the sides of rows and slightly deeper than the seed is generally more effective in increasing yields than the same amount broadcast.

(8) Most vegetables tolerate and many thrive best in a soil acidity adjusted to lie between pH 6 and pH 7.

these observations must be continued from year to year and future fertilizer applications based upon past observations. Yield data are useful in the same way. Applications of soluble nitrogenous fertilizers made during the growing season are effective for nitrogen hunger if washed down to the roots by rainfall or irrigation water. In general phosphates and potash applications must be made at a depth of 2 to 4 inches before the roots of the plants have made much growth because these fertilizing materials, with a few exceptions, do not move about in the soil.

Fertilizer test with vegetables at the Ohio College of Agriculture. Those on the left received a complete fertilizer and those on the right nitrogen only.

Quick soil tests and the ability to recognize the hunger signs of vegetables are useful supplements to the foregoing rules. Quick soil tests for acidity, phosphorus, potash, and in some instances other elements are made free of charge by the extension workers in some states. They are a valuable supplement, but should not be depended upon exclusively.

More reliable indices can be secured by noting the type of growth made by the plants. Chemical tests of these plants often confirm conclusions drawn from observations. To be most useful,

The hunger symptoms of vegetables have been described and illustrated in many publications. Every vegetable grower should have access to some such publication. The successful grower must be a plant doctor and as such must be able to recognize deficiency symptoms.

Nitrogen hunger is characterized by stunted plants that have light green to yellowish leaves on the older portions. The entire surface of the leaves becomes yellow without the presence of dead spots as is the case if the yellowing is caused by insect or disease attacks.

(*Turn to page* 36)

Response of French prune trees to potash in Santa Clara Valley district in northern California. Untreated (left) and potash treated (right).

Prune Trees Need Plenty of Potash

By M. E. McCollam

San Jose, California

THE very unfavorable situation of the prune grower has been changing rapidly under the tremendous war activity, and the dried prune is again being recognized as a concentrated food with high nutritional values, having the added advantage of being a non-perishable product easily shipped and stored. The price has risen to 4½ cents per pound, and the outlook for the grower has taken a distinctly brighter hue.

The major portion of the country's dried prune crop is produced in California. This consists of an average annual production for the State of 198,600 tons out of a national production of 225,000 tons. For a good many years the grower has had poor returns for his crops. The export market in Europe was lost, and a troublesome surplus had to be dealt with each year. Prices dropped to around one cent per pound for dried prunes, and the growing end of the industry was on the verge of disaster.

A considerable acreage of prune trees in California has been planted on soil which does not supply the crop with sufficient potassium for best results. In the prune district of the Northern Sacramento Valley the soils in addition to having inadequate potash-supplying power may also have a high fixing power for potash. Along with this the prune trees set unusually heavy crops of fruit, 10 tons fresh yield per acre being quite common. When three such unfavorable factors as inadequate potash in the soil, serious fixation of any potash applied to the soil, and heavy fruit sets exist together, the tree suffers, of course.

On top of this, extremely hot spells occur in the Sacramento Valley during the period of fruit formation and ripening, which undoubtedly add to the physiological disturbance in the trees. On some soils with a particularly high power to render potash unavailable to the plant, the prune trees are severely injured, and heavy applications of potash are of no avail. The foliage on an entire limb may scorch, and the limb die. Apparently healthy trees may go to pieces in a single season. About the only help in these cases is to prune out some of the fruiting wood or to thin the fruit so as to greatly decrease the fruit load.

On other soils in the Sacramento Valley where the potash situation is not so acute, applications of potash may be effective in supplying enough potash to carry the crop through and prevent tree damage. In one such case under observation heavy potash applications made years ago to plots of prune trees still show very marked effects in tree and fruit, whereas comparable trees which have not received potash are in very poor condition.

The most important prune district is Santa Clara Valley, and here, although soils low in potash supply also exist, we find a very different picture. The trees do not set as much fruit, and six tons fresh yield per acre are considered a very good crop for the district. The climate is more moderate, and while summer hot spells occur, they are not so prolonged nor so intense as in the Sacramento Valley. The soils which are low in potassium supply do not seem to have the property of "locking up" potash applications to a serious extent. Small amounts applied to soils have been effective.

Prune trees growing on extremely potash-deficient soils in Santa Clara County are stunted, and it is not uncommon to see trees which are more than 30 years old no larger than good 6- or 7-year-old prune trees. The leaves show tip and marginal scorch, are small in size, and chlorosis of the leaf tissue is quite apparent. There is a certain amount of die-back of the smaller wood each year. This condition becomes very bad in the tops of the trees, but the trees do not die. They have adapted themselves to the soil condition and

Prune orchard in Chico, California, district suffering from die-back due to potash deficiency. Note tree in foreground almost gone because of "potash hunger."

linger on, bearing light crops of mostly poor quality fruit. A large part of the fruit crop "sunburns" each year.

Fertilizer tests on prune trees have been carried on with growers in the various prune districts for the past 25 years. It has been found that this fruit utilizes relatively high amounts of potash, as fruit crops go, and generally responds well to this fertilizer.

Several tests in recent years have been particularly interesting, not only because of the response of the crop to potash applications, but also because analyses of the leaves have been made on both potash-treated and untreated trees. These leaf analyses have shown

Comparisons of prune twigs from potash-deficient soils. Nitrogen-potash treated (left) and nitrogen only (right).

that potash-treated trees build up a higher content of potash in the leaves along with their increased production of fruit. The potash in the leaves of untreated trees stays at about the same level, and if this level is low, the trees either show die-back and leaf scorch or produce poor crops, or may show a combination of both of these troubles.

On the Rasmussen orchard at San Martin, California, fertilizer test plots have been carried on with both French prunes and sugar prunes. The soil type is Pinole loam of which there are about 3,000 acres in Santa Clara Valley. Some very low readings for potash have been noted on this soil type; while in some other localities on the same soil, tests have shown the potash to be in medium good supply. Because of a rather tight subsoil condition at varying depths, the root systems of the trees may be restricted in their feeding area. While trees on this soil body do not show severe potash deficiency symptoms, quite generally they are small in size and yields are therefore limited.

The fertilizer treatments compared were sulphate of ammonia, and sulphate of ammonia with sulphate of potash. The average yields of the treated and untreated plots and the 1941 yields are shown in following tabulations.

Average Yield of French Prunes for 4 Years and 1941 Yields Separately

Treatment	4-year average yield per acre, lbs. (dried)	1941 yield per acre, lbs. (dried)
No fertilizer	2,282.7	2,844.0
Sulphate of ammonia	2,632.5	2,979.0
Sulphate of ammonia and Sulphate of potash	4,210.5	5,706.0

It is of great interest to note the French prune leaf analyses for potash in 1941, keeping in mind that the yield of dry prunes was about doubled by the potash treatment. The leaves on the trees treated with sulphate of ammonia, without potash, contained 0.91% potassium; those on the trees treated with potash in addition to the sulphate of ammonia contained 1.94% potassium. These results of leaf analyses show that the large increase in the leaf content of potash went hand in hand with the great increase in fruit production obtained.

Average Yields of Sugar Prunes for 4 Years and 1941 Yields Separately

Treatment	4-year average yield per acre, lbs. (dried)	1941 yield per acre, lbs. (dried)
No fertilizer	1,473.7	1,422.0
Sulphate of ammonia	1,562.6	1,498.5
Sulphate of ammonia and Sulphate of potash	2,140.3	2,025.0

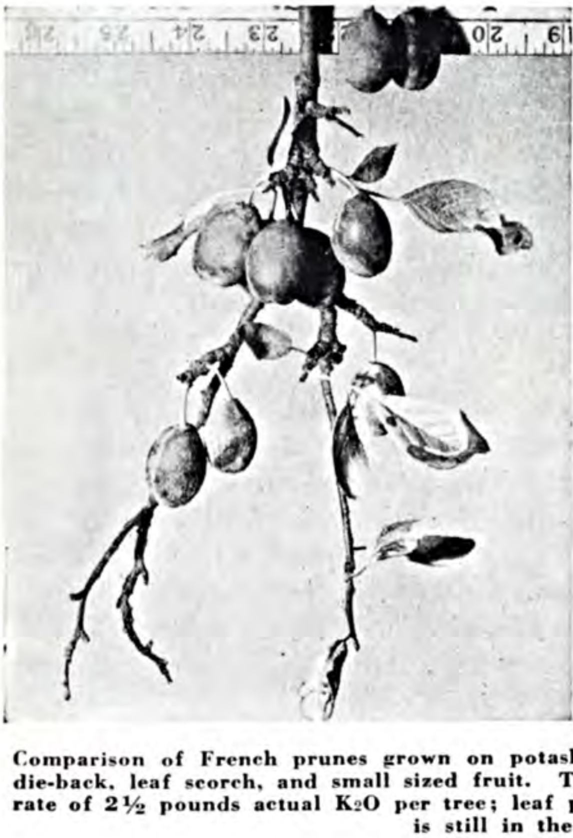
Although a substantial increase in yield of sugar prunes occurred with the potash treatment, this increase was not as large as in the case of the French prunes. Again, leaf analyses in 1941 corresponded to the results obtained in yield of fruit. The trees treated with only sulphate of ammonia had a potash content in the leaves of 1.06% potassium, while those treated with sulphate of potash in addition to the sulphate of ammonia had increased their leaf content to 1.72% potassium.

Additional tests have been carried out on the Otto orchard of French prunes at Morgan Hill, California. The main soil body in this orchard is classed as Rincon clay loam. In parts of the orchard a soil classed as Conejo clay adobe extends into the Rincon clay loam. Soil tests have shown the Rincon soil to be quite low in potash, and some low tests have been obtained on the Conejo soil. Poor drainage during some years of heavy winter rainfall undoubtedly has restricted root development of the trees in this orchard.

In a large part of the orchard the trees show severe potash deficiency symptoms, typified by small, severely scorched, and chlorotic leaves and small, "sunburned" fruit. The orchard has been irrigated at times and has been supplied with nitrogen and phosphorus fertilizers.

In 1936 four trees in a badly affected part of the orchard were treated with five pounds of sulphate of potash per tree. This treatment was repeated

(*Turn to page* 38)



Comparison of French prunes grown on potash-deficient soil. Without potash (left); note twig die-back, leaf scorch, and small sized fruit. Treated with potash (right) for several years at the rate of 2½ pounds actual K_2O per tree; leaf potash has been increased 300% in these trees but is still in the deficiency range.

W. M. Ross Conserves His Soil Fertility

By F. J. Hurst

Agricultural Adjustment Administration, Jackson, Mississippi

DESPITE the difficulties which have beset agriculture during the past two decades, you will find one or more successful farmers in practically every rural community—farmers who have developed their farms and improved their homes. It is both interesting and profitable to study such farms, one of the most successful of which is owned by W. M. Ross, who lives about eight miles north of Jackson in Hinds County, Mississippi.

Effective conservation of the soil and economical production of feed, major problems on nearly every farm, have been solved on this farm by the development of a scientific cropping system that puts the maximum acreage of all open farm land in sod-farming, soil-holding, feed-producing crops. And these crops are scientifically fertilized and economically harvested, either with labor-saving machinery or by grazing with dairy cows.

Agricultural research has shown that next to good forest cover, a thick sod of grasses and clovers is the most effective means of controlling erosion. A dense growth of grasses and clovers traps rainfall, slows water run-off, holds soil fertility, and at the same time produces the cheapest feed for all kinds of livestock. So, on the Ross farm you will find verdant pastures of luscious grasses and nutritious clovers, extensive meadows of luxuriant lespedeza, acres and acres of oats in the shock, and fields of tasseling corn and fruiting soybeans.

Of 615 acres of open farm land, Mr. Ross has 215 acres in improved permanent pasture; 120 acres in oats, 90 acres of which were seeded to lespedeza in February for hay, and 30 acres reserved for planting broadcast to Avoyelles soybeans after the oats were harvested; 50 acres of permanent lespedeza meadow; 25 acres of broadcast Laredo soybeans; 150 acres of corn interplanted to Biloxi soybeans; and 55 acres of cotton. Thus, only about one-third of all open farm land on this farm is devoted to cultivated row crops, and on this acreage either a summer or winter legume is grown. Bur clover is being grown for winter cover on cultivated land, and the acreage of this popular winter legume is being increased as the supply of home-grown seed is increased.

Follows Approved Methods

The most approved methods are followed in improving permanent pastures and in growing and harvesting field crops. There are seven well-fenced, well-kept permanent pastures on the farm to provide for rotational grazing and the best management of workstock, the milking herd, dry cows, and young dairy cattle.

The pastures are seeded to dallis grass, bermuda grass, carpet grass, lespedeza, hop clover, and white clover. Basic slag has been applied on a portion of the acreage in pasture, and recently Mr. Ross bought a carload of ground limestone for use on his permanent pastures. All pastures are mowed at least twice each year to control weeds. The productivity of the pastures is shown in the fact that they provide grazing for nearly one animal unit per acre from March through November.

Efficient use of fertilizer is playing an important part in maintenance of soil fertility and profitable production of crops. Mr. Ross says he "has taken the guess out of fertilization" by having his soils tested and by making a close study of results obtained from the use of fertilizers under crops on the farm. He says his soils are deficient in lime and potash, and his fertilizing practices are designed to meet the need for these two plant-food elements.

For cotton, Mr. Ross applies 400 pounds per acre of 8-10-10 in the drill when the land is bedded two to three weeks before planting time, and 100 pounds nitrate of soda and 35 pounds of muriate of potash mixed as a side-dressing soon after the cotton is chopped out.

For corn he uses 200 pounds per acre of 8-10-10 before planting and side-dresses with 100 pounds of nitrate of soda when corn is knee-high.

The 120 acres of oats, which this year yielded nearly 7,000 bushels, received an application of 200 pounds per acre of basic slag and nitrate of soda mixed in the proportion of 200 pounds of slag to 100 pounds of nitrate of soda. The mixture was applied broadcast with grain drill in February, just before lespedeza was seeded on the oats. Following application of this fertilizer, a rotary hoe was run over the oats to loosen the packed soil and hasten germination of the lespedeza seed, which was sown at the rate of 20 pounds per acre.

Biloxi soybeans are grown in all corn, and the entire crop—corn and beans—is saved. The corn and beans are harvested with a corn binder, and the stalks are run through a shredder. This gives a large supply of roughage, which is used for wintering young cattle and dry cows.

Mr. Ross has developed one of the highest producing dairy herds in the State. Although he has 175 head of dairy cows, he provides abundant pasturage and raises plenty of feed for them. Only a small quantity of concentrate feed is bought, and this is of the highest quality. He keeps a daily record of the production of each cow and feeds each animal concentrate according to her milk production. This assures him maximum production of milk from each cow at a minimum cost of feed.

His dairy barns and milk houses are models of sanitation. The milking barn is kept scrupulously clean. The cows are brushed thoroughly before

(*Turn to page* 41)

Mr. Ross in one of his fields of lespedeza which was 18 inches high on July 11. The yield on 140 acres averaged 3½ tons per acre.

Tobacco Growers Aim At Domestic Market

By Jack Wooten

Agricultural Extension Service, Athens, Georgia

TOBACCO growers should strive for domestic grades of leaf this year, in the opinion of J. M. Carr of the Bureau of Plant Industry who is stationed at the Coastal Plain Experiment Station, Tifton, Georgia. Every effort, he declares, should be made to grow the thin, luggy, ripe grades required by domestic tobacco manufacturers. He adds that if such an effort is made, there will still be produced sufficient quantities of export grades to satisfy the small export trade remaining.

Good plants transplanted to the field at the proper time are essential to good quality. Plants require proper heat, light, and moisture conditions and liberal quantities of plant food for early and rapid growth, according to Mr. Carr. Slopes to the south or southeast are warmer and promote more rapid plant growth than those facing north or west, because the sun strikes them earlier in the morning and more directly.

One year's tests on different slopes indicate that a south slope will produce 3 times as many early plants as the same degree of slope to the north and about 50 per cent more early plants than east or west slopes, the tobacco expert points out. Plant beds can also be made warmer by natural or artificial windbreaks on the north and northwest sides. Light conditions in most cases may be improved by cutting all trees that shade the south and east sides of seedbeds.

Attempts have been made experimentally to increase the light intensity on seedbeds by the use of aluminum-painted reflector boards placed so as to reflect the light downward on the plants. These boards did increase the light intensity on the beds and thereby increased the heat, resulting in more rapid plant growth. However, the soil dried out rapidly, necessitating frequent watering and very close attention.

Except where permanent water systems are available the moisture factor is largely one of rainfall, but many things may be done to make best use of the natural water supply or avoid damage from it. Since tobacco seed will not germinate except when the surface of the seedbed is moist, trouble is often experienced in securing a stand of plants. This was one of the biggest factors delaying the 1941 crop.

Aids to Germination

Germination may be helped materially by packing seedbeds firmly and to a smooth surface. The best way to accomplish this is with a heavy roller. Tramping by foot leaves the surface irregular and subject to rapid drying. However, heavy irregular packing is to be preferred over light smooth packing. Artificial watering should be done with some form of sprinkler rather than with a pan or bucket. All beds should, of course, be ditched to prevent the accumulation of excess water in periods of heavy rainfall.

Speaking of fertilization of tobacco, Mr. Carr says: "While plant food or fertilizer is essential to plant growth, it is not any more so than proper heat, light, and moisture conditions. Experiments have shown that tobacco seedbeds require approximately 2 pounds per square yard of a fertilizer analyzing 4 to 5 per cent nitrogen, 8 per cent phosphorus, and 3 per cent potash. Nitrogen is required in comparatively large quantities, but the heavy rates of fertilizer applications made on tobacco seedbeds make it possible to hold the potash content of such fertilizers to a rather low level.

"All potash in tobacco seedbed fertilizers should be derived from sulphate of potash or some form other than muriate. Practically all nitrogen applied to seedbeds prior to seeding should be in a form other than nitrates. Nitrates leach readily and are usually gone by the time the seed germinates and the plants have become established. However, nitrates make excellent top-dressers due to their solubility and availability and can be best applied in a solution of 5 pounds nitrate of soda or similar material in 50 gallons of water for every 100 square yards of seedbed area. Such an application should be followed with 50 gallons of water to wash the solution from the plants into the soil where it can be utilized."

Domestic Types Desired

In the seedbed, Mr. Carr adds, vigor and rapid growth are highly desirable, and quality is not a factor. However, after the plants are transferred to the field, quality becomes the primary consideration. The present demand, he reiterates, is for domestic types of tobacco which are luggy, thin, and ripe. "Highly colored, clear-leaf tobacco formerly going to high-class export trade is not in so strong demand as it was prior to the outbreak of the present war. We must, therefore, strive to produce the type most in demand and alter our methods of production accordingly."

There are a number of factors governing the type of tobacco produced, many of which the grower may control in part or entirely. Rainfall is the most important factor governing quality, and is the only factor over which the grower has no control. However, the farmer may select soils that are low enough not to suffer too much in temporary drought and yet rolling enough to drain properly during wet weather.

"Growers may be rather limited in the choice of soil for tobacco on their farms, but there is always some soil on every farm that is better suited to tobacco than others," Mr. Carr says. "These soils should be selected and a systematic rotation established with a view to disease control and the production of quality. From the standpoint of both quality and disease control, a three-year rotation of tobacco the first year, Spanish peanuts the second year, oats followed by a natural growth of weeds the third year, and back into tobacco the fourth year is as good as we have tried."

Quality is also governed to a considerable degree by the variety used. Experiments at the Georgia Coastal Plain Experiment Station have shown that Gold Dollar, Yellow Mammoth, Virginia Bright Leaf, and Bonanza are all excellent varieties. New varieties are being developed in which it is hoped to incorporate higher yields and better quality, together with some degree of disease resistance.

"Next to seasons and soil, fertilizers probably play the most important role in the production of quality," according to this tobacco specialist. "Overfertilization, especially excessive applications of nitrogen, quickly destroys quality. On the other hand, underfertilization reduces yield but will produce good quality. It is therefore much better to underfertilize than to overfertilize. Tobacco fertilizer formulas should contain the various plant-food elements in rather definitely balanced ratios. Under most conditions these fertilizers should contain 3 per cent nitrogen, 10 per cent phosphorus, 10 per cent potash, 2 per cent magnesia and 2 per cent chlorine.

"Certain quantities of calcium and sulphur are also required but are usually supplied in sufficient quantities by materials now in common use. On soils having a comparatively high potash

(*Turn to page* 37)

PICTORIAL

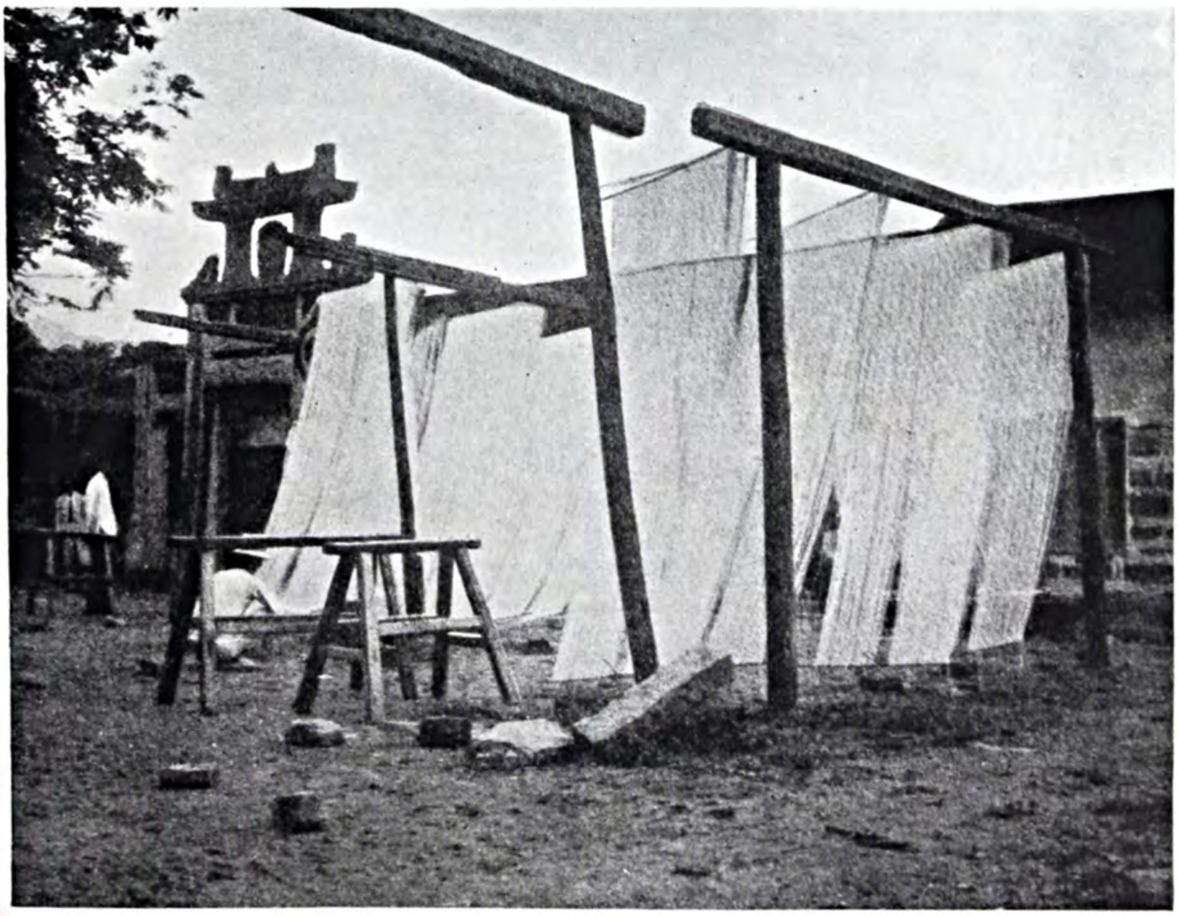
Yassuh, we'se gittin an early start on all we wants to eat this year.

Above: Tea pickers on their way home; Pengalengan Plateau, Java.

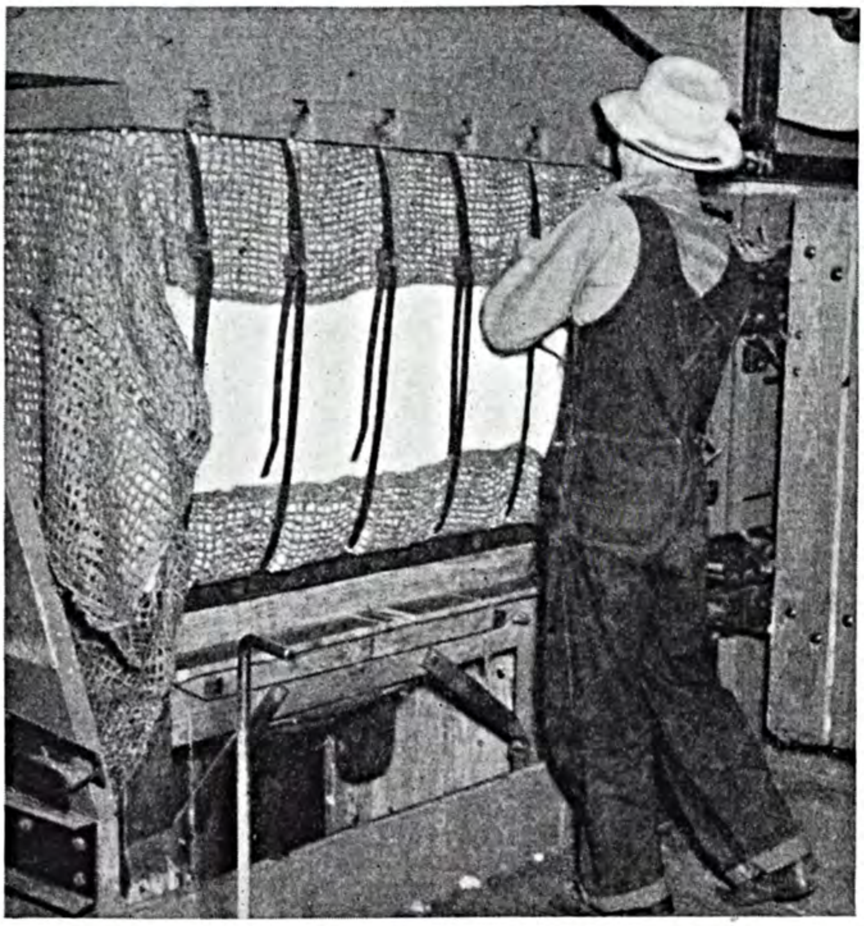
Below: Rice terraces in Bali; intensive farming feeds thousands.

Above: Work animals in the Philippines also provide transportation.

Below: Drying noodles at a factory near Amoy, southeastern China.



Above: Floyd Hiner (left) and E. W. Doubet, twin Corn Kings at the International Hay and Grain Show, Chicago. This is the first time in the history of the Exposition that the judges could not find one sample of corn on which to agree for the Grand Championship, so today both men are possessors of the Purple Ribbon. Mr. Hiner farms 160 acres in Rush County near Lewisville, Indiana, and Mr. Doubet farms 340 acres in Peoria County near Hanna City, Illinois. Both men produce about 60 acres of hybrid corn and both have been Reserve Champions but never Grand Champions at the International Show. Both also use 125 pounds of fertilizer per acre on their corn, but Mr. Doubet prefers a 2-16-8 analysis and Mr. Hiner a 2-12-12.



Left: "King Cotton" put up in bales like this commands honor for grower and handler.

The Editors Talk

The Forty-third Convention

Geared to war-time efficiency, the Association of Southern Agricultural Workers held its 43rd annual convention in Memphis, Tennessee, Feb. 4-6. Although the attendance, more than 800, was smaller than in some previous years, those present considered with a marked seriousness the problems of "Southern Agriculture in a Changing World," the theme set for all general and group conferences. This theme undoubtedly was picked in early preparations for the convention and before the United States entered the war. However, there was no mistaking the quick translation of "Changing World" to "Victory Program" in any of the sessions. The South is up in arms and ready to direct all of its research and advisory work into channels which will be the most effective in meeting the demands of the Government.

Today the South is much better prepared for more home gardens, more livestock and livestock products, increased production of vegetable oils, more fruits and vegetables, and other agricultural products with which to face our national crisis. The emphasis on the diversification or "live-at-home" program, started in these conferences several years ago, has borne fruit. The attention given its long-cropped soils is yielding results in rebuilding fertility and stopping erosion.

In connection with the ever due regard which should be accorded soil fertility, one of the resolutions passed by the convention related to fertilizers:

> "That the appropriate Federal agencies be advised of the inability of the South to produce needed crops without liberal quantities of fertilizers and that they be urged to give this fact special consideration in the allocation of nitrogen materials and mixed fertilizers; that fertilizer manufacturers make every effort to sell the grades that are recommended by the agricultural colleges of the South and grades that do not contain inert or worthless filler; and, further, that the agricultural agencies in cooperation with fertilizer manufacturers make every effort to reduce the total number of grades to the minimum number required to meet crop needs in the States where such action has not already been taken; that farmers be urged to order and receive their fertilizer in an orderly manner throughout the season and to employ the most efficient methods of application in order to obtain maximum yields from the fertilizer used."

New Orleans was chosen as the meeting place next year. It is to be hoped that nothing will prevent this gathering of representatives of all branches of agricultural science. The convention is needed, for it is "common ground" for all the forces so conscientiously working for the constant improvement of the South—the Nation's largest and most important source of agricultural products.

"In the Clover" A New Motion Picture

"In the Clover" is the title of a new motion picture made by the American Potash Institute in cooperation with agronomists of Northeastern agricultural colleges. Copies of the film are now ready for loan by the Institute to county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade for showings to interested groups. Requests should be directed to the Institute, 1155 Sixteenth St., Washington, D. C. To insure bookings this spring, alternative dates of showing should be given wherever possible. The picture is in color, silent, 16 mm., on 400 ft. reels, running time 45 minutes, and tells a human-interest story of the value of this crop in successful farming in the Northeast.

Ladino clover is a relatively new crop in America. Like any other new thing which promises to be of value to a large number of people, this crop has aroused an interest that is growing by leaps and bounds. Established on the irrigated lands of the Pacific Coast early in this century, Ladino is now being grown in many States in the Northeast. It can be grown in any area of the country having a normal rainfall of two inches or more per month, and particularly in valleys which get the effects of seepage. Strains of this clover, such as Louisiana clover, have shown marked adaptability in Southern regions. More research and greater refinement of plant selection may extend the growing of this legume to every important livestock growing area.

In the January issue of this magazine, an article by S. D. Gray reviewed the introduction and early development of this crop and outlined the important essentials for successfully growing it in the Northeast. Reprints of this article are available upon request.

For what avail the plow or sail,
Or land, or life, if freedom fail?

RALPH WALDO EMERSON

Garden Fever

As the days lengthen and the warm sun draws people outdoors, "garden fever" will descend upon us. The "temperature" will rise to much greater heights this year due to the war and the publicity given the value of home gardens and the Government's greatly increased vegetable goal. With no disparagement to the good effects of garden fever at any time and the very commendable enthusiasm which is currently being aroused, the experienced will realize that in some instances a sedative should be applied.

Unwise gardening endeavors are to be discouraged. Out of the National Victory Garden Conference held in Washington, D. C., in December came the recommendation that all back yards should not be plowed up for the sake of growing a few vegetables. Such a procedure would waste limited seed supplies, fertilizer, and other materials needed by farmers and commercial vegetable growers. Community plots or large-scale school gardens which can be located on fertile soil and in accessible places, with supervision and adequate instruction and help available, should be encouraged.

Considerable tact undoubtedly will have to be employed by advisory forces in directing garden enthusiasm. It will be an added burden to their already crowded schedules, but one which will prove immensely satisfying if it results in the kind of increased vegetable growing which the Government wants.

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 soils of Idaho have not been farmed so long as those in the East and South, but already they are beginning to show indications of fertility depletion due to continued cropping without replacement of the plant foods used. Agricultural authorities are alive to the situation and have conducted many experiments to determine the fertilizer needs of the soils of the State. Recommendations based on this work are given in Idaho Agricultural Extension Bulletin 138, "Fertilizers for Idaho Farms," by H. W. E. Larson. The author points out that markedly lower yields are now obtained in many parts of the State compared to 15 or 20 years ago. One of the reasons for the rapid depletion of soil fertility is the favorable climate, resulting in high yields with consequent greater removal of plant foods.

The author gives the amounts of nitrogen, phosphoric acid, and potash removed by a large number of crops, discusses briefly the functions of the principal plant foods and sources of plant foods in fertilizer materials, and gives recommendations for the important crops grown in the various parts of the State. Available phosphorus is low in many of the soils and this is reflected in the rather general recommendation of phosphorus fertilizers. Many of the soils are better supplied with available potash, but the author states that the large amounts of this nutrient removed by most crops will increase the need for potash. Already a number of soils are showing a response to this nutrient. Nitrogen is needed on soils low in organic matter that are not having legumes turned under regularly. Some of the high-lime soils are deficient in iron, and boron has also been found to give beneficial results, especially on alfalfa growing on soils in the northern part of the State. All farmers and agricultural advisers in Idaho will find this bulletin very useful, as will others interested in fertilizer usage in the Western States.

¶ Remarkable results from the use of borax on alfalfa are described by T. B. Hutcheson and R. P. Cocke in Virginia Experiment Station Bulletin 336 entitled "Effects of Boron on Yield and Duration of Alfalfa." The authors describe the typical yellowing on alfalfa due to boron deficiency and differentiate between yellowing due to this cause and other causes such as leafhopper injury, potash deficiency, or other factors causing a weakened plant. Results of experiments conducted at several locations in the State in which marked increases were obtained in yields of alfalfa due to the application of 10 to 20 pounds of borax per acre are given.

Of possibly even greater importance is the effect of borax on the life of the stand. In many places in Virginia most of the alfalfa dies out the second year and by the third year has almost entirely disappeared. This dying out is prevented by the addition of borax. The work has not yet progressed to the point where it is possible to state how long the stand is prolonged by the borax application. The authors state that in the experiments conducted for the past two years where no borax was applied alfalfa has almost completely died out, while where the borax was applied the alfalfa stand is healthy and vigorous.

An experiment on the effects of high applications of borax showed that yields were increased slightly with additions up to 60 pounds per acre and even with applications up to 100 pounds per acre there was only a slight depressing effect. The authors conclude from this that there is little danger of building up boron toxicity in the soil by the recommended application of 10 to 20 pounds of borax per acre annually. They do suggest that until further information is obtained on the carry-over effects of borax soils treated with borax should not be planted to dark tobacco the following year.

The influence of borax on the setting of seed on alfalfa also was investigated with very marked differences being obtained. Where the alfalfa was treated with borax there was a good set of seed, while where no borax was applied there was little or no seed set.

As a result of this work the authors recommend that boron deficiency on alfalfa soils may be corrected by applications of 10 to 20 pounds of borax per acre, either when the alfalfa is seeded or as a top-dressing in the spring or after any cutting. They state that the borax will increase the yield on boron-deficient soils, stimulate seed production, and increase thickness and duration of the stand. These results are of great importance to alfalfa growers. When borax is used along with other cultural practices, it apparently will be an important factor in obtaining and keeping good alfalfa fields.

¶ While the use of boron as a plant nutrient is a comparatively new development, interest in this subject has been very great and widespread within recent years and a remarkably large volume of literature has appeared. It is important that those interested in this field should occasionally survey the entire situation to learn the trends in the information being obtained and what gaps in our knowledge need to be filled. E. L. Overholser of the Washington Agricultural Experiment Station has made an important contribution of this type. He prepared this for the symposium on boron deficiency of horticultural crops held during the meetings of the American Association for the Advancement of Science at Pasadena, California, June 1941. His paper has been issued as an unnumbered mimeographed publication of the Experiment Station. He quotes from more than 150 references, briefly giving summaries covering the field of boron usage as a nutrient and suggestions of possible future lines of investigation.

"Annual Report of Commercial Fertilizers and Agricultural Minerals, July 1, 1940, to June 30, 1941," Div. of Agr., Denver, Colo., Nov. 1941.

"Fertilizers for Idaho Farms," Agr. Ext. Serv., Moscow, Idaho, Bul. 138, Sept. 1941, H. W. E. Larson.

"1940 Maine Fertilizer Sales," Agr. Exp. Sta., Orono, Maine.

"Fertilizers for Minnesota Small Grains," Agr. Ext. Serv., University Farm, St. Paul, Minn., Folder 101, Oct. 1941, George H. Nesom.

"Fertilizers for Minnesota Corn," Agr. Ext. Serv., University Farm, St. Paul, Minn., Folder 102, Oct. 1941, George H. Nesom.

"Fertilizers for Oklahoma Potatoes," Agr. Exp. Sta., Stillwater, Okla., Bul. B-249, Oct. 1941, Earl F. Burk.

"Commercial Fertilizers—Concerning Fertilizer Usage," Agr. Exp. Sta., Burlington, Vt., Bul. 476, Sept. 1941, L. S. Walker and E. F. Boyce.

"Effects of Boron on Yield and Duration of Alfalfa," Agr. Exp. Sta., Blacksburg, Va., Bul. 336, Aug. 1941, T. B. Hutcheson and R. P. Cocke.

Soils

¶ It has long been the hope of farmers and farm advisers that some day it would be possible to take a sample of soil, analyze it, and determine what it lacks to produce high yields of crops. Progress has been made in this direction, although investigators have pretty well given up the idea that it will be possible to analyze a soil chemically and from this alone tell just what is needed to grow a big crop.

The information that can be expected from testing soils is briefly discussed by F. E. Bear in New Jersey Agricultural Experiment Station Circular 417, "Testing Soils for Deficiencies." Dr. Bear points out that soil tests have now been worked out to the point where a careful investigator can determine the relative amounts of nutrients present and from this, based on his experimental work in the field, made a recommendation as to the lime and fertilizer likely to give good results. These results, however, cannot be guaranteed since weather, a factor which cannot be anticipated, plays an important part. The soil sample also may be a factor which can throw off the investigator since an improper sample may give rather misleading results. Directions on how and when to take a sample are given and also a resume of the tests that are made on the soil. It is pointed out that the test for acidity is the most important since the proper soil reaction is the first thing that must be corrected if good results are to be obtained.

Dr. Bear states that nearly all soils in New Jersey lack phosphate and that an increasing number are becoming deficient in available potash. The possibility of the need for magnesium, manganese, and boron also is discussed. Supplementing soil tests with plant tissue tests and with observation of nutrient deficiency symptoms on plants is suggested. By using all three methods of determining the fertility status of the soil, best results are most likely to be obtained.

¶ An inventory of the soils of Michigan is made by J. O. Veatch in Michigan Agricultural Experiment Station Special Bulletin 231, entitled "Agricultural Land Classification and Land Types of Michigan." The large soil groups are described, and a table of all the soil series so far mapped gives a brief description of the series, the general character of the land, its agricultural use and value, and the approximate area of each particular kind of soil. The proportion of good, fair, marginal, and poor soils in each county, and the areas of land suitable for growing the important crops in the State are given. This bulletin would appear to be an excellent basis for planning agricultural programs in Michigan.

"Warren County Soils," Agr. Exp. Sta., Urbana, Ill., Soil Rpt. 70, Oct. 1941, Herman Wascher and R. S. Smith.

"Agricultural Land Classification and Land Types of Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 231 (Rev.), Oct. 1941, J. O. Veatch.

"Testing Soils for Deficiencies," Agr. Exp. Sta., New Brunswick, N. J., Cir. 417, Sept. 1941, Firman E. Bear.

"Selenium Occurrence in Certain Soils in the United States, with a Discussion of Related Topics: Sixth Report," U. S. D. A., Washington, D. C., Tech. Bul. 783, Oct. 1941, H. W. Lakin and H. G. Byers.

"1942 Agricultural Conservation Program for the North Central Region," U. S. D. A., Washington, D. C., NCR-601, Dec. 1941.

"Soil-building Practices, 1942 Farm Program," U. S. D. A., Washington, D. C., NCR-601, Supp. 1, Jan. 5, 1942: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin.

Crops

¶ Coming at a time when the agricultural program calls for a greatly increased acreage and production of peanuts, Georgia Experiment Station Circular 131, "Cultural Methods for Growing Peanuts," by U. R. Gore is a helpful contribution to the war effort. Brief and practical information on all the phases connected with growing this crop are given. The author points out that while the crop is now grown mainly in the Coastal Plain section, there is no reason why it cannot be grown in the Piedmont and other sections of Georgia.

Seed should be carefully selected and treated before planting. The fertilization of the crop is very important since peanuts make a very heavy drain on the nutrient supply of the soil. While the author states that on fertile soils previously well fertilized no fertilizer may be needed for peanuts, it should be kept in mind that proper fertilization is not only important for the peanut crop itself but for the following crop since experimental work at other stations has shown that unless peanuts are well fertilized and especially with potash the crop following peanuts will suffer. Dr. Gore states that on most soils 300 pounds of a 3-8-8 fertilizer with an extra nitrogen top-dressing is a good general recommendation. Another method of fertilization is to apply superphosphate at planting time and use a nitrogen-potash top-dresser. Care should be taken that the fertilizer does not come in contact with the seed. All peanut growers, and certainly those who are not regularly growing the crop but are doing so this year under the expanded acreage program, could well afford to have this circular for guidance.

¶ Sweet clover is a legume which in many parts of the country is often neglected and even regarded as a weed. That it is unfortunate the many good qualities of this vigorous legume are not more fully understood is brought out by E. N. Fergus, R. Kenney, and W. C. Johnstone in Kentucky Extension Circular 366, "Sweet Clover for Kentucky." The authors state that if the soil is not acid and is fairly well supplied with minerals, sweet clover will grow under conditions unfavorable to many other plants. It will cover gullies, and what is even more desirable it favors the growth of grasses so that the soil soon becomes permanently covered and protected against erosion. Sweet clover can be used as a green manure crop, as a pasture crop, and for hay. If the soil is acid, it should be limed and appropriate amounts of phosphate and potash should be applied before seeding the crop. While sweet clover is a soil-improving crop so far as nitrogen is concerned, it makes heavy demands on the phosphate and potash in the soil. The authors bring out that potash especially may become deficient even though barnyard manure is returned, unless potash is included in the fertilizer for the crop. Practical directions on how to grow the crop and how to utilize it are given in the circular.

¶ Another neglected legume is Ladino clover. Although it has been known for some years, only within the last 5 or 10 years has any serious attention been given to it in this country. It is related botanically to ordinary white clover but is much taller. A series of experiments which give much valuable information on growing Ladino clover and how best to take advantage of its desirable features is described by B. A. Brown and R. I. Munsell in Connecticut (Storrs) Agricultural Experiment Station Bulletin 235, "Pasture Investigations." Experiments were conducted over a period of 10 years and covered a wide range of factors involved in growing the crop. It was found that Ladino clover seeded alone did not yield as much forage as mixed Ladino clover and grass. Under conditions in Connecticut, orchard grass and timothy are better companion crops than the bluegrasses or bent grass. If the mixture was to be cut for hay, timothy was preferable, while if the mixture was to be used for pasture, orchard grass appeared better. A combination of grasses and Ladino clover appeared to be effective due to the grasses preventing winter heaving and killing of the clover. No advantage was found with a mixture of grasses and Ladino clover over a single grass with the clover. Trials in seeding Ladino clover on cut-over land or sod without cultivation have on the whole been unsuccessful.

Ladino clover can withstand less favorable conditions than alfalfa, but for good yields and long-lived stands the soil should not be too acid and mineral fertilization should be provided. It is therefore recommended that on acid soils a generous liming be given. In order to take care of the high mineral requirements of Ladino clover and replace the rather large amounts of nutrients removed in the crop, good applications of phosphate and potash are recommended. It is stated that a good crop of Ladino clover and grass mixture may remove from the soil about 40 pounds of phosphoric acid, and up to 100 pounds of potash per acre annually. The fertilization should replace about these quantities of plant food. This would be equivalent to 200 to 300 pounds of superphosphate and 175 pounds of high-grade muriate of potash, which quantities are recommended by the authors. If very heavy applications of manure are made, these quantities might be reduced. The authors conclude that there is no need for applying nitrogen to fields having one-third or more of the stand composed of Ladino clover. So far none of the minor elements tried has given any beneficial results.

The authors strongly recommend that close and continuous grazing be avoided if a long-lived stand of Ladino clover and grass mixture is desired. Intermittent grazing with ample rest periods for the clover and grass to make good growth is strongly suggested. While no actual feeding trials with Ladino clover were conducted by the authors, they noticed that the animals seemed to like it very much. Chemical analyses indicate that it should have a high feeding value. The grass growing along with Ladino clover profits by the presence of the clover and also has a higher feeding value than ordinary grass growing alone.

¶ A timely publication is "The Year-round Home Garden" by R. O. Monosmith, issued as Mississippi Extension Bulletin 121. This bulletin gives excellent and very complete information on growing vegetables for the home. The country has been called upon to produce the largest amount of foods in history and in order to do this each farm must grow its share of vegetables. As pointed out by the author, this is very much to the benefit of the farmer since a home garden is both profitable and healthful. The garden should be located near the house in a protected position, and steps should be taken to make the soil as rich as possible. Manure and green manure should be turned under and liberal fertilization given. Mr. Monosmith states that 20 tons of barnyard manure per acre are not too much and this should be supplemented with 600 to 800 pounds of a complete fertilizer such as 6-8-8 or 4-8-8 plus additional phosphate and nitrogen as needed. Extra nitrogen top-dressers are frequently desirable in connection with growing of the leafy vegetables. Rather complete cultural directions for all the important vegetables, planting dates, and suggested arrangements of the garden to provide fresh vegetables for the entire year are given:

"Hairy Vetch," Agr. Ext. Serv., Little Rock, Ark., Cir. 201, Aug. 1941, Charles F. Simmons.

"Fifty-fourth Annual Report, 1940-41," Agr. Exp. Sta., Fort Collins, Colo.

"Propagation of Plants," Agr. Exp. Sta., Fort Collins., Colo., Bul. 468, Nov. 1941, L. R. Bryant and George Beach.

"Pasture Investigations, Ninth Report, Ladino Clover Experiments, 1930 to 1940," Agr. Exp. Sta., Storrs, Conn., Bul. 235, July 1941, B. A. Brown and R. I. Munsell.

"Crisp-head Lettuce in Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 365, Dec. 1941, J. R. Beckenbach, F. S. Jamison, R. W. Ruprecht, and F. S. Andrews.

"Cultural Methods for Growing Peanuts," Agr. Exp. Sta., Experiment, Ga., Cir. 131, Nov. 1941, U. R. Gore.

"Sweet Clover for Kentucky," Agr. Ext. Serv., Lexington, Ky., Cir. 366, June 1941, E. N. Fergus, Ralph Kenney, and W. C. Johnstone.

"Trace Metals and Total Nutrients in Human and Cattle Foods," Agr. Exp. Sta., Amherst, Mass., Bul. 379, July 1941, E. B. Holland and W. S. Ritchie.

"The First Twenty Years Results in a Michigan Apple Orchard," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 313, Dec. 1941, Walter Toenjes.

"Protein Surveys of American Hard Spring and Soft Winter Wheats," Agr. Exp. Sta., University Farm, St. Paul, Minn., Tech. Bul. 147, June 1941, C. H. Bailey.

"The Year-round Home Garden," Agr. Ext. Serv., State College, Miss., Ext. Bul. 121, Apr. 1941, R. O. Monosmith.

"Management of Sweet Clover in a Pasture System," Agr. Exp. Sta., Columbia, Mo., Cir. 215, Nov. 1941, C. A. Helm.

"Mineral Composition of Freshly Fallen White Pine and Red Maple Leaves," Agr. Exp. Sta., Durham, N. H., Tech. Bul. 77, June 1941, W. H. Lyford, Jr.

"Studies on the Bitter-pit Disease of Apples," Agr. Exp. Sta., Durham, N. H., Tech. Bul. 78, June 1941, O. R. Butler and Stuart Dunn.

"New Lawns," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul 429, Mar. 1940, Donald J. Bushey.

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

"The Wheat Contest—1941," Agr. Ext. Serv., Clemson, S. C., Cir. 199, Oct. 1941.

"Tennessee Shipper Strawberry," Agr. Exp. Sta., Knoxville, Tenn., Cir. 76, Dec. 1941, Louis A. Fister.

"Blossom Position in Pear Clusters and Set of Fruit," Agr. Exp. Sta., Burlington, Vt., Bul. 471, June 1941, E. W. Jenkins.

"Report of the Commissioner of Agriculture and the State Board of Agriculture and Immigration, 1939-1940," Dept. of Agr. and Imm., Richmond, Va.

"What's New in Farm Science," Agr. Exp. Sta., Madison, Wis., Bul. 453, Dec. 1941, Part I. An. Rpt. of Dir.

"Report of the Secretary of Agriculture, 1941," U. S. D. A., Washington, D. C.

"Report of the Chief of the Office of Experiment Stations, 1941," U. S. D. A., Washington, D. C.

"List of Bulletins of the Agriculture Experiment Stations for the Calendar Years 1939 and 1940," U. S. D. A., Washington, D. C., Misc. Pub. 459, Dec. 1941, Catherine E. Pennington.

Economics

¶ Bulletin 335 of the Nebraska Experiment Station "Income Levels of Contract Beet Workers in Nebraska," by F. Miller reports the results of a scientific approach to the problem of annual income levels of sugar beet contract workers in Nebraska. Since the involvement of this country in the war and the loss of supply of sugar from the Pacific area, our interest is all the more centered in the domestic beet sugar industry.

The growing of sugar beets requires approximately 93 hours of man labor per acre. Hand operations, including the loading of the beets when they are hauled from the fields, usually require about 53 man hours. Thus the opportunities for employment in the sugar beet field have attracted many people to the beet-growing areas of Nebraska and other important beet-producing states. It has been observed that the people who have grouped themselves around the industry vary a great deal in their capacity to accomplish useful work. The growing of sugar beets is a specialized type of agricultural production requiring skill and fitness of workers if the job is to be carried on efficiently.

The wages paid in the beet field are on a piece-work basis, and since 1934 minimum wages have been established for different areas of the country by the Secretary of Agriculture. For example, in the beet-producing areas of Scotts Bluff and Morrill counties, the minimum labor contract calls for $8 per acre for bunching and thinning, $2.50 per acre for hoeing, $1.50 per acre for weeding and 80¢ per ton for pulling and topping. Provisions of the Jones-Costigan Act setting up this procedure also provide that children under 14 years of age cannot be employed in the beet fields, and children 14 to 15 years of age may be employed only 8 hours per day.

The author calculated the average income levels of the beet workers' families through the survey method. Records were obtained from 135 families concerning the number and age of workers, acres of beets cultivated and harvested, the income from beet work and from all other sources, and the value of prerequisites furnished by the growers. The study disclosed that there was a rather wide variation in the average annual income of the various families ranging from $693.06 to $2,986.71. About 9.6% of the families interviewed received incomes between $693 and $800, and 20.7% received incomes in excess of $1,500. The average income of the 135 families from whom information was obtained was $1,296.08.

Approximately 78% of the families interviewed obtained living quarters from the growers during the beet-producing season. The size of houses furnished varied from one room up, with 56.2% having three or more rooms and about 26% having four or five rooms. Thirty-eight of the families interviewed owned homes clear of debt. Only three of the families interviewed did not own either an automobile or a truck. Purchase price of the automobiles varied from $25 to $1,468 and averaged $518.58. One-third of the fathers and 30.5% of the mothers in the families contracting beet work had never attended an organized school. It was found that children over 16 years of age who were reared by families contracting beet work had received more educational training than their parents. Only 2.9% of the children over 16 years of age had not completed at least one grade of school, and more than one-fourth of them had received some high school training.

"Types of Farming in California Analyzed by Enterprises," Agr. Exp. Sta., Berkeley, Calif., Bul. 654, Sept. 1941, L. A. Crawford and Edgar B. Hurd.

"What the Farmers Told Us in Cumberland County," Dept. of Agr., Halifax, N. S., Bul. 5, Oct. 1941.

"Illinois Farm Outlook for 1942," Agr. Ext. Serv., Urbana, Ill., Cir. 520, Jan. 1942.

"Earn AAA Tree Payments," Agr. Ext. Serv., University Farm, St. Paul, Minn., Pamph. 86, Dec. 1941.

"Income Levels of Contract Beet Workers in Nebraska," Agr. Exp. Sta., Lincoln, Nebr., Bul. 335, Nov. 1941, Frank Miller.

"Progress in Achieving Soil and Water Conservation and Its Economic Aspects on Dairy Farms in the Flemington Area, New Jersey," Agr. Exp. Sta., New Brunswick, N. J., A. E. 54, Oct. 1941, Charles Messer, John W. Carncross, and Allen G. Waller.

"For Better Farming in Western North Carolina," Agr. Ext. Serv., Raleigh, N. C., Cir. 252, Oct. 1941, R. W. Shoffner.

"Quality-price Relationships of Cotton at Local Markets in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Bul. 250, Oct. 1941, Trimble Raymond Hedges.

"Forage Seed Crops—1940, Production and Income Statistics for Oregon by Counties," Agr. Ext. Serv., Corvallis, Oreg., Cir. 375, Aug. 1941, M. D. Thomas, L. R. Breithaupt, and N. I. Nielsen.

"Farmers' Marketing and Purchasing Associations in Tennessee," Agr. Exp. Sta., Knoxville, Tenn., Bul. 177, Sept. 1941, B. D. Raskopf and P. W. Voltz.

"AAA Faces the Future," U. S. D. A., Washington, D. C., G-112, July 1941.

"Annual Report of the Manager of the Federal Crop Insurance Corporation, 1941," U. S. D. A., Washington, D. C.

"Agricultural Statistics, 1941," U. S. D. A., Washington, D. C.

"Annual Report on Tobacco Statistics, 1941," U. S. D. A., Washington, D. C., Nov. 1941.

Old Crops Coming Home

Modern civilization is indebted to the Americas for many products now essential, of which the Old World knew nothing before Columbus discovered the New World, says an article in "Agriculture in the Americas," monthly Department of Agriculture publication.

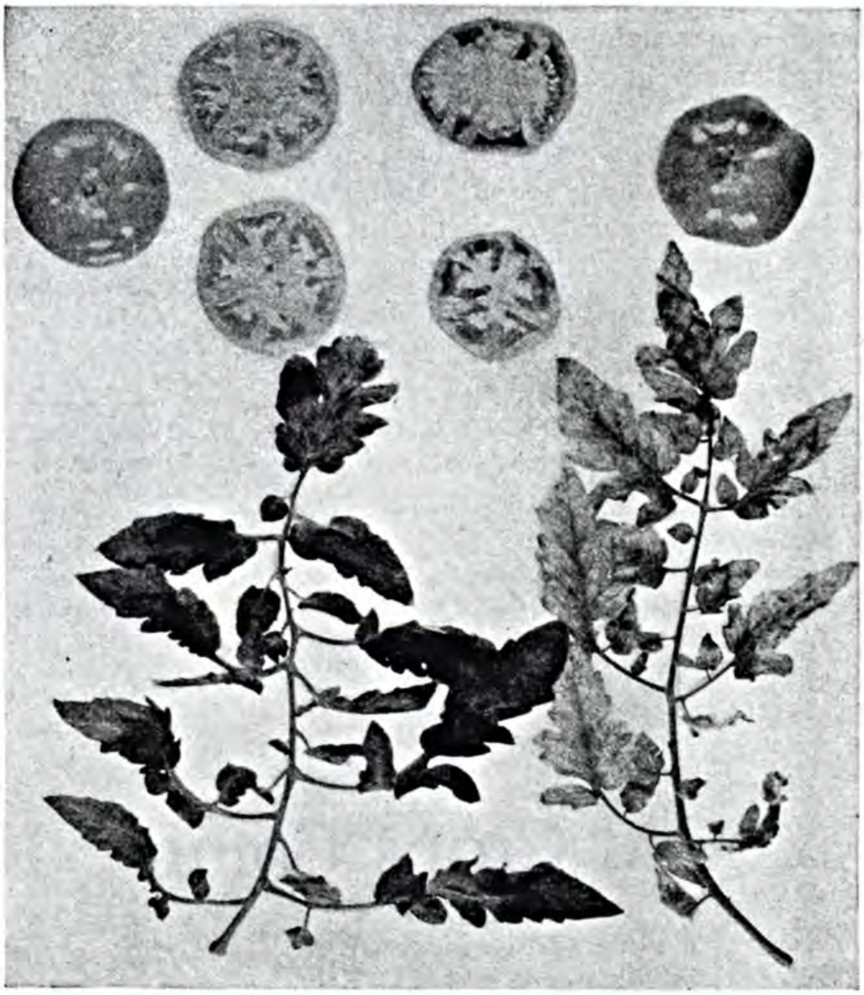
As outstanding American natives, the author, E. R. Burkland, includes corn, grown from Canada to Patagonia; sweet and white potatoes; cocoa, used by the Aztecs as a food and as a medium of exchange; the peanut, found in ancient graves in Peru; rubber, particularly from the cultivated Hevea tree; the tomato; the pecan; the drugs, quinine and cocaine; vanilla; and numerous products less widely known, such as quebracho extract for tanning; the fibers, kapok, henequen, and sisal; manioc root, the source of tapioca starch; and important rotenone-bearing plants used in insect poisons.

"Today, many of these American natives are grown more widely outside than in the Americas," says Burkland. "The potato is of outstanding importance in northern Europe, and maize is a staple food in Italy, Spain, and southeastern Europe. The sweet potato was distributed across the Pacific and is well-nigh universal in tropical and sub-tropical countries. British India, China, and Africa are the chief peanut-producing areas.

"Many of these crops of American origin are now produced in the Western Hemisphere either not at all or in such small quantities that consuming countries depend on sources outside the Western Hemisphere, where American natives thrive in foster homes. An important phase of the hemispheric agricultural program is to reestablish on their native soil products the Americas gave to the world."

Fertilizing for More and Better Vegetables

(*From page* 14)



Healthy tomato leaf and fruit (left); potash-starved leaf and fruit (right). Note the hollow, irregularly ripened fruit from the potash-starved plant. The leaves are yellowed, with greenish-tinted veins.

Nitrogen hunger is most prevalent on sandy soils and on older plants. It can be corrected in a few days time with surface applications of 100 to 200 pounds of sulphate of ammonia if water is applied so that the nitrogen reaches the roots.

Phosphorus hunger causes the plant to become stunted and the foliage to become dark green to purplish in color. The dark green color of phosphorus-starved plants is often deceptive since growers generally consider a dark green color to be essential for health. A light green colored tomato plant, for instance, often is capable of yielding twice as much as its dark green colored neighbor. As already indicated, phosphorus hunger must be anticipated and corrective measures taken prior to planting.

Potash hunger is often confused with conditions brought about by fungous diseases since it results in the speckling of the foliage and the death of the margins of the leaves. It also produces poorly colored and lopsided tomato fruits and cucumbers with constricted stem ends. Fertilizer applications for potash hunger also must be made prior to planting the crop.

With these generalizations in mind, we are now ready for some specific recommendations for fertilizer analyses. First we should correct the pH to 6-7 by the addition of lime, except for potatoes when it should be 5.0 to 5.2 if scab is prevalent. Muck soils require more calcium carbonate to effect pH changes than silt loam and sandy soils.

For silt loam soils a formula high in phosphorus such as a 2-12-6 or 4-16-4 is essential. The exact ratio should be modified if quick soil tests, hunger signs, or other data indicate a greater need for any fertilizer nutrient.

For sandy soils a 4-10-6, 4-8-8, or 6-8-6 may be advisable. Note that larger amounts of nitrogen are used. In addition to this, such soils frequently require surface applications of soluble nitrogenous fertilizers during the growing season. Larger amounts applied before the crop is planted are likely to be leached away. Sulphate of ammonia plowed under to a depth of 4 to 5 inches is not leached away nearly so rapidly as it is when applied as surface dressings.

For black soils and muck, an 0-8-24, 3-9-18, or 0-12-12 fertilizer is generally recommended. Here potash is generally the limiting element and applications should be made at a depth of 3 to 4 inches at or prior to the time the crop is planted.

The amount to apply varies with the method employed. The most effective results are obtained by applications placed in bands several inches away from both sides of the rows and slightly deeper than the seed, say three inches deep. For sweet corn and beans planted in rows 3 feet apart applications of 125 to 150 pounds per acre produce excellent results. Of course such applications do not add much to the fertility of the soil. Broadcast applications of 500 pounds or more are generally required to effect equally good increases in yield.

If the rows are 18 rather than 36 inches apart, the same rate applied as band applications would require 250 to 300 pounds per acre; and in rows 12 inches apart, as for onions, it would require 375 to 450 pounds per acre. Except for potatoes, where the fertilizer is applied well to the sides of the rows, it is not considered good practice to apply more than 1,000 pounds even if the rows are only 12 inches apart. If greater amounts are used for the production of bumper crops, some of the fertilizer is broadcast. Larger amounts are also applied as row applications when asparagus patches are started.

Surface applications of soluble nitrogenous fertilizers should be made during the growing season as needed. The need for these nitrogenous applications becomes greater as the amount of the phosphorus and potash applications is increased.

Tobacco Growers Aim At Domestic Market

(*From page* 22)

reserve, a 3-10-7 formula may supply all the potash required for quality. However, few Coastal Plain soils have high potash reserves. Tobacco fertilizers should be made up with one-third of the nitrogen from high-grade organics, one-third from nitrates, and one-third from standard inorganic sources. The phosphorus may be derived from any available phosphoric acid, provided the calcium and sulphur requirements are satisfied.

"Muriate of potash should be used in quantities sufficient to satisfy the chlorine needs, and sulphate of potash magnesia may be used to supply all or a portion of the magnesia requirements. The remainder of the potash may be derived from any chlorine-free source. Rates of applications required for optimum yield and quality will vary with soil type and previous cropping history. On light, thin, sandy soils 1,000 pounds of a 3-10-10 per acre are not too much, but on deep, dark, mellow, Norfolk sandy loam soils in a good state of fertility 800 to 900 pounds are sufficient."

Mr. Carr says that there are many things besides seasons, soils, varieties, and fertilizers that influence the grade of tobacco. Spacing, topping, cultivation, and methods of harvest and curing are the most important of these. Close spacing tends to make the leaves thin and luggy, but is seriously complicated by the increased moisture requirement of the greater number of plants per acre. In periods of drought closely spaced crops suffer severely which, in extreme cases, often results in serious losses of both yield and quality. It is doubtful that spacing closer than 22 inches in rows 3 feet 8 inches apart will pay.

The general practice of cultivating tobacco every week apparently tends to prolong the growth period and keep the crop green. In favorable seasons three cultivations after hoeing are about all that are needed. The crop should be laid by when about waist high. Later, if weed growth is bothersome, a wide scrape may be run through the middles. Laying a crop by early permits the roots to grow in the row middle which gives the plant a large root area and helps it to mature quickly. A quick-maturing plant produces the domestic grades now wanted.

The height at which a plant is topped also influences the grade of tobacco it produces. Leaving the top in a plant more or less starves the leaves which makes them thin and light and of the quality now wanted. However, leaving the tops in decreases yields about 25 per cent and also makes the crop highly susceptible to drought damage. In other words, a crop not topped is the same as a closely spaced crop—it requires large quantities of water. The risk of leaving the tops in is, therefore, not worth taking nor is it profitable. High topping will help to keep the leaves thin and will reduce the drought hazard considerably.

"Well-ripened tobacco is absolutely essential in producing domestic grades," declares Mr. Carr. "No doubt the fact that the 1941 crop ripened faster than it could be harvested had much to do with its surprisingly good quality. It was not highly colored, but ripe, thin, and luggy, or in other words, of good smoking quality.

"Let me urge each tobacco farmer to make every effort to produce a ripe, luggy, thin type of tobacco for 1942. The highly colored, solid, clear leaf grades no longer enjoy the demand they did several years ago."

Prune Trees Need Plenty of Potash

(*From page* 18)

each year for five years. In 1939 a second series of four trees in another badly affected part of the orchard was treated with sulphate of potash. This treatment has been repeated each year up to the present time. The effects of the potash were readily observable, even after the first treatment. Foliage was greener in color, scorch was lessened, and fruit size improved.

Yield records on the first series of trees in terms of green fruit per acre were obtained on the four potash-treated trees and four adjacent trees without potash in 1939 and 1940.

A record yield of green fruit was also obtained in 1940 on the second series of trees started in 1939. This showed: with potash, 4,575 pounds per acre; without potash, 1,762.5 pounds per acre.

Otto Orchard, French Prune Yields per Acre (green)

Year	With potash	Without potash
1939	5,831.2 pounds	881.2 pounds
1940	7,827.1 pounds	Crop worthless

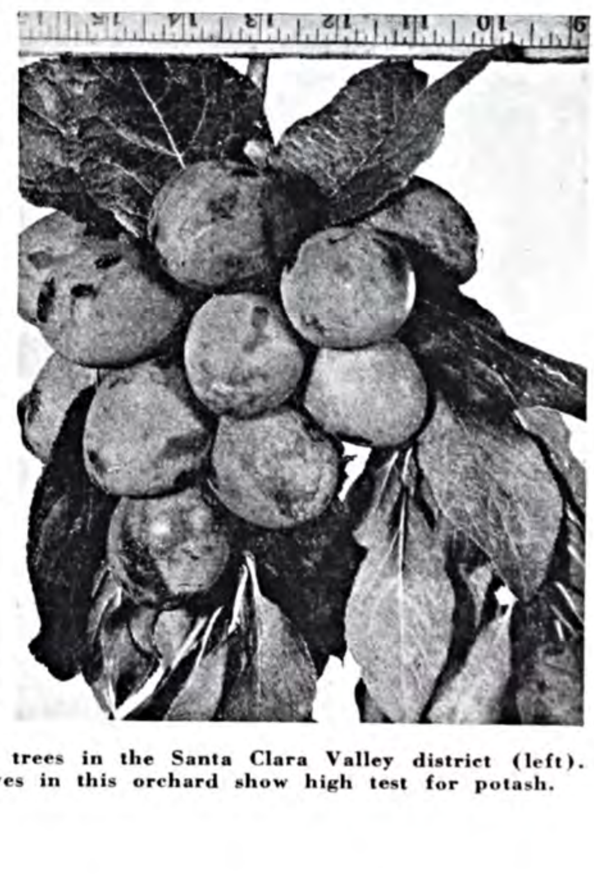
Leaf analyses in 1940 showed that the potash-treated trees had a leaf potash content of 0.99% potassium. The trees without potash showed the very low leaf potash of 0.34% potassium. In 1941 the leaves on the potash-treated trees had 0.77% potassium, and the trees without potash showed a leaf analysis of 0.21% potassium. Thus it is again demonstrated that a build-up in the potash content of the leaf is accompanied by increased yields and other desirable effects on the tree.

In the case of the Otto orchard, it should be borne in mind that the potash level in the leaves is extremely low, and potash deficiency is acute. Even with repeated treatments of potash, the level is still below 1%, and the trees have not recovered entirely by any means. We can only speculate on how much greater build-up of leaf potassium there would have been if only one heavy initial application of sulphate of potash, say 25 pounds per tree, had been made instead of the yearly application of 5 pounds per tree. There is some evidence accumulating that these single heavy applications to fruit trees are very effective in supplying potash to the tree over quite a period of years after the application. Undoubtedly the trees in this test never could be transformed into large, healthy trees. The great improvement which has taken place in both trees and crops because of the potash treatments, however, shows the possibility of bringing this type of orchard into the range of profitable operation.

Several years ago a new block of French prune trees was planted in the Otto orchard on Rincon clay loam. Two rows of these young trees were chosen for fertilizer treatments in 1939, and the materials were applied. The treatments have been repeated each year since. It is of interest that the potash content of the leaves of these young trees, which have not yet reached bearing age, is beginning to show variation on the different fertilizer plots. The average leaf content of potassium for the two plots for each treatment in both 1940 and 1941 is given below.

These results of leaf analyses on young trees indicate that potash seems to get into the tree more effectively

Treatment	Leaf content of potassium (%) Average two plots	
	1940	1941
Nitrogen-phosphorus	1.04	1.02
No treatment	1.58	1.38
Potash alone	1.84	1.50
Nitrogen-phosphorus-potash	2.19	2.08



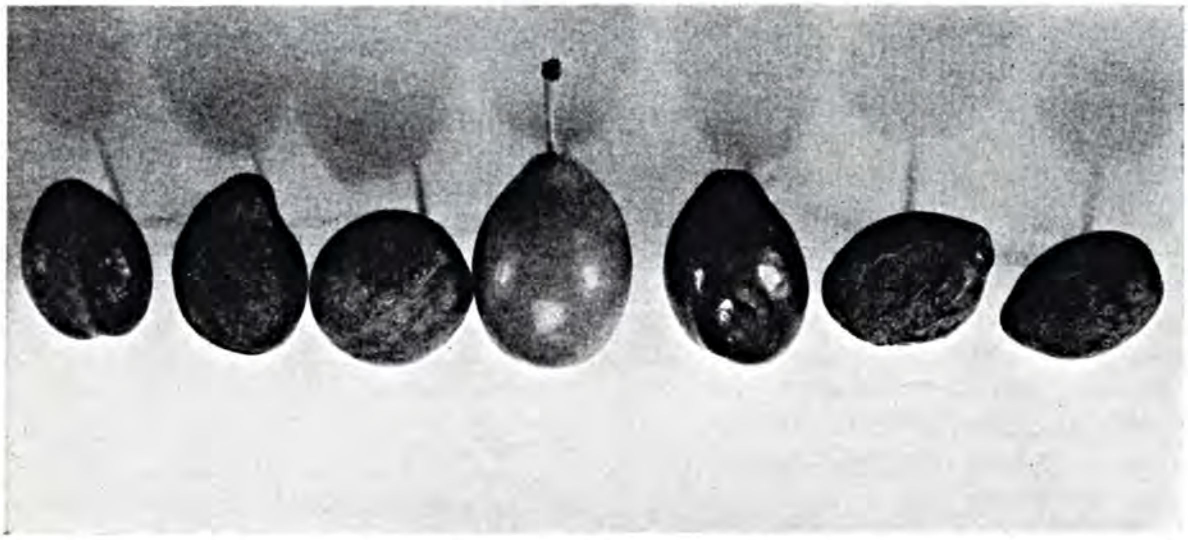
Symptoms of potash deficiency on sugar prune trees in the Santa Clara Valley district (left). Sugar prunes as they should be (right); leaves in this orchard show high test for potash.

when used with nitrogen and phosphorus; also, that when nitrogen and phosphorus are applied without potash, the potash content of the leaves is lower than in the case of no fertilizer at all. Symptoms of potash deficiency are not apparent on these trees as yet, but in future years, when their fruit crops draw heavily on the potash supply, differences in the condition of the trees will undoubtedly become marked.

As a guide to the potash needs of prune orchards, the analysis of leaves holds much promise. Of course there are always exceptions to any interpretations which may be placed on leaf analysis, but if the leaf content of potassium drops below 1%, deficiency symptoms are usually apparent. If the leaf content drops below 0.5%, severe deficiency symptoms usually occur.

It is quite probable that it will pay to apply potash at higher leaf potash levels than strictly deficiency levels; and it may be highly desirable from the standpoint of getting the best yields and quality of fruit to build up potassium levels in the leaves of prune trees to 2.5%.

Inevitably orchards suffer from neglect during the difficult periods of low prices for fruit. The prune grower has been going through just such a period of extremely low prices for his product, and has had to cut down on operating expenses a little more each year. Even though a good fertilizer program means lowered costs in the long run through better yields, better quality, and healthier trees, the use of adequate fertilizer has been omitted in many prune orchards under stress of difficult economic conditions. Now, however, when prune prices are higher and the grower again seems assured of reasonable returns on his crop, the improvement of trees and crops by using plenty of fertilizer should receive serious thought.



French prunes from trees suffering from potash deficiency. The prune in center is normal and from a tree which received potash.

Potash is one of the fertilizers which lends itself to the "humps and hollows" of fruit growing. Generous applications of potash during the "hump" periods of higher fruit prices will mean that the trees will have a reserve to draw upon. One application of potash, if large enough, exerts its effect on the trees for several years. This means that trees which are adequately supplied with potash will still have reserves to draw upon during periods when fruit prices are low and fertilizer use in the orchard is drastically cut. It also means that this reserve of potash will keep the trees in better condition and will bring in greater returns in yield and quality in the "hollow" times when every advantage counts.

Cooperation

(*From page* 11)

grown in this field; those grown in 1940 were fertilized with 1,500 pounds of 3-9-18.

Even though the Jachims were not quite "tops" in corn, their yield, along with their potato and onion yields, was high enough to enable them to qualify as Champion Muck Farmers. This award is given by the Baltimore and Ohio Railroad Company to the grower who has the best yield record on potatoes, onions, and one other commercial muck crop.

Ed Jachim won the title of Potato King by growing 639.79 bushels per acre. He plowed his 170-acre potato field 10 inches deep on April 10 to 15. The ground was then double disked twice, harrowed twice, and rolled once. Twenty-five bushels per acre of certified Chippewa potatoes were planted in 32-inch rows, 4 inches deep, and 11 inches apart on May 15 to 20. The potatoes were harrowed three times, weeded twice, hand weeded twice, and a tractor cultivator was used on them twice. They were sprayed 10 times with a Bordeaux mixture. The first few spray mixtures contained calcium arsenate also. The field was fertilized with 800 pounds of 0-8-24 put on with a wheat drill and 800 pounds of 3-9-18 put on with a potato planter. The potatoes were dug the last week in September.

Because they do not like to be tied down the year around, the Jachims keep only one cow and no pigs. Chores are no bugaboo for them. When their corn crop is in and next year's wood supply laid by, they will overhaul all their farm machinery and put it in shape for the next year. There is some talk of a short vacation trip, busy farmers like these having no time for vacations in the summer. But for the most part they will hunt and trap right on their own farm for diversion, and perhaps lay plans for trying to win high yield championships in corn and onions next year, as well as potato king honors. Here's luck to one loyal, united family, who live on the farm and like it, and wouldn't change it for any other life.

W. M. Ross Conserves His Soil Fertility

(*From page* 20)

each milking. The milk house has a concrete floor, electric screen panels for fly eradication, an abundance of both hot and cold running water, and all necessary equipment which is electrically operated. He has modern bottle washers, milk aerator, ice machine, and cold storage box. The milk is not only handled with the utmost care and cooled immediately after milking but when bottled is placed in ice in large cans for delivery directly to the customer almost ice cold.

Mr. Ross produces most of his own dairy cows, raising from 30 to 40 heifer calves each year, or enough to replace one-third of his milking herd annually. His herd is culled regularly, all old and otherwise unprofitable animals being removed as soon as their usefulness has ended.

It is not too much to say that if all Mississippi's farm land was conserved and used as effectively as is the land on the Ross farm, it would mean a saving of millions of dollars worth of fertility annually and would enormously increase production of crops, pasture grasses and clovers, livestock, and livestock products.

Boron Deficiency on Long Island

(*From page 9*)

deficiency in relation to seasonal precipitation between Long Island and the vegetable regions of western New York. On Long Island it is the wet seasons when boron deficiency tends to be worst, while "upstate" it is essentially the dry seasons when the deficiency does most harm.

Control Measures

When considering measures for the control of boron deficiency, there are four major factors to consider:

1. The crop to be grown and its boron requirement.
2. The rotation into which the crop in question is to be fitted.
3. The soil reaction at which the crop is to be grown.
4. The fertilizer program that is to be followed.

As has been indicated already, the boron requirement of crops is extremely variable. What may be an inadequate quantity of boron for one crop may prove toxic to another. Table 1 gives the yields of Green Mountain potatoes grown on the same soil with varying applications of borax over a three-year period. The soil showed 98 per cent boron deficiency on cauliflower in 1937. It is quite clear from these data that although 5 pounds of borax greatly stimulated the growth and yield of the crop in 1938, the continuance of the application for 1939 and 1940 caused a distinct toxic build-up so that the gain of 163 bushels per acre from 5 pounds of borax over zero in 1938 was reduced to a loss of 2 bushels in 1940. This can be seen very clearly by referring to the lower part of Table 1, which is arranged to show the yield differences between the treatments over the three-year period studied. It should also be mentioned that on Long Island 1938 and 1940 were favorable potato years while 1939 was a very dry and unfavorable season.

TABLE 1.—YIELDS OF POTATOES PRODUCED ON A BORON-DEFICIENT SOIL WITH VARIOUS APPLICATIONS OF BORAX

Treatment Borax lbs. per acre	Yields by year			Bushels per acre Average
	1938	1939	1940	
0	341	139	390	293
1	418	163	408	339
5	504	159	388	351
10	404	148	391	314
20	336	122	363	274
Average	401	146	389	

Treatment Comparisons Borax lbs. per acre	Yield differences over three-year period			Inter-action variance
0–1	−77	−24	−18	176
0–5	−163	−20	2	1,338**
0–10	−63	−9	−1	190
0–20	5	17	27	20
1–5	−86	4	20	544**
1–10	14	15	17	0.4
1–20	82	41	45	85
5–10	100	11	−3	520**
5–20	168	37	25	1,049**
10–20	68	26	28	138

** Highly significant.

Thus it is obvious that potatoes, although requiring boron and responding to it when grown on boron-deficient soils, can be very easily satisfied with small quantities of the element and will show up toxic effects very rapidly after the optimum amount of boron is supplied.

In contrast to potatoes, Table 2 gives the yields and percentages of boron deficiency symptoms of rutabagas obtained from varying applications of borax when grown on a boron-deficient soil. With this crop it is quite evident that up to 20 pounds of borax per acre were required for adequate growth,

TABLE 2.—YIELDS AND PERCENTAGE OF "BROWN HEART" OF RUTABAGAS GROWN ON A BORON-DEFICIENT SOIL WITH VARYING AMOUNTS OF BORAX

Treatment Borax lbs. per acre	Yield Tons per acre	"Brown heart" Percentage	
0	7.1	72	3-year average
1	7.7	38	
5	6.9	9	
10	7.2	6	
20	7.0	4	
50	9.9	0	1 year
100	7.9	0	
200	0.4	0	
400	0.1	0	
Least difference required	2.9	2	

TABLE 3.—YIELDS AND PERCENTAGE OF "BLACK CANKER" IN TABLE BEETS GROWN ON A BORON-DEFICIENT SOIL WITH VARYING QUANTITIES OF BORAX

Treatment Borax lbs. per acre	Yield Tons per acre	"Black canker" Percentage
0	9.3	33
1	9.1	23
5	9.1	13
10	8.4	11
20	8.2	9
Least difference required	Not significant	2

while as much as 50 pounds per acre did not decrease growth materially. Results with beets, given in Table 3, are quite similar. The yield data of other crops (Table 4) show the nature of the tolerance limits between deficiency and toxicity.

With these figures in mind, it is obvious that when a crop which requires a large quantity of borax, such as beets, is to be grown on a boron-deficient soil, the other crops which follow it must be considered also. If the chance of "carry-over" effect is considerable, then a compromise must be effected between controlling deficiency on the large boron feeder and avoiding a toxic residual effect on the succeeding crop. Naturally, the danger of toxic "carry-over" is inversely proportional to the leaching rate of the soil employed. As a rule, Long Island soils leach sufficiently to prevent any significant toxic accumulation for most crops; yet the case of potatoes, previously mentioned, is an instance where it can occur.

This particular instance is of considerable importance on Long Island since a standard practice is to rotate cauliflower with potatoes in a 1:3 year rotation respectively. Table 5 shows the relation of boron deficiency and resulting marketable yield which is

TABLE 4.—YIELDS OF VARIOUS VEGETABLE CROPS GROWN ON A BORON-DEFICIENT SOIL WITH VARYING QUANTITIES OF BORAX

Borax lbs. per acre	Snap beans Bushels per acre	Carrots Tons per acre	Brussels sprouts Quarts per acre	Peas Bushels per acre	Lima beans Bushels per acre	Spinach Bushels per acre
0	759	9.57	2,083	281	208	906
1	824	9.86	1,770	302	202	937
5	653	9.56	1,922	326	211	974
10	518	9.04	2,005	261	180	777
20	474	7.27	1,908	245	153	716
Least difference required	162	1.70	Not significant	41	Not significant	169

TABLE 5.—YIELD OF MARKETABLE CAULIFLOWER AND PERCENTAGE INCIDENCE OF "HOLLOW HEART" ON A BORON-DEFICIENT SOIL WITH VARYING APPLICATIONS OF BORAX

Treatment Borax lbs. per acre	Yield Crates per acre	"Hollow heart" Percentage
0	100	65.0
1	351	32.1
5	446	17.1
10	553	3.3
20	582	0.7
Least difference required	60	2.4

affected by various borax applications on cauliflower when the crop is grown on a boron-deficient soil. This clearly indicates that an application of 10 to 15 pounds of borax per acre would be good practice. However, we are naturally skeptical in recommending more borax than 10 pounds per acre for any one crop of cauliflower when it is known that potatoes are to follow. In recent years there have been many instances where 10 pounds of borax per acre were applied, and still the cauliflower developed some "hollow stem" and "brown rot." Under such circumstances it is obvious that 15 pounds of borax per acre should be applied, and it is doubtful that the possible reduction in yield of the succeeding potato crop would be sufficient to offset the material gain by the substantial control of "brown rot" on the cauliflower.

Soil reaction plays a highly significant role in plant growth through its effect upon the availability of plant nutrients. Boron cannot, at present, be considered an exception. Soils which are alkaline in reaction invariably tend to render boron unavailable. This does not infer that alkaline soils are invariably boron deficient, but merely that on alkaline soils any boron naturally present or artificially added will be less available for plant growth than it would be on an acid soil. The exact reason for this has received several explanations, which should be thoroughly substantiated before being accepted. To the grower, however, it is a fact. Any treatment

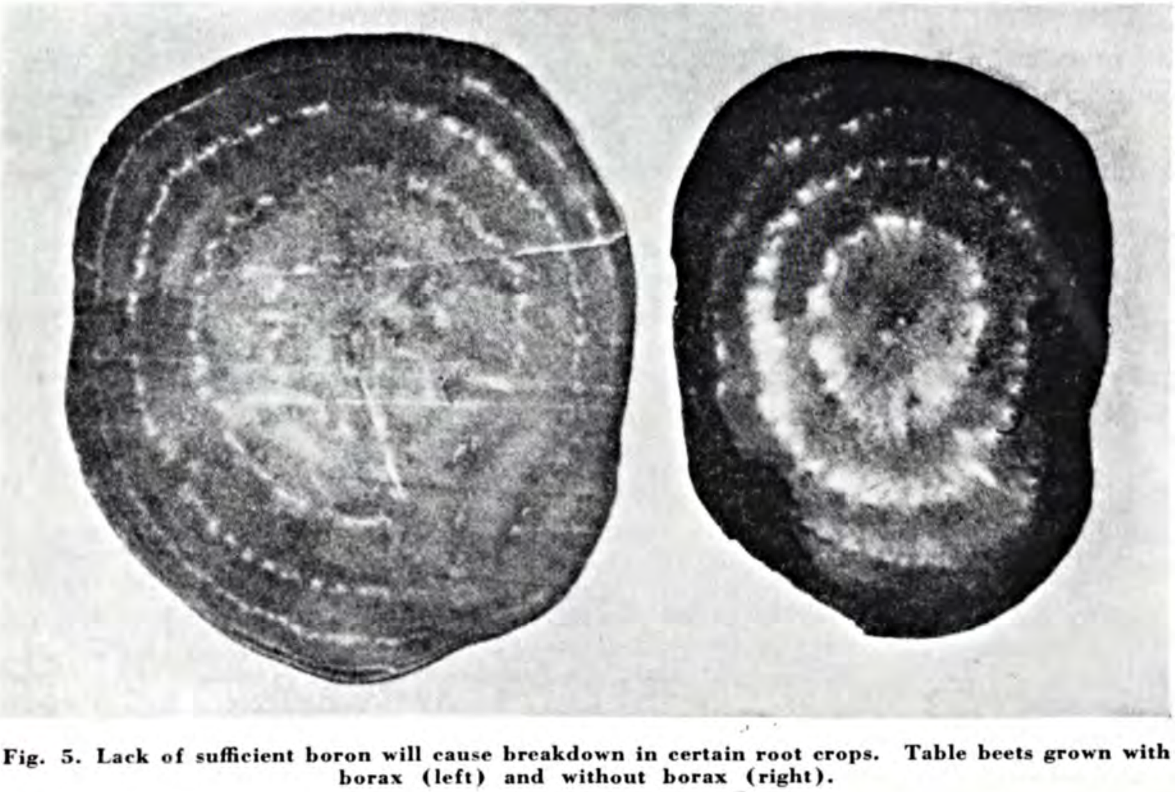


Fig. 5. Lack of sufficient boron will cause breakdown in certain root crops. Table beets grown with borax (left) and without borax (right).

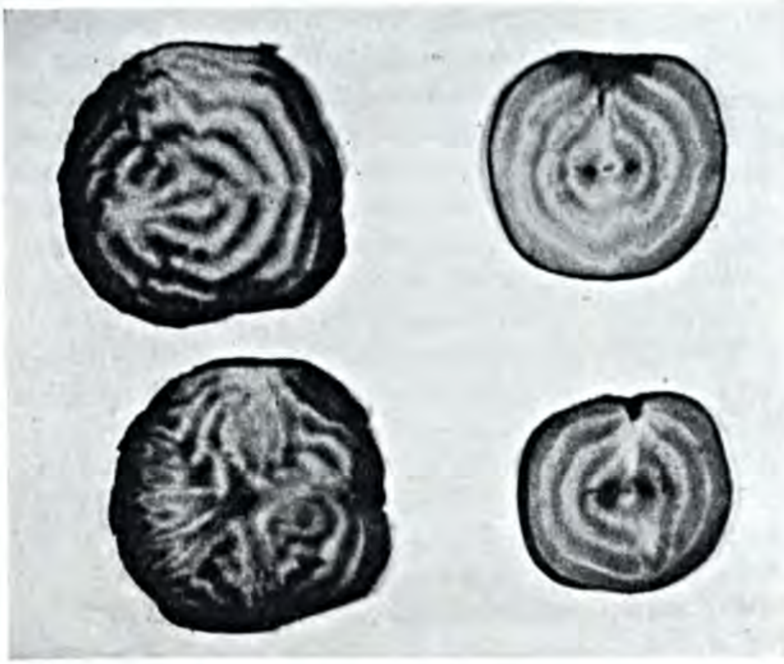


Fig. 6. Mangel beets showing external, pink variety, and internal, yellow variety, breakdown.

which tends to increase acidity on a boron-deficient soil tends to increase available boron. However, it also tends to expose boron to greater leaching on well-drained soils. Conversely, any treatment which tends to increase alkalinity tends to reduce boron toxicity, increase deficiency, and conserve the boron against leaching. On this basis the vegetable grower has to operate with a compromise. He should grow his crops at the optimal soil reaction for his particular rotation and apply borax when it becomes deficient in accordance with the requirement of the particular crop and in amounts to overcome the immobilizing effect of the particular soil reaction.

On Long Island certain cases of boron deficiency have been found to have been induced by applications of lime, but in general the deficiency appears to arise from leaching at acid reactions along with removal by harvested crops. Thus with cauliflower growing over a wide range of soil reactions, it was found that boron deficiency injury occurred to a greater extent at acid reactions when no borax was applied, but the application of borax was far more effective as a controlling agent at the more acid ranges than it was at the relatively alkaline reactions, indicating that an acid reaction permits more leaching than an alkaline reaction but that control in the acid region is easier. An illustration of this is given in Table 6.

Recent experiments have led to the conclusion that potash fertilization is related to the incidence of boron deficiency. It is found that where application of potash has greatly exceeded that required by any crop, particularly one which has a high boron requirement, the development of boron deficiency is accentuated. Carefully controlled experiments suggest, however, that this may arise from the application of an unbalanced fertilizer. Dr. J. W. Shive of New Jersey has obtained some very impressive results in support of this point. Therefore, it is premature to attempt explanation as to why potash should increase boron deficiency under certain conditions.

TABLE 6.—INCIDENCE OF BORON DEFICIENCY SYMPTOMS ON CAULIFLOWER AND RELATIVE CONTROL BY BORAX AT VARIOUS DEGREES OF SOIL ACIDITY ON LONG ISLAND SOIL

Soil reaction pH range	Degree of injury*		Difference (Relative control)
	Borax applied	No borax	
4.7 to 5.0	0.44	2.80	2.36
5.0 to 5.5	0.40	1.90	1.50
5.5 to 6.0	0.40	1.40	1.00
6.0 to 7.1	0.20	0.90	0.70

* Degree of injury determined by a grade index, 0 = no injury.

Data adopted from Hartman, J. D. Amer. Soc. Hort. Sci., Vol. 35: 523: 1938.

Methods of Application

Borax may be applied in various ways, of these the most practicable is inclusion of it in the general fertilizer. This is particularly the case when the fertilizer is applied broadcast. Application of borax in fertilizer applied in bands on either side of the plant row enhances the possibility of temporary toxicity which may prove harmful. Under such circumstances it is wiser to apply smaller amounts than when it is distributed broadcast.

A second method employed on Long Island, under certain conditions, is to include the borax in post-planting side-dressings. Here again it is recommended that the application be kept down to below five pounds of borax per acre.

The third method, which is more of an emergency procedure, is to apply the borax in a spray either alone at the rate of 1 pound per 100 gallons of water, or 2 — 3 pounds per 100 gallons of spray in a typical bordeaux mixture (the borax is added after the spray mixture is prepared). It is seldom that more than 2 — 3 pounds of borax per acre can be applied by this method, but under certain conditions when early symptoms of boron deficiency appear it is an effective measure for protection against further loss.

Many fertilizer companies include borax in certain of their standard fertilizer mixes. This is a great advantage as it eliminates the tiresome necessity of careful home mixing. However, it also has one drawback, the amount of borax included may not be enough for the crop and soil under consideration with the amount of fertilizer to be applied, or conversely it might be too much. This latter would be unusual, however, as few companies prepare a fertilizer with more than five pounds of borax per ton. Some local fertilizer agencies will mix up a specific fertilizer containing a prescribed quantity of borax to fit any situation the grower might encounter. This arrangement is, of course, admirable and well worth the slight cost involved.

Where the correct amounts of borax cannot be purchased ready mixed in a fertilizer, it is necessary to "home mix" the borax into the fertilizer at the rate prescribed. This must be done with extreme care as complete mixing is essential to avoid toxic and deficiency spots developing in the field later.

The final suggestion to vegetable growers who might encounter a boron deficiency is that local county agents and agricultural research workers probably have a far better understanding of the nature of the deficiency and how to control it under the conditions where they work than even the most specialized experts elsewhere, and therefore the grower had better rely mainly on their recommendations rather than solely upon "what he reads in the papers."

Squads Right!

(*From page* 5)

and yon and returning thence, is going to take some starch out of extension men too. Some states already have issued gubernatorial manifestos anent too much sashaying into the sticks. The cure for this may be more correspondence schools of agriculture like we had when I pushed a plow; or else we'll have to mix the Holstein, Jersey, Berkshire, Shropshire, and Rhode Island Red breeders into one mass meeting and learn how to picnic together and discuss farming as a whole, rather than piecemeal in compartments. Then again we can bunch up some of our roving saviors of the soil in one carload and pounce on the unsuspecting growers in a solid mass of united erudition.

They used to come that way anyhow in some sessions afield, and the farmers lasted through the ordeal safely. Now just let 'em come in one wagon and unload their maps together.

Such deprivation hits us older coots harder than it should, when you consider our antecedents afoot. But as for the younger generation, it's a different picture and one to be felt more keenly. Our kids grew up with a garage in the rear yard instead of a backhouse. Hitching blocks were unknown to them. Baby buggies were obsolete in their infanthood, and we gave them an auto airing instead of a change of diapers. We bought them broken-down jalopies instead of shaggy Shetland ponies. We taught them that the jerking thumb meant more than the willing foot. Theirs has been the era of gas and get-there.

BUT most of those lads are absent and all we've got to do is persuade the gals that complexions are gained by exercise and legs are something to use and not to look at. Barring a few bunches caused by a possible dearth of girdles and some snags induced by silk scarcity, our feminine scenery won't be utterly ruined by all this deprivation.

This has been a sedentary age and except for policemen, dime-store clerks, and mail carriers, precious few of us have legged it along very lively. Even farmers are so used to sitting down and pushing with their toes to accomplish everything from plowing to courting that the idea of hoofing it awhile sounds like an insult.

Since those delivery boys we knew are drilling now and extra calls for groceries are taboo, a lot of us must conserve on our traffic demands on merchants. Phoning to have a cake of yeast and a paper of pins toted out by a red-faced driver in a two-ton truck is a thing of the past. And the rival milk concerns that dip out of the same tank or buy along the same rural route while refusing to consolidate their city deliveries are bound to revamp their systems in a hurry, without much net loss in vitamins either.

And when it comes to keeping sweet in a crisis, we can do it without hoarding sugar. Several women in our locality stocked up so heavily that their attic floors are sagging, and one would think they intend to go into the confectionary trade. Yet a majority of them are so fleshy already that they are fretting about the girdle famine, so a little less sucrose and dextrose for them would prove a buxom boon. They should remember that hoarding sugar takes cheek but that going without a little spells "chic."

THEORIZING on the worst deprivations we have had up to ground hog day, I surmise we will improve our physique and stamina by doing more walking and less nibbling of sweets. I for one won't kick until they begin to ration our paper and typewriter oil, after which I'll quit trying to reform the public in general each month and volunteer in the civilian defense squad to perform patriotic nonessentials in a highly becoming way.

While we are on this subject, what are essentials and nonessentials? Some wisecracker working in a munitions plant was recently credited with a new fancy slogan—"He who relaxes helps the Axis!" I give him due praise for coining a catchy motto that every agitating union boss should note with some remorse over past performances. I take it that the author of this phrase meant "soldiering" as we know it in civilian terms. I hope he didn't mean relax in the sense of taking time out for rest and refreshment, or a pause in the pace that kills.

There is no greater threat to the morale and courage and persistency of a community in wartime than grinding tension and an overwrought, nervous force. Folks in the farm belt have come to me seriously asking if rural social clubs, musical programs, summer picnics, harvest festivals, and plowing and husking contests should be permitted to interfere with the direction of defense activities.

In reply, why not inquire if any or all of these wholesome rural divertissements ever hindered the conduct of progressive crop and livestock production or soil improvement, or diminished the zest for standardizing and grading foods. Quite the opposite in most experience, because such periods of recreation, change of pace, social contacts, and cultural refreshment have reinvigorated and strengthened the aim, purpose, and practice of rural craftsmanship.

THIS war period keys soil tillers to a concerted high pitch of enthusiasm and often induces them, by a blend of patriotism and profits, to exert extra efforts in their profession. Short of help and without intervals of release and recess, these high-geared soldiers of the soil are apt to get out of step, fumble their accouterments, and miss the mark. Moreover, some of them are going to have a sorry reaction, a sad letdown and a bad hang-over from the effects of too much of this persistent pressure. We must train ourselves to be as clear-headed and resolute when victory comes as we are during the winning of it.

Every army post has its spells of relaxation and intervals of fun and frolic. Defenders of the Philippines shouted loudly for more cheerful radio broadcasts from home, short-waved across the vast expanse of "ocean sea" as happy ties binding them to the home circles for which they fought and died. So it is thumbs down on the crepe-hangers who want us to be dour and dolorous. You can't win on a sour mind any more than you can on an empty stomach.

Finally, we've got to think out a system to handle the kicks and complaints. Quite often I become superheated about some passing injustice or awkward impasse in public events and administrative maladjustments. We all do, or we wouldn't be native Americans with traditions of outspoken opinion. It's our job to attach some kind of safety valve on some of this before it gets into the wrong drift.

One way would be to hold regular grumble fests like we used to stage rummage bees. Have the neighbors save up their pet peeves and come up to bat ready to unload them and have them done with for keeps. Uncork our bitters and pass the bottle around. Give prizes for the best grouches and treat them like we do the tales of Munchausen—something to hear in amusement and nothing to take very seriously. If we could go a step further and have a Grumble Collector in every township and let him pass on the best ones to a state Grumble Department, thence direct them by express to Washington for the archives or for the appendix to the Congressional Record, by this means we would release the pent-up feelings and drain them all off to a common cesspool of reserved comments—keeping them there in cold storage until the war is over.

AND at the last count, we'll need a strong stock of imagination to do a "squads right" along with vibrant youth! All the old moss-grown ideas and habits which in ordinary times the elder citizens find it hard to cast aside are in for a unique overhauling. Our own generation has seen the privations and makeshifts of pioneer communities, and also realized the fruit of invention and progress. It shouldn't be so tough on us to recast our lives awhile in the terms of our own youth while we keep the home fires blazing brightly.

Whatever comes, let's remember we can't be "all out" and complain of being "all in" at the same time. While this fracas continues, we who undergo rationing while the boys take their rations are the reserves and the home guards. I am sure history teachers in 1965 won't be able to say it was the lack of "ground crews" that clipped the wings of victory.

A Few Whinnies

A small boy, eight, eyed a small spider.

"Daddy, do spiders bite?"

"Very few of them we find around here do."

"Not at all?"

"Not at all."

"Well, do they pinch?"

"No, lad, they don't pinch."

"Don't they hurt you at all?"

"Nope, they don't hurt you at all."

"Well, anyhow they scare hell out of you!"

She: "Do you think I show distinction in my clothes?"

He: "Well, I wouldn't say distinction. I think distinctly would be a better word."

The morning after
The night before,
Our cat came home
At the hour of four;
The innocent look
In her eyes had went,
But the smile on her face,
Was a smile of content.

She Didn't Care

"Madam, you'll have to pay for that boy."

"But I never have before."

"That don't matter to me. He's over 12 years old and you'll have to pay his fare or I'll put him off the car."

"Put him off. What do I care? I never saw him before."

Grandma says that in her girlhood days the girls never thought of doing the things they do today, and then she added wistfully, "That's why we didn't do them."

"Darling, I could sit here and do nothing but look at you forever."

"Yeah, that's what I'm beginning to think, too!"

Mistress: "Marie, you were entertaining a man in the kitchen last night, weren't you?"

Marie: "That's for him to say, ma'am. But I tried my best."

Expensive

At a certain college in the north of New England the male students were not permitted to visit the resident lady boarders. One day a student was caught in the act of doing so and was court martialed.

Said the Dean: "Sir, the penalty for the first offense is 50 cents, for the second, $2.50, for the third, $5, and so on up to $15."

In solemn tones the trespasser inquired: "How much would a season ticket cost?"

Sergeant: "Now, suppose you are on your post one dark night. Suddenly a person appears from behind and wraps two arms around you. What will you call then?"

Doughboy: "Let go, honey."

A census enumerator approached a lounging Negro dandy. He asked and learned the man's name, age, place of residence; then inquired, "What's your business?"

The answer came superciliously: "I owns a hand laundry, I does."

"Where is it located?"

"Dar she comes now!"

Printed in U. S. A.

Better Crops with PLANT FOOD

March 1942 — 10 Cents

The Pocket Book of Agriculture

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

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Tree (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)

Reprints

B-8 Commercial Fertilizers in Grape Growing
C-8 Peanuts Win Their Sit-down Strike
K-8 Safeguard Fertility of Orchard Soils
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
NN-8 Does Weather Affect Tomato Yields?
A-9 Shallow Soil Orchards Respond to Potash
N-9 Problems of Feeding Cigarleaf Tobacco
R-9 Fertilizer Freight Costs
T-9 Fertilizing Potatoes in New England
X-9 Hershey Farms Find Potash Profitable
CC-9 Minor Element Fertilization of Horticultural Crops
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
NN-9 Grass Is a Crop, Treat It as Such
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
B-2-40 Pasture Problems Still Unsolved
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
M-4-40 Ladino Clover "Sells" Itself
N-4-40 How Shall We Fertilize Vegetable Crops?
O-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
Z-8-40 Permanent Pasture Treatments Compared
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podzols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
KK-12-40 Better Pastures for Better Livestock
LL-12-40 Tripping Alfalfa
A-1-41 Better Pastures in North Alabama
B-1-41 Our Defense Against Soil Fertility Losses
C-1-41 Further Shifts in Grassland Farming?
D-1-41 How, Where, When Apply Fertilizers?
E-2-41 Use Boron and Potash for Better Alfalfa
F-2-41 Meeting Fertility Needs in Wood County, Wisconsin
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
J-3-41 Soil, Substance of Things Hoped For
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
M-4-41 Available Potassium in Alabama Soils
N-5-41 Soil Productivity in the Southeast
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
T-6-41 The Concept of Available Nutrients in the Soil
U-8-41 The Effect of Borax on Spinach and Sugar Beets
V-8-41 Organic Matter Conceptions and Misconceptions
W-8-41 Cotton and Corn Response to Potash
X-8-41 Better Pastures for North Mississippi
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
AA-9-41 The Newer Ideas About Fertilizing Orchards
BB-11-41 Why Soybeans Should Be Fertilized
CC-11-41 There's Enough Potash for National Defense
DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
EE-11-41 Cane Fruit Responds to High Potash
FF-12-41 A Five-year Program for Corn—Livestock
GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
JJ-12-41 Potash Demonstrations on Statewide Basis
A-1-42 Canadian Muck Lands Can Grow Vegetables
B-1-42 Growing Ladino Clover in the Northeast
C-1-42 Higher Analysis Fertilizers As Related to the Victory Program
How to Determine Fertilizer Needs of Soils

THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON, D. C.

Better Crops with PLANT FOOD

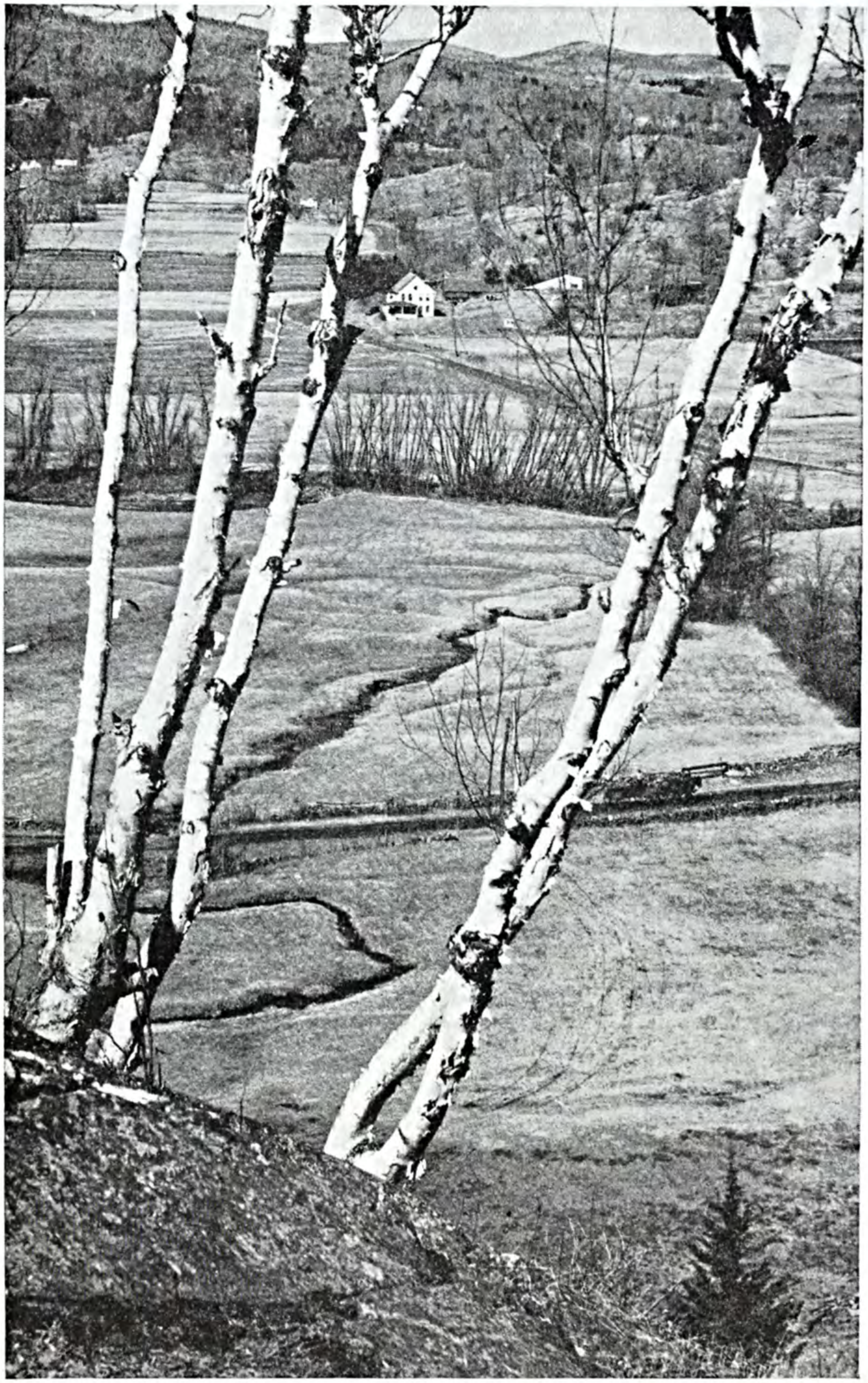
The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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

VOLUME XXVI NUMBER 3

Table of Contents, March 1942



MARCH LANDSCAPES HOLD PROMISE OF THE BEAUTY TO COME.

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI   WASHINGTON, D. C., MARCH 1942   No. 3

Civilian's need a new word . .

"Civ-ense"

Jeff McDermid

WHAT an awe-inspiring feeling it is to create a brand new word, such as the above title discloses! Look at it again! You're in at the "delivery" of it and should appreciate what that privilege signifies. And there are no extra admission charges either.

What in tarnation does it mean, anyway? Well, this commanding word will soon be accepted in our common parlance along with "jeep" and "blitz" and "axis," which you understand. Think a minute—it stands for Civilian Defense, being a short-cut through three or four useless syllables to reach the heart of home and community safeguards.

"Civ-ense!" Get it? Sure you do, but no plaudits, please; I'm just a humble citizen like yourself and ask no public praise for a modest moniker. "Civ-ense"—it has a hyphen now, but I'll operate on it shortly and remove the ligament, after the English-speaking world adopts it. As "Civense" it will stand thereafter.

Every loyal Yankee secretly yearns to be of sterling service to his beleaguered bailiwick, and I am no exception. For several weeks since they took the ice out of isolation over in Hawaii, this scribe has been pondering how a maturing fellow in the fourth draft category could emerge as a pluperfect patriot without learning to knit or go stumbling around in the home guards.

Being no fan dancer, blues singer, or teacher of terpsichore, and having no experience in the movies, I did not thrust myself upon the attention of Washington organizers. But I have haunted the county office of Civense which is lodged alongside the tire-rationing board—without having any designs upon the latter, however. I have scanned their occupation lists assiduously for signs of some echoing talent lying dormant within my noble spirit, some rare and inspiring motif perhaps, which yours truly might bring forth to stem the tide of local confusion and blast the daylights out of the prevailing complacency.

All my deliberations up there in that rickety Civense office over Cal Smither's harness shop I shall reserve for later mention. Suffice it to say, my goal is attained in one mental leap in the dark, and in coining another new medium of verbal exchange the same calm satisfaction steals over me as Francis Scott Key or General Sherman must have felt when they burst out with the Star Spangled Banner and War Is Hell.

I MAINTAIN that anyone who can shear off a lot of Webster's red tape and thus keep step linguistically with modern streamlined campaigns is doing yeoman service. We Americans think we are hustlers, but we "ain't seen nothin' yet" to match the swift, clipped, abbreviated action ahead of us. Using my new word is just a beginning.

To be cluttered up in our communication with scores of useless letters and syllables would be as conducive to our defeat as keeping those old civil war cannons on our humble public squares for anti-aircraft flak.

Having stolen a base on the enemy in this deft manner, I shall return to my watchful position in the drafty office over Cal Smither's place, noting some of the painful attempts of my worthy but misguided compatriots to justify their idle existence here, so far from Luzon or Port Darwin.

Heading the list of desirable jobs in the Civense Corps is the post of Air Raid Warden. I was rather slow in making up my mind over its duties and my own qualifications, so I found last week to my chagrin that my neighbor, Abel Gooch, had appointed himself to that office for our residential block, No. 77 in Ward 25, where Abel has retired after a noteworthy career in the fire insurance business.

ABEL comes in better qualified than many of us. He has inspected all the houses from cellar to attic and knows all the firemen and garbage collectors personally. The only things Abel lacks are tact and reticence, which are not qualities likely to be fostered by the insurance profession, but which, peradventure, seem also not indispensable for a persistent air raid alarmist. The very fact that we are well removed from the coast is no reason why such a capable gent as Abel should not make the most of his duty.

In explaining to us his undertaking, Abel remarked that he had been a game warden and a church warden earlier in life, but that the grinding routine of insurance soliciting sadly interfered with his getting beyond the amateur stage with either. At last, he said, in his declining years he felt free to go to town with the warden business, and being used to keeping his eye glued aloft for chimney fires and thunderstorms, it would be no trick for him to scan the skies day and night, if need be, in the interest of his neighbors under siege or apt to be.

I can't exactly say whether Mrs. Roosevelt or F. LaGuardia told Abel to start regular practicing, but ever since he signed the roster with our Civense Board he has devoted eighteen hours daily to limbering up for the first bomber attack. Confidentially, Abel has become somewhat of a public enemy thereby, but our neighborhood is tolerant and fully aware that this is going to be a tough war and Abel isn't the worst phase of it.

To begin with, Abel got himself a complete outfit copied out of the British code, including ropes tied around his waist, several flashlights, a referee's whistle, a first-aid kit, a gas mask, and a pulmotor. Every night Abel goes the rounds covering our block faithfully

—almost too faithfully at this stage—drawing a cart with part of his clutter behind him.

One night the Enoch Millers had a bridge whist festival, and just as they were getting set to hand around the prizes to those who had successfully doubled and redoubled, Abel let go with a shrill whistle, rang the doorbell, walked in and shouted, "Blackout for half an hour!" He went down-stairs and unscrewed the fuses, besides.

Two nights later Val Upson was sparking Sis Jones along about midnight in a quiet way, when Abel barged in with a raucous blast and jerked his flashlight on them, saying, "Blackout's over. All's clear. Lights on!" Poor Sis fainted and Abel got to use the pulmotor.

Personally, I had no grievance against him until he started practicing the school kids in seeking raid shelters. He led a passel of boys down into our basement and left them in Mother's preserve cellar, with consequences which were natural under the circumstances. If their parents think they can sue me for gastronomic damages to their youngsters, I'll sic them onto OCD or Abel himself—whichever is the more vulnerable. Anyhow I suspect we'll feel safer this summer having a night watchman prowling around without getting socked for it extra at tax time.

We have other patrioteers too. Not to be outshone by Abel Gooch, we have for our local Information Specialist on Civense no other than Miranda Hix. By all odds Miss Hix is born to the job voluntarily assigned to her. A retired schoolma'am with a talent for assembling both intimate and international data, Miranda brings a zealous ardor to her rather thankless duty.

She spends many laborious hours poring over tomes and tracts in the Carnegie free library, and boils forth with sparks of erudition like one of the canny Scot's own Bessemer converters. Here again I confess to being sluggish myself in not seizing this job before Miranda got her mitts on it. However, it may be best in the long run, as folks are more apt to believe what she says because her imagination and textual embellishment are sadly inferior to mine, after all the moons I have practiced on you. Anyhow, she makes the circuit once a week and litters up our reading tables with everything from Japanese Shinto and samurai to synthetic rubber and sugarless recipes.

I DOUBT if Claude Wickard's best bureau of repetitious releases and explanatory speeches can hope to perform as well with as little recompense as Miranda—but it must be said in defense of the department aforesaid that Miss Hix is not obliged to spend any precious time hanging around waiting for diverse O. K. signatures. She alone is responsible and she scorns to pass the buck to the government for any overstatements or inaccuracies. Moreover, her output reaches the ultimate consumer direct without having to run the hard-boiled gauntlet of newspaper desks.

Noting how successful Miranda is in her public interference, I studied that list again and had about decided to try out for Recreation Regulator. Here again I was frustrated and nudged out by a former Y. M. C. A. athletic coach, Nobby Nolan. Nobby argued the Civ-

(*Continued on page* 46)

More Legumes for Ontario Mean More Cheese for Britain

By W. B. George and B. L. Young

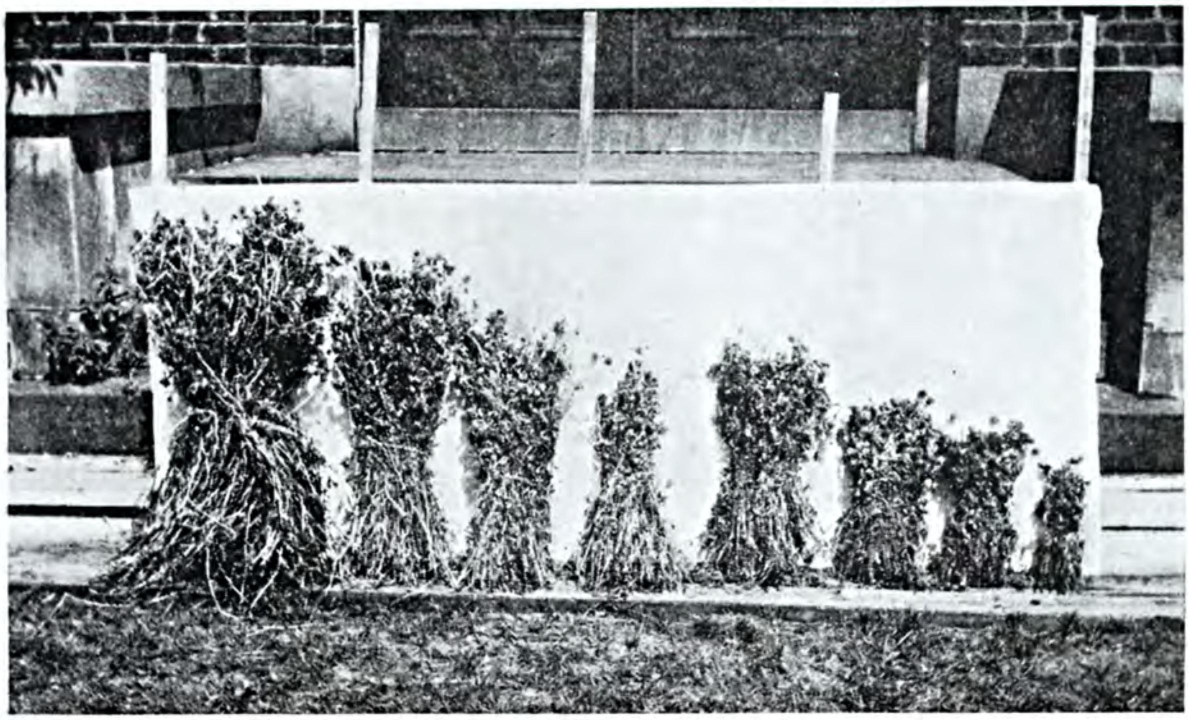
Kemptville Agricultural School, Kemptville, Ontario, Canada

WAR has thrown the spotlight on eastern Ontario because cheese, and more cheese, is one of the most urgent needs in sustaining the fighting forces and civilian population of Britain, and this section of Canada supplies a great proportion of the exported cheese.

The production of cheddar cheese has long been the mainstay of eastern Ontario agriculture. Sixty-five per cent of Ontario's cheese comes from the counties which lie between the Ottawa River on the north and the St. Lawrence River, the great highway to the sea, on the south. There are more than 500 cheese factories in this area.

As a natural sequence to this demand for cheese and other dairy products and due to the fact that more than 90 per cent of the cheese is produced during the period from May 1 to November 1, dairymen have become interested in the improvement of pastures and legume hay crops. Since many good dairymen had reported increasing dif-

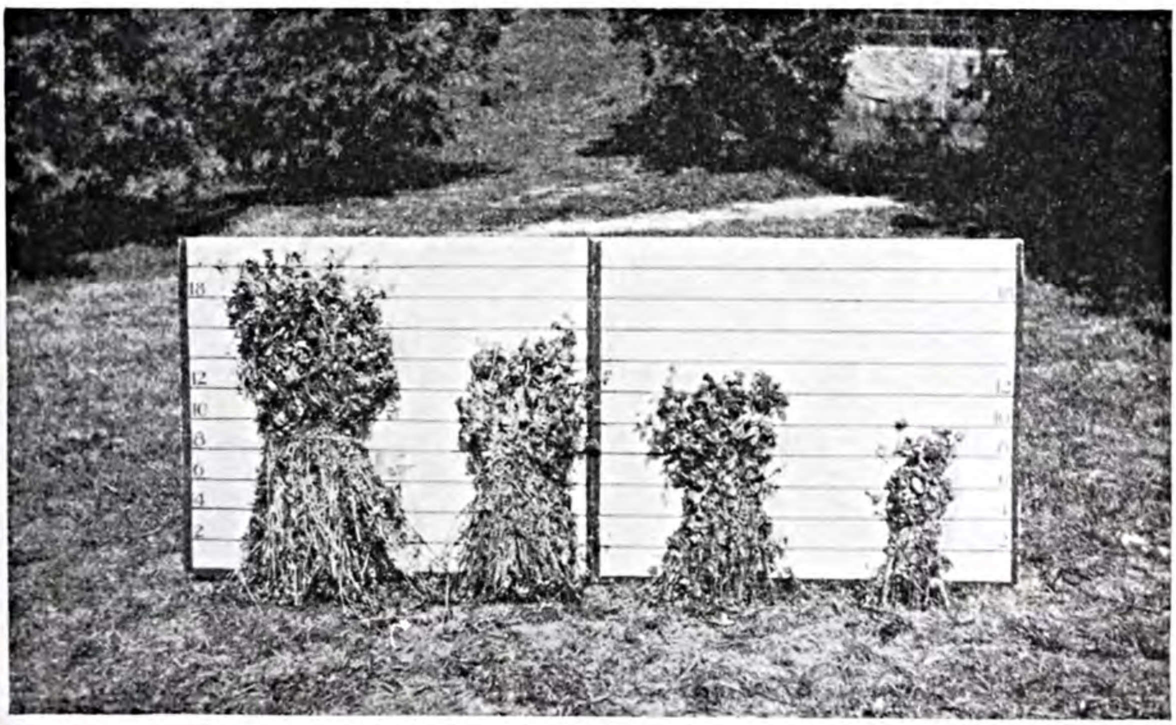
Examining the plots on the Newman farm are Dr. J. W. Turrentine, President of the American Potash Institute; H. G. MacLeod, Agricultural Representative of the Grenville Company; B. L. Young, Fellow, Kemptville Agricultural School; Dr. L. H. Newman, owner; Dr. Taylor, Agricultural Attache, U. S. Consulate, Ottawa; and M. C. McPhail, Principal, Kemptville Agricultural School.



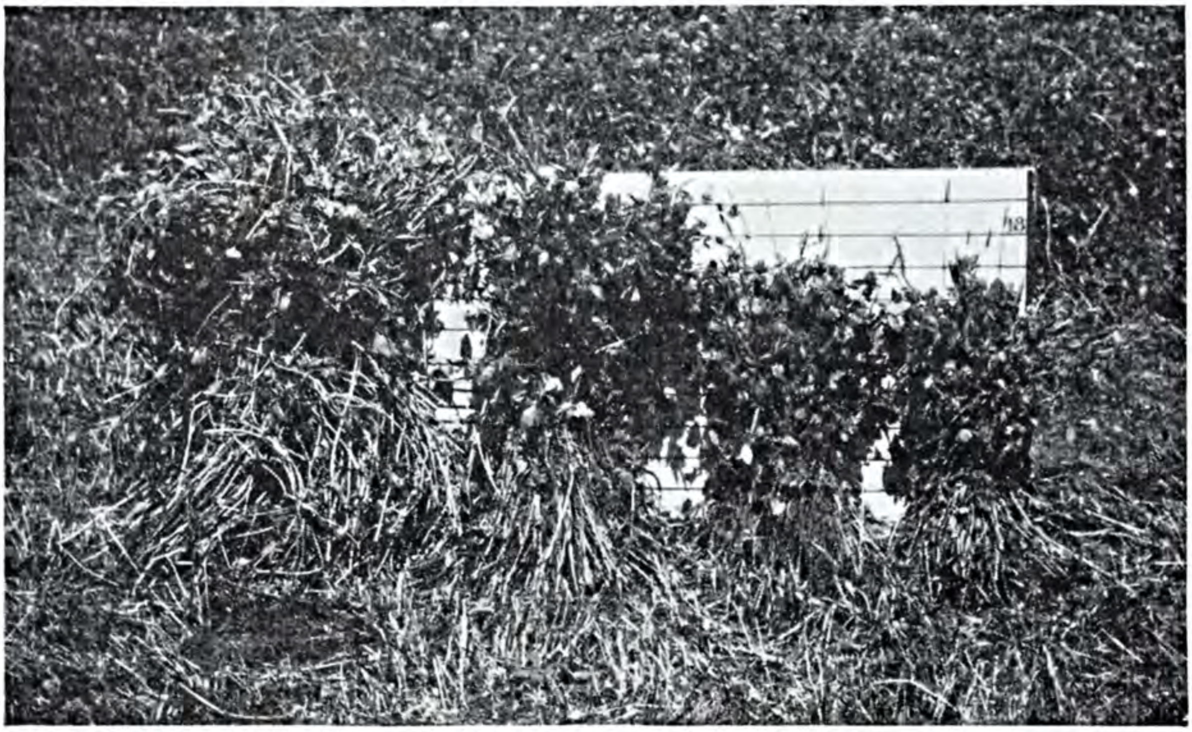
One square yard from plots 1, 2, 3, and 4; first cutting (left) and second cutting (right).

ficulty in securing catches of clover and retaining this seeding for future pasture, investigation of the problem began three years ago.

The first permanent fertility field chosen for investigation was on the farm of L. H. Newman, Merrickville, Ontario, in the heart of a dairy section. The field was 12 acres in size, the soil of a sandy loam type representative of considerable area in eastern Ontario, fairly well drained naturally, low in organic matter, and with a pH of 6.5. Subsequent soil tests by the Neubauer method revealed that both phosphate and potash were at very low levels. A 5-year rotation was in practice, namely, corn, oats, legume hay, mixed hay, and pasture. The entire field received an applicaton of 12



Samples of second cutting from plots 1, 2, 3, and 4; August 1941.

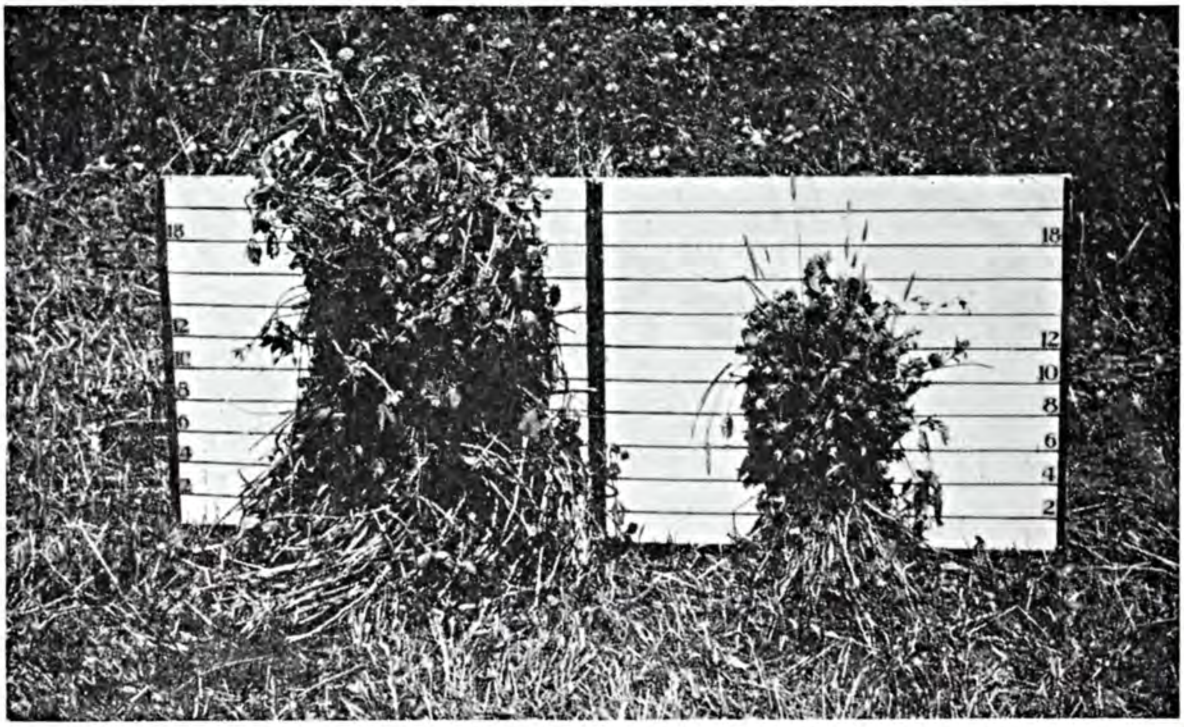


Close-up of first cutting from plots 1, 2, 3, and 4; June 1941.

tons of manure per acre in the spring of 1939 previous to planting corn.

This field was divided into four areas of three acres each with different fertility treatments applied to each area. Plot 1 received an application of 500 pounds of superphospate and 350 pounds of muriate of potash previous to planting corn in the spring of 1939. An additional application of 250 pounds of 2-12-10 was given at planting time. This plot received similar treatments in 1940 and 1941 with the exception that the muriate of potash was reduced to 300 pounds in 1940 and 250 pounds in 1941 due to an increase in the potash levels.

Plot 2 has received 250 pounds of 2-12-10 each year in the rotation, while plot 3 received only one such applica-



Samples of first cutting from plots 1 and 4.

tion on the corn crop, the customary fertilizer practice in the neighborhood being the application of fertilizer once during the rotation. Plot 4 was left as a check plot but received the same amount of manure as all other plots. The yields of corn and the oat crop which followed were not high, neither were there spectacular differences in yields as between the various plots.

CROP YIELDS PER ACRE—CORN 1939 AND OATS 1940

Crop	Plot 1	2	3	4
Corn (tons)	18.01	15.2	15.2	14.65
Oats (bushels) .	48.0	38.5	38.1	32.8

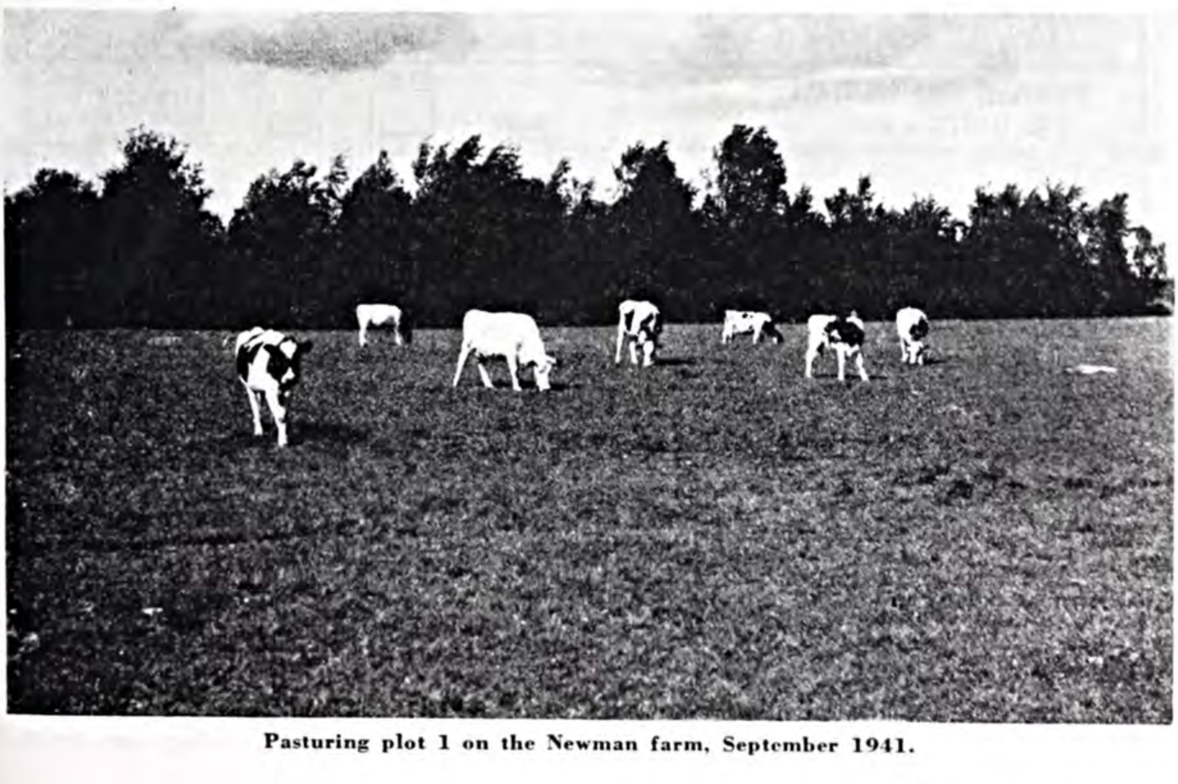
There were, however, obvious differences in the quality of the oats, with plot 1 weighing 33 pounds per measured bushel and 16.2 per cent small oats, while plot 4 weighed 24 pounds per measured bushel and 32.3 per cent small oats.

Prior to the harvesting of the oat crop in 1940 it became clearly evident that the young clover plants were responding vigorously to the higher fertility treatments. While the plant population on plot 4 was satisfactory, the growth lacked vigor. On plot 1, however, the clover plants were so rank that the owner decided more value would be secured from feeding the oats in the sheaf. Parts of this plot were cut for hay, and the sheaves, which consisted largely of clover, were cured on tripods. Later in the fall, 12 head of young cattle were pastured on this area which provided valuable feed for at least 5 weeks without causing any injury to the new seeding.

The 1941 crop of legume hay provided the greatest surprise. From the time growth started in the spring, the differences between the various plots could be noticed. By May 20 plots 1 and 2 were thoroughly covered with a dense mass of red clover, alsike, and alfalfa, with timothy and orchard grass filling in any thin spots. In spite of an unusually dry season, these plots continued to thrive without any setback. At no time was growth vigorous on plots 3 and 4, and in early June, due to the prolonged drought, the crop practically ceased growing.

The first cutting of the plots was made on June 21 and the second cut-

(*Turn to page* 39)



Pasturing plot 1 on the Newman farm, September 1941.

High-grade Fertilizers Are More Profitable

By M. H. Lockwood

Manager, Fertilizer Division, Eastern States Farmers' Exchange, Springfield, Massachusetts

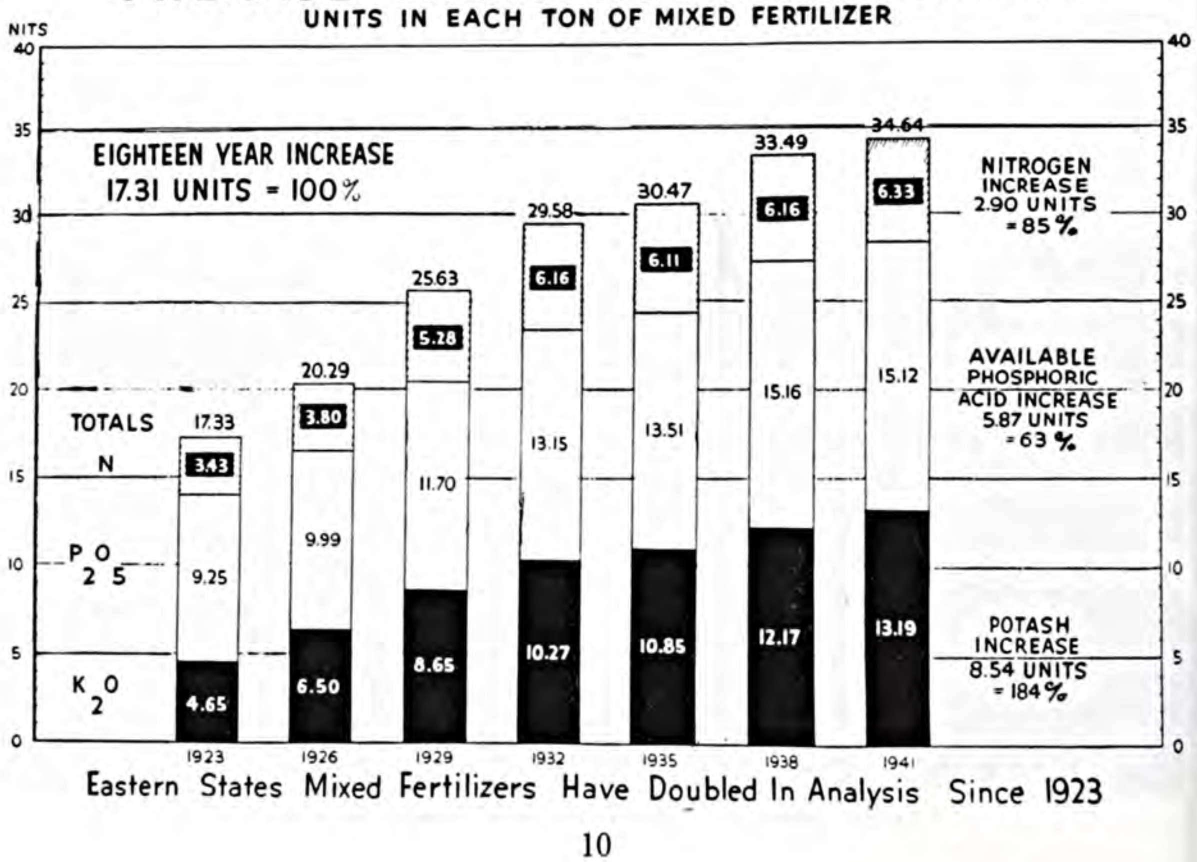
EIGHTEEN years is a long time, yet not too long in which to accomplish something worth-while. We state this because it took us from 1923, when our average mixed fertilizer contained 17.33 units of plant nutrients, until 1941 to double the average analysis of our mixed fertilizers. Actually our program of high analysis mixtures of the 40-unit type began in 1925, although there had been a definite trend upward before that year. Right now, however, most of us are interested in those practical things which we can do at once to contribute toward our nation's Victory Program.

The possibilities along this line in higher analysis fertilizers lie principally in increasing 15- and 20-unit mixtures to 20- and 25-unit grades. The savings thus made will be largely in the greater efficiency of package use, in manufacturing margins, and in distribution costs such as railroad freight. Users naturally question whether such higher analysis fertilizers are as satisfactory in terms of crop results. The answer is yes, as indicated by yields on thousands of farms. Equally satisfactory yields have proven the agronomic soundness of higher analysis fertilizers year after year.

If there were available plentiful sup-

AVERAGE PLANT NUTRIENT CONTENT

UNITS IN EACH TON OF MIXED FERTILIZER



Eastern States Mixed Fertilizers Have Doubled In Analysis Since 1923

RELATIVE CONSUMER COST FOR FERTILIZER IN SEVEN CONCENTRATIONS

FROM 15 TO 45 UNITS OF PLANT NUTRIENTS

100 = COST FOR 3 TONS OF 3-6-6

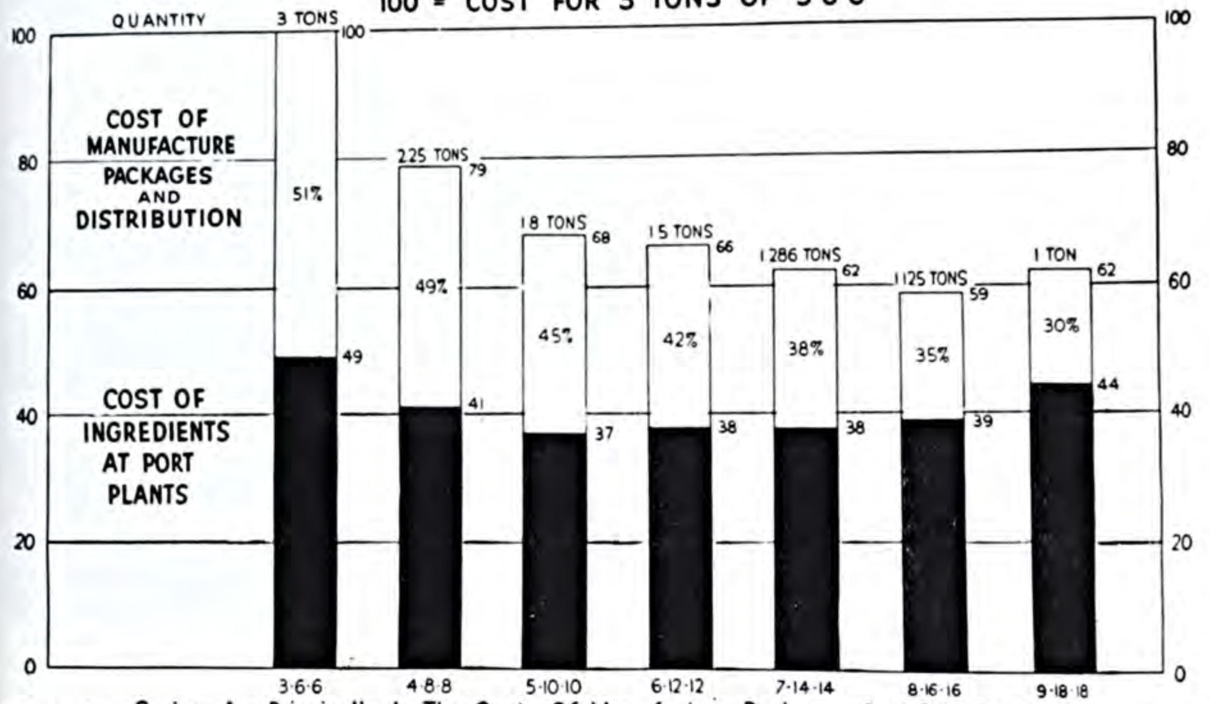


CHART C Savings Are Principally In The Costs Of Manufacture. Packages And Distribution **1942**

plies of high analysis materials, we might well go further in our present recommendation. The fact remains, however, that in both the phosphates and the nitrogen carriers, our supplies of high analysis materials are quite definitely limited. The changes we can make right now in our mixed fertilizer concentration are confined to those made practical by the gradual increase in analysis of the ingredients we use in making up some of the grades of mixed fertilizer of which our national tonnage is heavy.

The survey of fertilizer distribution for the year ending June 30, 1939, indicated that of the 12 leading grades in ton volume, only three had a plant nutrient content of 20 units. This indicates that we have a lot of room for improvement. With the present heavy demand on our transportation facilities and the urgency for conservation of packages and farm labor, we can see added reasons for doing without delay everything we can to take up the slack in any of our present customs. One of the ways we can do this in fertilizers is to increase 15- and 20-unit mixtures about five units in concentration. Such an increase would result in substantial savings in cost to the fertilizer user, in packages, manufacturing costs, and in transportation.

The relative savings in cost for increases in concentration are illustrated in Chart C, which shows that in a 1-2-2 ratio there are substantial savings in increasing the concentration from 15 units as in the 3-6-6 grade to 20 or 25 units as shown in the 4-8-8 and 5-10-10 grades.

The room with which to make these changes has been developed largely during the past 15 or 20 years by increases in the analysis of many fertilizer materials commonly used. In ordinary analysis superphosphate, for instance, 18% and 20% material are commonly produced now where 10 or 15 years ago the analysis of this material was usually two or more units lower. There are numerous other parallels that could be drawn, but we shall mention only one. In muriate of potash, for instance, 10 years or more ago, most of us were using a grade of this material analyzing 48 to 50% potash, but for several years now, the industry has been able to secure muriate of potash analyzing 60%

or higher. In fact, we have, today, in our domestic potash distribution the uneconomic practice of refineries rediluting muriate of potash to make 50% material before shipping it across the continent largely because there is an insistent demand for 50% muriate of potash which the trade for so many years used when it was the highest analysis available.

Habits Must Be Changed

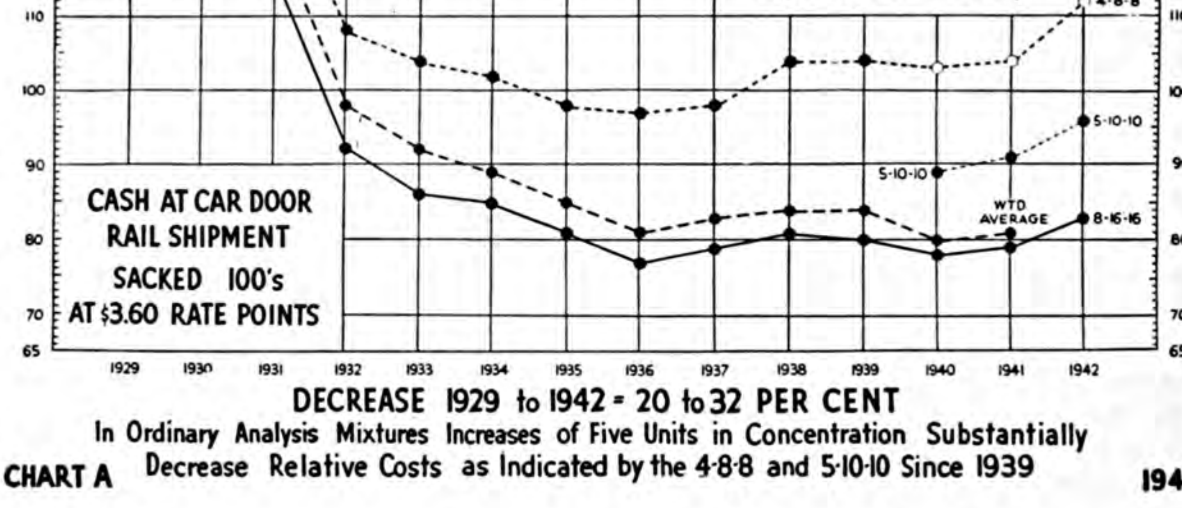
Probably the chief difficulty we in the fertilizer industry have to overcome is the mental hazard of "figures." It is human for us all to like something because we are accustomed to it. We become used to the grade numerals of a particular mixed fertilizer. We become used to a certain analysis of an item like superphosphate and muriate of potash and if we are not careful, we find ourselves in the awkward position of leaving our fertilizer grades too much like they used to be without taking into consideration the sound changes that could be made in them if we took advantage of the increases in analysis of the ingredients that go to make up those mixtures.

In order to get down to cases, I will cite an illustration in my own organization. In 1939, we resurveyed our position on grades and ratios in an effort to follow the suggestions of agronomists who were making a new set of recommendations. In this survey, we discovered that during the preceding 11 years, one of our leading ordinary analysis grades, the 4-8-8, had become somewhat out-of-date because of the advent of higher analysis ingredients. And what did we do? We replaced it with a 5-10-10 which, as Chart A shows, brought its plant nutrients to consumers at a cost well under the level at which we could have furnished them the same plant food in the 4-8-8 mixture.

The question naturally arises as to whether we experienced difficulty in making this change. The answer is that there were many questions asked and there was quite a lot of explaining to do during the first season or two, but in spite of many users having been thoroughly accustomed to the 4-8-8, the change was made and made abruptly.

(*Turn to page* 32)

RELATIVE CONSUMER COST OF MIXED FERTILIZERS FOR FOURTEEN YEARS



DECREASE 1929 to 1942 = 20 to 32 PER CENT

In Ordinary Analysis Mixtures Increases of Five Units in Concentration Substantially Decrease Relative Costs as Indicated by the 4-8-8 and 5-10-10 Since 1939

CHART A **1942**

Scenes like this are commonplace in No-Pone Valley in the acid soil area of East Tennessee. Erosion damage is everywhere in evidence—bushes, briers, bitterweed, and "Poor Joe" predominate.

The Hope of No-Pone Valley

By Joe A. Elliott

Agricultural Extension Service, Knoxville, Tennessee

SOILS in No-Pone Valley are notoriously poor. Crop yields are low and living is meager. Idle land and abandoned homes are commonplace.

The very name is significant. It originated during the War Between the States when soldiers quartered there claimed they had to leave the valley and go into the limestone valleys to find sufficient corn to make bread. Hence the name "No-Pone," because natives had no corn for pone. More recently the area has been facetiously called by such names as "New Egypt" and "Land of Canaan." One section is sometimes referred to as "Kettle Hollow" because so much of the little corn that is produced is processed in copper kettles.

No-Pone is one of several valleys of acid shale soils which parallel the dolomitic limestone ridges of the Appalachian region. These shale veins start at the alluvial plains of Georgia and run in a northeasterly direction into Pennsylvania. They constitute some 15 per cent of the farm lands of east Tennessee and a lesser percentage in west Georgia, east Kentucky and southwest Virginia.

During recent years a few farmers have learned to do a very creditable job of farming on acid shale soils with the aid of fertilizers. One of them is O. H. Ledford, a young farmer in Meigs County, Tennessee, and a kind of hero in No-Pone Valley.

Shortly after he married 10 years

ago, Ledford bought a 125-acre tract of land adjoining the farm on which he had been reared. There were 40 acres in woods, 10 to 12 acres in creek bottoms, and the remaining acreage was in various degrees of abandonment to pine thickets, briers, and gullies. Since hauling logs and driving a school bus brought in most of Ledford's income, little thought was given to farming except in the creek bottoms where grain was raised for the work stock.

would try an adjoining field," Ledford says, "and we had similar results there." He now plans to keep 12 acres in alfalfa, bringing in a new field of 3 acres each year.

Most everyone was skeptical at the start; few still are. Several neighbors ridiculed the idea of spending money for fertilizer and seed to be, as they said, "thrown away on that old shale soil." They even accused County Agent Shadow of driving out in the moon-

The O. H. Ledford family on the porch of their recently completed modern residence. They have also added a livestock barn, poultry houses, and a milk house during the past few years.

Ledford was having to buy hay so he asked County Agent W. A. Shadow if his creek bottoms wouldn't grow alfalfa. Shadow, who knew this land to be poorly drained, suggested they try a small acreage on the shale hillsides as an experiment. Land was prepared early; 2½ tons lime, 600 pounds 16% superphosphate, 50 pounds muriate of potash, and 50 pounds nitrate of soda per acre were applied; and seed was sown in August.

Results surprised the neighborhood. Land that was a barren waste the year before produced a good stand of alfalfa that yielded an average of 3½ tons hay per acre for 4 years. "We figured if this field would grow alfalfa we

light to check on results, saying that he was ashamed to be seen around. This was eight years ago. There are now 60 acres of alfalfa on 45 different farms within a range of 20 miles of Ledford's farm as a result of his demonstration.

Good results from alfalfa don't end with the hay, either. Ledford says that corn yields following alfalfa are at least doubled, and he regularly makes 50 to 60 bushels per acre to prove this statement. Average corn yield on shale soils would probably not be over 20 bushels per acre. And one farmer said, "Plenty of it won't average."

Soil experts with the Tennessee Extension Service have classified Ledford's land as 3rd, 4th, and 5th class; 3rd class land is recommended for cropping every 5 to 6 years, 4th class every 7 to 10 years, and 5th class is unsuited for cropping and should be devoted to permanent pasture or forest land. To meet recommended land use, Ledford has worked out three rotations. In over-flow creek bottoms, he follows a 5-year rotation of 1 year in corn and 4 years in meadow; on the less steep shale hillsides he follows a 6-year rotation of alfalfa 4 years, corn and small grain the next 2 years; steep hillsides are in permanent pasture with a small acreage selected each year for corn and cotton so that land is not cropped more often than once in 10 years.

Ledford had a small herd of beef cattle when he started farming. To meet land payments, these had been sold down to one cow. When it was found that he could grow alfalfa, refinancing was arranged through the Farm Credit Administration and a few dairy cows added. The herd has been built to 27 at present.

Milk checks from the Chattanooga, Tennessee, Milk Producers Association average $250 a month. Egg sales from a flock of 300 Brown Leghorn hens return around $800 annually. Add to this several hundred dollars from strawberries and a small acreage of cotton and you have a substantial farm income for any valley.

A complete set of farm buildings, including a modern residence, milk house, livestock barn, and poultry houses, has been built. A much-used room in the new home is the storage pantry for canned goods. Even though there are three children, two boys and a girl, "It's mighty little food we buy at the grocery stores," Mrs. Ledford says.

Ledford Showed the Way

Bill Runyan operates the farm of his father, J. F. Runyan, adjoining Ledford on the west. Bill returned to the farm 4 years ago after having traveled for a large dry goods company for 21 years. In discussing the return to farming, he said, "Obed Ledford showed us what this shale will do. It takes fertilizer though. I wouldn't plant a seed of any kind without fertilizing. But when you use fertilizer, you know what to expect."

Runyan's theory is that alfalfa, sericea, and other deep-rooted legumes add needed nitrogen and organic matter

(*Turn to page* 36)

The Ledford dairy herd of 27 cows. Milk checks average $250 monthly.

Mr. and Mrs. Caesar Pedroni with some of their Kenyon Easter Lilies, a variety now being produced along the Oregon coast.

Lilies for Easter

By J. C. Burtner

Agricultural Extension Service, Corvallis, Oregon

IF Americans enjoy their usual plentiful supply of Easter lilies in the next few years, it will be because a few pioneer American lily growers in widely scattered portions of the American Continent have nursed along an infant industry which has suddenly assumed outstanding importance.

In the past an estimated 28 million Easter lilies have been grown by American florists each year. The chief source of the bulbs used for forcing in greenhouses was Japan. Approximately $4,500,000 have been sent to Japan each year in return for these lily bulbs. That supply is now cut off, of course, for the duration of the war at least and possibly for a considerable period thereafter.

A partial American supply has been developed recently in the deep South and in the far West. In the South the Creole lilies have supplied a portion of the normal market. In the extreme West along the Pacific Coast, in fact within sound of the breakers, a promising lily industry is developing which may prove to be the chief source of stock in the future.

So far the output is not great, but with an exceedingly brisk demand, the available supply of stock will be increased as rapidly as possible. In 1940, 90 acres of lilies were grown in Oregon, but only about half of these were the Easter lily type. The acreage increased materially in 1941 and will expand just as rapidly as planting stock can be developed.

If a complete domestic supply is obtained, approximately 9,000 acres will

(*Turn to page* 38)

Legumes Are Essential to Sound Agriculture

By A. F. Gustafson
Cornell University, Ithaca, New York

LEGUMES deserve a large place in hay mixtures on dairy, general, and livestock farms. Moreover, legumes serve a useful purpose in green manure crop mixtures on vegetable, fruit, cotton, tobacco, and other cash crop farms. In general, legumes produce larger yields than nonlegumes and have a higher protein and mineral content, therefore, a higher feeding value for livestock. Legumes in green manure seedings are markedly beneficial to intensively grown crops.

A common requirement for popular crops is plentiful, inexpensive seed. Legume seed is less plentiful and ordinarily costs a little more per acre than the seed of nonleguminous crops. The current relatively high cost of the seed of leguminous crops should stimulate seed production in this country so that costs may be brought back to normal in a year or two. In spite of somewhat higher seed costs, however, legumes should be sown on large acreages because of their real value.

A number of things may be done to cut acre seed costs. Good farmers should use only clean, high-quality, high-germinating seed that is adapted to the climate of the area and to the soils of the farm on which it is to be sown. Meadow mixtures are often covered so deeply that the legumes especially fail to come up. A suitable seedbed, usually one that is mellow on top and firm underneath, should be prepared if the labor is available. By covering seed lightly, a considerable reduction can be made in the quantity of seed to the acre. On the lighter soils, covering the seed with a corrugated roller gives excellent results under a variety of conditions. On silt loams and clay loams in the north Mississippi Valley and in the north central and northeastern states, sowing on the surface and covering lightly with a weeder or a brush harrow are common practices. Beyond question, much clover and other legume and grass seed has been wasted by covering it too deeply. Failure to come up often results from the formation of a crust on the surface of moderately heavy soils. Legume seedlings often cannot penetrate such crusts. A poor stand results unless seeding was done at a heavy rate. Seed treatment, by increasing the percentage of germination, also may aid in holding the acre cost of seed to moderate amounts.

The Need for Lime

Legumes vary somewhat widely in their lime requirements. Red and sweet clover, soybeans, and alfalfa are regarded as having moderate to high lime requirements. The annual lespedezas, cowpeas, alsike, and wild white clover grow well without liming on soils that are too acid for the high-lime legumes. Soils should be tested. If found deficient in lime for the particular legume to be grown, the soil should be limed liberally. Liberal liming is particularly desirable at present for the perennial legumes, especially alfalfa which usually occupies the soil for a period of years. For this crop it is essential to divide the application if much more than a ton of limestone to the acre is needed. Putting one-half of the lime on for an intertilled crop is advisable. The lime becomes mixed with the soil during tillage, and acidity is corrected in part during that season. After the land is plowed for alfalfa the remaining half of the required lime is applied and mixed with the soil. Application well in advance of seeding is particularly desirable when the slower-acting forms such as limestone or blast furnace slag are used. Advance application of lime for red, alsike, and ladino clover is less imperative than for alfalfa.

Finely ground basic slag, rock phosphate, or superphosphate (calcium metaphosphate is satisfactory insofar as it is obtainable) may be used. Legumes make somewhat better use of rock phosphate than nonlegumes. This use of rock phosphate for legumes is feasible, especially near the Tennessee mines where delivered costs are relatively low. In general, the same may be said of basic slag in the areas where its cost delivered and spread on the soil is correspondingly low. The phosphorus

Alfalfa is an efficient gatherer of nitrogen, but yearly applications of phosphate and potash usually are needed.

in slag is regarded as available and, in addition, slag carries other essential mineral nutrients of value. Superphosphate is used in the East, Southeast, South, Southwest, and to some extent in the Midwest.

The fact that some soils are calcareous in the surface as well as the subsoil should not be overlooked. This condition would be revealed by testing the soil. Although liming a calcareous soil will do no harm, it cannot be expected to prove profitable for the leguminous crops under consideration here.

Legumes are heavy feeders on many of the mineral plant nutrients. Many soils aside from the bluegrass area of Kentucky and perhaps other local areas, are deficient in phosphorus. Phosphorus should be applied in liberal quantities, particularly for the longer-lived legumes.

Basic slag and rock phosphate do not lose availability in the soil. Applications of one-half to one ton per acre, therefore, are feasible and usually profitable. Liming the soil sufficiently to produce red clover should aid greatly in holding phosphorus in relatively available forms in the soil.

Because surface application of super-

(*Turn to page* 43)

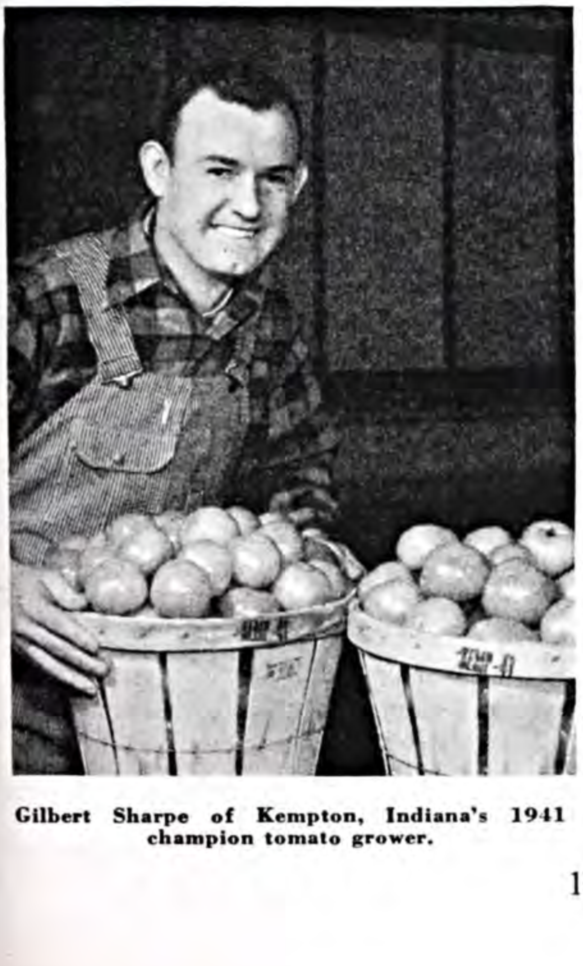
Indiana's Red Gold

By Roscoe Fraser

Agricultural Extension Service, Purdue University, Lafayette, Indiana

DRIVING on any of the highways or crossroads through Indiana last fall, you were doubtless amazed at the amount of tomatoes you saw—vast fields of tomatoes, Indiana's own red gold, with rows of filled hampers crossing them, nimble-fingered pickers filling yet more hampers. Trucks of every kind, size, and description, big semi-trailers, regular farm trucks, trailers hitched behind the family car or tractor, every type of conveyance hurrying toward the nearest canning factory. Trucks lined up for blocks around the canneries waiting to unload. Indiana farmers were busy doing their bit for the National Defense Program.

Under the Lend-Lease Bill 15 million cases of tomatoes were ordered for foreign shipment by the Federal Surplus Commodities Corporation. Indiana's share of this order was 1½ million cases. Indiana was the only state able to fill her quota, although the order was not signed until May 7, after much of the planting had been done.



Gilbert Sharpe of Kempton, Indiana's 1941 champion tomato grower.

Normally every year 25,000 farmers grow tomatoes for the canning industry on 75,000 to 100,000 acres in the Hoosier State. Three million cases of tomatoes are packed annually in the 250 Hoosier canneries. It is estimated that last year with an increase of only 25 per cent in acreage, four million cases of tomatoes were packed, 35 per cent more than formerly. Hoosiers accept this as just one more proof that Bill Herschell was right when he wrote, "Ain't God Good to Indiana?"

Champion 1941 tomato grower, winning over 6,000 other club members, was Gilbert Sharpe, who lives near Kempton, in Clinton County, Indiana. Mr. Sharpe drives a school bus and works by the day for his neighbors, renting only about six acres for tomato raising. His yield was 21.672 tons per acre, grading 83.74 U. S. No. 1's. When he was asked how he had maintained such a grade, one of his neighbors who was present said, "Because he left those tomatoes in the field three or four days too long each picking."

This tomato field was fall plowed seven inches deep. The last of April it was gone over with a spring-tooth harrow. Just before plant-setting time, 85 pounds of muriate of potash per acre were put on with a lime spreader. The ground was again gone over with a spring-tooth harrow, then double disked twice. After that 150 pounds of 2-16-8 per acre were put on with a wheat drill.

Certified Georgia-grown Indiana Baltimore plants, 3,500 per acre, were set May 23, 24, and 25. The plants were set deep, in rows 3′6″ x 3′6″. Starter solution made of 8-20-5 was used.

Three acres were cultivated twice with an International cultivator, applying 75 pounds of 3-12-12 per acre each time. The other three acres were also cultivated twice, receiving 75 pounds of 3-9-18 each time. Mr. Sharpe intended to keep a close check on these two plots, but the tomatoes came so thick and fast that the records were all mixed up. Besides the two cultivations, the field was hand-hoed once. Twice the plants were dusted by airplane with cuprocide. The first dusting also contained calcium arsenate for tomato worms.

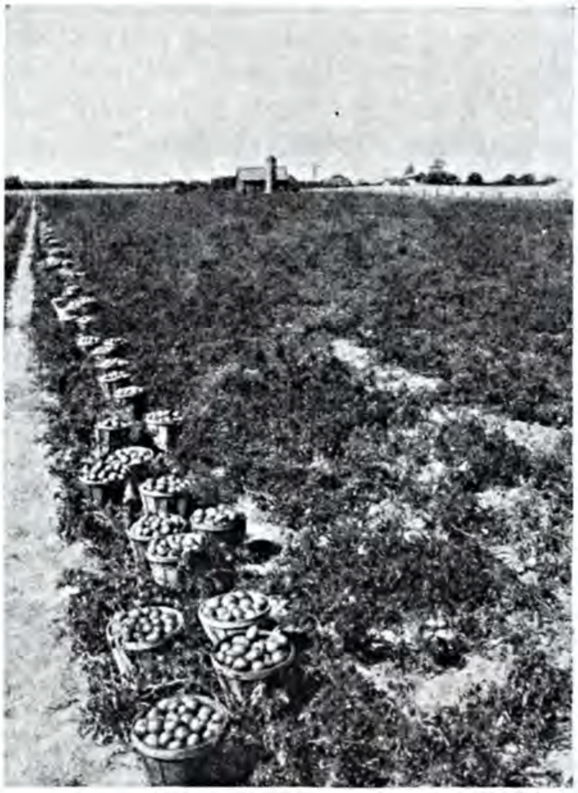
Sweet clover, cut early for hay, was grown on this field in 1940. After the hay was cut, the field was pastured. In 1939, 70 bushels of oats per acre were produced here, and in 1938 the field was planted in corn, producing 80 bushels per acre. When this farm was purchased by the present owner in 1929, it was in very poor condition, but by the use of sweet clover and pasturing the ground has been built up to a high state of fertility.

Mr. Sharpe's tomatoes were picked by five itinerant pickers, one woman picking 210 hampers in six hours. From this field of 5.9 acres, 127,867 tons of tomatoes were picked, and about two tons per acre were left in the field when the factory closed.

Indiana's soil is particularly adapted to the growing of highest quality tomatoes, and last year climatic conditions were just about right; early rains to get the plants started, then hot, dry growing weather, with the fall rains coming late enough to interfere very little with picking.

The quality produced was a long jump from the tomatoes that were introduced into Europe during the sixteenth century from western South America where they were grown as perennial herbs. Small and wrinkled, they were then regarded with disfavor as a food and were used only as garden ornaments. Not until the nineteenth century was much done toward their development and introduction as a vegetable.

Purdue University and the Indiana Canners Association have been working for more than 25 years to develop better tomatoes, to increase quality and quantity. One wonders if better tomatoes than were grown last year can be produced; tomatoes of such lusciousness, good color, and meatiness



Tomatoes on Charles Powers' farm near Kokomo ready for transporting to the factory.

that they would almost melt in your mouth; tomatoes growing so abundantly on the vines that a hamper set in a square formed by four plants could be filled from those plants—35 pounds or more from four plants at one picking! Many pickers averaged 200 hampers a day. One teen-age girl picked 152 paskets in a day. As many as 10 tons were picked from one acre at one picking. Fields were gone over by the pickers once each week.

Schools were conducted by the Purdue University Horticultural Extension Tomato Specialist to train pickers to

(*Turn to page* 41)

Nutrient Availability

An Analysis

By S. R. Dickman

Soil Chemist, Agricultural Experiment Station, Urbana, Illinois

ONE of the most misused and misinterpreted terms in all agronomic science is "availability." A reading of the soil literature of the past one hundred years reveals that the term is an old and popular one that has been widely used without ever having been defined. Some idea of the present status of the term may be obtained by a careful reading of the papers in two recent symposia on availability (1, 9, 18, 19, 23, 24, 27, 29, 30, 33, 35). These papers clearly demonstrate the lack of general agreement on the concept, and also show that many soil scientists are aware of the confusion, vagueness, and ambiguity in this realm of their work. Since this condition exists, the next question is, "What is the most satisfactory method of solving the difficulty?" The author will attempt to answer this question by presenting, as impartially and thoroughly as he is able, a review of the various usages and meanings of the term, a critical analysis of present concepts, and some suggestions and definitions which may be found useful by other workers.

In a previous paper (12) the author attempted to show that the term "the available nutrient" is *not* a symbol for something definite in the soil, and suggested that it be no longer used to express the results of chemical soil tests. In that discussion the term "availability" was used with a precise, though not explicitly stated meaning. It thus appears that availability can be rigorously defined in terms of the operations of its measurement. Such a definition, however, would restrict its use to the conditions of the experiment, and new terms would have to be coined to cover the other meanings and usages which availability now has. Such a procedure might be feasible if agriculture were more strictly a science. The fact that so many agronomic technical words are used by non-scientists, extension workers, farm advisers, farmers, etc., makes especially difficult a wide acceptance of a new definition of an old term. For these reasons no attempt will be made to define availability, but several new terms will be introduced and defined.

Present Usages of Availability

In general there have been two viewpoints involved in availability studies. One emphasizes variations in the ease of absorption of different available forms of a nutrient, while the other emphasizes variations in amount of an available nutrient present in different soils. According to the former, which will be called the "ease" concept, superphosphate would be said to have a higher availability than rock phosphate. According to the latter, which will be called the "amount" concept, the availability of a nutrient is said to increase as its quantity in a given soil increases.

An example of the ease concept is afforded by Bray (6) in speaking of the difficultly soluble soil phosphorus: "Even though difficultly available, this fraction often furnishes crops with significant amounts of phosphorus, partly making up for its low availability by its presence in relatively large quantity." Another example of this viewpoint is found in the bulletin by Bartholomew (4) who added a series of phosphatic fertilizers to soils in pots and grew Sudan grass on them. He states, "Therefore, the growth of crops after an application of a phosphatic fertilizer should give a reliable index to the availability of the phosphorus in the fertilizer applied." The ease concept is based on the assumption that some idea of the total amount of the nutrient is known. If the same amount of phosphorus was absorbed by a crop from two forms of phosphates, one of which was present in twice the quantity of the other, the form in the lesser concentration would be considered to have double the availability of the other. Conversely, it has been reasoned that if equal weights of different fertilizers or nutrient elements are added to a soil, the jar or plot from which the crop has absorbed the greatest amount of the element or on which the highest yield has been obtained will indicate the material of the highest availability.

Many examples of the amount viewpoint come from Truog and his students. Thus Ford (13) in studying phosphorus availability in Kentucky soils concluded that since the "available phosphorus" values (as determined by Truog's method) on the limed plots of six fields were not much higher than those on the check plots, "the use of lime did not seem to influence the availability of the native phosphates." Likewise, Cook (10) determined "readily available" phosphorus by Truog's method in soils that had been either limed or had calcium hydroxide added and concluded that, ". . . in seven out of ten acid soils ranging from pH 4.83 to pH 6.30, lime significantly increased the availability of soil phosphates while in two cases it caused only slight increases." Hester (17) also has utilized the Truog method of determining "available phosphorus" as a criterion of phosphorus availability. The A.O.A.C. (2) method of determining available phosphorus in a fertilizer is also based on the amount concept. The greater the amount of phosphate soluble in the extractants used, the greater the content of available phosphorus in the material, and consequently the higher the availability of the fertilizer. Other examples can be given but it is thought that these are sufficient to illustrate what is meant by the amount concept.

The recognition of these basically distinct notions leads to a consideration of what we mean when we say, "Phosphorus availability is increased when superphosphate is added to a soil." Has phosphorus availability been increased because the total amount of available phosphorus has been increased or is it because a substance of higher availability than the phosphorus compounds originally present in the soil has been added?

Other Uses of Availability

1. Mitscherlich. Although the amount and ease viewpoints are the most common found in American publications, the Mitscherlich conception of "available nutrient" occurs frequently in agrobiologic literature (26, 36). This usage of "available nutrient" seems to express a combination of both the amount and ease concepts. The amount of an available nutrient in a soil is said to be calculated by substituting known values in the Mitscherlich yield equation. This value is determined on the basis of the proportional dry weight or yield increase of a crop to added fertilizers, and is not dependent on chemical soil analysis. For example, "the available phosphorus" in the Mitscherlich sense does not involve any direct assumptions as to either the ease of absorption of different phosphates, the chemical forms in which phosphorus occurs in soils, or the amount of any one form of phosphate present in a soil.

2. Neubauer. The Neubauer conception of "available nutrient" is similar to the Mitscherlich viewpoint in that plant responses are used as the criteria of availability of nutrients in both. Details of this method may be found in articles by Thornton (32) and McGeorge (25).

3. Jenny. Jenny and Ayers (22), in

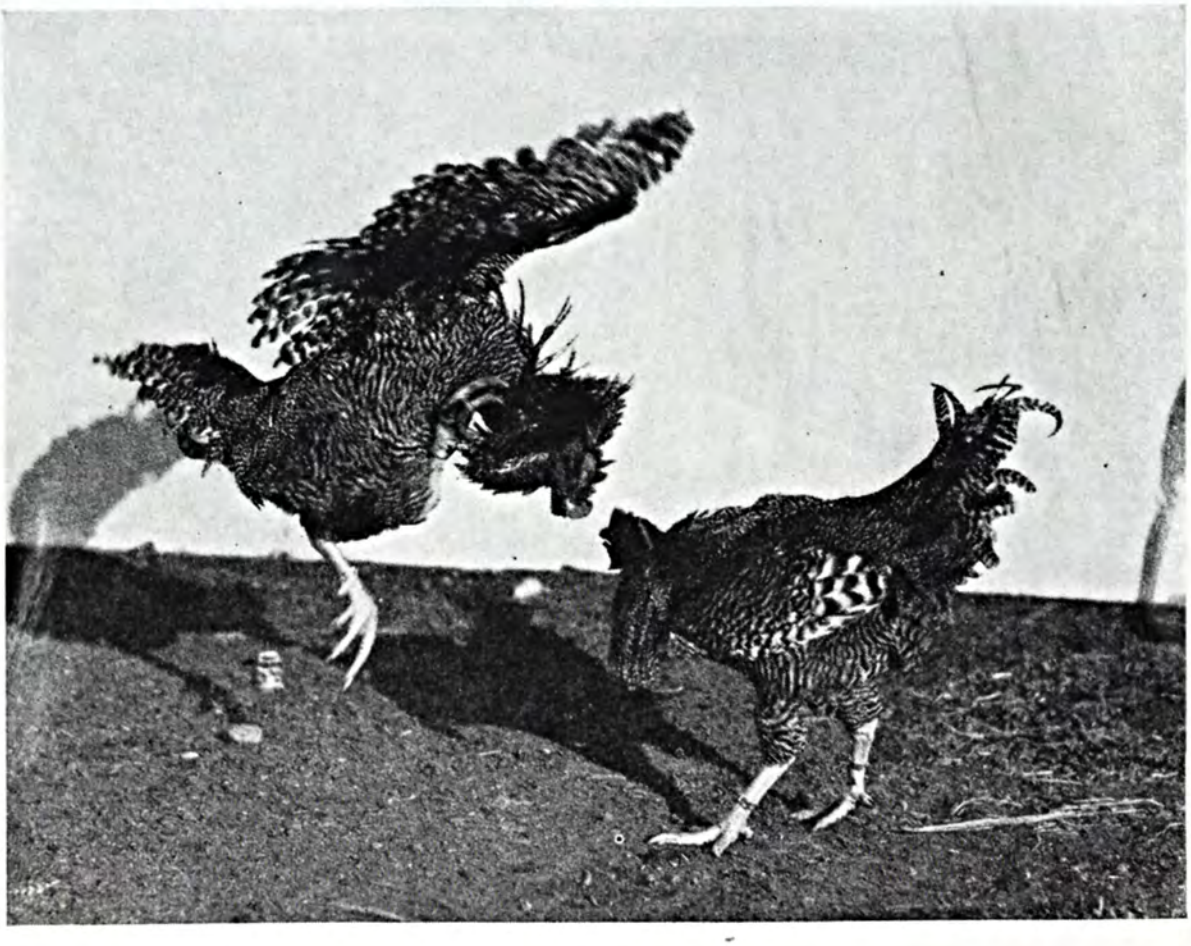
(*Turn to page* 33)

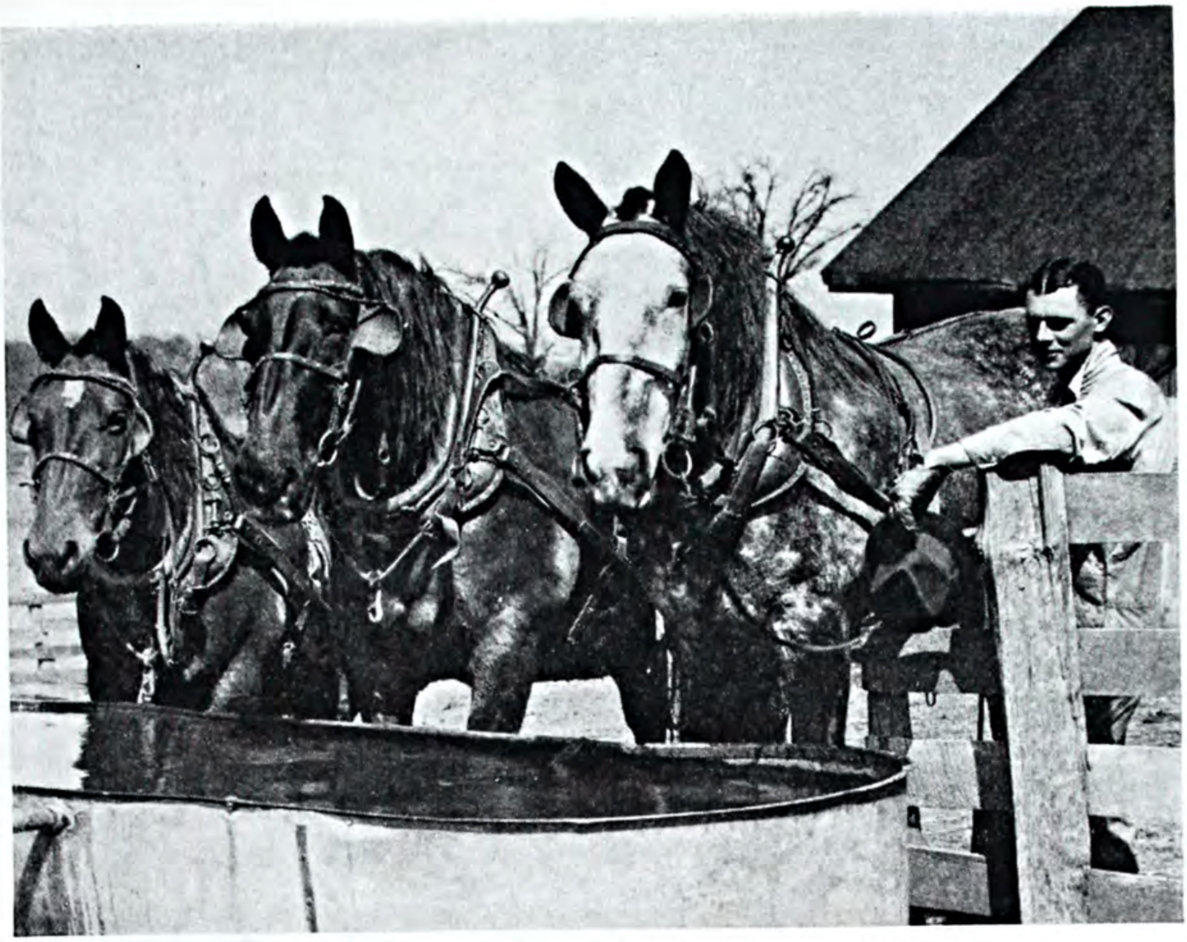
PICTORIAL

A CAREFUL SHEPHERD SEES THAT HIS FLOCK IS WELL FED.

Above: Modern mechanized horsepower in full swing.

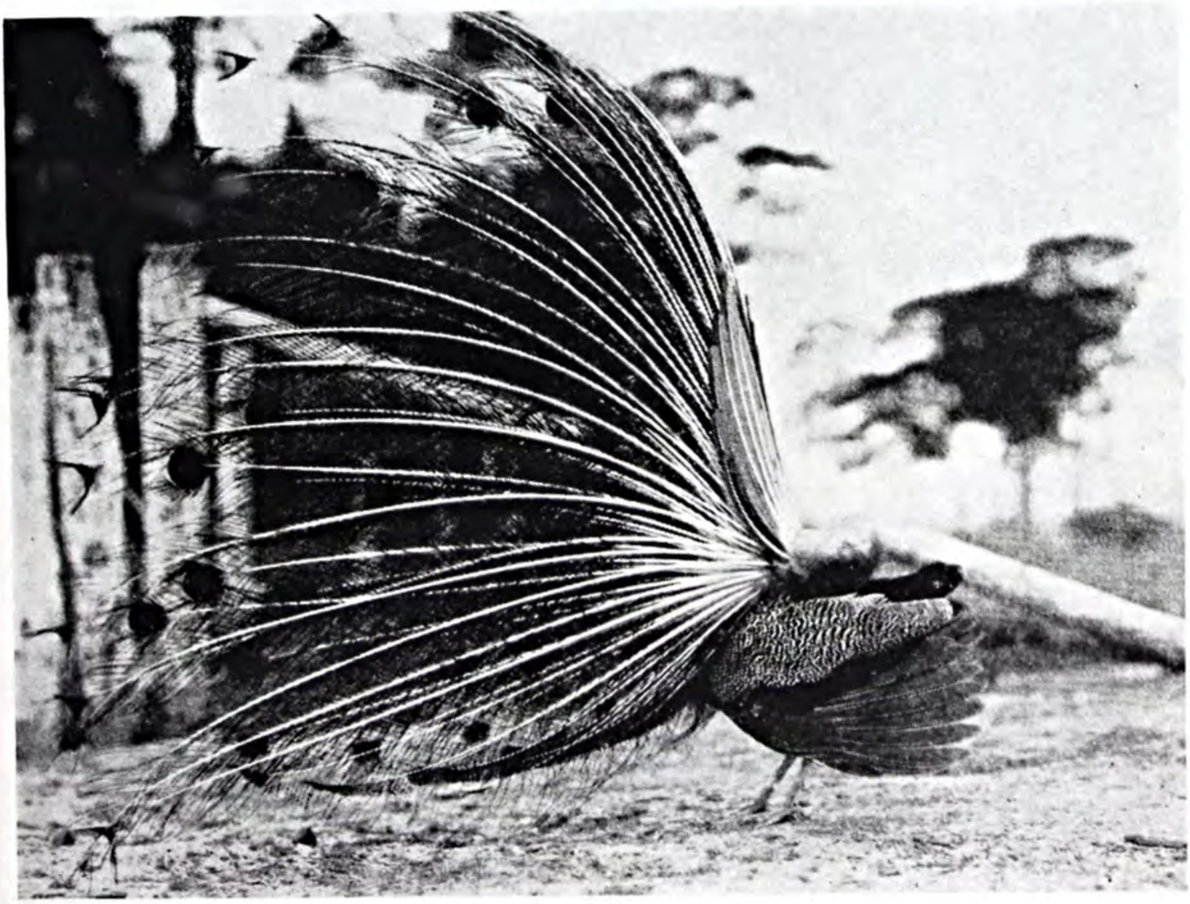
Below: Blitzkrieg in the barnyard.

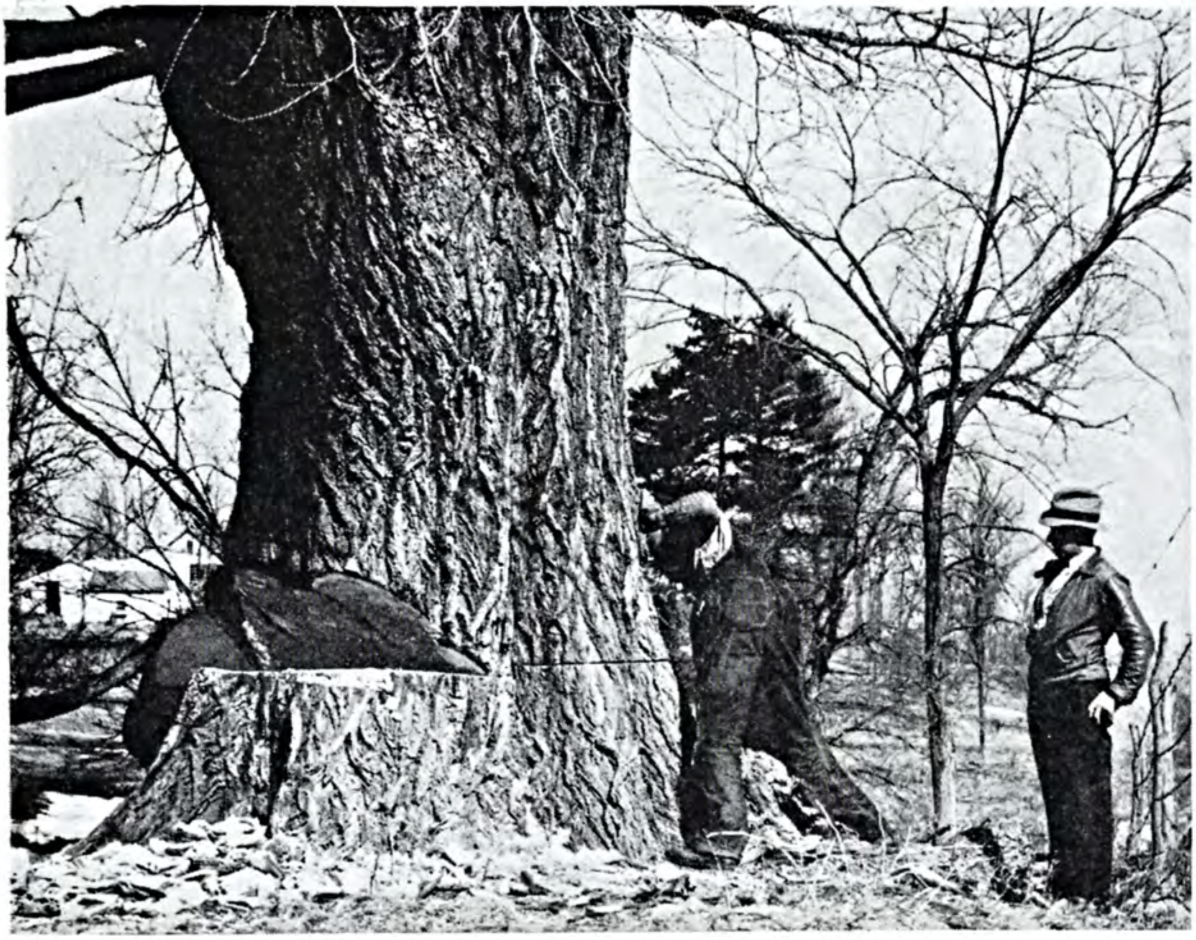




Above: This type of horsepower never goes out-of-date.

Below: Caught in a March wind.





Above: A 100-year-old cottonwood tree bows to civilization.

Below: Twisted and bent, but still a monarch.

The Editors Talk

Our Cover

The emblem appearing on the cover of this issue, although only introduced the latter part of January, is now becoming well known to the reading public. It was especially designed by Walt Disney to identify United States food products wherever they are sent throughout the world. Made available by the Government for the voluntary use by packers, it is expected to become a familiar part of the labels for food containers.

The detail of the emblem shows an American Eagle poised protectively over a cargo boat, fending off a bombing plane. The four stars represent the four freedoms pledged in the Atlantic Charter and later by the United Nations—freedom of speech and expression, freedom of every person to worship God in his own way, freedom from want, and freedom from fear.

"Farmers and all of us are proud of the contribution United States food is making, and will make increasingly, to the job of building and maintaining the fighting strength of the United Nations," said Secretary Wickard. "The new emblem is a symbol. It visualizes the determination to see that American food is used as a powerful weapon in winning the war—and in building the right kind of world when peace comes."

There is no doubt that the American farmer is "all out" for Victory. The addition of this "trade-mark" to stamp his contributions in the eyes of the general public can but help the rapidly increasing realization of the importance of an efficient agriculture in any nation's existence.

Business As Usual

"Business as Usual" is out. Since Pearl Harbor, things have been happening so fast that there probably is no business left which has not felt the demands of the crisis in which the Nation finds itself. The new agricultural goals have been widely publicized, and all industries allied with agriculture not only have had their "priorities" to deal with, but have been made to feel keenly the necessity for a more efficient production which is being put upon the grower.

In the January issue of this magazine we were privileged to present the viewpoint of a government official on the use of more efficient fertilizers in the Victory Program. This month we have another article on higher analysis fertilizers, this time by M. H. Lockwood, Manager of the Fertilizer Division of the Eastern States Farmers' Exchange, who has had many years of experience in the manufacture of fertilizers to conform with official state recommendations and the public demand. Mr. Lockwood emphasizes, as did Mr. Mehring in January, the greater efficiency of high-grade materials and the savings in manufacturing and distribution costs.

"Probably the chief difficulty we in the fertilizer industry have to overcome is the mental hazard of 'figures,'" Mr. Lockwood says in connection with "business as usual." "It is human for us all to like something because we are accustomed to it. We become used to the grade numerals of a particular mixed fertilizer. We become used to a certain analysis of an item like superphosphate and muriate of potash and if we are not careful, we find ourselves in the awkward position of leaving our fertilizer grades too much like they used to be without taking into consideration the sound changes that could be made in them if we took advantage of the increases in analysis of the ingredients that go to make up those mixtures."

Thus does Mr. Lockwood aptly apply to his industry the hold which habit gets on everyone who is not alert to the advantages so very often obtainable in "change." This application to growers, by and large, is even more fitting, since one of the long-recognized drawbacks to improved agriculture has been the resistance agricultural advisory forces have encountered in getting widespread adoption of new practices.

Higher analysis fertilizers are on the market. They are being recommended and many growers are using them. Because of their proved efficiency and the need for the employment of every efficiency in meeting the new production goals, more and more emphasis must be placed on the advisability of using concentrated plant-food mixtures. It will be a change in habit for the majority of the growers, but "business as usual" is out.

Selective Service For Each Acre

These five words, "Selective Service for Each Acre," bring the war down to the land and might well become the slogan of every farm-owner, renter, and share-cropper for the duration. We saw them as the title of an article by Glennon Loyd in the March 1942 issue of the magazine, Soil Conservation. They have a ring, are easy to remember, and seem to furnish the clue for the farmer torn between his desire to go "all out" in line with the emergency and still keep within the bounds of allotments, production goals, and the teachings of soil conservation.

There must be many such farmers, men who remember the disastrous after-effects of plowing up every available acre during the last war and yet who are anxious to do everything in their power to produce the food, textile, and other agricultural products needed to win this war. If they can find the time to analyze their acres as the draft boards analyze the draftees which come before them, considering the best fitted first, and classifying the others in relation to their ability to produce, a start has been made.

Mr. Loyd in his article has several suggestions for conserving cropland while producing, among them: liming acid soils; using commercial fertilizer; installing soil-conserving rotations; holding soil and water on the hillsides by contouring; and preventing wind erosion. He sees no reason for bleeding the remaining topsoil from our hills nor any excuse for removing what is left of the precious fertility from our other less productive soils. He sees little need for farmers to call gully scarred or wounded acres to the front lines of this food production campaign.

Selective service will involve continuance of the principles of good soil management which employ the best land first, more production from fewer acres through the use of proper fertilizers, improvement and increased use of grasslands, and the expansion of those lines of farming activity in which the operator has had the most experience. The acres to be deferred now should serve in other capacities, such as forestry, or be built up for a higher classification in future selective service.

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

"Inspection of Commercial Fertilizers and Agricultural Lime Products," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 109, Sept. 1941.

"Fertilizer Analyses and Regulations, 1941" St. Dept. of Agr., St. Paul, Minn.

"Fertilizer Report, 1940," St. Dept. of Agr., Harrisburg, Pa., Gen. Bul. 577, Vol. 24, No. 5, Sept.-Oct. 1941.

"Arsenic in Natural Phosphates and Phosphate Fertilizers," U. S. D. A., Washington, D. C., Tech. Bul. 781, Nov. 1941, T. H. Tremearne and K. D. Jacob.

Soils

"The Muck Soils of Michigan," by Paul M. Harmer, Special Bulletin 314 of the Michigan Agricultural Experiment Station, is the most complete publication available on the farming of organic soils in the northern United States. The chemical composition of a number of peat and muck soils and of several mineral soils for comparison is given. It is pointed out that the organic soils usually are much lower in phosphoric acid and potash and frequently also in manganese than many mineral soils. The origin and method of formation of various muck soils and the influence of these differences on the properties of the soils and their practical bearing on soil management are discussed.

A classification of muck soils into three broad groups based on the lime content is made. Lime is recommended for the low-lime mucks, while on the alkaline mucks sulphur and manganese sulphate usually are recommended. The use of borax to control cracked-stem of celery, girdle of table beets, and boron deficiency disease of sugar beets is recommended with the rate of application 25 to 100 pounds of borax per acre. Copper sulphate has been found beneficial on most of the acid mucks, particularly when carrots, lettuce, onions, potatoes, spinach, and tomatoes are grown. Ordinary rock salt also has been found beneficial to some crops but is not at all beneficial to others.

The use of fertilizers for all of the crops commonly grown on muck soils is discussed in detail. In the general consideration of the use of fertilizer, it is pointed out that muck soils are usually relatively higher in nitrogen and, therefore, this nutrient frequently is low or entirely lacking in the fertilizer used on muck soils. Phosphates are moderately lacking and are usually included in a fertilizer for muck soils, while potash is generally needed the most and, therefore, is included in practically all muck fertilizers. The age of the muck, the type of muck with reference to its lime content, the crops grown, and previous fertilization will also influence the choice of the best fertilizer to use. Among the analyses recommended for the various crops are 0-8-24, 2-8-16, 3-9-18, 3-12-12, 0-20-20, 0-10-20, and 0-8-32. Rather detailed information is given on drainage, irregation, breaking new mucks, cultural practices, frost and temperature relationships, wind injury and its prevention, and crop adaptation.

"Limestone, the Key to Soil Conservation," Agr. Ext. Serv., Urbana, Ill., May 1941, C. M. Linsley.

"Solving Land-use Problems," Agr. Ext. Serv., Orono, Maine, Ext. Bul. 298, Jan. 1942, Stacy R. Miller.

"The Muck Soils of Michigan—Their Management and Uses," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 314, Dec. 1941, Paul M. Harmer.

"Effects of Slope, Character of Soil, Rainfall, and Cropping Treatments on Erosion Losses from Dunmore Silt Loam," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 72, Aug. 1941, James H. Lillard, H. T. Rogers, and Jesse Elson.

"The Effect of Green-manure Crops on Certain Properties of Berks Silt Loam," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 73, Sept. 1941, S. S. Obenshain and P. T. Gish.

"Report of the Chief of the Soil Conservation Service, 1941," U. S. D. A., Washington, D. C.

Crops

¶ A simple and practical publication on pasture improvement has been prepared by E. D. Walker and J. C. Hackleman and issued as a mimeographed Department of Agronomy pamphlet by the Extension Service of the University of Illinois. This is entitled "Five Steps in Pasture Improvement." These steps include: first, the testing of the soil and the application of lime, phosphate, and potash as needed according to the results of the test; second, disking in order to work the lime and fertilizer into the soil and provide at least a semblance of a seedbed; third, heavy seeding principally with sweet clover but also with alfalfa, alsike or red clovers, and with timothy, redtop or orchard grass possibly also included; fourth, careful grazing so as not to over-graze or under-graze; and fifth, clipping of the weeds so as to give the desirable forage plants a better chance to grow. Somewhat similar directions are also given for establishing new pastures. This bulletin is well worth study by everyone who has to deal with pastures.

"Hays and Hay Making in the Prairie Provinces," Dom. Dept. of Agr., Ottawa, Ont., Pub. 722, Farmers' Bul. 104, Nov. 1941, M. J. Tinline.

"Apple Harvesting and Storage in British Columbia," Dom. Dept. of Agr., Ottawa, Ont., Pub. 724, Farmers' Bul. 105, Nov. 1941, J. E. Britton, D. V. Fisher, and R. C. Palmer.

"Crotalaria for Forage," Agr. Exp. Sta., Gainesville, Fla., Bul. 361, Aug. 1941, Geo. E. Ritchey, Roland McKee, R. B. Becker, W. M. Neal, and P. D. Dix Arnold.

"Bromegrass," Agr. Ext. Serv., Urbana, Ill., Apr. 1941, R. F. Fuelleman.

"Five Steps in Pasture Improvement," Agr. Ext. Serv., Urbana, Ill., June 1941, E. D. Walker and J. C. Hackleman.

"Annual Report of the Maine Extension Service for the Year Ending June 30, 1941," Agr. Ext. Serv., Orono, Maine, Ext. Bul. 299, Dec. 1941.

"Commercial and Experiment Station Corn Yield Trials, 1941," Agr. Ext. Serv., University Farm, St. Paul, Minn., Ext. Pamph. 88, Jan. 1942, Ralph F. Crim.

"Small Grains in Minnesota," Agr. Ext. Serv., University Farm, St. Paul, Minn., Ext. Bul. 228, Nov. 1941, W. W. Brookins.

"Orchard Grass in Missouri," Agr. Ext. Serv., Columbia, Mo., Cir. 431, July 1941, E. Marion Brown.

"Science and the Land—The 62nd Annual Report of the New Jersey State Agricultural Experiment Station and the 54th Annual Report of the New Jersey Agricultural College Experiment Station, 1940-41," Agr. Exp. Stas., Rutgers Univ., New Brunswick, N. J.

"Apple Growing in New York," St. Agr. Exp. Sta., Geneva, N. Y., Cir. 158, Rev. Oct. 1941.

"Strawberry Production in Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 626, Jan. 1942, Leon Havis.

"Utilization of Home Grown Feeds in Fattening Steers in the Trans-Pecos Region," Agr. Exp. Sta., College Station, Texas, Bul. 604, Sept. 1941, J. H. Jones, J. M. Jones, and J. J. Bayles.

"Barley Production in Texas," Agr. Exp. Sta., College Station, Texas, Bul. 605, Sept. 1941, I. M. Atkins and P. B. Dunkle.

Factors Affecting Physiological Breakdown of Maturing Tobacco," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 74, Oct. 1941, G. M. Shear.

"The 4-H Club Garden," Agr. Ext. Serv., Pullman, Wash., 4-H Cir. 58, Nov. 1941, John C. Snyder.

"Growing Grapes in Washington," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 271, Aug. 1941, John C. Snyder.

"Growing Austrian Winter Field Peas in Washington," Agr. Ext. Serv., Pullman, Wash., Ext. Cir. 38, Nov. 1941, Leonard Hegnauer, I. M. Ingham, and L. G. Smith.

"Peach Growing in Washington," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 162, Aug. 1941, E. L. Overholser, A. L. Kenworthy, and R. M. Bullock.

"Experiments on the Burn of Cigars," Agr. Exp. Sta., Madison, Wis., Res. Bul. 140, Aug. 1940, James Johnson.

"Report of the Chief of the Bureau of Plant Industry, 1941," U. S. D. A., Washington, D. C.

"Report of the Chief of the Bureau of Agricultural Chemistry and Engineering, 1941," U. S. D. A., Washington, D. C.

Economics

¶ "What the Farm Should Contribute Toward Family Living" is the title of an interesting Popular Bulletin (No. 163) of the State College of Washington Agricultural Experiment Station. The bulletin was prepared by a special committee representing the Agricultural Experiment Station and the Agricultural Extension Service of the State College of Washington, the State Nutrition Committee, and the State Land-use Planning Committee.

Interest in nutrition, while not new, has received considerable stimulus as a result of the war. Even before the beginning of this war, more and more attention was being given to a balanced national diet and to the problems of producing products sufficient to provide such a diet. The first paragraph of the prefatory note states very clearly the far-reaching importance of a properly balanced diet. "That every family be well fed is of vital importance. Without proper nutrition neither children nor adults can be in the best physical condition. No job is more important than the proper feeding of the men and women of tomorrow. Their wholesome development is essential to the happiness of the family, to the welfare of the community, and to the future of the Nation."

The bulletin deals specifically with problems in the growing of essential food requirements on Washington farms, but is applicable in a general way to large areas of the United States. The foods which should be provided for every boy and girl, man and woman, for proper health are milk and milk products for vitamin A, calcium, phosphorus, and protein; eggs for vitamin A, iron, phosphorus, and protein; fruits and vegetables for vitamins A to G inclusive and many necessary minerals; meats for protein, which builds strong muscles and other body tissues, phosphorus, and iron. Cereals in their natural state are important in all diets because of their rich source of vitamin B complex and iron. It is difficult to secure adequate quantities of the B vitamins unless reasonably generous amounts of whole grain are included in the daily diet.

According to the interesting charts shown in the bulletin, 50% of the farm families receive good diets, 25% receive fair diets, and 25% poor diets, whereas in villages and cities only 20% receive good diets, 45% fair diets, and 35% poor diets. It has also been shown that on the farms where a large percentage of home-produced products are consumed, the families on the whole receive better than average diets. According to data quoted in the bulletin, it requires about $700 per year to properly feed a family of five, whereas data from the Washington home accounts indicate that 65% to 75% or $400 to $600 of the value of the food needs for the average family can be produced on the farm in most sections of the State. It is suggested that farmers can use this means of increasing their real income quite successfully. For example, in order to produce $500 worth of food products, it would take about 8 cows or 450 hens, or in terms of wheat about 775 bushels.

The State has been divided into four districts and the discussion of gardens centers around the crops that are adaptable in the different districts. The bulletin contains interesting data on the type of crops to grow, a typical plan for a garden for a family of five, the time to plant, and the materials needed. Other sections deal with the production of dairy products and other animal products on the farm. In view of the wide interest in family gardens as a result of the war, this publication should prove of wide interest throughout the United States.

"Arizona Agriculture, 1942, Supplies, Prices, and Income," Agr. Exp. Sta., Tucson, Ariz., Bul. 178, Jan. 1942, George W. Barr.

"Connecticut Vegetable Acreages, 1939, 1940, 1941," St. Dept. of Agr., Hartford, Conn., Bul. 75, Jan. 1942.

"The Challenge to Democracy," Agr. Ext. Serv., Ames, Iowa, Bul. P26, Oct. 1941, E. D. Ross.

"Classification of Agricultural Areas, Frederick County, Maryland," Agr. Exp. Sta., College Park, Md., Bul. 440, Apr. 1941, Robert W. Harrison and Paul L. Searfoss.

"A Study of Dairy-farm Management in Onondaga County, 1938 and 1939," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 767, Oct. 1941, R. W. Hoecker.

"An Economic Study of the Organization and Management of Beef Cattle and Other Types of Farms in Russell County," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 71, July 1941, J. J. Vernon.

"Washington Apples on the New York and Chicago Fruit Auctions," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 275, Oct. 1941, Mark T. Buchanan.

"Settlement and Development of Cut-over Lands of Western Washington," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 277, Nov. 1941, Carl P. Heisig.

"Looking Ahead into 1942," Agr. Ext. Serv., Pullman, Wash., Cir. 41, Dec. 1941.

"Washington Apples on the New York and Chicago Fruit Auctions," Agr. Exp. Sta., Pullman, Wash., Bul. 401, June 1941, Mark T. Buchanan.

"The Marketing of Washington Apples in Los Angeles, California," Agr. Exp. Sta., Pullman, Wash., Bul. 406, Sept. 1941, Mark T. Buchanan and E. F. Dummeier.

"After Three Years: A Restudy of the Social and Economic Adjustment of a Group of Drought Migrants," Agr. Exp. Sta., Pullman, Wash., Bul. 407, Oct. 1941, Paul H. Landis.

"Report of the Director of the Office of Foreign Agricultural Relations, 1941," U. S. D. A., Washington, D. C.

"Report of the Administrator of the Agricultural Adjustment Administration, 1941," U. S. D. A., Washington, D. C., G-113, Nov. 1941.

"Wartime Work Program of the Bureau of Agricultural Economics," U. S. D. A., Washington, D. C., Jan. 1, 1942.

"Farm Adjustments in the Southeast to Meet Defense Needs," U. S. D. A., Washington, D. C., Prelim., Nov. 1941.

"Farm Adjustments in the South Central States to Meet Defense and Post-war Needs," U. S. D. A., Washington, D. C., Dec. 1941.

"Farming Adjustments in the Northeast to Meet Defense and Post-defense Needs," U. S. D. A., Washington, D. C., Nov. 1942.

"Farming Adjustments in the Far West to Meet Defense Needs and Stabilize Agriculture," U. S. D. A., Washington, D. C., Rev. Oct. 1941.

"Planning Adjustments on Truck Crop Farms in Wicomico County, Maryland," U. S. D. A., Washington, D. C., June 1941.

High-Grade Fertilizers Are More Profitable

(*From page* 12)

The success of this and similar changes indicates, we believe, the readiness of most of us to follow well-reasoned changes.

Fertilizer users frequently wonder whether they are changing to as satisfactory a mixture when they use higher analysis grades. The answer is fairly simple and positive: first, that crop yields are as high with one as with the other; second, that whether the user is a potato grower applying a large amount of fertilizer on each acre or a grower of corn or wheat or grass using relatively smaller amounts, the returns have been equally good. Another important consideration is that the higher analysis ingredients contain generally as little or less of the factor called "soluble salts" for each unit of plant nutrients furnished. Thus one ton of 4-8-8 usually has more total soluble salts than 1,600 pounds of a 5-10-10, and one ton of 4-16-20 has less potential crop injury factors in it in terms of total salts than two tons of 2-8-10.

May I venture the opinion that if fertilizer consumers have presented to them 20- and 25-unit mixtures in place of the present 15- and 20-unit grades, most of them will make the change provided those presenting the change make the presentation constructive and really try to put such a program across. I am also quite confident that such a change can be made rather abruptly as well as smoothly. I am equally confident that everyone involved will gain directly or indirectly from it.

Nutrient Availability—An Analysis

(*From page* 22)

discussing the influence of the degree of potassium saturation on potash absorption by barley roots, state, ". . . the degree of saturation assumes a dominant role because it controls the exchangeability and therefore the availability of nutrient ions." They conclude that with any given degree of potash saturation, the nature of the complementary ion markedly affects the availability of potassium. This view seems to be a special case of the "ease of absorption" concept since here the chemical form of the nutrient as well as its amount is constant. Tiulin (34) has discussed similar relationships with regard to the availability of absorbed phosphate.

Criteria of Availability

Another aspect of the question is that of deciding what measurement or group of measurements give the most reliable index of the availability of nutrients. Evidently there are two separate schools of thought on this subject: (1) that which favors soil measurements; and (2) that which favors plant measurements. Since a review of the first group was discussed in a previous paper, (12) only the second group will be mentioned here. The Neubauer method utilizes plant analysis and absorption of nutrients, whereas the Mitscherlich calculations are based on total dry weight of plant substance produced. On the other hand, the results of most field experiments with fertilizers are judged on the basis of the yield produced, with or without quality considerations.

Another divergence in availability studies is connected with the amounts of fertilizer applied to the soil. Some workers (28) have added equal weights of the fertilizers being compared. Others (15) have supplied equal weights of the nutrient element in the fertilizer, while still others (5) with a more practical viewpoint have added equal money values of the materials to be tested. There are comparatively few field experiments which include more than one increment of the fertilizer being tested. When these diverse methods, all presumably concerned with nutrient availability, are considered, it is not surprising that there is so much disagreement on the best use of fertilizers and the proper use of quick tests in American agriculture.

When the question of plant nutrition is examined, it is found that there are two primary interest points: (1) the nutrients in the soil; and (2) the plants themselves. Plants use the essential elements in their growth function. It is evident that there is a relationship between the nutrients in the soil and their absorption by plants. This relationship varies with the type of soil, amount and form of nutrients, kind of crop, length of growing season, water supply, etc., and if any one of these factors is changed in a given experiment, the effect of all the other factors is likewise altered. In other words, nutrient ions in the soil, or fertilizer salts, do not possess an inherent availability as a fixed or constant property.

The author believes that the soil-plant relationship should serve as the fundamental basis of what are now called availability experiments. If this relationship is used as a figurative yardstick with which to measure present availability concepts, it is found that these concepts all fall far short of expressing the whole.

The amount concept thus clearly fails to include one of the two primary subjects in its measurement. Because no plant data are included, this concept must assume that plants differ very little in their "feeding power" for nutrients or in their relative responses to added nutrients. Since the availability of a nutrient in a soil is supposed to be measured by a single chemical determination, this viewpoint also ignores the effect that the presence or absence of other nutrients has on crop growth and nutrient absorption. Adherents to this viewpoint further ignore the influence of other factors of the soil-plant relationship, such as the physical condition of the soil, the climate, spacing of plants, etc., on ion availability.

When these notions are applied to fertilizer availability, an even larger number of fallacious assumptions appear. Besides all those mentioned above, assumptions are made that there is no interaction between the soil and the fertilizer, and that the time and manner of application of the fertilizer play no part in determining its availability. In short, that the solubility of a fertilizer in a given reagent is the sole criterion of its availability.

To speak of measuring the availability of superphosphate in the laboratory by a chemical method is no more sensible than to claim to measure intelligence by weighing a person's brain. Both availability and intelligence are abstract concepts, and identification of any one of the factors which influence the net result, with the general concept itself, results only in hopeless confusion.

The ease concept is more nearly correct in its approach than the amount viewpoint in that the influence of the plant factors is explicitly recognized. The ease concept assumes first, that the available forms of each element are known and can be accurately measured, and secondly, that these forms do not vary during the course of a growing season. Thus any equilibria between an available form and non-absorbable compounds of the element would upset such calculations, as well as any leaching losses of soluble forms. Another complication that arises from acceptance of this viewpoint occurs when more than one available form of an element is present in the soil. Absorption from one form of a nutrient at an early stage of the plant's development may profoundly influence uptake from another form at some later phase of development and thus the ease of absorption and hence the availability would not depend solely on the chemical characteristics of the second form with any given species of plant. An illustration of this is found in the work of Dickman and DeTurk (11), which shows that the presence or absence of soluble phosphate in nutrient solutions at an early stage in the development of the corn plant may result in dry weight increases at later phases which are in direct opposition to phosphorus absorption from either soluble phosphate or rock phosphate.

Additional Criticisms

Another criticism of the ease concept follows from the fact that in many fertilizer experiments conclusions have been drawn with respect to the availability of the added fertilizers when only one rate of application of each had been made. Many of these experiments have as their object the measurement of the availability of the applied fertilizer. This type of experiment rests on two fallacious assumptions. The primary fallacy springs from the assumption that it is possible to measure the availability of a fertilizer by *any* method. The non-acceptance of this assumption becomes reasonable when one realizes that as soon as a fertilizer is placed in the soil it reacts with the soil and is altered. Furthermore, since no two soils are exactly alike, the change in the fertilizer will be different and the fertilizer will have different effects on the crop being grown (16). An increase in crop growth results from the soil-fertilizer combination, and the yield increase thus obtained should not be attributed solely to either. The usage of Jacob and Ross (21) in speaking of the "efficiency" or "nutrient value" of fertilizers appears to be a simple and convenient way of discussing fertilizer results. Thus if 50 pounds of one fertilizer increased the yield of a crop as much as the application of 100 pounds of another, the efficiency of the former would be double that of the latter on the soil used for the experiment.

This brings us to the second fallacy of the one-rate-of-application experiments, (15, 25). Such experiments assume that the single amount of each fertilizer added to a soil will lead to a fair comparison of their relative availabilities. Yet how can one be certain that he is making a fair comparison? Mitscherlich (26) has conclusively demonstrated that as larger and larger increments of fertilizer are applied to a soil, crop response from any two successive increments becomes progressively smaller. Crop response from any one addition, therefore, can be properly interpreted only in relation to the yields obtained from a larger and a smaller amount. Conclusions drawn from one-rate-of-application experiments can not justifiably be generalized to cover other rates of application. Of what value, then, are availability measurements from such data?

It would seem, then, that a comparison of fertilizer efficiencies can be most fairly made at equal crop yields or at equal amounts of the element absorbed. A comparison of the amount of each different fertilizer added in the experiment for any given level of crop production then serves as a direct measure of relative fertilizer efficiency. If, for example, it is found that one phosphatic fertilizer helps produce a 150-bushel corn yield, while the maximum yield with another is 100 bushels, no comparison of the efficiency of these fertilizers can be made at the 150-bushel level. The smallest amounts of each which resulted in a 100-bushel yield, however, make possible a quantitative estimation of their relative efficiencies at this level. It should not be forgotten that fertilizers are of importance because of their aid in sustaining and increasing crop yields. Therefore, the most practical common denominator or standard for comparing relative fertilizer efficiencies would seem to be at equal yields.

Quantitative Agrobiology

Since an adequate discussion of the Mitscherlich approach to availability questions alone would require a long article, the author will not presume to offer an adequate criticism of the theory here. It can be said, however, that from a purely logical viewpoint the Mitscherlich equations and theories form a self-consistent system. Yet some of the assumptions on which this system is based are of doubtful validity and have been seriously questioned by Briggs (8) and by Balmukand (3).

The author has closely examined the Mitscherlich conception of "available nutrient" and wishes to point out some of the qualifications of the term. The available potassium in the Mitscherlich sense does not refer to the amount of potash actually absorbed by the plant, or to an actual quantity of a nutrient form of potassium such as the replaceable potash present in a soil. The measure of available potash is solely in terms of plant yield or dry substance responses. By utilizing the proportional responses obtained with each plant genotype, this viewpoint is said to acquire general applicability. In other words, the available potash is considered to be a constant in a given soil even if two strains of corn yield 25 and 50 bushels respectively on the unfertilized soil. This reasoning assumes that each increment of added potash increases the yield of the second variety exactly twice that of the first variety of corn until the maximum yield of each is attained. An adoption of this viewpoint thus would lead one to predict that a variety with the greatest "quantity of life" (36) would always yield proportionately more than another variety with a lesser "quantity of life" on any given soil. Illinois data (20) that bear on this question are at variance with this prediction.

Willcox (36), in applying the Mitscherlich equation, also considers that the amount of an "available nutrient" is independent of the quantities of the other nutrients present in the soil. He states, ". . . every factor of plant growth has a yield-producing potency that in the limit is independent of the potencies of any and all other growth factors. One Baule unit of potash will always produce 50% of whatever crop the soil is otherwise capable of producing."

The unqualified acceptance of this statement would lead one to predict that the addition of a fertilizer to a soil would always increase the yield of a given variety unless 10 Baule units of that nutrient were already present. This is at variance with other crop yield data secured in Illinois which show that superphosphate additions sometimes result in corn yield decreases. The evidence indicates that the superphosphate additions have induced a higher nitrogen requirement in the crop since the superphosphated plants showed marked symptoms of nitrogen deficiency, whereas the non-phosphated plants appeared normal. It would seem, therefore, that the above data demonstrate that the "available nitrogen" is not an independent variable as is considered in agrobiological literature, but is dependent on the phosphate status of the soil. In the last chapter of his book Willcox recognizes the depressive influence of nutrient unbalance and accounts for it by saying, "This situation discloses that one and the same growth factor may have opposite effects on plant growth and yield." It is thus necessary for him to introduce a negative constant, called the depression constant, into the yield equation. This constant, k, ". . . depends on the character of the hostile influence at work and has to be determined in each specific instance, and, it should be added, for each particular variety of plant" (36). The necessity for introducing a variable "constant" into the universal yield equation causes one to seriously question the general applicability claimed for the Mitscherlich yield equation and the concept of available nutrient derived from it.

In addition, it is difficult to conceive of an independent chemical determination which will confirm the Mitscherlich value for an available nutrient. A chemical test can determine only forms of nutrients or the soluble equilibrium products of a number of forms in a given soil, and these values do not agree with those obtained by the Mitscherlich calculations. It thus appears that any chemical extraction method which is based on a non-chemical available nutrient concept, such as that of Mitscherlich, and is not devised to recognize and to determine specific chemical forms of nutrients in soils is scientifically unsound.

(Continued next month)

All references will be listed at the end of the next instalment.

The Hope of No-Pone Valley

(*From page* 15)

and loosen up the tight shale subsoil so other crop roots can penetrate.

The Runyans grow alfalfa, too. They fertilize a little heavier than Ledford, however. For 2 acres seeded in 1940, they used per acre applications of 2½ tons lime, 450 pounds 45% superphosphate, 200 pounds muriate of potash, and some manure. Three cuttings made 12 tons of quality hay last year.

Most of the cotton in No-Pone Valley is of the "bumblebee" type. That is, local farmers say, a bumblebee can lay on his back and suck the blooms. Bill Runyan's cotton looked good for a bale per acre. On Apison shale soil, it followed lespedeza and had received 500 pounds per acre of 2-10-4 and a side-dressing 100 pounds of nitrate of soda.

Corn followed rye and crimson clover turned under and was fertilized with 300 pounds of 0-10-4 per acre in the row and side-dressed with 125 pounds nitrate of soda.

The Runyans keep beef cattle. When Bill returned to the farm, they had 4 head; on the same acreage they now have 54 head. The increase was made possible by more and a better grade of hay and grain and increased carrying capacity of pastures. Most of the crop and some of the pasture land has been terraced during recent years.

Fertilizer Aids Pioneer

Seventy-five miles away from Ledford and the Runyans in Union County lives D. R. "Uncle Rex" Nicely. He hasn't seen their demonstrations, but has learned a few tricks of his own during 61 years living in the shale valley. Uncle Rex's 107-acre farm and homestead stand out like an oasis in a desert.

What's the trick? Liberal use of lime and fertilizer—a good grade of complete fertilizer—to get red clover, lespedeza, and grasses. This puts organic matter in the soil to keep it from packing and "running together." "Otherwise crops can't stand summer droughts," he says.

Uncle Rex has lived in the shale valley all his life but didn't find out until recent years what response liberal fertilization gave. "If I had known years ago how this old worn-out shale soil would respond to lime, phosphate, and potash, I could have been a rich man," he declares.

Typical pioneers in this country, Mr. and Mrs. Nicely can sit on the porch of their comfortable and attractively landscaped home and look across the valley to a cleared field high up in the ridges where they grew their first crop two years after they married. "Worked as a hired laborer for 50 cents or a bushel of corn a day the first 2 years," Uncle Rex relates. "One day I worked hard all day for a bushel of corn. Took it to the community store and sold it for 30 cents and bought a pound of coffee for 25 cents. It was that night we decided to clear some land and farm for ourselves. I haven't bought a bushel of corn since. We traded our first wheat crop for a milk cow."

Uncle Rex has quite a reputation as a burley tobacco grower. His crop last year was particularly good. A yield of 1,915 pounds per acre sold for an average price of nearly 35 cents. "It was the cheapest crop I ever grew," Uncle Rex says.

In addition to some manure, Uncle Rex used 400 pounds of 3-8-5 fertilizer

A bale of cotton per acre, unheard of before in No-Pone Valley. Bill Runyan did it by turning under a crop of lespedeza, applying 500 pounds of 2-10-4 per acre, and side-dressing with 100 pounds of nitrate of soda.

D. R. Nicely, Union County, Tennessee, turned under barley and crimson clover, applied 400 pounds of 3-8-5 per acre, side-dressed with nitrate of soda, and produced this tobacco which made 1,915 pounds per acre and sold for 35¢ a pound.

per acre in the hills and side-dressed with 100 pounds nitrate of soda. The field was in barley and lespedeza in 1940 and received an application of 250 pounds 45% superphosphate per acre at that time.

Both Ledford and Uncle Rex are unit-test demonstrators, and Bill Runyan is an area demonstrator in the co-operative farm-improvement program of the Tennessee Extension Service and the Tennessee Valley Authority. It looks as though they may have found "pay dirt" in No-Pone Valley.

Lilies for Easter

(*From page* 16)

have to be devoted to this purpose and in more than one climatic zone. The Oregon growers, who operate on exceptionally well-adapted land along the coast, are expected to grow lilies largely for "seed" purposes to be increased in other localities. The situation will be somewhat comparable to that of the seed-potato industry.

Most of the lilies being grown on the Oregon coast are known as the Croft and Kenyon lilies. A third and newer variety grown there is called Slocum's lily, which was judged the best among all those at the Government's Beltsville testing ground in 1941. Experiment station pathologists have been working with the Oregon lily growers in keeping the stock free from the many diseases which are a constant threat to the industry. Virus diseases constitute the worst threat, though these have been successfully controlled in the stock thus far.

The lily industry, while still confined to a comparatively small area, holds such large potential promise that careful study is being given to cultural methods and marketing plans. Fertilizer high in both phosphorus and potash is necessary for the best results. The usual practice is to apply a complete 3-10-10 or 3-12-12 fertilizer unless a leguminous cover crop has been used, in which case only the phosphorus and potash are applied.

Marketing is largely through established channels, with practically none of the growers attempting any retailing. A movement has been started to obtain state grades and compulsory inspection so as to insure standardization of pack and quality and prevent the new industry from being harmed by even a small quantity of inferior bulbs reaching the market.

Greenhouse men throughout the country who have had opportunity to try the Oregon lilies have been so enthusiastic about the quality and freedom from disease that for several years they have had standing orders for every bulb the growers would part with. Although the first commercial sales of these Oregon lilies were made less than 10 years ago, present indications are that a $3,000,000 industry will be developed within the next 10 years.

More Legumes for Ontario

(*From page* 9)

ting on August 1. Fine weather prevailed and the hay was all well cured. The weights of air-dry hay in tons per acre were as follows:

Date of cutting	Plot 1	2	3	4
June 21	4.99	2.45	1.18	1.09
August 1	1.18	.72	.43	.24
Yields from 2 cuttings	6.17	3.17	1.61	1.33

As already stated, the weather was unusually dry. Less than three inches of rain fell during May and June when the greatest growth was made. The splendid yields on plot 1 and the reasonably good yields on plot 2 can be attributed to the higher levels of fertility, both directly and indirectly. The dense growth of herbage in early May prevented evaporation of soil moisture, while on plots 3 and 4 much of the ground was uncovered by either grasses or clovers and became seriously desiccated.

In dairy farming in eastern Ontario, one of the most difficult problems confronting the dairyman is the necessity of maintaining an adequate supply of pasture throughout the summer months, particularly July, August, and September. Dr. Newman's farm is no exception in this respect, and during July and August of 1941 pasture became a serious problem. This field was turned over to the milking herd, and sufficient pasture was obtained to maintain an even production of milk. The regular pasture was permitted to recuperate. The cattle were turned in to pasture this area during the first part of August, and in order to obtain subsequent yields cages were placed on all plots and the following dried weight yields in tons per acre were obtained:

Date of Clipping	Plot 1	2	3	4
August 27	.90	.40	.37	.37
October 24	.75	.45	.18	.10
Yields from 2 clippings	1.65	.85	.55	.47
Total yield hay and clippings	7.82	4.02	2.16	1.80

While these investigations are still incomplete, certain tentative conclusions may be drawn.

(1) Legumes respond in a remarkable manner to high fertility levels.

BALANCE SHEET OF FERTILITY *

(Three-acre basis)	Plot 1			Plot 2			Plot 3			Plot 4		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Plant food applied	152	424	732	152	124	192	142	64	142	137	34	117
Plant food removed	441	136	470	263	87	299	190	68	235	161	59	205
Balance of fertility	−289	+288	+262	−111	+37	−107	−48	−4	−93	−24	−25	−88

* *Data from: "When Fertilizing Consider Plant-food Content of Crops," J. D. Romaine, Better Crops With Plant Food, Vol. 24, No. 3.*
"Feeds and Feeding," F. B. Morrison, Morrison Pub. Co., Ithaca, N. Y.
"Manures and Fertilizers," F. T. Schutt and L. E. Wright, Canada Dept. of Agr. Bul. 585.

(2) Moderate applications of a properly selected fertilizer applied to each crop in the rotation have proven highly profitable.

(3) The weather should not be blamed entirely for crop failures in dry periods in this part of the country. Adequate nutrients in the soil are an insurance against drought damage.

An interesting "balance sheet of fertility" can be shown by subtracting the pounds of nutrients removed by the crops from the total amounts applied during the three crop years.

From these figures it may be noted that the only plot in which fertility levels are actually being raised is in plot 1. With respect to nitrogen, no figures are obtainable at this date as to the amount of nitrogen accumulated in the roots and residue of the legumes, but it is known to be a substantial amount, probably not less than 200 pounds for each 3 tons of hay harvested. At any rate, there were no symptoms of nitrogen deficiency on either plot 1 or 2. On the contrary, a luscious foliage was found on these plots right up until frost.

Soil samples have been taken from the plots at regular and frequent intervals. To date the results of soil tests have shown a remarkable conformity with the appearance and yield of the legume crop and with the amounts of plant food applied. Plot 1 is the only area on which soil tests indicate higher levels of phosphate and potash. Plots 3 and 4 show extremely low mineral content, while plot 2 is somewhat better but still low.

That the quality of the forage has been affected by soil treatment is also shown by the following data:

COMPOSITION OF HAY IN POUNDS PER ACRE (OVEN-DRY BASIS), FIRST CUTTING JUNE 1941

Plot	Dry matter	Protein	Calcium	Phosphorus	Ash
1	9,980	1,303	165	23	619
2	4,900	604	128	7	274
3	2,360	320	66	3	151
4	2,180	287	50	2	126

These data show how strikingly the protein yields per acre may be increased by feeding the plant. Plot 1 produced a very high amount of high-quality feed. While this would entail a heavy investment in fertilizer, it would appear as though from a practical standpoint the increased yield would justify consideration of using such amounts of fertilizer. Plot 2, requiring a much lower investment, certainly was highly profitable. Only $11.50 was expended in fertilizers for this plot over a period of three years, but the protein yield was almost doubled over that of plot 3, which received about the average treatment for that district.

Using the current price of oil cake as a base, the values of the protein yields from the respective plots are as follows:

Plot 1	$86.78
" 2	40.22
" 3	21.31
" 4	19.11

With the rise in price of protein feeds and the difficulty in securing certain feeds normally used as a source of protein, it is of increasing importance that livestock feeders grow more of their own protein.

The increased phosphate content of the forage due to high phosphate applications should be of very great interest to dairymen, for livestock ills due to phosphate deficiency have been observed over a wide area, and in the great majority of investigated cases soil and crops are found to be abnormally low. True, phosphate can be added to the ration with good results, but this is only a palliative and does not correct the conditions responsible for the deficiency. Until adequate treatment is given to low phosphate soils, crops will suffer in both yield and quality and livestock ills will persist. With the aid of soil and plant tissue tests and with a knowledge of deficiency symptoms in plants, soil management becomes a more simple matter. Hungry plants like hungry animals must be fed.

Indiana's Red Gold

(*From page* 20)

correctly gather the fruit. The vines must not be torn or bruised, and only red-ripe tomatoes are picked. Since most of the tomatoes are bought on grade, it is to the growers' best interest to see that they are picked to meet Government U. S. No. 1 standards.

Schools for growers were held in various communities. At these schools soils were tested and analyzed by Purdue specialists so that the correct fertilizers might be recommended. Latest developments in growing and marketing were discussed. Cooperation between grower and canner was stressed so that the entire tomato industry could be knit into one big business.

Once a year graders, too, go through a training school. Each factory buying on grade has a federal grader appointed who checks three hampers picked at random from each load brought to the factory. Payment for the load is made on the basis of the grade of these three hampers. Last year there were 93 federal graders working at Indiana factories.

Normally there are 30,000 people employed in the Indiana tomato industry. A shortage of pickers was expected last season because of the many other jobs available. Everett L. Gardner, Director of Unemployment in Indiana, was appealed to and he promised to rake the highways and byways if necessary to get pickers. But this was unnecessary since itinerant workers turned up from everywhere. In the little town of Hemlock, whose normal population does not exceed 100,

Peeling and sorting tomatoes at the Kemp Brothers factory, Kempton, Indiana.

there were quartered 500 Mexican workers, living in any kind of place they could find. Pickers were paid five, six, and seven cents a hamper.

Indiana farmers find tomatoes a good cash crop. In normal years six million dollars are paid to growers. Another six million are paid to labor, and ten million are paid to allied industries, manufacturers of cans, labels, bottles, boxes, etc.

Certified Seed Used

Tomatoes are usually grown from certified Indiana Baltimore seed which is shipped to Georgia and planted there. When the plants are quite small, they are returned to Indiana farmers. In recent years, direct seeding has been tried and is gaining much favor. Several direct seeders report they have sold enough plants at blocking out, or thinning time, to pay for the seed, labor, and fertilizer.

Very modern methods are used by grower and canner alike. Airplanes are used for dusting the fields, and one factory checked picking operations by plane so they could better gauge the amount of help they would need at the plant the next day.

One group with whom the tomato industry is popular consists of the housewives who live in the small towns where the canning factories are located. Homemaking is the chief interest of these women. Ordinarily they would not think of taking jobs of any kind outside their homes, but when the canning season is on they hurry off in a body, glad to earn the extra dollars which often spell the difference between necessities and luxuries. During the depression those extra dollars frequently meant the difference between living and merely existing. These white-capped, white-gowned women set the social standard in the factory as well as in the town, and woe be unto any canner who, short-handed, may hire outside help of anything less than unimpeachable character.

Probably the most important byproduct of the industry is tomato juice. Here Indiana canners surpass all others. It is doubtful if any other commodity has made the rapid rise in popularity that tomato juice has.

As early as 1924 one of the up-state plants was experimenting on the development of a palatable juice. In 1927 a French Lick Springs hotel reported to a neighboring canner that their guests were drinking the juice from the canned tomatoes and leaving the solid tomatoes. That manufacturer then began his experiments on juice making. The pale amber, pulpless juice developed as a result of these trials was not looked upon very favorably. It was not until the next year that the homogenizing process, which gives us the non-separating, rich-colored juice we have today, was discovered and patented by Kemp Brothers. Proof that tomato juice is popular is shown by the fact that this factory shipped an entire trainload (59 cars) in one shipment to New York.

The therapeutic value of tomato juice must have been known rather early, for Gene Stratton Porter used tomato juice to cure her hero in the book, "The Keeper of the Bees," published in 1925. (Oh yes, it was tomato juice, even though the movie version did give the credit to orange juice.) Proof of the health-giving qualities of tomato juice is shown by the fact that all baby specialists prescribe it as a first "must-have" for infants. And whoever heard of a child having to be cajoled by a fictitious Popeye into taking his tomato juice? On the contrary, one of the joys of childhood, and one that we never outgrow, is to wander into the tomato patch with a handful of salt to eat our fill of first-quality tomatoes, grown nowhere as fine as in the Hoosier State.

Yes, Indiana is particularly proud of this part of the health- and body-building program she is playing in the Nation's Drive for Victory.

Legumes Are Essential to Sound Agriculture

(*From page* 18)

phosphate to alfalfa often is not highly beneficial, it is desirable to apply enough phosphorus at seeding time to carry the crop through its usual period of productivity. Yearly applications of 150 pounds of 20% superphosphate per acre, or 750 pounds for a 5-year period, should be profitable under current conditions. Equivalent quantities of phosphorus in other grades may be used.

Legumes need available potash. Light sandy and gravelly soils are short on potash for legumes unless such land has been liberally manured over a period of years. Unmanured silt loams, also, often respond to potash treatment. And lately, medium-textured soils that have received only moderate applications of manure during recent years have shown good increases in yield as a result of putting on potash. Under present conditions, especially with potash obtainable at very reasonable cost, the use of 100 to 200 pounds of 60% muriate of potash to the acre for such long-lived legumes as alfalfa, ladino clover, and lespedeza sericea should be profitable. If complete fertilizers have been used in fairly liberal amounts and some manure applied, extra potash is less likely to be profitable on medium to heavy soils. For annual and biennial legumes, smaller quantities of potash should serve the purpose.

On light sandy and gravelly soils and on a few heavier ones in the Northeast, alfalfa responds to small applications of boron. Even small amounts of boron may be harmful where it is not deficient. For this reason, it is suggested that borax be withheld until the symptoms have been diagnosed definitely as boron deficiency.

Because alfalfa, ladino clover, and lespedeza sericea are perennials, they should remain productive over a period of four to five years or longer under favorable soil and climatic conditions. The cost of establishing short-lived legumes such as red or alsike clover is approximately the same per acre as for alfalfa. Red clover produces hay only a single season. The one crop, therefore, must bear the entire cost of establishing it. With the longer-lived legumes, this expenditure is spread over several seasons and constitutes a valid argument in their favor. Furthermore, the rental value and the taxes on land are the same regardless of the size of crop harvested.

Alfalfa, in particular, produces larger yields than red or alsike clover. Corresponding yields in the Northeast are approximately 2½ to 3 tons per acre for alfalfa and 1½ to 2 tons for red and alsike clover under soil conditions favorable for alfalfa.

Oats following clover (left) produced double the yield of oats following timothy (right). Both clover and timothy were harvested for hay and removed from the land.

Legume seed should always be inoculated before sowing it on soil that has not previously produced a successful crop of the particular legume or on soil that does not carry the required bacteria. If several years have elapsed since the legume was grown or if conditions with respect to lime, organic matter, and productivity are not entirely favorable, inoculating the seed before sowing is advised.

Wilson and Leland[1] at the Cornell University Agricultural Experiment Station, reported the yield of inoculated red clover as one-third greater than that of the uninoculated as an average on limed and unlimed soils. Inoculation increased yields of alfalfa one-seventh under similar conditions. In view of the increased yields and the very slight cost, a few cents an acre, of inoculating the seed, the practice is urged for medium- and coarse-textured soils in particular. Conditions for the survival of bacteria in heavy soils seem to be somewhat better than in lighter ones. Nevertheless inoculation is advised until it is definitely determined to be unnecessary with a particular legume on a particular field.

Numerous measurements have been made of the quantities of nitrogen per acre fixed by different legumes. Lyon and Bizzell[2] reported that red and alsike clover grown separately fixed 146 and 136 pounds of nitrogen per acre respectively, and even more when grown together. Alfalfa fixed 241 pounds, sweet clover 163, and soybeans 102 pounds per acre annually. As an average of widespread experiments, alfalfa fixed 113 pounds of nitrogen per acre annually, red clover 92 ponnds, soybeans 91, one test each of sweet clover and cowpeas 117 and 86 pounds respectively, and for an average of three separate reports on mixed legumes 112 pounds. This gives a composite, unweighted average of 104

[1] Wilson, J. K. and Leland, E. W., *Jour. Amer. Soc. Agron.*, 21, 574-586, 1929.

[2] Lyon, T. L. and Bizzell, J. A., *Jour. Amer. Soc. Agron.*, 26, 653, 1934.

pounds per acre annually. The perennial legume, alfalfa, fixed most nitrogen; the biennials, red, alsike, and sweet clover, followed closely; and the annual legumes usually fixed least nitrogen.

To supply 104 pounds of nitrogen would require 500 pounds of sulphate of ammonia or 650 pounds of nitrate of soda. Such quantities of nitrogen are important to agriculture and at approximate current prices represent a value of $10 or more per acre in sulphate of ammonia and a still larger amount in nitrate of soda.

If clover and alfalfa hay are fed and the manure is carefully handled, from 20 to 24 pounds of nitrogen for each ton of hay may be returned to the soil. For each ton of timothy fed and the manure similarly returned, the soil loses about 12 pounds of nitrogen. On the basis of about 2½ tons per acre of legume hay and 2 tons of timothy, legumes leave the soil 50 to 60 pounds better off and the timothy 24 pounds worse off. Growing and feeding clover or alfalfa, therefore, leave the soil 74 to 84 pounds of nitrogen per acre better off than if timothy is grown. Careful handling of manure is assumed for both legumes and timothy.

On the basis of the average fixation of 92 pounds of nitrogen per acre by red clover and the fact that a 2-ton yield of timothy takes 50 pounds of nitrogen from the soil, the farm may be regarded as being 142 pounds of nitrogen per acre a year better off after growing clover as compared with growing timothy.

Legumes are useful in seed mixtures for cover crops or green manures. These crops are often grown on soils that have been heavily fertilized, and since they grow over brief periods only, may not fix appreciable quantities of nitrogen. Nevertheless, legumes should be included because the leguminous material, when turned under, tends to activate the nonleguminous green manure and the soil organic matter. In this way legumes are especially useful with coarse crop residues.

If the threatened nitrogen shortage becomes acute, as many think it will over the next few years, legumes can do much to relieve that shortage. Dairy and other livestock and grain farms can obtain most of the nitrogen needed by growing legumes, feeding them to livestock, and conserving the resulting manure and returning it to the soil

Sweet clover at good stage for plowing under. It has already fixed approximately 150 pounds of nitrogen per acre.

with minimum losses. Should lack of nitrogen threaten to reduce vegetable and fruit production, manure could be diverted from livestock farms that grow large acreages of legumes for use on fruit and vegetable crops.

Through the use of high-grade legume seed, liberal use of lime if needed, thorough inoculation of the seed, and liberal applications of phosphorus, potash, and trace elements as needed, legumes may be of great service during periods of shortage of nitrogen in the present emergency and in the agricultural depression that usually comes a few years after a war.

"Civ-ense"

(*From page* 5)

ense boys into giving him the post, which, he said, tallied with the national slogan because he intends to make everybody get "all out"—all outdoors. Staying inside and mooning around the radio for the latest war scare or vitiating ourselves in closed rooms with atlases in his opinion stifles the supreme sacrifice we ought to be able to meet. His main campaign will be centered on what he calls "Tire-less Hikes," a regimen intended to regiment us into calm nonchalance over Henderson's rubber edict. It doesn't look so good for gardening this summer, what with Abel's sleepless nights and Nobby's tireless days. What the enemy can't think up to discommode us, our loyal leaders will. But we can at least thank our unlucky stars that Nobby hasn't planned to lead us into badminton.

Finally, only yesterday I had picked me out a profession and had raised my hand to take the oath as Ward Case Worker, when the Civense secretary asked me if I really knew what it was all about. I replied urbanely that my long experience during numerous humid summers ordering and emptying countless cases to refresh my friends should indeed make me an adept at this entertaining diversion, one which, I further stated, would be found handy as an antidote to war's alarms. When they told me that it meant butting into other folks' homes to find out why some feeble-minded provider wasn't buying the groceries, I shuddered at the brink I had almost dashed into.

Feeling sorry for me in this dilemma, one board member sought to cover my confusion by suggesting that the most vital staff office of all remained unfilled. Whereupon he tendered me the post of Recruiting Officer, and asked me to extend myself widely soliciting volunteers for everything and anything in the Civense career field from Accountant to Zither Player. He astonished me with the news that our township quota remained woefuly unfilled and away below patriotic par. This in spite of the calamity of Pearl Harbor. His caustic comment may have been undeserved when he said, "It's like casting Pearls before Swine, the indifference we encounter."

But I soon discovered for myself that the tire office was under constant siege while the Civense department next door was almost as lonesome as an auto salesroom. Evidently the Abels and Mirandas deserved more credit than our neighborhood bestowed on them. Working for America for nothing and paying your own expenses hasn't come first in the hearts of our countrymen. But if slogans won't do it maybe the slugs will later on.

Consequently, I'm finding it harder to get other folks to join than it was to land a soft berth myself in the Civense circle. You can easily secure emotional zealots on the verge of paranoia or dementia praecox who couldn't be trusted to wield any implement or weapon more rugged than a sofa pillow. You can find volunteers readily among the professional lodge and parade brothers, owing to the glamour and regalia they look for in any organized defense. But what we need are genuine hard-working citizens, realistic and healthy, sensitive without being squeamish, who are aware that a total war may jump right into their own back yard all the way from Burma.

Cynics and detractors may find nevertheless that many of our citizens who are backward about coming forward at the dress rehearsal may be depended upon for action when the enemy bombers cross the border. The only bad feature of this delayed action is the penalty we must pay for resulting confusion and frenzy. There's a lot we ordinary non-technical fellows don't know about meeting emergencies, and the longer we wait for somebody else to take the initiative, the better the chance for the Japs to toss some of our old scrap-iron through our church and library roofs.

IF, as we hope and trust, the armed forces resist the onslaught before we are imperiled at home, there remains the maintenance of courage, faith, and loyalty for the Civense units to foster. Maybe, after all, these are the real elements which make a country internally resolute and steadfast. Thus it becomes more vital to insulate ourselves from our own weak cussedness than to isolate ourselves from conquest.

Since assuming the recruiting job, I have heard nasty cracks jibed at the rural populace by some solicitors who claim the farmers are not signing up for anything, not even defense bonds. I merely tell them that farmers are so busy figuring out ways and means to plant the crops and make the hay next summer with a few city high school lads and volunteer farmerettes to help them that they can't put their minds to Civense duties. One farmer told me, however, that he had a choice Civense job planned for his hired man, who, he thought, would make a right smart airplane spotter on account of his being flat on his back so often on bright days in summer. But he withdrew that application just as soon as I reminded him that a spotter is obliged to rush off and report the tidings by 'phone. He said the only way he could think of to make it work would be to keep the telephone on the dinner table and keep the table well loaded.

After some deep pondering I have deduced the idea that maybe our Civense program resembles the old fable of the boy who didn't budge when the fellows who had been fooling him so often finally discovered a big, bad wolf in the offing. That is, I wonder if we haven't been subjected to a continuous series of emergencies, big and little, real and imaginary. I wonder if those impulses begotten by emergency campaigns have perhaps begun to peter out. I know it's a completely different kind of emergency and the repercussions from it will be more than big words out of a dictionary, and that partisanship and pettiness ought to be buried deep and be left without a headstone.

OUR economic campaigns and our political campaigns too often have been sandwiched together and taken in one gulp. Now we face a terrific reality and lack the stomach or the appetite to swallow it. I'm confident we will recover our zest and begin to caper around again after this little bilious attack from an overdose of emergencies has subsided.

However, I am mighty glad to report that we still have our doughty Abels and Mirandas willing to forget and forgive any and all former mistakes of administrative ardor; and who have girded their loins with overalls and tweed skirt to work humbly among the rank and file who stand in need of training, shelter, and sustenance.

When my recruiting task is finished and abler folks than myself are engaged in protective efforts in our modest district, I can at least snatch at the first alphabetical post on the rural roster and go forth serene and sweaty to last as long as I can on a July day in the imperative duty nature assigns me—Alfalfa Pitcher!

A Few Whinnies

IN SOME CASES

The teacher was explaining to her class what was meant by "bigamy."

"It means," she said, "having two wives at one time. Now, can any boy tell me what word means having only one wife?"

"I can, teacher," said one boy; "monotony."

Mrs. Malone: "What did your uncle die of, Mrs. Flanagan?"

Mrs. Flanagan: "Gangrene it was Mrs. Malone."

Mrs. Malone: "Thank hivins for the color, anyway, Mrs. Flanagan."

Two fussy traveling salesladies were riding in opposite seats in the train. One thought the car was too hot, the other said it was too cold.

Just then a dusky porter came through.

"Porter," commanded the first lady, "I wish you'd open that window. I'm nearly smothered."

"Don't you do it!" snapped the other. "If you do I'll freeze to death."

The porter scratched his head.

"What you 'spose Ah should do in a case lahk dat?" he asked a portly-looking traveling man, about two seats to the rear, trying to enjoy a little reading.

"Open it a while and freeze one; then shut it and smother the other."

Drunk: "Didjoo shee me come in?"

Desk Clerk: "Yes."

Drunk: "Didjoo ever see me before?"

Desk Clerk: "No."

Drunk: "Then how'd you know 'twush me?"

A young man and his fiancee had wed and were spending their honeymoon at a large hotel. When bedtime came the bride went to bed and the groom sat by the window and gazed at the moon and stars. The bride called to him and asked: "Why don't you come to bed?"

He replied: "My mother told me my wedding night would be the most beautiful night of my life, and I'm not going to miss a minute of it."

She: "I walked three miles last night."

He: "For goodness sakes?"

She: "For what other reason, I'd like to know."

The hillbilly boy walked into the town confectionery and asked for an ice cream soda. The clerk presented the drink, all done up with a cherry and two straws. After a few minutes, the boy called the clerk and said, "Mind ef I take them holler sticks out? They keep a-knockin' my hat off."

BYE NOW

Doctor—"Nurse, you've been with that handsome patient in 408 over an hour."

Nurse—"Don't stop me now. I've got to get a thermometer."

Doctor—"Gosh, is he running a temperature?"

Nurse—"No, but I am."

"You've left off your medals," snapped the Captain.

The man looked down at his chest. "Great Scott!" he cried, "I forgot to take them off my pajamas."

Printed in U. S. A.

Better Crops with PLANT FOOD

April 1942 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI NUMBER 4

TABLE OF CONTENTS, APRIL 1942

The American Potash Institute
Incorporated

American Chemical Society Building, 1155 16th Street, N. W., Washington, D. C.

J. W. TURRENTINE, *President*

FLAX—ANOTHER CROP WHICH THE WAR HAS BROUGHT INTO INCREASED ATTENTION.

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., April 1942 No. 4

For farmers Nature has..

Secrets Galore

Jeff McDermid

FROM our mutual friend, Jonathan Turnipseed, I gleaned a text for an April piece. In remarking to me lately about a chat with the stockyards weighmaster, this farmer friend described the colloquy as follows:

"It's gettin' to a pretty pass when the whole Nation goes in fer secrecy," says the stockyards man when I unloaded my steers yesterday. "As fer me, I can't be secret about anything, not even my income, which is so small you can't hardly see it after I pay my taxes. Why don't you farmers start secretin' your plans, too? It might make the enemy think you had some super-duper new kind of foods to double the Army's stayin' powers."

"Well," I says, "I've been thinkin' about that a lot, but farmers are too open and aboveboard about everything they do. They have to go right outdoors from seedin' time to harvest where everybody can see 'em operate. But just the same, we belong to a big secret society and don't know it."

"What's that?" asks the stockyards man.

"Well," I says, "We're steady partners with old Dame Natur' and she's so close-mouthed about her plans all the time that us farmers don't need to be secret our own selves. Fact is, we don't know what's headin' our way on the weather calendar much of the time, and future crop yields are mostly a big mystery. Why, there's more secrets out there on my old eighty acres and hid up in my seed bin than anything Congress or the high military tribunal can cover up at Washington in a month of Sundays," I says.

"Uh-huh," says the stockyards man, "It surely looks like you and Natur' and the Government will keep the rest of us guessin' after all."

Which brings me full blast into the subject assigned. If we would stop berating authorities for necessary secrecy long enough to think things over, we would agree with Jonathan and his friend, the stockyards man, that you can't find much in the secrecy line to beat the unpredictables of natural growing things or to equal the unsolved mysteries of the soil and the seasons.

We have been prone to take things for granted hereabouts in our civil life of humdrum standardization and panicky when little upheavals arise to disrupt some traditions associated with customary procedure. In thus doing our daily dreadfuls we have overlooked the self-evident facts of life, including the truth that we know not where we came from ourselves, nor whither bound, and that our basic food supply is not so simple as it looks arranged on the grocery shelves, being itself a product of forces and solvents and reactions yet but partially known and none too well secured. Jonathan was dead right when he said that the seed bin and the springtime soil hide a bigger mystery and carry more uncertainty than Congress.

BEFORE going further we can state the one place where Government plans and farm policies meet on the border line of the unknown realm of the future—the one bright and sure certainty perhaps in the whole category of things yet to come. It is this: The Government and the Army know that you invite disaster when your men are poorly trained and equipped or your attacking force comes too little and too late. Likewise, the farmer knows that unless he follows at least the bare necessities of culture, uses fairly good germinating seed, and has his land in ordinary shape, he is going to get licked at harvest. Beyond knowing these awful truths to build on as a starter, neither the Government nor the farmer can do more than hope and pray for the success of the campaign or the magnitude of the crop.

But to get into that desired state of preparedness for eventual struggles, both the armed forces and the food providers must have the best of information. Information in the Army is secured by a complex "intelligence" department, some branches of which spy on the enemy and others do research work to perfect offense and defense.

Similarly, we of the food-building corps must and do possess our intelligence service, operating through many state experiment stations, government laboratories, and private channels. Its function has been to discover secrets within the vast realm of the plant world so that commercial value might be obtained from vegetation and the animals which derive their life sustenance from vegetation. In spite of all this "big talk," we are still groping in many mysteries.

FOOD and fiber builders, like farmers, are so often unaware of the secrecy and mystery surrounding them that they lack full appreciation of the forces with which they deal. One need name only a few things that make agriculture so much of an unknown quantity to see how true it is that secrecy is the rule rather than the exception in life.

From the towering pine he hopes to saw into timber for a barn clear down to the lowly form of plant life which ripens his cheese, the farmer is steeped in a continual maze of mystery and uncertainty. Of course, he can copy down an axiomatic definition in answer to the query, What does it mean to be alive? He can reply, "A living plant or animal has ability to take in outside material and to transform this material into substances like itself, so that it is nourished and kept alive, grows from within, and reproduces its kind."

But the farmer and his soil are more concerned directly with another question arising from the first one, and that is, "Why is plant culture the basis of agriculture?" Here again he can get a dogmatic answer which only stirs the surface and yields further dilemma—"Green plants manufacture food from raw materials and chemical formulas found in sun, air, and soil; while animals and colorless plants are unable to make their food from such bare raw materials."

That makes the farmer feel mighty big and important for awhile because he must be the go-between, the animating and managing director in this process of growing the plants so that when they are ripe they can be utilized by the two-legged and four-legged species to which the farmer himself is related. But before he gets too sure that he knows the whole secret, he runs up against a couple of tough-looking babies, photosynthesis and chlorophyl. Before he can swallow hard and get his eyes focused back to normal again, he realizes that the Army and the Navy and the Marine Corps plus every bureaucrat in Washington have nothing on him for secrecy.

He finds that as soon as his cereals and vegetables begin to "show green" they start up a factory business more complex than anything going on over in the munitions plant. They take the carbon dioxide from the air and the water from the soil and mix them up somehow in those tiny green-celled chambers, using sunlight as the dynamic energy to make an inorganic element into sugars and starches. Most any scientist is prepared to exhibit slides and texts galore about this everyday agricultural process, but we haven't met any of them yet who can explain it well enough to reproduce the crops by artificial gadgets.

Looking further, the farmer meets other puzzles. When he tries to figure out how all that soil water with its fertilizing chemicals got inside the root hairs and tissues of the plant, some wise guy tells him it is caused by "osmosis;" but that's as far as the wise guy ever gets, and this is another mystery for our collection. On top of that, the farmer wonders how in tarnation it happens that all this plant sap keeps moving up and down through the leaves, stems, and roots, and how a pine tree ever gets its top needles fed from the earth so far below.

Maybe a scholarly friend will seek to explain it by saying that sap moves because of the pulling power of leaf transpiration. But if that extends much light on the constant operation of those inner elevators up and down a plant, then I'll let you guess awhile. Folks who think of plants as motionless might as well move over and take the next bus, 'cause they've missed this one.

Then in spite of all the photosynthesis and sap running and osmosis and transpiration, the farmer gets to know by experience that he's expected to keep a well-stocked soil larder on tap for all his agricultural plants. As he starts in to find out what his land needs and his plants like most, he runs smack-dab up against a whole Library of Congress full of items he doesn't know and science hasn't discovered yet.

Of course, in general he gets to know that nitrogen is good for crops that are grown for their leaves, that phosphorus hastens crop maturity, that calcium overcomes harmful acidity, and that potassium improves plant vigor and helps resistance to disease. If he tries to get too chummy with a lot of the old-timers and experts in the plant-food business, he'll find them at odds and

(*Turn to page* 45)

Hogging off corn and peanuts produces pork profitably and is one of the best soil-improvement practices known.

Fertilizing Peanuts in Georgia

By J. Lloyd Burrell

Agricultural Extension Service, Athens, Georgia

THE peanut crop has recently become very important since peanuts are a good source of oil now being increasingly demanded, not to mention other food and feed which they can furnish directly or indirectly.

In 1941 some 670,000 acres of peanuts were harvested for nuts in Georgia, and 431,000 acres were used for other purposes, mostly hogging off. The per-acre yield was 785 pounds; but many farmers, through using good cultural practices, including fertilization, produced from 1,200 to 1,500 pounds per acre.

Essentially, the good cultural practices for peanuts, according to E. D. Alexander, agronomist for the Georgia Agricultural Extension Service, include planting on adapted soil, rotating with highly fertilized crops, thorough soil preparation, use of good seed, proper fertilization, close spacing, thorough cultivation, and the use of good harvesting and curing methods.

All sections of Georgia are adapted climatically to peanuts. Sandy loam to sandy clay loam types of soil are best. However, most soils, with the exception of heavy clays, will produce peanuts provided there is good drainage. When peanuts are planted for hogging off, the lighter or sandier types of soil should be used since the heavier or clay types will puddle and be injured if grazed wet.

To obtain satisfactory yields, Mr. Alexander explains that good stands are necessary. Securing good stands begins with preparation of the soil. Land for peanuts should be thoroughly broken and harrowed a sufficient number of times to make a smooth, well-prepared seedbed with as little surface vegetation as possible. Land previously in lespedeza, cowpeas, soybeans, velvet beans, weeds, or light growths of grass which will decay rapidly when turned under is easier to get into condition for peanuts than areas previously in crops such as cotton, corn, or heavy growths of grass which leave slow-decaying plant residue.

If the peanut crop is to follow a winter legume or other green cover crop, the cover crop should be turned under 10 days to 2 weeks before the peanuts are planted. All weeds and grass possible should be killed before the crop is planted. Harrowing or disking frequently previous to planting is necessary, and the soil should be thoroughly harrowed or disked just before the seed is planted.

Mr. Alexander points out that the response of peanuts to fertilization has varied a great deal in the various states and in different sections of Georgia. An application of 200 to 300 pounds of fertilizer such as a 3-8-6, 4-8-6, or 3-8-8, depending upon the fertility of the soil, should give good results with Spanish peanuts. In the more fertile soil, if fertilizer is to be used, an application of 150 to 200 pounds of an 0-14-10 or 150 pounds of 16 per cent superphosphate and 40 to 50 pounds of muriate of potash or their equivalents per acre should be sufficient. It is generally agreed, however, that if peanuts are grown in rotation with other crops which have been fertilized with good amounts of fertilizer containing high percentages of nitrogen, phosphoric acid, and potash, such as cotton and tobacco fertilizers now being recommended, and where well-phosphated cover crops are used, little profit is obtained by the use of extra fertilizer applied direct to the peanut crop.

North Carolina Runners are seldom fertilized and there is little information on fertilizing this crop, but if fertilizer is thought necessary, 150 pounds of 16 per cent superphosphate and 40 to 50 pounds of muriate of potash or their equivalents are suggested. These fertilizer materials will replace a part, at least, of the plant-food elements removed by the peanut crop.

Tests with Spanish peanuts over a 10-year period at the Coastal Plain

Peanuts should be clean cultivated from the time the plants appear until they cover a good portion of the ground, and laid by on a slight ridge.

Experiment Station, Tifton, Georgia, show that good increases in yields can be obtained from the use of 200 to 400 pounds of a fertilizer containing 2 to 4 per cent nitrogen, 8 to 10 per cent phosphoric acid, and 4 to 6 per cent potash. The Georgia Experiment Station, Griffin, Georgia, in tests made on farms in the peanut area and at the Station got good increases in yields from the use of 300 pounds of a 3-8-8 and 100 pounds of nitrate of soda as a side-dressing.

Spanish and North Carolina Runners are the leading varieties grown in Georgia. The Spanish is grown largely for shelling and oil, but some are planted for early hog feed. The small, white Spanish is the variety or strain desired by the trade. North Carolina Runners are planted mainly for hogging off, but some are planted for oil.

For best stands and yields, peanuts should be planted as soon as the soil becomes warm, the Georgia Extension agronomist recommends. The best planting dates for Spanish seem to be April 1 to 15 in south Georgia, and April 15 to May 1 in north Georgia. North Carolina Runners can be planted a week or 10 days earlier. Yields will be greatly reduced if peanuts are planted late.

Good stands of peanuts are necessary for profitable use of fertilizer.

In order to prevent injury to the seed, fertilizer should be applied in the row and mixed with the soil a few days before planting and in such a manner as not to come in direct contact with the seed. Poor stands of peanuts or unfavorable weather will give little return for any fertilizer applied.

Whenever possible, clean, bright, well-filled-out, disease-free seed should be used for planting. Seed of uniform size will feed through the planter more evenly than seed which is not uniform in size and shape. If pegs are to be planted, the No. 1 grade should be used. However, peanut plants from pegs are weaker than from better seed and are slower in getting started.

Peanuts should be planted in shallow furrows on a well-prepared seedbed and covered 1½ to 2 inches on light sandy soils and 1 to 1½ inches deep on heavier soils. Late plantings can be planted deeper. Also, seed should be planted deeper when the soil is not moist. Other things being equal, spacing of plants has more to do with yields per acre than any other factor in peanut production.

(*Turn to page* 36)

Boron Stopped Fruit Cracking

By J. C. Burtner

Agricultural Extension Service, Corvallis, Oregon

EACH year is adding to the knowledge of the role of the so-called minor elements in soil fertility. Among these half dozen or so minor elements one of the most interesting in its effect is boron, usually applied in the familiar borax form.

As the result of experiments carried on at the Oregon State College Experiment Station, boron is already commercially used in the Pacific Northwest in the control of such troubles as celery stem crack, beet canker, and yellow top of alfalfa. Recent experiments go still further and indicate that boron applied to soils deficient in this element has a pronounced effect on controlling the cracking of cherries and prunes in rainy weather.

It is well known to fruit growers that a tree of ripe cherries, prunes, or plums is likely to suffer a heavy loss from cracking if caught in a rainy spell of any duration. Having found that boron apparently has a pronounced effect on elasticity of plant tissues, W. L. Powers, head of the soils department at Oregon State College, decided to attempt control of this cracking difficulty with a boron application. The idea was tried out first in 1941 with an application at the rate of 30 pounds per acre on a test area in a prune orchard. An unusually rainy fall was experienced, resulting in a 25 per cent cracking of prunes in the untreated portion of the orchard. Where the borax had been applied, the loss from cracking amounted to only 9 per cent.

Similar results were obtained in limited tests with Bing cherries, which had previously cracked severely during rainy weather but which came through a rather wet June in 1941 with little or no cracking of commercial importance. The same effect was observed where boron had been applied to an alfalfa field which was adjacent to a cherry orchard. Those cherry trees which were directly beside the alfalfa field showed markedly less cracking than those farther away.

Dr. Powers points out that these results are quite preliminary and require further proof. The indications are so promising, however, that he believes tests on a field scale would be justified in view of the relatively inexpensive nature of the trials.

The Way to Test

The recommended application of 30 pounds of borax per acre is usually made in the early spring. A fair test would be to apply the material to two middles involving three rows of trees, while two adjacent middles are left untreated to compare picking tests of the interior rows.

Tests started in 1940 have also revealed that a borax application at the rate of 40 pounds per acre greatly reduced the growth cracks in carrots grown on peat land. The carrots grown on the untreated land showed a 10 per cent loss from cracks, while on the treated plots the cracking amounted to only 4 per cent. In 1941 the difference was even more marked, with the untreated plots showing 11 per cent loss and the treated plots only 1 per cent. Cracking and canker on broccoli and asters have also responded to boron.

(*Turn to page* 38)

Permanent Hay—
the Plant Food Way

By A. R. Midgley and D. E. Dunklee[1]

Agricultural Experiment Station, Burlington, Vermont

ON MOST dairy farms chemical fertilizers and manure are primarily used on the corn crop. Furthermore, the fertilizer is usually placed so close to the corn plants that they get most of this added fertility. Under such circumstances oats, clover, and timothy which follow in rotation receive only the plant food left by the corn.

Ordinarily this fertility lasts only two or three years. The yield and quality of hay rapidly decline thereafter in spite of occasional top-dressings of manure, and finally ebb so low that the farmer is compelled to plow again and repeat the same rotation. Such a scheme is apt to be characterized by several years of hay hardly worth cutting and leads to the prevailing thought that a field of run-off grassland needs "the plow."

Formerly, it seemed that the farmers were correct, that the only sure-fire method of attaining better hay was plowing and rotating more often, growing more corn, and fertilizing it more heavily. Now, however, good permanent hay on many fields seems to be a better way.

To some readers permanent hay might imply worn hayfields covered with brambles, brush, and goldenrod and given to the neighbor for the expense of harvesting. Such fields usually have not received fertilizer and, therefore, should not be taken as a measure of what plant food can accomplish.

There are many good reasons why permanent hay is an advantage over the present method of hay production and why it has a place on many farms. First, there are often serious obstacles to plowing, especially on many New England farms. To plow heavy clay soils in the spring is almost impossible because the plow gathers wet clay like a snowball. This puddles, the soil forms hard clods, and makes a poor seedbed. Also, in the summer, the clay dries out and toughens up brick-hard, making plowing impossible. Fall is about the only time when the moisture is just right to leave the seedbed in good condition. Fall plowing, however, has the disadvantage of leaving the soil bare and unprotected during the winter.

Plowing on upland hay farms is likewise a drudgery, hampered by hidden stones and blocked by boulders and rock piles that restrict the length of furrows. Even where rocks do not trouble, the fields are often too steep or too wet, most of the year, to be readily plowed. Elimination of such tough and expensive plowing would provide a considerable saving with which to buy plant food.

Furthermore, it would be an advantage to reduce corn acreage on heavy clay soils, since at best the crop never grows too well and sometimes almost fails. Corn, too, is not very well adapted to wet land nor to localities bordering Canada which have too short a growing season. In such areas where hay is desired and where land is usually plowed up and seeded back down to hay as soon as possible, permanent hay is a logical goal.

Another good reason for maintaining permanent hay is to avoid erosion. In fact, a good sod is nature's best protec-

[1] Research Agronomist and Assistant Research Agronomist.

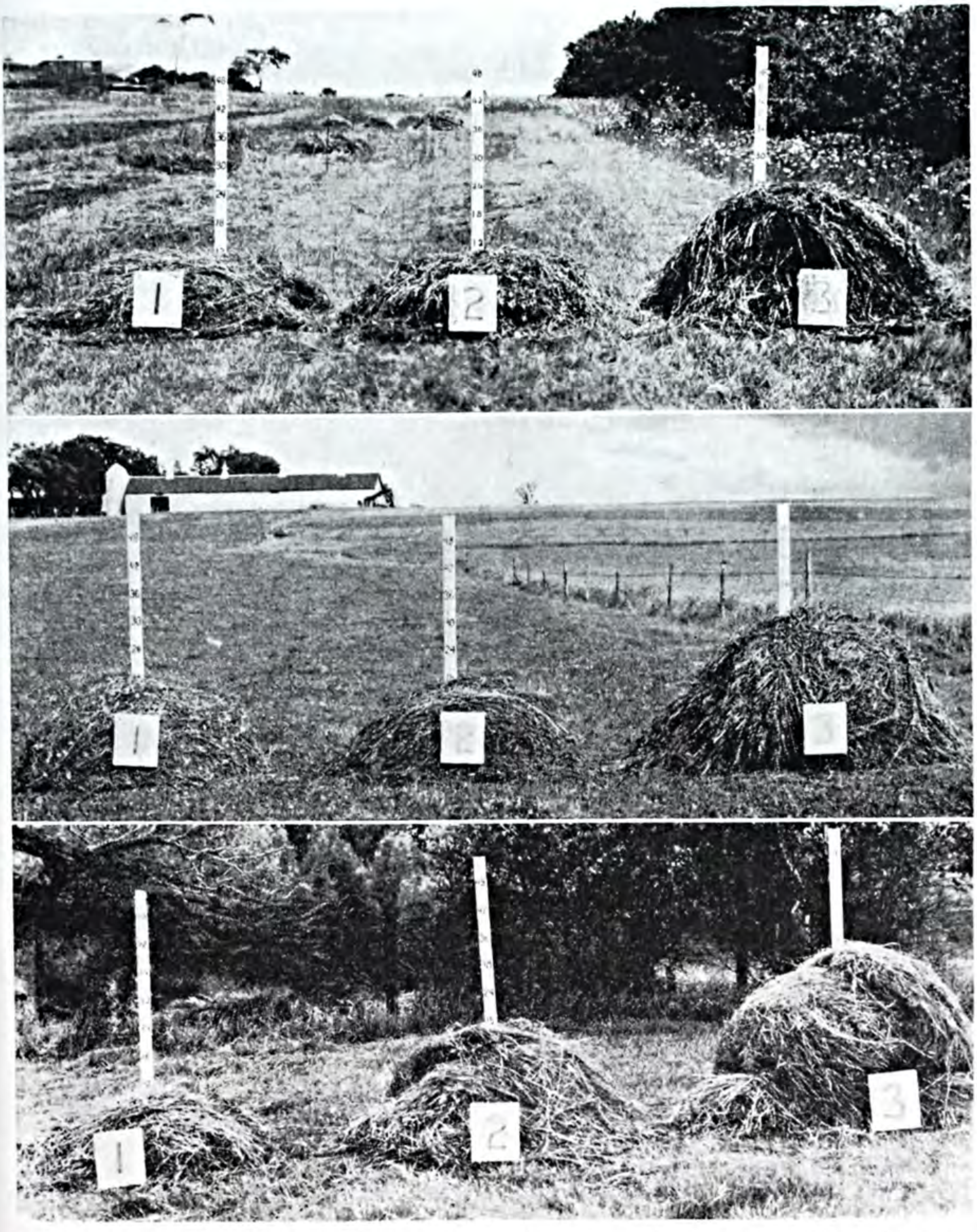


Fig. 1. The effect of untreated check (1), nitrogen alone (2), and a complete fertilizer (3) upon hay yields from similar sized plots on Addison clay loam (top), Colton fine sandy loam (middle), and Suffield silt loam (bottom). The complete fertilizer was outstanding in performance while nitrogen alone was not enough.

tion. Plowing soils in the fall, especially clay soils, exposes them to erosion during the winter even though the slope may not be very steep. In New England there are also many steep fields on which any very extensive plowing at any one time exposes the soil to the formation of rills and gullies. Such loss of soil is always serious and doubly so where not more than 18 inches cover the ledges, as is sometimes the case. Once permanent hay has been established, pelting summer showers will find no steep cultivated fields of corn to beat upon and wash away soil. A hay sod intercepts the raindrops and filters them off harmlessly. For erosion control, permanent sodded waterways are also recommended and highly desirable. Under all such conditions permanent hay is not only desirable but essential if the soils are to be left in good condition for generations to come.

Permanent hay is also desirable because it is a soil-building process. Some of the very best soils in the country, those in the Midwest, were built up by continuous grass over a period of centuries. Grass builds up organic matter, while frequent plowing and cultivation destroy it through oxidation.

The writers do not propose the elimination of corn from fields where it is well adapted, because in some years of short hay crops, 1941 for example, corn may be a lifesaver. It can provide large quantities of feed when hay fails. The idea is mainly to eliminate it from those acres with serious obstacles to growing it. Nearly every farmer has some land that is primarily adapted for hay purposes.

On many farms permanent hay probably should partly displace corn. On others, new developments in the ensiling of grasses may make it possible to practically eliminate corn and substitute grass ensilage. In such cases, machinery for planting, harvesting, and cultivating corn would not be needed. Corn cultivation would not interfere with haying, and more attention could be paid to putting in the hay before it was damaged by rain.

Permanent hay when properly harvested makes better feed, is more digestible, more palatable, and richer in bone-building minerals and protein by reason of the extra plant food of necessity employed to grow it. Furthermore, it is generally recognized that less labor and expense are involved in growing hay than in growing corn, a fact that will bear more weight as the Victory Program makes farm labor ever more scarce.

Fig. 2. Effect of fertilizers on an old sod. Nitrogen only (3), complete fertilizer (4), and no treatment (5). Complete fertilizer without seed changed the vegetative cover of poverty grass and weeds to desirable hay plants—timothy and clover.

Five years ago experiments were initiated at the Vermont Agricultural Experiment Station to find out if commercial fertilizers would prolong the productive life of hay for a year or two, and perhaps even longer. Five hay fields on scattered farms representing clay, loam, and sandy soils were selected for test plots. Some were producing good timothy hay at that time, while others were more or less worn and beyond the likelihood of again being made productive without plowing and reseeding. On each field, fertilizer applications were broadcast evenly over the sod each succeeding year. To determine the relative merits

(*Turn to page* 41)

The Production and Use of
Potash in America

By R. H. Stinchfield

Washington, D. C.

WITHOUT potash, there would be no plant and animal life, because potash is one of the essential plant foods. Whether you live on a farm or in a city apartment, your welfare depends upon an adequate supply of this mineral, not only because of the plant products which you consume and wear but for the animal products without which our modern civilization could not exist.

It therefore has been deemed particularly fortunate that this continent is now independent of any foreign sources for its requirements of potash. Such was not the case during the first World War, prior to which almost all of this country's potash came from German mines. When the United States entered that war and these supplies were cut off, prices of potash rose from $35 per ton to $350 and in some cases $500 per ton and there was little to be had at any price. Growers became desperate in their efforts to get the material in order to meet the increasing demands for food. Out of that emergency came the roots of an American potash industry which has grown through the intervening years to a point where in this war lack of potash will not impede America's march to victory.

The Role of Potash

To fully realize how essential potash is to everyday life and particularly to the increased demands for food in any war effort, something of just what potash is and its role in plant life must be understood. According to Van Slyke, noted plant-food authority, the element potassium is never found in nature uncombined, only in compounds. It is a constituent of many minerals, and much of the potassium in the soil is not in a form available for plant growth. The word potash is almost universally used in agricultural literature referring to potassium compounds.

Plants require the element in relatively much greater quantities than do animals. It forms a larger part than any other mineral element in the ash of plants. While the role of potash has been the subject of intensive research for more than 100 years and still continues to be, it is known that potash is vital to the formation of starches and sugars and their transference to the storage parts of the plant. It is also necessary in protein synthesis and appears to be involved in a number of other reactions in the plant, many of which are not fully understood. Potash is credited with making the cell wall stronger and in the case of supporting tissue, makes the wall thicker. This gives strength to the stem parts of the plant, a particularly important feature in grain and fiber plants. It is also known that potash increases disease resistance of plants and enables them to better withstand unfavorable weather conditions, such as droughts and early frosts.

In fulfilling its numerous functions in the plant, potash exerts considerable influence on many of those factors which go to make up what is termed quality of the crop. It has been shown that by the use of sufficient amounts of potash, the shape, size, and cooking qualities of both Irish and sweet potatoes are greatly improved. Sugar beets and other root crops produce a better shaped root and usually have higher percentage of sugar. In the case of cabbage, potash produces a firmer, tighter head, and kraut made from the crop has a much better flavor.

The effects of a good supply of potash on cucumbers are very striking, the fruit being well shaped, while they are pointed and frequently club-shaped when insufficient potash is used. Tomatoes produce a fruit which is firmer, with more meat, better color, and more even maturity. There is less tendency for the fruit to crack. Celery is firm and crisp instead of stringy and tough. In the case of strawberries, potash gives the fruit more color and flavor and makes it carry much better, so that it comes on the market in a more desirable condition. Apples and peaches have a richer color and flavor and will keep longer in storage. Oranges that can get plenty of potash have a thinner rind and a much higher juice content.

A large amount of experimental work has shown very strikingly that potash is the biggest single factor in determining the quality of tobacco leaf. It improves the body and texture of the leaf and greatly improves the burning properties. The plumpness and test weight per bushel of wheat and other grains are increased by potash fertilization. It influences the protein and grazing quality of pasture by favoring the growth of clovers and legumes. Legumes have a very high potash requirement and when they cannot get enough of this nutrient, they tend to be weak and soon die off.

It has been shown that potash will increase the length and strength of cotton fiber, as well as increase yield and proportion of lint to seed. It controls cotton rust and aids in the control of wilt. With corn, potash reduces lodging of the plants and chaffiness of the ears. In the case of peas, the seed coats are more tender. Among the many other crops recorded as showing marked response to potash are prunes, apricots, walnuts, hops, cantaloupes, flax and grapes. This great influence of potash on the various factors entering into the quality of the crop has caused this nutrient to be termed the "quality" element in the fertilizer.

Potash in Fertilizer

In the fertilizer trade potash is signified as K_2O and is frequently used synonymously with potassium. Most of the potash used in the fertilizer in this country is in the form of potassium chloride, known in the fertilizer trade as muriate of potash. Since a majority of the soils which need fertilizers lack potash and frequently nitrogen, as well as phosphoric acid, most of the potash is applied in mixed fertilizers containing the other nutrients. In the plant-food analysis statement printed on every fertilizer bag, the first figure refers to the percentage content by weight of nitrogen, the second figure to the phosphoric acid, and the third figure to the potash. Thus a 3-8-8 fertilizer would contain 3% nitrogen, 8% phosphoric acid, and 8% potash. The analysis is always given in the same order.

Use of Potash

Industries using potash include the chemical industry, tanning and dyeing, electroplating and photography. Potash is needed for medicine, metallurgy, and the manufacture of glass, soap, matches, paper, and explosives. However, more than 90% of all the potash produced is used in fertilizers.

The first use of potash in agriculture is not recorded. It is known that long before this country was colonized, the Indians had discovered that on spots where there had been a bonfire, plants grew better, and in Europe and Asia wood ashes, which contain from 3 to 8% potash, had been used on gardens for centuries. America's first potash industry grew out of the burning of great quantities of wood cleared by the Colonists and the leaching of these ashes in pots (from which it is assumed the word potash originated). This potash was used for making soap, gunpowder, and glass, and was exported to the older

(*Turn to page* 35)

Mississippi Studies Cotton Fertilizer

By J. I. Hurst

Southwest Junior College, Summit, Mississippi

SINCE 1937, the Mississippi Agricultural Experiment Station has conducted a fertilizer analysis test with cotton in cooperation with the Southwest Mississippi Junior College, Summit, Mississippi. The soil on which the test has been conducted is a grey upland soil of a silty texture, and somewhat cold in nature. In 1935 and 1936 this land had been planted to oats which were cut for hay, and both years the oats were followed with sorghum which was cut for silage.

This land had not been planted to winter legumes previous to 1937, but since then has been planted to Austrian winter peas, and a blanket application of 400 pounds of basic slag per acre has been applied each year in addition to the fertilizer applied under the cotton at the time of planting. The peas were plowed under in the spring in time to plant the cotton during the latter half of April, usually from April 20 to 25. With the exception of 1940, the stand of cotton was fairly uniform. The fertilizer was applied at the rate of 600 pounds per acre except on one plot which did not receive any fertilizer. The 4-8-4 treatment was used as a check and appeared three times in each of the three series included in the test.

The discussion of results will be as follows: First, the effect on the yield of seed cotton by increasing nitrogen applications, with a constant application of phosphorus and potash; second, the effect on the yield of seed cotton by increasing phosphate applications, with a constant application of nitrogen and potash; and third, the effect on the yield of seed cotton by increasing potash applications, with a constant application of nitrogen and phosphate.

Each year as the nitrogen was increased from no nitrogen to 4%, the yield of seed cotton increased. In every year except 1940 and 1941 there was an increase in yield as the nitrogen application was increased from 4% to 6%, but there was a decrease in the yield of seed cotton as the nitrogen application was increased from 6% to 8% every year except 1939 when 8-8-4 produced 7 pounds of seed cotton more than the 6-8-4 plot, and 1941 when it produced 5 pounds more. It is reasonable to believe that the results would have been more noticeable if the winter peas had not been grown.

Effects of Phosphate and Potash

In those plots where phosphorus was the variable element, there was an increase in yield of seed cotton every year except 1940 and 1941 on the plot receiving the 4% application as compared with the no-phosphate plot. In every year there was an increase in yield as the phosphorus was increased from 4% to 8%, but in every year except 1941 a decrease in yield resulted when the phosphorus application was increased from 8% to 12%. The increases in yield of seed cotton as a result of the phosphorus applications under the cotton at time of planting probably would have been larger if 400 pounds of basic slag per acre had not been applied to all of the plots every year. In general, when the percentage of phosphorus was increased, there appeared to be an increase in the quality of the bolls and somewhat earlier maturity. This may

TABLE I.—ANALYSIS TEST WITH COTTON, SOUTHWEST JUNIOR COLLEGE, SUMMIT, MISSISSIPPI

Treatment 600 lbs. per acre	Yield in pounds of seed cotton per acre					5-year average
	1937	1938	1939	1940	1941	
No fertilizer	230	225	404	717	417	399
4–8–0	531	405	614	1,112	600	652
4–8–4	881	1,170	1,243	1,252	1,068	1,123
4–8–8	1,112	1,571	1,683	1,129	1,251	1,351
4–8–12	1,184	1,706	1,813	1,077	1,299	1,416
4–0–4	567	873	1,115	1,158	1,092	961
4–4–4	725	986	1,224	1,128	990	1,011
4–12–4	878	1,013	1,201	1,223	1,092	1,081
0–8–4	770	972	1,206	1,210	1,005	1,033
6–8–4	954	1,247	1,370	1,162	963	1,139
8–8–4	945	1,170	1,377	1,116	968	1,115

account for the high rank of 4-12-4 in the yields of 1940, a year in which the boll-weevil was very active. No poisoning was done in 1940, as it rained every day during the time poisoning should have been done.

The yield of seed cotton was greatly increased by an increase in the application of potash in the first three years of the test. In 1937, the 4-8-0 (no potash), 4-8-4, 4-8-8, and 4-8-12 plots yielded 531, 881, 1,112, and 1,184 pounds of seed cotton per acre, respectively. In 1938, the 4-8-0, 4-8-4, 4-8-8, and 4-8-12 plots yielded 405, 1,170, 1,571, and 1,706 pounds of seed cotton per acre, respectively. The results in 1939 showed increases for potash applications similar to those in 1937 and 1938, but in 1940 the 4-8-12 yielded less than the 4-8-8 and the 4-8-8 less than the 4-8-4. This was a result of the wet season and rank growth on these plots, which made ideal conditions for boll-weevil damage.

(*Turn to page* 38)

A view of the cotton tests at the Mississippi Station. Fertilized with 4-8-0 (left) and 4-8-8 (right). Note prevalence of rust on plot receiving no potash.

Modern Fruit Production

(A Book Review)

A NEW book on fruit growing is a real contribution to the literature on horticulture. The authors are J. H. Gourley and F. S. Howlett of the Ohio State University, and their book is entitled "Modern Fruit Production" (The Macmillan Company, New York, 1941. $4.50). The authors have drawn on their broad training, experience, and travel to write a book that lives up to its name of modern. The general outline of their approach to the subject is conventional, but their treatment of the various subjects reflects changes in fruit growing, the significance of which does not appear to be recognized by many horticulturists.

The first chapter is a general introduction, and might be termed the geography of fruit production. The next two chapters furnish fundamental background information necessary for the intelligent management of fruit trees or plants. One chapter covers rather thoroughly the structure or anatomy of fruit plants, and the other is devoted to the functioning or physiology of the plants, with particular reference to the fruiting parts. Chapters four and five consider the establishment of the orchard, including the site, soil, arrangement of trees or plants, and sources of trees.

The next three chapters take up factors affecting the health, vigor, and growth of the trees. One of the chapters treats mainly the soil organic matter and the orchard cover; chapter seven is devoted to fertilizers and manures; while chapter eight has to do entirely with water, in the plant, in the soil, and the control of soil moisture. Pruning of all types of fruits is taken up in detail in chapter nine. Fruit setting and factors affecting it are covered in chapter ten, while the next chapter treats with fruit thinning and alternate bearing. The twelfth chapter considers the harvesting, handling, and storage of fruits; chapter thirteen is devoted to the various aspects of winter injury to fruit trees and plants.

Nutrient deficiencies and physiological disorders are the subject of chapter fourteen. The next chapter covers the propagation of fruit plants from seed and cuttings, with most attention given to grafting methods and fruit stocks. Chapter sixteen takes up the origin of the various fruits, and how they have been or may be improved. The last chapter considers the economic aspects of fruit production as a business.

Information Up-to-date

It has been said that a book is always out of date as soon as it is written. This book is an exception to that statement since the authors have included in their book a surprisingly large number of recent findings. Instances of these are too numerous to give in their entirety, but a few will be mentioned. The principles of thin wood pruning and graduated space thinning, which appear to be significant improvements over older arbitrary methods, are explained. Recent work on soil conservation and erosion control is utilized in the chapter on laying out and planting the orchard. The great importance of maintaining and increasing soil organic matter, if the orchard is to be kept in a productive condition, is stressed.

The newer concepts of mineral nutrition in orchard management are given more attention in this book than in any so far published in this country. The latest developments in the use of phosphorus, potassium, boron, magnesium, zinc, and calcium and the effects of deficiencies of these and of nitrogen are given in quite some detail. Chapters seven and fourteen, dealing with these

(*Turn to page* 36)

Fewer and Higher Fertilizer Grades

By T. K. Wolfe

Director of Distribution, Southern States Cooperative, Richmond, Virginia

HIGHER analysis fertilizer has new and added significance in wartime. Through its use farmers save money, time, labor, and transportation. Now it is not only sound economy for farmers to use higher analysis fertilizer, but it is patriotic—because of the saving in shipping space and labor in manufacturing and distribution.

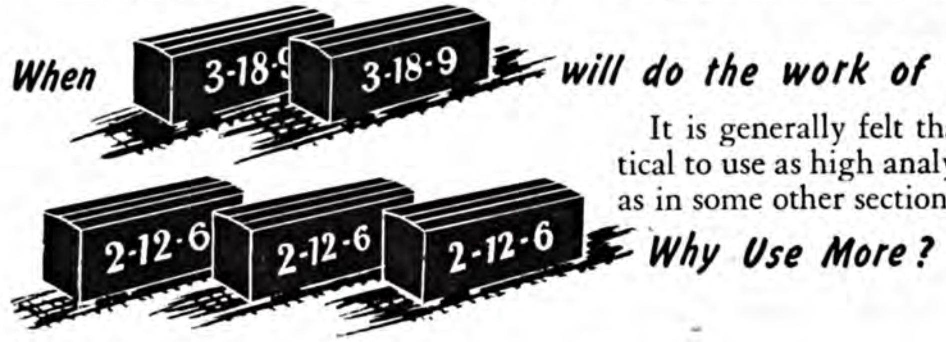
M. H. Lockwood of Eastern States Farmers' Exchange has played a leading role in furthering the production and use of higher analysis fertilizer, particularly in the New England States. He has shown that: (1) In general, the consumer cost per unit of plant food decreases as the percentage of plant food in the fertilizer increases. (2) The proportion of the total cost the consumer pays for manufacturing, packaging, and distribution decreases rapidly as plant food increases. (3) The greatest savings are made when the plant food is increased from 15 units to 20 units.

Experiment stations in the Middle Atlantic States are recommending that fertilizers containing not less than 20 units of plant food be used. The trend of legislation, although slow, is toward requiring the use of fertilizer higher in plant food.

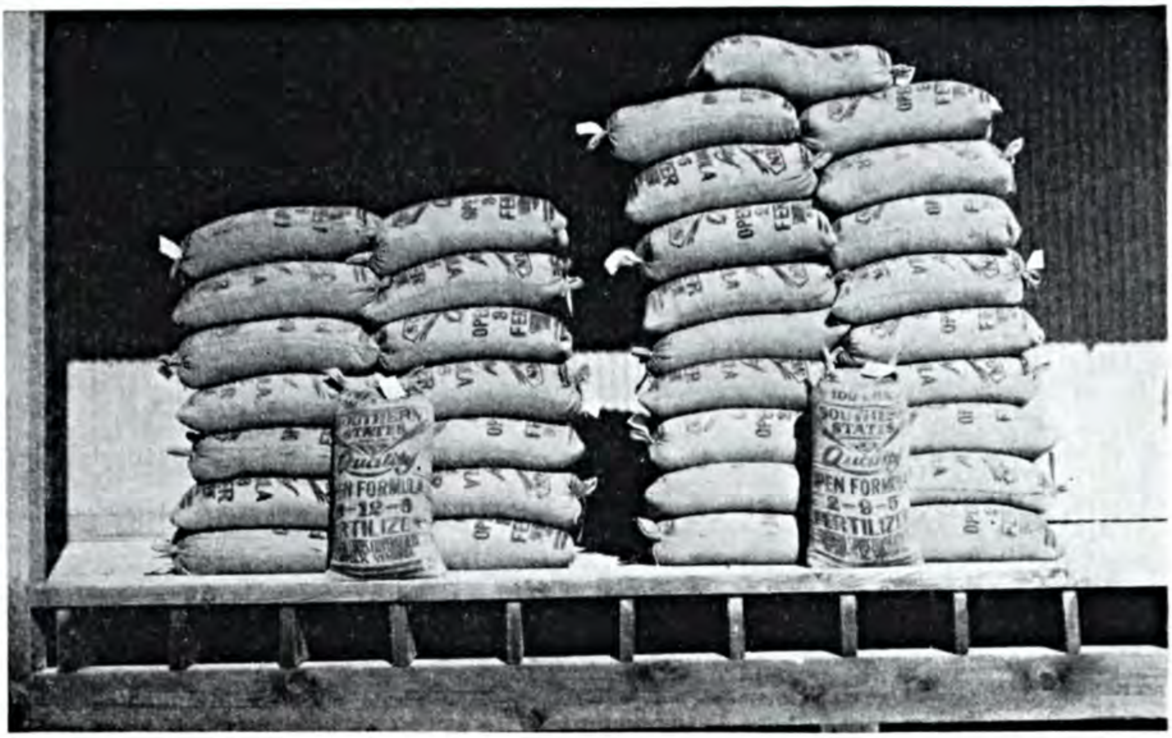
Some years ago 2-8-2 was the leading analysis of fertilizer. It is now largely forgotten. It is not legal to sell it in most states. In its place 4-16-4, a double strength 2-8-2, is being used in increasing quantity. Even 3-8-3, for a long time so popular in the South, is now losing much of its popularity; and more 4-12-4, which has practically the same ratio of plant food, is being used. Total content of the plant food may be increased also by adding more of one or two nutrients, thus changing the ratio. For example, the 4-8-8 is being used in place of 3-8-3 on soils where potash deficiency has become a problem.

Only recently North Carolina made it illegal to sell in that State 3-8-3 and other fertilizers containing 14 units of plant food unless a red tag is attached to each bag setting forth the inadvisability of farmers using fertilizer containing less than 16 units of plant food. Mixed fertilizer containing less than 14 units of plant food cannot be sold under any circumstances.

Southern States Cooperative has consistently urged its members and other farmers to use higher analysis fertilizer. Manufacturing earnings, however, may appear greater in case of lower analysis goods, since plants are usually compensated on the basis of tonnage.



It is generally felt that it is not practical to use as high analyses in the South as in some other sections of the country.



These two analyses carry plant food in about the same ratio; 1,500 pounds of 3-12-6 (left) contain about the same amount of plant food as 2,000 pounds of 2-9-5 (right). Farmers save money, handle 500 pounds less fertilizer, and make shipping space available for ¼ ton of wartime supplies when they use 3-12-6 instead of 2-9-5.

J. J. Skinner of the U. S. Department of Agriculture suggests that fertilizer containing more than from 20 to 25 units of plant food not be recommended for general use in the South for the following reasons:

1. Much of the fertilizer distributing machinery on farms is antiquated and it is difficult to apply small quantities of fertilizer uniformly.

2. On many farms the machinery places fertilizer improperly in reference to the seed. The use of fertilizer too highly concentrated, containing a high percentage of water-soluble materials, may hinder germination of the seed.

With the introduction of improved fertilizer attachments on machines, these difficulties are overcome.

The production and distribution of higher analysis fertilizer containing at least 20 units of plant food is in the interest of farmers. It is the better part of wisdom to move in the direction of higher and higher analysis fertilizer only as fast as farmers can be informed and educated as to its advantages and use. Farmer acceptance is an important consideration, and is largely a process of education. Far too many farmers still purchase fertilizer on the basis of price per ton rather than on the basis of price of plant food. The use of higher analysis fertilizer increases when farmers are told of the advantages they gain in actual savings of money, time, labor, and transportation.

The 2-12-6 analysis is widely used in certain sections. Southern States Cooperative has aggressively urged farmers to use 3-18-9 instead of 2-12-6, and with great success. Two tons of 3-18-9 contain the same amount of plant food as three tons of 2-12-6, and the saving to farmers, on the basis of the prices they pay, is approximately $11. The saving in transportation is shown graphically here. There are also the savings in time and labor of handling. The question is well put: "When 2 cars of 3-18-9 will do the work of 3 cars of 2-12-6, why use more?"

Higher analysis fertilizer gives farmers one of the best means of accomplishing their great desire—to get fertilizer with less sand, with less filler of any kind. For years they have resented the large quantities of sand so widely used in fertilizer. However, in most sec-

(*Turn to page* 34)

Nutrient Availability

*An Analysis**

By S. R. Dickman

Soil Chemist, Agricultural Experiment Station, Urbana, Illinois

Nutrient Hetoemia [1]

This term is derived from the Greek verb "hetoemos"—to be ready. Hetoemia as used here is considered as the summation of all the factors involved in the absorption of nutrients by plants. This viewpoint may perhaps best be understood if the term is first defined and the implications of the definition subsequently discussed.

The hetoemia of a given plant nutrient is determined by calculating as pounds per acre the average total amount of that nutrient absorbed by a field crop from each treatment in an experiment when no other nutrient has limited absorption.

Nutrient hetoemia in this broad sense is concerned with the essential elements in the whole soil mass. Thus the expression "potassium hetoemia" does not refer merely to the replaceable potassium in the surface layer but includes all the potash the plant absorbed from any depth and irrespective of its original condition in the soil. In other words, this type of abstraction measures the over-all reaction without explicitly recognizing the mechanisms involved in achieving it. It is comparable to the thermodynamic approach in physical chemistry which is concerned solely with energy relationships and completely ignores the actual mechanism of a reaction and the specific factors which determine the rate of the reaction, etc. It seems plausible that the recognition of such a general concept in agricultural science might serve as a sound basis for detailed experiments which would then attempt to separate and describe the various factors in a specific, mechanistic manner.

The definition is stated in terms of field conditions for several reasons. The first is that of practicality. Since the ultimate purpose of nutrient experiments is to secure results which will be of use in making recommendations to the farmer, it is obvious that the final criterion must be field results. This does not mean that other methods are not acceptable; in fact, the search for more rapid, less expensive methods and techniques should be encouraged. But as long as farmers till their land, field results will remain the final basis of judgment. In the second place, all the possible factors in a particular area will be active in the field, while some may be absent or less active under other conditions. A conscious selection of the widest, most complex situation for expressing the concept is the safest way to insure that no factor will be ignored. Yet it can not be too strongly emphasized that other methods, such as "quick tests" and the Neubauer and Mitscherlich techniques, not only are preferable to field experiments for certain investigations but also are necessary for an intensive study of specific factors.

The total amount of an element which is absorbed by a crop throughout the growing season in an hetoemia experiment rather than the yield is selected as a basis of judgment because

* Continued from March issue of BETTER CROPS WITH PLANT FOOD.

[1] The author wishes to thank W. A. Oldfather, Professor of Classics, University of Illinois, for suggesting the term "hetoemasia." The author has shortened this to "hetoemia".

the two do not always vary proportionately with each other. Many are familiar with experiments in which the amounts of a single nutrient, nitrogen, for example, are varied; all the other nutrients being supplied in uniformly "sufficient" quantities. Because of the "secondary" effects of nitrogen in plant metabolism on the absorption of other nutrients, the grain yield with the lower amounts of added nitrogen will be proportionately greater per pound of nitrogen absorbed, while with the higher amounts of added nitrogen, an excess of vegetative development may proceed at the expense of yield of grain. As a means of treating this discrepancy, the author proposes the introduction of a concept of "feracity"[2] which is defined as follows:

The feracity of a particular plant nutrient is expressed by the average yield of a certain crop on each plot in a field experiment, when no other nutrient has limited the yield.

The NP plot of various soils will furnish data to enable one to compare the "natural" potassium feracities of the soils. The effect of K additions on the potash feracities of the fully treated plots can then be quantitatively evaluated.

Nutrient Important

Especial attention should be given to the role of nutrient in these definitions. Both of these definitions are based on the assumption that the climate, water supply, physical condition of the soil, presence of claypans, depth of the topsoil, etc., are uncontrolled variables in these experiments, the effects of which can be averaged over a period of years so that their long-time effect is essentially constant in any one location. It is apparent that these non-nutrient factors determine the hetoemia and feracity of nutrients in any one region. While theoretically it might be predicted that potassium hetoemia would not be the same on two different soils, practically these differences might be insignificant on similar soils of a region, so that conclusions based on one soil could be generalized to cover similar soils in that area. The potential hetoemia and feracity of the phosphorus in a bag of fertilizer will depend on the particular soil to which it is applied, the kind of crop to be grown, etc. Since experimental set-ups in different areas may have one or more of these factors different, we are forced to devise a concept which can accommodate the wide variations found in the field or give up general notions altogether. The fact than two soils differ markedly in their physical constitution should not hinder us from carrying out fertility experiments on them with as accurate a nutrient control as can be devised. Indeed, it is this recognition of field differences which precludes the possibility of answering fertility problems solely by greenhouse or laboratory experiments.

Future fertilizer experiments should be planned so that there is but one nutrient variable in any system of treatments. One nutrient should not be a limiting factor while another one is varied. A phosphate experiment on potassium-deficient soils will lead to no justified conclusions concerning phosphate hetoemia or feracity in that soil. Likewise, the hetoemia concept ceases to apply in those situations where yield increases no longer result from further absorption of the nutrient by the plant.

As was mentioned before, the hetoemia and feracity of a nutrient are over-all values. In order to understand how a certain value was secured, it is necessary to analyze the various factors which contributed to it. Many of these factors have been called kinds of "availabilities" by Fraps (14) and by Spencer and Stewart (31) as though they were independent variables. That they are not can be illustrated by an example.

A high percentage of the total potash in most soils is in such an insoluble form that plants can utilize but very small amounts of it in any one grow-

[2] The author wishes to express his appreciation to W. A. Oldfather for suggesting this term.

ing season. According to the present terminology, this potash would be said to have a high positional availability but a very low chemical availability. On the other hand, in those soils which contain significant amounts of replaceable potassium in a claypan layer beneath the surface, potash is said to have a low positional availability but a high chemical availability. If crops were grown on two such soils, potash availability as measured by plant analysis might be very low on both. It seems inconsistent to admit that a certain kind of availability can be high in a soil and yet find that the total availability is very low. It might be less confusing to consider the so-called kinds of availabilities as interdependent factors, each contributing to and affecting the net absorption.

It is in this interrelated sense that the following factors are included in the hetoemia-feracity concepts:

1. Chemical. A recognition that the essential elements occur in the soil in various chemico-physical structures some of which are significantly utilizable by plants, others not. Research in this field is concerned with describing these structures (forms) and determining their value as sources of plant nutrients. When once the principal nutrient forms of the elements have been established, the next step is their quantitative measurement in various soils. As Bray (7) has pointed out, a calibration between the amount of a nutrient form of an element found in a soil by a chemical test and crop yields on soils containing various quantities of this form provides a very practical means of relating laboratory determinations and field data. For example, the original Illinois potash calibration was based on the observation that corn did not respond profitably to further potash additions on soils which contained over 150 pounds of replaceable potash per acre.

2. Positional. Fertilizer placement experiments are primarily concerned with the accessibility of nutrients. A study of different rates of application for each fertilizer in combination with different methods of placement will furnish feracity data that will make possible a quantitative evaluation of the placement-accessibility factor. The lowest weight of each fertilizer that helps produce equal feracities with each method of placement will enable one to judge not only the amount of fertilizer to add but also the most effective placement of it to attain any desired level of crop production.

3. Physiological. A measure of the comparative absorbability of nutrients can be made when the chemical and positional factors are held constant and the variety or species of plant is the only variable.

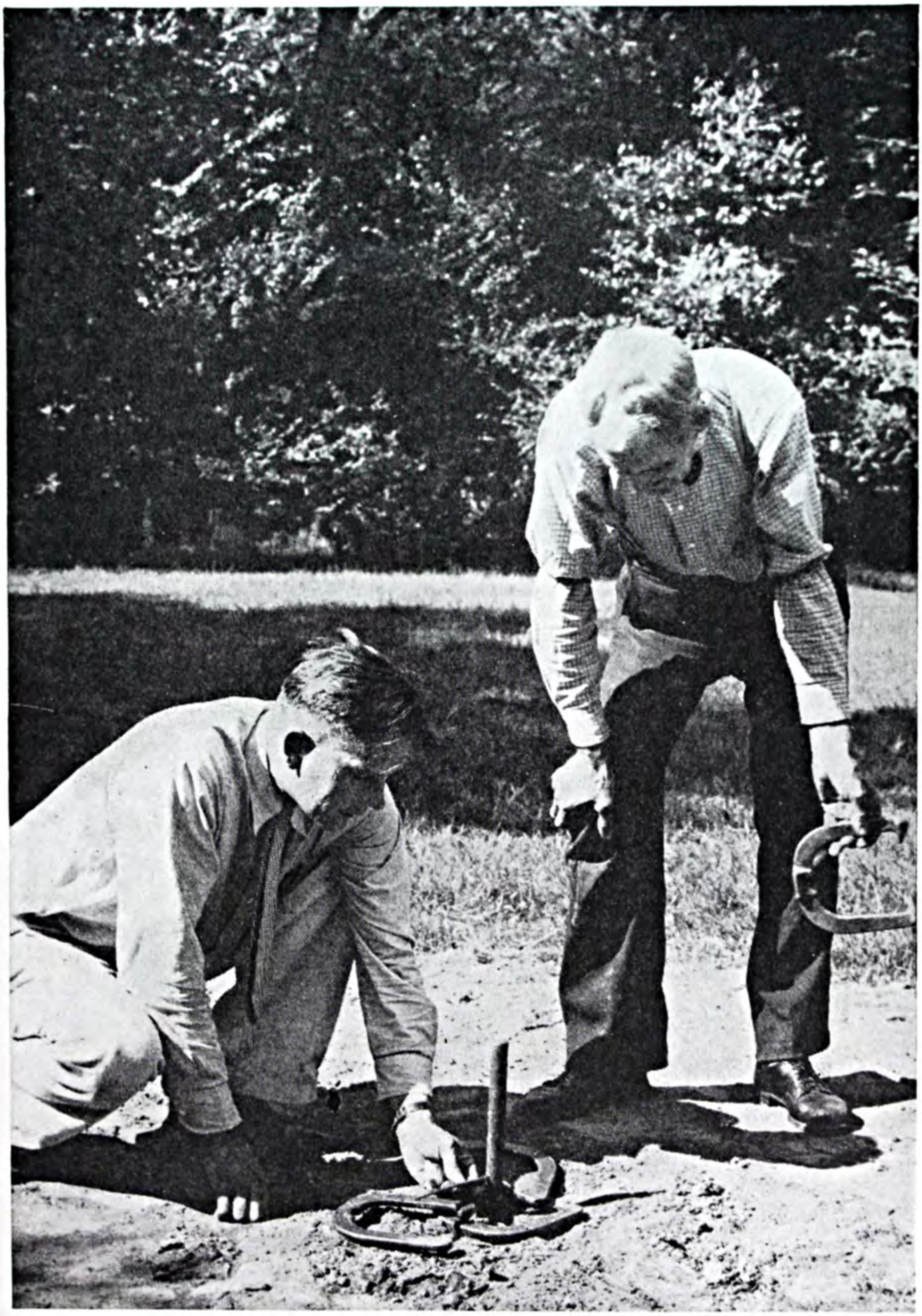
Feracity Concept Applications

Let us suppose that a soil chemist is in charge of directing experiments in an area known to be markedly deficient in available forms of phosphate. How shall he secure information that will aid the farmers of that area and what questions must he answer to obtain that information? He has two main problems to solve: (1) The determination of the phosphorus status of the individual farmer's fields, and (2) the trial and testing of various phosphatic fertilizers in conjunction with determining the effect of management practices on nutrient requirements. An experimental procedure for answering the first question has been briefly indicated in the preceding section and has been fully discussed by Bray (7). An answer to the second question which utilizes the feracity concept will be described below.

The first requisite for the solution of the problem is a typical field known to be low in phosphorus supplying ability. If the field is deficient in other nutrients as well, sufficient amounts of the indicated fertilizers should be applied over the entire area. Soil samples of the various plots should be taken before any phosphatic fertilizers are applied. A crop rotation which is common in the area is selected, and if pos-

(*Turn to page* 39)

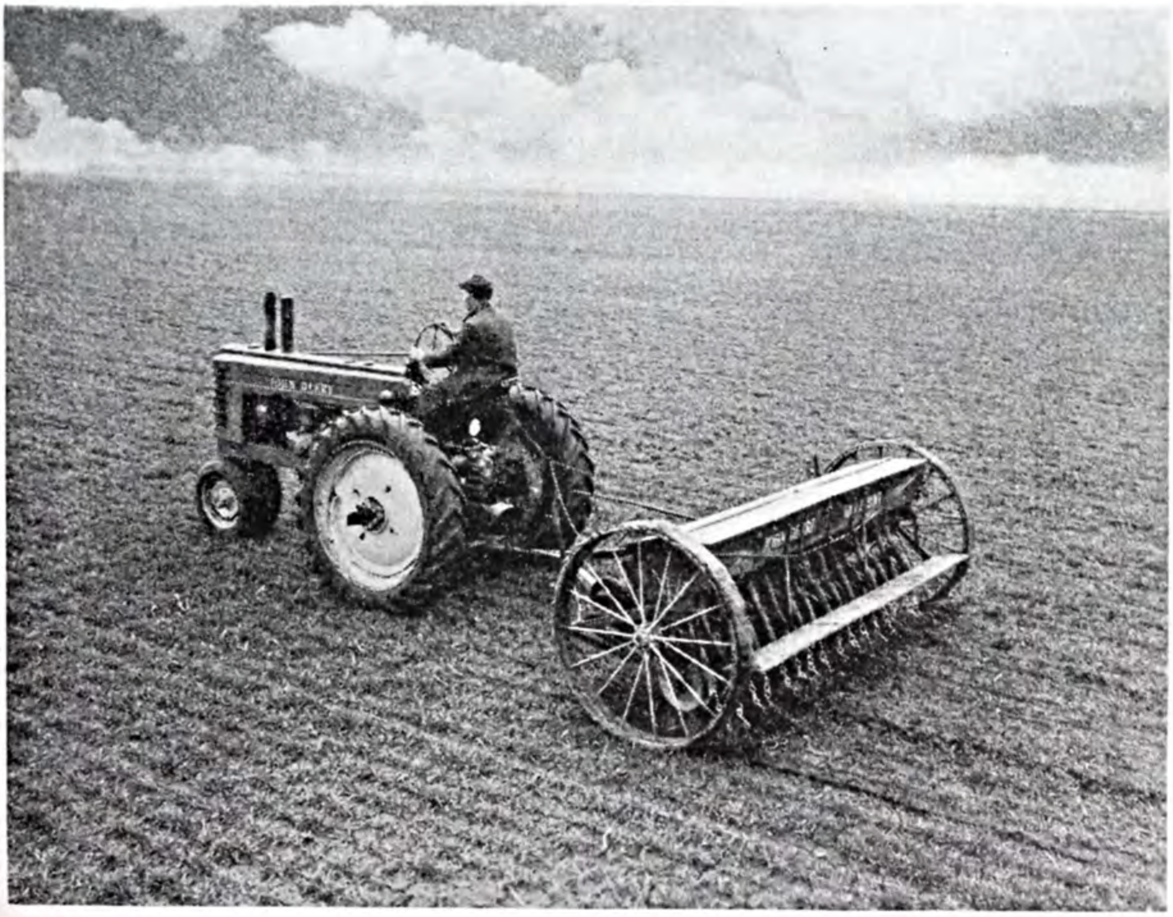
PICTORIAL



Momentous decisions often depend upon very small differences.

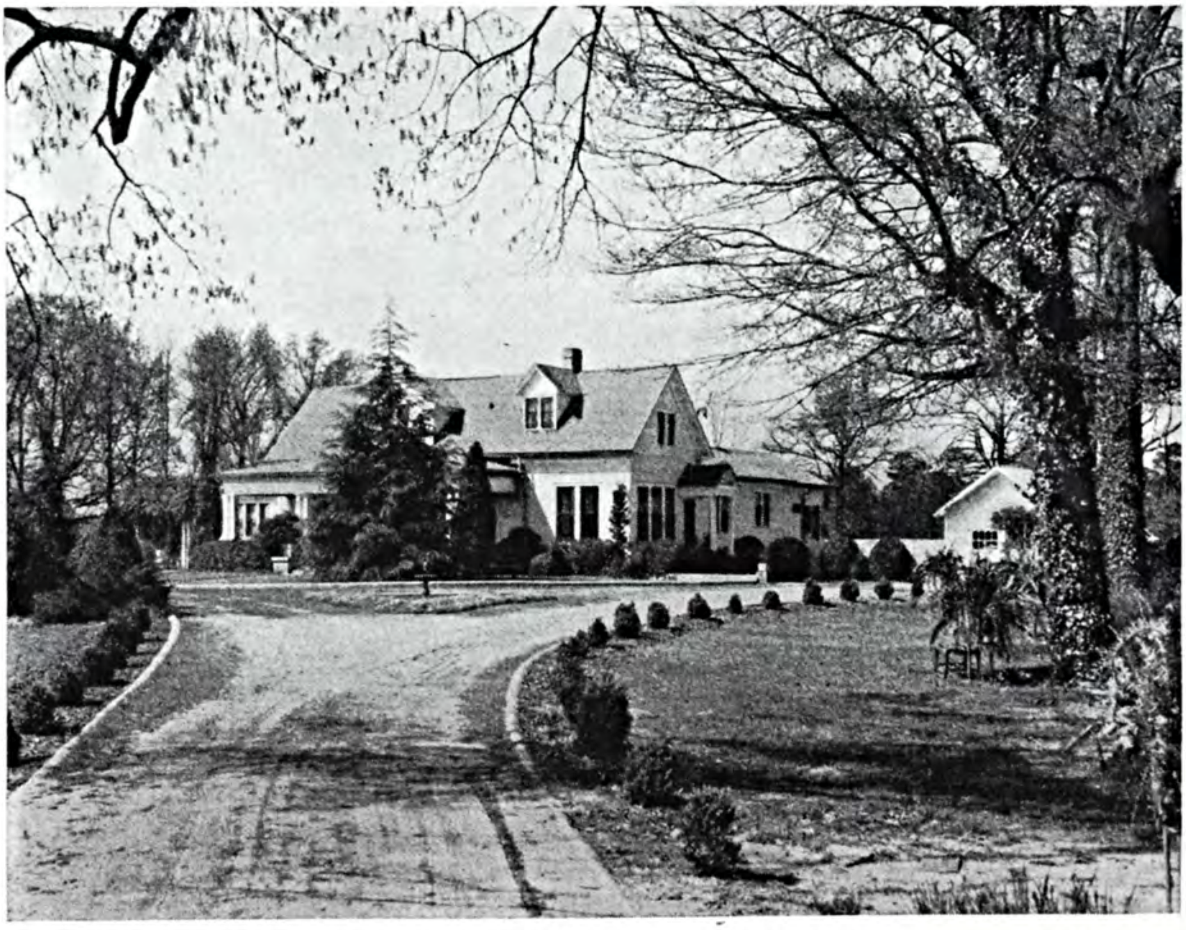
(Above) Many farm girls are doing war production work at home. This California girl plows an acre per hour with this equipment. (Below) Cultivating the Chase Gardens, near Eugene, Oregon. These gardens contain more than 100 acres and are devoted entirely to flowers.

(Above) Not a tented city, but a scene on a southwestern Pennsylvania truck farm where capped cantaloupes are interplanted with radishes. (Below) Top-dressing wheat with 150 pounds of 0-10-25 per acre and seeding sweet clover on the Monon Valley Farm, Monon, Indiana.



(Above) "Ummm . . . it sure smells good."—But let's hope there are no angry bees around.

(Below) Attractive farm home of Mr. and Mrs. W. N. Minor, Eatonton, Georgia.



The Editors Talk

Plant-food Tonnage Reports

Until very recent years it was generous to call figures relating to fertilizer usage and consumption in this country—"statistics." They mostly were figures selected on the basis of estimation, guess-work, and various expediencies pending on the ingenuity, resourcefulness, and enterprise of the compiler. It was almost impossible to get very definite figures even on total tonnage of fertilizer except in those States where tonnage tax tags were required. Now there are a great many States which compile figures on fertilizer usage which are very helpful. There is still a woeful lack of uniformity in the data and far too many cases where there are serious gaps in the data available.

Typical of the progress being made in fertilizer records are a number of releases on fertilizer figures in the list of reviews this month. Announcement FM-37 from California gives the tonnage of various fertilizer materials and mixed goods used in the last quarter of 1941 in California. This shows that less than one-third of all the tonnage was mixed goods, with nitrogen carriers making up most of the tonnage of the straight materials sold. Connecticut Agricultural Experiment Station Bulletin 453 gives figures on the fertilizer tonnage in that State for 1941. Over half the tonnage was mixed goods and of these mixed goods about three-quarters contained 20 or more units of plant food. In a mimeographed release by the State Chemist of Maryland, it is indicated that 128 analyses were registered for sale in that State in 1941 although 15 analyses accounted for nearly 80% of the total tonnage and nearly 60% of the tonnage consisted of analyses recommended by the Experiment Station.

A very complete analysis of fertilizer usage in Michigan has been prepared by the Soil Science Department of Michigan State College. In 1941 nearly 90% of the total consumption was in the form of mixed fertilizers of which over 97% contained 20 units or more of plant food. The percentage of total sales containing 20 units or more of plant food is high and this remarkably good record is of even greater significance when it is noted that only 72% of the tonnage contained 20 or more units of plant food in 1934. About 92% of all fertilizers were composed of grades or ratios recommended by the College and about 79% of the total sales were made up of 10 leading grades. Forty-nine grades of mixed goods are listed in addition to materials.

In New Jersey a mimeographed report of fertilizer sales in 1941 prepared by the Soils and Crops Department of the Experiment Station showed that around 90% of the total sales were in the form of mixed goods. About 40% of the mixed goods consisting of 19 different grades were in the ratios recommended by the Experiment Station. Nearly 90% of the total tonnage of mixed fertilizers consisted of the 23 leading grades, but there were 108 other grades sold in amounts of 1,000 tons or less.

These various compilations show that great progress has been made in increasing the usage of fertilizers containing 20 units or more of plant food and in the usage of recommended grades or ratios. This is highly satisfactory in view of the urgency of use of high analysis fertilizers in this country's war effort. As has been pointed out in previous issues of this magazine, and again in this issue in the article by T. K. Wolfe, concentrated fertilizers not only mean savings in the cash, time, and labor of the consumer and producer, but saving in transportation space which is now in such great demand.

There is still much improvement to be made in the matter of reducing the number of grades on the market; in fact, it would look as though little progress was being made in the reduction of the total number of grades except where regulations prevent sale of more than a specified number of grades or ratios. Undoubtedly the trend to use of higher analysis fertilizers which is now under way will be speeded up, if not voluntarily, under Government pressure, and will have its effect on lessening the total number of grades. Thus another emergency will be added to the list of those out of which comes benefit to all concerned.

Conservation in an All-out

The role of soil conservation in an all-out war effort undoubtedly is puzzling many people. How can we conserve the fertility of our fields, the wealth of our forests, the power of our streams, and the natural bounty of our lands and still meet the huge production goals?

Hugh H. Bennett, Chief of the Soil Conservation Service, U. S. Department of Agriculture, gave the answer in a recent address before the Seventh Annual North American Wildlife Conference held in Toronto, Canada. Stating that there is no place in wartime for the conception of conservation as hoarding, scrimping, saving up, or putting aside for a rainy day, he briefly outlined six foundation blocks for a productive conservation: 1—Conservation of soil and water means greater yields from cropland, pasture, forest, and range; 2—Conservation means putting every acre of land to work on the production job it is best suited to perform; 3—Conservation means the elimination of waste in farming—the elimination of wasted soil, water, fertilizer, seed, or of any other element of productive capacity; 4—Conservation means increasing the area of arable land—by control of erosion, by drainage, irrigation, or other proved conservation practices; 5—Conservation means assurance that crops will be produced in spite of drought, rainstorms, wind, and snow—as far as it is possible to protect crops from unusual weather conditions; 6—Conservation means assurance that the agricultural plant will not break down in the middle of the war. Conservation is the only assurance that we will be able to produce at top speed, year in and year out, as long as our critical needs may last.

Dr. Bennett pointed out that the United States was in the last war only 19 months, but millions of acres of farm and ranch lands were so badly damaged as a result of the unwise way we used them then that they have not fully recovered yet. That was a mistake we cannot afford to repeat. Four or five years' abuse like that might seriously impair our farm plant. Every inch of topsoil washed or blown away now means decreased yields from now on. We can't afford to follow production methods that might get results this year at the risk of failure a year or so later. We've got to be ready to run our agricultural plant at full capacity—to produce more and more, and still more—year after year.

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

Fertilizers

¶ A new edition of the fertilizer recommendations for Ontario has been issued by the Provincial Department of Agriculture. This is "Recommendations for Soil Management and Use of Fertilizers." It was prepared by the Advisory Fertilizer Board for Ontario, and is one of the best pamphlets of its type issued anywhere. Brief and concise but clear and practical information and advice on soil organic matter, lime, manure, soil testing, method of fertilizer application, and specific recommendations for various crops growing under different conditions are given. Field crops, fruits, vegetables, lawns, and specialty crops are included.

¶ A pamphlet of great practical use to farmers and farm advisers is Illinois Extension Service Mimeographed Pamphlet AG-1022, "Mixed Fertilizers and Practices Related to Their Use in Illinois," by A. L. Lang. This briefly covers what fertilizers are, describes the principal nitrogen, phosphorus, and potassium carriers, explains such terms as fertilizer grades and fertilizer ratio, gives the amounts of plant foods required to produce some important farm products, discusses the maintenance of the fertility of the soil by the use of lime, organic matter, and fertilizers, summarizes results obtained by the use of fertilizers on wheat, corn, and soybeans, on various experimental fields in the State, and makes suggestions on the use of fertilizers for corn, wheat, and legumes growing on different soils under various systems of management.

¶ An interesting series of papers was presented at a Fertilizer Conference held jointly by the Tennessee Experiment Station and fertilizer groups in that State last fall. These have been collected and issued by the Tennessee Extension Service as Mimeographed Pamphlet CL 9909. Among the papers was one by Director Mooers of the Experiment Station giving the general fertilizer requirements in the several agricultural regions of Tennessee, based on experiments and observations of the Experiment Station and Extension staffs. Phosphate is usually the first limiting element, and when this need is met potash also is usually needed. Nitrogen is deficient in these soils so that as a rule a complete fertilizer would appear to be needed. In the Central Basin the soil has better supplies of phosphate, but nitrogen usually is very deficient and potash is frequently deficient, especially on tobacco. Western Tennessee generally needs phosphate, potash, and nitrogen.

Dr. MacIntire showed that, contrary to a common belief, the use of lime does not increase the soluble potassium in the soil, but rather the opposite. Whenever lime was applied, potash in leached water and in the plants growing on the soil was decreased. This is not meant to imply that lime should not be used, but rather that when lime is used as needed appropriate potash fertilization should also be given. This was stressed by Dr. Winters in his paper on the subject of liming needs for Tennessee soil in relation to fertilizer usage. Dr. Washko showed that alfalfa yellows might be caused by five different factors; namely, potash deficiency, heat and drought injury, leafhopper injury, a disease due to micro-organisms, and boron deficiency. The latter apparently is becoming an increasingly troublesome factor in growing alfalfa in Tennessee, particularly on the second crop. The use of borax in appropriate amounts has been found to be very effective in preventing alfalfa yellows due to boron deficiency, but additional work is needed to learn the amounts and time and frequency of application needed for best results. Other papers dealing with fertilizer problems and farm management, the fertilizer supply situation as affected by war conditions, and ways of meeting these problems were presented.

¶ Much interest has been aroused among those growing specialty crops and plants and even among those interested primarily in field crops in the value of vitamins on plant growth. Many have felt that these vitamins had much the same effect as fertilizers and might be used as such. This has been investigated by G. S. Fraps and J. F. Fudge, who published their results as Circular 95 of the Texas Agricultural Experiment Station. This publication is entitled "Vitamin B_1 (Thiamin) and Other Vitamins as Fertilizers." They found that some flowers were benefited by the use of vitamins but many others and several vegetable crops were not benefited when growing under ordinary greenhouse conditions. They also found some indication that the use of thiamin helps the plant recover from the shock of transplanting. Little benefit from the other vitamins was found, and they would not replace fertilizers. The authors conclude from their work and from an extensive survey of literature that plants growing under ordinary conditions usually can produce all the vitamins they need.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended December 31, 1941," St. Dept. of Agr., Sacramento, Calif., Anns. FM-37, Feb. 18, 1942.

"Recommendations for Soil Management and Use of Fertilizers," Ont. Dept. of Agr., Toronto, Ont., Canada, Jan. 1942.

"The Nitrogen Requirement of Sugar Beets," Agr. Exp. Sta., Fort Collins, Colo., Tech. Bul. 28, Feb. 1942, Robert Gardner and D. W. Robertson.

"Commercial Fertilizers, Report for 1941," Agr. Exp. Sta., New Haven, Conn., Bul. 453, Nov. 1941.

"Fertilizer, Seed, and Ice Cream Report, July-December 1941," St. Bd. of Agr., Dover, Del., Quarterly Bul., Vol. 31, No. 4.

"Mixed Fertilizers and Practices Related to Their Use in Illinois," Agr. Ext. Serv., Urbana, Ill., AG-1022, Feb. 20, 1942, A. L. Lang.

"Maryland Fertilizer Facts for 1941," Insp. and Reg. Serv., College Park, Md.

"Commercial Fertilizers, Feeds, and Agricultural Liming Materials," Insp. and Reg. Serv., College Park, Md., Control Ser. No. 181, Jan. 1942.

"Tonnage of Different Grades of Fertilizer Sold in Michigan, 1941," Mich. St. Col., East Lansing, Mich.

"Report of Fertilizer Sales in New Jersey for 1941," Agr. Exp. Sta., New Brunswick, N. J.

"Twelfth Annual Report of the New Mexico Feed and Fertilizer Control Office for Year Ending December 31, 1941," St. Feed and Fert. Control Off., State College, N. Mex., Feb. 1, 1942, R. W. Ludwick and Lewis T. Elliott.

"Proceedings of Fertilizer Conference, Nashville, October 21, 1941," Agr. Ext. Serv., Knoxville, Tenn., CL-9909, Jan. 3, 1942.

"Distribution of Fertilizer Sales in Texas for 1940-1941," Agr. Exp. Sta., College Station, Texas, Prog. Rpt. 759, A. D. Jackson.

"Vitamin B_1 (Thiamin) and Other Vitamins as Fertilizers," Agr. Exp. Sta., College Station, Texas, Cir. 95, Mar. 1942, G. S. Fraps and J. F. Fudge.

Soils

¶ A number of different methods have been devised for running relatively rapid chemical tests on soils in an effort to determine their fertilizer needs. One of the most widely used of these tests is the Universal Soil Testing System devised by Dr. M. F. Morgan. He has described this in detail in several bulletins. His latest publication is entitled "Chemical Soil Diagnosis by the Universal Soil Testing System," and is issued as Bulletin 450 of the Connecticut Agricultural Experiment Station at New Haven. This is the most complete bulletin issued on a soil-testing method and the subject is covered very thoroughly. Practically all of the quick-testing methods are briefly reviewed, and the method devised by Dr. Morgan is given in sufficient detail to enable anyone with proper training and experience to use his testing system. Complete directions for the preparation of reagents and conducting the tests are included. Considerable attention is devoted to interpreting the results of the tests, which admittedly is the most difficult part of soil testing. Everyone interested in soil testing will find this bulletin of great value.

"Chemical Soil Diagnosis by the Universal Soil Testing System," Agr. Exp. Sta., New Haven, Conn., Bul. 450, Oct. 1941, M. F. Morgan.

"A Method for Determining the Lime Requirement of Georgia Soils," Agr. Exp. Sta., Experiment, Ga., Cir. 133, Feb. 1942, L. C. Olson.

"Bench Terracing by the Barrier Method," Agr. Ext. Serv., Honolulu, Hawaii, Cir. 126, Nov. 1941, Norman King.

"Soil Survey, the Sacramento-San Joaquin Delta Area, California," U. S. D. A., Washington, D. C., Ser. 1935, No. 21, July 1941, Stanley W. Cosby.

Crops

¶ Much importance is being attached to the growing of a sufficient volume of vegetables to meet the needs of ourselves and our Allies. While large scale commercial production will have to meet the needs of the canners and large buyers, it is felt that the situation can be greatly helped by having a number of small gardens to take care of the family needs of those who have the land available for this purpose. The aggregate productions of these gardens would be large, and the demands on the commercial growers who meet domestic needs would be correspondingly reduced, releasing more of their crops for war needs. In order to supply information for those who want to grow such gardens, the U. S. Department of Agriculture and many of the state experiment stations or agricultural extension services have issued bulletins and pamphlets on home gardens. These will be found listed below.

In most cases suggestions are given on the kinds of vegetables to grow, the quantities that will be needed to supply the average family needs, the amounts that should be planted to supply these needs, how to lay out the garden, the preparation and fertilization of the soil, varieties, planting methods including time and rate of seeding, and in some cases disease and insect control. The consulting and use of these bulletins will save much disappointment by many amateur gardeners and will aid in the efficient utilization of our seed and fertilizer resources, which are just about ample to go around and cannot be wasted.

¶ Within the last several years there has been increasing attention paid to the growing of small grains in the South. It has been found that these crops are well suited to Southern agriculture and climate and produce comparatively good yields of feed either as grain or as hay. They are also very efficient winter cover crops. Information on growing oats, wheat, rye, and barley is presented by E. D. Alexander in Georgia Agricultural Extension Service Bulletin 486, "Small Grains in Georgia." Time and rate of seeding, varieties, fertilization, harvesting, and utilization of each of these crops are briefly discussed. A complete fertilizer at planting time with nitrogen or nitrogen-potash top-dresser in the spring is suggested for these crops except when they are planted on soil that has received heavy applications of phosphate and potash for the preceding crop, in which case a nitrogen top-dressing in the spring will be sufficient.

"Fifty-first Annual Report, January 1 to December 31, 1940," Agr. Exp. Sta., Auburn, Ala.

"Utilization of California Fruits," Agr. Exp. Sta., Berkeley, Calif., Cir. 349, Oct. 1941, W. V. Cruess and G. L. Marsh.

"Methods and Equipment for the Sun-drying of Fruits," Agr. Exp. Sta., Berkeley, Calif., Cir. 350, Nov. 1941, E. M. Mrak and J. D. Long.

"Sweet Corn Hybrids Lexington, Lincoln, and Lee," Agr. Exp. Sta., New Haven, Conn., Cir. 148, Oct. 1941, W. R. Singleton and D. F. Jones.

"Herbs and Their Culture," Agr. Exp. Sta., New Haven, Conn., Cir. 149, Nov. 1941, Ruth M. Hendrickson and Frances M. Johnson.

"Florida Farmers and Food for Freedom," Agr. Ext. Serv., Gainesville, Fla., Cir. 60, Jan. 1942, J. Francis Cooper.

"Research and Investigational Activities—Annual Report for the Fiscal Year Ending June 30, 1941," Col. of Agr., Athens, Ga., Univ. Bul., Vol. XLI, No. 26, June 30, 1941.

"Small Grains in Georgia," Agr. Ext. Serv., Athens, Ga., Bul. 486, Oct. 1941, E. D. Alexander.

"Dahlia Variety Test, 1941," Agr. Exp. Sta., Experiment, Ga., Cir. 132, Dec. 1941, H. L. Cochran, David D. Long, W. D. Ricks, and T. L. Bissell.

"Cotton Variety Experiments in Georgia, 1937-1941," Agr. Exp. Sta., Experiment, Ga., Cir. 134, Feb. 1942, R. P. Bledsoe and U. R. Gore.

"Culture of Tomatoes," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 119, Sept. 1941, Ashley C. Browne, L. A. Dean, and W. A. Frazier.

"Increasing the Germination of Koa Haole Seed," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 122, Oct. 1941, J. C. Ripperton.

"Home Garden Questions and Answers," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 123, Sept. 1941, L. A. Dean, W. A. Frazier, F. G. Holdaway, F. Okumura, and A. C. Browne.

"Harvesting, Packing, and Marketing Tomatoes," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 125, Oct. 1941, W. W. Jones and Kenneth I. Hanson.

"Head Cabbage in the Home Garden," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 131, Fuyuki Okumura.

"Eggplant—(Round) in the Home Garden," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 132, Dec. 1941, Fuyuki Okumura.

"Tomatoes in the Home Garden," Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Serv., Honolulu, Hawaii, Agr. Ext. Cir. 133, Dec. 1941, Fuyuki Okumura.

"An Illinois Garden Guide," Agr. Ext. Serv., Urbana, Ill., Cir. 522, Feb. 1942, B. L. Weaver and L. A. Somers.

"Iowa Corn Yield Test, 1941," Agr. Exp. Sta., Ames, Iowa, Bul. P38, Feb. 1942, Joe L. Robinson and Marcus S. Zuber.

"A Preliminary Report of Certain Variety, Fertilizer, and Other Tests Conducted by the Crops and Soils Department of the Louisiana Experiment Station—1941," Agr. Exp. Sta., University Station, Baton Rouge, La.

"Spelt in Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 180, Feb. 1942, H. M. Brown.

"Factors Which Make for Success in Orcharding," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 181, Jan. 1942, H. P. Gaston.

"Forty-eighth Annual Report, July 1, 1940 to June 30, 1941," Agr. Exp. Sta., University Farm, St. Paul, Minn.

"Crop Rotation Studies," Agr. Exp. Sta., University Farm, St. Paul, Minn., Tech. Bul. 149, Dec. 1941, H. Y. Chen and A. C. Arny.

"Garden for Victory," Agr. Ext. Serv., University Farm, St. Paul, Minn., Pamp. 91, Feb. 1942.

"Grow Greens for Health," Agr. Ext. Serv., University Farm, St. Paul, Minn., Pamp. 92, Feb. 1942.

"Soybeans for Grain," Agr. Ext. Serv., State College, Miss., Leaf. 20, Feb. 1942, J. M. Weeks.

"Peanuts," Agr. Ext. Serv., State College, Miss., Leaf. 21, Feb. 1942, J. M. Weeks.

"Commercial Strawberry Culture in Missouri," Agr. Exp. Sta., Columbia, Mo., Cir. 216, Dec. 1941, T. J. Talbert and A. D. Hibbard.

"Soybeans for Grain," Agr. Ext. Serv., Columbia, Mo., Cir. 450, Feb. 1942, J. R. Paulling.

"Representative Missouri Weeds and Their Control," Agr. Exp. Sta., Columbia, Mo., Bul. 433, Aug. 1941, W. B. Drew and C. A. Helm.

"The Montana Farm Garden," Agr. Ext. Serv., Bozeman, Mont., Bul. 196, June 1941, E. E. Isaac.

"Ornamental Trees and Shrubs for New Mexico," Agr. Exp. Sta., State College, N. Mex., Bul. 284, Oct. 1941, J. V. Enzie.

"Controlling the Pre-harvest Drop of Apples," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 766, July 1941, M. B. Hoffman.

"The Winter Hardiness of Some Ornamental Woody Plants of New York State," Cornell Univ., Agr. Exp. Sta., Bul. 772, John F. Cornman.

"The Relation of Spacing to Yield and to Plant and Ear Development of Some Yellow Sweet Corn Hybrids in New York," Agr. Exp. Sta., Geneva, N. Y., Bul. 700, Feb. 1942, W. D. Enzie.

"Methods of Growing Strawberries and Bramble Fruits," Agr. Ext. Serv., Stillwater, Okla., Cir. 133, Rev. 1941, D. C. Mooring and G. F. Gray.

"Home Vegetable Garden," Agr. Ext. Serv., Stillwater, Okla., Cir. 196, Rev. 1941, D. C. Mooring.

"Corn in Oklahoma," Agr. Ext. Serv., Stillwater, Okla., Cir. 324, Rev. 1941, Luther H. Brannon.

"Extension—Its Aims and Accomplishments. Twenty-seventh Annual Report of the Extension Division, 1940," Agr. Ext. Serv., Stillwater, Okla.

"Influence of Spacing on Yield and Grade of Strawberries," Agr. Exp. Sta., Kingston, R. I., Bul. 283, Nov. 1941, E. P. Christopher.

"Grow Winter Cover Crops," Agr. Ext. Serv., Knoxville, Tenn., Leaf. 6, Sept. 1941.

"Green Shell Soybeans as Garden Crops," Agr. Ext. Serv., Knoxville, Tenn., Sp. Cir. 153, Oct. 1941, W. C. Pelton and Maude Guthrie.

"Apple Varieties and Important Producing Sections of the United States," U. S. D. A., Washington, D. C., Farmers' Bul. 1883, Nov. 1941, J. R. Magness.

"Birdsfoot Trefoil and Big Trefoil," U. S. D. A., Washington, D. C., Cir. 625, Nov. 1941, Roland McKee and H. A. Schoth.

"The Anatomy of the Seedling and Roots

of the Valencia Orange," U. S. D. A., Washington, D. C., Tech. Bul. 786, Jan. 1942, H. E. Hayward and E. M. Long.

"Victory Gardens," U. S. D. A., Washington, D. C., Misc. Pub. 483, Feb. 1942, Victor R. Boswell.

"Peanut Oil and the War," U. S. D. A., Washington, D. C., BAE-Ext. Flier 3.

"The Fruit Industry of Argentina," U. S. D. A., Washington, D. C., Foreign Agr. Rpt. 1, Jan. 1942, Fred A. Motz.

"The Fruit Industry of Brazil," U. S. D. A., Washington, D. C., Foreign Agr. Rpt. 2, Jan. 1942, Fred A. Motz.

"The Fruit Industry of Chile," U. S. D. A., Washington, D. C., Foreign Agr. Rpt. 3, Jan. 1942, Fred A. Motz.

Economics

¶ The Georgia Experiment Station, in cooperation with the Bureau of Agricultural Economics of the U. S. Department of Agriculture, has published a very timely circular, No. 135, entitled "Producing Peanuts for War Needs (Sumter County, Georgia)," by James C. Downing, Robert Terry, and W. E. Hendrix.

As a part of the war program farmers have been asked to plant 5 million acres of peanuts, about 2½ times the 1941 planting. Considerable reorganization in the peanut-producing areas must be made if the goal is attained. The fact that Georgia is one of the most important peanut-producing states and that Sumter County is one of the leading peanut-producing counties in the State makes this study especially interesting and timely.

The reason for this tremendous increase in peanut production, primarily for oil, is due to the closing of shipping lanes from about one-half of our sources of imported fats and oil. Peanut oil is used for food purposes such as shortenings and oleomargarines, and in addition large quantities are used in soaps, pharmaceuticals, glycerine, lubricants, putty, and paints. With the war requiring the production of so many substitutes and increases in the production of most oil products, peanut oil will undoubtedly become a major raw material for the chemical industry.

With respect to the income from peanuts, it is calculated that under average Sumter County conditions, peanuts harvested for oil will return about $20.50 per acre above cash expenses. This return per acre is less than that for cotton and edible peanuts, but is greater than the returns from "hogging off" peanuts or growing corn. However, on a labor basis the returns from hogging off, edible peanuts, and cotton are all higher than peanuts grown for oil.

It is emphasized further that low peanut yields will always result in relatively small returns per acre. This fact demonstrates clearly the desirability of using good seed, getting operations done at the proper time, fertilization, and other practices affecting the quantity produced.

With respect to fertilizers, it is pointed out that on very fertile soils or soils that have been heavily fertilized in the past, increases in yields from fertilizer application are relatively small. However, in most instances on land that will not produce 1,000 pounds of peanuts per acre, it will pay to fertilize. Much of the peanut increase is expected to be planted on land that had little or no fertilizer applied to it in 1941. Consequently, an application of 200 to 300 pounds per acre of 3-8-8 on Spanish or 0-8-8 on Bunch or Runners before planting is recommended as a means of insuring maintenance of soil fertility, a good yield, a good money return, and a maximum contribution toward the war effort.

The bulletin sets up five alternative farm plans for reorganizing medium-sized cotton-peanut farms to meet war needs and discusses them from the standpoint of the labor requirement, cash income, and soil fertility. Each of the plans seems to have its advantages and disadvantages and would have to be considered from the standpoint of the organization and available labor on the individual farm.

The authors state that large increases in the acreage of crops are often accompanied by lower average yields because of scarcity of the adaptable land. If this same principle holds true for peanuts, present rates of yield may not be maintained except at higher costs for fertilizer. It generally will be best to use the idle land for feed crops, thereby releasing other parts of the cropland for the peanut acreage increases. Farms that do not have idle cropland will find it necessary to replace some corn, cotton, and miscellaneous crops, if they are to help meet the peanut goal.

It is concluded that all of the plans outlined in the pamphlet drain soil fertility heavily. This situation makes it imperative that more winter cover crops be planted and turned and more fertilizer used during the war emergency than has been the usual practice in this area. When the war is over, and prices have returned to normal, farmers should immediately begin to follow a more soil-conserving program than is consistent with meeting the necessary war needs in 1942.

"Systems of Farming for the Central Bluegrass Region of Kentucky," Agr. Exp. Sta., Lexington, Ky., Bul. 419, June 1941, W. D. Nicholls, George B. Byers, and John H. Bondurant.

"The Transmission of Farming as an Occupation," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 768, Oct. 1941, W. A. Anderson.

"Agricultural Production in New York, 1866 to 1940," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 769, Oct. 1941, T. E. LaMont.

"Changes in the Prices of Apples and Other Fruits," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 773, Dec. 1941, M. D. Woodin.

"Farm Management in Newberry County, South Carolina," Agr. Exp. Sta., Clemson, S. C., Bul. 338, Jan. 1942, M. J. Peterson and J. D. Kinard.

"Cost and Profit of Ginning Cotton in Texas," Agr. Exp. Sta., College Station, Texas, Bul. 606, Jan. 1942, W. E. Paulson.

"Bibliography on the Agriculture of the American Indians," U. S. D. A., Washington, D. C., Misc. Pub. 447, Jan. 1942, Everett E. Edwards and Wayne D. Rasmussen.

"A Method of Estimating the Economic Effects of Planned Conservation on an Individual Farm," U. S. D. A., Washington, D. C., Misc. Pub. 463, Jan. 1942, Arthur C. Bunce and George W. Collier.

"Report of the Chief of the Agricultural Marketing Service, 1941," U. S. D. A., Washington, D. C.

"Report of the Chief of the Commodity Exchange Administration, 1941," U. S. D. A., Washington, D. C.

"Report of the Chief of the Bureau of Agricultural Economics, 1941," U. S. D. A., Washington, D. C.

"Improving Low Incomes on Tobacco Farms, Caswell County, North Carolina, U. S. D. A., Washington, D. C., FM-24, June 1941, Robert E. Graham, Jr.

"Summaries from Farm-business Analysis Studies in the United States, 1907-39," U. S. D. A., Washington, D. C., FM-26, Dec. 1941, H. W. Hawthorne.

"Uses for Cotton," U. S. D. A., Washington, D. C., Agr. Ec. Bib. N 91, Sup. 44, Feb. 1941, Dorothy M. Ellis.

"War and Agriculture in the United States, 1914-1941," U. S. D. A., Washington, D. C. Agr. Ec. Bib. 93, Jan. 1942, Walter T. Borg.

Fewer and Higher Fertilizer Grades

(*From page* 19)

tions, they have not gotten very far in doing much about it, except through certain organizations.

Sand and other worthless fillers are expensive at any time. But in wartime, of all times, it is exceedingly important to conserve the great amount of shipping space that useless fillers in low analyses consume. A. L. Mehring in his article, "Higher Analysis Fertilizers as Related to the Victory Program," published in the January 1942 issue of BETTER CROPS WITH PLANT FOOD, says: "It requires the equivalent of 20,000 box cars moving 100 miles to haul the half million tons of unnecessary filler in mixed fertilizers."

Now is the time for fertilizer manufacturers to take bold and courageous action to eliminate the multiplicity of analyses, particularly the low analyses such as 0-10-4, 2-8-4, and others high in filler and costly on the basis of plant food. It is time to move aggressively to higher analyses. Such steps are in the interest of the farmer, the manufacturer, and the Nation.

The Production and Use of Potash in America

(*From page* 14)

sections of Europe for similar purposes. As early as 1810, the value of the exported potash had reached a figure of more than one and one-half million dollars. This industry died when the forests dwindled and potash began to be imported from Europe.

It was not until 1840 when Justis von Liebig reported that plants through their roots fed upon minerals in the soil that potash was recognized as an important plant nutrient. Liebig disclosed that potash is one of the principal constituents in the ash of all plants and emphasized the fact that since plants use such large amounts, soils should be well supplied with potash. At about the same time the large deposits of potash in Stassfurt, Germany, were discovered while drilling for salt, and in 1860 the first plant for the processing of these crude salts was built. The development of this industry gave Germany almost a monopoly on potash until the first World War.

American Potash Production

During that war, the scarcity of potash in America and the prices which had skyrocketed for any that could be obtained led to attempts to recover the element from all possible sources. These included industrial wastes from the cement, iron, beet sugar, alcohol, tobacco, hardwood, and wool industries and from kelp and brines. More than 70 plants sprang up, producing potash at high cost but still meeting only a small fraction of the demand. Following the armistice and the reimportation of potash from Europe, all but three of these domestic producers were forced to close for economic reasons. These three included the production of potash from brine and the small amounts recovered from the wastes of the cement and alcohol industries.

The one American producer of any volume to survive was the plant at Searles Lake, California, where potash is being extracted from the brine of a dried-up salt lake, with side products of borax and other industrial chemicals. However, the search for deposits in the United States which had begun during the war continued, and in 1926 the Government appropriated enough money for exploring areas in Texas and New Mexico. There, in what is known as the Permian Basin, rich beds of potash salts were discovered lying at a depth of about 1,000 feet underground. Subsequently a company was formed for the mining of these salts, and in 1931 another company was formed. The third important producer in this area began the marketing of its products late in 1940.

At the Searles Lake plant, brine is pumped from wells drilled in the crystal body of the lake. This brine is piped into evaporators where the potash is separated from other constituents. A high-grade muriate of potash is produced, most of which is used as such in the fertilizer and chemical industries. Some of this may be treated with sodium sulphate to produce sulphate of potash.

In the New Mexico plants, the crude ore, which resembles rock salt, is mined and crushed. Some of this is used directly for fertilizer under the name of manure salts. These consist of muriate of potash with sodium chloride and other impurities present. However, most of the raw salts are sent to the refineries where the impurities are removed, producing high-grade muriate of potash for fertilizer and chemical use. Some of the muriate is treated with sulphuric acid to make sulphate of potash with hydrochloric acid as a by-product.

At one of the mines a natural deposit of potash and magnesium sulphates, called langbeinite, occurs. This is ground and used as such after treatment to remove some of the impurities, or it is treated with potassium chloride to produce straight sulphate of potash with magnesium chloride as a by-product.

The potash salts commonly occurring on the fertilizer market are:

Muriate of potash, containing 80-99% potassium chloride, equivalent to 50-62½% K_2O.

Sulphate of potash, containing 90-96% potassium sulphate, equivalent to 48-52% K_2O.

Manure salts, containing 22-26% K_2O in the form of muriate of potash.

Sulphate of potash-magnesia, containing 22-26% K_2O in the form of sulphate of potash and 10-18% magnesium oxide in the form of magnesium sulphate.

By far the greatest part of the potash used in agriculture is in the form of high-grade muriate since this is the cheapest per pound of plant food and is satisfactory for nearly all conditions. The manure salts may be more economical at points where shipping costs per pound of potash contained do not make them more expensive than the muriate form. Sulphate of potash, since it is a manufactured product, costs more per pound of plant food than muriate and its use is therefore restricted to those crop or soil conditions where a high chloride content in the fertilizer is not desirable. Sulphate of potash-magnesia is used where the sulphate form of potash is desired and where magnesium also is needed.

The production at all of these plants has been constantly increased, and now when European sources are again cut off and America's need for potash has increased from a recorded importation of 1,400 tons of potash salts in 1871 to an estimated consumption of well over 1,000,000 tons in 1941, this relatively new American industry is proving itself equal to the demands being placed upon it.

Modern Fruit Production

(*From page* 17)

subjects are modern in concept. The application of nitrogen in the fall is another comparatively new practice covered in the book.

The authors have presented their subject matter in a clear and interesting manner. They have quoted many references, which are conveniently listed at the end of each chapter. "Modern Fruit Production" will be of use and value to practical growers and their advisers as well as to students, since along with fundamental information, sufficient detailed material is given to make the volume a good handbook as well as reference.—*J. D. Romaine.*

Fertilizing Peanuts in Georgia

(*From page* 8)

Spacings of 24- to 30-inch rows and 4 to 6 inches in the row for Spanish and 30- to 36-inch rows and 8 to 12 inches in the row for North Carolina Runners have given best yields at the Experiment Station at Tifton. For these spacings, it will require 30 to 40 pounds of shelled or 65 to 80 pounds of unshelled seed for Spanish and 20 to 25 pounds of shelled seed for North Carolina Runners.

Peanuts should be cultivated frequently from the time the plants begin to come up until they cover a good portion of the ground. First cultivations are usually given with the weeder or spiketooth harrow. These imple-

Land may become infertile unless peanuts are grown in long rotations with soil improvement and other crops well fertilized.

ments can be used until the plants begin to be injured or the pegs commence to form. Small plows or sweeps are recommended for later cultivations. One- or two-horse cultivators with small plows and sweeps are excellent for this work. Vines must not be disturbed after pegs begin to form and only the middles should be cultivated after pods or nuts start forming.

A great deal of trouble, Mr. Alexander points out, is experienced in getting stands of peanuts due to the seed decaying in the soil before or at the time of germination. This trouble is caused by seed- or soil-borne diseases that appear to be controlled by seed treatment with 3 ounces of 2 per cent Ceresan for each 100 pounds of shelled or unshelled seed. From increases reported by the Georgia Experiment Station, seed treatment is practical.

Peanuts are ready to dig when the foliage begins to show a general yellowish maturity color, the nuts are well formed, and the inside of the shells begins to color and show darkened veins. If harvested too early, the kernels will shrink, curing will be more difficult, and the quality of the nuts will be greatly reduced. If harvested too late, leaves will be lost, and in the case of the Spanish variety kernels will be lost by sprouting, and nuts of both Spanish and North Carolina Runners will be pulled off and left in the soil. Vines should be well stacked and should remain in the stack until the nuts are

Approximate Amounts of Plant-food Elements in a Crop of Peanuts
(1,000 Pounds of Nuts and 2,000 Pounds of Hay)

Portion of crop	Yield per acre, lbs.	Nitrogen, lbs.	Phosphoric acid, lbs.	Potash, lbs.	Lime, lbs.
Peanuts	1,000	40.5	8.0	5.6	1.0
Hay	2,000	30.4	5.0	32.0	30.0
Total	3,000	70.9	13.0	37.6	31.0

thoroughly cured, usually from four to six weeks before the nuts are picked.

Machines used for picking should do a thorough job of removing the nuts from the vines, break as few nuts as possible, and clean the nuts of soil and trash. For best quality hay, peanuts should be harvested as soon as the nuts are ready, the vines should be stacked for best protection against rain, and picked and baled with as little loss of leaves as possible.

When the entire plant is removed from the land, as is done when peanuts are harvested for nuts, the fertility of the soil is rapidly depleted, provided proper rotations are not used to restore it. On the other hand, hogged-off peanuts are one of the best soil-improvement practices known, according to Mr. Alexander.

As with other crops in Georgia, it has been found that peanuts make best yields in soils with good amounts of nitrogenous organic matter and minerals. For best yields, for protection of the soil, and for control of disease, peanuts should not be planted on the same land more often than once in three or four years. Crops such as cotton, tobacco, possibly the small grains, winter legumes, and lespedeza are to be fertilized with good amounts of fertilizer as recommended for them.

Boron Stopped Fruit Cracking

(*From page* 9)

Another interesting result of the tests with boron is that the vitamin A content of alfalfa leaves has been increased as much as 30 per cent. This is, of course, connected with the enhanced green color of second and third crops where the boron is used on soils deficient in this element. Other stations have found similar results with respect to other vitamins.

In tests at the Oregon station it appears that old, leachy or peaty soils or those derived from igneous rocks are most likely to be deficient in boron. The soil reaction or lime and moisture content and temperature may affect the availability of boron in the soil, it was found. The boron treatment has carried over at least for two or three years and sometimes longer.

Mississippi Studies Cotton Fertilizer

(*From page* 16)

Rust was less noticeable on all of the plots in 1940 than in any preceding year. The plots receiving no fertilizer and 4-8-0 showed the greatest amounts. In 1937, 1938, and 1939, when it was dry in the summer and fall, the plots with increasing amounts of potash showed very marked differences in the prevalence of rust. The plots with no fertilizer and 4-8-0 lost most of their leaves as a result of rust before the bolls were mature thus resulting in low yields. As the percentage of potash increased, there was a decrease in rust, the plants remained green for a longer period and were larger, the bolls matured better, and the top bolls were larger. The excessive need for potash on this particular tract may be due to the large plant food removal by the crops grown previously. This test clearly shows the need for potash on soils where rust is prevalent.

The five years' average results, together with the yearly yields for each fertilizer treatment, are shown in Table 1. It is interesting to note that the yield on practically every plot increased from year to year during the first three years. Some of this increase was probably a result of growing the winter peas and applying the basic slag. The increase in yield on the no-fertilizer plot indicates that this may be the case. However, the accumulative effect of the plant food on the fertilized plots may have some influence on the yearly increases in yield.

The results of this test indicate a need for increased application of potash where rust is prevalent and that the use of winter legumes and basic slag each year should reduce the need for heavy application of nitrogen and phosphorus fertilizers. It should be kept in mind that this test was conducted on a grey, silty upland soil, somewhat cold in nature.

Nutrient Availability—An Analysis

(*From page* 22)

sible another rotation which illustrates the best practices should also be included.

Let us further assume that two different forms of phosphatic fertilizers are being compared and that the time and manner of application are to be similar with both. Different amounts of each fertilizer are added to the individual plots, the crops grown, yields taken, and analyses made for their total phosphorus content. On the basis of such an experiment one might obtain average results like the following:

Fertilizer A

Phosphate added lb. per A.	Yield bu. per A.
0	30
50	45
100	55
200	70
300	80
500	90
1,000	100
1,500	100

Fertilizer B

Phosphate added lb. per A.	Yield bu. per A.
0	30
100	35
300	40
600	45
1,000	50
2,000	55
3,000	55

Each fertilizer has increased phosphorus feracity and hetoemia on this soil, but to different degrees. When the fertilizers are compared at equal phosphorus feracities, it is found that at the 45-bushel level fertilizer A was 12 times as efficient as fertilizer B in that only one-twelfth as much was needed. At the 55-bushel level, however, its relative efficiency has increased to 20 times that of fertilizer B. If fertilizer A is more expensive than B, a farmer who operates at the 45-bushel level might find it more economical to use B. But due to the much greater relative efficiency at the 55-100-bushel level of fertilizer A, a farmer might find it more economical to buy A. In the 60- to 100-bushel levels, of course, no relative comparisons between A and B are possible. Experiments of this type thus readily lend themselves to practical applications. A knowledge of the relative efficiencies of fertilizers on various soils makes possible other calculations involving the costs of the fertilizers, and a farmer can determine the most economical source of nutrients at whatever fertility level he chooses.

This method of evaluating fertilizer efficiencies at equal feracities is not restricted to a comparison of different fertilizers. It is also applicable to different methods of application of the same fertilizer such as a broadcast—drilled—hill-drop comparison. In such an experiment, different rates should be tested with each method of application. The amount of fertilizer for each method which results in equal feracities can then be used in a direct calculation of placement efficiency.

Literature Cited

(1) Albrecht, William. *Soil Organic Matter and Ion Availability for Plants.* Soil Sci. 51:487-94. 1941.

(2) Association Official Agr. Chemists.

(3) Balmukand, Bh. *Studies in Crop Variation V. The Relation Between Yield and Soil Nutrients.* Jour. Agri. Sci. 18:602-28. 1928.

(4) Bartholomew, R. P. *The Availability of Phosphatic Fertilizers.* Ark. Agr. Exp. Sta. Bul. 289. 1933.

(5) Bauer, F. C., et al. *Crop Yields from Illinois Soil Experiment Fields.* Ill. Agr. Exp. Sta. Bul. 425. 1936.

(6) Bray, R. H. *Phosphorus Availability and Crop Response.* Soil Sci. Soc. Amer. Proc. 2:215-221. 1937.

(7) Bray, R. H. *New Concepts in the Chemistry of Soil Fertility.* Soil Sci. Soc. Amer. Proc. 2:175-179. 1937.

(8) Briggs, G. E. *Plant Yield and the Intensity of External Factors—Mitscherlich's "Wirkungsgesetz."* Annals Bot. 49:475-502. 1925.

(9) Bryan, O. C. *The Availability of the Essential Nutritive Elements as Affected by Soil Types.* Soil Sci. Soc. Amer. Proc. 1:121-124. 1936.

(10) Cook, R. L. *Divergent Influence of Degree of Base Saturation of Soils on the Availability of Native, Soluble, and Rock Phosphate.* Jour. Am. Soc. Agron. 27:297-311. 1935.

(11) Dickman, S. R. and DeTurk, E. E. *Influence of Additions and Withdrawals of Soluble Phosphate on Subsequent Development and Phosphorus Absorption from Rock Phosphate by Young Corn Plants.* Unpublished data.

(12) Dickman, S. R. *The Concept of "Available" Nutrients in the Soil.* Better Crops With Plant Food. 25:6, 20. 1941.

(13) Ford, M. C. *The Distribution, Availability, and Nature of the Phosphates in Certain Kentucky Soils.* Jour. Am. Soc. Agron. 24:395-410. 1932.

(14) Fraps, G. S. *Active Phosphoric Acid and Its Relation to the Needs of the Soil for Phosphoric Acid in Pot Experiments.* Texas Agr. Exp. Sta. Bul. 126. 1909.

(15) Fraps, G. S. *Availability of the Phosphoric Acid of Finely-divided Rock Phosphate.* Texas Agr. Exp. Sta. Bul. 509. 1935.

(16) Hawaii Agr. Exp. Sta. Ann. Report. Pg. 33. 1940.

(17) Hester, J. L. *The Relationship of Liming to Soil Fertilization.* Am. Fert. 92:5. 1940.

(18) Hibbard, P. L. *Availability of Plant Nutrients.* Soil Sci. Soc. Amer. Proc. 1:149-151. 1936.

(19) Hoagland, D. R. and Arnon, D. I. *Physiological Aspects of Availability of Nutrients for Plant Growth.* Soil Sci. 51:431-44. 1941.

(20) Illinois Corn Performance Tests. Ill. Agr. Exp. Sta. Bul. 474. 1940.

(21) Jacob, K. D. and Ross, W. H. *Nutrient Value of the Phosphorus in Defluorinated Phosphate, Calcium Metaphosphate, and Other Phosphatic Materials as Determined by Growth of Plants in Pot Experiments.* Jour. Agr. Res. 61:539-60. 1940.

(22) Jenny, H. and Ayers, A. D. *The Influence of the Degree of Saturation of Soil Colloids on the Nutrient Intake by Roots.* Soil Sci. 48:443-459. 1939.

(23) Magistad, O. C. *Ion and Plant Relationships in Western Arid Soils.* Soil Sci. 51:461-72. 1941.

(24) McGeorge, W. T. and Breazeale, J. F. *Some Limiting Factors in Estimating the Fertilizer Requirements of a Soil.* Soil Sci. Soc. Amer. Proc. 1:131-134. 1936.

(25) McGeorge, W. T. *Factors Influencing the Availability of Native Soil Phosphates and Phosphate Fertilizers in Arizona Soils.* Ariz. Agr. Exp. Sta. Tech. Bul. 82. 1939.

(26) Mitscherlich, E. A. *Die Bestimmung des Düngerbedürfnisses des Bodens.* 1930.

(27) Peech, Michael. *Availability of Ions in Light Sandy Soils as Affected by Soil Reaction.* Soil Sci. 51:473-86. 1941.

(28) Salter, R. M. and Barnes, E. E. *The Efficiency of Soil and Fertilizer Phosphorus as Affected by Soil Reaction.* Ohio Agr. Exp. Sta. Bul. 553. 1935.

(29) Shaw, W. M. and MacIntire, W. H. *The Relationship Between Water-soluble, Replaceable, and Fixed Fractions of Potash Additions to Soils.* Soil Sci. Soc. Amer. Proc. 1:143-48. 1936.

(30) Shive, John W. *The Balance of Ions and Oxygen Tension in Nutrient Substrates for Plants.* Soil Sci. 51:445-460. 1941.

(31) Spencer, V. and Stewart, R. *Phosphate Studies I. Soil Penetration of Some Organic and Inorganic Phosphates.* Soil Sci. 38:65-79. 1934.

(32) Thornton, S. F. *Factors Affecting the Availability of Phosphate Fertilizers as Shown by the Neubauer Method.* Jour. Assoc. Off. Agr. Chem. 15:163-66. 1932.

(33) Thornton, S. F. *"Root Solubility" of the Essential Elements in the Soil as an Indication of Availability.* Soil Sci. Soc. Amer. Proc. 1:125-30. 1936.

(34) Tiulin, A. Th. *Availability of Soil Phosphates for the Plant from the Viewpoint of Colloid Chemistry.* Soil Sci. 42:291-99. 1936.

(35) Truog, Emil. *Availability of Essential Soil Elements—A Relative Matter.* Soil Sci. Soc. Amer. Proc. 1:135-142. 1936.

(36) Willcox, O. W. *A. B. C. of Agrobiology.* Norton. 1937.

Permanent Hay—the Plant Food Way

(*From page* 12)

of fall vs. spring use of fertilizers, one series of plots was fertilized in the early spring, about April 15 to May 1, and an adjacent series in the late fall, about November 1 to 10.

Very simple fertilizer treatments were made on each field, comparing nitrogen alone in the form of cyanamid at 300 pounds per acre with a complete fertilizer containing its nitrogen as cyanamid at the above rate and superphosphate and potash to make a 1-1-1 ratio of plant food. In simple terms, the complete fertilizer was approximately equal to 600 pounds per acre of a 10-10-10 fertilizer. Untreated check plots in duplicate were maintained for comparison.

Yields for two cuttings of hay were obtained each year and observations recorded. Since trends were found much the same on all fields, the average data for the five experiments will be presented here for sake of simplicity.

Results Outstanding

Results obtained from the use of the complete fertilizer (Table 1) much exceeded expectations. It gave outstanding increases in the yields of hay the first year of application and progressive increases throughout the 4-year period of the experiment. Year by year the appearance of the stand also continued to improve until an average of more than 1½ tons of extra hay per acre per year was being obtained on all fields over and above the untreated check plots (Figs. 1 and 2).

Not only did timothy stool and make a marked comeback with the complete fertilizer; but clovers, including red, alsike, and white, also volunteered. In fact, the stands looked so good that farmers seeing them wished to try the treatment on their own fields. They would not want to plow under such a good looking and prolific stand of hay. It appeared that the hay could be maintained permanently without plowing and reseeding by means of a complete fertilizer at the rates employed. The complete fertilizer performed well on all five fields whether the soil was clay, loam, or sand. From these experiments it was very evident that a sufficiency of plant food would maintain hay in a permanent productive condition, and that the reason why hay stands "run out" is because they exhaust the available plant food.

However outstanding the result from its use, it still seemed possible from the appearance of certain of the plots that the complete fertilizer was not used in the most economical rate or in the most economical ratio on each particular soil. Therefore, experiments have been recently established to determine the best fertilizer rates and ratios for permanent hay on different soils, but sufficient time has not elapsed to obtain these data.

Farmers often have time to apply

TABLE I.—THE EFFECT OF NITROGEN ALONE VS. COMPLETE FERTILIZER ON YIELDS OF HAY FROM FIVE FIELDS.

	Average increase over check, dry weight basis (lbs.)				
	1937	1938	1939	1940	Total
Nitrogen alone	711	1,059	1,010	1,158	3,938
Complete fertilizer	2,075	2,394	2,963	3,448	10,880

fertilizer in the fall, whereas they are apt to be rushed in the spring. If complete fertilizer were just as effective when applied in the fall as in the spring, the former would be a good time to apply it. Therefore, early spring (April 15 to May 1) and late fall (November 1 to 10) applications of complete fertilizers were compared to see if they were equally effective for the growth of hay. Here again resulting trends in yields for the five fields, with one exception, were much alike.

Average data are shown in Table 2.

in early spring, Cal-Nitro particularly so. This indicated that leaching and washoff of nitrogen did occur and were probably the cause of the inferior effect of fall applications. Although fertilizer is not supposed to move laterally very much, vegetation on some plots indicated that fertilizer applied on rolling land in the late fall had moved several feet out of bounds. Washoff of fertilizer applied in the late fall may be more of a factor than is usually considered, especially if the surface soil freezes before the fertilizer leaches

TABLE 2.—EARLY SPRING VS. LATE FALL APPLICATION OF COMPLETE FERTILIZERS ON THE YIELDS OF HAY FROM FIVE FIELDS.

	Average increase over untreated check, dry weight basis (lbs.)				
	1937	1938	1939	1940	Total
Early spring application	2,075	2,394	2,963	3,448	10,880
Late fall application	2,049	1,885	2,355	3,067	9,356

Over the 4-year period the early spring application of complete fertilizer was better than a late fall application of the same fertilizer. Observations also confirmed these data.

Although the difference was not great the first year, it was noticeable thereafter. The fall application of complete fertilizer was inferior probably because its nitrogen leached or washed away and thus became partly ineffective during the winter. Cal-Nitro (nitrate), a more easily leached form of nitrogen than cyanamid, was also included among the fertilizers used as a possible check on the validity of such an idea. If fall applications of cyanamid-containing fertilizers were inferior to spring applications by reason of leaching, Cal-Nitro fertilizer should be still more inferior because of greater leaching. Results obtained in this connection are shown in Table 3.

Both cyanamid and Cal-Nitro yielded much less when used in late fall than into it. It now seems possible that the fall application was made later than it should have been for most efficient use, but previous to the experiment it had been recommended that the fall application should be made after active plant growth ceased.

In general, under Vermont conditions it may be concluded that an early spring application of ready-mixed commercial fertilizers on hayland will give better results than a late fall application. It is not known what the effect of the fertilizer might have been had it been applied on the sod at other times during the growing season.

If ingredients of a complete fertilizer are purchased and applied separately, the nitrogen should be applied in the spring. It would seem that superphosphate and potash might be applied either in the fall or spring although no experiments have been conducted to show this. While extra penetration from fall fertilizer application may appear desirable, extra contact and con-

TABLE 3.—LATE FALL VS. EARLY SPRING APPLICATION OF CYANAMID AND CAL-NITRO UPON HAY YIELDS, AVERAGE OF ALL DATA.

	Yields per acre, dry weight basis (lbs.)		
	Fall application	Spring application	Difference in favor of spring
Cyanamid nitrogen	1,318	2,027	709
Cal-Nitro nitrogen	1,099	2,367	1,268

sequent soil fixation of plant food in unavailable form probably offset this advantage.

At the outset of these experiments it was thought that nitrogen alone on ordinary grass hayfields would be sufficient to prolong the productive life of hay for a year or two. However, the results obtained on all five fields indicated that nitrogen alone would not suffice. Fertility being at the customary farm level, nitrogen at a liberal rate of application increased the hay yield less than 900 pounds the first year, and not over 1,200 pounds thereafter, without visibly improving quality. At 1939 prices, this increase in yield from nitrogen alone was obtained at a fertilizer cost of about $14 per ton of hay, which is considerably more than one can afford.

Nitrogen alone gave little trend toward improvement in yield, whereas complete fertilizer gave a marked trend. With nitrogen alone grasses, like timothy, blue, and orchard, were stimulated only to a small extent; and new hay species were absent. This was in marked contrast to the accomplishments of the complete fertilizer which stimulated and propagated clovers and hay grasses.

On hayfields in the usual state of fertility, phosphates and potash are so badly needed that nitrogen alone could not be recommended even for one year. Only where phosphate and potash have been recently and generously applied could the use of nitrogen alone on hay be justified. At 1939 prices for the complete fertilizer used on all farms, the hay was produced at an average fertilizer cost of less than $7 per ton of hay. Under ordinary circumstances this complete fertilizer would pay if the hay was needed and had to be bought. Furthermore, there is undoubtedly considerable residual fertility not yet used by the plants. It is very likely that the fertilizer cost per ton of hay can be reduced without impairing quality when results of present research work on fertilizer rates and ratios are available.

Reinforcing Manure

For maintaining permanent hay, manure is a valuable plant food deserving more attention than it often receives and special attention this year when fertilizer supplies, especially nitrogen, are short. One ton of ordinary farm manure is equal to approximately 100 pounds of 10-5-10 commercial fertilizer. In practice such value is seldom attained because an appreciable fraction of the nitrogen in the manure is lost into the air as ammonia before it can be used by plants. This is especially true of manure top-dressed on hayland where it is subject to drying and freezing, which expel the ammonia. Furthermore, on the phosphate-hungry soils prevalent in this region, manure is much poorer in phosphate than it should be for maintaining permanent hay.

Several practical ways have been found to increase the crop-producing value of manure. Each has a place in the fertilization of permanent hay.

Single strength 20% superphosphate at the rate of two pounds per cow per day or its equivalent can be spread evenly in the clean barn gutter to strengthen the "weak phosphate link" in manure and save some ammonia that would otherwise escape into the air in storage and in handling. Also, in this way the value (availability) of the superphosphate has been markedly increased on a number of soils. No fertilizer chemical has been found that can save all of the ammonia in manure. Superphosphate is as effective as any known at present.

On the same weight basis, 20% superphosphate is more effective than triple strength in retaining ammonia because of the gypsum, which the former contains and the latter does not. It has been found that gypsum, together with phosphates, has power to react with and retain some ammonia under conditions prevailing in manure.

Either granular or pulverized forms may be used on hay by way of the gutter. The choice depends on individual preference. Pulverized, coming in better contact with manure, retains more ammonia than granular, but this advantage may be practically offset because the pulverized is more slippery under the cow's feet.

While superphosphate added on the loaded manure spreader will distribute the phosphate evenly on hayland, it lacks the advantage of conserving ammonia because it doesn't come in contact with the freshly voided urine which readily ammonifies and from which ammonia so readily escapes. Recent experiments have well proven the merit of phosphated manure on hayland.

Muriate of potash on the top of the loaded manure spreader is another way to improve permanent hay. There are a number of soils, especially sands and loams, in this region that need extra potash in addition to manure to produce good hay. Experiments indicate that the potash has no beneficial or detrimental effect upon the nitrogenous part of manure, but since the manure is moist it absorbs and holds the potash. In this way potash is protected against excessive fixation because only part of the potash becomes intimately mixed with the soil. This is especially true on some soils that are known to fix rather large amounts of potash. There is no harm in using potash in barn gutters provided the liquid manure is carefully conserved, but perhaps the most practical way is to use it on top of the loaded spreader. It has been found just as effective on the spreader where the manure has previously been phosphated.

Means of Liming

Hydrated or burned agricultural lime spread evenly in the clean gutter (two pounds per cow per day) is a means of liming hayland. It also preserves some nitrogen which would otherwise escape into the air as ammonia, (Vt. Sta. Bul. 456). Its beneficial action depends on making the urine so alkaline that ammonifying bacteria and enzymes are prevented from converting urea to ammonia. Hydrated lime eventually carbonates and finally loses its main preservative action. The length of time depends upon the temperature—the cooler the longer the period of active preservation. The manure should be applied to the land before the lime completely carbonates if nitrogen is to be preserved for plants in this fashion.

Probably such use of caustic lime with manure seems contrary to all established rules and teachings to the effect that lime on manure would drive off valuable ammonia. It is recognized that if ammonia is present, caustic lime will drive it off. Nevertheless, all good rules have exceptions, and a valuable one now discovered is, in brief: Caustic lime used in the clean gutter can not drive off ammonia because it is present before ammonia is formed, and because its strong alkalinity blocks ammonia formation.

Most of the urine naturally goes to the bottom of the gutter where it comes in direct contact with the very alkaline lime, but the urine not in contact with the lime begins to ammonify. When the manure is shoveled from the gutter, the limed bottom portion becomes partly mixed with the upper part and some ammonia is immediately released. However, in spite of this slight immediate loss, the treated manure ultimately loses less nitrogen (from subsequent drying or freezing) when it is spread on the land. Barn trials conducted bear out this statement.

For the improvement of hayland it is recommended that caustic lime and superphosphate be used in the gutter one at a time, otherwise their chemical actions would nullify each other. When the yearly allowance of superphosphate is thus used up, change to caustic lime. One can thus separately phosphate and lime his land by way of the gutter.

Ground limestone seems to have no beneficial or detrimental effect on manure because both are about the same degree of alkalinity. Farmers who do not have lime spreaders may add ground limestone (not caustic lime) on top of the loaded manure spreader and thus spread it this way. Ground limestone may also be applied in this way on phosphated manure with no detrimental effect either to the availability of the phosphate or the manurial nitrogen. This, therefore, permits two effective ways in which lime for permanent hay can be applied by way of the manure spreader.

The prime objective in maintaining permanent hay is an abundance of well-balanced plant food. This can be attained either with complete fertilizers and lime, or with manure improved with superphosphate, potash and lime. Furthermore, such permanent hay improved the plant-food way is a better food for animals by reason of the extra minerals it contains and thereby is indirectly a guarantee of better human nutrition.

Secrets Galore

(*From page* 5)

loggerheads like the food faddists and vitamin dopesters, because some think one way and some another and nobody has really found the whole truth or got it trade-marked yet.

Rare elements not yet fully recognized as contributing to the welfare of agricultural plants are bound to come into the picture sooner or later. It means new ways of farming a hundred years hence, and maybe fewer farmers to work the land besides. Nothing shows the "utter unknown" horizons in agriculture to a greater degree than trying to match your wits with wilted crops and wasted soils.

That's why Jonathan was correct when he said that there are more secrets lying loose out in his old eighty than anything we *don't* get to read in the war bulletins. And if he lays himself out this spring to unlock some of that fertility when it's most useful on that old farm, he's going to be as patriotic as the President and busier than five Japs fighting one American.

But the farmer's stock of mystery stories about plant life is not ended with providing satisfactory environment below ground level for his crops. Myriads of pests threaten the security of agricultural plants as soon as they peer into the sunlight. At this point he begins a defensive as well as a continuous offensive struggle extending from germination test to harvest. Each season seems to bring forth some new and alarming insect or disease germ to give the lie to the old wheeze, "There's nothing new under the sun."

In case the producer still feels he is working in a sphere of comparative placidity and humdrum routine, the weather breaks into his pipe dream with dust storms and floods, tornadoes and early frosts, withering droughts and backward springs—each and every change kept strictly secret, both by Dame Nature herself and now by federal manifesto to boot!

But let's presume all the plant secrets work with him and the mystery story of his crop turns out well, may the farmer then heave his grain and alfalfa into the contented kine and say to himself, "Here at last I face a certainty, for I bought me a fine bull at a consignment sale, one with a fancy pedigree and a good top line and guaranteed to be a sure breeder!"

Why, that too is just as big a myth as the defense of Singapore and not any too reliable to bank on. In order to make doubly sure that the bull is worth his salt and silage you'll have to prove him up, Friend Farmer, using a series of dam-and-daughter production comparisons so as to obtain his real index as a go-getter of something better. Until that is done and the bull is either crowned with laurel in the Holstein hall of fame or cast into the outer darkness of the slaughter pen, you'll have a secret on your hands—and one with horns on it, too.

NOW suppose he proceeds according to plan, proves his bovine Lothario, and gets some promising heifers thereby. Sure, by this time all his secrets are an open book and there's not a thing left for Sherlock Holmes. You wouldn't think so a few months later when you notice how his yard is infested with vets and inspectors inquiring into the why and wherefore of a mess of mastitis he has caught; or maybe a wave of abortion comes along and he loses half of his profits in a fortnight.

To date nobody has a sure cure for garget or abortion, and they both remain among the unpredictables on the farm front. I suppose the same may be said for sundry maladies and miseries affecting the other species of domestic Herbivora whose welfare spells the final successful utilization of the plants the farmer produces in a welter of secrecy, mystery, and uncertainty.

However, we may finally surmise that long and constant association with these familiar secrets entitles us to survey the world with calm and unbroken confidence insofar as agriculture's duty and responsibility go.

That is, we may think that the above list of unknown hazards is not worth worrying over; that America is perfectly self-sustained and capable of coping with prolonged strife without bothering much over the reserve supply of goods derived from agricultural plants. But we're wrong again, because the latest restrictions, priorities, and scarcities bring us sharp against the critical realization that we do not live to ourselves alone. We're going to be concerned as never before with the success of tropical farming below the Gulf of Mexico. And if that isn't a mystery to most of us then I'm an opera singer!

MYSTERY used to be thrown around some of our common farm crops by Latinizing them into Zea mays, Trifolium repens, and Medicago sativa; and when we translated these in terms of bumper ears and tonnages of legumes it sounded sort of fancy and romantic.

But few of us would recognize on sight two of the strategic plants of the present crisis, Cinchona and Hevea, nor would we have given them much thought a few months ago. Neither represent anything we can rush right into and get excited about cultivating, but they both widen our professional outlook into the realm of the necessary unknown. We can't afford to postpone aid to the brethren of the South American plantations whose privilege and opportunity it is to grow quinine and rubber for us. For once, their worries are our worries, their pests are our pests, and we welcome such imports instead of abusing them.

Taken together with coffee, tea, spices, and some other tropical products, it looks as though such noncompeting crops would loom in far greater significance in our balance of trade than before the war. Maybe they will assume such importance to our economy and necessity that our Midwest farmers will stop squawking about Argentine corn and Brazilian beef long enough to get the right perspective.

WE WERE so wild-eyed waving the Monroe Doctrine around the hemisphere during the past 40 years that we overlooked the little secret that one or two good ideas might be let in with good results, even if some other things were kept out. While we were guarding the western neighborhood, we also let some things out that should have been kept in, which include further experiments with quinine "fever trees" and rubber plants. We let a lot of precious cultural secrets go into the Pacific Archipelago when we did that. That's why we have a courageous corps of plant specialists and botanical scouts delving in the jungles of Central and South America, trying to detect the secrets, long lost to western mankind, relative to the culture of these two critical crops.

Exacting requirements of climate and soil are necessary to raise quinine successfully. Seedlings are very delicate and need artificial protection, altitudes make great differences in the degree of bark growth, and the soil must have just the right blend of sand and clay. All these facts must be discovered all over again down in Guatemala and Colombia, where much of this pioneering is going on. Only glimmerings of meager records are available from the times prior to the civil war when the original commercial culture of Cinchona started, fostered by the legendary cure made by use of quinine on the Countess of Chinchon by the court physician, Dr. Juan de Vega, in the seventeenth century.

But at least ten years must elapse before the laudable but late attempts now under way are successful in assuring the Western Hemisphere of a sufficient home-produced quantity of fever-and-ague dosage.

No less "feverish" efforts are being made to develop the Hevea rubber tree to meet the tremendous demand in this country which we realized only when the trade routes to the Orient were shut in our faces. According to recent reports, more small individual plantation systems for growing rubber are to be encouraged in South America, instead of putting emphasis on huge estate production. Crude rubber of top quality can be produced on small acreages with makeshift equipment costing not over fifty dollars, and by making double use of the land with intertilled crops growing between the rubber rows, the small farmer can compete with the "hacienda" or wealthy rancher. Besides trying to encourage small scale enterprise, there is a veritable land army of scientists studying the problem at the Brazilian experiment farms. Latin America already has a small output of crude rubber from wild trees, and they say the jungles are full of millions of untapped trees which might supply the temporary demand until the plantation tracts are all set for business.

SINCE the hullabaloo about secret cartels between domestic and foreign corporations was brought to light, folks are less inclined to boost the synthetic rubber proposition and tend to put most of their dependence upon the final solution of the campaign to grow and manufacture the real article. They are willing to wait for patient plant doctors to unravel growth secrets, but they have no time or relish for the tricksters who dabble in international secrets to retard the general welfare.

But as our farmers return to the land again in preparation for a bumper yield, we repeat the old truth, which is, that despite grave uncertainty and secrets galore ahead of them, the tillers will carry on with customary faith—"substance of things hoped for and the evidence of things not seen"—and finish the season with relative satisfaction. This fact, plus a dearth of labor, makes their contribution unique among the patriots of the world.

A Few Whinnies

MISQUOTED

Emperor of Japan: "When we win this war I'm going to rule the world."

Mussolini: "No, you're not—I am, because the Lord said, 'The meek shall inherit the earth.'"

Hitler: "That's a lie—I never said any such thing!"

The three bears were taking a walk on the desert, so Goldilocks could eat the little bear's porridge.

Papa Bear sat on a cactus and said "Ouch!"

Mama Bear sat on a cactus and said "Ouch!"

The little bear sat on a cactus and didn't say anything—just sat.

Mama Bear turned to Papa Bear. "Paw," she said, "I hope we're not raising one of those Dead End Kids."

She: "My husband is always away on business trips. What would you do in my place?"

He: "Well, take me over to your place and I'll show you."

A henpecked looking little man was escorting his wife to a concert and arrived late. Slipping into his seat, he turned to his neighbor.

"What are they playing?" he whispered.

"The Fifth Symphony," came the low answer.

"Well," muttered the little man, "Thank God, I've missed four of 'em, anyway."

The visitor joined his companions on the first tee. He took his stance, waggled his club, took a tremendous swing and missed the ball completely.

"Be gad," he said to his opponents, "It's a good thing I found out early in the game that this course is at least three inches lower than the one I usually play."

There was a young lady from Kent
Who said that she knew what it meant,
When men asked her to dine,
Gave her cocktails and wine,
She knew what it meant—but she went.

Two salesmen met in a Pullman after not seeing each other for three years. "Jim," said one of them, "the defense program is speeding everything up but you still talk just as slow as ever."

"Well," said Jim, "if—you—think—I talk—slow—you—should—hear—my secretary. She — had — a date — the — other — night — and — her — boy — parked—on the—way—home. And—before — she — could — say — I'm — not — that — kind — of — a — girl, — she was."

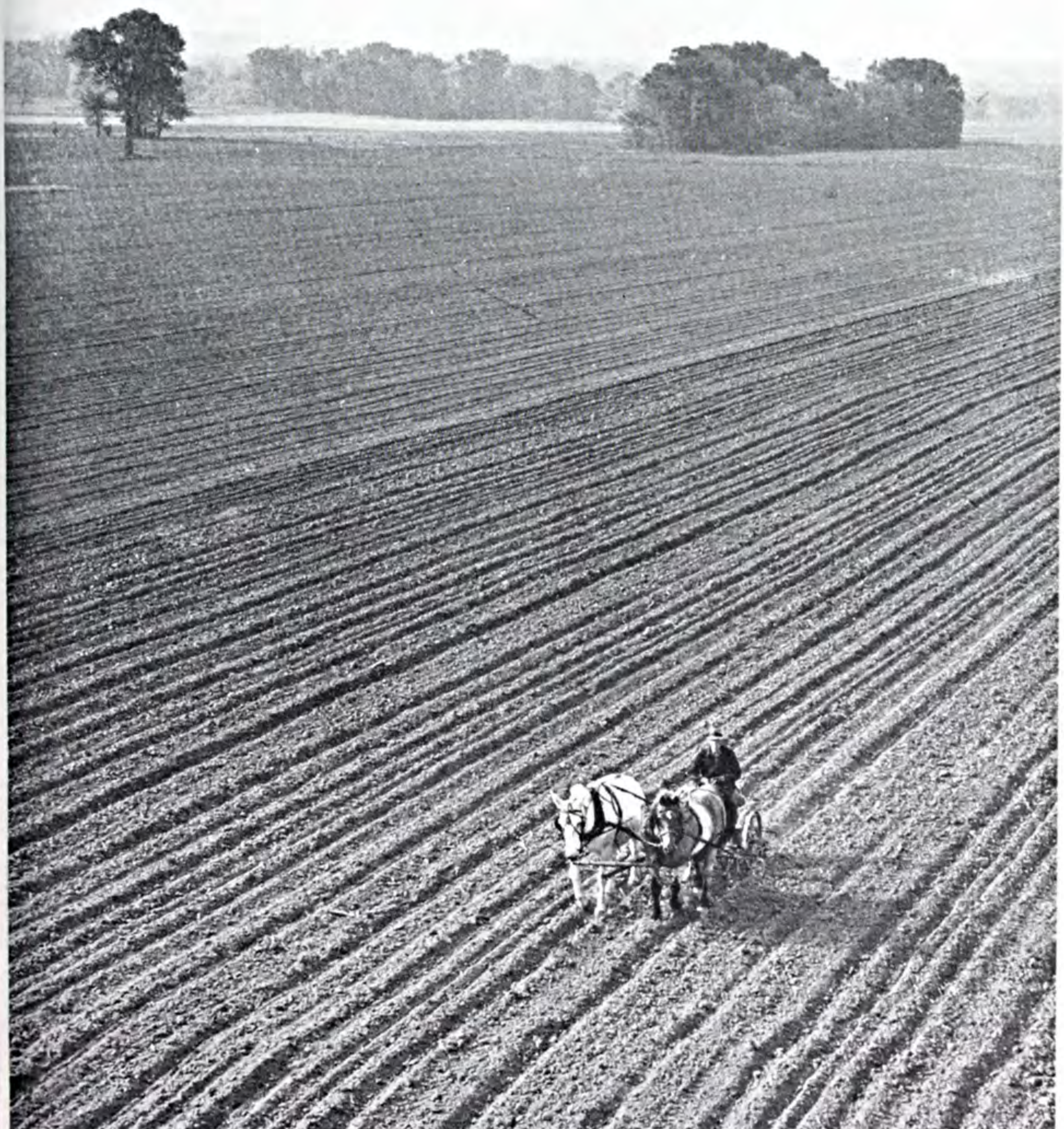
Judge: "This man says that after he fired a shot he saw you run from his chicken coop."

Rastus Johnsing: "He could easy be mistaken, Jedge, fast ez Ah was runnin', it mought have been someone else what faintly resembles me."

Printed in U. S. A.

Better Crops *with* PLANT FOOD

May 1942 10 Cents



The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI — NUMBER 5

TABLE OF CONTENTS, MAY 1942

Determined plans for victory are not all made near the battle front.

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., MAY 1942 No. 5

There're jobs aplenty for those in . . . . . .

The Senior Draft

Jeff McDermid

SOME of us have just signed the roll of the Great Unwanted. By that I refer to the last-ditch resource of American manpower, to which hosts of us so-called "Oldsters" were classified during the last days of April.

When I read that scathing term in the headlines a few weeks ago it startled me into full realization that my age had found me out. From this time hence I shall be cataloged with the ancients and remain unable to deny it by any ordinary form of subterfuge or foolish camouflage.

It will do me no good hereafter to wear nobby hats with colored feathers in the bands, don youngish raglan topcoats with gaudy plaids or stripes, patronize the nifty floor shows, whistle jazz tunes, attempt to jump fences, or wink at young women.

Nay, the lists are loaded with fateful names and the wise old world is now aware that we who were young firebrands in the days of Foch and Pershing are rusty and moss-grown relics in the national arsenal.

When I think of the instances when I have been able to cut enough capers to belie my seniority, or have perjured vital statistics to retain junior standing, it grieves me to thus have the veil of secrecy torn asunder by Uncle Sam. Had I been as young as I felt I ought to be, I might have thrust myself into the third draft category instead, safe in the knowledge that I would be sent home anyhow on account of sinus trouble and flat feet. But the social admonition of my wife to be "my own age" has driven me into the "rheumatic reserves." Here I stand at attention, alongside of other ardent but archaic and arthritic patriots bearing the wrinkled necks, liverspots, and bloated paunches of two score years and five, plus more.

Of course a few of us "reservists" gleaned some slight consolation from the flattering attention of certain young damsels who helped out in the draft board records office. Just a few of us who still retain a little hair above the eyebrows and a good set of teeth felt somewhat easier when these girls claimed to be astonished when they put down our true and legal birth date. However, it may have been but a flicker of the same sympathetic cajolery with which the dainty young nurses administer sedatives to tired middle-aged businessmen in psychopathic wards. Women are all alike in this respect, that they like to mother folks more or less from the cradle to the grave.

YET my spirit is more resilient than my body, and this experience does not get me down. Especially when I happen to think that I'm still young enough not to be left off the roster entirely! It's "what you ain't" that comforts a fellow more often than what you are. Therefore, I shall await the coming of those index cards to see what kind of occupation may still be open to one whose chances of saving the country are none too good.

It has been the fate of Oldsters and Boys to be left behind in countless wars. Theirs was the proud and pathetic duty of serving as home guards or doing the work of able-bodied recruits in store and shop and mine and farm. But not since the savage Indian wars of New England and the western Plains have the stay-at-homers been in such likelihood of being actual physical defenders of the hearth and the heath. For recent tragic attacks on civilian zones indicate that we are in for more chances to "smell powder" than occurred to noncombatants in the brave days of old.

This war also brings about the first real official classification of the men considered by ordinary vital statistics of the wear and tear of life to be "past masters" of the legion. We are familiar with the ritual of the lodge of liberty and have served our time as active supporters of its creed. No stigma attaches to those who have thus served their day and age unless they assume a narrow reluctance to hand on the insignia to younger and more capable leaders.

When we acknowledge our limitations without flinching and refuse to be daunted by creaking joints and puffing breath, it leaves us freer to use our still-seething brainpower to accept duties and tasks suitable to the talents and the background of patriotic past masters. For we know that the same world that envies the eagle and the hawk also finds solace and value in the humble domestic fowl. Maybe we can't soar and dive and pounce, but we've got some stamina left for pecking and scratching gravel.

WE glean more comfort from the thought that some noble gents are in our classification these days, including the President, Vice President, most of the Cabinet, and a brace of topnotch generals like Douglas MacArthur, et al. However, that doesn't signify that age alone qualifies for brilliant leadership, which sends us again into some soul-searching reveries.

It simply indicates that man's span of life in which to get wise to a lot of things is very short indeed. Almost before we get used to being of voting age we approach the middle years, and lo and behold, from that time on the slope becomes steeper and the coasting into elderly attitudes gets swifter. I really suppose that the only sound qualification a chap has for leadership and respect in later life consists of his ability to take it gracefully and philosophically. When he grows hidebound in his ideas and resentful of younger command, it means that his egotism has dwarfed his patriotism.

One of the hardest things to learn

in this war of power politics and racketeering is that the lone individual seldom counts for much. All these irksome controls and restrictions and regulations are calculated to impress one with this same tough situation. It's the mass and the total might of an unswerving race or nation that goes forth to battle actively and economically these days, no matter who began it that way. We who partook of the personal "success story" era of America and nursed great private ambitions to get us a nice niche somewhere must now unlearn all that tripe and be content to hustle with the herd. But here is a nice discrimination bobbing up—how may we submerge our ego and at the same time not neglect a decent amount of personal responsibility? Can one be a dynamic atom, as it were?

Yes, I think we can all fix it so we can be dynamic atoms whether we shoulder arms or plow corn. If we can't be dynamic except while we are just thinking it through, that's something to conjure with. America is going to need plenty of advance thinking as well as immediate acting, and it may possibly be some of us stay-behinds who uncover a few rich veins of mental minerals for future development. Anyhow, the elder civilian who lets the draft close up his reservoir of thought and conjecture is entitled to rejection and earns his discharge, *non compos mentis*. And that's just as bad as A. W. O. L. or "drunk and disorderly."

In peace time, if left to ourselves to grow elderly in the normal American way, too many of us seniors get crusted over with affairs inside our own fence lines. We grow aloof and preoccupied with dreams of the past and pottering around with selfish chores and private diversions—such as keeping up the lawn and the flower beds or fulfilling some neglected hobby.

All this we do quite innocently to be sure; thinking all the while that this is a patriotic thing to do, to improve some nook or develop some corner—and raging at the other guy for tossing over dead cats and old tin cans. If they issue a call for a neighborhood caucus or community rally, we either stay awake and sulk and stew or we go there awhile to glower and grumble at new ways of doing old stunts. It's all very human and natural, because older folks are expected to get dull and conservative and caustic, because this is the land of liberty and those who have enjoyed it the longest should cling to it the hardest. That is, if you mean personal liberty to live unto yourself alone.

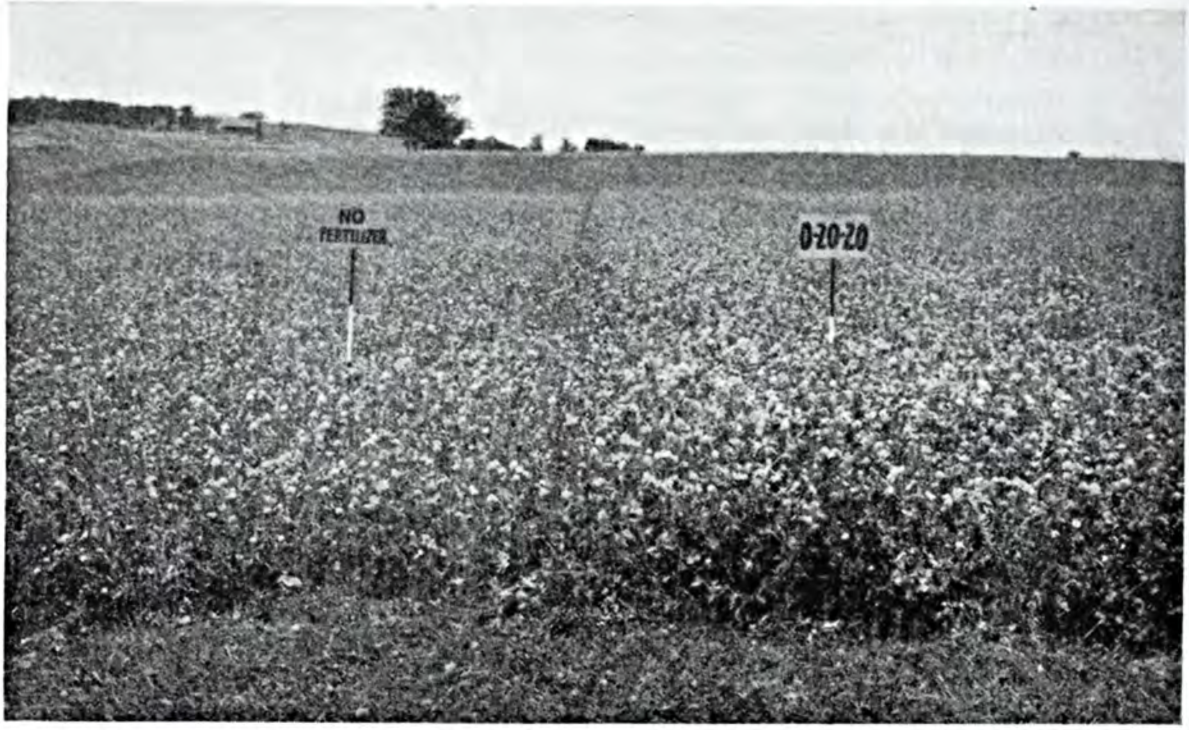
But here and now in this crisis we have to take a new lease on life. We have a real chance to live more fully and keep awake and alert, even if we don't live any longer. Yes, we can afford to neglect the fence corners of our property rights and hustle into the streets and highways to mingle with those who share the common lot of morale building. We can forget to look into the glass for more wrinkles each morning and begin limbering up for liberty in a new way.

THIS new kind of freedom will mean that we have time and inclination to assist the widow and the orphan bereft by the present catastrophe, to study new lessons of progress and defense, time to use our experience on some community problem, and time to work with those younger fellows belonging to the draft-to-come.

Those who have been fortunate enough to associate constantly with Youth as 4-H leaders or Boy Scout executives certainly have an opportunity—not only a direct one with their chosen charges, but perhaps a sort of destiny as trainers of some of the rest of us to go and do likewise.

Not all of us Oldsters are fitted for this critical job. I would not

(*Continued on page* 45)



The residual effect of 200 pounds of 0-20-20 per acre applied at the time of seeding resulted in more than a doubling of the yield of clover hay on the Leo Wellman farm in Wood County in 1941. The yield of oats was increased from 42 to 65 bushels per acre on this same field in 1940.

Soil Bank Investments Will Pay Dividends

By C. J. Chapman

Wisconsin College of Agriculture, Madison, Wisconsin

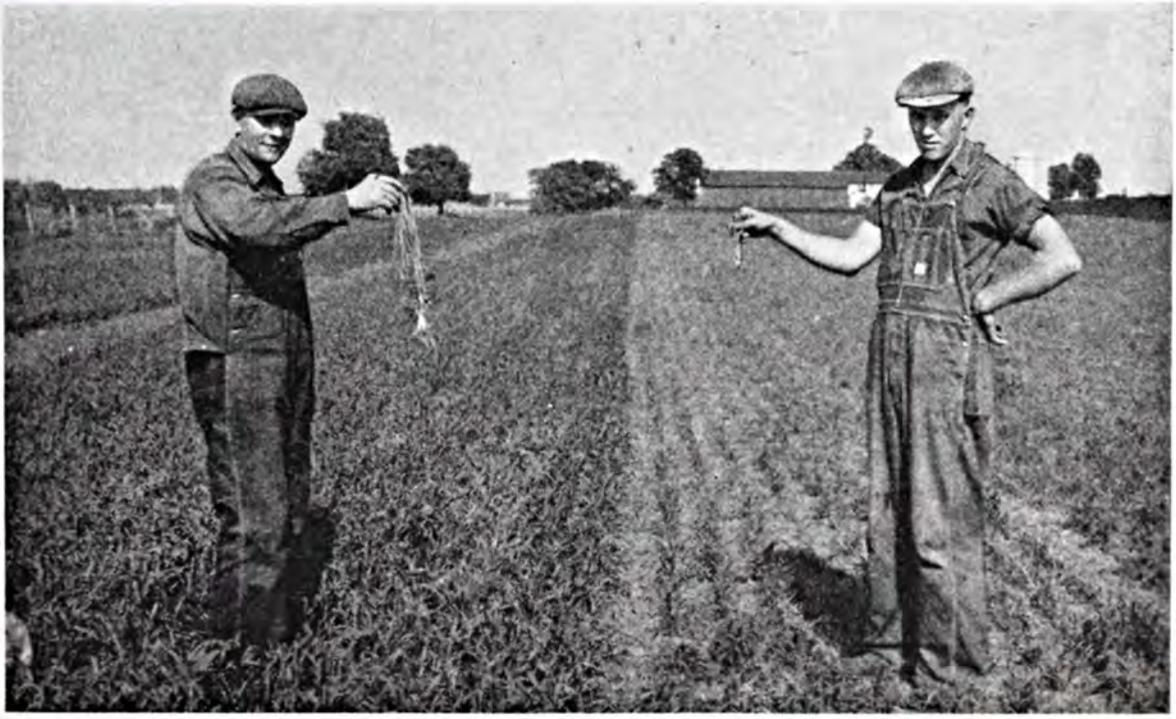
TOO much of our seed is falling by the wayside, on barren rocks, and among the thorns of a depleted and impoverished soil. We of America have been exploiting the riches of our once-productive, fertile farm lands.

Federal authorities tell us that in the United States more than 50 million acres of farm land which at one time supported farmers and their families have already been laid waste and are no longer fit for agricultural purposes. They tell us that an additional 100 million acres of farm land are well on their way to abandonment. When we compare this acreage of ruined land with the limited acreage of land devoted to farm crops in England (expanded now to about 18 million acres in crops), when we think of Japan with a population of 72 million living off less than 16 million acres of arable cropland, when we think of the State of Wisconsin with its 11 million acres of cropland, we may catch a glimpse of the tremendous and appalling waste and destruction of farm lands that has taken place in the United States.

As never before in history, we Americans are now faced with the problem of adjusting ourselves to a program of economy and self-sacrifice. We are not at present worrying about a shortage of food supplies, but we are concerned about shortages and restrictions of certain other commodities which are causing no little inconvenience and even hardships, and this situation will get steadily worse as the war progresses.

We are pouring the current and borrowed resources of our present income, as well as the incomes of generations to come, into what may well turn out to be a cataclysm of the whole world's political, social, and economic structure. But this war will eventually end, and the peoples of the earth will assume the task of reconstruction. Nations will adjust themselves to their inherent and local resources; a new political economy will be molded out of the wreckage of war-torn countries. However, the soil resources of every nation will again play a big role in the pattern and fabric of a reconstructed economy. The debts incurred by our own nation must be paid or adjusted. The cost of this war will eventually be levied against every living survivor, as well as sons and grandsons of generations to come.

In a recent talk before a group of 800 boys and girls and their parents at a 4-H achievement day gathering in one of our Wisconsin counties, I tried to draw a picture of what had been happening to the soils of this Nation, of Wisconsin, and particularly of the county in which these boys and girls and their fathers and mothers live. I pointed out that for three generations we have gained a living from the soils of Wisconsin; that we had built our homes and barns and equipped and stocked these farms all out of the wealth of the virgin soils which at the outset were not too well stocked and supplied with native fertility. But in turning to the future welfare and security of the boys and girls, I called to the attention of the fathers and mothers the debts which we are incurring right now that will have to be paid eventually by their sons and daughters, the farmers of the next generation. And I appealed to those parents to invest some of their present incomes in lime and fertilizer and thus build up the fertility of soils that will be heavily called upon in the inevitable lean years of a post-war depression. "Bank in the soil, and we will have soils we can bank on in years to come."



Barley on the Hans Olson farm in Dane County gets off to a vigorous start on the fertilized plots. Yields were: no treatment—45.6 bu. per acre; 0-20-0 at 200 lbs. per acre—68.8 bu. per acre; 0-20-20 at 200 lbs. per acre—73.0 bu. per acre.

Thousands of farmers in Wisconsin have limed all of their acid soils. In fact, Wisconsin farmers have applied more than 5 million tons of lime in the past 7 years, but still this tonnage of lime has sweetened only about 2 million out of a total of 8 or 9 million acres of acid soils.

Tests on more than 191,000 soil samples from all parts of the State indicated that 65% of our farm lands are still acid. The tests for available phosphorus and potash on these same 191,000 soil samples showed 75% to be deficient in available phosphorus and 49% deficient in available potassium. But Wisconsin farmers are responding to our educational program for the increased use of commercial fertilizers. The tonnage of commercial plant food used has increased rapidly in the past three years; in fact, has doubled in two years. In 1939 Wisconsin farmers used a total of 42,623 tons of commercial fertilizers. In 1940 the tonnage increased to 64,253, and in 1941 84,120 tons were used. No doubt the tonnage in 1942 will go to more than 120,000 tons. But even 120,000 tons are less than 20% of the plant food needed to offset annual losses which are being incurred in the sale of farm produce and in the handling of animal manures produced on our farms.

That fertilizers are needed and can be used with profit on Wisconsin farms has been demonstrated without any question or doubt. Hundreds and thousands of field trials have been conducted throughout the State during the past few years. They have shown a need for and the profitableness of using commercial fertilizers. In fact, in actual field tests on small grain on more than 1,000 Wisconsin farms in the past two years, the value of increases in yield of grain alone has more than paid the entire cost of the fertilizer treatment in 86% of these tests. When the residual carry-over effect of the fertilizer on the hay crop the following year was checked and measured, we found that in 95% of the tests the fertilizer more than paid for itself. It has been interesting to observe that in about 60% of these demonstrations the largest increases were secured where potash was used in addition to phosphate.

In many of our demonstrations con-

The application of 125 pounds of 0-20-20 per acre (left) made a big difference on this field of corn on the Otto Haberkorn farm in Fond du Lac County.

TABLE 1.— AVERAGE OF 423 DEMONSTRATIONS (9 YEARS, INCLUDING 1941) WHERE A COMPARISON WAS MADE OF 0–20–0 AND 0–20–10

Crop	Treatment	Rate per acre (lbs.)	Average yield (bu.)	Increase yield (bu.)	Average yield straw (lbs.)	Increase straw (lbs.)	Value of increases grain + straw [1]	Cost of fertilizer	Net profit per acre
Oats and barley	0–20–0	200	50.6	10.0	2,517	431	$5.65	$2.50	$3.15
	0–20–10	200	54.1	13.5	2,675	589	7.63	3.60	4.03
	Check	......	40.6	....	2,086	....	....	....	....

[1] *Oats and barley figured at average value of 50¢ per bushel, straw at $3 per ton.*

ducted during the past nine years, we used only one treatment. In fact, the 0-20-10 combination has become a popular fertilizer for grain and legume seedings in Wisconsin, and in many counties this was the fertilizer used for comparison with no treatment. However, in some of the demonstrations a comparison was made between 20% superphosphate and 0-20-10, and Table 1 shows the average results of 423 such comparisons. Here we observe that the straight 20% superphosphate has given an increase of 10 bushels per acre in yield of barley and oats with a net profit of $3.15 over and above the cost of the fertilizer. Where the 0-20-10 mixture was used, there was an average increase of 13½ bushels with a net profit of $4.03 per acre.

It should not be concluded from the above data that all soils in Wisconsin are responding profitably to fertilizer. In this summary we have included a number of test plots where no profit was shown. However, on a high percentage of these test plots on a wide range of soil types over the State, fertilizers have been used with profit and increases in the yield of grain alone have paid for the fertilizer.

Where the residual carry-over effect has been measured and the value of the increase in yield of hay has been added to the value of increases in grain, we observe that the relative response to potash is somewhat greater and, of course, net profit considerably higher for the 0-20-10 mixture.

The actual amount of potash carried over and available to the hay crop the second year is small where 0-20-10 is used at 200 pounds per acre, but one of the benefits of this potash in the mixture seems to be in the establishment of

(*Turn to page* 41)

TABLE 2.— RESIDUAL CARRY-OVER BENEFIT TO HAY CROP (9 YEARS, INCLUDING 1941). TOTAL VALUE OF HAY, GRAIN AND STRAW AND PROFIT OVER COST OF FERTILIZER (88 PLOTS)

Soil type	Treatment	Rate per acre (lbs.)	Average yield grain (bu.)	Value of increase grain + straw [1]	Average yields of hay (lbs.)	Pounds increase hay	Value of increase, grain, straw, and hay [2]	Cost of fertilizer	Net profit per acre
Mostly silt and clay loams	0–20–0	200	53.4	$6.04	4,196	882	$10.45	$2.55	$7.90
	0–20–10	200	56.7	7.97	4,572	1,258	14.26	3.70	10.56
	Check	......	42.4	....	3,314	....	....	....	....

[1] *Oats and barley figured at average value of 50¢ per bushel, straw at $3 per ton.*
[2] *Hay at $10 per ton.*

Nutritional Information From Plant Tissue Tests[1]

By Paul T. Veale

Assistant in Soil Survey, Purdue University, Lafayette, Indiana

A SOIL surveyor is constantly confronted by farmers with questions relative to the fertility of the soil. Although the surveyor has much information bearing on that question derived from many soil characteristics that are associated with the different soil types, the management history of any particular soil becomes an important factor in its current fertility situation.

The Purdue plant tissue test[2] has been found valuable in obtaining additional diagnostic information on the current fertility status of soils, and the determinations can be made in the field where they are most helpful in passing on to farmers information valuable in their fertility programs.

In the summers of 1939 to 1941 plant tissue tests were made on field crops in Newton, Noble, and Parke Counties, Indiana. While conditions on several soil types were studied, special emphasis was directed to obtaining many tests on one important soil type in order to get a more significant picture of its fertility level. Other reasons for this study were to determine if a particular soil type showed any characteristic pattern relative to the availability of nitrogen, phosphorus, and potash, and to find if this method would be a practical aid in improving the soil survey service to farmers.

Since the number of tests was limited, it was felt the data would be more significant if grouped according to the soil characteristics; and since these types are of similar geological age, they have been assembled into relative-drainage-profile groups according to Bushnell.[3]

Group V (Terrace and upland soils, excessively drained as in the Fox series.) The soils of this group are the best oxidized soils of the whole list, due to the porous nature of the soil and the underlying material which may consist of gravel and sand or stones. In order for a V-profile to develop in flat land it is, of course, necessary that the water table be low enough so that underlying sand or gravel is dry and not saturated with moisture.

These soils are commonly characterized by level to steep topography (0-25% slope), slight to excessive surface drainage, brown surface color,[4] light brown subsurface color,[4] reddish brown subsoil color, good to excessive internal drainage, medium to low productivity, none to moderate erosion, with droughtiness, acidity, and low fertility as the major farm problems.

Group IV (Rolling, light-colored, well-drained upland soils of north central Indiana as in the Miami series.) Group IV soils may be considered as the best drained, aerated, and oxidized group with the exception of Group V soils. Their development correlates very closely with a degree of slope which insures rapid run-off of rainfall and good aeration most of the time.

These soils are commonly characterized by moderately to steeply sloping topography (4-15% slope), good to

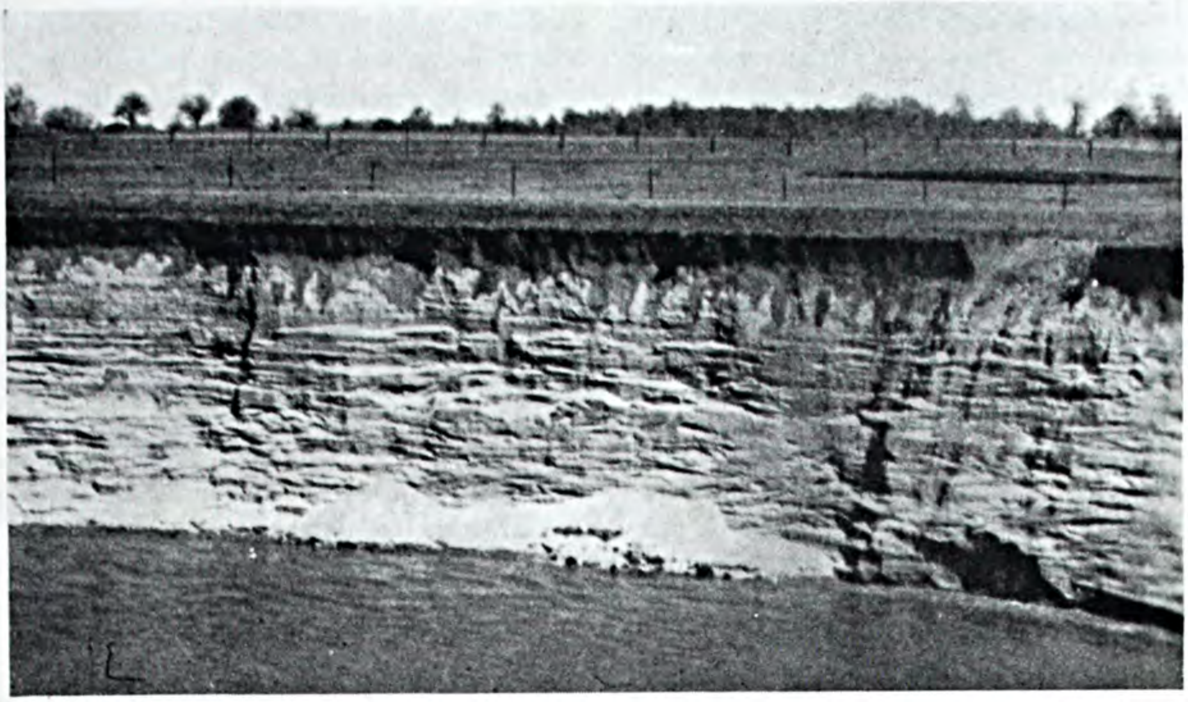
---

[1] *Journal Paper No. 16, Purdue Univ. Agr. Exp. Sta., Lafayette, Indiana.*

[2] *Scarseth, George D. Soil and Plant Tissue Tests As Aids in Determining Fertility Needs. Better Crops with Plant Food. March 1941.*

[3] *Bushnell, T. M. An Outline of the Classification of Indiana Soils. Indiana Acad. of Sci., Vol. 49, 1940.*

[4] *These descriptions apply to timber soils only, the color being much darker with prairie vegetation.*

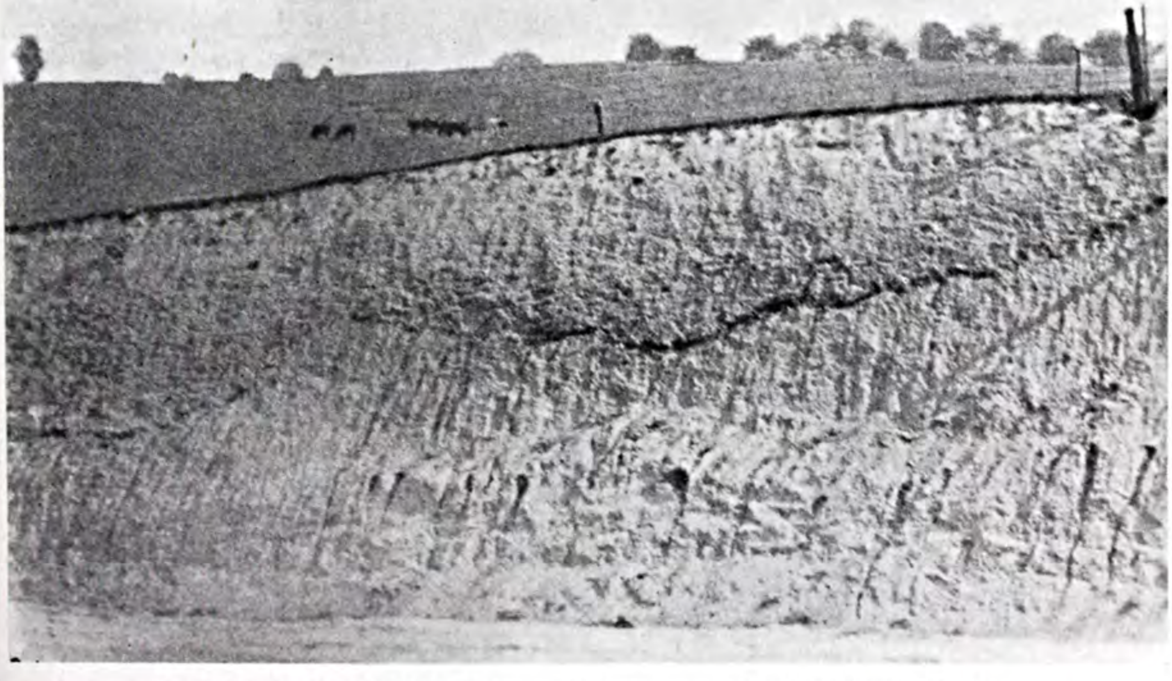


Typical group V soil. Note 12 to 14 inches of brown, fine sandy loam surface and horizontal bedding of sand and gravel in subsoil.

rapid surface drainage, brown surface color,[4] light brown subsurface color,[4] unmottled subsoil, good internal drainage, high to medium productivity, slight to severe erosion, with erosion control, acidity, and fertility as the major farm problems.

Group II (Level, light-colored [4] upland soils typical of north central Indiana as in the Crosby series.) These soils are commonly characterized by level to gently sloping topography, slow surface drainage, light brownish gray surface color,[4] mottled subsurface, slow internal drainage, usually claypan in subsoil, medium to low productivity, none to slight erosion, with low fertility and artificial drainage as the major farm problems.

Group VIII (Formerly ponded, dark,



A group IV soil. Surface is light brown silt loam over glacial till with high lime content.

depressional upland soils as in the Brookston series.) These soils are commonly characterized by slightly depressed topography, originally ponded surface drainage, deep, dark gray surface color, mottled yellow, brown, and gray subsoil, very slow internal drainage, high to medium productivity, none to slight erosion, with artificial drainage as the major farm problem.

Group X (Muck soils.) These soils are commonly characterized by depressed topography, originally ponded surface drainage, black organic surface, black organic subsurface, dark brown organic subsoil, very slow internal drainage, high to low productivity, none to severe erosion (wind erosion), with artificial drainage being the major farm problem.

Bottom land soils, such as the Genesee series, are depositional soils commonly characterized by level topography, occasional to frequently ponded surface drainage, brown to gray to black subsurface color, light brown to mottled subsoil, no development of weathered horizons, high to medium productivity, no erosion, with protection from overflow as the major farm problem.

Plant Tissue Tests Made

Plant tissues from general field crops were tested at random on the various soils. Great care was taken to get representative samples of both good and poor fields of various crops. The tissue tests were then made on two or more plants from each field to be sure the samples were representative. The tests for nitrogen, phosphorus, and potassium were not considered limiting unless *the test rated very low or none;* any tests rating "low" to "medium" were interpreted to mean the supply was not limiting plant growth.

The nitrogen test was not used on legumes as legumes do not contain nitrate nitrogen, and it was assumed that they could acquire sufficient amounts from the air. On the bottom land soils corn was the only crop tested.

Since only 195 fields on 26 different kinds of soils were tested, it was felt that the data would be more significant if grouped according to the soil drainage profile characteristics. To determine if this system of grouping was adequate, 64 tests were made on Fox sandy loam and the results compared to its drainage group. This soil type had almost the same nutritional pattern as other soils of this group, indicating soils of similar geological age and drainage have a similar nutritional pattern.

Since plant growth is governed by the limiting factor, whether nutritional or physical, it seems desirable to analyze many potentialities. If one nutrient which is limiting growth is supplied, the plant will be able to respond only so far as the other factors will permit. For example, if nitrogen and potassium are both limiting, the application of potassium alone or nitrogen alone will not give as complete a response as if both are supplied. If water is the limiting factor, the additions of nitrogen, phosphorus, or potassium or some combination of these plant nutrients will help only so far as the moisture will permit. Big crops are, therefore, dependent upon a balanced equation between plant nutrients, moisture, and physical properties of the soil.

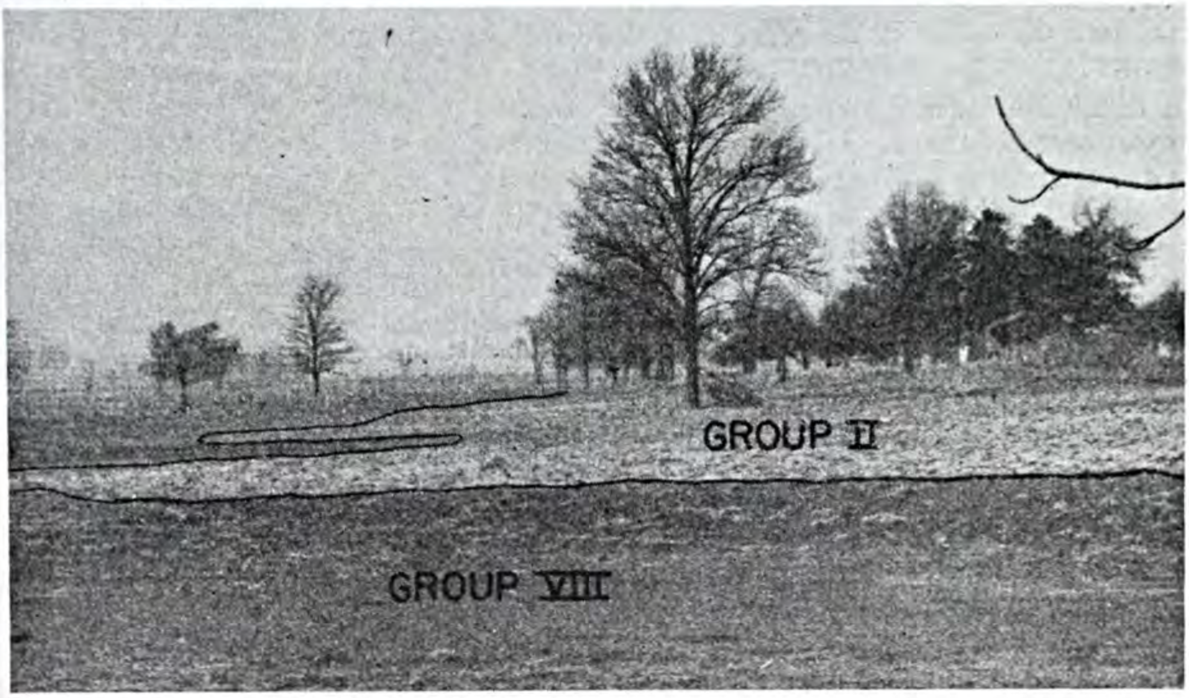
From the plant tissue data it was found that 78% or more of these soils were inadequately supplied with either nitrogen, phosphorus, or potassium or some combination of these plant nutrients. With the present low standards of production, the addition of plant nutrients should be our primary concern.

On Fox sandy loam nitrogen was one of the limiting nutritional factors in 68%, potassium 56%, and phosphorus in 19% of the cases. The major nutritional problems on Fox sandy loam, therefore, are nitrogen, potassium, and phosphorus in this relative order. In 81% of the fields tested it was found that one or more of these three elements were limiting plant growth, or in only 19% of the cases did the crops receive adequate balanced nutrition.

In addition to the deficiency in plant nutrients, it should be mentioned that Fox sandy loam is a very droughty soil, and is very dependent upon ample rainfall distributed throughout the growing season. This is especially true if the water table is very low. Considering all of these facts, and since the field tests were made under more or less dry conditions, it would seem that under ample moisture conditions the nutritional limitations would be even greater than found.

nitrogen on 12, and potassium on 6 fields.

In the "IV" profile group, Miami silt loam, Miami fine sandy loam, and Metea fine sandy loam, a slightly different situation was found. Nitrogen was one of the limiting factors in 60%, phosphorus in 64%, and potassium in 62% of the cases. It seems, therefore, that the nutrient deficiency on the IV profile soils is about the same magnitude for nitrogen, phosphorus, and potassium. One of the most significant facts observed with the IV profile soils was that in 94% of the cases the crops were limited in growth by at least one of the three elements studied.



Group II and VIII soils. Group II is level, poorly drained silt loam of medium productivity. Group VIII consists of lower-lying adjacent soils of high productivity when drained.

On the "V" drainage profile soils, such as Buckner sandy loam, Princeton loamy sand, and Bellefontaine sandy loam, the same nutritional limitations were observed as on the Fox sandy loam. Taking all the V profile group, nitrogen was one of the limiting factors in 68%, potassium in 60%, and phosphorus in 24% of the cases. In 80% of all the field crops tested in this group, it was found that one or more of the three elements were limiting plant growth, or only 20% of the fields had adequate nutrient elements.

The individual field tests indicated that nitrogen, phosphorus, and potassium were limiting plant growth on 15 fields, nitrogen and potassium on 27,

The individual tests indicated that nitrogen, phosphorus, and potassium were needed for the crops on 7 fields, nitrogen and potassium on 6, nitrogen alone on 2, phosphorus alone on 8, potassium alone on 2, and phosphorus and potassium on 6.

In the "II" profile soils group, which consists of Fincastle silt loam, Ayrshire silt loam, Crosby silt loam, Crosby loam, and Conover loam, nutrient deficiency tests showed that nitrogen was one of the limiting factors in 60%,

(*Turn to page* 42)

Purpose and Function Of Soil Tests

By W. H. Garman

Associate Professor of Soils, University of Georgia, Athens, Georgia

SOIL fertility can be spoken of as that dynamic property which renders the soil capable of producing high crop yields. What constitutes a fertile soil for one crop may not hold true for other crops. If a soil is properly located for a given crop, and possesses a suitable pH, sufficient organic matter, desirable physical and biological properties and adequate drainage, and contains ample nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and iron, together with certain of the so-called trace or minor elements such as copper, boron, manganese and zinc, it can be said to be a fertile soil for this crop. This, of course, does not imply that this would constitute a fertile soil for other crops.

Just as the nutrient requirements of different crops vary, so do the soils themselves with respect to the amount of available nutrients which they can supply. It has often been said that soils differ from each other much the same as plants or animals differ from each other. For best results efforts must be made to evaluate soils from the standpoint of the crop to be grown. Such evaluation should go a long way toward supplying the basis for prescribing that treatment which will render a given soil a more desirable medium for the production of this crop.

For the past three-quarters of a century soils investigators have endeavored to evaluate soils through the use of chemical methods. Toward this end many different techniques have been employed. On the whole, these methods have been too complicated and time-consuming to be of much practical use on a large scale. Within the past decade numerous modifications of these older methods have been made, and certain newer ones advanced, with the result that today we have procedures for testing soils which can be carried out in a relatively short time.

In the hands of properly trained workers these rapid methods will give a fairly reliable picture of the available nutrient status of the soil, which could be secured in no other such simple and economical manner. This information is of considerable value when employed in conjunction with the basic knowledge which the agronomist already possesses. With the results of these tests before him, to supplement his knowledge in the fields of soil fertility and plant nutrition, he is in a much better position to prescribe fertility needs for a given crop on a certain soil than he would otherwise be.

Plant Tissue Tests

Rapid techniques are also now in use for testing plant tissues for their content of soluble nutrients. Quite commonly these tests are of value in diagnosing nutritional disturbances. Thus they may be used to advantage in supplementing soil test data, especially where these data fail to fully account for the observed conditions.

Naturally, tissue tests are not capable of determining in advance of planting that treatment or fertilization most likely to be adequate for a given crop on a given soil. For this reason they will be of less value in practical agriculture than soil tests. However, where tissue tests are made during the growing season, information may well be obtained which can be of value in planning fertilization for this crop when again grown on this soil. It has been the writer's experience that where soil tests are made, and the resulting recommendations followed in the field, there is very seldom need for making tissue tests. Where soil tests have not been made, nutritional disturbances are more likely to occur, and it is in such instances that tissue tests have been of greatest value.

Soil scientists who have had considerable experience with rapid soil tests have no doubt as to their tremendous practical value in agriculture. Others may have a tendency to discourage the use of such tests as an aid in prescribing fertilizer treatment or in diagnosing fertility troubles. The use of soil tests has been discouraged chiefly because of two reasons, the more common of which has been due to the lack of actual experience in the use and interpretation of the tests. The second, and less common reason, has been due to the fact that a certain test (such as the potash or magnesium test) has failed to correlate with the need for this nutrient as judged by plant response to applications of it.

Conditions for Correlation

Here, let us ask ourselves this question: Under what conditions could one expect correlation between a single test and field response? The answer is obvious since a high degree of correlation would be possible only where all other elements, as well as growth conditions, were at their respective optimum levels. It is likewise obvious that such a condition will seldom, if ever, be encountered under agricultural conditions, especially on soils which have been subjected to long continuous cultivation and erosion. Therefore, it goes without saying that any one test alone could rarely be used to advantage.

When all tests are made it is quite likely that the limiting elements or element can be singled out and thus supplied. Then, and only then, would one be in position to attempt to correlate the test for a given element with plant response to applications of this nutrient. Making complete tests requires but little time and expense. Had all workers in the past taken time to make complete tests, they very likely could have saved both farmers and themselves time and unnecessary expense, at least in certain instances, and as a result the use of soil tests would be more common in certain localities than is true today.

In spite of the above discouraging elements, active testing services are in operation in many states. In all of these states there apparently has been an ever-increasing demand for this service. In most laboratories several determinations are made on each sample. These usually include phosphorus, potassium, calcium, magnesium, pH, aluminum, and organic matter. In addition, nitrate and ammonia nitrogen are frequently estimated. Recently, widespread evidence of minor element deficiencies has introduced simplified tests for boron and manganese. A determination now made by all laboratories is "lime-requirement." In this determination there is evident need for improvement; however, the same may be said for certain of the other tests. At any rate, it is of considerable importance, since humid region soils tend naturally to become more and more acid, and many soils are today so low in active calcium and magnesium that a prosperous agriculture is impossible.

It should always be kept in mind that many factors (other than available nutrient content) can, and often do, affect plant growth. It is obvious that rapid laboratory tests reveal little or nothing as to such factors as drainage, general physical condition, biological activity, quality of seed used, diseases, weeds, insects, and moisture supply. As many of these factors as possible should be considered in conjunction with the result of soil tests.

All of this adds up to the fact that it is highly desirable to have considerable information furnished along with each sample that comes to the laboratory. This should include the names of all crops grown; yields received; the kind and amount of all treatments such as fertilizer, manure, and lime applied; diseases encountered; and the rotation and management practices planned for the future. In addition, there should be information on such factors as size, shape, and general topography of the area; depth of topsoil; approximate depth to bed-rock; predominate slope; degree of erosion; whether drainage is normal, excessive, or poor; whether topsoil is uniform in color over the area; whether or not plants have shown peculiar coloring and dying of leaves prematurely; and whether the area is uniform in fertility as judged by the growth of previous crops.

Soil Sampling Important

The matter of soil sampling is one of the most important of all phases of soil testing. Unless a sample is truly representative of the area, it is not worth the time spent in securing it. Since soils are so extremely variable in nature, it is obvious that a sample obtained from only one spot in the field will most certainly not represent the entire field. The chemical tests on such a sample may be twice as high, or much lower, than the average for the field. It can readily be seen that incorrect recommendations would very likely result from the use of such a sample. Too great care cannot be exercised in obtaining samples according to accepted sampling procedures. As soil testing is carried out in most states today it is not possible to have experienced persons available to meet the large sampling demands on the part of the farmers. This means that the farmer must frequently do his own sampling. Under these conditions it is well to contact the Agricultural Experiment Station, where detailed instructions for sampling can usually be obtained.

It would be well if soil-testing services could handle their samples through county agents, extension agronomists, and vocational agricultural teachers. Complete cooperation could be possible only where these individuals were acquainted with sampling techniques and the interpretation of the chemical soil-test data. If all such individuals were in position to properly take samples and to evaluate the results of soil tests, the practical value of a testing service theoretically would be at a maximum. This would result from the fact that these individuals are familiar with many plant diseases, general growing conditions, variety adaptations, management practices, as well as the soils in their respective localities, and thus would be in position to make complete evaluations of the combined factors.

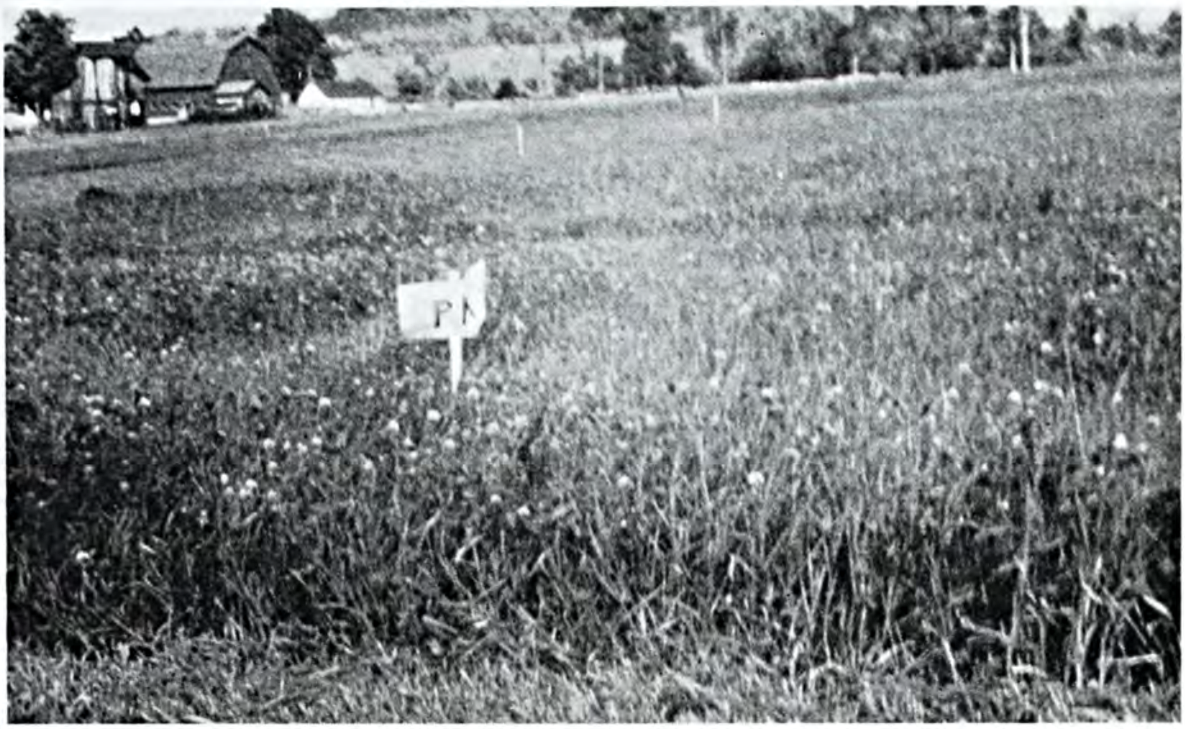
As the public demand for soil testing increases, it will be more and more essential that field representatives make the actual interpretations of the testing results and formulate the recommendations. This will require the laboratory to do only the testing and mailing of the results, together with making brief suggestions in special instances. This will eliminate a detailed letter being written in each case, such as is the general practice today in most states.

Conclusion

From this brief discussion of soil testing, the layman should not receive the opinion that these tests are foolproof in all respects. In fact, in some instances they may be far from that, especially when the results of only one or two tests are considered, or when the history of the sample is not known. However, when the information of all the commonly made tests is considered in conjunction with other essential facts, one is not likely to go far wrong. This, of course, implies that the individual in question is thoroughly trained in all aspects of the laboratory work and in the fields of soil fertility and plant nutrition. In the hands of individuals with little or no experience in these fields, it is very unlikely that results of value would be forthcoming.

Each of the tests has certain limita-

(*Turn to page* 42)



Close-up of mixed clover hay, second crop 1940, on PK plot.

Potash Extends the Life Of Clover Stands

By Ford S. Prince

Agronomist, Agricultural Experiment Station, Durham, New Hampshire

IF THE dairymen in the northeastern part of the United States had all the clover and alfalfa hay they needed, their minds would be easier on two matters at least. First, and foremost, is the need just now for more milk. With the kind of hay they have this year and with a very short crop due to the drought of 1941, a good many dairymen are feeding a grain-milk ratio narrower than one pound of grain to three of milk. With plenty of legume hay, it wouldn't be necessary to feed so much grain and later on run the risk of mastitis, udder troubles, and possibly other ills to which the dairy cow is subject.

Then there is a nitrogen shortage in prospect, particularly of nitrates. This may be only temporary. New manufacturing establishments now under construction may be able to produce synthetically all the nitrogen that we need for our expanding war machine as well as our huge farm effort. Anyway, just now there seems to be a shortage of nitrates and their use will have to be curtailed somewhat this year in spite of the urge for greater production on the farmers' part.

Farmers have been synthesizing nitrogen on their farms for quite a while. The only trouble is, they don't do quite enough of it. They do not raise a large enough percentage of legumes to maintain the nitrogen income and outgo in proper balance in their hay and pasture fields. Maybe that is their fault and maybe it isn't. Perhaps we are all to blame for not finding a perennial legume that would fit into their long rotations, or for not working out a suitable scheme of fertilization that would keep a bigger percentage of legumes, clover, alfalfa, or whatnot in these hayfields.

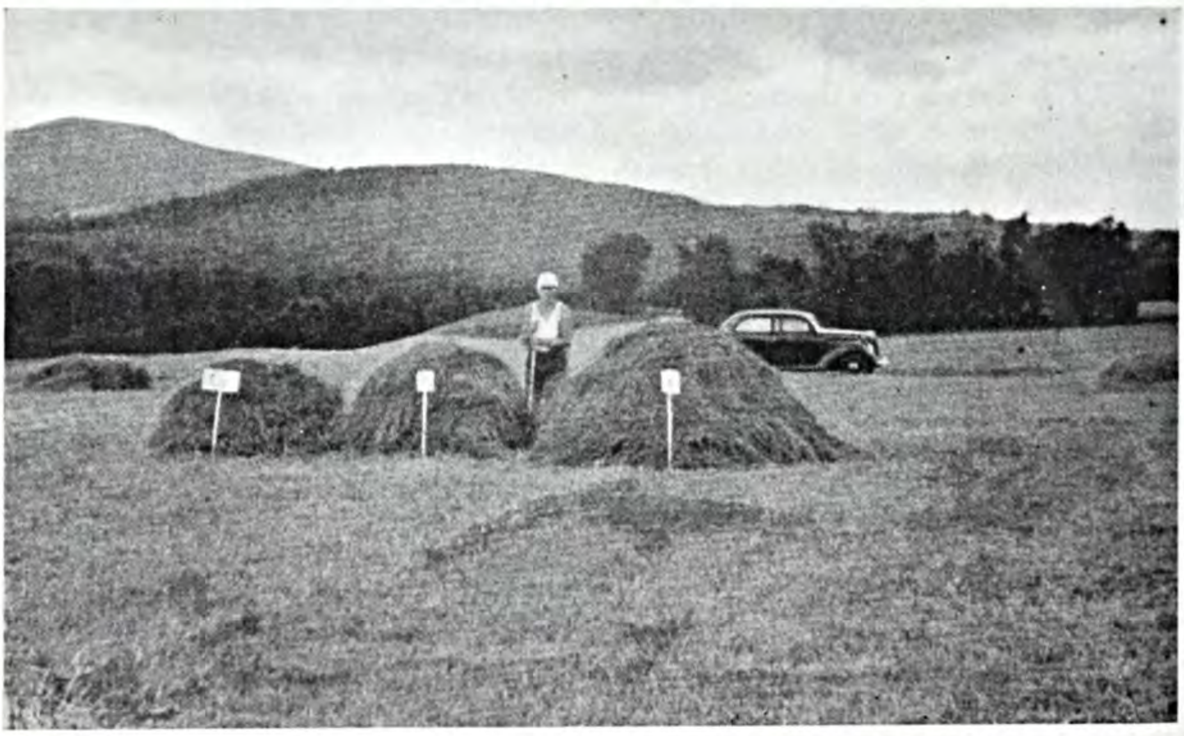
At least we have a long rotation as an excuse. In fact, not many farmers in the Northeast have a cut and dried rotation system, in which a field is left in hay just so long, no matter. On the other hand, fields are usually left in hay crops as long as they will cut a satisfactory tonnage, regardless of whether there is any clover or alfalfa there.

In justification for these long rotations it should be pointed out that plowing is never as easily done here as it is farther west where the fields are larger and more level. A good deal of the land is tipped up "on edge" and with much tillage is easily susceptible to erosion. Hay and pasture are the principal crops on the dairy farm, and most dairy herds are so large that the farmer is hard pressed to produce the hay, pasture, and silage that his herd will eat during the season.

Too often the emphasis has been placed on tonnage or bulk rather than on the quality of the roughage produced, but in most cases hayfields are left as such for five, six, or eight years after seeding, long after the legumes that were included in the mixture have disappeared.

With such a system of crop rotation, a perennial legume is a godsend. Alfalfa is used by some farmers with good success. Unfortunately the soils have a high lime requirement which makes a seeding costly, and because of hardpan or lack of under drainage many of the soils will not hold alfalfa long. Ladino clover is coming into prominence, serves its purpose well, and will be used more widely when seed costs are lower, Even though alfalfa and ladino are available, most dairymen place their trust in red clover, or red and alsike, and these clovers ordinarily behave as biennials. The result is that after the second hay year the clover in most cases has practically disappeared from the hayfields, leaving only the grasses that were seeded, and we need clovers, in profusion, to counteract the nitrogen shortage and to give quality to the hay.

Every farmer recognizes the value of clover, both as a feed and as a source of nitrogen. But we may have been placing too much emphasis on it in



Single plot yields, showing comparisons, first cutting 1939. Check plot on left, phosphorus center, and potash right.

our long rotations for the conditions under which we have been farming. Perhaps we haven't grown enough of the perennials, alfalfa and ladino. Or maybe we haven't studied sufficiently the needs of our soils so that by modifying them red clover will persist longer than two years.

Plant breeders in Wales have developed a strain of red clover that has persisted under favorable conditions for seven or eight years. Workers in other countries have brought out red clover strains with a perennial tendency. Work is under way at the moment in this country on a perennial red clover. Here in New Hampshire in our red clover breeding work we have held individual plants through three full seasons without any special soil treatment.

Why Red Clover?

Why all this effort on red clover? Well, it is a rugged plant, easy to grow, bulky in yield and, of course, an excellent cow hay. It will grow on soils too wet for alfalfa to persist long and its lime and fertility requirements aren't quite so high as those of alfalfa. Dean C. E. Ladd of Cornell University stated at the Pennsylvania State Grassland Conference in 1940 that a triennial red clover would be worth a million dollars annually to the farmers of New York State. If we could only make it live one more year!

That we will undoubtedly be able to do. Breeding for the perennial tendency certainly offers great promise. But while the plant breeders are studying the chromosomes and making their crosses, all of which take time, let's take a tip from an experiment which has been in progress near Claremont, New Hampshire, for the last five years and make the soil conditions right so that clover will stay in, even while the plant breeders are doing their stuff.

Here is the gist of that experiment. A seeding of red and alsike clovers and timothy was made in August 1937 on a field situated on a terrace of the Connecticut River Valley. The field had been in plots which were continued. Some of the plots had received and continued to get an annual application of superphosphate or potash, and others both. Still others had other treatments including lime and complete fertilizers.

No harvest was made in 1937, but hay has been cut every year since. In 1938 there was a good crop on all the plots, mostly clover. By 1939, clover had almost disappeared from all plots except those which had received potash, but in 1940 and 1941 red clover persisted on the potash plots, with not only tremendous increases in yield but in quality too, of course. But it persisted only on the plots which had received potash, and it didn't matter what else they got.

Lime had no influence on clover persistence and, on this soil, very little effect upon yields. Superphosphate used alone didn't hold the clover nor did it increase yields appreciably. But potash held the clover there and practically doubled the yield over the untreated plots. When phosphate and potash were used together or in combination with nitrogen, the yields went to town. The potash had held something in the stand that responded—clover.

I do not mean to leave the impression that the clover was a full stand. But it was there in amounts sufficient to make good mixed hay on all the potash-treated plots. The question naturally arises, were these perennial plants of red clover or did dormant seeds lying in the soil germinate and grow? They didn't come from manure, since manure was not used as a top-dressing and none had been applied since 1936, the year before the seeding was made. Of course, we'd like to know whether they were perennials and we are studying them in our nursery. But from the farmer's point of view, it doesn't matter whether they were biennials or perennials, the feed is just as good from one type as it is from another. What we do know is that it wasn't a perennial on any of the plots that didn't get potash.

(*Turn to page* 38)

Legumes Will Furnish Needed Nitrogen

By R. Y. Bailey

Chief, Agronomy Division, Southeastern Region, Soil Conservation Service, Spartanburg, South Carolina

PRODUCTION for war needs is probably the most generally discussed topic in the country today. Although food and fiber crops are not as spectacular as the planes, tanks, and guns that are coming from the assembly lines, they are just as essential to the successful prosecution of the war.

One of the most important of the problems in production is that of providing adequate supplies of nitrogen to meet the needs of both industry and agriculture. A shortage of nitrogenous fertilizer will be particularly serious in the South where most of the soils are deficient in nitrogen. Since most of the commercial supply is likely to be needed in the manufacture of munitions, it will probably be necessary for a large part of the nitrogen required in agriculture to be derived from legumes.

Legumes for Nitrogen

Fortunately, state agricultural experiment stations have studied the possibilities of growing legumes in cropping systems to supply nitrogen for the production of other crops. Information derived from these studies is of unusual importance to the Nation as a whole at this time. It is entirely probable that through the application of the findings of these institutions Southern farmers may be able to produce adequate supplies of certain vital crops, of which there might otherwise be serious shortages.

Results of experiments with legumes have shown that it is possible to produce large yields of other crops with nitrogen from legumes grown in rotations and plowed into the soil. Because of the abundance and relatively low price of commercial sources of nitrogen, farmers have not made as general use of legumes as they are likely to find it necessary to do during the war period.

Much emphasis has been placed on experiments with winter legumes such as the vetches, winter peas, and clovers, either alone or in combination with small grains and grasses. Yields of crops following winter legumes turned under have compared favorably with yields where liberal applications of commercial sources of nitrogen or barnyard manure have been used.

For example, on Tifton sandy loam at the Georgia Coastal Plain Experiment Station a 9-year average yield of 740 pounds of seed cotton per acre was made without nitrogen, compared with 1,316, 1,206 and 1,168 pounds following crops of Austrian winter peas, Monantha vetch, and hairy vetch, respectively.

At Knoxville, Tennessee, corn grown on Cumberland loam, without legumes in the cropping system, made a 4-year average yield of 30.8 bushels per acre, compared with 43.4 bushels where crimson clover was turned under. Many other similar examples could be cited.

In addition to the direct benefit derived from turning under winter legumes, it has been shown by results at the Alabama and the Louisiana Agricultural Experiment Stations that there is a residual effect the second and third years after winter legumes are turned under. On light sandy loam at St. Joseph, Louisiana, the residue from three crops of hairy vetch resulted in an increase of 195 and 399 pounds of seed cotton the second and third years, respectively, after vetch was turned under.

On Norfolk sandy loam at Auburn, Alabama, vetch was turned under about March 25, April 5, and April 15 during the three years 1925 to 1927, inclusive. The average yields of green vetch at the three dates of turning were 5,259, 8,849 and 12,072 pounds per acre. Corn was planted about 10 days after vetch was turned under and a companion plot planted on the same day was fertilized with 200 pounds of nitrate of soda per acre. In 1928, Monantha vetch was killed by cold, and as a result the yields that year represented a comparison of the residue from the three previous crops of vetch that were turned at early, medium, and late dates and the 200 pounds of nitrate of soda that were applied on each companion plot. The acre yields on the vetch plots were 16, 28.9, and 34.6 bushels, compared with 22.6, 22, and 25 bushels on companion plots where 200 pounds of nitrate of soda per acre were applied. The average yield of the four check plots that received no nitrogen was 9.5 bushels per acre.

Compare corn growing where no lespedeza was grown (above) with corn following Kobe lespedeza that was turned under (right).

The annual summer legumes have not been emphasized as much as have the winter legumes. Considerable work has been done with such summer annuals as cowpeas, soybeans, and crotalaria as interplanted crops with corn. Variations in dates, rates, and methods of seeding, and in seasonal conditions have resulted in such wide differences in the growth of interplanted summer legumes that the influence on yields of succeeding crops has been far less impressive than the effect of winter legumes. Where large yields of summer legumes have been turned under, yields of succeeding crops have been substantially increased.

Most of the summer legumes seeded after small grain crops have been considered as forage rather than soil-improving crops. As a result, the stubble of summer legumes has been returned to the soil, whereas, it has been common practice to turn the entire crop of many of the winter legumes under to supply nitrogen for succeeding crops.

Crotalaria is a summer legume that

cannot be used for hay and is, therefore, returned to the soil. Crotalaria has proved very effective as a soil-improving crop in Florida, in the sandhill section of the Carolinas, and on the sandy soils in the Coastal Plain section of other Southern states. It seems to make more satisfactory growth than most other legumes when interplanted with corn. It makes the major portion of its growth in the fall after corn matures. It is a good seed producer and volunteers for several years if a crop is produced and left on the land. Crotalaria has grown well when seeded on small grain in February or March. It is particularly promising on sandy soils where lespedeza sometimes fails during periods of spring drought when the grain crop is drawing heavily on soil moisture, or as a result of heavy infestations of nematodes. Crotalaria spectabilis is one of the most completely nematode-resistant crops grown in the Coastal Plain.

Lespedeza Deserves Attention

Annual lespedeza is the ugly duckling of the annual legumes in the South. This crop has probably received less attention in research than any other legume of major importance. Published results of experiments with lespedeza as a soil-improving crop are extremely limited. Wherever lespedeza has been included in soil fertility experiments and treated as a soil-improving rather than as a hay crop, it has given remarkable increases in the yields of succeeding crops. In six trials at the North Carolina Station, there was more than a 100% increase in the yields of crops following lespedeza.

Miller reported in Farmers' Bulletin 1724 that an average yield of corn on six fields in North Carolina, Kentucky, and Tennessee was 19.3 bushels per acre where no lespedeza was grown, compared with 41.1 bushels following lespedeza. He also reported an average increase of 317 pounds of lint cotton per acre following lespedeza on 10 farms in Tennessee and North Carolina.

E. C. McArthur, Gaffney, South Carolina, won the State 5-Acre Cotton Contest in 1941 with an acre yield of 1,140 pounds of lint on a field where Kobe lespedeza had been grown in the rotation. Lespedeza was turned in the fall of 1940 and followed by a mixture of barley and Austrian winter peas, which was grazed off during the winter and early spring. The stubble of the winter crop was turned under and cotton was fertilized with 600 pounds of 4-8-6, 120 pounds of nitrate of soda, and 80 pounds of muriate of potash per acre. Although the cotton was fertilized liberally, Mr. McArthur does not believe he could have obtained such a large yield if the land had not been in a high state of fertility as a result of growing lespedeza in the rotation.

Probably the strongest point in favor of lespedeza is its ability to produce an abundance of seed that can be either harvested for planting additional acreage or left for reseeding on the land where lespedeza is to be left for an additional year.

Interest in perennial legumes has developed rather slowly in the South. Both kudzu and lespedeza sericea are hardy, deep-rooted perennials that have shown ability to grow on a wide variety of soils. They have grown well on poor, eroded soils, with less liming and fertilizer treatment than is required by most other legumes. Although information about their value for soil improvement is limited, results to date have been most encouraging.

A 3-year-old stand of kudzu at Auburn, Alabama, was plowed up in the spring of 1919 and followed by other crops. Yields of both sorghum hay and corn were approximately twice as large over a period of several years as were the yields on an adjoining plot where kudzu was not grown. There was a substantial increase in the yield of oats on the kudzu plot. Results of this experiment were published but did not create sufficient interest to stimulate the use of kudzu on an extensive scale.

Further studies that were made by

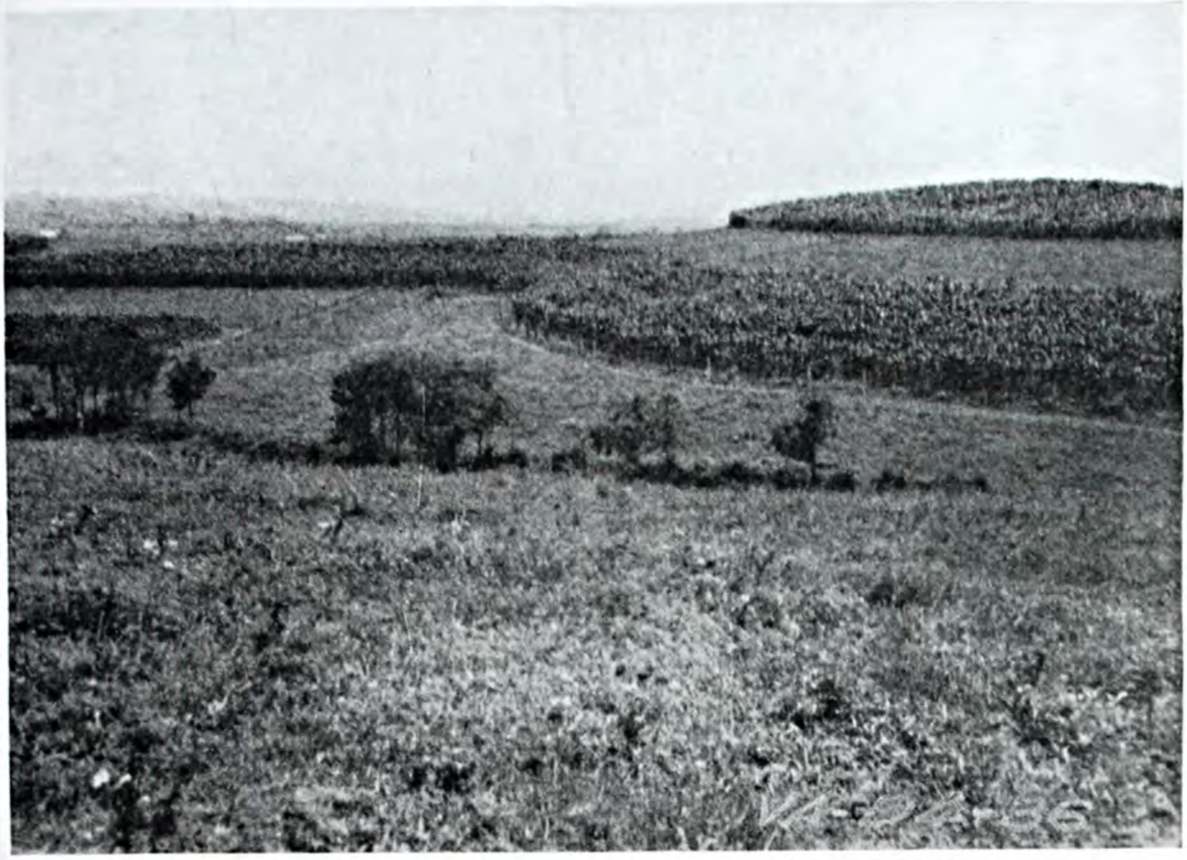
(*Turn to page* 39)

Above: This Mississippi farm boy is helping his father harvest 270 bushels of bur clover seed, worth $135, from six-tenths of an acre.

Below: A yield of 40 bushels of corn per acre following kudzu near Dadeville, Alabama. The kudzu was mowed for hay and grazed for three years before it was plowed for corn.

Above: This steep, eroded slope near Lineville, Alabama, was considered too poor for further cultivation when seeded to lespedeza sericea in 1936. It has been mowed for hay since 1937. Last year a strip planted to corn yielded 53 bushels per acre.

Below: Austrian winter peas on Orangeburg sandy loam in Escambia County, Florida, furnished enough nitrogen for the row crop that followed after peas were turned under.



Above: Clovers grown in a mixture with grasses in a rotation arranged in strips on this sloping Virginia farm are supplying nitrogen for corn and also reducing the amount of soil lost through erosion.

Below: Crotalaria seeded on oats in March near Gainesville, Georgia, produced a large crop of seed and will supply nitrogen for the next crop. It also furnished excellent protection against erosion.

Above: This home-made seed pan does not save as large a percentage of the seed as a combine, but it enables this Alabama farmer to harvest enough lespedeza seed for his own use.

Below: This Alabama farmer wanted crimson clover seed, and found a way to harvest enough for the needs of his small farm.

The Editors Talk

Legumes—Front!

Fast being called to the front of major war crops, legumes are beginning to share the publicity and emphasis given the food and oil-producing crops in American agriculture's all-out war effort. The shortage of nitrogenous fertilizers this spring and the possibility that this shortage will become more acute as the war progresses have hastened this call, for legumes will grow the much needed nitrogen.

We feel fortunate in being able to present in this issue two articles on growing legumes—one from the South and one from the North. In his article, R. Y. Bailey, Chief, Agronomy Division of the Southeastern Region, Soil Conservation Service, not only outlines the possibilities of growing legumes in cropping systems to supply nitrogen for the production of other crops, but relates some of the many benefits to be derived from both winter and summer annual legumes in rebuilding soil fertility and checking erosion. "If we in the South take full advantage of the information that is available," says Mr. Bailey, "we can through the simple medium of legumes draw upon the inexhaustible store of atmospheric nitrogen. . . . We may thereby produce in abundance the food and fibre crops required in the struggle to restore order in the world, and in so doing build for ourselves a safer and more profitable post-war agriculture."

Mr. Bailey submitted so many good pictures to illustrate points in his article that our entire "Pictorial" section in this issue is devoted to their presentation.

Professor Ford Prince, Head of the Agronomy Department, University of New Hampshire, author of the article from the North, says, "If the dairymen in the northeastern part of the United States had all the clover and alfalfa hay they needed, their minds would be easier on two matters," and designates these "matters" as the need just now for more milk and the nitrogen shortage.

"Farmers have been synthesizing nitrogen on their farms for quite a while. The only trouble is, they don't do quite enough of it," Professor Prince declares. "They do not raise a large enough percentage of legumes to maintain the nitrogen income and outgo in proper balance in their hay and pasture fields." To substantiate what can be done, he details the results of an experiment begun in 1937 in the Connecticut River Valley where clover persistence was maintained with the practical and profitable use of mineral fertilizers, particularly potash.

In concluding, Professor Prince says, "This seems to be a good time to let potash 'pinch-hit' for nitrogen by using more of it or taking better care of manure to grow more clovers. Farmers who find that their soils respond to potash, as this one does, and capitalize on that fact, will certainly be well repaid during the next few years by harvesting better hay with more clover in it and thereby adding to the nitrogen supply of the farm."

A rough calculation of the nitrogen situation shows how legumes can fit into this emergency. It is estimated that due to the reduced importations of nitrate of soda and cyanamid and the complete diversion of ammonia liquors and concentrated nitrogen synthetic materials there may be a nitrogen deficit of 160,000 tons during the coming year. Data at numerous experiment stations show that legume green manures can furnish the equivalent of 15 to 100 pounds or more nitrogen per acre. If an average figure of 30 pounds per acre is taken, it would require only 10,700,000 acres of legumes to supply 320,000,000 pounds of nitrogen which may be lacking in fertilizers the coming year.

In the South, much of this can be supplied by winter cover legumes; and in the North, by the aftermath in legume meadows. Thus only a part of this acreage would have to be taken out of crop production during the year in order to fully meet the requirements. This would appear to be a practical solution to the possible nitrogen shortage during the next year or two.

The One-Year Rotation

Rotation vs. the one-crop or cash-crop system of farming has long been a subject of extension education. The relative merits of three- and four-year rotations are well established and quite generally known. Now comes a feasible one-year rotation. The possibility of growing a grain crop, having a legume pasture, and a winter cover on the same field year after year for as many years as desired is explained in a new Missouri Experiment Station bulletin, No. 439, "Growing Good Crops of Oats in Missouri," by J. M. Poehlman. Based on experimental work, it has been shown that lespedeza can be sown in oats or oats can be sown on old lespedeza sod by disking. When the oats are cut, the lespedeza will come along for a summer pasture and the dead plants will act as a fairly good cover over the winter. Enough volunteer lespedeza will appear the next year to establish a good stand, and oats can be planted again by disking the old sod, thus completing a rotation in one year. Barley can be used in the place of oats.

A large annual return per acre, produced at a low cost, is the most conspicuous feature of the small grain-lespedeza rotation. If the grain crop is at least moderately treated with fertilizer and the lespedeza is pastured down, adding nitrogen and organic matter to the soil, the fertility will be improved rather than reduced, notwithstanding the heavy production.

Many people consider small grain and lespedeza as crops not needing fertilization, but there is important evidence from work in Missouri and other places that both of these crops will respond to fertilization under many conditions and will be better feeds if well fertilized. The legume crops are not efficient nitrogen fixers if they are not well supplied with mineral nutrients. In a rotation of the type mentioned, it therefore would be necessary to provide adequate lime, phosphate, and potash if the fertility of the soil is to be maintained and high yields and good quality forage obtained year after year.

It is readily seen that one of the great advantages of this type of one-year rotation is the saving of time and labor in plowing, since only disking is needed each spring to prepare the seedbed. Losses from soil erosion undoubtedly would be held to a minimum, thus making it an important soil conservation practice.

An abundance of winter feed and summer forage would be produced with low harvest labor requirements, and soil fertility would be maintained and even improved. There probably would be some problems to be worked out in a wide adaptation of such a rotation, yet the possibilities offered make it worth serious consideration, and trial in those areas where lepedeza can be grown.

REVIEWS

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

Fertilizers

¶ Several additional pamphlets dealing with fertilizer statistics have been received during the month. One is from New York, Mimeographed Pamphlet 663 of the Agronomy Department of Cornell University, compiled by E. L. Worthen. This shows that the total fertilizer tonnage for 1941 was substantially higher than that of the last four years with almost 60% of the tonnage in the form of mixed goods, the other 40% consisting mostly of phosphates with some nitrogenous materials and still less straight potash salts. About 80% of the fertilizer contained 20 or more units of plant-food. There were 104 different analyses sold, 3 less than the year before, which as Dr. Worthen points out does not indicate a rapid progress in the reduction of the number of fertilizer grades offered for sale in the State. Over 80% of the mixed goods offered for sale, however, were included in the 12 leading analyses, 7 of which were grades approved by the Experiment Station. The two leading grades were 5-10-5 and 4-8-8.

Earl Jones of the Agronomy Department, Ohio State University compiled figures for his State in 1941. The total fertilizer tonnage for Ohio was just a little higher than that in New York, and in 1941 was much higher than any year back to 1930. Over this period nitrogen increased more than 3,000 tons, phosphoric acid more than 5,000 tons, potash more than 12,000 tons, the latter almost double that in 1930. About 97% of the tonnage was in the form of mixed fertilizers, the straight material sold consisting mostly of phosphates with some ammoniates and a small amount of potash salts. Most of the fertilizers contained 20 or more units of plant food, while nearly three-quarters of all the fertilizers were included among the standard analyses or multiple strength analyses. The leading analysis was 2-12-6 which was far ahead of any other grade, and almost 54% of all the fertilizers sold in the State.

¶ Another publication dealing with fertilizer statistics is the Annual Fertilizer Report, issued as Bulletin 230, of the Wisconsin State Department of Agriculture. This was prepared by W. B. Griem and shows that 1941 had by far the highest fertilizer consumption in the State's history—84,120 tons. More than 80% of this tonnage consisted of mixed fertilizers, the remainder being mostly phosphates. Nearly all fertilizers contained 20 or more units of plant food. The 2-12-6 was by far the most popular grade of fertilizer, although the combination of the 20% and 45% superphosphates would exceed this figure. The second most popular was the 3-12-12, this grade having shown a remarkable increase in popularity over the last 15 years.

"Commercial Fertilizers, 1941," Agr. Exp. Sta., Orono, Maine, Off. Insp. 181, Oct. 1941, Elmer R. Tobey.

"Rules and Regulations Governing Commercial Fertilizers," St. Dept. of Agr., Lansing, Mich.

"Soil Fertility Experiments with Cotton,

Hemphill Field," Agr. Exp. Sta., State College, Miss., Serv. Sheet 327, Jan. 1942, Roy Kuykendall.

"Commercial Fertilizers and Winter Legumes for Cotton Production, Gary Field, Tallahatchie River Soil," Serv. Sheet 328, Jan. 1942, Roy Kuykendall.

"Soil Fertility Experiment with Cotton, Schaefer Field, Yazoo River Soil in the Southeast Delta," Agr. Exp. Sta., State College, Miss., Serv. Sheet 329, Jan. 1942, Roy Kuykendall.

"Growth and Composition of the Strawberry Plant as Affected by Source of Nitrogen and pH Value of the Nutrient Medium," Agr. Exp. Sta., New Brunswick, N. J., Bul. 691, Dec. 1941, J. Harold Clark.

"Fertilizer Tonnage for New York, 1941," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Mimeo. 663, Apr. 8, 1942, E. L. Worthen.

"Fertilizer Sales in Ohio, 1941," Agr. Ext. Serv., Columbus, Ohio.

"The Effect of Certain Nitrogenous Fertilizers on the Chemical and Vegetative Composition and Yield of Pasture Plants," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 75, Nov. 1941, J. F. Eheart and W. B. Ellett.

"Surface Run-off and Erosion from Permanent Pastures in Southwest Virginia as Influenced by Applications of Triple Superphosphate," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 77, Dec. 1941, W. H. Dickerson, Jr., and H. T. Rogers.

"Effect of Fertilizer Placement on Yields of Peas Used for Frozen Pack in Western Washington," West. Wash. Exp. Sta., Puyallup, Wash., Mimeo. Cir. 108, Jan. 1942, Karl Baur and G. A. Cumings.

"Commercial Fertilizers, 1942," St. Dept. of Agr., Madison, Wis., Bul. 230, May 1942.

"What Fertilizers for Canning Peas?" Agr. Ext. Serv., Madison, Wis., C. J. Chapman and H. H. Hull.

"Soil Fertilization and Management in 1942 in the 'Food for Victory' Program," Agr. Ext. Serv., Madison, Wis., Jan. 15, 1942.

"What Kind of Lime Shall I Use?" Agr. Ext. Serv., Madison, Wis., C. J. Chapman and Emil Truog.

"1942 Suggestions for Fertilizers for Various Crops on Sandy Soils," Agr. Ext. Serv., Madison, Wis., A. R. Albert.

"1942 Suggestions for Fertilization of Various Crops on Peat or Muck Soils," Agr. Ext. Serv., Madison, Wis., A. R. Albert.

Soils

¶ A rather detailed chemical study of 57 soil samples taken from pastures in various parts of Virginia has been made by M. O. Price, W. B. Ellett, and H. H. Hill, who have published their findings in Virginia Agricultural Experiment Station Technical Bulletin 78, "Pasture Production as Affected by Type and Chemical Composition of the Soil." For each sample, acidity, carbon, total and available nutrients, exchangeable bases, exchange capacity, base saturation, and the condition of the pasture are recorded. The good pastures tended to be higher in total and available phosphoric acid and exchangeable potash, and had a higher exchange capacity and a higher percentage base saturation than poor pastures. Total potash, however, did not correlate with condition of the pasture.

¶ "Soil Conservation in Indiana" by R. O. Cole, Purdue University Agricultural Extension Bulletin 128, revised, covers the subject in a practical and non-technical manner. The bad effects of erosion are clearly brought out and methods for controlling it are explained. The author has kept in mind the important fact that farmers have to make a living off their land and that soil conservation, while very important in the long run, must be adapted to the problem of making a profit from farming this year as well as 10 years from now. He shows how farmers can conserve their soils and grow a better crop in the present and also in the future.

¶ Two very useful special circulars on the management of soils have been issued by the Wisconsin Agricultural Extension Service. One of these is "Central Wisconsin Heavy Soils" by A. R. Albert and his co-workers at the Marshfield Branch Experiment Station. The other is "How to Manage Sandy Soil" by A. R. Albert. Both of these circulars contain practical information for farmers on how to manage, crop, lime, and fertilize their soils. The practices vary considerably on the two groups of soils.

On the heavy soils proper drainage must be provided and at the same time surface erosion must be controlled. Lime must be applied as needed, this being determined by the acidity of the soil and the crops to be grown. The kind and variety of crop selected should be adapted to the soil on which it is being grown and at the same time provide diversification and profitable returns to the farmer. It is suggested that legumes be grown on one-third to one-half of the plowed land since these provide high-quality feed and obtain nitrogen from the air. It is strongly suggested that the soil be tested for its lime requirement and also for its fertilizer needs.

As a general guide on the fertilization of the crop, 0-20-10 and 0-20-20 are suggested for grain and hay seedings with the rate of application 150 to 250 pounds per acre; for peas 0-20-20 or 0-20-10 at 175 to 200 pounds per acre if the preceding crop was a legume, otherwise 3-12-12, 3-18-9, or 2-12-6; while for soybeans the 0-20-10 and 0-20-20 are suggested. On the grass pastures and meadows a part of the area might well receive 200 to 300 pounds per acre of a quickly acting nitrogen fertilizer in the spring so as to produce some early pasturage. Nitrogen fertilizer should not be used on legume meadows. For corn 3-12-12, 3-18-9 or 2-12-6, at 75 to 200 pounds per acre depending on the method of application, is recommended. It is brought out that this small amount of fertilizer supplies only a part of the nutrient needs of the crop. The corn must obtain the major part of its nutrients from the fertility built up in the soil during a well-managed rotation.

On sandy soils the plow should be used sparingly. This can be accomplished by having a longer rotation with proper steps taken to establish alfalfa stands that are kept in for a number of years and by the use of the disk harrow for some of the operations. The diversification of crops is very important since in years of low rainfall a failure of some of the crops must be anticipated. Steps should be taken to reduce wind erosion by the use of windbreaks and by keeping the soil rough and covered. The author points out that sandy soils usually are not high in fertility to begin with and this is often still further reduced by improper management. Sandy soils frequently must have lime, phosphate, and potash added, with provision made to supply organic matter. Sometimes nitrogen also should be applied.

Great stress is laid on the growing of legumes, for which lime, phosphate, and potash are recommended. A legume may be grown in rye as a nurse crop, using about 250 pounds of 0-9-27 or 0-20-20. The alfalfa should be topdressed every 2 years with 200 to 500 pounds of 0-9-27. For soybeans 175 to 200 pounds per acre of 0-15-30 or 0-20-20 are recommended, with the caution given that the fertilizer should not be applied with the seed. For rye alone nitrogen along with phosphate and potash is beneficial. The equivalent of a 13-7-9 at the rate of 300 pounds per acre is used for this crop. For most of the vegetable crops and for corn in hills 3-12-12 is recommended. While the information in the two circulars was prepared primarily for Wisconsin farmers, all farmers living in the northern states can well consider the principles set forth and will find much information that can be applied to their own conditions.

"Soil Conservation in Indiana," Agr. Ext. Serv., Lafayette, Ind., Bul. 228, Jan. 1942, R. O. Cole.

"Soil Defense in Oklahoma, A Bibliography of Soil Conservation Publications," Agr. Exp. Sta., Stillwater, Okla., Cir. C-97, Apr. 1942, Kathryn Drake.

"Pasture Production as Affected by Type and Chemical Composition of the Soil," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 78, Dec. 1941, N. O. Price, W. B. Ellett, and H. H. Hill.

"Erosion and Related Land Use Conditions on the Box Elder Creek Project, Nebraska," U. S. D. A., Washington, D. C., Erosion Survey 22, 1941, H. C. Mortlock and R. D. Greenawalt.

Crops

¶ The agricultural program for the coming year calls for a large increase in canning crops, particularly tomatoes and peas. In order to help fulfill the goal set up under this program, Maryland, one of the most important canning States in the country, has issued pamphlets dealing with each of these crops. Popular Bulletin 1, of the Agricultural Experiment Station, "Greater Production of Tomatoes for Canning," by C. H. Mahoney and H. A. Hunter gives practical information on the growing of this crop. The types of soil best suited for tomatoes, where they should be grown in the rotation, the liming and fertilization of the crop on different soils, varieties, planting, transplanting, cultivation, and disease control all are briefly covered.

"Growing Peas for Canning," Extension Mimeograph No. 23, of the Maryland Extension Service and by the same authors, furnishes the same general type of information for peas. A similar type of publication on tomatoes is Oklahoma Experiment Station Miscellaneous Publication 5, "Production of Tomatoes for Canning in Oklahoma," by H. B. Cordner.

¶ The question of when and how to cultivate cotton has been investigated by the Mississippi Agricultural Experiment Station. The results of this work are reported in Technical Bulletin 29 of the Station, entitled "Weed Control and Cotton Tillage," by T. N. Jones, I. E. Hamblin and O. A. Leonard. They found that cotton had to be cultivated in order to control weeds, but too frequent or too deep cultivation reduced yields. Too great an interval between cultivations allowed weeds to get such a start that cultivation had to be very deep and thorough in order to control the weeds, and this often tended to reduce yields. About every 10 or 12 days was found to be the most desirable frequency of cultivation and except for the first one or two times through, the cultivation should be rather shallow since many of the feed roots are near the surface. A good, deep seedbed favored deeper rooting of the cotton, and under this condition there was less likelihood of root damage during cultivation. Fall and winter preparation of the seedbed gave higher yields than spring preparation and it was found that seedbed preparation had more effect on yield than did cultivation. This work was done on what is known as the Black Belt soils of the State and the results are directly applicable to these conditions, but cotton growers on other soils might well consider the facts brought out in this work.

¶ Again this month there are a number of bulletins dealing with gardens. There are so many of these that it is not possible to review them in detail, but particular attention is called to "Victory Gardens," Washington Extension Service Bulletin 180, by J. C. Snyder, L. G. Smith, and G. J. Harrar. This is put out in two editions, one for the farm and one for the town. Practical information on locating the garden, preparation of the soil, fertilization, time of planting, amount to plant, and pest control are given. Large applications of well-composted manure are recommended, and if this is not available, such fertilizers as 3-10-7, 5-10-10, and 3-10-10 at the rate of 500 to 800 pounds per acre are recommended. A large section of the bulletin is devoted to quite detailed information and directions on pest control. The town edition gives much the same information but in abbreviated form with fertilizer recommendation, for example, based on 1,000 square feet rather than an acre, and the information on pest control is very much reduced. These, and the other pamphlets listed this month and last month, are to be recommended to those who contemplate growing gardens under the Victory Garden Program.

¶ A good practical circular on potatoes has been prepared by J. G. Milward entitled "Potato Growing in Wisconsin," Wisconsin Agricultural Extension Service Circular 325. Varieties adapted to the State, preparation of the seedbed, method of planting, fertilization, cultivation, insect and disease control, and harvesting are briefly covered. Seed cutting and treatment are given particular attention as is also fertilization. It is stated that popular fertilizers for growers on upland soils are 3-9-18 and

3-12-12, while muck soil should receive 0-9-27 when growing this crop.

¶ The greatly increased demand for oils as a result of interruption of imports and increased use due to war activities has led the Department of Agriculture to place a goal of about five million acres of peanuts for the coming year. This is about two and one-half times the acreage planted last year. Practically all this increase should be put in the oil-producing varieties if the goal is to be met. Such a large increase in acreage means that many farmers who grew very few or no peanuts in the past will probably make peanuts an important enterprise on their farms this year. To supply information needed by these newer growers and to help other growers increase their efficiency of production, a number of circulars on peanut growing have been prepared by experiment stations in the South. In the list this month are circulars from North Carolina, South Carolina, and two each from Georgia and Mississippi. All of these have been written to supply practical information for the grower and cover soil adaptation, lime requirement, varieties, planting, fertilizing, cultivation, diseases, harvesting and curing.

There probably is no crop grown in the country on which there is such diversity of opinion as to proper fertilization. Experimental data on response of the crop to fertilizers also are confusing. As a result almost every type of conceivable fertilization is practiced and some practices almost approach the inconceivable. Out of the information at hand, however, it would appear as though there can be general agreement on a number of factors which should help in determining the proper fertilization. There seems to be but little doubt that peanuts have a high calcium requirement. In most sections this is met by applying ground limestone or some other lime material; in other sections gypsum or land plaster is rather commonly used. Many investigators have found that when peanuts are grown in a rotation of crops that are generously fertilized, the peanuts themselves do not respond so much to fertilization. This is particularly true so far as yield is concerned, although the quality even under these conditions is likely to be better if fertilizer is applied to the peanuts. There is also general agreement that peanuts make a heavy drain on the fertility of the soil, especially if the nuts are grown for oil and the hay is fed. Thus crops following peanuts frequently do poorly unless the peanuts are well fertilized. Under these conditions a fertilizer high in phosphate and potash is advisable and little or no nitrogen may be needed. When peanuts are grown in a rotation in which the previous crop was not well fertilized, the peanuts themselves usually respond to fertilization. On moderately fertile soil a phosphate-potash combination may be satisfactory although on poor soil some nitrogen fertilizer also is recommended.

¶ Soybeans also are receiving attention as an oil-producing crop. To supply information on the growing of this crop, Extension Circular 256 has been issued by the North Carolina Agricultural Extension Service. This was prepared by J. A. Rigney and E. R. Collins and is entitled "Growing Soybeans in North Carolina." For the fertilization of soybeans on Coastal Plains soils it is recommended that 200 to 300 pounds of fertilizer such as 0-8-8, 2-10-6, and 0-8-16 be used on soils with medium to high fertility, while on soils with lower fertility 2-10-6, 3-8-6, 3-12-6, or 2-8-10 should be used. On the Piedmont and mountain soils 0-10-6, 2-10-6 and 3-12-6 are recommended.

¶ As a part of its contribution to the war effort of the country, our agriculture has been called upon to furnish greatly increased amounts of dairy products during the coming year. Obviously only a small part of this increase can come from new producing units, since a cow cannot be produced in six months. The answer to the problem lies largely in more efficient handling of the livestock we already have so that they will produce more. Probably the most important single item in increasing the efficiency of live-stock production is improvement in pasture utilization. It has been shown time and again that a well-managed pasture will produce high quality feed at the lowest cost and with the least expenditure of labor. How pastures can be better utilized either by improving those already established or by making new pastures is shown in a very interesting and significant publication, "Pasture Culture in Massachusetts," by W. G. Colby, Massachusetts Agricultural Experiment Station Bulletin 380. A great deal of background material is given by the author so that present practices and reasons for them can be better understood. The soils are first considered from the viewpoint of their origin, formation, and early treatment. It is brought out that Massachusetts soils do not have the large reserves of natural fertility that soils in some other sections possess. They naturally tend to be acid in reaction, and are deficient in nitrogen, calcium, potassium, magnesium, and to a lesser degree in phosphorus. While the soils may not be naturally over-fertile, with proper handling they can be made very productive.

The early settlers found that the initial productiveness of the soil soon decreased. Sometimes they would seek out other soils, but as the settlements became more densely populated other measures had to be employed. These involved the use of manure and certain other fertilizer materials or amendments, particularly wood ashes and gypsum, with occasionally bone fertilizer and guano being used. These treatments usually were given to the more intensely cultivated areas, with little or no attention being paid to grasslands. The constant pasturing and removal of the fertility of the grasslands tended to lower their productiveness so that fewer animals could be maintained. This resulted in less manure being produced so that there usually was never any left over for application to pasture land. The constant transference of fertility from the pasture to the plowed areas accelerated depletion of fertility of the pastures. A few early and very successful attempts at pasture improvement by some outstanding farmers were reported, but in general there was little attention given to improving grassland.

With present-day knowledge of how to improve pastures and with fertilizer materials available, there is little excuse for such large areas of unproductive pastures as still exist. The author points out that the secret of successful production on pastures or anywhere else is having all factors necessary for high production provided in proper balance to each other. First of all, if the soil is too thin and too poor to support a good growth, no attempt should be made to pasture it at all. Such lands should revert to forests. Thus a pasture should be tillable and the author brings out that the old type of permanent pasture is largely a thing of the past, or at least it should be under efficient management. The modern pasture should be of a semi-permanent type, land which will be in pasture for a number of years and then plowed and reseeded to pasture or seeded to other crops for a year or two. Such a system permits a closer control of the type of plant in the pasture so as to maintain a sod composed of the more desirable forage plants.

Proper attention must be paid to improving the soil with treatments as needed. Usually lime in amounts sufficient to correct soil acidity and provide available calcium is the first thing needed. Potash is usually the next limiting element in Massachusetts, but phosphate also is needed so that after lime, a phosphate-potash fertilization should be applied. On some infertile soils, nitrogen also will be needed to get the pasture started although when soil has been properly built up and a good sod established, the nitrogen should be supplied by the legumes in the pasture. More recently other nutrients, particularly boron and magnesium, are likely to be needed on many of the soils, especially if some of the more desirable legumes are to be grown. Top-dressing with lime, phosphate, and potash is recommended in order to maintain the fertility of the pastures and promote the growth of desirable forage plants. Good seed mixtures and the management of the grazing so as to utilize the forage produced also are discussed by the author.

"Better Farming in 1942," Agr. Ext. Serv., Auburn, Ala., Cir. 225, Feb. 1942.

"Cooperative Potato Projects in Ontario; Progress Report 1941," Ont. Dept. of Agr., Ottawa, Canada.

"Soybeans for Delaware Farms," Agr. Ext. Serv., Newark, Del., Mimeo Cir. 14, Feb. 1942, C. E. Phillips.

"Ground Covers for Florida Gardens," Agr. Exp. Sta., Gainesville, Fla., Bul. 364, Nov. 1941, J. M. Crevasse, Jr.

"Some Analytical Studies of the Perisian Lime," Agr. Exp. Sta., Gainesville, Fla., Tech. Bul. 368, Feb. 1942, S. J. Lynch.

"Factors Affecting Peach Tree Longevity in Georgia," Agr. Exp. Sta., Experiment, Ga., Bul. 219, Mar. 1942, E. F. Savage and F. F. Cowart.

"Peanut Culture in Georgia," Agr. Ext. Serv., Athens, Ga., Bul. 490, Feb. 1942, E. D. Alexander.

"Peanut Production in the Coastal Plain Area of Georgia," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 9, Feb. 1, 1942.

"Establishing Bermudagrass," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 10, Feb. 1, 1942.

"Soybeans," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 11, Feb. 15, 1942.

"Home Garden for the Coastal Plain of Georgia," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 12, Mar. 5, 1942.

"Growing Lettuce from Seedlings," Agr. Ext. Serv., Honolulu, T. H., Cir. 143, Jan. 1942, Ashley C. Browne.

"Ten Points on Potato Growing," Agr. Ext. Serv., Urbana, Ill., Ve-2, Jan. 1942, Lee A. Somers.

"Spring Oat Varieties for Illinois," Agr. Exp. Sta., Urbana, Ill., Bul. 481, Jan. 1942, George H. Dungan, O. T. Bonnett, and W. L. Burlison.

"Illinois Corn Performance Tests, 1941," Agr. Exp. Sta., Urbana, Ill., Bul. 482, Feb. 1942, R. R. Copper, G. H. Dungan, A. L. Lang, J. H. Bigger, Benjamin Koehler, and Oren Bolin.

"Spring Wheat—Adaptability for Illinois," Agr. Exp. Sta., Urbana, Ill., Bul. 483, Feb. 1942, G. H. Dungan and W. L. Burlison.

"Spring Barley," Agr. Exp. Sta., Urbana, Ill., Bul. 485, Apr. 1942, G. H. Dungan and W. L. Burlison.

"Growing Fruit for Home Use," Agr. Ext. Serv., Urbana, Ill., Cir. 524, Mar. 1942, Victor W. Kelley.

"Pasture for Cheap Gains and Healthy Hogs," Agr. Ext. Serv., Lafayette, Ind., Leaf. 226, M. O. Pence and C. M. Vestal.

"A Study of Some Factors Affecting the Yield and Market Value of Peppermint Oil," Agr. Exp. Sta., Lafayette, Ind., Bul. 461, June 1941, N. K. Ellis, K. I. Fawcett, F. C. Gaylord, and L. H. Baldinger.

"Forage Sorghums for Indiana," Agr. Exp. Sta., Lafayette, Ind., Agron. Mimeo. 15, Rev. Dec. 1941, R. R. Mulvey.

"1941 Report of the Muscatine Island Field Station," Agr. Ext. Serv., Ames, Iowa, FG-558, Victor E. Hollar.

"Kansas Corn Tests, 1941," Agr. Exp. Sta., Manhattan, Kans., Bul. 299, Jan. 1942, A. L. Clapp, R. W. Jugenheimer, H. D. Hollembeak, and J. H. Lonnquist.

"Korean Lespedeza in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 210, Dec. 1941, Kling L. Anderson.

"The Hot Water Treatment of Sugarcane," Agr. Exp. Sta., University, La., Bul. 336, Feb. 1942, C. W. Edgerton, I. L. Forbes, P. J. Mills, Jean Dufrenoy, and W. J. Luke.

"Report of Progress for Year Ending June 30, 1941," Agr. Exp. Sta., Orono, Maine, Bul. 405, June 1941.

"Greater Production of Tomatoes for Canning," Agr. Exp. Sta., College Park, Md., Pop. Bul. 1, Apr. 1942, C. H. Mahoney and H. A. Hunter.

"Growing Peas for Canning," Agr. Ext. Serv., College Park, Md., Mimeo. 23, Apr. 1942, C. H. Mahoney and H. A. Hunter.

"Highlights of the Work of the Mississippi Experiment Station—Fifty-fourth Annual Report for the Fiscal Year Ending June 30, 1941," Agr. Exp. Sta., State College, Miss.

"Weed Control and Cotton Tillage," Agr. Exp. Sta., State College, Miss., Tech. Bul. 29, Dec. 1941, T. N. Jones, I. E. Hamblin, and O. A. Leonard.

"Mississippi's Food for Freedom Goal 1: 130,000 Acres of Peanuts for Oil," Agr. Ext. Serv., State College, Miss., Cir. 1, Feb. 1942, J. M. Weeks and J. F. O'Kelly.

"Mississippi's Food for Freedom Goal 2: 250,000 Acres of Soybeans for Grain," Agr. Ext. Serv., State College, Miss., Cir. 2, Feb. 1942, J. F. O'Kelly and J. M. Weeks.

"Peanuts for Victory," Agr. Ext. Serv., State College, Miss., J. M. Weeks.

"Selecting Fruit Varieties," Agr. Exp. Sta., Columbia, Mo., Bul. 437, Nov. 1941, T. J. Talbert and A. D. Hibbard.

"Growing Good Crops of Oats in Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 439, Jan. 1942, J. M. Poehlman.

"Varieties of Vegetables for 1942," Cornell Univ. Agr. Ext. Serv., Bul. 476, Feb. 1942, Paul Work.

"Peanut Production in North Carolina," Agr. Ext. Serv., Raleigh, N. C., Cir. 257, Apr. 1942.

"Tomatoes for Oklahoma Gardens," Agr. Exp. Sta., Stillwater, Okla., Cir. C-98, Mar. 1942, H. B. Cordner.

"Better Wheat for Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Cir. C-99, Mar. 1942, Horace S. Smith.

"1941 Report, Cotton Variety Tests in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., MP-4, Apr. 1942, H. E. Dunlavy, I. M. Parrott, F. W. Self, and E. Hixson.

"Production of Tomatoes for Canning in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., MP-5, Mar. 1942, H. B. Cordner.

"Legume Silage in Dairy Feeding," Agr. Exp. Sta., State College, Pa., Bul. 411, Apr. 1941, S. I. Bechdel, R. W. Stone, P. S. Williams, and F. R. Murdock.

"Peanuts for Victory," Agr. Ext. Serv., Clemson, S. C., Cir. 203, Jan. 1942, H. A. Woodle.

"The Cotton Contest—1941; for Better Yield and Staple Value," Agr. Ext. Serv., Clemson, S. C., Cir. 205, Feb. 1942.

"The Corn Contest—1941," Agr. Ext. Serv., Clemson, S. C., Cir. 206, Mar. 1942.

"The Virginia Farm Victory Garden," Agr. Ext. Serv., Blacksburg, Va., Cir. E-356.

"Fiber Flax in Western Washington," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 166, Mar. 1942, E. G. Schafer.

"Fifty-first Annual Report for the Fiscal Year Ended June 30, 1941," Agr. Exp. Sta., Pullman, Wash., Bul. 410, Dec. 1941.

"Lawns for Western Washington," Western Wash. Exp. Sta., Puyallup, Wash., Mimeo. Cir. 44, Apr. 1942, Maynard S. Grunder.

"Better Pastures—More Milk," Agr. Ext. Serv., Pullman, Wash., Ext. Cir. 42, Mar. 1942, Leonard Hegnauer.

"Victory Gardens," Agr. Ext. Serv., Pullman, Wash., Bul. 280, Farm and Town Editions.

"Washington 4-H Clubs Work for Victory," Agr. Ext. Serv., Pullman, Wash., 4-H Cir. 59, Mar. 1942, Charles T. Meenach.

"Pastures—West Virginia's Most Important Crop," Agr. Ext. Serv., Morgantown, W. Va.

"Planting Forest Trees," Agr. Ext. Serv., Morgantown, W. Va., Cir. 330, Mar. 1941, R. B. Smith and Jack Byers.

"4-H Progressive Farmer Project," Agr. Ext. Serv., Morgantown, W. Va., R. J. Friant.

"Potato Growing in Wisconsin," Agr. Ext. Serv., Madison, Wis., Cir. 325, Mar. 1942, James G. Milward.

"A Home Garden on Every Farm," Agr. Ext. Serv., Madison, Wis., Cir. 329, Jan. 1942, James G. Moore and O. B. Combs.

"Put Pastures to Work," Agr. Ext. Serv., Madison, Wis., Cir. 330, Feb. 1942, F. V. Burcalow and H. L. Ahlgren.

"Pastures Suggestions for April—Keep 'em Eating," Agr. Ext. Serv., Madison, Wis., H. R. Lathrope.

"Strawberry Culture, Western United States," U. S. D. A., Washington, D. C., Farmers' Bul. 1027, Rev. Nov. 1941, George M. Darrow and George F. Waldo.

"The City Home Garden," U. S. D. A., Washington, D. C., Farmers' Bul. 1044, Rev. Feb. 1942, W. R. Beattie.

"Growing Alfalfa," U. S. D. A., Washington, D. C., Farmers' Bul. 1722, Rev. Nov. 1941, H. L. Westover.

"Experiments with Annual Crops and Permanent Pastures to Provide Grazing for Dairy Cows in the Sandhill Region of the Southeast," U. S. D. A., Washington, D. C., Tech. Bul. 805, Nov. 1941, E. W. Faires, J. R. Dawson, J. P. LaMaster, and G. H. Wise.

"The Amazon Basin Brazil Nut Industry," U. S. D. A., Washington, D. C., For. Agr. Rept. 4, Jan. 1942, Walter R. Schreiber.

"Some Landmarks in the History of the Department of Agriculture," U. S. D. A., Washington, D. C., Agr. History Ser. 2, Jan. 1942, T. Swann Harding.

"The Naturalization of Roadbanks," U. S. D. A., Washington, D. C., Tech. Note 51, Feb. 1, 1942, C. R. Hursh.

"Nutritional Science and Agricultural Policy," U S. D. A., Washington, D. C., Ext. Serv. Cir. 376, Jan. 1942, M. L. Wilson.

"Extension's Job in the War," U. S. D. A., Washington, D. C., Ext. Serv. Cir. 381, Mar. 1942, J. E. Carrigan.

Economics

¶ The South Carolina Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture, Bureau of Agricultural Economics, has recently published an interesting new Bulletin No. 339, "Attitudes of Edgefield County Farmers Toward Farm Practices and Rural Programs." The study is somewhat different from the usual type of social economic surveys in that it is an attempt to analyze the attitudes and values of farmers in relation to a selected group of agricultural programs and proposals. The study was conducted in Edgefield County because the farmer members of the County Agricultural Planning Committee had made a request for information that could be obtained only through field research. The field interviewing was begun in the fall of 1940, but the bulletin is based largely on the results of the work conducted during the spring and summer of 1941.

The success or failure of group programs, either Federal or State, depends largely upon farmer cooperation, and unless agricultural workers are informed with respect to farmer attitudes and the reasons for their thinking, the value of the work is likely to be severely lessened.

In this particular study the following 14 different programs were studied: Live-at-home, terracing, old-age assistance, school buses, conservation payments, winter cover crops, CCC programs, seed loans, cotton allotments, tenant loans, forest purchase, recreational programs, county agricultural planning, and transfer of cotton allotments.

In general the opinions of farmers were more definite on the issues which they understood best. For example, in the case of the live-at-home program 93.9% approved with only 5.5% neutral and only .6% disapproving. In the case of county agricultural planning, only 37.4% approved, whereas 52.2% were neutral and 10.4% disapproved. The approval of the different programs varied from 93.9% with respect to the live-at-home program down to 31.3% on the transfer of cotton allotments.

In the case of county agricultural planning, which produced the greatest number of undecided opinions, it appears that farmers are willing to give the committees a chance to see what they can do.

In this connection it is pointed out that since first impressions are likely to be lasting, it is important that the early proposals of such planning committees shall be of a type that will arouse the least controversy and enjoy most universal approval. It is essential that planning committees receive almost universal approval because in the future it can be expected that farmers will turn to such committees for leadership on problems concerning which there is a sharp difference of opinion as to the desirable course of action.

The conclusion with respect to demonstrations was particularly interesting. In this connection it is pointed out that demonstrations seem to lose some of their effectiveness if the farm on which the demonstration is located is considered by the neighboring farmers to represent a soil type different from their own or a combination of farm enterprises which they do not follow. It is particularly important that demonstrations not be located on farms considered by neighboring farmers to have any advantages over the existing conditions under which they are compelled to farm.

The authors have made many interesting comments with respect to approval or sound opposition with respect to the various programs. It should prove interesting reading to all those concerned with Southern agriculture.

"Avocado Production Cost Analysis, Orange County, 1941," Agr. Ext. Serv., Berkeley, Calif.

"Canadian Agriculture and the War," Dom. Dept. of Agr., Ottawa, Ont.

"Principal Methods of Share Renting and Compensation for Unexhausted Improvements in Four Type-of-farming Areas in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 464, Jan. 1942, O. G. Lloyd, H. S. Morine, Jr., and J. R. Hays.

"New Settlement Problems in the Northeastern Louisiana Delta," Agr. Exp. Sta., University, La., Bul. 335, Feb. 1942, P. E. Jones, J. E. Mason, and J. T. Elvove.

"Factors Affecting Profits from Dairy Herds," Agr. Exp. Sta., University, La., Bul. 338, Feb. 1942, D. M. Seath and E. W. Neasham.

"Ranch Organization and Operation in Northeastern Nevada," Agr. Exp. Sta., Reno, Nev., Bul. 156, Nov. 1941, G. Alvin Carpenter, Marion Clawson, and C. E. Fleming.

"The New York State 1942 Agricultural Outlook," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 472, Jan. 1942.

"Attitudes of Edgefield County Farmers Toward Farm Practices and Rural Programs," Agr. Exp. Sta., Clemson, S. C., Bul. 339, Feb. 1942, M. T. Matthews, D. R. Jenkins, and R. F. Sletto.

"Virginia's Marginal Population—A Study in Rural Poverty," Agr. Exp. Sta., Blacksburg, Va., Bul. 335, July 1941, W. E. Garnett and A. D. Edwards.

"Economic Conditions and Problems of Agriculture in the Yakima Valley, Washington: Part III. Fruit Farming," Agr. Exp. Sta., Pullman, Wash., Bul. 409, Oct. 1941, E. B. Hurd, C. P. Heisig, M. Clawson, H. F. Hollands, and B. H. Pubols.

Potash Extends the Life of Clover Stands

(*From page* 19)

That brings us to the matter of hay yields. From the dairyman's viewpoint these are important. In the following table all the yields are compared with those of the check plots which are rated at 100, and the data are for the 4-year average on this series of plots, 1938 to 1941, inclusive:

Treatment	*% of check*
Check	100
Superphosphate	99
Potash	179
Phosphate and potash	279
Complete fertilizer	307
Lime, 1 ton	98
Lime and phosphate	106
Lime and potash	196
Lime, phosphate and potash	286
Lime and complete fertilizer	303

The amounts of fertilizer used were 125 pounds of 60% muriate of potash, 400 pounds of 20% superphosphate and 100 pounds of nitrate of soda, all top-dressed annually in all treatments in which these materials were applied. Lime was not used in 1937, but the lime which was added had been applied in 1929. Manure was applied to all plots uniformly in 1936, during which year the land was in corn.

The tremendous response for potash is indicated by its comparative yield of 179. The curious minded may be interested in actual yields, which may be obtained by multiplying the percentages given by 1.145, which was the yield in tons of the check or untreated plots. Even more remarkable perhaps is the jump in yield to 279 when superphosphate and potash were used together. Nitrogen added to the superphosphate and potash (in the complete fertilizer) further increased the yield to 307.

Perhaps this is an unusual soil in the way it responds. As a matter of fact legumes have always responded very well to potash here, but they have also on other soils in New Hampshire where similar tests have been run. The chief difference brought out in our tests isn't the difference in potash response but in the response to superphosphate which has usually run higher in other tests than it did in this case. In all of our tests, however, potash appears to have a greater effect on persistence of legumes, whether clovers or alfalfa, than either lime or superphosphate.

Since an increased production of dairy products is of prime importance at this time, and since nitrogen is limited, our best bet appears to foster the production of legumes with ample potash. This can partly be done with manure. But the manure must be carefully protected so that its fertilizing value will be preserved since its potash content is very susceptible to leaching and washing away before it is applied. On fields such as the one here described, it is doubtful if manure can or should be used in amounts sufficient to supply all of the available potash that legumes require, even if it gets to the field with its full potash quota.

As a matter of fact, the response in hay yields to manure has fallen off quickly in this and other tests which we have conducted. The effect of manure used as a variable in the experiment in question was practically gone at the end of two years, and manure had no effect on clover longevity. This fact, coupled with the results of soil tests on these plots which show no accumulation of available potash even with annual top-dressings, leads us to believe that any available potash in manure is quickly rendered insoluble after its application by being fixed in the soil in some exchange complex. Unless manure is used, then, as an annual top-dressing or unless potash is applied annually, clovers are destined to go out.

Farmers often have reported that topdressing an old hayfield with manure brings in clover, and have wondered why clover has appeared after an application of manure. We have always casually explained this phenomenon by saying that probably the manure carried clover seeds which had passed through the digestive tracts of the animals. Maybe that is a partial explanation, but after studying the results of the above experiment we are inclined to ascribe more credence to the idea that clover has come into the stand in these instances because manure temporarily raised the potash level of the soil.

There is a nitrogen shortage. There is always a deficiency of *good* cow hay in New England. This seems to be a good time to let potash "pinch-hit" for nitrogen by using more of it or taking better care of manure to grow more clovers. Farmers who find that their soils respond to potash, as this one does, and capitalize on that fact, will certainly be well repaid during the next few years by harvesting better hay with more clover in it and thereby adding to the nitrogen supply of the farm.

Legumes Will Furnish Needed Nitrogen

(*From page* 22)

the Soil Conservation Service in 1939 and cooperatively by the Alabama Experiment Station and the Soil Conservation Service in 1940 and 1941 served to confirm the earlier results obtained at Auburn. Trials conducted on farms in various parts of Alabama resulted in an increase of approximately 20 bushels of corn per acre following kudzu. Most of these trials were on land where yields of corn were extremely low before kudzu was planted. In general, farmers have been unwilling to plant kudzu on any except the most severely eroded portions of their farms.

Where cultivation of corn was limited to that necessary for weed control, a sufficient number of living plants were left to restore the stand of kudzu by the end of the growing season. Usually the stand recovered sufficiently to furnish a cutting of hay the year after corn was grown. Both recovery of stand and growth of plants were influenced by soil conditions. On areas where a considerable portion of the topsoil remained, recovery was rapid; whereas, on severely eroded, galled areas, recovery was not sufficient for a hay crop to be cut the year after corn was grown.

Lespedeza sericea has been used for soil improvement to only a limited extent, but results have shown that this deep-rooted perennial has great possibilities.

At the West Tennessee Agricultural Experiment Station at Jackson, sericea was planted in the spring of 1930 on land that normally produced 25 to 30 bushels of corn per acre. Seed or hay was harvested each year. Beginning in 1933 and each year thereafter two 1/40-acre plots of sericea stubble were turned and planted to corn. Corn has been planted on all plots each year since. Thus, it has been possible to study the immediate effect of sericea on corn yields and the residual effect through the ninth crop after sericea stubble was turned.

Sericea Increased Yields

Results of this experiment as reported at the Southern Association of Agricultural Workers at Memphis, Tennessee, in February 1942, by Ben P. Hazlewood, Station Superintendent, showed that the average yields in bushels per acre for the different years after sericea stubble was turned were: 9 first-year crops 70; 8 second-year crops 65; 7 third-year crops 59; 6 fourth-year crops 52; 5 fifth-year crops 46; 4 sixth-year crops 39; 3 seventh-year crops 33; 2 eighth-year crops 32; and 1 ninth-year crop 26.

Several cases have been observed where farmers plowed areas on which lespedeza sericea was growing and planted corn. Increases in corn yields have been comparable to those obtained where corn followed kudzu. These increases have been obtained on land that had been severely eroded and was consequently in a low state of productivity when planted to sericea.

On much of the steep, eroded cropland in the South, it will be a slow and expensive process to restore a high level of soil fertility through the use of annual crops. It will be necessary to rehabilitate these soils under a cover of deep-rooted perennial legumes. After fertility has been restored under such a cover, annual legumes will be valuable in maintaining a high level of soil fertility.

In addition to soil fertility and degree of erosion, the slope and soil type have an important bearing on the kind of vegetation required to build and maintain a satisfactory level of fertility. On moderate slopes, where favorable soil types occur, annual and biennial legumes, particularly when grown in mixtures with grasses, are usually adequate for erosion control and for the maintenance of a satisfactory level of fertility, provided the land is sufficiently fertile to grow these crops satisfactorily. On steeper slopes and on soil types that are highly erodible, deep-rooted perennials will be useful in building up a satisfactory level of fertility and also for reducing erosion to a sufficient degree to maintain the soil in a productive state.

Although little has been said here about soil treatments required by the various legumes, it is generally understood by farmers and agricultural leaders that sufficient lime and fertilizer must be applied before satisfactory growth of legumes can be expected. It is necessary to give sufficient soil treatment to insure satisfactory growth if an adequate supply of nitrogen is to be expected.

Lack of seeds and plants will limit the acreage of many legumes during the war period unless definite steps are taken to produce and harvest the supplies needed. It is, therefore, of utmost importance that seed and plant production patches of adapted legumes be

Nitrogen from a crop of crotalaria that was turned under helped produce an excellent crop of corn on this North Carolina farm.

established on every farm. Although the total quantities of seeds and plants that would be required to plant the acreage of legumes needed in the South are almost inconceivably large, the quantities needed on each farm could be grown on a relatively small percentage of the cropland. Of equal importance with production will be the development of the habit of harvesting seeds and plants. When we become as conscious of the value of lespedeza, crimson clover, crotalaria, and other crop seeds as we are of the last scattered bolls of seed cotton, most farmers will find a way to get sufficient seed harvested to meet the needs of their own farms.

If we in the South take full advantage of the information that is available, we can, through the simple medium of legumes, draw upon the inexhaustible store of atmospheric nitrogen which the Master Builder of the Universe so wisely placed within the reach of all to use, but beyond the power of any to control. We may thereby produce in abundance the food and fiber crops required in the struggle to restore order in the world, and in so doing build for ourselves a safer and more profitable post-war agriculture.

Soil Bank Investments Will Pay Dividends

(*From page* 9)

the legume seedings the first year. Potash also seems to give greater vigor to the new seedings which aids in withstanding severe winters.

It would appear, therefore, that the indirect effect of both phosphate and potash in the establishment of deep-rooted, healthy legume seedings is as much responsible for increases in the yield of hay the second year as is the actual plant food supplied.

On the dairy farm where small grain, legumes, and corn are grown in rotation, we recommend that fertilizers be applied at the time of seeding down to legumes. We have been urging Wisconsin farmers to replace their old grain drills with the new combination fertilizer drills which sow grain, fertilizer, and grass seed all in one operation. Thousands of Wisconsin farmers are now equipping themselves with these new combination drills or attachments for their old drills. We point out that larger increases in yield of grain are usually secured where the fertilizer is applied in direct contact with the seed at the time of seeding. Manufacturers of grain drill equipment tell us that more than 95% of all new drills sold in Wisconsin the past two years are the combination fertilizer type.

For years farmers in Wisconsin have applied small amounts of fertilizer with attachments on their corn planters. The 3-18-9, 4-16-4, or 3-12-12 mixtures are recommended for corn at rates of from 90 to 125 pounds per acre. This small amount of fertilizer, drilled or checked with the corn at the time of planting, results in stronger and more vigorous growth in the early part of the season, advances maturity in the fall, and increases the yield and improves feeding quality of the corn. Wisconsin, of course, is situated in a northern latitude with a short growing season. We frequently experience periods of cool weather following corn planting, and thus the benefits from hill application of fertilizer containing nitrogen are greater than may be expected in states farther south.

While Wisconsin farmers have for many years used some commercial fertilizer on special crops such as canning peas, sugar beets, onions, and potatoes, the more general use of fertilizers on small grain and seedings of clover and alfalfa on the dairy farms is a practice which we are recommending. We advise farmers that the application of from 200 to 300 pounds of commercial fertilizer per acre at the time of seeding down to clover and alfalfa and repeated every rotation will gradually build up the fertility of the farm as a whole. Larger yields of grain and better crops of alfalfa and clover will add to the home-grown feed supply, will cut feed costs, and will increase the possible livestock-carrying capacity of our farms.

There never has been a period in history when the opportunity for the profitable use of commercial fertilizer in Wisconsin was as great as it is right now. A program of liberal fertilization of all feed and food crops is recommended. The generous application of commercial fertilizers will not only contribute to our Food for Freedom effort and give us a liberal return on the investment, but at the same time we will be building up reserves of plant food in our greatest national bank of potential wealth, the soil.

Purpose and Function of Soil Tests

(*From page* 16)

tions. The success of soil testing lies in the complete understanding of these limitations. There is no doubt that, within certain reasonable limits, they will afford much useful information relative to the supply of available plant nutrients. In addition, they can be employed to detect the presence of toxic elements, such as aluminum. They give, beyond doubt, a clear differentiation between soils of high nutrient level and those of low nutrient level. One of the most important uses of these tests today lies in the detection of low levels of any given nutrient. In some cases only one or two elements may be low, and in others an extremely unbalanced condition may exist. This type of information is useful in determining the nature of soil amendments and management practices to be followed.

When rapid soil tests are viewed from the standpoint of their value and use in the hands of properly qualified personnel, there is little that can be said today to discourage their use. Within the past decade these tests have rendered a tremendous service to farmers in many states. In the future, in view of constant improvements in methods, more complete standardization, and increased experience in interpreting and applying the results, the benefits to agriculture should be increasingly greater.

Nutritional Information from Plant Tissue Tests

(*From page* 13)

phosphorus in 52%, and potassium in 24% of the cases. In 86% of the cases plant growth was restricted by at least one of the three elements studied.

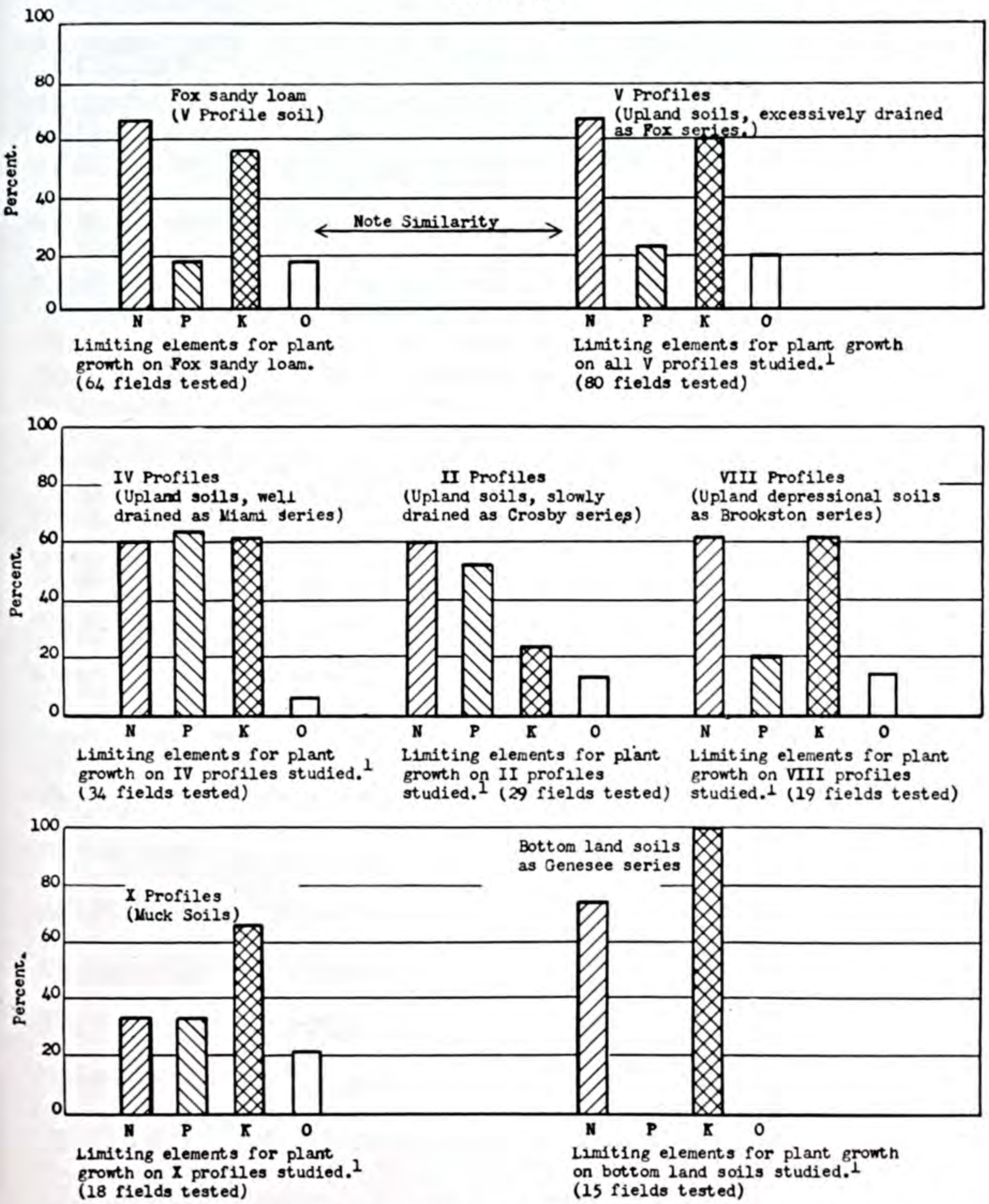
Field tests indicated that nitrogen, phosphorus, and potassium were needed for the crops on 2 fields, nitrogen and potassium on 4, phosphorus alone on 6, potassium alone on 2, and nitrogen and phosphorus on 5.

In the "VIII" profile group of soils consisting of Brookston silty clay loam, Westland loam, Ragsdale loam, and Washtenaw silt loam, nitrogen was one of the limiting factors in 63% of the cases. This fact is somewhat startling as it was previously thought that these soils, dark on the surface, or high in organic matter, usually carried sufficient available nitrogen for maximum plant growth. Phosphorus was one of the limiting factors in 20% of the cases and potash in 63%. Here it seems that the first nutrient deficiences were nitrogen and potassium to about the same extent.

From previous chemical analysis [5] it was found that many group VIII soils had 30,000 pounds of potassium per acre in the surface 6 to 7 inches. Evidence, therefore, indicates the availability of a nutrient is of greater importance than the total supply in the soil. With the high-yielding soils, as represented by groups VIII, X, and bottom lands, the available supply of nitrogen and potassium seems to be

[5] *See Soil Survey publication of Vermillion and Rush Counties, Indiana.*

Percentage Deficiencies of Nitrogen, Phosphorus, and Potassium, as Well as No Deficiencies of These Plant Nutrients, in Certain Indiana Soil Groups as Found by Plant Tissue Tests of General Field Crops.



[1]The soil types studied for the various graphs are listed in their respective soil drainage groups.

limited in spite of the large supply within these soils.

On all the crops studied on the soils of the VIII profile group, it was found that the plant growth was limited in 85% of the cases by one or more of the three elements studied, or only 15% of the crops were receiving a balanced diet in sufficient quantities. Tests indicated that nitrogen, phosphorus, and potassium were needed by the crops on 2 fields, nitrogen and potassium on 13, and phosphorus alone on 2.

In the "X" profile group of soils, Carlisle muck, Edwards muck, muck over sand, and Walkill silt loam [6] nitrogen was one of the limiting factors in 33% of the cases. Here again the presence of a large amount of organic matter did not supply the plants with sufficient nitrogen for optimum plant growth. As is commonly recognized, potassium was deficient as a nutrient on most of these mucky soils. Nitrogen and phosphorus were deficient in about half as many cases as potassium, and both nitrogen and phosphorus in 33% of the cases. Muck farmers lead all others in supplying all the elements needed by a crop, still they had many cases of insufficient nutrition. Muck soils are generally considered very fertile, but nevertheless 78% of the crops studied showed a deficiency of one or more of the three elements, or only 22% were receiving adequate balanced nutrition.

With the 12 muck soils studied, a deficiency of both nitrogen and potassium was limiting plant growth on 4 fields, potassium alone on 4, both phosphorus and potassium on 2, and both nitrogen and phosphorus on 2.

On bottom land soils, which are represented by Genesee silt loam, Genesee loam, and Eel silty clay loam, it was found that nitrogen was one of the limiting factors in 73% of the cases. In no case was phosphorus one of the first limiting factors, while potassium was one of the limiting factors in 100% of the cases. Therefore, the prime nutrient deficiency on these bottom land soils seems to be only potassium and nitrogen in this respective order. In no case were the crops receiving adequate balanced nutrition. On bottom soils the moisture supply is conducive to producing large crops. This may cause even a fairly high supply of a nutrient to become a limiting factor in production. Yields can be increased if more of the relatively deficient nutrient is supplied.

On the bottom lands, 11 fields indicated nitrogen and potassium were both limiting corn production, and potassium alone in 4 cases. This evidence seems to challenge the belief that fertilizers need not be used on bottom land soils.

[6] *Walkill silt loam was included in this group as it is underlain by muck.*

Summary

Purdue plant tissue tests were made on different crops growing in 195 fields on 26 different soil types in order to get additional diagnostic nutritional information on the soil types and to obtain current information which could be passed on to the farmer as an aid to his fertility program.

On the second bottoms, or V profile soils, nitrogen was limiting plant growth in 68%, potash in 60%, and phosphorus in 24% of the cases.

On the light colored, rolling, central Indiana upland soils, nitrogen was limiting plant growth in 60%, phosphorus in 64%, and potash in 62% of the cases.

On the level, light colored upland soils of central Indiana, nitrogen was limiting plant growth in 60%, phosphorus in 52%, and potash in 24% of the cases.

On the dark, depressional soils, nitrogen was limiting plant growth in 63%, potash in 63%, and phosphorus in 20% of the cases.

On the muck soils, potash was limiting plant growth in 66%, nitrogen in 33%, and phosphorus in 33% of the cases.

On the first bottom soils, potash was limiting corn growth in 100%, nitrogen in 73%, and phosphorus in none of the cases.

These plant tissue test data were combined and summarized according to the soil drainage groups; 78% or more of these soils were producing crops that were inadequately supplied with either nitrogen, phosphate, potash, or some combination of these nutrients. Plant nutrients may be only partially available to crops even though soils contain large amounts of them.

The Senior Draft

(*From page* 5)

try to force anybody without the inner light of inclination to try hobnobbing with the Junior phalanx. It might prove to be a flop and set the cause back considerably. But here and there we can develop older heads with young aspirations to take a course of this nature under the guidance of men who have a real hold on young men and boys. It seems rather neglectful on the whole to herd the coming Twenty-oners into the Army without a preliminary tutelage. Maybe veterans of the first world war could take a hand in this ambitious task.

In proposing such a plan, it seems to me that Himmler and Hitler and his cohorts have rather beaten us to a sense of the vital importance of teamwork between Youth and Maturity; and if they can teach sadistic and fatalistic philosophy, why can't we senior draftees organize to coach our own future soldiers in the opposite manner? We can give them some underlying principles of what we have called the "American Dream," and in their hands put the weapons to use with the motive and the ideals. Indeed this very thing is what this war lacks—a goal and not a goad, vision instead of vengeance!

At least we can give them something besides a bottle of pop and a pat on the back when they are called to the colors—and that's worth considering. Conscription is hard enough, but consecration makes it easier.

But prior to setting up as mentors and consecrators of the young warriors, I suppose most of us Oldsters must crystalize our thoughts anent the so-called American Dream. We have lived through years of glory and goodness here and have seen many praiseworthy deeds performed, but we have also seen the tarnish on our democracy and must be frank to reveal it and denounce it. We cannot go forth as armorers of the knights of liberty or keep their home fires burning unless we are honest about our own mistakes, and pledge what strength we retain to make the American Dream come true.

Ours has been a great heritage and a life of marvel, but material things and blatant optimism, money-grabbing and figure-worshiping have intruded too often on our search for quality and spiritual values.

Yet our best service to the younger generation of men, those who have gone as well as those who are about to go, is to remember the old adage that actions speak louder than words. Lots of us may not incline toward preachment or have rapt ideas to impart with bated breath to the young comrades. Others will find deaf ears owing to their inability to make the message about the American Dream ring true.

Therefore, we must go about our daily routine of business and production aware that what we do will carry more weight in building up that crusading spirit than all the philosophy we might spill. If we wrangle and complain about government rules and wartime restrictions; if we voice the whine of some pressure group; if we take short cuts and try to hoard valuable necessities; if we seek the main chance and insist on excess profits; if we try to inject partisan politics into grave human issues;—these misdeeds will make the soldiers wonder if it's worth while to be homesick or not. And those who are yet to enroll for the draft will sign their names with cynical indifference, feeling that they are just pawns and not patriots.

So when you look at it this way you'll begin to see that after all us old draftees control more forces and direct more object lessons than one might suppose possible. For if an expeditionary army drifts away from America and then America goes sour and stagnant, wouldn't it be a hell of a trick to play on the heroes?

Then along with the serious, owly side of this nation-saving business there is bound to be room for harmless fun and care-banishing sports. I think maybe this is a field also where some of the Oldsters will find scope for talents long since forgotten in the hurly-burly of trade and profession.

This activity is bound to come in mighty handy at times when the news from abroad is bad. It's going to be our part as seniors to strike a nice balance between the grim preparedness and guard-mounting affairs and the simple pleasures that endear our country to us by old associations.

I AM not one who decries the dancing and the game-playing features that have met so much thoughtless jibing during the early days of civilian defense. Even the Army has its moments of relaxation, and why should we stay-behinds cease our tension-easing foolishness? Organization of keen squads of athletes and entertainers among the younger generation likewise points to another task for the senior expert.

No, it doesn't appear to be vitally necessary for many of the men between forty-five and sixty-five to rush off and volunteer, when so many important enterprises call for their unselfish attention on the home front. Besides, unless a man in that age limit is qualified by experience for active duty, he has no business crowding himself into the military ranks. He'd only be in the way and dilute the payroll. The hospitals will be full enough without subjecting them to the misery of keeping up an old man's infirmary.

And finally, I want to reprint a cordial and appreciative letter that appeared in a Midwest newspaper right after the Oldsters checked in with Uncle Sam. Somehow it did me a heap of good to read it. It struck a vibrant note of faith and good will which we all need plenty of in stock for the next few years.

"THE other day we registered the 'old men' of America—the fifties and the sixties. As a member of the younger generation I take off my hat to the gallant men who won the last World War. Without exception, they were courteous, cooperative and patient; ready to a man to defend your land and mine; willing and anxious to work, to fight, to help in whatever way they can to preserve America, which to many of them is an adopted land. They are now asking, 'What can I do and how soon can I do it?'

"Of the forty-one men I registered, only two were unemployed; both were physically handicapped, one a veteran gassed in the last war. I was impressed with their youthfulness, their apparent physical fitness, their sprightliness and their magnificent spirit.

"If this war produces no other good, perhaps it will at least convince employers that a man's usefulness does not end when he passes the forty-mark. Youth may yet learn that 'the old fogies' have a few tricks up their sleeves. Old heads and young blood can and must mix. Let Young America not forget that the 'old men' built and preserved our Union.

"I salute the older men who will keep the wheels turning while our young ones keep the planes flying.—M. H."

And so if that's the way the rest of the country regards us Oldsters, we won't have to wear old medals and tell old stories to retain self-respect among the Nation's loyal defenders.

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

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)
Of Course I'm Interested (Pastures, Canada)

Reprints

B-8 Commercial Fertilizers in Grape Growing
C-8 Peanuts Win Their Sit-down Strike
K-8 Safeguard Fertility of Orchard Soils
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
A-9 Shallow Soil Orchards Respond to Potash
N-9 Problems of Feeding Cigarleaf Tobacco
R-9 Fertilizer Freight Costs
T-9 Fertilizing Potatoes in New England
X-9 Hershey Farms Find Potash Profitable
CC-9 Minor Element Fertilization of Horticultural Crops
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
M-4-40 Ladine Clover "Sells" Itself
0-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podsols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
LL-12-40 Tripping Alfalfa
A-1-41 Better Pastures in North Alabama
B-1-41 Our Defense Against Soil Fertility Losses
C-1-41 Further Shifts in Grassland Farming?
D-1-41 How, Where, When Apply Fertilizers?
E-2-41 Use Boron and Potash for Better Alfalfa
F-2-21 Meeting Fertility Needs in Wood County, Wisconsin
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
U-8-41 The Effect of Borax on Spinach and Sugar Beets
V-8-41 Organic Matter Conceptions and Misconceptions
W-8-41 Cotton and Corn Response to Potash
X-8-41 Better Pastures for North Mississippi
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
CC-11-41 There's Enough Potash for National Defense
DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
EE-11-41 Cane Fruit Responds to High Potash
FF-12-41 A Five-year Program for Corn—Livestock
GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
JJ-12-41 Potash Demonstrations on Statewide Basis
A-1-42 Canadian Muck Lands Can Grow Vegetables
B-1-42 Growing Ladino Clover in the Northeast
C-1-42 Higher Analysis Fertilizers As Related to the Victory Program
D-2-42 Boron Deficiency on Long Island
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
1-3-42 High-grade Fertilizers Are More Profitable

THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. — WASHINGTON, D. C.

That Man Again

Among the people who dislike hearing a speaker read a speech, was an old colored woman, who went to church where the young minister always read his sermons. Someone asked her how the preacher was getting on.

"How's he gettin' on?" she repeated scornfully. "Jes like a crow in a corn field—two dabs an' a look-up."

He: "Please?"

She: "No."

He: "Just this once."

She: "No, I said."

He: "Aw hell, ma—all the rest of the kids are going barefoot."

Auto ages: Honk, ah-ooga, beep-beep, tooot, x&!zx!!*!

A drunk boarded a two-story bus; it was crowded, but he finally found a seat by the driver.

He talked and talked, and finally the driver tactfully suggested that he go on the top deck and enjoy the fresh air and wonderful view.

The drunk amiably clambered through the crowd and disappeared upstairs. But in a few minutes he was back.

"What's the matter? Didn't you like the fresh air, or the view?" asked the driver resignedly.

"Yep, nice view, nice air," answered the drunk. "But, 'tain't safe—no driver."

A couple of nurses were sneaking into the hospital late one night when they met two young internes sneaking out.

"Sh-h-h," warned one of the girls. "We're just coming in after hours."

"Sh-h-h," whispered one of the internes. "We're just going out after ours."

An American applied at a recruiting office to enlist.

"I suppose you want a commission," said the officer.

"No, thanks," was the reply, "I'm such a poor shot, I'd rather work on straight salary."

"Yassum," said Callie, the Negro cook, "I been engaged for goin' on ten days."

"Who is the bridegroom?"

"Willum, he's a mighty nice man."

"Have you known him long?"

"Yes, indeedy. Don't you remember, Miz Aronoff, dat about two weeks ago you lemme off one day right after dinner time so's I could get to the fun'el of a lady friend of mine?"

"Yes, I do."

"Willum, de one I'm fixed to marry is de departed's husband."

A cow barn is a lot like a tavern. Go in either one for half an hour and everybody knows about it all the rest of the day.

Printed in U.S.A.

Better Crops with PLANT FOOD

June-July 1942 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

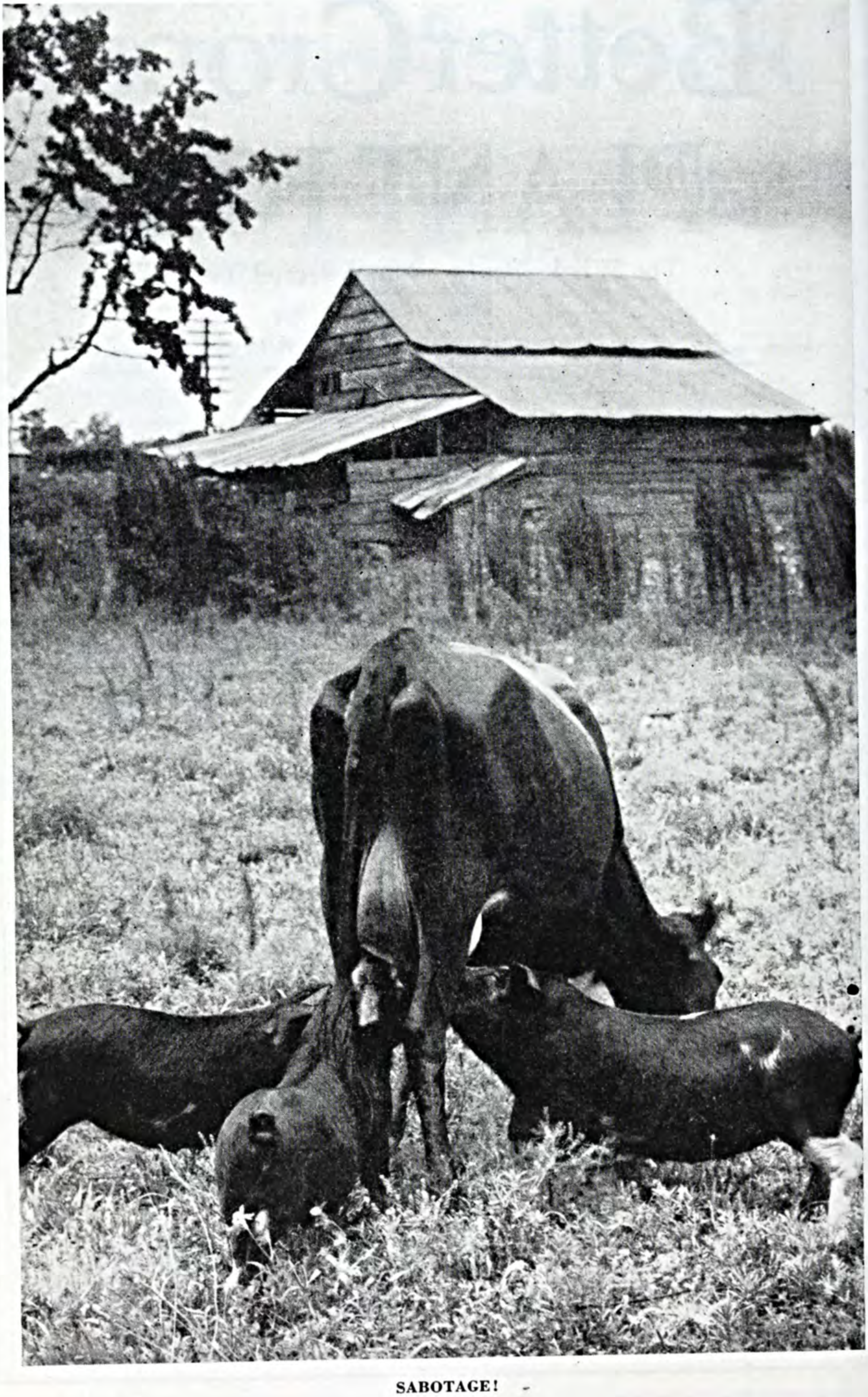
The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI NUMBER 6

TABLE OF CONTENTS, JUNE-JULY 1942



SABOTAGE!

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., JUNE-JULY 1942 No. 6

Patriotism and . . .

Old Glory

Jeff McDermid

WHEN they asked me to write a piece about the Flag, it sounded like it might come easy, amid all this national turmoil. Not much reason to hesitate. Look at our mutual background for it:

Yorktown, the Alamo, Gettysburg, San Juan Hill, Chateau-Thierry, Bataan, and Midway Island—battles we've read about where the banner flew over brave boys of ours!

Boy Scouts, Campfire Girls, 4-H Clubs, Y. M. C. A., Rotarians, Kiwanians, Masons—lodges our folks belonged to where the banner and the bible were equally honored!

G. A. R., D. A. R., Sons of Veterans, Veterans of Foreign Wars, American Legion—patriotic societies who have pledged the banner and tried to teach us its history!

Sunday schools, grade schools, high schools, academies, colleges—where somebody saw to it that the banner was displayed and saluted!

Hamilton's History of the Flag, Admiral Preble's Origin of the Flag, Stewart's Stars and Stripes, Hughes's Famous American Flags—familiar references all about the banner, shelved in our town library!

"Liberty Boys of '76," "Young Glory," "Yankee Doodle, the Drummer Boy," "the Red, White and Blue Weekly"—dime novel inspirations concerning the banner, perused zestfully as urchins.

"Stars and Stripes Forever," "Star Spangled Banner," and "It's a Grand Old Flag"—songs and marches we've hummed about the banner since boyhood!

Yet somehow when it comes to writing a piece about the Flag I'm awkward and diffident, like a clumsy swain trying to say the right thing to his sweetheart, of whom he feels himself unworthy. Or possibly more like a person talking about a great symbol of sacrifice, when it really hasn't cost him much to uphold it. That's when you start thinking of those poor fellows held in prison by the Japs, and from then on it sure cramps your style! It sure does, because anything you might venture to write about the Flag under such circumstances sounds hollower than a rain barrel, when all you do to prove your mettle is to hunt for scrap rubber and go without two cups of coffee.

Then a whole lot of us haven't quite got around to a sense that our Flag is a world emblem now, and the vastness and futility inherent in world-wide movements catch up with us sometimes and leave us confused. While we were growing up, you see, the Flag we talked about was a Defense Flag and an American Union Flag combined, and to wave it overseas in any but a peaceful mission was called Imperialism.

I DON'T think we need to apologize any about that sentiment either, because it hasn't a blamed thing to do with our reverence or our patriotism. Only that, like the miserable fate of our soldier boys who surrendered on Bataan, it just cramps your style, wondering how it's all going to turn out. We want Old Glory to stand for the right thing when they get to writing the peace preambles.

No siree, we don't want to live to see a time when such a bloody mess will end up in social chaos or have anybody come back at us and claim that we ought to take the "1" out of Old Glory because we yielded to expediency or greed.

However, that's just a passing idea to let you see how big a strain they put on me when they suggested I send in an essay about the Flag. But from now on I'll stick to the text and take it for granted that wherever Old Glory goes the outcome will be a "decent respect for the opinions of mankind."

As I said before, we have been conscious of the old Flag ever since our early childhood. For my part the first tenderness I developed for the banner was when I was a sort of little "mascot" for a rural G. A. R. post and used to be allowed to march with the veterans on Memorial Day and the Glorious Fourth. Last week in rummaging around I located an old print from a wet-plate negative taken of that old bunch of warriors seated on the courthouse steps away back in the Nineties. Tucked into a prominent spot between the Commander and the Color Bearer is a dim image of a kid in a velvet jacket and a rolled brim straw hat. That was the day I got blisters tramping along beside old John Blowers, who balanced the heavy silken banner in an oilcloth belt pocket and stepped off so fast you'd think he imagined Jeb Stewart's best scouts were trailing him.

I can see those old plank seats in the grove, crowded with doughty and dusty citizens, while the silver cornet band played Hail to the Chief. By the time the parade was over I was more inclined to welcome a "chef" than a chief, but sundry gulps at the town pump assuaged my vacancy until picnic lunch was ready.

When I write about the Flag and Patriotism, my memory goes back to those musty, mysterious realms of a smoky Grand Army lodge room, down three flights of broken stone steps under the county courthouse, into an anteroom with rush matting on the floor and a few card tables.

TO THE rear was the "banquet" hall that in my youthful belief was large enough and grand enough for the old Colonel's boasted regiment, including the ghosts. To the right was a thin board partition having a peephole station for the convenience of the outer and inner guards.

On privileged occasions and celebration days a few of us sons and grandsons were allowed to proceed into the inner sanctuary without any password. Here indeed was the holy of holies for boys who read history with awe and delight. There was the altar with its crossed swords; the roll of frayed battle flags in the corner wrapped in silk and tied with braid; the pictures of heroic members who had died in uniform; the mottoes and emblems; the lithographs of generals on dashing steeds, framed in smoke and leaping ahead over stricken comrades.

I often doubt if the veterans of foreign strife bring home to us the same kind of patriotism in quite the same vintage as we imbibed so freely from the G. A. R.—and likewise in the South from the Confederate Veterans. You see, those old recruits came back from nearby battlefields, places we might some time see ourselves on relics bent. And family quarrels are more searching anyhow! I bear witness from reading the current dispatches that the boys from Texas and elsewhere must have also felt the same tugging at their hearts and received perpetual veneration for the Flag from this same old soldier shrine.

In bringing this up I am fully aware that some of the customs of those old vets did not square with the colors of the Flag. I acknowledge that we youngsters drew from them some rank ideas on the sacred protective tariff and the divine right to rule of the Republican Party. I also remember that they voted the way they "fit" and carried the "all's fair" idea home with them to use it sometimes when they got into tight places and wanted a boost. Yet above and beyond all of these human failings there remained in them a hopeful spark that kept the home fires glowing with provincial Americanism.

And so I can look back through the shimmering memory waves of many hot July celebrations to those times when as a bumptious lad I strode along the wood-block pavement trying to hold myself as erect and ramroddy as the nifty Guppy Guards, and maybe toward the end hanging onto my Father's fist lest I betray my weary stumbling. But as I recall it, the things which kept me going to the last droop were the lilting of the music and the fluttering of the Flag. And I reckon after all that's the way with most of us soldiers, young or old. The thrill and the fervor get us.

Thus reverence and sacrifice for the Flag are taught by our elders and then carried out in courageous devotion by our younger generations.

Exploits of a deathless hero like Colin Kelly and the bravery of our Army nurses over there in the South Seas recall an incident relative to the origin of the title, "Old Glory." Old as the story is to some, I believe there are many unacquainted with the beginning of this reference to our banner.

Strange to say, it all starts in Salem, that ancient little Massachusetts town, famous for its witchcraft hunting by Cotton Mather and its quaintly lovely doorposts and fireplaces designed by Architect McIntyre and his associates.

It was for long a spot where men went down to the sea in ships, and widows' watches were common on the hills and housetops. In its harbor many sloops and frigates bravely cast anchor and flew the Stars and Stripes.

Here in 1831 lived a certain Captain William Driver, master of the brig, "Charles Doggett." That spring his neighbors wanted to give him a happy

(*Turn to page* 45)

Good pasture is the key to profitable livestock management. Pasture will not remain "good" without some attention to replacing the fertility removed from the soil in meat, milk, and wool sold off the farm.

The Fertilization *of* Pastures and Legumes

By S. D. Gray

Washington, D. C.

PASTURES constitute the greatest undeveloped resource in American agriculture. They have had a profound influence on the livestock industry, the margin of profit in most phases of this industry being dependent upon the extent to which good pasture is utilized. Fertilization of good pasture to keep it good or of below average pasture to restore it to a satisfactory level of production is a wise investment on any soil suited to the growing of grass and clover.

While pasture use has contributed much to the success of livestock farming by supplying a cheap and highly nutritious feed, it has been largely at the expense of the virgin fertility of the soil. Continuous removal of the mineral plant-food elements, lime, phosphorus, and potash, in the meat, milk, and wool sold off the farm without replacement by fertilization has reduced yields and increased cost for barn feeding to a point which seriously lessens economic production.

It is estimated that our livestock population of approximately 90,000,000 animal units consumes three-fourths of the products of our improved farm land. In addition, it uses practically all of the products of the humid and arid grazing lands of all descriptions. More than one-half of the forage requirement is supplied by the 231,000,000 acres of humid grassland pastures representing approximately one-fifth of our entire grazing area. The significance of these figures will become more apparent when we consider the carrying capacity of the grasslands and the relation of treatments to carrying capacity. On practically all of this acreage, fertility exhaustion has reached the point where some form of fertilization is now necessary. The fertilization of this large acreage to restore it to a satisfactory level of production opens up a vast new field for profitable fertilizer use.

Carrying Capacity Low

The carrying capacity of many of our pasture lands is ridiculously low. A study of the statistics on this subject reveals that on the arid and semi-arid ranges from 25 to 100 acres of land are required to support one full-grown cow or steer. In the humid regions where moisture is not a factor and where the soil fertility is still such as to support a fair growth of herbage, about five acres are required to support one animal unit. An examination of records on carrying capacity of pastures in important European countries shows that the number of acres required to carry one animal unit ranges from .91 in Belgium to 2.65 in Great Britain and Ireland. Corresponding figures from Germany, Denmark, and the Netherlands are 1.24, 1.46, and 1.60 respectively.

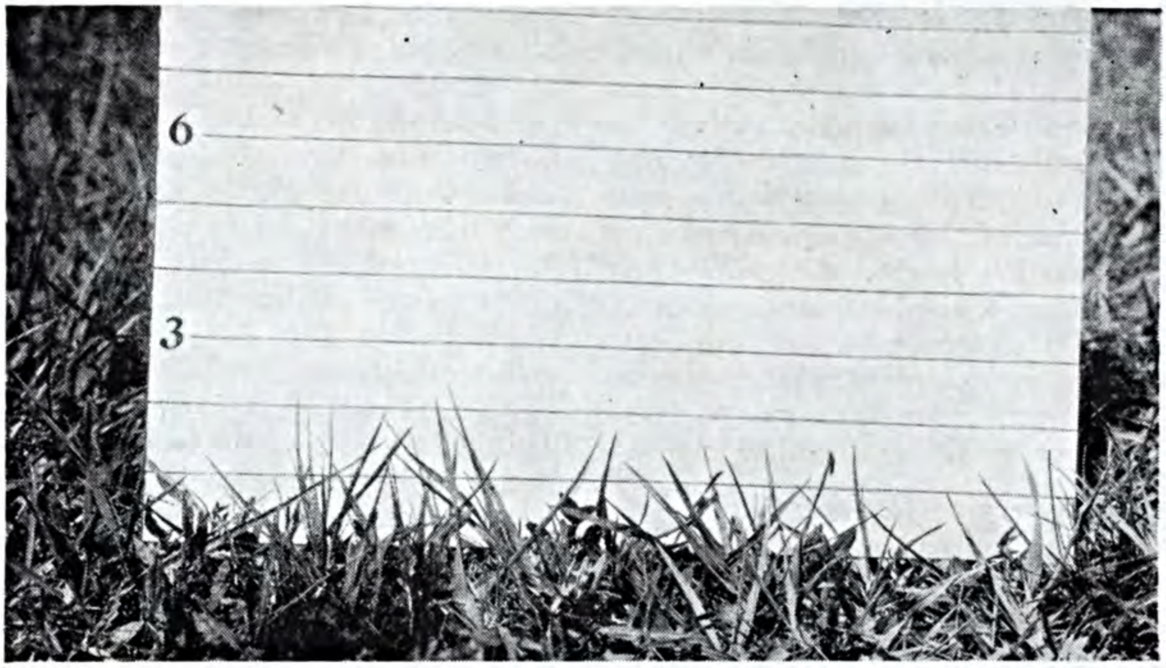
European farmers are far ahead of American farmers in the management and care of pasture lands, economic conditions and scarcity of lands for grazing having compelled them to employ a system of intensive fertilization and rotational grazing. The basic fertilizer treatment usually employed involves the use of lime every five to six years, annual applications of phosphoric acid and potash in amounts to supply approximately 50 pounds of each, and successive doses of nitrogen applied in three or four different applications supplying a total of approximately 100 pounds of nitrogen per acre per year. While this system has been highly satisfactory under American conditions wherever land values have been high or limited in acreage, the time has not yet come for its extensive use.

Pastures in the humid regions of the United States have gone through several distinct stages of impoverishment, each followed by lower production of forage of inferior quality. Depletion of the supply of lime and phosphorus is usually the first stage encountered and is usually reflected in a less vigorous growth of the grasses and legumes. This is followed by the exhaustion of potash, disappearance of legumes, and the appearance of inferior species of grasses, weeds, moss, and finally brush. In the first stages of soil fertility exhaustion, the use of phosphorus alone or with lime is likely to be sufficient to bring back the clover and through its growth help maintain the nitrogen supply. Most of our permanent pastures in the humid area probably passed the first stage of fertility exhaustion more than a generation ago. They are now, therefore, about equally deficient with respect to potash, organic matter, and nitrogen.

Results of Research

Results of fertilizer experiments on pastures have been on the whole impressive and clear cut. Quite generally they have emphasized the importance of liberal fertilization. While authorities are agreed that phosphoric acid is almost universally deficient and consequently the basis of any successful treatment, repeated tests have shown that it is not always a sufficient treatment. Evidence is accumulating from experimental work in widely separated areas showing that potash is frequently as necessary as phosphoric acid particularly in areas where emphasis is placed on the need for legumes in the pasture. These data have also stressed the relationships of lime to efficient utilization of phosphorus and potash.

Typical of the research findings with respect to pasture fertilization are recommendations recently emanating from the New Jersey Agricultural Experiment Station from which we quote:



An unfertilized check plot in a pasture experiment in Vermont. Note the sparseness of the herbage and lack of clover, so typical of old pastures which have received no attention for years.

This plot in the same Vermont pasture received an application of nitrogen, phosphoric acid, potash, and lime. Note the vigorous growth and the generous sprinkling of clover brought in by the potash.

"On farms with limited acreage a greater net gain to the farm might be obtained from the more intensive system of fertilizer treatment. On farms with more adequate acreage, however, the treatment with lime, phosphorus, and potash which brings in clover would be the most profitable. Perhaps the best system on many farms would be the use of heavy nitrogen fertilization balanced with lime, phosphorus, and potash on a part of the pasture for early spring grazing and the use of the straight mineral treatment, lime, phosphorus, and potash, to stimulate clover on the remainder of the farm."

A shortage of either phosphorus or potash, or both, is often a primary cause of poor clover growth, according to the Pasture Production Manual published by Mississippi State College, and where they are lacking as indicated by present or previous crops, these minerals should be applied before reseeding old pastures or seeding new ones on depleted soil. Muriate of potash should be applied at the rate of 100 pounds per acre, and superphosphate at 200 to 400 pounds per acre, or 500 to 1,000 pounds of basic slag per acre, the manual suggests.

While the recommendations of the different experiment stations vary with respect to the fertilization of pastures, they are, generally speaking, in very close agreement on the matter of major objectives and practical management practices. Supplementing the excellent experimental programs in the several states where pastures are important are the extension demonstration programs taking the results of research direct to the farms of the Nation.

Pasture improvement demonstrations conducted in 45 counties in Indiana during 1939 developed some very interesting facts. From 26 of the demonstrations on which records were secured, results show that permanent pasture definitely responded to plant-food treatment. Phosphoric acid increased the average yield only 36%, phosphorus plus manure increased the yield 48%, phosphorus plus potash 47%, and complete fertilizer 69%. In all demonstrations lime was added where needed.

Results of 34 pasture experiments in Ohio during 1933 calculated on the basis of equivalent production per acre in pounds of beef and milk gave for the O, P, and NPK treatments respectively, 111, 203, and 389 pounds for beef and 1,080, 1,983, and 3,789 pounds for milk. In terms of cost of pasture per 100 pounds of beef and milk, the

(*Turn to page* 38)

White clover is an excellent indicator of diminishing soil fertility. Pointed out above are potash-starvation symptoms—white spots beginning around the borders of the leaf and working inward. These denote advanced stages of potash depletion in the soil.

Cotton on Sandy Soils Needs Plenty of Potash

By R. W. Wallace

Sandhill Experiment Station, Columbia, South Carolina

LONG before farmers knew anything scientific about "potash hunger," observant ones among them noticed that a "brown rust" occurred most often in sandy types of soil under certain weather conditions. The more progressive farmers found more or less by chance that less "rust" occurred when the fertilizer contained potash, an ingredient not previously considered so important or valuable on most soils strong enough for cotton production.

Potash deficiency has been found to occur more often following a dry season, as a result of insufficient moisture to replenish the supply of potash in the soil solution. The first deficiency symptoms in cotton usually occur from the middle of July to early August or after the plants have made nearly mature but somewhat diminutive growth. The symptoms first appear as a yellowish white mottling of the leaf followed by a change to a light yellowish green color with yellow spots appearing between the veins. The center tissue of these spots dies, and other numerous brown specks occur at the tip, around the margin, and between the veins of the leaf. The tip and margin of the leaf break down first, followed by a curling downward of these areas. As the physiological breakdown progresses, the remainder of the leaf finally becomes reddish brown in color, dries, and the leaf is shed prematurely. This premature shedding prevents the proper development of the bolls and, therefore, many bolls fail to open. The seed cotton from such stalks is hard to pick and the lint is inferior in quality.

In 1931 a series of experiments were started at the Sandhill Experiment Station, Columbia, South Carolina, to determine the optimum rate and time of applying potash fertilizers to cotton. These experiments have been continued on the same plots for 10 years. The supply of available plant food in the coarse, sandy soils of the sandhill area is generally known to be exceedingly low, which makes this an ideal area for the study of plant response to fertilizer treatment. Valuable data have been obtained annually from these experiments and passed on to the farmers in the sandhill region. The results have shown that potash and magnesium are very closely associated and essential in the production of cotton on sandy soils.

The manifestation of magnesium deficiency is contrasted with potash deficiency in that it is more prevalent during wet seasons. There has been a consistent increase in yields of seed cotton on these plots from applications of dolomitic limestone, and the increase has been greater as the rates of potash applied increased from 0 to 60 pounds (K_2O) per acre.

Fertilizer Applications

All plots have received an annual basic fertilizer application equivalent to 600 pounds per acre of a 5-10-0 in addition to potash as a variable before the cotton was planted, and were side-dressed with 15 pounds of nitrogen from calcium nitrate or Cal-Nitro. Potash varied at the rates of 0, 15, 30, 45, and 60 pounds per acre, making the total complete fertilizer application equivalent to 600 pounds of 7.5-10-0, 7.5-10-2.5, 7.5-10-5, 7.5-10-7.5, and

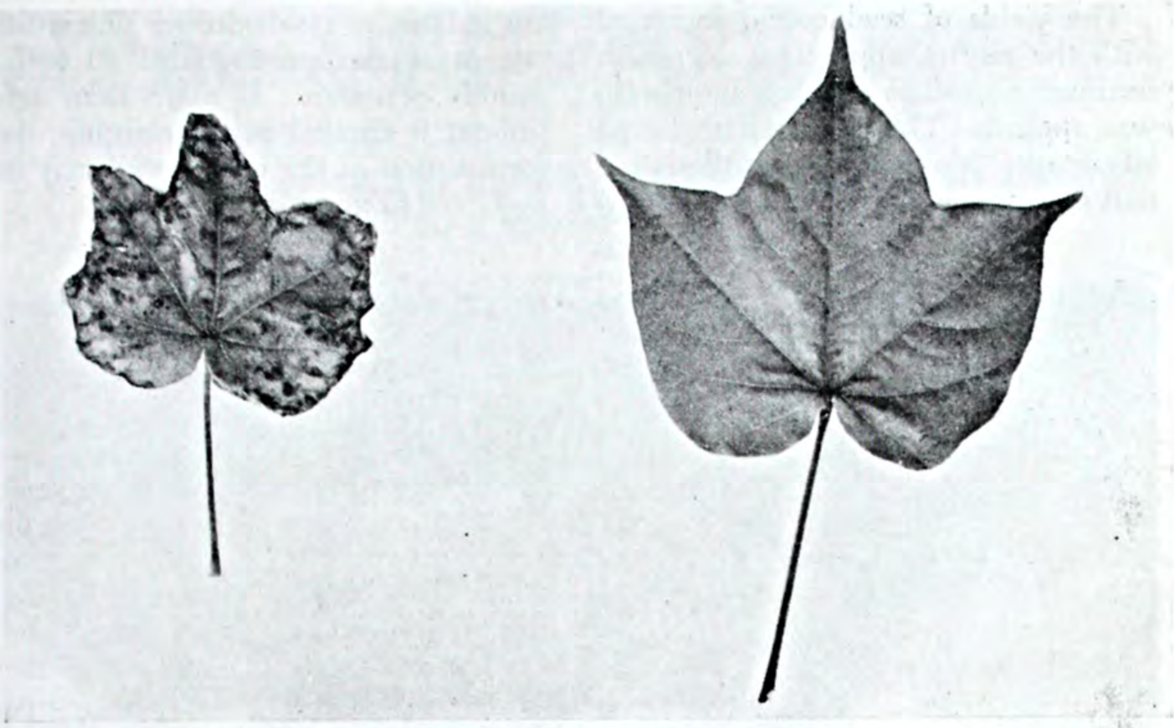


Fig. 1. Cotton leaves, from a potash-deficient plant at left and from a normal plant at right. Sandhill Experiment Station, Columbia, South Carolina.

7.5-10-10 per acre respectively. The periods of application were (1) all before planting, (2) half at planting and half at chopping, and (3) all at chopping.

No sodium nitrate was used in the fertilizer applied in this experiment, as experiments from this station have shown that where sodium salts are used in fertilizers there may not be as marked response from the use of potash fertilizer. This is because sodium may have an effect of substituting for potassium in the growth of the cotton plant.

Fig. 2. Left: Normal cotton plant taken from plot which received 30 pounds of N, 60 pounds of P_2O_5, and 30 pounds of K_2O per acre before planting and was side-dressed with 15 pounds of N at chopping. Right: Potash-deficient cotton plant taken from plot which received the same treatment with the exception of no potash. Potted for photographing.

The yields of seed cotton increased with the rate of application of potash fertilizer regardless of when the potash was applied. There seemed to be no advantage, however, in withholding part of the potash at planting and applying it later as a side-dresser unless the rate of application exceeded 50 to 60 pounds per acre. If more than this amount is applied before planting, the germination of the cotton seed may be

(*Turn to page* 35)

Fig. 3. Left: Plot received 30 pounds of N, 60 pounds of P_2O_5, and 30 pounds of K_2O per acre before planting and was side-dressed with 15 pounds of N at chopping. Right: No potash. At this stage of growth (Picture taken July 1, 1940), the cotton on both plots looked fine.

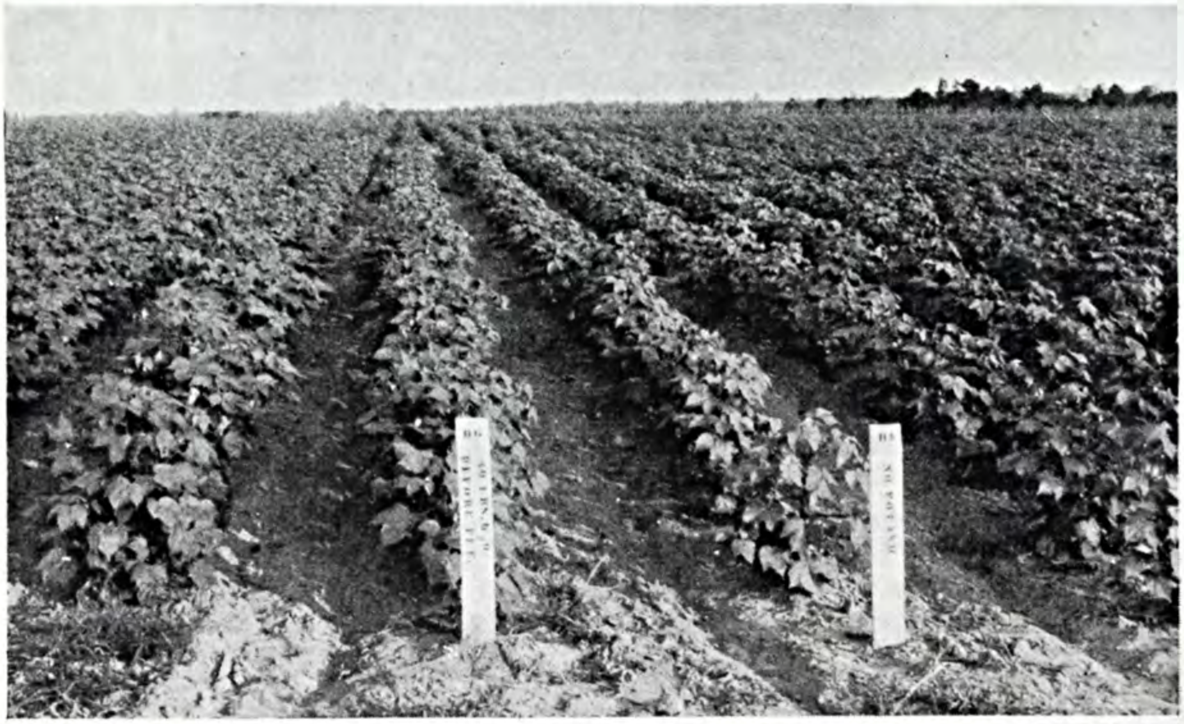


Fig. 4. Left: On September 30 the cotton which received the complete treatment still looked fine and healthy; whereas, right, that which received no potash was badly "rusted."

Some Soil Problems of the Piedmont

By W. H. Garman

Associate Professor of Soils, University of Georgia, Athens, Georgia

AGRICULTURAL scientists, landowners, and land users the world over know that soil erosion is the greatest of all enemies of the agriculture upon which our civilization is founded. They have varying degrees of appreciation as to the inestimable loss of soil that has occurred, and in addition have various viewpoints with regard to the planning and effective use of an adequate system of conservation. All are aware of the decreased fertility of our soils of today; however, all may not be in complete agreement as to the fundamental reasons for this impoverishment.

Once topsoil has been removed by erosion, the most valuable portion of nature's greatest natural resource has been lost. The subsoil may contain considerable amounts of plant nutrients, but it contains practically no organic matter. It is well known that nutrient elements exist in a condition of lower availability in the subsoil than in the topsoil. Today many of our farms are what might be called subsoil farms. It is indeed fortunate that both nutrients and organic matter can be supplied in sufficient amounts to sustain plant life.

The effects resulting from the loss of organic matter from our soils are today causing all of us great concern. As they have been depleted by cultivation and erosion, soils in many instances have lost from 20 to 50% of their original crop-producing power. One has only to review the better known functions of this more or less "living" portion of the soil to understand why fertility has been so markedly affected.

Without organic matter soils lack a source of energy necessary to support the micro-organisms which are essential to the well-being of all higher forms of life. They are not capable of supplying nitrogen throughout the growing season. They lack the physical qualities without which their permeability to rainfall may be extremely limited. This means that excessive water is lost from the soil, bringing about unnecessary soil erosion. So it goes, as soils become more highly eroded they almost of necessity become more erosive.

Frequent Cause of Drought

Soils low or lacking in organic matter do not possess the capacity for holding water that may penetrate into the surface few inches during the average rainfall. This factor perhaps largely accounts for the frequent crop injury noted on Piedmont soils as the result of relatively short dry spells, which in all likelihood would have caused our grandfathers little or no concern 50 to 75 years ago. Soils depleted of organic matter lack the ability to hold ample supplies of available plant nutrients. The fixation of both phosphorus and potassium can usually be expected to be more acute in such soils. Also, the occurrence of minor element deficiencies is considerably more common in soils of low organic matter content.

Obviously, all of the desirable attributes which organic matter imparts to soils are not mentioned above. However, from those mentioned it can safely be stated that organic matter might properly be considered the "cure" of many soil "evils."

In all sections of the country many acres of desirable land have been destructively depleted of organic matter. In this respect the old agricultural soils of the Piedmont have suffered a very serious loss. In a study (1) of the effects of cultivation on these soils, it was found that continuously growing clean-tilled crops (for periods ranging from 45 to 150 years) decreased the organic carbon content by 56.8% and the total nitrogen content by 44.2%. This indicates that roughly one-half of the organic matter in these soils has disappeared due to cultivation.

Such a reduction in organic matter would naturally be reflected in certain changes in physical properties of the soils. As a result of physical studies on duplicate samples from 19 paired sites (representing 15 counties in the Piedmont Plateau soil province of Georgia), the following changes were found to have occurred:

Mean volume weight was increased 27.88% (from 1.137 ± 0.017 to 1.454 ± 0.015.)

Mean weight per cubic foot increased 19.78 pounds.

Mean pore space decreased 20.95% (from 57.09% ± 0.88 to 45.13% ± 0.46.)

Mean dispersion ratio (the per cent of total silt and clay in a soil which is easily dispersible) increased 63.3% (from 23.20% ± 1.90 to 37.99% ± 2.98.)

Mean maximum water-uptake capacity decreased 28.4% (from 36.22% ± 0.154 to 25.94% ± 0.100.)

Mean water-holding index (2) decreased 13.2% (from 61.3% to 53.2%).

At this point it might be stressed that the above differences are due chiefly to the effects of cultivation rather than to erosion. Samples were collected on level land to very gentle slopes where erosion had been at a minimum despite continuous cultivation. Had the average Piedmont field (which had lost approximately 50% to 75% of its topsoil) been studied, there can be little or no doubt that the above factors would have been considerably more affected. Nevertheless, considering the results obtained, it is very easy to visualize certain limitations being imposed on soil-water-air relationships by each of these factors. Considered collectively, these limitations may directly or indirectly account for the decreased inherent fertility of the average Piedmont soil of today.

Effect of Temperature

It is well known that mean annual temperature affects the decomposition of organic matter. As one travels from a region of lower temperature to one of higher temperature he encounters a lower level of organic matter, other things being equal. That this is true can be shown by comparing the above results for Piedmont soils with those of Shaulis and Merkle (3) for Pennsylvania soils. They found the mean organic carbon content of 23 forest sites in Pennsylvania to be 28,618 pounds per acre, while the mean for 19 such sites in Georgia was 20,274 pounds. Thus, under native conditions the soils of Piedmont Georgia contained 8,344 pounds per acre less carbon than the soils of Pennsylvania. In other words, there was 29% less organic matter in the more southerly location.

That cultivation has caused a greater destruction of organic matter in Georgia than in Pennsylvania can also be shown by comparing the losses of carbon under Georgia conditions with those reported by Shaulis and Merkle. They reported a mean of 18,233 pounds of organic carbon per acre in 23 clean-cultivated orchards, while the corresponding figure for 19 clean-cultivated Piedmont fields was 8,754 pounds of organic carbon, or 52% less under Georgia conditions. Thus it is evident that there has been an appre-

[1] Giddens, Joel and Garman, W. H. Some Effects of Cultivation on the Piedmont Soils of Georgia. Proc. of Soil Sc. Soc. of Amer., 1941.

[2] Water-holding index is arbitrarily defined as that per cent of the maximum weight of water absorbed from a free water surface, that remains in the soil after 48 hours of evaporation under laboratory conditions.

[3] Shaulis, N. J. and Merkle, F. G. Orchard Soil Management. Pa. Agr. Exp. Sta. Bul. 373. 1939.

ciably greater relative loss (52% less organic carbon in Piedmont soils under cultivation, and only 29% less under virgin conditions) of organic matter due to cultivation in the Piedmont soils of Georgia than in the soils of Pennsylvania.

In planning systems of conservation for states, counties, conservation regions or districts, and farms, it is natural that the best lands always be given first consideration. However, if all the land unsuitable for economical cultivation (on a long-time basis) should be retired to permanent vegetation, there is the added problem that the good land might eventually be subjected to improper management and thus destroyed more rapidly than it would otherwise. For the time being it appears more economically sound to reforest that land which is too steep to cultivate and too severely eroded to afford productive pasture and hay crops. The next class of land with respect to degree of erosion could well be put into permanent pasture and hay crops. The better lands should be carefully guarded, and only systems of cropping of known reliability be employed.

Return of Organic Matter

The system used in cropping the better lands should be one that returns to the soil adequate supplies of organic matter to prevent the deterioration of the fundamentally important physical characteristics of the soil. Without additions of organic matter soils will deteriorate in a few years, as pointed out by Jenny under Missouri conditions. He showed that in the first few years of cultivation soils lost organic matter at a very rapid rate, after which they appeared to reach a stabilized equilibrium-level, depending upon the system of agriculture employed. He further related the nitrogen content of Missouri soils to crop-producing power. He found that declining yields over a period of 60 years were associated with decreasing nitrogen content of the soil. In most Missouri upland soils of medium texture, with less than 2,000 pounds of total nitrogen per acre, the corn yield was usually under 20 bushels; while with a soil containing 3,000 to 4,000 pounds of total nitrogen, the corn yield averaged between 25 and 40 bushels per acre.

In the South it is impractical, under general agriculture, to attempt to increase organic matter to what might be considered a high level. The essential feature is that a certain amount be added to the soil at more or less regular intervals. This turn-over of organic matter appears of utmost importance, both to the soil and to the pocketbook. Such a system, to be most effective, should employ legume and grass crops extensively. It should return green manures whenever possible. The soil should be protected from beating rain and moving water throughout the greater part of the year. Such a system of agriculture would naturally mean a considerably more diversified type of farming than is now common in most sections of the South. This in itself seems highly desirable in view of the fact that the average Piedmont farm is far from being domestically self-sufficient.

If a system of true soil conservation is ever to be adopted by the Southern farmer, it is quite possible that the major obstacle to overcome will be the reduction of acres devoted to cultivated crops. As individual farm programs are planned today, they are revolved around a relatively large portion of the cultivated land area being in cotton and corn every year. To be successful from the standpoint of soil betterment and economical crop production, this acreage may have to be curtailed to the extent that the most effective cropping system devisable can be employed. In a system of soil conservation designed for local, as well as state and national improvement, the continuous growth of maximum acreages of clean-cultivated crops obviously can not permit true conservation of the soil.

Reducing the number of acres de-

(*Turn to page* 37)

Revolving sprinklers applying an inch of water every two hours. Each sprinkler covers an 80-foot circle.

Water, Fertilizer and Good Farming

By A. S. King

Extension Specialist in Soils, Oregon State College, Corvallis, Oregon

TALK ABOUT WEATHER—few places have a wetter reputation than the Willamette Valley in western Oregon. This native haunt of "Web-feet" is a land of rubber boots and raincoats, with an annual rainfall exceeding 40 inches. Water to flow away, yet the outstanding agricultural development of the past 15 years has been the development of irrigation. And there is a reason. Rain, varying in intensity from the gentle fog-like "Oregon mist" to downpours of "cat and dog" proportions, falls over this country from October through April. These months receive 90 per cent of the total rainfall. The remaining four months, May through September—the best part of the growing season—receive only 10 per cent, or a little over four inches.

In the past century, this Emerald Empire of forest and farms has developed a prosperous agriculture based on the use of this natural moisture supply, and it is still a prosperous agriculture. Nevertheless, farmers on some 50,000 acres of land have found that it can be made better with the use of irrigation during the summer season—better because they can make use of the long days of sunshine during the summer months when, otherwise, the fields are parched and brown.

The development of irrigation here might be termed unusual. There are no elabroate irrigation systems with colossal dams and intricate canals. Public funds have not been involved. It has been a development born of individual enterprise and ingenuity, with irrigated farms scattered throughout the length and breadth of the valley between farms tilled by conventional methods. It seems a bit unusual to irrigate in an area where the annual rainfall totals between three and four feet, and that is exactly what the farm population of western Oregon used to think. When irrigation first started, it was generally looked upon as a needless waste of time, money, and energy, but experience has proved otherwise. Irrigation is now recognized as a sound practice on any crop that might grow throughout the summer months, particularly on pastures, specialty crops, and commercial vegetables. Most of the available water is now being utilized. Further expansion is dependent upon the development of additional water.

The production of vegetables for processing and for fresh market occupies about one-fourth of the Willamette Valley irrigated acreage. The grower now needs no salesmanship on the advantages of irrigation for these crops. Past experience has fully shown that the yields produced without water are too small to permit the operator to stay in business. Furthermore, the processors now insist that the vegetables be irrigated. Willamette Valley produce must be shipped a long way to market and must compete with areas where transportation costs are a relatively small item. And these Oregon irrigated products do compete on a favorable basis as shown by the impressive growth of the industry in the past few years, with exports to distant markets now measured by the millions of dollars. Processors insist on irrigation for another reason in addition to quality. Operating schedules can be maintained more easily with produce coming from irrigated farms, since crop failures are few and delays due to unseasonable dry spells do not occur.

Phenomenal Yields

Crops produced under irrigation include snap beans, carrots, beets, sweet corn, and a variety of other crops. Yields under irrigation are phenomenal and might better be left unmentioned for fear of the suspicion that this whole story is interspersed with more than a tinge of Paul Bunyanism. But we might

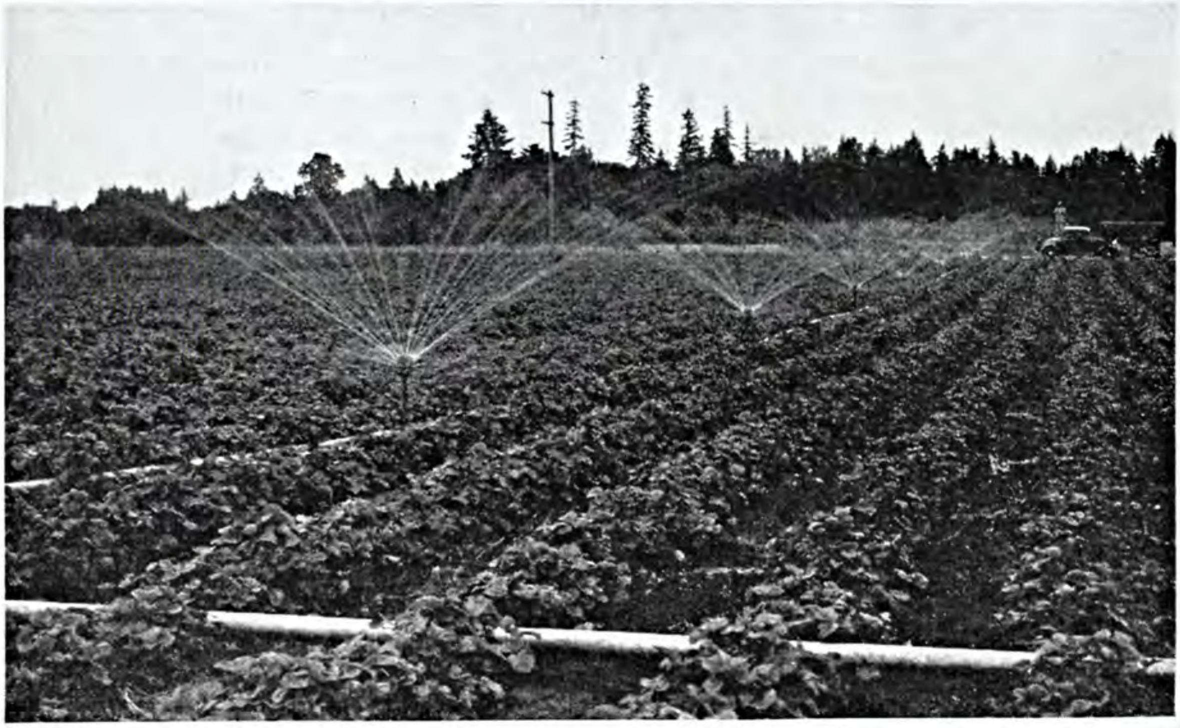
"It droppeth as the gentle rain from heaven upon this earth beneath"—portable revolving sprinkler on a field of Blue Lake beans which yielded over 10 tons per acre.

risk one illustration. Producers for one of the largest processing plants in Oregon average in excess of 10 tons per acre for the season with snap beans, with recorded yields in excess of 15 tons per acre. These are marketed beans of the better grades. Oregon is so far from market that cull beans have no sale value.

Most vegetables are irrigated by individually owned and operated irrigation systems. Wells and streams are the major sources of water supply. The resourcefulness and originality of these irrigators are reflected in the wide variety of equipment used, as diverse in appearance as ladies' hats and used with results almost as attractive. Water is applied not only by conventional furrow or rill systems but also by a wide variety of sprinkler equipment. Because of the rough topography and porous nature of much of the better land, most of the vegetables are irrigated by some type of sprinkler equipment.

Centrifugal pumps are used to lift the water and to provide the necessary pressure for sprinkling. Low-pressure pumps are used for surface methods and higher-pressure pumps are used with sprinkler systems, the type of pump depending on the type of sprinkler used. Electricity is the most popular and the most economical source of power, but farm tractors and old automobile engines are also widely used.

The first sprinkler systems in this area used overhead nozzle lines, locally known as the "Skinner" system. Water was sprayed through stationary nozzles placed at regular intervals along the pipe line. These pipes were carried across the field on posts at an elevation high enough to be above the crop irrigated. As the water was sprayed, the pipes were rotated back and forth either by hand or by a mechanical oscillating device. At the present time, the revolving sprinkler method of irrigation is most popular, utilizing sprinklers that spread the water in a circle 70 to 100 feet in diameter. Some of these are used in connection with permanent piping systems, with underground lines, permitting the spacing of standpipes to cover the entire field. With this system, only the sprinklers need be moved. Revolving sprinklers are much more generally used in connection with portable pipe lines. On these systems light-



Each one of these "punctured pineapples" throws the water in a square 40 x 40 feet, operating at 15 pounds pressure. The crop is strawberries, which also like irrigation.

weight steel pipes, varying in diameter from 1½ up to 6 or 8 inches, depending on the amount of water used, are laid in a temporary position across the land to be irrigated. This pipe is equipped with quick couplings that permit the pipe to be joined together or taken apart instantly. Sprinklers are spaced along a portable line, usually every 40 feet or every two lengths of pipe. This will ordinarily irrigate a strip 60 feet wide. When the irrigation is completed, the line is moved.

Recent developments gaining in popularity include sprinkling with perforated pipe, a type of irrigation in which water is applied through holes drilled directly in lightweight pipe. It requires less power but slightly more labor than the revolving type. Stationary sprinklers that throw the water in a square pattern are also available. These sprinklers are located on movable pipe lines much like the revolving sprinklers.

Individual Equipment Varies

Usually, the choice of equipment used depends on more than the personal whim of the farm operator. Each type of irrigation fits a particular need. Economical operation depends on getting the right pump, power plant, pipe, and sprinkler to fit each individual job.

Willamette Valley irrigators are affected by the war emergency. Vegetable producers are asked for more of these vitamin-packed foods that, when produced under irrigation, are tasty as well as healthful. Processors are planning to increase their packs, which, in turn, calls for increased acreages on the part of growers. The acreage could be doubled or trebled without much difficulty if the selfsame war emergency did not impose definite limitations. There are shortages of cans, processing equipment, building material, and labor which limit plant capacity to only a small increase over a record pack in 1941. The war also affects expansion of irrigation back on the farm.

Most growers are already using their irrigation equipment to capacity. New equipment requires steel, iron, copper, rubber, and other materials vital to the war effort. Equipment is not so plentiful as before the emergency, but because of the importance of irrigated products the War Production Board has granted growers a preferential priority for irrigation equipment so that some expansion is possible.

To conserve on equipment, more new land is being irrigated by surface methods which require a minimum of equipment. Where sprinkler systems are used, the sprinklers can be equipped with larger nozzles to permit the application of more water with less pipe and fewer sprinklers. An extreme shortage of electrical equipment makes it necessary to use more gasoline engines for power. An increased diversity of crops permits covering more land with the same amount of equipment. Whenever the entire acreage is devoted to one crop, the entire area needs water at the same time. With several crops the requirements are staggered, permitting the coverage of more land with the same equipment through longer hours of operation, and a 24-hour-a-day operation, 7 days per week, is not uncommon in this area.

The amount of water required will depend on the crop grown. Most vegetable growers will apply from 6 to 20 inches of water to their crop during the season. The total amount used is not so important as getting the right amount of water on the crop at critical times. Usually two or three inches of water will be applied at each irrigation. The experienced grower never lets his crop slow down for lack of moisture. He knows that a shortage of moisture at any critical period in its growth is reflected in a reduced yield and, of even greater importance, in a serious reduction in quality.

Crops cannot grow on water alone. With irrigation an intensive program of soil fertility must be followed to obtain satisfactory yields of quality produce. An ample moisture supply makes

(*Turn to page* 41)

A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa[1] . . . . .

By W. E. Colwell and Charles Lincoln

Cornell University, Ithaca, N. Y.

A YELLOWING of alfalfa caused by the potato leafhopper, *Empoasca fabae,* was described in 1927 (4)[2] and since that time several papers have dealt with the nature of this injury (1, 2, 3, 6, 7). In describing the yellowing, Granovsky (2) placed emphasis on the striated discoloration of the areas between the lateral veins. He also reported a shortening of the internodes of the new growth, and rosetting of the new shoots.

Boron deficiency symptoms on alfalfa were recognized some 10 years later (5, 8) and in the description of McLarty, Wilcox, and Woodbridge (5), there was emphasized a uniform yellowing and (or) bronzing over the intercostal area of the terminal leaves, a shortening of the internodes, and death of the growing points.

The leafhopper symptoms were described before boron deficiency was known to be a problem, and the symptoms due to a lack of boron were described either in the absence of leafhopper injury or without recognizing it as contributing to the abnormality. Since the existing descriptions are not adequate to differentiate clearly between the two types of injury, a comparison of these symptoms has been made in the greenhouse and under field conditions in New York where both agencies contribute to alfalfa yellowing.

Experimental

GREENHOUSE STUDIES

The general plan of the greenhouse investigation was to infest healthy alfalfa cultures with leafhoppers and to compare these symptoms with those caused by a deficiency of boron under similar conditions.

Forty 2-gallon stone jars containing two or three 18-month-old plants growing in a subsurface sample of Dunkirk sandy loam which was deficient in boron were used as a source of material.[3] To 20 of these, boric acid to supply 0.046 p.p.m. B (dry weight basis) was added on April 14, 1941. The 20 remaining pots received no added boron. All plants were clipped on April 14. On May 19, six of the boron-treated jars and two of the minus boron jars were each caged and infested with 25 nymphs and 10 adults of the potato leafhopper.

Complete nutrient solution minus boron was supplied to all cultures, and distilled water was used to maintain moisture. They were placed in the regular greenhouse, receiving only natural light. On June 2, final observations were made. Symptoms of boron deficiency and leafhopper injury were each obtained in the absence of the other.

The results of this comparison are presented with those of the field investigations.

[1] Reprinted from JOURNAL OF THE AMERICAN SOCIETY OF AGRONOMY, Vol. 34, No. 5, May 1942.

[2] Figures in parentheses refer to "Literature Cited."

[3] Acknowledgment is made to Prof. J. K. Wilson who donated these cultures which he had used for other work prior to this time.

PLATE I

A, leafhopper injury in which the reddening is the main type of discoloration. Hopper infested cage, boron plot at the Belleville station. B, severe leafhopper injury, Jefferson County. C, left, leafhopper injury; center, healthy; right, boron deficiency. Greenhouse test. D, boron deficiency showing pronounced rosetting and death of the terminals with little or no yellowing. Greenhouse test. E, severe boron deficiency. Uninfested cage in untreated area at the Belleville station. F, left, an advanced stage of boron deficiency, the lower side of several leaflets are red; right, a moderate stage. Monroe County demonstration.

Field Investigations

A further comparison was made in the field during the summer of 1941 at two locations in north central New York, one station designated as Belleville, the other as Lowville. In October, 1940, borax at the rate of 40 pounds per acre was added to an area 20 by 40 feet in a field which, in each case, had been cut for hay only one year. The response to borax was in each case a mild one, but more definite at the first-mentioned station.

During the second crop in 1941, there were set up at each station four aster cloth cages, the dimensions of which were 4 by 4 by 2 feet. Two were set on the borax plot and two in the adjacent untreated area. One of each was infested with 500 leafhoppers, adults and large nymphs. Caging the plants did not noticeably affect growth.

At the Belleville station the natural leafhopper population was low (around 75 per 100 sweeps), but the two uninfested cages were dusted with impregnated pyrethrum to insure their being leafhopper free. At the Lowville station the natural population was still lower (around 30 per 100 sweeps), and the two uninfested cages were not dusted. Infestations were made at the Belleville station on August 5 and at the Lowville station on July 31. At each location the alfalfa was about 12 inches high and growing luxuriantly. At this time there was no visible response to the added borax.

Semi-weekly observations were made, but the cages were left undisturbed until August 26 when they were removed for the final observations.

Results

As a result of these studies, the following differences between the two types of injury were found to exist. The source of information, greenhouse or field, will be apparent in each case by reference to the various figures.

Type of Discoloration

Yellowing.—The *type* of yellowing alone is not adequate as a means of differentiation, although there is some tendency for the leafhopper yellowing to be characterized by a streaked appearance in which the veins and mesophyll adjacent to them remain green (Plate I, C). Leafhopper yellowing often takes place at the distal portion of the leaflet as a "V" in which the apex represents the point of feeding,[4] and the sides are bounded by veins extending to the edge of the leaflet. (See certain lower leaflets in Plate I, B.) In other cases the yellowing is more uniform (Plate I, C) and from this standpoint alone cannot be differentiated from the uniform yellowing of boron deficiency (Plate I, E and F). There may be a pronounced boron deficiency with little or no yellowing (Plate I, D).

Reddening or bronzing.—Leafhopper reddening occurs either in a "V" as described above (Plate I, A, upper left) or as a uniform discoloration of the entire leaflet (Plate I, B, right). This latter type is difficult to differentiate from boron reddening. In general, the leafhopper reddening tends to have more of a purplish cast, but this is not always true. Boron reddening is believed to represent an alternative symptom, not necessarily a more advanced stage. In New York, yellowing is the more common symptom, but both may occur even on the same leaflet. Many times, though not always, those leaves which are yellow on the upper side may be red underneath. This was true of the severely deficient specimen in Plate I, F.

Distribution of Discoloration

This is one of the most valuable criteria for distinguishing between the two types of injury. The leaves injured by leafhoppers occur at various heights on a given shoot, whereas the yellowing or reddening caused by boron deficiency is always confined to terminals. Lateral terminals may be affected, and, under these conditions, yellowing is obviously not confined to the top of the plant (Plate I, E). (*Turn to page* 44)

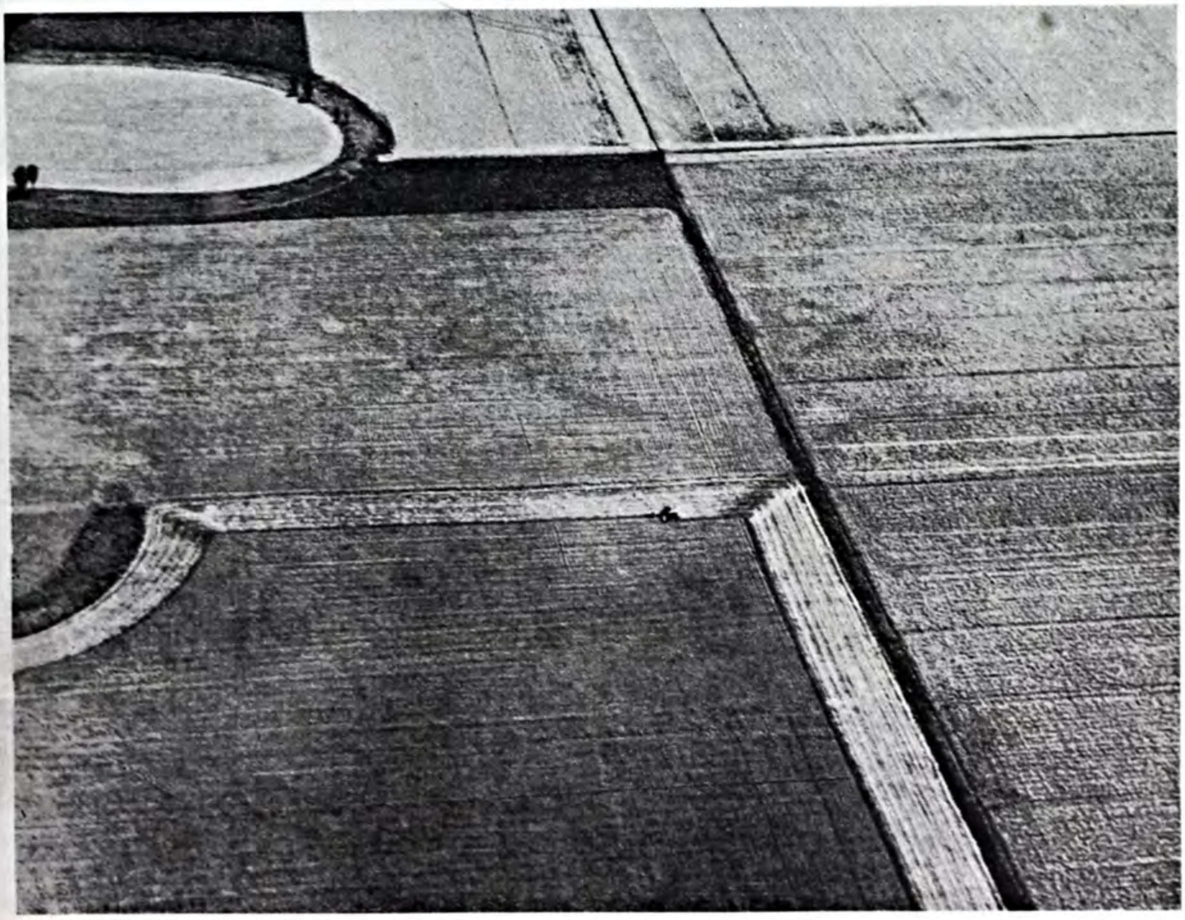
[4] The observation of punctures at the points of feeding is not reliable as a method for field diagnosis.

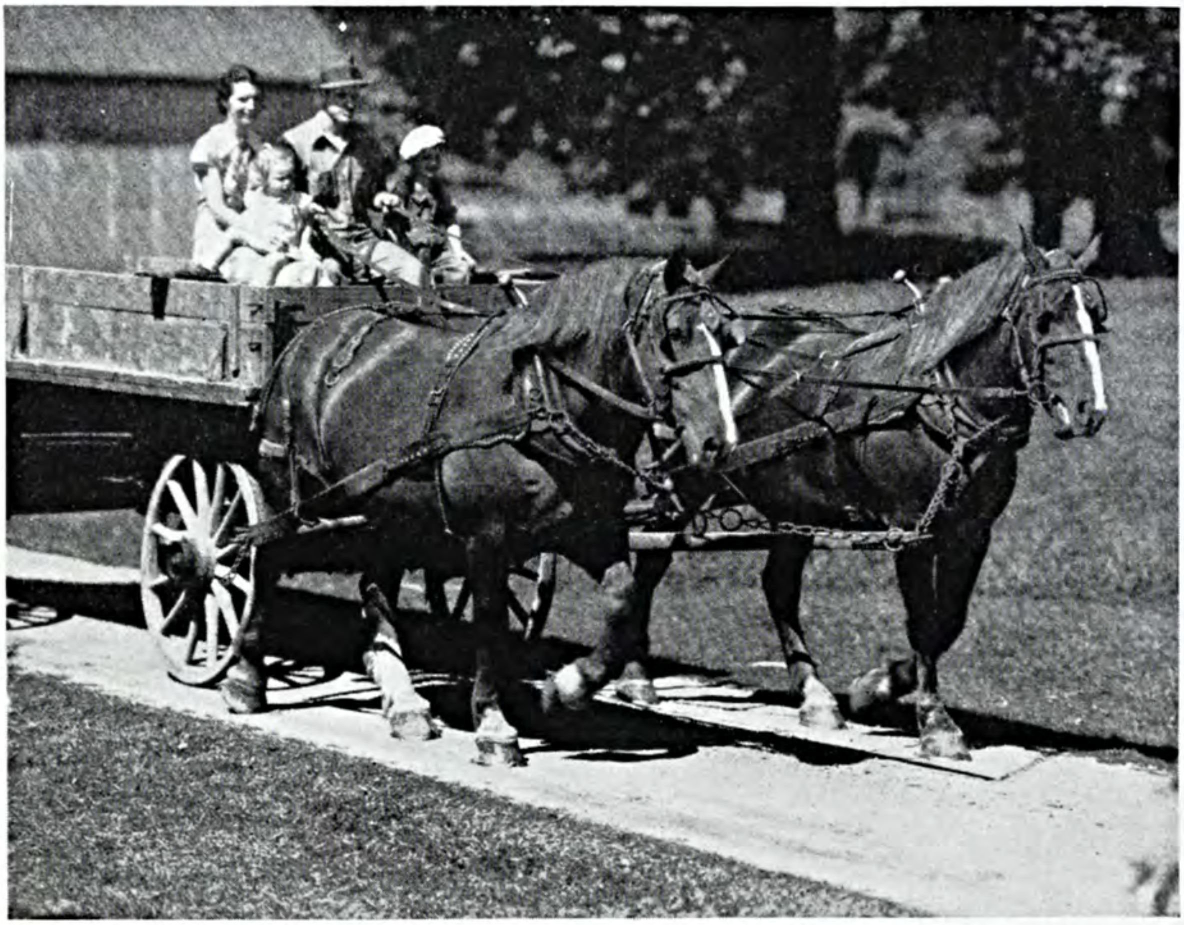
PICTORIAL

FARM LABOR SHORTAGE IS MAKING "MEN" OUT OF ALL "HANDS" AVAILABLE.

On the Spot "Shots" from

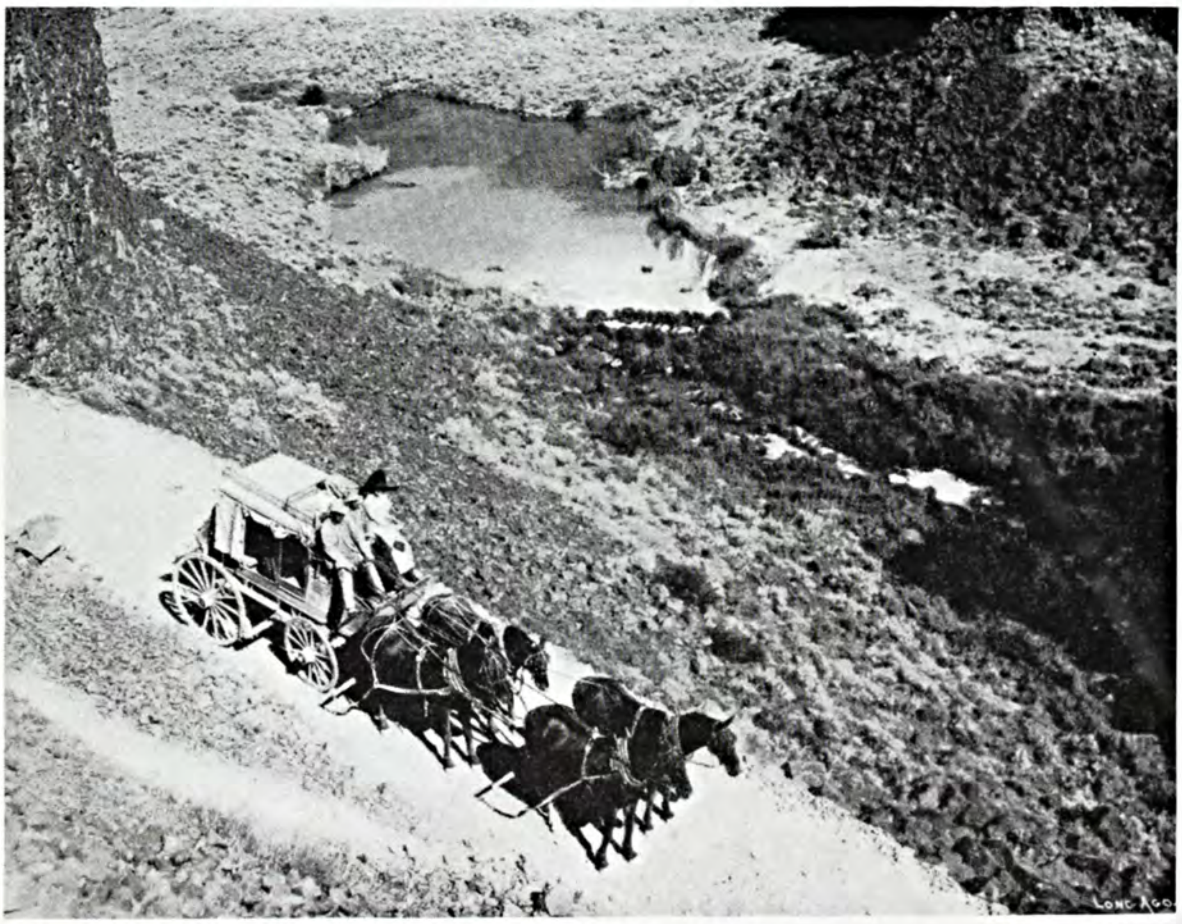
the American Home Front





Above: **Transportation is proving no problem to this young farmer.**

Below: **In the "good old days" before gas and rubber worries.**



The Editors Talk

A Farmer's Wartime Creed

In a recent issue of the Tennessee Farm and Home News, we noted "A Farmer's Wartime Creed" which was prepared by H. C. Holmes of the State's Agricultural Extension Service. This creed embodies so much of what is being asked of and given by farmers as their contribution to the war effort, and says it so concisely, that we are presenting the text in full in the hope that others may find in it phrased ideas of value to them in their work.

We are at war. We did not want it. We love peace. We want to live as God would have us live. We love freedom, freedom of action, freedom of thought, freedom of soul for ourselves and for our children and our children's children. To keep and preserve that freedom and that way of living, we know that we must fight, and fight we will.

We know that we can't all take a gun and face the enemy on the field of battle. Some must provide the food, the clothing, the implements of war. This task is no less important, for without these things we cannot win the freedom and the way of living we hold so dear.

To preserve these things, to prove my faith, to support my sons, my brothers, and my friends who are daily giving their lives for this cause—

1. I WILL produce and save every possible pound of food and feed, knowing that in so providing for my family and my stock I am releasing necessary foods for our armed forces, the workers in war industries, and our allies who are unable to produce.
2. I WILL use all my skill, energy, and land resources to help meet the needs of my community, my country, and its allies for food products by producing a surplus for market, realizing that food is as essential as bullets and that it is my privilege to be able to make this contribution.
3. I WILL save everything and waste nothing. I know that time is precious. Food stuff, feed, clothing, seed, machinery, fertilizer, rubber, scrap iron, paper—all are essential. I will practice good judgment, I will economize; I will be thrifty.
4. I WILL strive for more efficient production of all farm products. I will give that extra care needed to save my pigs, my chicks; that extra effort to secure the last half pint of milk; that extra pound of seed. I will constantly be on guard to prevent disease, insect damage, and accidents.
5. I WILL cooperate with my neighbors in the exchange of labor and equipment; join with them in hauling to and from market when one

trip can accomplish the work of two. I will share whatever I can that is needed, for I know that by helping each other we help ourselves.

6. I WILL pay all the debts I can. I will get my farm business in as good shape as possible. I will save for the future. I will buy war bonds and stamps for I want more shares in America.
7. I WILL cooperate with my church. I will put aside selfishness, petty jealousies, and greed. I will search within myself for those values worth fighting for, for I know that from the wreckage of a war-torn world such values must rise if our fight is not to be in vain.
8. I WILL encourage, aid, foster, and by every means work for community betterment. I will support my school, 4-H club, and community organization in all their worth-while undertakings.
9. I WILL instill the ideals of democracy in the minds of my children; fairness, tolerance, industry, and thrift, for I know that in a lasting peace, hate and injustice can have no part.
10. I WILL be no party to idle rumor, gossip, defeatism. I will be strong, resolute, immovable in my stand. I will remain unconquerable as an individual citizen of an unconquerable nation. I will do my part and more.

The Three Essentials

In all probability, after more than six months of our active participation in this war, there are not many people in this country who do not realize that with men, equipment, and food the three prime essentials of a concerted war effort, farming is more than "a way of life." The broad intelligence and specialized skills of the successful farmer are being recognized and appreciated along with outstanding performance among our armed forces and unprecedented production in munition factories. We haven't seen any public proposals for medals or awards of merits for farmers who are going "all-out" in their war effort, but it is not unlikely that with this year's harvest in, some suitable citations will be made.

In the meantime it is well for everyone connected with crop and livestock production to know within himself that his is no small part in the achievement of an early victory and that the more he puts into it, the greater his help. Removed from scenes of intense activity, the farm individual may have a feeling that he is not contributing much to the emergency. This feeling should be counteracted, particularly in the case of the younger man eager to go into armed service, whom the draft board exempts because he is vital to a successful farm front. There should be a satisfaction in the fact that not only is his work becoming increasingly important, but that it is being widely honored.

"For the long pull, food is as essential a weapon in this war as ships, planes, and tanks," declared Secretary of Agriculture Claude R. Wickard in an address before the Federal-State Conference on War Restrictions held in Washington, D. C., early in May. "I'm sure," he went on to say, "that everyone in this group feels just as strongly as I do about the importance of food and other farm products in making victorious war. But I wonder if all of us realize what a huge job we are up against in undertaking to supply Food for Freedom. There are recent developments which bring out more clearly than ever the great urgency of increasing and speeding the flow of farm products. That's our main concern here in the Department of Agriculture, and each day the necessity for all-out effort becomes plainer."

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

¶ R. H. Bray has made some changes in the rapid tests he has devised for determining available phosphate and potash in soils. The phosphate test is described by him in Illinois Experiment Station mimeographed pamphlet AG-1028, "Rapid Tests for Measuring and Differentiating Between the Adsorbed and Acid-soluble Forms of Phosphate in Soils." It is well known that the phosphate in the soil may be present in several different forms, not all of which are of equal availability to the growing plant. The testing method previously used frequently would not appear to distinguish closely enough among the various forms present, and consequently the crop response did not always correlate well with the results of the test.

Bray has modified his extracting solution so that he thinks he can estimate much more accurately than in the past the relative amounts of the different forms of phosphate present. In order to remove the adsorbed phosphate, the author uses either a neutral or weak acid solution of ammonium fluoride. This removes what he calls adsorbed phosphate which probably is the most available form present other than the small amounts of water-soluble phosphate that, of course, are always removed by any of the methods used. In order to determine the amount of what might be termed the next lower range of available phosphate, Bray makes a second extraction on another sample of the same soil, using this time a stronger acid solution of ammonium fluoride. The acid used in each case is hydrochloric acid. Rather complete directions on preparing and conducting the tests are given. The author also makes suggestions on the interpretation of the test, although he makes it clear that the results must always be correlated with local conditions.

The potash test is described in Illinois Experiment Station mimeographed pamphlet AG1033, "Directions for Modified Test for Replaceable Potassium in Soils." According to Bray, the advantage of this test lies in the fact that the solutions used will keep for a much longer period of time than solutions previously used, less glassware is required, and the test is more easily manipulated. The replaceable potassium is that which is considered to be a measure of the available potassium, and this is determined by leaching the soil with a neutral solution of sodium nitrate. The potassium is then determined by the cobaltinitrite turbidity method. Complete directions for preparing solutions and conducting the tests and precautions with reference to the necessity of having the soil air dry before running the test and for using the cobaltinitrite at the proper temperature are given. These precautions should be carefully observed by anyone running these tests. Methods of reading the tests and interpretation of the results are described.

¶ Considerable interest in the growing of sweet potatoes for starch has developed in Mississippi during the last six or eight years due largely to the establishment of a sweet potato starch factory at Laurel, Mississippi. While sweet potatoes for table use have been grown extensively throughout the South, there was practically no information on growing the crop for starch purposes. W. S. Anderson has conducted a number of excellent investigations to obtain this needed information. His latest results on fertilizers have been published as Mississippi Agricultural Experiment Station Bulletin 367, "Fertilizer for Starch Sweet Potatoes." These fertilizer tests were conducted on several different soils over a period of four years. The Triumph variety was used throughout, since this is the variety used for growing starch sweet potatoes. The author points out that the results obtained with this variety cannot be applied directly to other varieties but may have some significance for them.

Varying the nitrogen content in the fertilizer had quite an influence on the yield and profit, with a tendency for the higher nitrogen application to be the most profitable unless a legume cover crop was turned under, in which case a low-nitrogen fertilizer was the most profitable. The author clears up an idea prevalent among many growers that too much vine is not favorable to good root development. He points out that this is true on late planted potatoes, but when the crop is planted early a large vine is highly desirable and is correlated with high yield. When small, poorly colored vines are noticed early in the season he recommends that extra nitrogen fertilizer be applied immediately so as to correct this difficulty. Phosphorus was of less importance than nitrogen in the opinion of the author. Results from potash were variable but the conclusion is drawn that more than the commonly used 4% potash in the fertilizer is desirable and the author recommends that from 6 to 8% be used. In a test on the influence of potash on starch content of the root there was found to be no correlation. It is pointed out that the crop was grown on a soil well supplied with potash and the effect of potash on starch formation might be much more marked if the soil is deficient in this nutrient. None of the fertilizer applications had any particular influence on the shape of the root. In drawing general conclusions and in making recommendations on a basis of this work, it is suggested that for sweet potatoes grown for starch on the average soil in Mississippi, 50 pounds each of nitrogen, phosphoric acid, and potash should be applied. About half of this nitrogen can be furnished by winter legume cover crops turned under with the remainder of the nitrogen and all of the phosphate and potash coming from a fertilizer application. It is pointed out that this plant food can be supplied by 600 pounds of an 8-8-8 or 800 pounds of 6-6-6 fertilizer or appropriate quantities of material. If a legume cover crop is turned under, the nitrogen in the fertilizer can be reduced.

¶ In order to obtain some idea as to the relative amounts of different forms of boron in soils over the country, R. R. Whetstone, W. O. Robinson, and H. G. Byers conducted a more or less systematic survey, taking samples from various parts of the country and analyzing them for boron. The results of this work are published in U. S. Department of Agriculture Technical Bulletin 797, "Boron Distribution in Soils and Related Data." To give some idea as to the relative availability of the boron, as well as total supplies, the authors made three differentiations. These are the water-soluble which unquestionably is available to plants, the phosphoric acid-soluble which is slowly available to a crop and probably represents reserves that are not immediately available to plants, and the highly insoluble forms, such as tourmaline, determined by a fusion of the soil and representing boron that is so slowly available as to be of no significance so far as any one crop is concerned but serving as a guide to the total boron reserve in the soil. Most attention was given to the acid-soluble boron and wide differences in the amounts of this form present were found among various soils. In general the lighter soils of the Coastal Plains and the adjacent Piedmont areas were lowest in acid-soluble and usually also in total boron. The soils along the West Coast were naturally very low in acid-soluble boron, the high boron content frequently found in them being due to accumulation from irrigation water. The poorly drained soils of glacial lake outwash or till origin were much higher in boron contents. In general the more acid soils contained lower quantities of acid-soluble boron. Soils of low colloidal content were low in acid-soluble boron. The data show very markedly that the acid-soluble boron tends to be concentrated principally in the soil colloid fraction. There was no uniform relationship between total boron and acid-soluble boron, some soils having seven or eight times as much total boron as acid-soluble while other soils had practically all their boron present in an acid-soluble condition.

Water-soluble boron was determined in only a few soils. In the humid regions it tended to be somewhat higher in the surface soil than in the lower horizons. There seems to be no consistent relationship between water-soluble boron and either the acid-soluble or total boron contents. In a few samples where a boron content of crops was correlated to the boron content of the soils, the boron content of the crop tended to be lower if the acid-soluble boron in the soil was lower. Crops showing signs of boron deficiency in practically every case were lower in boron than crops not exhibiting the pathological symptoms characteristic of boron deficiency. In the case of apples, the boron content of the leaves and fruit varied considerably among varieties. Those which are known to frequently show boron deficiency symptoms when healthy tend to contain more boron than those which usually do not show boron deficiency symptoms.

On the basis of their work, the authors conclude that there are three large areas in the United States that are likely to show boron deficiency on crops. These include the Atlantic and Gulf Coasts from Maine to Texas, and extending up into eastern Canada; northern Minnesota, Wisconsin, and Michigan; and the West Coast States. The authors also conclude that natural boron toxicity is unlikely to occur except in the arid regions, and any excessive amounts applied are not at all likely to cause any permanent injury. In general it would appear as though about 10 p.p.m. of boron in the soil is the minimum that will supply sufficient readily available boron for healthy plant growth. It is pointed out, however, that this value is more or less arbitrary and would be influenced considerably by other factors such as soil acidity, lime content, kind and variety of plant grown, etc.

¶ An interesting bulletin on fertilizers has been prepared by L. C. Wheeting, E. L. Overholser and F. V. Vandecaveye. This is entitled "The Farmer's Fertilizer Handbook" and is issued as Popular Bulletin 165, of the Washington Agricultural Experiment Station. It briefly describes what fertilizers are and what they are supposed to do. The functions of nitrogen, phosphorus, potassium, calcium, sulphur, boron and zinc, the principal nutrients supplied in fertilizers, are summarized. The latter half of the bulletin contains specific recommendations for the fertilization of the principal crops grown under irrigated and non-irrigated conditions, with and without manure, and in the eastern and western parts of the State. The recommendations are made in terms of pounds of nitrogen, phosphoric acid, and potash per acre rather than in terms of fertilizer analyses. Farmers using these recommendations then are supposed to apply the analyses and rates of application of fertilizer which will most nearly supply the plant food recommended. The method of recommending pounds of plant food rather than percentages of plant food has much in its favor since, after all, the plant uses plant food in terms of pounds not per cent, and farmers frequently use an analysis recommended but not the quantity recommended so that the actual pounds of plant food the experiment station recommended are not applied. It will be interesting to see whether the system of recommendations adopted by these authors will improve the situation. While it undoubtedly is sound, the system is not so easy to grasp by those who are not accustomed to working with decimals.

"Commercial Fertilizers and Agricultural Minerals, 1941," Dept. of Agr., Sacramento, Calif., Sp. Pub. 188.

"Fertilization of Citrus Trees," Agr. Ext. Serv., Berkeley, Calif., Harold E. Wahlberg.

"Rapid Tests for Measuring and Differentiating Between the Adsorbed and Acid-soluble Forms of Phosphate in Soils," Agr. Exp. Sta., Urbana, Ill., AG1028, Mar. 1942, R. H. Bray.

"Directions for Modified Test for Replaceable Potassium in Soils," Agr. Exp. Sta., Urbana, Ill., AG1033, Mar. 1942, R. H. Bray.

"Fertilizers for Starch Sweet Potatoes," Agr. Exp. Sta., State College, Miss., Bul. 367, Apr. 1942, W. S. Anderson.

"Commercial Fertilizer Report for 1941," Agr. Exp. Sta., Bozeman, Mont., Bul. 402, May 1942, A. H. Kruse, W. E. Carlson, and A. R. Patton.

"The Farmer's Fertilizer Handbook," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 165, Jan. 1942, L. C. Wheeting, E. L. Overholser, and S. C. Vandecaveye.

"Boron Distribution in Soils and Related Data," U. S. D. A., Washington, D. C., Tech. Bul. 797, Jan. 1942, R. R. Whetstone, W. O. Robinson, and H. G. Byers.

Soils

¶ Fertilizer interrelationships for a rotation of crops growing on a Piedmont soil are strikingly brought out in North Carolina Agricultural Experiment Station Bulletin 331, "Soil Fertility Studies in the Piedmont. I. The Effect of Limestone and Fertilizers in a 4-Year Rotation," by C. B. Williams, W. H. Rankin, and J. W. Hendricks. This is a summarization of some of the fertilizer plot work originally laid out by the senior author in 1903, although the data in this publication cover a period beginning with 1918 and running through 1934, during which period a 4-year rotation of corn, wheat, red clover, and cotton was grown with various rates and applications of nitrogen, phosphoric acid, and potash both limed and unlimed.

Lime alone increased markedly the yields of all crops with greatest effect shown on red clover. The use of nitrogen alone did not result in very much increase in yield over the untreated plot. Phosphoric acid alone gave fair increases in yield, while potash alone frequently depressed the yield under the unfertilized plot, especially on the unlimed series. In comparing the combination of any two of these elements, the phosphorus and potassium were the best combination, being particularly beneficial on clover and cotton. On wheat the nitrogen and phosphorus combination usually was best. Highest yields and profits were obtained with the complete fertilizer.

Studying the effects of the elements by omitting one of them from the complete fertilizer indicated that phosphorus was the most important, potash second in importance and nitrogen third. All crops were benefited by the addition of phosphorus to a nitrogen-potassium combination. Addition of potassium to a nitrogen-phosphorus combination also increased the yields of all crops but the greatest effects were on cotton. Nitrogen added to phosphorus and potassium also increased the yields of all crops but was most effective on wheat.

Changing the ratio of the nutrient in complete fertilizer had marked effects on the yields of the crops. Increasing the nitrogen increased the yields of all crops except clover. Triple nitrogen applications gave best results on wheat on both limed and unlimed soil, and on corn on unlimed soil, but the double normal nitrogen was best on the limed soil. The latter probably was due to the greatly stimulated clover growth due to the liming, possibly coupled with an unbalanced nutrient condition due to insufficient potassium and phosphorus where the large amount of clover was grown. Increase in the ratio of phosphoric acid in the complete fertilizer increased yields of all crops except cotton on the limed soil where half the normal rate of phosphorus gave best results. It was observed that in all cases where larger amounts of phosphorus were used, cotton rust, indicative of potassium deficiency, was increasingly evident showing that potassium became a limiting factor. Increasing the ratio of potassium in the complete fertilizer had its greatest effects on cotton and also increased the yield of clover. It did not have much effect on wheat and corn.

Lime had a very marked effect on the crop response on this soil. Benefits from liming, however, were much greater with lower amounts of phosphate than from the higher amounts, indicating that the phosphate applications were to some extent serving the same purpose as the lime applications but probably at a higher cost. High phosphate applications relative to potash resulted in a lower response to lime, apparently due to the development of an unbalanced nutrient condition as indicated by marked potash deficiency symptoms on corn and cotton. Many other interesting and valuable facts on fertilizer usage which space does not permit giving in detail are brought out in the data presented in this bulletin.

"Conservation Measures Which Produce Larger Crops," Agr. Ext. Serv., Newark, Del., Agron. Leaf. 2, May 1942.

"Soil Reaction as a Basis for Certain Land Management Practices," Agr. Ext. Serv., Gainesville, Fla., Misc. Pub. 30, Mar. 1942.

"Soil Fertility Studies in the Piedmont," Agr. Exp. Sta., Raleigh, N. C., Bul. 331, Jan. 1942, C. B. Williams W. H. Rankin, and J. W. Hendricks.

"Soil Fertilization and Management in 1942 in the 'Food for Victory' Program," Agr. Exp. Sta., Madison, Wis., Jan. 15, 1942.

"New Landmarks of Soil Conservation," U. S. D. A., Washington, D. C., Misc. Pub. 473.

"Soil Survey, Catoosa County, Georgia," U. S. D. A., Washington, D. C., Series 1937, No. 4, Nov. 1941, A. E. Taylor, J. C. Mercer, G. D. Thornton, and J. H. Bowers, Jr.

"Soil Survey, Story County, Iowa," U. S. D. A., Washington, D. C., Series 1936, No. 9, Nov. 1941, H. R. Meldrum, D. E. Perfect, and C. A. Mogen.

"Soil Survey, Roseau County, Minnesota," U. S. D. A., Washington, D. C., Series 1936, No. 11, Jan. 1942, P. R. McMiller, E. A. Fieger, H. Arneman, M. A. Lauffer, S. Hill, O. R. Younge, E. Kneen, A. T. Hagen, J. C. Hide, and S. Labovitz.

"Soil Survey, Puerto Rico," U. S. D. A., Washington, D. C., Series 1936, No. 8, Jan. 1942, R. C. Roberts.

Crops

¶ Alyce clover is a comparatively new crop, introduced about 30 years ago from Asia. It is finding a rather important place in Florida and other southern states where it is used as a hay, cover, and seed crop. General information on growing Alyce clover is given in Florida Agricultural Experiment Station Press Bulletin 570, "Alyce Clover," by R. E. Blaser, G. E. Ritchey, and W. B. Stokes. The crop should be grown on well-drained soils that are free of nematodes. The authors found that good stands of Alyce clover were obtained regardless of fertilizer treatment but hay yields were greatly increased by proper fertilization. On sandy soil on which the fertilizer trials were conducted phosphate and potash were very important. Omitting phosphate from the fertilizer decreased the yield considerably, while omitting potash depressed the yield almost to the same level as the unfertilized areas. In the particular test reported lime was of little benefit, but it may be needed on other soils. The general fertilizer recommendation is 200 to 400 pounds of 0-16-16 fertilizer per acre. Work so far conducted indicates that inoculation of the seed is not necessary. Other information on growing and handling the crop is briefly given in the bulletin.

¶ An excellent compilation of information and experimental data on peanuts has been made by H. O. West and published as Mississippi Experiment Station Bulletin 366 entitled "Peanut Production." This is a revision of Bulletin 341 of a similar title issued a couple of years ago. Essentially the same type of material is presented in the revision, but newer data reported since the first edition have been incorporated in the present bulletin. The subjects covered are soil adaptation, varieties, seedbed preparation, fertilization and liming, planting, cultivation, digging, stacking, picking, marketing, use of vines for hay, insect pests and diseases, and the use of peanuts as feed on the farm. Data are quoted from numerous experiment station publications. The information on fertilizer shows why there is so much confusion in the fertilization of this crop, since the data are often contradictory or else do not show any particular trend. The bulletin is a very useful source of information on experimental work with peanuts in this country.

¶ The New Jersey Experiment Station is recommending two new types of red clover to growers in that State. Descriptions and brief cultural directions for these are given by C. S. Garrison in New Jersey Agricultural Experiment Station Circular 419, "Better Strains of Red Clover." The two strains recommended are Kentucky 101 and Cumberland. These strains can be cut for hay two years instead of the customary one year for the ordinary red clover. It is pointed out that many clover failures are due to low soil fertility and if full advantage is to be taken of these improved strains, adequate fertilization must be supplied. The small grain preceding the clover should be well fertilized with 300 pounds of fertilizer such as 3-12-6 or 5-10-10 per acre unless the land has been heavily manured, in which case superphosphate may be all that is needed to supplement the manure. After the grain crop has been harvested, a top-dressing of 200 pounds of 0-12-12 per acre should be applied on the clover; and after the first year's cutting, 400 pounds of 0-12-12 per acre should be applied in the fall in order to maintain a vigorous stand for the second-year hay crop. Lime should be applied as needed prior to seeding the small grain.

¶ With so much attention being given to vegetable and oil crops there may be a tendency to overlook the importance of maintaining efficient practices in growing our regular staple crops. Realizing the necessity of producing sufficient quantities of the longer staple upland cotton to meet the increased demand for strong yarn, agricultural authorities in North Carolina have issued North Carolina Extension Circular 258, "Cotton Growing in North Carolina." This briefly gives recommended varieties, seed treatment, crop rotation, fertilizer application, planting, insect control, and harvesting. In the fertilization of the crop attention is called to the advantage of using high analysis fertilizer and to the importance of keeping in mind that when peanuts, soybeans, clovers, and lespedeza are harvested as hay the potash content of the soil will be considerably reduced and provision should be made to supply cotton following these crops with enough potash to meet the full needs of the crop. When the hay is removed, cotton following these crops should receive 500 pounds of 4-8-8 in the Coastal Plain and a 4-10-6 in the Piedmont with 150 pounds of a 10-0-10 nitrogen-potash top-dresser in each case. Where only the seed in removed, 500 pounds of 2-8-10 with a straight nitrogen top-dresser are recommended on the Coastal Plain and 500 pounds of 2-10-6 in the Piedmont. For continuous cotton or when cotton follows corn or tobacco in rotation 500 pounds of 4-8-4 with 100 pounds of a nitrogen top-dresser are recommended for the Coastal Plain soils and the same quantity of 4-10-4 with the top-dresser for the Piedmont. On potash-deficient soils, 150 pounds of a 10-0-10 nitrogen-potash top-dresser should be used instead of the straight nitrogen top-dresser in addition to the fertilizer at planting time.

"Irrigation Requirements of Cotton on Clay Loam Soils in the Salt River Valley," Agr. Exp. Sta., Tucson, Ariz., Bul. 181, Mar. 1942, Karl Harris and R. S. Hawkins.

"Pasture and Forage Crops for Irrigated Areas in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Bul. 469, Mar. 1942, D. W. Robertson, R. M. Weihing, and T. G. Stewart.

"Winter Wheat Production in Colorado,"

Agr. Exp. Sta., Fort Collins, Colo., Bul. 470, Apr. 1942, D. W. Robertson, J. J. Curtis, D. Koonce, J. F. Brandon, and O. H. Coleman.

"Forest Lysimeter Studies Under Hardwoods," Agr. Exp. Sta., New Haven, Conn., Bul. 499, Sept. 1941, Herbert A. Lunt.

"Sixty-fourth Report for the Year 1940," Agr. Exp. Sta., New Haven, Conn., Pub. Dec. 24.

"Annual Report of the Director for the Fiscal Year Ending June 30, 1941," Agr. Exp. Sta., Newark, Del., Bul. 235, Dec. 1941.

"Alyce Clover," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 570, Apr. 1942, R. E. Blaser, Geo. E. Ritchey, and W. E. Stokes.

"Sugar Beets," Agr. Exp. Sta., Urbana, Ill., AG1084, Mar. 1942, R. F. Fuelleman.

"Renovating the Pine Lot for Continuous Production," Agr. Ext. Serv., Orona, Maine, Bul. 303, Apr. 1942, M. A. Huberman, R. F. Taylor, and A. D. Nutting.

"Pruning and Care of Ornamental Trees and Shrubs," Agr. Ext. Serv., East Lansing, Mich., Bul. 172, Rev. Apr. 1942, O. I. Gregg.

"Annual Crops for Hay and Pasture," Agr. Ext. Serv., East Lansing, Mich., Bul. 238, Apr. 1942, C. R. Megee.

"Peanut Production," Agr. Exp. Sta., State College, Miss., Bul. 366, Mar. 1942, H. O. West.

"Cottonseed Treatment in Mississippi," Agr. Exp. Sta., State College, Miss., Cir. 103, Feb. 1942, J. A. Pinckard.

"Oat Variety Tests in Montana," Agr. Exp. Sta., Bozeman, Mont., Bul. 399, Jan. 1942, A. M. Schlehuber, J. J. Sturm, and R. H. Bamberg.

"Better Strains of Red Clover," Agr. Exp. Sta., New Brunswick, N. J., Cir. 419, Jan. 1942, C. S. Garrison.

"Fifty-fourth Annual Report, 1941," Col. of Agr. and Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y.

"Victory Garden Planting Schedule," Agr. Ext. Serv., Raleigh, N. C., Misc. Pamph. 60, Jan. 1942.

"Cotton Growing in North Carolina," Agr. Ext. Serv., Raleigh, N. C., Cir. 258, Apr. 1942.

"Four-H Cotton Club Manual," Agr. Ext. Serv., Stillwater, Okla., Cir. 349, Rev. 1941, Roy W. Ellithorp.

"Science for the Farmer," Agr. Exp. Sta., State College, Pa., Bul. 414, 54th An. Rpt., Nov. 1941.

"Seventh Annual Report," Dept. of Agr. and Cons., Providence, R. I.

"Fifty-fourth Annual Report for the Year Ended June 30, 1941," Agr. Exp. Sta., Clemson, S. C., Dec. 1941.

"Sudan Pasturage for Beef Production," Agr. Ext. Serv., College Station, Texas, B-123, Sept. 1941, G. W. Barnes, A. L. Smith, and J. H. Jones.

"You Can Grow Trees in Spite of Drought and Wind," Agr. Ext. Serv., College Station, Texas, C-123, 1942, Sadie Hatfield.

"Plants of Ornamental Value for the Rio Grande Valley of Texas," Agr. Exp. Sta., College Station, Texas, Bul. 609, Mar. 1942, W. H. Friend.

"Vegetable Adaptability in the Wichita Valley," Agr. Exp. Sta., College Station, Texas, Bul. 610, Jan. 1942, B. S. Pickett and L. E. Brooks.

"Report of Agricultural Research and Other Activities of the Western Washington Experiment Station for the Fiscal Year Ended March 31, 1941," W. Wash. Exp. Sta., Puyallup, Wash., Dec. 1941, J. W. Kalkus.

"What's New in Farm Science," Agr. Exp. Sta., Madison, Wis., Bul. 455, Pt. II, 58th An. Rpt.

"Harvesting and Handling Cultivated Cranberries," U. S. D. A., Washington, D. C., Farmers' Bul. 1882, Jan. 1942, H. F. Bain, H. F. Bergman, and R. B. Wilcox.

Economics

"Arizona Farm Leases," Agr. Exp. Sta., Tucson, Ariz., Bul. 179, Feb. 1942, E. D. Tetreau.

"Connecticut Vegetable Industry and Its Outlook for 1942," St. Dept. of Agr., Hartford, Conn., Bul. 77, Apr. 1942.

"Food for Home and Victory," Agr. Ext. Serv., Gainesville, Fla., Cir. 61, Mar. 1942, C. M. Hampson.

"The Potato Enterprise in Garrett County, Maryland," Agr. Exp. Sta., College Park, Md., Bul. A4, Oct. 1941, A. B. Hamilton, and S. H. DeVault.

"Financial Management Analysis of Farmers' Cooperatives in Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 315, May 1942, H. E. Larzelere.

"The Competitive Position of Dairying in Southern New England," U. S. D. A., Washington, D. C., Tech. Bul. 812, Feb. 1942, H. C. Fowler.

Cotton on Sandy Soils Needs Plenty of Potash

(*From page* 12)

affected. In that case a split application would be recommended.

The average yield for the 10 years from the plots not receiving any potash was only 543 pounds of seed cotton per acre. The difference in yield between

0 and 15 pounds of potash was 389 pounds, an increase equivalent to 71.6 per cent in favor of the 15-pound application. The increase in yields obtained from the various rates ranged from 389 pounds to 990 pounds of seed cotton per acre, equivalent to increases varying from 71.6 to 182.3 per cent over the yield from the no-potash plots. From the average yields from the 10-year test for the rates used and under the conditions prevailing, it is calculated that the addition of 1 pound of potash has increased the yield from 17 to 26 pounds of seed cotton, depending upon the rates of application.

Pictures Tell Story

Some typical normal and potash-deficient leaves and plants where potash was applied or omitted on sandy soils are shown in the accompanying photographs. All photographs were taken of plants from the same two plots in which the one on the left for ten years received 30 pounds of potash and the one on the right had received no potash. However, both plots received the same amount of nitrogen and phosphoric acid. In Fig. 1 are shown a normal leaf and a typical potash-deficient leaf. In Fig. 2 the stalk of cotton on the left was taken from a plot (potted for photographing) which received 30 pounds of K_2O annually for 10 years, and the stalk on the right was taken from a plot which had not received any potash for 10 years but had received amounts of nitrogen and phosphoric acid equal to those applied to the one on the left. Note the premature shedding of the leaves and small bolls on the stalk on the right as compared with the normal plant on the left. In Fig. 3 the plot on the left had received 30 pounds of K_2O for 10 years whereas the one on the right had had no potash. Both plots have an excellent stand and show a promising crop with no indication of a plant-food deficiency at this stage of growth which was on July 1. Figure 4 is a picture of the same plots shown in Fig. 3 but taken 91 days later on September 30. The plot on the right which had not received any potash shows a severe potash deficiency with a premature opening of the bolls and shedding of the leaves. The final comparative yields of the two plots are shown in Fig. 5.

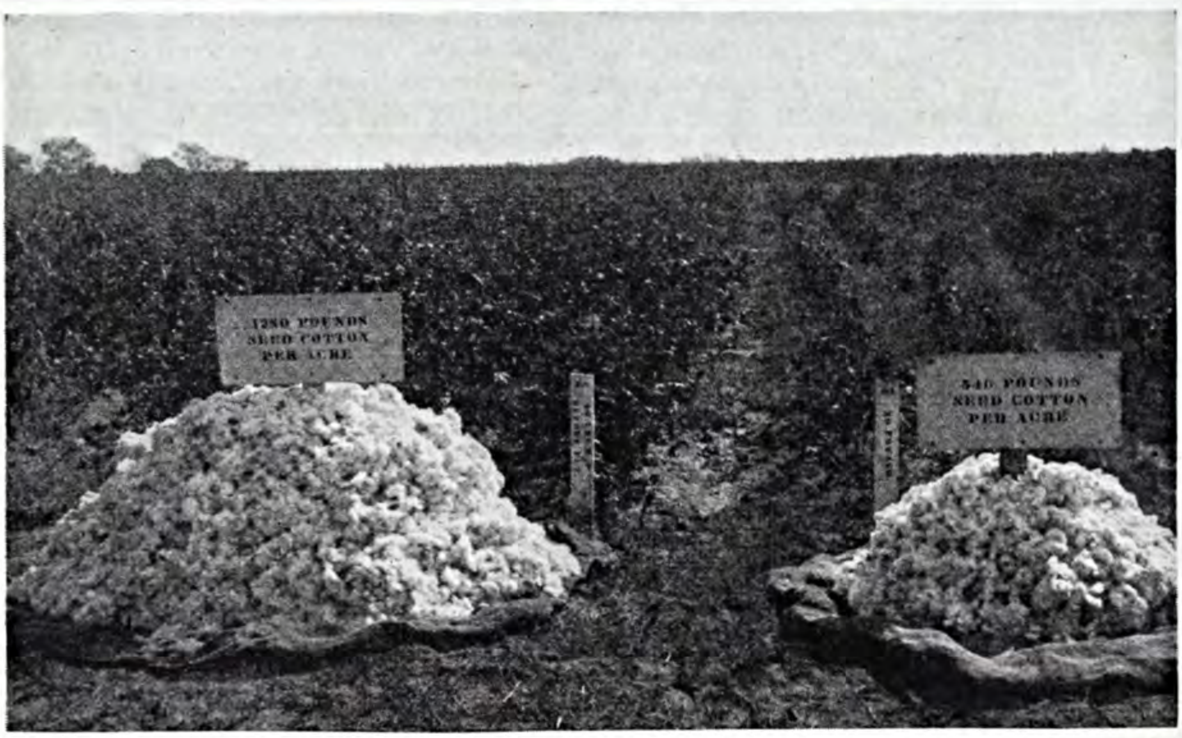


Fig. 5. Final comparative yields told the whole story. Left: The complete treatment produced 1,280 pounds of seed cotton per acre. Right: Where potash had been omitted, the yield was only 546 pounds of seed cotton per acre. Picture taken October 15, 1940.

Some Soil Problems of the Piedmont

(*From page* 15)

voted to cotton and corn does not necessarily imply a corresponding reduction in total yields of these crops in any given area. In this system those fields, or sections of fields, not suited for clean cultivation (by virtue of slope, erosion, or other reason) would be retired to permanent vegetation. If this were carried out on a large scale, then there could and would be increased effort devoted to the better lands. This would mean that these lands would be farmed under the best management practices known for the particular locality. Such practices should, and very likely would, permit high yields and at the same time maintain fertility. It is not unlikely that the better lands on many farms, if managed properly, would produce more cotton and corn than the entire farm is now producing. Continuing on this basis, it is conceivable that most of the land not suited for these crops could be retired from cultivation without materially affecting the total yields. In fact, it is conceivable that the total yields might even be increased under such conditions, at least in certain localities. If such an increase were obtained, it would without doubt be of economic advantage to the farmer. He would have no more man-hours of labor in each acre, and would be cultivating fewer acres. His cash outlay for seed would be less; his fertilizer and limestone would be more efficiently utilized. From the standpoint of net income these factors are of paramount importance.

Returning to the subject of soil impoverishment, probably the average Southern landowner fully realizes that the history of agriculture in the South is largely responsible for the condition of his soils today. Yet, many of these same individuals continue to adhere to practices which have destroyed their soils. The economic and social factors which to a certain degree govern every cooperative accomplishment have played and are still playing a predominate role in retarding developments which might eventually lead to a desirable system of diversification which would form the foundation for a more self-sufficient agriculture.

Down through the years the South as a whole has imported a large proportion of its manufactured goods, in addition to certain essential food requirements such as beef and dairy products. To rapidly undertake the production of a large part of its own agricultural necessities would undoubtedly be to the economic disfavor of those sections of the country which have for so long enjoyed the vast Southern markets; in fact so much so that a certain amount of political and economic pressure might naturally become involved.

Depends on Diversification

Nevertheless, if there is to be a more prosperous agriculture in the South in our day, it can come only through sufficient diversification to permit preserving and restoring of soil fertility. This could possibly come about in due time through basic and scientifically sound types of predominating agriculture; however, from the viewpoint of conservation of the soil the most promising salvation within our grasp lies in the use of grass and legume cover, pasture, hay, and green manure crops.

This alone possibly suggests a livestock program, especially for the eastern cotton states. It is not unlikely that within the coming decade further steps will be made in this direction. To this end cooperation of agricultural leaders in plant breeding, soil conservation, soil fertility, plant nutrition, and animal nutrition will be essential.

It is well that we recognize it has been man alone who is responsible for the inestimable soil destruction for which he has already undergone untold suffering. This Nation, modern, progressive, and farsighted though it is, has wrought upon itself a rate of self-destruction never before known on the face of the earth. An unwavering effort should be devoted to the "most important of all tasks," employing agricultural methods which will permit the soil, that still remains where nature placed it, to remain there continuously, and to increase its usefulness for an agriculture upon which a modern civilization can stand securely.

The Fertilization of Pastures and Legumes

(*From page 9*)

figures for the same treatments were $4.05, $2.96, and $2.71 for beef and $0.42, $0.30, and $0.28 respectively for milk. Whether calculated as per acre production or cost of pasture per 100 pounds of beef or milk, the economic returns were significantly favorable for each fertilizer treatment.

Pasture top-dressing tests on 103 farms in 15 states and the Province of Ontario were reported by the National Fertilizer Association in 1930. Average results expressed in terms of dry matter and pounds of protein per acre present one of the most convincing pictures for fertilization that has been made available. Yields from the O, P, LP, LPK, and LNPK treatments were 1,051, 1,392, 1,548, 1,850 and 2,501 pounds dry matter per acre. For the same plots the yields of crude protein per acre were 171, 235, 266, 344, and 488 pounds. On 50 of these farms where accurate records were kept, an average application of fertilizer costing $15.14 per acre returned an average net profit of $29.62, or in other words, 195% on the investment in six months. Decreased feed costs and increased milk production practically paid for the cost of the fertilizer before the unfertilized pasture was ready to graze. In the opinion of those who conducted these tests, the use of high analysis fertilizer offers the dairy farmer quicker returns than any other investment he can make.

Pastures are recognized as being the best and cheapest source of protein feed. In the young, tender stage pasture grasses contain more protein than alfalfa hay, about twice as much as mixed clover hay. Cost of this protein is about one-third as much as in purchased feed. It is quite clear from the experimental work that has been reported that both the yield of dry matter as well as the protein are greatly increased by proper fertilization.

It is well known that apart from bulk the feeding value of pastures varies in different areas. It has been shown in recent investigations, reported by Dr. J. B. Orr of Aberdeen in his book "Minerals in Pastures," that one of the most important factors in determining the feeding value is the amount of calcium, phosphorus, sodium, potassium, and chlorine present in the herbage. Some pastures may be so poor in one or the other of these elements as to be the cause of disease among grazing animals. Rickets in young animals, general unthriftiness and low producing capacity in mature animals are characteristics of mineral deficiencies most frequently observed. In considering the mineral content of a pasture in relation to its nutritive value, it is necessary to have some standard of the requirements of animals for the different minerals. In the present state of our knowledge, according to Orr, the amount of minerals found in milk affords the best available standard for growing and lactating farm animals. The following table compares the amounts of the important minerals found in the quantities of cow's milk and good pasture which yield 1,000 calories.

It will be seen that there is a fairly

COMPARISON OF MINERAL CONTENT OF GOOD PASTURE WITH THAT OF MILK
(1,000 calories contain the following amounts in grams)

	Na_2O	CaO	P_2O_5	K_2O	Cl	Nitrogen
Cow's milk	0.81	2.38	3.43	3.21	1.4	8.32
Good Pasture	0.94	3.64	2.75	11.54	3.5	10.40

close resemblance between the mineral content of good pasture and that of cow's milk. There is no natural foodstuff so well balanced in this respect as good pasture. The close correspondence of the mineral content of a good pasture to the mineral requirements of the animals is doubtless one of the most important factors in the well-known high nutritive value of pasture for promoting growth and maintaining health of animals grazing thereon.

The mineral composition of different species of plants varies quite widely. The most outstanding difference is that between legumes and grasses. Legumes as a group tend to be richer than grasses in all of the minerals, especially in calcium. Grasses, however, are relatively richer in phosphorus than legumes. It is well-known that the addition of clovers or other legumes to grasses increases the value of the grazing. This is probably due in some extent to the fact that the two together in the proper proportions make a well-balanced diet.

In a thought-provoking paper Dr. William Albrecht, University of Missouri, points out that natural prairie grasses carry a high percentage of calcium and other cations including potassium. He further points out that leached soils may be so depleted of potassium as seriously to interfere with the production of proteinaceous plants. The theory advanced by Dr. Albrecht in respect to the importance of calcium and potassium in producing plants carrying a relatively high content of nitrogen, plants such as the grasses and clover, suggests very careful consideration of their importance in any pasture fertilization program.

White clover is sometimes styled as

Jersey cows on an excellent crimson clover pasture at the Belle Mina Experiment Station in Alabama.

the key to pasture improvement. By many authorities it is regarded as an excellent indicator of mineral deficiencies. When it fails, it is a reasonably sure sign that the supply of potash, phosphorus, and/or lime is deficient. The importance of mineral plant food in increasing yield and quality of herbage as well as for the health and productive capacity of animals gives a high degree of significance to this type of fertilization. A deficiency of minerals is usually associated with deficiency of protein and absence of properties such as leafiness and succulence on which the nutritive value of pastures depends so much.

The old axiom, "take care of the legumes and the grasses will take care of themselves," is being put into practice throughout the humid areas of the United States. The big problem in this connection is quite naturally that of supplying the necessary minerals, lime, phosphorus, and potash, before planting the legume. The second most important probably is that of selecting the legume best suited to the particular soil and climatic conditions. White clover, the premier legume for growth in association with grasses, does best under cool, moist growing conditions.

In the Northeastern States ladino clover, a giant type of white clover, is receiving a great deal of attention. It is a triple-purpose crop—valuable for hay, pasture, or silage. It is distinguished from ordinary white clover by having much larger leaflets and taller stems. Owing to its more erect growth, it is able to compete with tall growing grasses and legumes. Although not so well adapted to closely grazed pasture sods as the smaller types of white clover, under favorable management and liberal mineral fertilization, ladino is permanent and produces large yields of high quality feed.

In areas that are subject to drought, such as in our Midwestern States, white clover has been largely replaced by the deeper rooted legumes, alfalfa and sweet clover. In the South and Gulf Coast States, a number of shallow rooted legumes have been tried out. Among the best for use in pasture mixtures have been the white Dutch and Persian clovers for wet soils and on the well-drained soils species such as the California burr, sweet clover, black medic, little hop, and Lespedeza. Of one thing we are quite sure and that is for almost every condition or section of the country where pastures need to be grown, there is a legume well suited for pasture uses. In practically all cases it has been found that these clovers are highly responsive to mineral fertilization.

Excellent pasturage is one of the three uses which results in ladino clover being called the new triple-purpose crop.

No discussion of pastures would be complete without some mention of the part they play in soil conservation. As a means of protecting soil against erosion, pasture is universally recognized as the best form of land occupation except woodland. Its value for this purpose has received Nation-wide emphasis under the several programs of the Soil Conservation Service and Agricultural Adjustment Administration. Large tonnages of lime and commercial fertilizers have been used in establishing permanent pasture sods, the basis of soil conservation in many areas.

There is probably no other means of so greatly reducing the cost of production of livestock and livestock products and so greatly increasing the net farm income as through the improvement of farm pastures. The development of a satisfactory soil-fertility program for the maintenance of the fertility of pasture soils is the surest means of making pastures the greatest agricultural resource of our country. In the achievement of this objective, vast quantities of fertilizers and lime will be required.

Water, Fertilizer and Good Farming

(*From page* 19)

it possible to use heavier fertilizer applications and to use them profitably. The program should include commercial fertilizers, but they cannot be expected to do it all.

Fertilizing this year's crop of vegetables should have started two or three years ago. It is more important to build up a productive soil than it is to attempt to supply all of the plant-food needs to the growing crop. A good supply of the right type of organic matter in the soil is more important than anything else in producing a good crop of vegetables or any other crop. Decaying organic matter releases the natural supply of plant food in the soil—the cheapest source of plant nutrients. Without it, even very heavy applications of commercial fertilizers might not be effective. If the supply of active organic material is ample, mistakes made in the use of commercial materials are often automatically corrected. Organic material absorbs plant food applied to the soil and, in effect, releases it in the right amounts to supply the needs of growing crops. Applications of commercial materials that might damage or even kill the crop on a soil low in organic matter could be used to advantage on a soil with an ample supply.

There are many confusing facts and ideas regarding organic matter. Soil scientists are developing new information constantly, but still there is a dearth of clear-cut information on when the beneficial effects of organic matter occur. The word "humus" is responsible for most of the confusion. For the good of the grower, the word should be banned from usage. Apparently, humus is only one stage in the decomposition of organic material, and just when organic material becomes humus and when bacterial and chemical action progresses (or should we say deteriorates) until it becomes entirely inert, no one seems to know for sure. Who cares? As growers, let's forget that there ever was such a word and assume that organic matter is responsible for beneficial processes in the soil from the time it is first incorporated until it completely disappears. What if the value of organic material is due to the material itself, to the bacteriological processes during decay, or to a combination of both? The crop doesn't care and the grower must still resort to cover and green manure crops, barnyard manure, and other available materials. He can't buy humus by the sack.

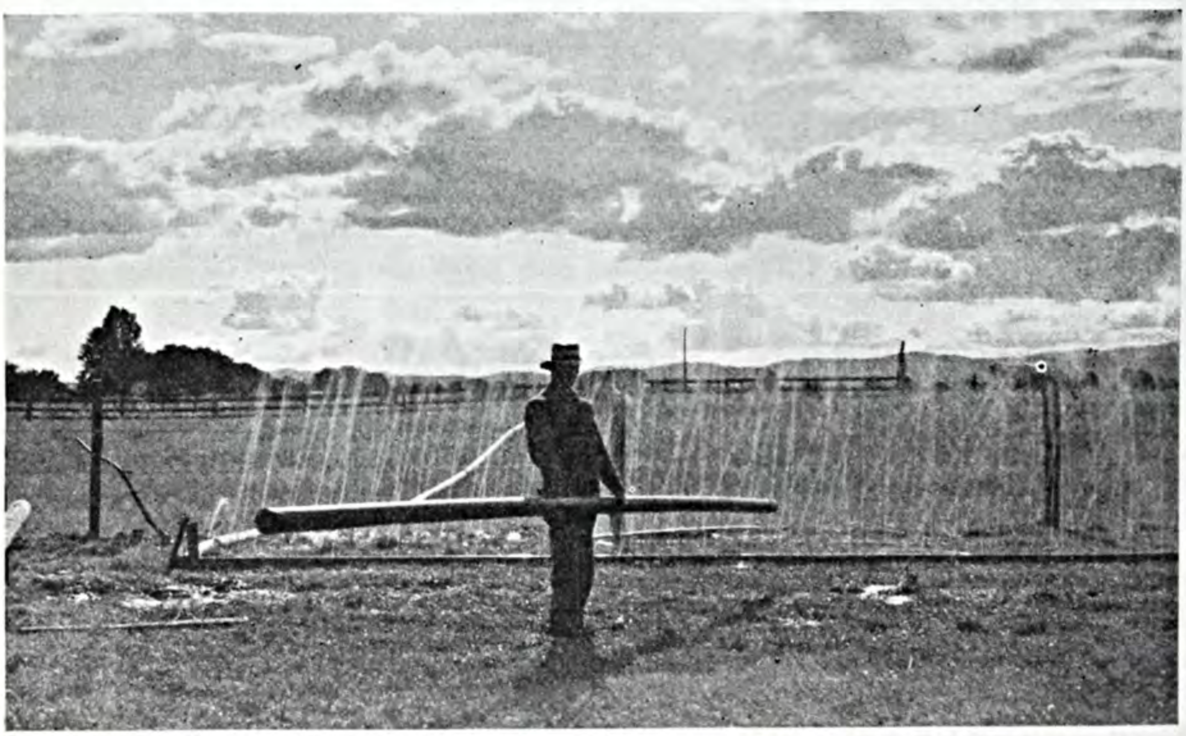
Forms of Organic Matter

Good organic matter should decay rapidly and should be high in nitrogen, and usually any material high in nitrogen will decay rapidly. Legume cover crops and legume sod are ideal forms, and fertilizer, particularly phosphorus and sulphur carriers, may pay double dividends on these crops. Barnyard manure is ideal but is becoming increasingly hard to obtain. Non-legume cover crops and sod of non-legume crops can be improved by applications of a nitrogen fertilizer. If this material is used at the time the sod is broken or the cover crop is turned under, non-legume material will be just as valuable as vetch, alfalfa, or other legumes. The nitrogen material is not lost; it will be available for use by the following crop.

The ideal situation for growing commercial vegetables would be to produce them on general farms where a good crop rotation could be followed—vegetables to be rotated with crops such as clover, alfalfa, and pasture. The situation would be still better if these other crops were marketed through livestock, leaving a supply of barnyard manure on the farm to furnish organic material and replace necessary purchases of commercial fertilizers.

Many of our growers are situated on acreages too small to make a rotation possible. Other means of maintaining a supply of organic material must be adopted. This should center around the consistent and constant use of cover and green manure crops. The land permanently devoted to vegetables should have the benefit of at least one good cover or green manure crop each year. Sometimes it may be possible to use more. It is good farming to seed some type of crop for green manure whenever the soil is not occupied by a salable crop. The crop to use will depend on the time available for growth. Even a 3-weeks' growth of turnips would be worth the expense of seeding and, possibly, an extra irrigation. During the winter months, all vegetable land should be protected by a winter cover crop, not only to supply organic material for the succeeding crop but to prevent wastes of plant food during the wet winter season. Vegetable land left fallow over the winter months will lose more than a season's supply of plant food through leaching.

No type of farming can use heavier applications of commercial fertilizers and use them more profitably than commercial vegetable production under irrigation. It is impossible to develop specific recommendations for each crop. Vegetables are grown on 40 or 50 different soil types in the Willamette Valley. Each of these supplies plant foods in different quantities. Each one of these types, likewise, has been subject to as many different types of farming as there are farmers, resulting in the removal of different quantities of plant food. The fertilizer that works satis-



Perforated pipe operating at 15 pounds pressure.

factorily on one farm might not perform the same on the neighboring farm. Different responses can also be noted even in different parts of the same field on the same farm.

On most vegetables it is desirable to make a basic application of a complete fertilizer — one containing nitrogen, phosphorus, and potash. The ratio of the three and the rate of application will vary with the crop and the soil. Usually two to three times more phosphorus than nitrogen will be included in the mixture. Potash will vary from an amount equal to the nitrogen to an amount equal to the phosphorus. Ratios of 1-2-1 and 1-3-1 are popular. The amounts used also will depend on the soil and crop. Applications supplying 50 to 75 pounds of nitrogen, 100 to 200 pounds of phosphorus, and 50 to 200 pounds of potash per acre often give profitable returns even on the best soils. Many growers have been able to use much heavier applications to advantage.

It is good management to apply as much of the commercial fertilizer as possible to the cover crop. Cover crops can utilize applications of nitrogen and phosphorus to advantage. When used in this manner, the fertilizer gives double returns since the yield of organic matter is increased and the commercial fertilizer is returned for use by the "money" crop.

Economies in the use of fertilizers can result from the use of machinery which applies the material close to the seed at seeding time. This avoids unnecessary losses in the soil and makes the fertilizer immediately available to the plant the minute it starts to grow. The initial application should include the total supply of phosphorus and potash to be used during the season, but additional supplies of nitrogen should be added during the season. These applications can be applied as side-dressings, or they can be applied through the irrigation equipment (a method especially effective with sprinkler equipment). If they are applied to the soil, the applications should be followed with an immediate irrigation.

Fertilizers make cover crops and cover crops plus fertilizers make yields of quality vegetables.

Do you want to grow vegetables in the Willamette Valley? All you need to do is to get hold of some good land; install an efficient irrigation system and operate it to maintain the correct amount of moisture throughout the season; provide a generous and constant supply of effective organic matter; apply ample amounts of commercial fertilizer of the correct formula at the right times; and follow carefully recommendations on varieties, cultural practices, and disease and insect control. Will you succeed? Possibly. All these must be blended by an indescribable something not taught in school and all too often not even acquired through years of experience. It's that natural "know how" or "savvy" that marks a successful vegetable grower anywhere.

A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa

(*From page* 22)

Although leafhopper yellowing is not confined to terminals but occurs well over the plant, it is not to be confused with the common leaf spot caused principally by *Pseudopeziza medicaginis*. This organism causes small, circular, dark brown spots on the lower leaves, and if sufficiently severe causes them to turn yellow and drop. There is likewise no danger of confusing leafhopper yellowing with that caused by potash deficiency or even by *Phytomonas insidiosa* (bacterial wilt) which, from a distant field view may appear somewhat similar.

Rosetting

There is always a shortening of the terminal internode in plants showing boron deficiency (Plate I, C, right, D, E, F). This rosetting may occur even in the absence of pronounced yellowing (Plate I, D, and E, right). Even in severe cases of leafhopper injury, this terminal internode is not appreciably affected (Plate I, A, B, and C, left). There may, however, be a general stunting of leafhopper-injured plants.

Death of the Terminal

The terminal bud of a boron-deficient alfalfa plant is always found to be abnormal. Dead buds may be found on shoots showing no yellowing, and in this case are sometimes associated with causes other than boron deficiency. However, even in the absence of yellowing, when the dead bud is accompanied by pronounced rosetting, true boron deficiency is represented (Plate I, D).

The terminal growth in those plants severely affected by leafhopper may be normal; in fact, blossoms are often abundant in a field supporting a rather heavy leafhopper population.

During the latter part of the growing season, boron deficiency and leafhopper injury occur in the same fields in several sections in New York. It is not uncommon to find both types of injury on the same plant and this cumulative effect is readily recognized by noting the two types of symptoms.

Literature Cited

1. GRANOVSKY, A. A. Alfalfa "yellow top" and leafhoppers. Jour. Econ. Ent., 21:261–267. 1928.
2. ———. Differentiation of symptoms and effect of leafhopper feeding on histology of alfalfa leaves. Abs. Phytopath., 20:121. 1930.
3. JOHNSON, HOWARD W. Nature of injury to forage legumes by the potato leafhopper. Jour. Agr. Res., 49:379–406. 1934.
4. JONES, FRED R., and GRANOVSKY, A. A. Yellowing of alfalfa caused by leafhoppers. Abs. Phytopath., 17:39. 1927.
5. MCLARTY, H. R., WILCOX, J. C., and WOODBRIDGE, C. G. A yellowing of alfalfa due to boron deficiency. Sci. Agr., 17:515–517. 1937.
6. POOS, F. W., and JOHNSON, H. W. Injury to alfalfa and red clover by the potato leafhopper. Jour. Econ. Ent., 29:325–331. 1936.
7. SMITH, FLOYD F., and POOS, F. W. The feeding habits of some leafhoppers of the genus *Empoasca*. Jour. Agr. Res., 43:267–285. 1931.
8. WILLIS, L. G., and PILAND, J. R. A response of alfalfa to borax. Jour. Amer. Soc. Agron., 30:63–67. 1938.

Old Glory

(*From page* 5)

farewell on a perilous voyage, so they donated a hand-made banner to him for his vessel. Some claim that Cap Driver had a party aboard the vessel before she sailed and as the flag soared aloft he christened her Old Glory.

Possibly this was an echo in his memory of an old poem he had read in the Massachusetts Spy,

"A ray of bright glory now beams from afar,
The American ensign now sparkles a star."

This Flag, according to a note from Cap Driver written much later to the Essex Institute in Salem where the original Old Glory is kept, was carried by him around the world and among the icebergs and along the palm tree beaches, his constant companion and reminder of home through fair winds and foul.

THE Essex Institute got this flag in 1880 from Cap Driver's niece, Mrs. Harriet Cooke; although in 1913 it was claimed by his daughter, Mrs. Mary Roland of Denver, that she carefully kept the original flag and that the one now in the Institute is her crafty substitute for it. However this may be, the story is true enough that Old Glory waved over the coral reefs of the vast Pacific archipelago more than one hundred years ago, flying from old Cap Driver's brig, amid most thrilling circumstances.

In August of 1831, under the folds of Old Glory, Cap Driver rescued the mutineers of the British ship Bounty and restored them to their tropical home on Pitcairn Island—the historical romance made popular a few years ago by Nordhoff and Hall. The Essex Institute has the acknowledgment of the Pitcairn Island dwellers for this gallant service performed by Cap Driver under the American Flag. So you see, we've caught Old Glory up to early tricks in restoring justice beyond Hawaii.

Yet this does not end the history of Cap Driver and his treasured banner. In 1837 he grew weary of seafaring life and moved to Nashville, Tennessee, where he served for a time as provost marshal, and died there in 1887, aged 83 years.

Outspoken and choleric like most sea captains are, Cap Driver got himself into several scrapes during the early days of the Civil War. His pronounced New England sentiments furnished trouble for him, although he and his kindred may have had enough to do with rum and slave traffic afloat to render his remarks at Nashville rather inconsistent.

At any rate he sewed Old Glory onto his bed coverlet and so kept it hid during 1860 and 1861. When Buell's forces got to Nashville in 1862 they first raised a small United States ensign over the State Capitol. The next day Cap Driver toted out his much worn Old Glory, having ripped the seams that fastened it to his quilt. He asked the army officers to hoist it up on the staff in place of the smaller flag, where it remained for several weeks over the State House where sixty years or so later they honored the valiant deeds of Sergeant York of Fentress County. He too, like old Cap Driver, defended Old Glory in foreign lands.

When it comes to this theme of patriotism, I really doubt if the august Supreme Court itself could hand down an inclusive, satisfying definition that would depict the glory, the suffering, and the grimy grins which are woven into the sacred tapestry of our national life. In short, the Court might have a worse time than Sherman had in describing war politely, and not be able to make it so brief either.

Patriotism is as varied as the individual's own inherited or acquired traditions. To some it visions the theme of "my country, right or wrong." To others it means Mayflower ancestors, antique furniture, baked beans, liberty and equality, one and inseparable. Some folks look into the glass darkly and see brotherhood-of-man, communism, distribution of income, plenty of spaghetti, and swift justice. There are some who explain it by wisecracks, and a few others like ourselves off in a corner who try to fit patriotism to befuddling modern conditions.

Patriotism is also like religion because it adapts itself to the user. Americanism to the tolerant means tolerance; to the intolerant it means revenge; to soldiers it means sacrifice and maybe medals; to traitors and schemers it means a great selfish opportunity. We have to fumble around with the word when talking with Indians and Negroes, and we need fresh injections of it even in wartime to keep us in step.

During the first fifty years of American independence the citizens had to get weaned away from Royalty and accustomed to Loyalty. Then plenty of the civilians broke away and tried to grow bigger than the Flag itself. There are even some of us yet who think this is the land of the spree and the home of the knave, and for whom there will be a day of reckoning when we polish off the enemy.

I GET pretty tired sometimes trying to weed out the false from the true patriots. Lip-service loyalty and feverish hysteria do not represent the brand of American patriotism we like to depend upon in a pinch to rally 'round the Flag.

When we stretch our stipends to pay honest debts here at home, we are being loyal to the country. When we try to live like dukes on somebody else's ducats, when we stand up at The Star-Spangled Banner and lay down on law observance—is that the kind of tradition we want to behold when the banner flies?

Sure, I think it's mighty important to know just how to arrange the Flag and display it right, and not to dishonor it with advertising or commercial propaganda. I'm for learning how to say the American Creed and I am strong for the Flag salute, but don't ever ask me to sing the National Anthem! My inherited and acquired musical and vocal scale is not up to it, yet I feel just as proud as you do when it's sung by real singers. All these technical and ritual points are well meant and quite all right with me, but still I would not bash a man down for making a mistake over Flag routine, outside the Army and Navy. I think there are deeper and finer things below the surface in this reverence for the Flag than gestures and positions and red tape.

THEN finally I think the government bosses can be perfectly frank and open with us about our taking the bad news well and facing the worst issues calmly. They don't need to keep us in suspense or leave us in the dark on issues which are not veiled in military or naval significance.

We look to the Flag as something so serene and ennobling that a few dirty cracks and poison arrows and bad spells of blues won't cause us to lose faith in its meaning or destiny. In fact, the thing that makes the Flag stand for this country with all the feeling one gets in a cathedral is that so many fellows have got tired and muddy and bruised and bloody just trudging along after it anywhere they were sent.

It isn't the joy-riding and the happy old Fourth celebrations that endear this old Flag to us. It's the seamy side of its folds that make it strong.

So, after all, this thing we call patriotism in America is something priceless and complex, something independent and inclusive, something both cooperative and personal. Under its folds we shall, I trust, see that the Flag stands for a land which remains a haven for something besides expediency and explosives.

And now I'll stop, seeing that I got more off my chest than I expected to, and you have stayed with me longer than anticipated. To the Flag and you, a salute!

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

- Potash Pays on Grain (South)
- Greater Profits from Cotton
- Tomatoes (General)
- Asparagus (General)
- Vine Crops (General)
- Sweet Potatoes (General)
- Grow More Corn (South)
- Fertilizing Small Fruits (Pacific Coast)
- Potash Hungry Fruit Trees (Pacific Coast)
- Fertilize Potatoes for Quality and Profits (Pacific Coast)
- Better Corn (Midwest) and (Northeast)
- The Cow and Her Pasture (Northeast) and (Canada)
- Fertilize Pastures for Better Livestock (Pacific Coast)
- What You Sow This Fall (Canada)
- Home-grown Grains for Profitable Hogs (Canada)
- What About Clover? (Canada)
- Of Course I'm Interested (Pastures, Canada)

Reprints

- B-8 Commercial Fertilizers in Grape Growing
- K-8 Safeguard Fertility of Orchard Soils
- T-8 A Balanced Fertilizer for Bright Tobacco
- CC-8 How I Control Black-spot
- II-8 Balanced Fertilizers Make Fine Oranges
- MM-8 How to Fertilize Cotton in Georgia
- A-9 Shallow Soil Orchards Respond to Potash
- N-9 Problems of Feeding Cigarleaf Tobacco
- R-9 Fertilizer Freight Costs
- T-9 Fertilizing Potatoes in New England
- CC-9 Minor Element Fertilization of Horticultural Crops
- DD-9 Some Fundamentals of Soil Management
- KK-9 Florida Studies Celery Plant-food Needs
- MM-9 Fertilizing Tomatoes in Virginia
- PP-9 After Peanuts, Cotton Needs Potash
- UU-9 Oregon Beets and Celery Need Boron
- A-2-40 Balanced Fertilization For Apple Orchards
- F-3-40 When Fertilizing, Consider Plant-food Content of Crops
- H-3-40 Fertilizing Tobacco for More Profit
- J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
- M-4-40 Ladine Clover "Sells" Itself
- O-5-40 Legumes Are Making A Grassland Possible
- Q-5-40 Potash Deficiency in New England
- S-5-40 What Is the Matter with Your Soil?
- T-6-40 3 in 1 Fertilization for Orchards
- AA-8-40 Celery—Boston Style
- CC-10-40 Building Better Soils
- EE-11-40 Research in Potash Since Liebig
- GG-11-40 Raw Materials For the Apple Crop
- II-12-40 Podsols and Potash
- JJ-12-40 Fertilizer in Relation to Diseases in Roses
- LL-12-40 Tripping Alfalfa
- A-1-41 Better Pastures in North Alabama
- B-1-41 Our Defense Against Soil Fertility Losses
- C-1-41 Further Shifts in Grassland Farming?
- D-1-41 How, Where, When Apply Fertilizers?
- E-2-41 Use Boron and Potash for Better Alfalfa
- I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
- K-4-41 The Nutrition of Muck Crops
- L-4-41 The Champlain Valley Improves Its Apples
- Q-6-41 Plant's Contents Show Its Nutrient Needs
- R-6-41 A Balanced Diet for Nursery Stock
- S-6-41 Boron—A Minor Plant Nutrient of Major Importance
- U-8-41 The Effect of Borax on Spinach and Sugar Beets
- V-8-41 Organic Matter Conceptions and Misconceptions
- W-8-41 Cotton and Corn Response to Potash
- Y-9-41 Ladino Clover Makes Good Poultry Pasture
- Z-9-41 Grassland Farming in New England
- BB-11-41 Why Soybeans Should Be Fertilized
- CC-11-41 There's Enough Potash for National Defense
- DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
- EE-11-41 Cane Fruit Responds to High Potash
- FF-12-41 A Five-year Program for Corn—Livestock
- GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
- HH-12-41 Some Newer Ideas on Orchard Fertility
- II-12-41 Plant Symptoms Show Need for Potash
- JJ-12-41 Potash Demonstrations on Statewide Basis
- A-1-42 Canadian Muck Lands Can Grow Vegetables
- B-1-42 Growing Ladino Clover in the Northeast
- C-1-42 Higher Analysis Fertilizers As Related to the Victory Program
- D-2-42 Boron Deficiency on Long Island
- 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-3-42 High-grade Fertilizers Are More Profitable
- J-4-42 Boron Stopped Fruit Cracking
- L-4-42 Permanent Hay the Plant Food Way
- M-4-42 Nutrient Availability—An Analysis

THE AMERICAN POTASH INSTITUTE

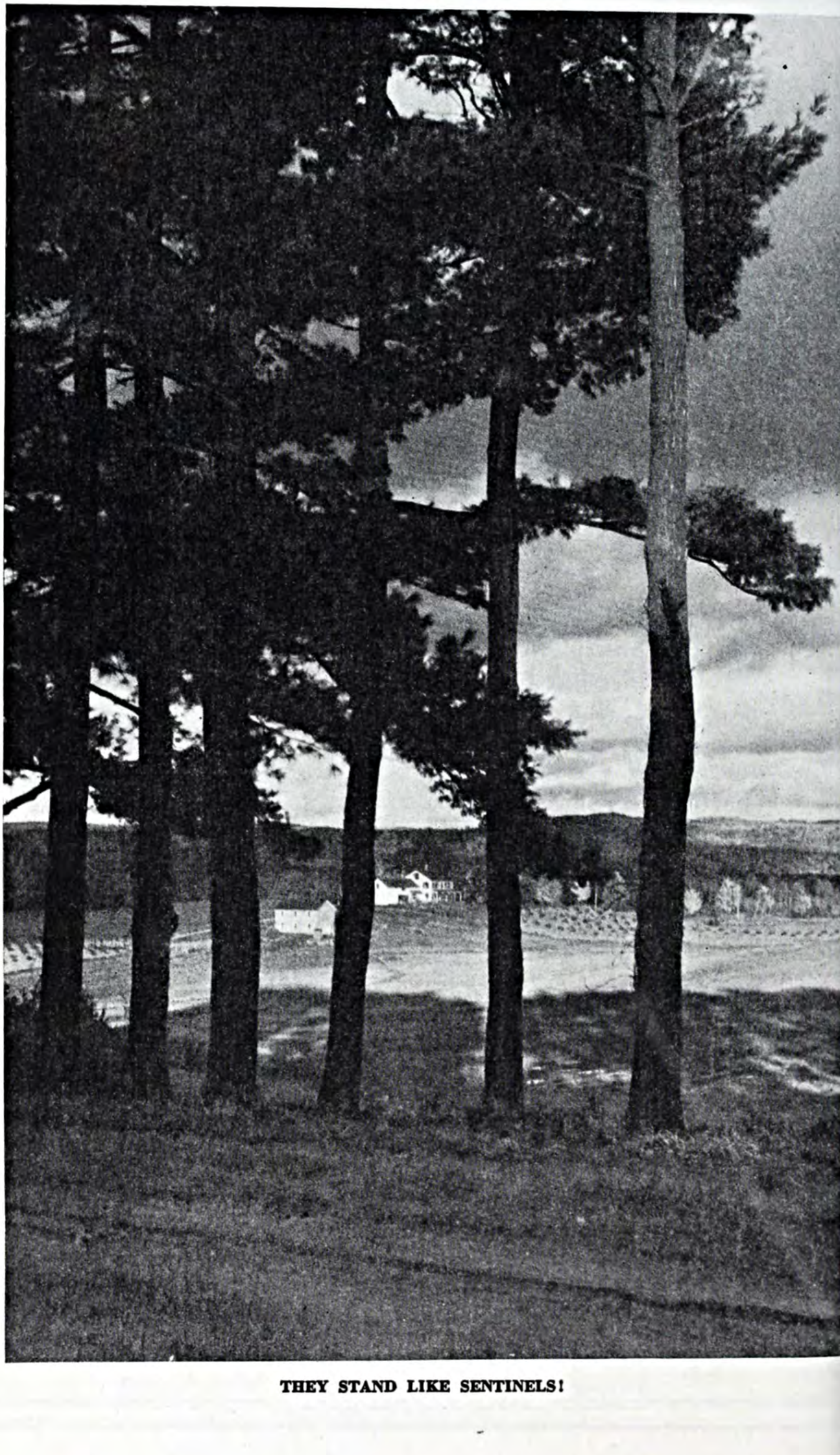
1155 16TH STREET, N. W. WASHINGTON, D. C.

Printed in U.S.A.

Better Crops *with* PLANT FOOD

Aug.-Sept. 1942 10 Cents

The Pocket Book of Agriculture



THEY STAND LIKE SENTINELS!

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI | NUMBER 7

TABLE OF CONTENTS, AUGUST-SEPTEMBER 1942

The American Potash Institute
Incorporated

American Chemical Society Building, 1155 16th Street, N. W., Washington, D. C.

J. W. TURRENTINE, *President*

consumers, battles and bargains with union labor, and hardly squeezes through under a ceiling price on pork.

Consumers on the whole have much more cash to spend on victuals, and yet they voice raucous indignation aimed at every element engaged in the meat business, from farrowing pen to retail counter.

The farmer uses family labor early and late, loses trusted help to competing government war plants at very critical harvest periods, and can't get the steel for machine replacement or the lumber to build winter storages.

The trend of wages for all labor, from deft artisans to lumbering wood butchers, is geared upward in a spiral powered by the relentless dynamos of defense production.

Boys and girls who normally go to Pa for their spending money or earn a little at odd jobs in vacation are thrust into factories and offices, where they often earn more than dear old Dad ever did. (Some such bonanza bubbles may burst in time, leaving disillusioned youth to an ordinary beginner's income, likely to be an insult to them for the moment.)

THEN I listen to a farm organization's talented Washington scout and lobbyist tell his followers that "consumers of America have been spoiled with cheap food."

On the return trip I ride with a railway conductor who says the greatest enemy of the American masses earning their bread is "the selfish and greedy agricultural agitators."

Despite the claims of the farm lobbyist, I read reports of undernourishment still among us, as shown by rejected draftees from crowded cities suffering from traces of rickets, anemia, poor teeth, and bad digestion.

In contradiction to the critical conductor, I know thousands of calm, humane, self-sacrificing farm folks who never argue over long about their share of the national wealth or the attainment of the "parity" Utopia.

I see the legions of 4-H clubs and other youth movements clinging fast to the "four freedoms" they know best—of head, heart, hands, and health.

In the same towns I see youthful sailors on "shore leave" often taking personal liberties and parading with silly young giddies beyond the limits normal society grants to guys who wear civilian clothes or overalls. But it is not considered right to chide their folly because they have become symbols of an American dream answering the drum.

In taking subscriptions for victory bonds, I receive stamps and pennies from the blistered palms of young girls delving in war plants, signing up for the bond issue jointly with a sweetheart in the ranks.

Then I read Congressional reports reeking with the scandals of contracting agents nabbing fat fees for shaking down the plum tree.

Out of this daze of good and bad, of affirmative and negative, one emerges groggy and bewildered. Here is our big danger point. We can't sit down and see injustice done or the scales unfairly balanced; but in working on through this first phase of dilemma much depends on just keeping our shirts on.

We are only human, even though geared to a mad machine eruption. The warp and woof of our old American fabric has always presented its lights and shades, its frayed spots and snarls, along with its strength and character.

YOU can dip back into almost any critical rush period of our history and find disagreement, argument, selfishness, class prejudice, and chaos, coming to the surface or hidden beneath.

You and I recall incidents related in our youthful school days about the raw treatment accorded to statesmen we since revered, like Washington, Jefferson, and Lincoln; financial scandals in high places; jealousy among generals; secret pacts; treachery and deceit—but

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., AUGUST-SEPTEMBER 1942 No. 7

United to overcome . . .

The Daze Phase

Jeff McDermid

MY SEGMENT of America seems to be in a coma for the present—not a complacent unawareness and indifference, but a queer form of hysteria surrounded by a nebulous vacuum. What with official smoke screens and plenty of civilian fog, it might be said we are experiencing the "daze phase" of a new war psychology.

I have tried to put together some stray fragments of the Old America I grew up in, browsing around in a groping muddle like we do when we pick up a jumbled set of mosaics to fit into a puzzle picture.

When I find that points don't match and corners don't fit like they always did before, my first impulse has been to say, "All bets are off because this is a war-time era, and old values and traditions belong in the bone-yard during this game of dominoes with destiny." But my other self won't accept such an excuse.

Some examples will show what a pother my addled mentality has experienced since December 7, 1941. Although I have been called a submerged genius, I am sure the thinking processes work in most of us along the same grooves, unless we have a military or bureaucratic viewpoint.

Perplexing contradictions like the following vex us in a democracy going through the daze phase:

The farmer feeds grain without a ceiling price to hogs on which there is no ceiling price, and maybe he averages $14.50 at the market, or five times the price ten years ago.

The meat trade packs and services

Clifton Smith Succeeds On Worn-out Farm

By L. R. Combs

Soil Conservation Service, Milwaukee, Wisconsin

ON a cold, raw, windy day in January 1936, Clifton Smith moved 30 miles to a farm 3 miles northwest of Eagleville in Harrison County, Missouri. Clifton and his brother alternated in driving the old Model-T coupe and the team hitched to a wagon-load of furniture and farm equipment. The driver of the Model-T would stop every few miles at a filling station and wait to exchange places with the driver of the team. Mrs. Smith and two small daughters rode in the coupe.

As they neared the farm, cold and somewhat discouraged over things in general, Mr. Smith told a filling station operator, who was well acquainted with Harrison County land, the name of the farm to which they were moving.

"You've got the poorest gol-darned farm in Harrison County," the station operator said with brutal frankness.

That was the Smiths' introduction to their new home.

But the Smiths weren't downhearted for long. They had bought the 120-acre farm for $3,500, nothing down, and with the understanding that they need pay nothing on the principal for five years. The land had been foreclosed by a bank because the previous owner had been unable to pay off the mortgage.

Today things are looking brighter for the Smiths, and the farm is a better farm. Back of this brighter outlook is a story of the reclamation of a worn-out Missouri farm, a story of careful planning, of hardship, and of self-denial.

For four years the Smiths did without a car. They raised a large garden, watering tomatoes and other essential crops to produce the bulk of their own food when many gardens were killed by drought. Mrs. Smith canned garden products. Home-butchered hogs provided meat, and the White Leghorn flock provided eggs. Mr. Smith gradually increased his cattle, hogs, and sheep, improved his pastures, protected his land from erosion, rebuilt fertility, and put what money he could get his hands on into the land. The first year the Smiths made only a living and enough to pay taxes; they borrowed to pay the interest.

Mr. Smith inspects lespedeza after period of severe drought and heat. Bluegrass was gone, ground was cracked, but the lespedeza was green and furnishing good pasture.

"I had to figure twice a good many times before I spent some of the money I did," he says. "In fact, I spent a little when I didn't know where the cash was going to come from. But it paid."

it all finally got straightened out and the sun shone again on a republic recovered from its bacterial fever.

Even yet they among the teaching profession sometimes debate about the way history books are written—some liking them polished up and starry with glory, and others enjoying some choice and frank de-bunking. There is always room for anything you want to find when human nature gets on a rampage. But let's wait until the time

comes when we can stand back from the canvas of our era and get a good, true perspective of it.

If we listen to mean gossip and buck-passing all the time and never rouse ourselves into doing something active, we'll get to be like a man with a microscope—no perspective, but a darn lot of dirt in one fly-speck.

Getting down to specific details and taking up a field best known to us, I'd like to mention the recent flurry and furore set going amidst our organized farm phalanx by current war-time problems.

We all know that farm organizations are composed of human beings with all their acquired and inherited preferences and prejudices. In times like these we must try to be patient and overlook small foibles unless their existence tends to interfere with the larger and broader objective of the Nation in a crisis.

Likewise we know that groups within these same organizations have held varied viewpoints on basic social subjects of our times. For instance numbers of our good leaders and followers have decried the "spoon-feeding and babying" of the so-called sub-marginal rural populace.

Much of their dislike to such practices and the use of public funds for rejuvenation and loans is traced to sectional outlooks in part, and also to the inherent tradition of rural America to insist on self-reliance and hard labor as the pathway to agricultural independence. It is true that exponents of this rock-ribbed conservatism have maybe forgotten that a good man may fail on poor land during adverse financial periods, and that all the sub-marginal sheep are not "goats."

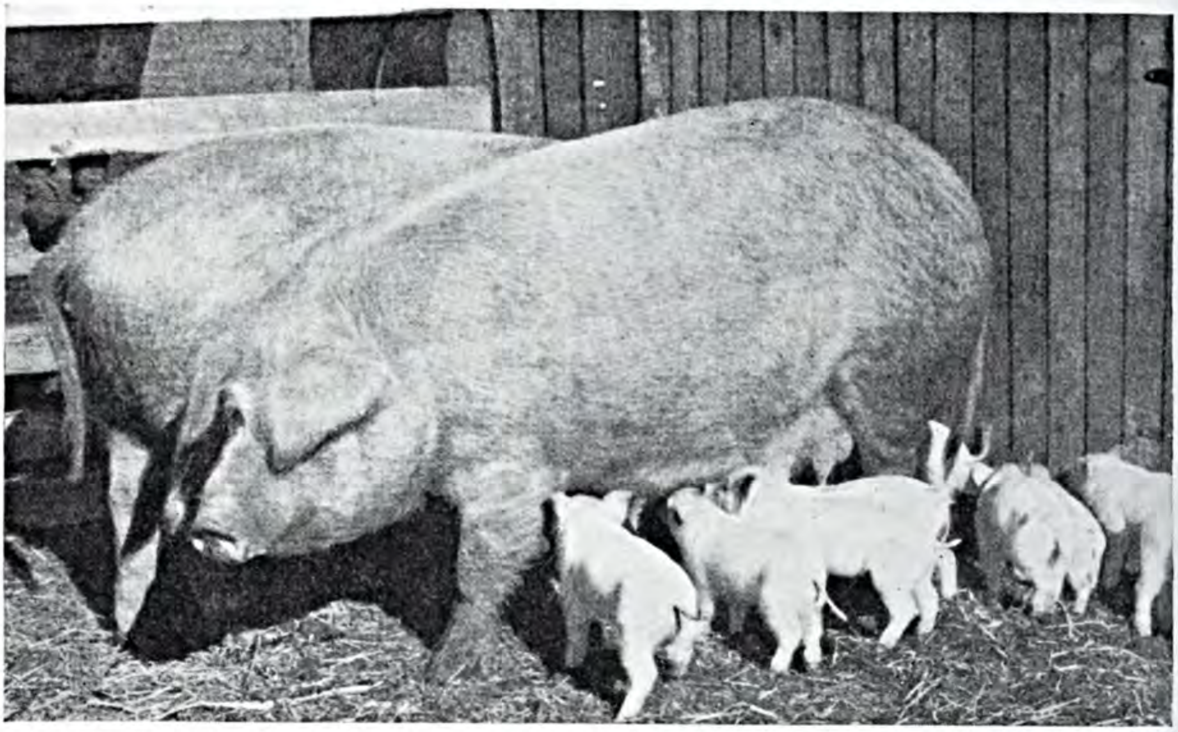
During the recent depression the conservative farmers looked askance at the government aid to submerged groups, but tolerated it in a way because they had some taste of adversity themselves.

But when the fulness of the financial boom arrived and prices became more promising to agriculture in general, the conservatives held to the doctrine that it is folly to give further paternal assistance to weaklings, arguing from many ample proofs that such farms seldom contribute over much to the war-time goal of food and fiber. That is, their thesis was that the poorer farmers did well to eke out a subsistence unaided, and not much more with loans to boot. Some even went so far as to exclaim that "all the money granted to such farmers would more than pay for all the production they ever contributed."

It was then that the other vocal group among our organized farmers took up the cudgel in behalf of the less fortunate brethren. Their answer was that the conservatives in this case were the radicals in former times, who sought all kinds of public aid and subsidy, providing the bread was buttered on the upper crust.

And so the fight went on, even into Congress and beyond into small meetings everywhere. Charges and countercharges flew thick and fast, which to our way of thinking proved nothing and gained little—except to divide the

(*Turn to page* 44)



None can say this sow with her nine pigs isn't helping produce food for freedom—not to mention helping pay for the farm.

Service demonstration project at Bethany and was completed by Mr. Smith with a six-foot blade and four horses. He plans to construct some more terraces to protect more of his land.

One of the first things Mr. Smith did was to divide a 40-acre bluegrass pasture into two equal fields, improve the pasture, and start rotation grazing. Water is piped from a pond to a tank on the fence line to provide water for stock in either pasture. A similar arrangement at the other pond and a well at the barn enable him to water livestock in any field on the farm which he may have occasion to pasture.

To supplement his bluegrass, he started liming, fertilizing, and manuring as rapidly as possible in order to establish pastures of sweet clover, timothy, and lespedeza or small grain and lespedeza. One hundred and eighty-six tons of lime have been applied to about 60 acres, 20 per cent superphosphate has been applied ahead of the small grain crops, and all manure is returned to the land. In fact, Mr. Smith locates his hay and straw stacks on or near the thin spots in his fields so this land can get the full benefit of the feeding operations.

One field was so badly gullied that farm machinery couldn't cross it. Terracing and seeding part of the field to pasture are enabling the gullies to heal so that now only scars of the original gashes can be seen.

Evidence of the success of his pasture program—which he says is the key to "what little success" he modestly admits he has made—is also found in the fact that he won first place in his county and second place in the north district in the Missouri pasture improvement contest in 1939. Winners of the contest are chosen not only on the basis of pasture production alone, but also on the basis of management and use of pastures for livestock production, balance between pastures and other crops, the general quality of the farm management plan, and other related activities.

A 20-acre "weed field," a so-called pasture which had been overgrazed and neglected, was treated with lime and manure and seeded to sweet clover, timothy, and lespedeza. Later 20 per cent superphosphate was applied at the rate of 150 pounds per acre and the field sown to oats and seeded to a grass-legume mixture. This was one of the fields drawing considerable comment

Evidence that it did pay is found not only in the appearance and productivity of the land, but also in the cold, black-and-white figures in the bank and finance company records. (Since buying the farm, Smith has refinanced the debt, giving a mortgage as security to a local trust company.)

Five years after he bought the farm, Smith had paid off $1,100 of the debt, had increased the number of livestock, had a two-year-old, second-hand car paid for, and had bought some farm equipment. At this rate he will have the farm paid for in another five years. On a farm that wouldn't make a living let alone pay for itself before, that is a record of which the Smiths can be proud.

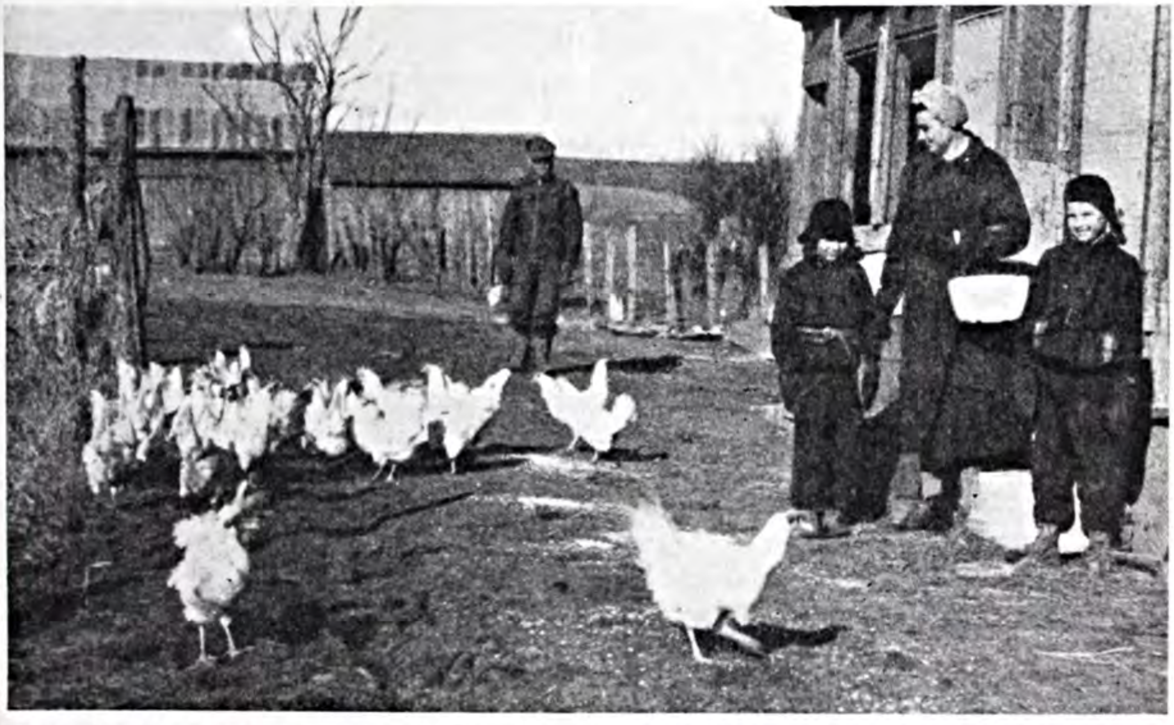
The how and why is a long story, but here it is in brief.

When Smith came to the farm, 37 of the 120 acres had been in corn and 5 acres in soybeans. Seventy-one acres were in meadow, but most of those acres were so weedy that a self-respecting cow would go on a sit-down strike. Overgrazed, gullied, and weedy, they marked a farm on the verge of abandonment. The usual patch-work of square fields with up-and-down hill rows confronted the new owner. Some of the fields had been in corn when nature never intended them to produce anything but grass.

Mr. Smith immediately began to change this condition. He developed a farm plan which by 1938 had reduced the corn acreage to 12. That same year he had 28 acres of oats and 16 acres of mixed grass-legume meadows on his 56 acres of cropland. Another 49 acres were in permanent pasture and 4 acres were in alfalfa. Two acres of wildlife cover surrounded a couple of ponds which had been constructed to check large gully heads and to furnish a water supply for livestock. Feedlots, buildings, and lanes took up the other 9 acres.

Terraces protect all 56 acres of cropland. Smith uses a rotation of one year corn, one year oats seeded to legumes and grasses, and one year of grass-legume meadow which, considering the fact that his land is protected by terraces and contour tillage, is a safe rotation. He planned to have no corn in 1942, however, and was shifting to a small grain, grass, and clover rotation.

The terrace system was laid out and partly built by the Soil Conservation



Part of the White Leghorn flock which is helping the Clifton Smiths pay for their farm. Mr. Smith is in the background and at right are Donna, Mrs. Smith and Dixie.

Conserve Nitrogen Now

By F. G. Merkle

Pennsylvania State College, State College, Pennsylvania

NITROGEN is a peculiar element. It is the characteristic chemical element in the proteins which are the "preeminent" constituents of living cells. It is important, therefore, in giving life to all living things. But, paradoxically, it is a basic constituent of explosives which are important in giving death to living things. Hence, at this time there is a double demand for nitrogen, that is, for growing crops and for munitions. The latter is so great that we are now threatened with a shortage of fixed nitrogen.

Nitrogenous fertilizers were among the first fertilizers used in addition to animal manures. Their use has become almost imperative for many types of crop production, because our agricultural methods allow losses to occur which never took place under natural conditions. In the native forest which covered the soils of eastern United States, the trees and shrubs assimilated from 50 to 100 pounds of nitrogen from the soil per acre per year. This was the most readily available nitrogen Very little nitrogen was lost by leaching because the roots of perennials were alive in the soil at all times. Nearly all the nitrogen taken up by the trees and shrubs was returned to the soil sooner or later in the fall of leaves and finally the entire tree. Neither was there much loss by erosion under these conditions. Cultivated crops do not require more nitrogen than the native vegetation did, but in the way we grow them, the losses are much greater.

Most Eastern soils contain from 1,500 to 3,000 pounds of total nitrogen which is chiefly in the surface soil. A small portion of this becomes available yearly. This small amount is either taken up by the crops planted or it is lost by leaching. If taken up by the crops, it may be removed far from its original soil. In addition, the accelerated erosion which takes place on cropped land may remove as much as the crops remove. In these crops the most available portion of the 1,500 to 3,000 pounds of total nitrogen in the soil is gradually depleted. Replenishing with fertilizer nitrogen becomes essential because year by year the most readily available soil nitrogen is removed far from the soil in which it originally existed.

In general, those types of agriculture which most nearly resemble natural conditions are the least likely to need fertilizer nitrogen. Of all types of farming, dairying is perhaps most nearly like natural forest, because the dairy cow consumes her food either in the pasture or in the barn. In the first case, the excrements are returned directly to the soil with little loss. In case she is fed in the barn, the manure is presumably returned with some loss.

Plant-food Removal

In the production of vegetables, tobacco, cotton, or any crop which is sold from the farm, there is little or no prospect of returning the nitrogen it contained to the soil from which it came. This may mean the yearly removal of from 50 to 150 pounds of the best nitrogen that the soil contained. This cannot continue long.

In addition to the above, losses by leaching and erosion take place in considerable amounts when soil is cultivated. During the fall, winter, and spring when the corn and potato lands are bare, leaching may remove almost enough soluble, available nitrogen to grow an ordinary crop. Erosion, likewise, may be considerable during the spring months on poorly covered land.

These cows, some Angus cattle, hogs, chickens, sheep, a prize-winning pasture renovation program, and soil conservation practices are helping the Smiths "make a go of it."

the year Smith won the pasture contest.

Mr. Smith harvested 2 crops of hay and nearly 7 bushels of alfalfa seed from a 7-acre field of alfalfa in 1941, a year which was not a good alfalfa seed year and when it was worth $12 to $15 a bushel. He always plans to seed winter rye in his lespedeza in the fall, not only to provide much-needed early spring pasture but to give additional protection from erosion during the winter when the annual lespedeza dies out.

When Smith came to the farm he had 3 cows and some calves, 4 horses, a couple of sows, and a few ewes. He now has 9 Angus cows, 5 of which are purebreds, 4 mixed Jersey and Guernsey cows, 30 ewes, and 4 sows with pigs. During the last 5 years he has sold $650 worth of mule and horse colts. His pig crops the past 2 years have averaged 7 pigs or better per sow.

Next year he plans to keep six sows. The flock of White Leghorns is being increased from about 150 to 200. These increases, in addition to increased milk production from improved feeding and possibly increased numbers of stock, will be the Smiths' contribution to the Food for Victory program. Not a large increase in itself, but it and hundreds of thousands like it will help produce the food that the nations fighting dictator aggression will need to win the war.

And as Smith pointed out, his conservation practices are enabling him to increase production on a farm which otherwise might be entirely out of production. This production will come not at the cost of wasted topsoil or decreased fertility but as a result of soil-saving methods and improved soil productivity with no increase in grain acreage. There's no question, he says, but that conservation practices enable the average farmer to produce more from fewer acres, while at the same time protecting his soil from erosion and improving fertility.

Last fall Smith rented a 20-acre stock and grass field for pasture, and he operates about 40 acres on the farm of his father-in- law, J. W. Craig. On that land he also applies soil conservation practices, following a rotation designed to check erosion and maintain fertility.

The work of building a new farm home on a foundation of rundown soil

(*Turn to page* 43)

the gaseous form, as ammonia, is probably not nearly as great as the loss through leaching, and it is not as easily controlled. Loss of ammonia gas may take place in the stable, in the storage pile, or in the field. The use of superphosphate in the gutters helps reduce this loss by converting the ammonia to a non-volatile compound. One or two pounds of superphosphate per cow per day, scattered in the gutters, is a customary quantity.

In Terms of Dollars

Pennsylvania farmers have in past years used over 8,000 tons of fertilizer nitrogen yearly for which they paid over two million dollars. Big as this figure is, the nitrogen losses in handling manure are easily two or three times as great. And, with a little care, the losses in nitrogen may easily be cut in half. Here indeed we have a supply of "scrap" nitrogen for the emergency, "scrap" of A-1 quality.

Another instance in which high quality nitrogen is wasted is in leaching from soils. Each year, during the winter and spring, a considerable proportion of the melted snows and the rains filters through the soil, finding its way into the ground waters. Any nitrates left in the soil at the close of the growing season may be completely removed by the percolating waters. Analyses show that soils contain little or no nitrate nitrogen in the early spring. It has been washed out. The amount so lost is very considerable and is of high quality.

Research has shown that land left bare during the leaching months may lose enough nitrate to grow an ordinary crop. It also has shown that when soil is growing fibrous-rooted, sod-forming crops, there is almost no loss of nitrogen by leaching. This information suggests the value of cover cropping cultivated lands during those periods when it would otherwise be bare. At the close of the growing season, after harvesting such crops as corn, potatoes, tobacco, and most vegetables, there remains in the soil more or less unused nitrate and more nitrate continues to be produced by bacterial action during the fall months. This nitrate is quite certain to be leached out during the winter unless it is taken up by some crop.

A cover crop planted, either while the main crop is still occupying the land, or as soon as possible after harvesting, will quickly take up this nitrate and build it into plant protein which will be released the next spring when this cover crop is plowed under and decays. Rye grass or meadow fescue may be planted in the standing corn at the last cultivation. Rye or rye and vetch may be planted immediately after digging potatoes. Rye grass, meadow fescue, and, in some cases, crimson clover may be satisfactorily used as cover crops in vegetable production. These may be sown even before the vegetables have been harvested, after the chief growing season has passed.

It may be roughly assumed that a good stand of cover crop will assimilate possibly 20 to 40 pounds of nitrogen before it is plowed under the following spring. This nitrogen would be lost were the cover crop not grown. Of course, the cover crop will perform other benefits besides simply controlling nitrate loss; it will add organic matter, improve the soil physically, and control erosion.

Checking Erosion

Erosion, which likewise takes its greatest toll when the soil is bare or in row crops, is another loss which can be reduced considerably by cover cropping. While the nitrogen lost by leaching of manure or leaching from soil is of the highest quality, a good portion of the nitrogen lost by erosion is crude organic nitrogen. Possibly 20 to 120 pounds of total nitrogen may be lost in a single year by erosion from bare soil, small grains, or row crops.

Preventing or decreasing the losses described above seems to be the most

(*Turn to page* 41)

It seems, therefore, that while the present shortage of nitrogen exists, the producers of vegetable crops, both those grown intensively and extensively, should receive first consideration in the rationing of nitrogen, whether the rationing be voluntary or compulsory. This is so, because a good supply of available nitrogen is essential for the production of nutritious, palatable vegetables and truck crops. Furthermore, these growers have less opportunity to make use of legume and animal manures. Fertilizer nitrogen is likewise essential in tobacco production and in tree and small fruit production. Generally, these producers have little or no manure and are producing a crop which is much benefited by available nitrogen. Economic production of these crops demands fertilizer nitrogen.

Meeting the Emergency

The general dairy and grain farmer is much less dependent upon nitrogenous fertilizers. In normal times, when nitrogen is cheap and plentiful, he may use it and should do so if needed. But, in the present emergency, he may dispense with fertilizer nitrogen for a few years at least.

When there is plenty of anything, we are prone to obtain it the easiest way, to use it extravagantly, and even to waste it. However, when a shortage arises, our attention is attracted to conserving what we have. "A penny saved is a penny earned." While it is well known that leguminous crops fix atmospheric nitrogen in sufficient quantity to feed themselves and some of the crops which follow them, it is true that if the legume program is not already in progress on a given soil, it may take a year or two to whip it into shape so that it will begin to supply our needs. We need the nitrogen now for next year's crop. Therefore, we must first turn our attention to conserving and using supplies at hand and, in the meantime, institute a program of legume fixation.

The amount of highly available good quality nitrogen wasted in Northeastern agriculture is tremendous. It is safe to estimate that two or three times as much highly available nitrogen is lost in handling manure as is contained in all purchased fertilizers. If this loss could be reduced to one-half its present amount, the nitrogen shortage problem would be solved at once.

Nitrogen may be lost from manures through fermentation in the gaseous form, as ammonia, and in the liquid form, as soluble compounds consisting of nitrate, ammonia, and soluble organic nitrogen. The greater loss, and the one most feasible to control, is the loss in the liquid form in leaching. If one makes it a point to examine every stable and barnyard as he tours cross country, he will observe that a large percentage of them are so arranged that loss of liquid manures is considerable. These liquids contain over half the total nitrogen excreted by the animal and the nitrogen they contain is over twice as active as that contained in the solid excrements. Urine may be lost in poorly constructed stables with leaky floors, particularly when insufficient bedding is used.

Additional losses occur if manure is piled on a sloping surface near the barn. The pressure produced when manure is piled in high piles squeezes much of the liquid portion out so that, even though the loose bedding appears to absorb considerable liquid, it may be lost later when piled under pressure. Many barnyard walls are little better than sieves which hold the solids and allow the valuable liquids to leak through.

To Reduce Losses

The measures which suggest themselves to reduce these losses are: First, the use of ample absorbent and the transferring of the manure in the loose condition directly to the field before the juice is squeezed out; second, if it must be stored for periods, it will pay well to construct a water-tight concrete pit having both sides and bottom completely waterproofed. The loss of nitrogen in

This picture shows what a proper application of borax did for crimson clover.

The Southeast Can Grow Clover and Alfalfa

By L. O. Brackeen

Agricultural Experiment Station, Auburn, Alabama

DR. J. A. NAFTEL, soil chemist, believes that officials of the Alabama Experiment Station may have found a solution to maintaining stands of crimson clover and alfalfa and to producing seed of these crops on coastal plain soils where they have not been successfully produced in the past. For several years the Station has grown crimson clover on sandy soil in greenhouse experiments by applying 15 to 20 pounds of borax per acre in addition to the lime, phosphate, and potash ordinarily used. Excellent results were obtained in field tests in 1941-42.

"Our investigation indicates that the practical application of fertilizer containing small amounts of boron may be necessary for the successful growth of crimson clover and alfalfa on soils of the lower coastal plains and other soils low in boron," he says. "We definitely know that the proper amount of borax per acre will prevent alfalfa yellows and will increase the production and improve the quality of several root crops, especially turnips and beets.

"It has been our observation that crimson clover and alfalfa made good yields where blast furnace slag was the source of lime. When boron was applied to other sources of lime, similar favorable response was obtained.

"Our results not only showed that the growth of crimson clover and alfalfa was successful in vegetative yields, but also pointed to the possibility of producing home-grown seed. Each of these factors is vitally important in the establishment of successful legume programs in the Southeast."

Early attempts to grow crimson clover and alfalfa on sandy soils of the coastal plains area have showed that, although satisfactory germination of the seed was obtained, in many instances the seedlings died at an early stage. Examination of the roots of the seedlings showed darkening of the conducting tissue and retarded de-

Fertility Program Makes a Wheat King

By C. E. Skiver

Agricultural Experiment Station, Purdue University, Lafayette, Indiana

Herb Johnson, Ft. Branch, Indiana, 1942 champion wheat grower of the State, used 0-20-20 fertilizer.

FOR the past three years southwestern Indiana's Pocket Area has picked a wheat king on the basis of a score card which emphasizes soil management and fertility practices, as well as wheat production. In this new "show window" for corps, fields are judged by committees of farmers using a carefully prepared score card where plenty of stress is placed upon the crop history and treatment of the field.

This year the honors went to Herb Johnson of Gibson county on his 10 acres of Rudy wheat and the practices that he used to grow it. The Johnson farm lies on the edge of the "Mash" which is the local expression for what was formerly a marsh. The lands of this area were extremely fertile, and crop production was good for the first 50 years of farming.

But starting in 1914 Herb noticed that his yields were not holding up, and he began to search for the best known methods of preserving his greatest natural resource, his soil fertility. His first thought was that he should improve his soil-building crops, and so he started a liming program which he completed in the course of nine years. This he noticed improved his clover stands as well as their growth and materially increased the return of valuable humus to his fields.

With his lime content up and his nitrogen supply on the gain, Mr. Johnson was quick to see that the mineral reserve of his soil was rapidly being depleted. He naturally reasoned that the only way to replenish this was through the purchase of these elements in the form of commercial fertilizer. To his rotation of corn, wheat, and clover Mr. Johnson has applied liberal applications of 0-20-20 to his wheat and 0-12-12 in the row for the corn. Through the past 18 years this program of liming, returning a generous supply of good humus, and supplementally feeding his rotation with minerals has made the Johnson farm one of the outstanding producers in the area.

Coupled with this program of retaining a reservoir of fertility have been good production practices. Several years ago Johnson adopted Rudy as the variety of wheat that would best trans-

(*Turn to page* 39)

following year. This will prevent alfalfa yellows, increase the yield and quality of hay, and lengthen the life of the stand.

Borax applied at the rate of 15 pounds per acre on Cecil sandy loam in North Carolina resulted in an increase in yield of alfalfa from 289 to 743 pounds per acre. The application of borax resulted in the production of 82 to 184 pounds of seed per acre; whereas, the plants on the plots receiving no borax failed to set any seed.

Similar results have been obtained by the Virginia Experiment Station. "Applications of 10 to 15 pounds of borax to the acre on boron-deficient soil will greatly increase the yield of alfalfa hay and also stimulate alfalfa seed production as well as increase the thickness and duration of the stand," concludes T. B. Hutcheson, station agronomist.

At the Sand Mountain Experiment Station in North Alabama, it has been found that alfalfa yellows can be controlled by the use of 20 pounds of borax per acre. Many farmers in that area are now planning to make considerable increase in their alfalfa acreage this year.

How to Apply

Relative to the methods of applying borax to crimson clover and alfalfa, Dr. Naftel says that on new seedings the borax should be applied along with the lime, phosphate, and potash. On established fields the borax may be applied any time of the year, either in the fall or after any cutting, with a cyclone seeder or by hand. He also calls attention to the fact that the State Department of Agriculture has recently authorized fertilizer manufacturers to produce and distribute a 0-14-10 and that some manufacturers are now planning to include borax. Such fertilizer will be referred to as a special fertilizer for alfalfa and crimson clover.

Dr. Anna L. Sommer, soil chemist of the Alabama Experiment Station, has found that many Alabama soils are deficient in boron, a necessary plant food just as nitrogen, phosphate, and potash. Sandy soils are usually much more deficient in boron than other types. The two main causes of this deficiency seem to be not enough actually in the soil to begin with, or an overliming of the soil, which makes the boron present unavailable. Some of the vegetable crops that have been tested at the station are turnips, cabbage, tomatoes, Irish potatoes, and beets. Of these crops, beets and turnips seem to respond more readily to boron.

Work by Dr. L. M. Ware on boron deficiencies shows that 10 pounds of borax applied to an acre of sandy soil or 15 to 20 pounds on medium to heavy soil are sufficient for turnips and beets. He also has found that basic slag applied to land will partly overcome the boron deficiency, also that irrigation and plenty of organic matter reduces the need for boron.

Field Observation

Will Howard Smith, master farmer and successful truck crop producer, Prattville, Alabama, prevents brown heart in turnips by applying 10 pounds of borax per acre along with the other fertilizer at planting time.

"Briefly, we make a practice of using 10 pounds of borax per acre annually under our 300 to 350 acres of turnips, mustard, and collards," says H. Owen Murfee, Jr., general manager of Mr. Smith's farm. "From a field observation, these crops yield about 10 to 25 per cent more and have an improvement in quality of 25 to 100 per cent, especially the roots of the turnips. When we do not use borax, 75 to 100 per cent of our rooted turnips develop black hearts before they mature. By using borax, we have practically eliminated this in our turnips.

"In regard to other crops Mr. Smith ran some tests on vetch last year on sandy soils and the borax increased the vetch yield easily 25 per cent. This year we are applying 10 pounds of borax per acre under each of our 1,000 acres of sandy land vetch. We also are running a few tests on crimson clover,

(*Turn to page* 39)

Same experiment as pictured at the left except this clover received no borax.

velopment of roots as compared with healthy, vigorous roots on seedlings where boron was applied. Seedlings that survived on boron-deficient soils showed deficiency symptoms. Although seeds were inoculated with commercial legume cultures, few or no nodules developed on the winter legume plants on boron-deficient soils.

It appears from the results of our investigation that crimson clover and alfalfa require the addition of small amounts of boron for normal growth on some soils," says Dr. Naftel. "Many of the soils of the coastal plains are extremely low in boron and where lime is applied, the need for boron by leguminous and other crops is increased. It is entirely possible that some failures on soils low in available boron content have been due to a deficiency of this essential element."

Dr. Naftel recently made a trip through Tennessee in which he observed some 30 of the 300 alfalfa demonstrations in that State. The contrast between those treated with boron and those untreated was very noticeable with the areas receiving borax showing very little, if any, sign of alfalfa yellows.

The Tennessee results on alfalfa have been so striking that H. E. Hendricks now recommends that every acre of alfalfa seeded should have an application of from 20 to 30 pounds of borax per acre applied either at the time of seeding or by April 1 of the

Results on alfalfa were also striking. The alfalfa left got borax; right, none.

phosphate, and five tons of manure. A similar application of manure was made in 1939. In 1940 the manure application was repeated, and one ton of ground limestone, and 400 pounds of an 0-24-12 per acre were applied. The treatment in 1941 was a late fall application of 300 pounds of an 0-20-20 fertilizer per acre. Other practices employed were harrowing each fall with Scotch chain harrow, clipping twice during the season, and use of a cultipacker in the spring.

Response to the above treatments was beyond all expectations. Kentucky bluegrass and the wild white clover came in abundance, and despite the early dry spring in 1942 it was necessary to clip this pasture with a mower before June 3 in order to keep the grass succulent and tender. In other words, 60 head of Guernseys could not keep down the grass.

The next field to be observed was the Ladino field, adjacent to the improved pasture. This field consisted of 20 acres which had been in timothy for a number of years. The subsequent treatment was as follows: the field was in silage corn from 1937 to 1939, inclusive, and received one ton of ground limestone and 10 tons of manure each year. In addition to the above, the corn received 300 pounds of 4-8-8 in 1937 and in both 1938 and 1939, 300 pounds of a 3-12-6 fertilizer per acre. Twenty pounds per acre of domestic rye grass were broadcast at last cultivation of the corn in 1939. In the spring of 1940 the rye grass was plowed in early spring, one ton of ground limestone and 400 pounds of a 3-12-6 fertilizer were applied and a grass-legume mixture composed of 15 pounds of alfalfa, 5 pounds medium red clover, 5 pounds timothy, and 2 pounds Ladino clover was seeded with 2 bushels of oats as a nurse crop. The oat crop was harvested in the milk stage and used for grass silage.

Results of the 1941 production on the above field are clearly revealed in the table below.

	Green hay tons per acre	Dried hay tons per acre	Approximate protein content
1st Cutting—June 11	12.5	3.75	17%
2nd Cutting—July 29	11.5	3.1	19%
3rd Cutting—Aug. 18	7.8	1.4	24%
4th Cutting—Sept. 12	4.5	.8	30%
	36.3 T	9.05 T	

During the Field Day on June 3 of this year a 3′ x 3′ area was harvested and weighed, and it was estimated that this particular cutting produced 15 tons of green hay per acre.

The first cuttings on all the Ladino fields at Sterling Farms are harvested in early June and the crop is ensiled. Seventy-five pounds of molasses per ton are mixed with the chopped material as it goes into the silo. The remaining cuttings, which are higher in protein, are usually made into high quality hay.

On the Sordoni Farm more than 150 acres of Ladino have been seeded, mostly into the Triple-Purpose Mixture developed by Dr. Fred V. Grau of the Pennsylvania State College Agricultural Extension Department. This mixture consists of the following grasses:

Orchard Grass .... 5 # per acre
Meadow Fescue (Fall or
Alta Fescue) .... 5 # per acre
Alfalfa .... 5 # per acre
(Use 2 # Alsike if soil is unsuited for Alfalfa)
Red Clover .... 3 # per acre
Ladino .... 1 # per acre

The lime requirement for the above mixture should be brought up to 7 pH.

(*Turn to page* 40)

This tractor, with wind-rower attachment, was in operation during the Field Day.

Ladino Field Day

By J. D. Hutchison

County Agent, Luzerne County, Wilkes-Barre, Pennsylvania

FIVE years ago there was not an acre of Ladino clover on farms in Luzerne County, Pennsylvania, but today there are in the neighborhood of 1,500 acres of this new and profitable crop being grown. In order to convince farmers from Luzerne County and the adjoining northeastern counties of Pennsylvania of the value of this crop, a Field Day was held at the Andrew J. Sordoni Sterling Farms on June 3. Despite the gas and rubber situation, more than 400 farmers and their wives attended to make their own observations on this "new" clover and to learn more about its possibilities.

The Sterling Farms were purchased by Andrew J. Sordoni in 1937. They were typically rolling, stony, Volusia type of clay loam, and had been in the hands of the Stull Estate for a great many years. The fields had had no treatment for the past 15 years, having been laid down in timothy. Annual applications of nitrate of soda were made, and as a result they had become timothy poor. A sprinkling of timothy, five finger, paint brush, the roving wild strawberry, and hummocks of moss comprised the main plant population.

The first field to be observed on the trip was a permanent pasture consisting of 29 acres that since May 1 had been carrying 60 head of Guernseys. This permanent pasture had been renovated in the following manner. In 1938 one pound per acre of wild white clover was sown. No other grass or legume seed was added. The field was top-dressed with one ton of ground limestone, 300 pounds of 16% super-

Fig. 2. Proper fertilization and planting of cotton are accomplished in one trip by modern tractor equipment.

ing the common practice of mixing the fertilizer with the soil under the seed. Considering that North Carolina planted 860,000 acres in 1942, approximately one-fifth of the seed saved would be a considerable item.

With cotton valued at seven cents per pound and 500 pounds of fertilizer valued at $5, the return per dollar spent for fertilizer was $6.10 where the fertilizer was placed in a band under the seed, $6.99 where the fertilizer was mixed with the soil under the seed, and $9.04 where the fertilizer was placed in bands 2½ inches to each side and slightly below the level of the seed.

It has been estimated that North Carolina uses approximately 167,000 tons of fertilizer on cotton. Valued at $20 a ton, this means the farmer outlay of slightly more than $3,340,000 for cotton fertilizer. The difference between $6.99 and $9.04 return per dollar spent for fertilizer by the two methods of placement means an increase to the farmers' income of $6,800,000 per year.

must be furnished with a machine that will lower his cost of production. Can it be done?

The method of placing the fertilizer has a marked effect on the number of seed germinating. The average results in North Carolina over a nine-year period show that 95 per cent of the seed germinated where the fertilizer was placed in bands to the side of the seed, 75 per cent where the fertilizer was mixed with the soil under the seed, and 62 per cent when the fertilizer was placed in a band under the seed. This indicates that a farmer will have one-fifth more seed germinating when the fertilizer is side-placed than when us-

One of the peak labor loads on the farm is at the time of planting crops in the spring. Shortage of labor and equipment usually makes it necessary for the farmer to spread out his planting over a longer time than is desirable for the best stand and yield.

With the present one-mule farm equipment as shown in Fig. 1, it requires 5½ trips per row

Fig. 3. Proper fertilization and planting of cotton are accomplished in one trip by modern two-mule equipment.

Fig. 1. Typical procedure used by one-mule farmers to fertilize and plant cotton.

The One-Mule Farmer Needs a New Machine

By G. W. Giles and E. R. Collins[1]

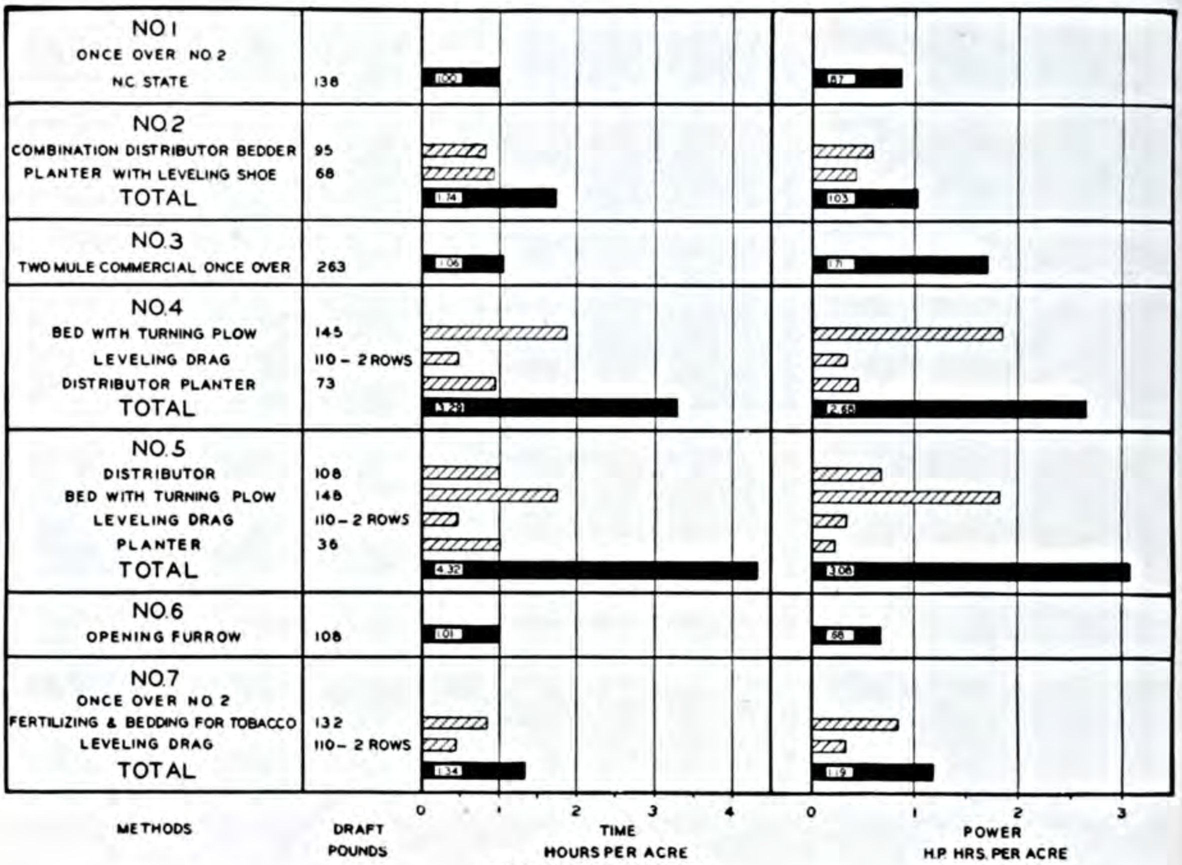
North Carolina Agricultural Experiment Station, Raleigh, N. C.

THE picture at the top of this page, Fig. 1, illustrates what we mean when we say the Southern farmer is handicapped by the lack of suitable equipment. Looking from right to left, the first man is opening the row; the second distributing and mixing the fertilizer; the third and fourth men are throwing up a bed with a turning plow; the fifth man is using a leveling drag to knock off the top of the bed on two rows, and the sixth man is planting the seed.

This picture tells a story of large production costs, great labor and power requirements, and inefficient use of fertilizer. All of this is due to the fact that the equipment he is using is out-of-date. Some modifications are made in the procedure illustrated in Fig. 1 so that fewer trips are made per row, but still the one-mule Southern farmer is severely handicapped by the lack of more modern equipment.

The tractor equipment illustrated in Fig. 2 requires only one man to perform all operations in one trip. The two-mule machine shown in Fig. 3 also performs all of these operations in one trip per row. The tractor and the two-mule equipment, however, are too expensive for the one-mule farmer. In order to successfully compete with the modern equipment as used by the larger farmer, the one-mule farmer

[1] Agricultural Engineer and Extension Agronomist, respectively, of the North Carolina Agricultural Experiment Station and the North Carolina Extension Service.



REQUIREMENTS OF VARIOUS MACHINE METHODS FOR THE PLANTING OF ROW CROPS

necessary to throw the soil back to make the bed. This takes extra power. One disc on this machine is set ahead of the other, thus making it possible to throw the dirt in without the difficulty of clogging from trash as would be the case with the present practice on commercial machines.

The bedding discs to complete the bed are adjustable in depth, width, and angularity so that it is possible to throw up any type of bed. Following the bedding discs is a leveling shoe which smooths off the bed to permit more uniform planting of the seed.

The planter is attached to the fertilizer distributor by an approximately vertical pin which permits the planter to move sideways independently of the distributor. Part of the load is carried on the rear press wheel in order to give a firm seed bed. The hinge point is midway between the distributor and planter so that in planting along terraces on the contour or going around a curve the seed are planted between the two bands of fertilizer. The seed hopper, driven by the rear press wheel, is a proven commercial type adapted to plant cotton, corn, peas, beans, peanuts, and other farm seed.

The machine has a lever for raising the discs out of the ground and stopping the fertilizer flow, making for easy transportation to and from the field and easy turning at the end of the row. The fertilizer distributor can be used separately from the planter by removing the pin of the hinge. The distributor used as a separate unit will place the fertilizer in two bands and throw up a bed desirable for transplanting crops such as tobacco and sweet potatoes.

Draft measurements and time measurements were made with an electric self-reading dynamometer and a stop watch on this machine and a number of commercial machines commonly used by farmers. The labor was expressed in hours per acre, as calculated from the draft and time measurements

(*Turn to page* 42)

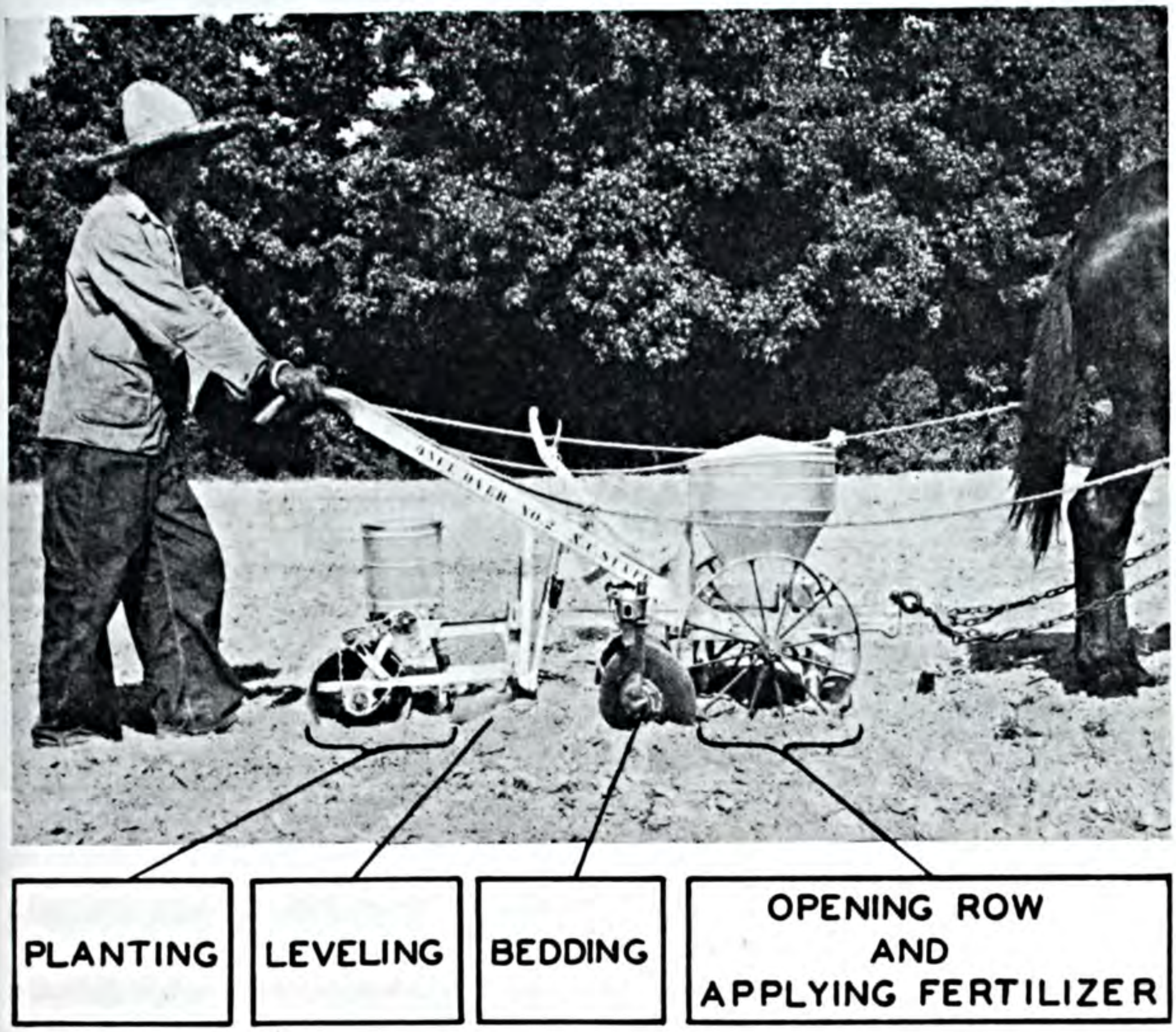


Fig. 4. One-mule, one-row, once-over distributor and seed planter accomplishes all operations in one trip.

to plant the crops. Assuming 3½ foot rows, and the mule traveling at a speed of 2.4 miles per hour, one acre would be covered by each machine in approximately one hour. The practice shown in Fig. 1 would require 5½ man-hours per acre and 5½ mule-hours per acre. The modern two-mule riding distributor and planter shown in Fig. 2 would require one man-hour per acre and two mule-hours per acre.

For tobacco, sweet potatoes, and other transplanted crops, the common practice is about the same as for cotton, peanuts, and beans except the last machine operation of planting is omitted and the plants are set by hand. The conventional method for preparing the bed for these crops also requires excessive man-hours and mule-hours.

The average results on Coastal Plain soils for nine years show that fertilizer applied in bands under the seed produced 1,111 pounds of seed cotton per acre. Fertilizer mixed with the soil under the seed produced 1,174 pounds per acre and fertilizer placed on each side below the seed level produced 1,321 pounds per acre. This is an increase of 147 and 211 pounds, respectively, due to the methods of applying fertilizer.

Fig. 4 shows the one-mule, one-row, once-over machine which opens the furrows for the fertilizer, places the fertilizer in two bands, beds on the fertilizer, levels off the bed, and plants the seed with one trip to the row.

Two discs, adjustable to place the fertilizer in two bands from five to twelve inches apart, open the furrow for placing the fertilizer. The present practice of commercial machines is to throw the soil out, after which it is

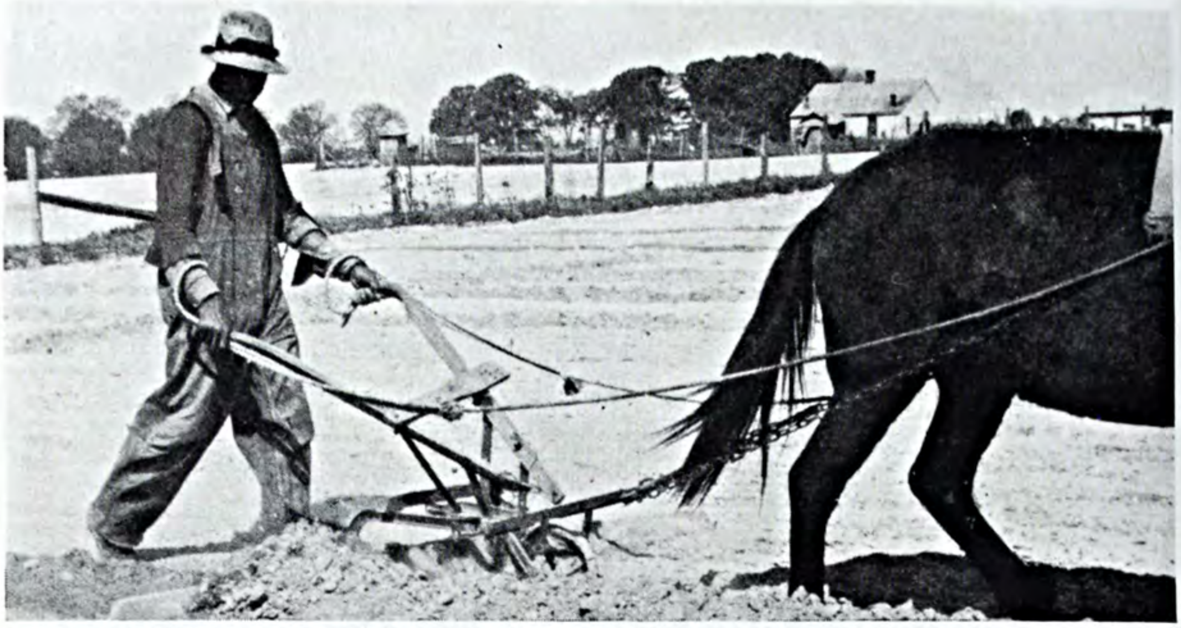


Fig. 7. (Above) Leveling drag used in Methods No. 4 and No. 5.

Fig. 8. (Left) Bedding with a turning plow used in Methods No. 4 and No. 5.

Fig. 9. (Below) Distributor and planter used in Method No. 4.

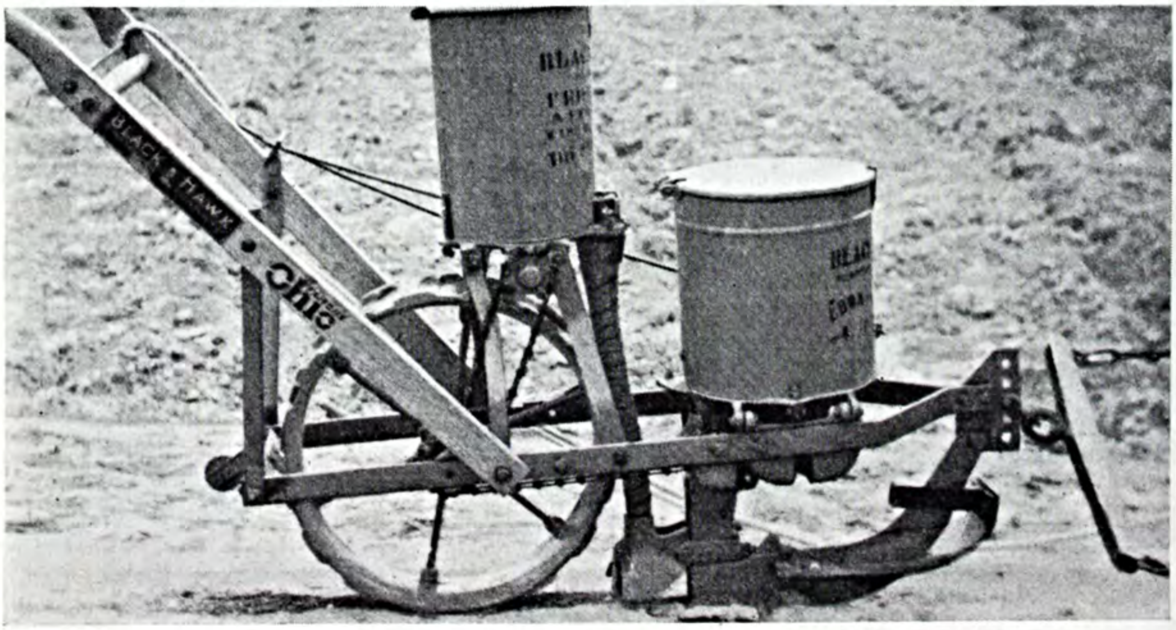
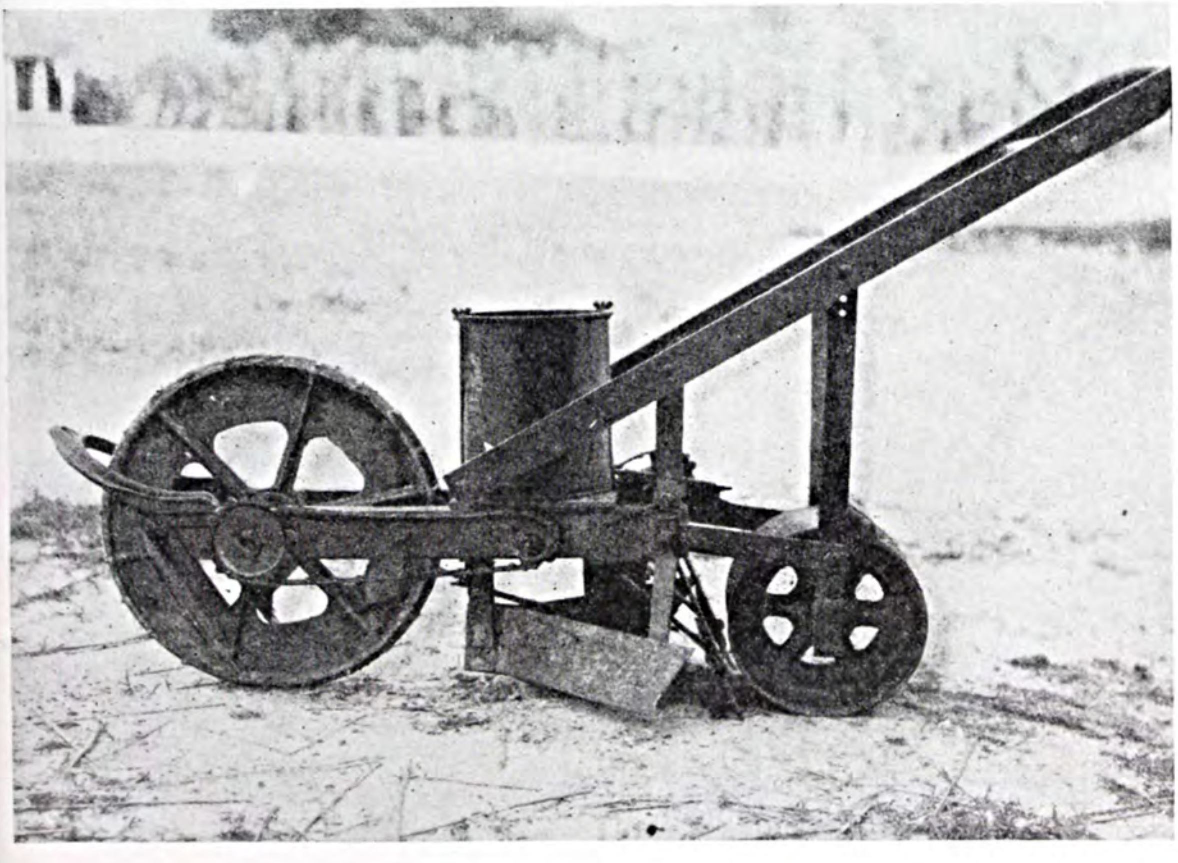
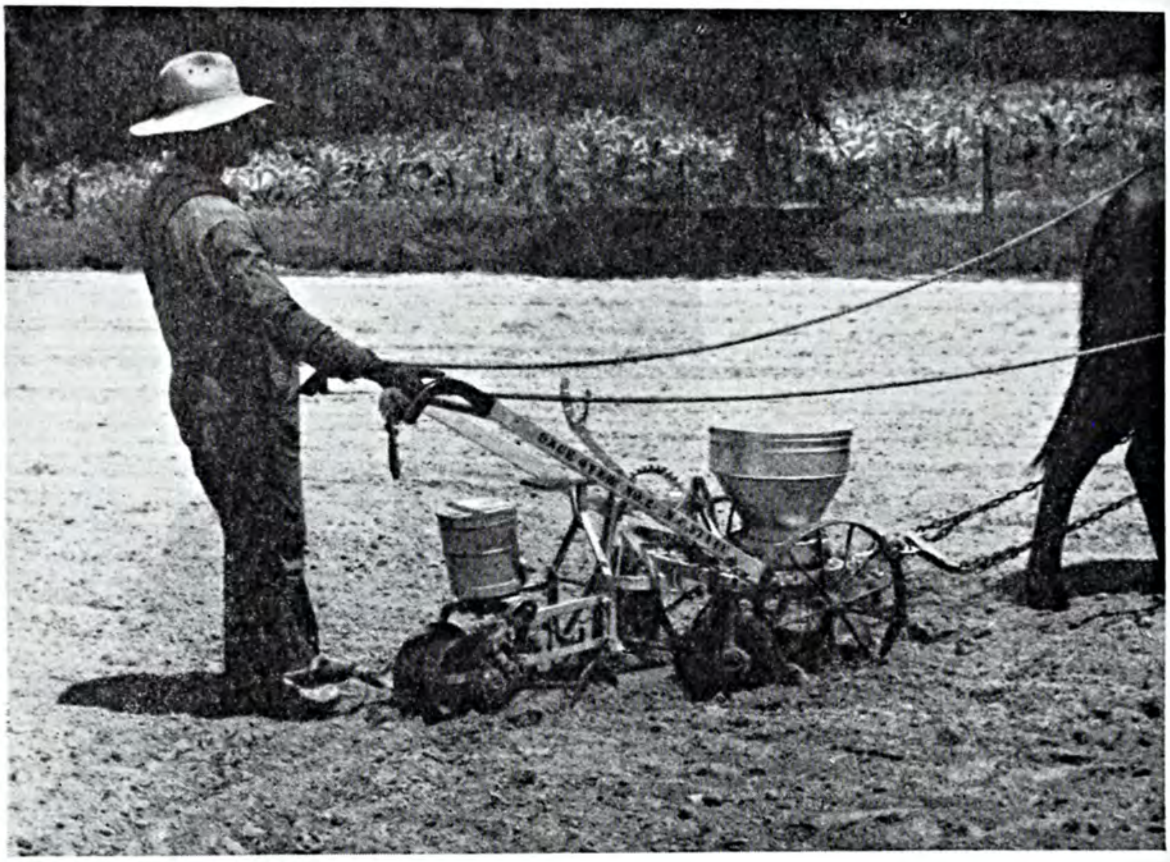


Fig. 5. Combination distributor and bedder used in Method No. 2. This applies the fertilizer, but does not plant the seed.

Fig. 6. Seed planter with leveling shoe used in Method No. 2 and used without the shoe in Method No. 5.





Above—Illustrating how this side-placement distributor and planter could plant on a contour.

Below—Side-placing fertilizer and planting cotton with one trip to the row. Would this help solve the labor problem?

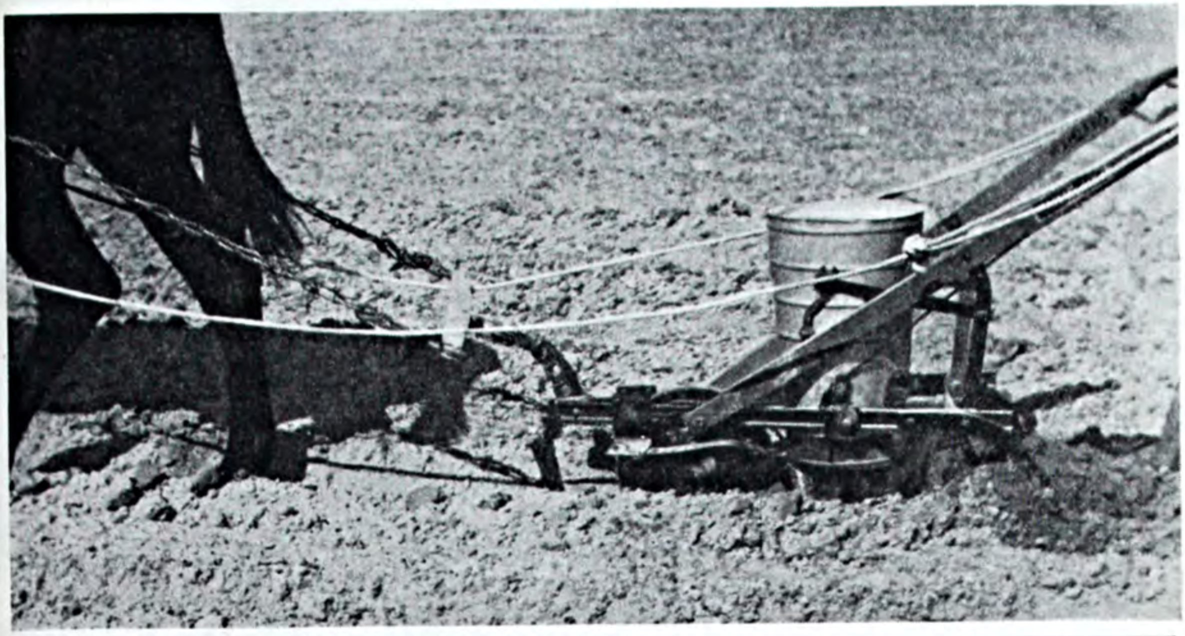
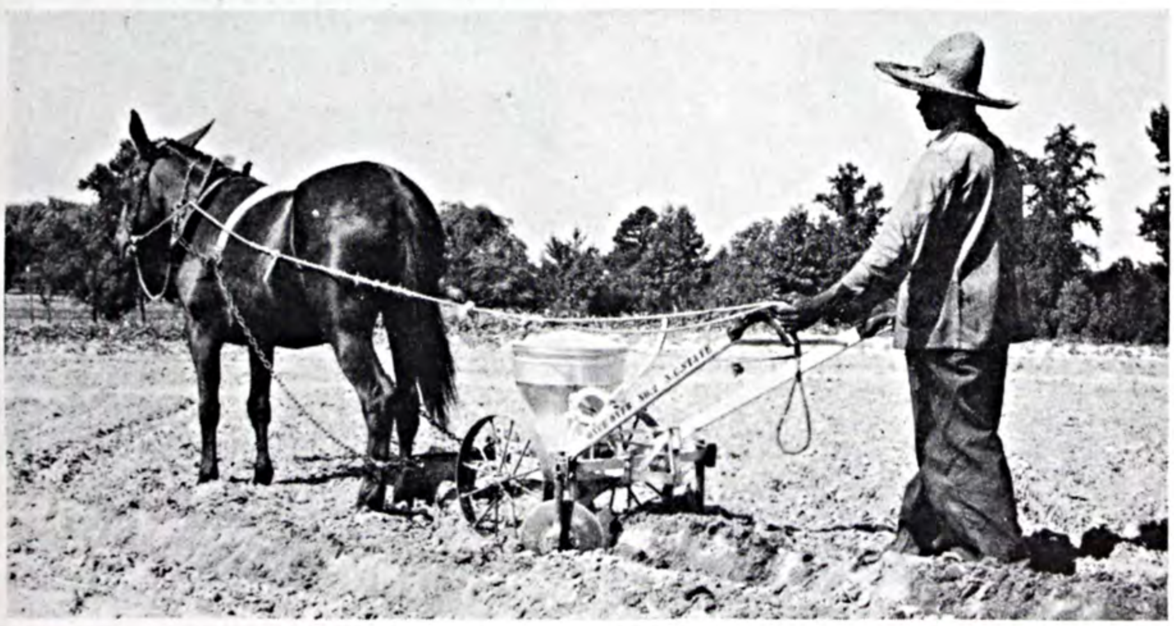


Fig. 10. (Above) Distributor used in Method No. 5.

Fig. 11. (Right) Dynamometer on plow for opening furrows—Method No. 6.

Fig. 12. (Below) Once-over No. 2 fertilizing and bedding for tobacco—Method No. 7.



at all when proper mineral nutrients such as phosphorus, potassium, boron, magnesium, and calcium are not available.

Legumes are one of the greediest of all crops in their feeding upon the mineral plant foods. A 3-ton per acre crop of alfalfa will utilize 35 pounds of phosphoric acid and 135 pounds of potash; 5 tons of sweet clover, 45 pounds of P_2O_5 and 165 pounds of K_2O; 2 tons of red clover, 20 pounds of P_2O_5 and 70 pounds of K_2O; 3 tons of lespedeza, 30 pounds of P_2O_5 and 70 pounds of K_2O; 2 tons cow peas, 25 pounds P_2O_5 and 90 pounds K_2O; 25 bushels and 1¼ tons (straw) of soybeans, 40 pounds P_2O_5 and 60 pounds K_2O. Too often in the past this factor of proper mineral nutrition has been overlooked when growing legumes, with the probable result that frequently the nitrogen supply in the soil was not being augmented by the growing of a legume crop.

Under present conditions we cannot afford to risk valuable legume seed and cropping time by growing improperly fertilized legumes. In any program for the growing of nitrogen it, therefore, is expedient to carefully consider the mineral requirements of the crop and the soil's ability to meet these requirements. Fortunately there is a widespread use of soil tests. Fortunately again, there are adequate supplies of lime, borax, phosphoric acid, and potash.

Dr. Henry G. Knight

Announcement of the passing of Dr. Henry G. Knight, Chief of the Bureau of Agricultural Chemistry and Engineering in the U. S. Department of Agriculture, came too late for us to comment on this great loss to American agriculture in our last issue of BETTER CROPS WITH PLANT FOOD. Dr. Knight died in Washington on July 13 after a short illness. Many fine tributes were paid this eminent agricultural scientist and he and his work were well known to our readers. Yet, we feel it fitting at this late date to express our deep regret and sincere sense of loss to the agricultural research field in the passing of one who for so many years had stood out in his efforts for the betterment of agriculture.

Secretary of Agriculture Wickard said of Dr. Knight: "He has been an important factor in the development of scientific agriculture and the relationship between farming and industry. His loss is particularly heavy at this time when the country is using its every resource to win the war. However, we are fortunate in having the modern research organization he did so much to build."

With a well-rounded past of actual farm experience and service in several important agricultural college posts, Dr. Knight in 1927 became Chief of the Nation's Bureau of Chemistry and Soils (the present Bureau of Agricultural Chemistry and Engineering). In this capacity, one of his outstanding services during the past few years was the organizing and establishing of the four Regional Research Laboratories provided for by Congress in 1938. These laboratories have been planned for the development of industrial uses of farm crops, and their research men are now engaged on many problems important in the furtherance of our interests in the war. It is safe to say that many of these findings will be just as important in keeping agriculture on a level keel with other industries long after the war.

Dr. Knight and his work will long be remembered.

The Editors Talk

Growing Nitrogen

Like a pack of hounds in full voice after the disappearing fox, publicity on "growing your own nitrogen" to help tide over the shortage of nitrogen for agricultural use during the war period is in full hue and cry in the agricultural press. This is praiseworthy. Not only is the nitrogen-fixing ability of legumes being emphasized, but much of their very real value as soil conditioners and rebuilders is being brought out.

However, in some of this publicity it would seem that two important factors in the growing of nitrogen are being left out: First that it takes time and careful preparation to establish a good stand of nitrogen-fixing legumes; and second that such a stand must be amply fed with the mineral plant foods if the plants are to perform efficiently and at full capacity.

The first point is ably discussed in the article by Dr. F. G. Merkle of Pennsylvania State College appearing in this issue. Dr. Merkle's plea is to conserve now all the nitrogen available in animal manures, crop refuse, and the nitrogen to be lost through erosion and leaching if control measures are not taken; for if the legume program is not already in progress on a given soil, it may take a year or two to whip it into shape so that it will begin to supply our needs. He does not minimize the importance of growing legumes, but points out that as a quick emergency measure, conservation of all available nitrogen must be considered.

Attention to the omission of the second factor mentioned above centers in recently noting some releases from experiment stations which had been inadvertently "headlined" by the press to the effect that "Legumes May Have To Serve As Substitute For Fertilizer In War." Among the agricultural advisory groups it is so well known that nitrogen is the only plant food which legumes can add to the soil that it is scarcely necessary to take exception to such a statement as was "headlined." However, it is conceivable that some farmers not fully informed as to the importance of mineral plant foods might conclude that legumes will prove a cure-all for all their fertilization problems.

The mere growing of a legume will not necessarily produce the results desired in helping to solve the nitrogen problem. Legumes growing with unbalanced nutrients may not fix any nitrogen from the air. Dr. W. A. Albrecht of the Missouri College of Agriculture has shown that when these plants seriously lack calcium, phosphorus, potassium, and other nutrients, they do not fix nitrogen but actually behave much like non-legumes and at the end of the cropping period there may be less nitrogen in the crop than there was in the seed at planting time.

Other work has shown that the organisms in the nodules of legumes, which are really the means for fixing nitrogen from the air, function inefficiently or not

Detailed information on the plant food sold by Provinces also is given.

An interesting compilation of the nitrogen, phosphoric acid, potash, and lime removed from the soil by important crops grown in Ohio has been compiled by J. S. Slipher and issued as a Mimeograph Sheet by the Ohio State University. The data have been calculated on a bushel or a ton basis, and on an acre basis for corn, wheat, barley, oats, soybeans, sugar beets, tobacco, red clover, alfalfa, sweet clover, lespedeza, and timothy.

¶ Brief notes on the fertilization of soybeans are given by A. L. Lang and L. B. Miller in Illinois Experiment Station mimeograph pamphlet AG1087, "What About Fertilizing Soybeans?" The nutrient removal of this crop compared with several other standard crops is given, showing that soybeans make a very heavy drain on the mineral elements in the soil. This crop also contains large amounts of nitrogen but, of course, a large portion of this can be obtained from the air due to the nitrogen-fixing capacity of soybeans. The authors bring out that common with much other work on this crop, results from fertilization have frequently been disappointing. They found a favorable response to fertilizers only on the potash-deficient soils. In the work so far conducted they have not had promising results from plowing down heavy applications of fertilizer. The authors recommend the use of lime on acid soil and the use of high-potash mixer fertilizer such as 0-9-27 or straight muriate of potash on potash-deficient soils. Care should be taken that little or none of the fertilizer comes in direct contact with the seed.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended March 31, 1942," Dept. of Agr., Sacramento, Calif., Bu. of Chem. Ann. FM-40, May 19, 1942.

"The Fertilizer Trade in Canada, July 1, 1940-June 30, 1941," Dom. Bu. of Statistics, Ottawa, Ont., W. H. Losee.

"Official Results of Fertilizer Analyses for the Registration Year 1940-41," Dept. of Agr., Ottawa, Canada.

"Commercial Fertilizers Inspected and Analyzed in the State of Georgia 1941," Dept. of Agr., Atlanta, Ga., Serial No. 126, Jan. 1942.

"The Laws, Rules and Regulations Governing the Analysis, Manufacture, Sale and Inspection of Fertilizer, Fertilizer Materials and Cotton Seed Meal in the State of Georgia," Dept. of Agr., Atlanta, Ga., Jan. 1, 1942.

"The Problem of Phosphate Fertilizers," Agr. Exp. Sta., Urbana, Ill., Bul. 484, Apr. 1942, E. E. DeTurk.

"Fertilizers Sold in Illinois in 1941", Dept. of Agron., Urbana, Ill., May 1942.

"Fertilizer Tonnage Sold in Indiana in 1941 as Reported by Fertilizer Manufacturers," Dept. of Chem., Purdue Univ., Lafayette, Ind.

"Fertilizer Consumption in Iowa—1941," Dept. of Agron., Iowa State College, Ames, Iowa.

"Results of Cooperative Basic Slag Demonstrations with Winter Legumes, Summer Legumes and Pastures for 1939-40," La. State University & A & M College, Ext. Cir. 206, Feb. 1941, R. A. Wasson.

"Tonnage Showing the Different Grades of Fertilizer Shipped in the State of Louisiana from Sept. 1, 1941 to June 15, 1942," Dept. of Agron., La. State Univ., University, La.

"Louisiana—Tabulation Showing Tonnage of the Different Grades of Fertilizer Shipped to each Parish in the State from Sept. 1, 1941 to June 15, 1942."

"Amounts of Manure and Fertilizer to Use in Home Vegetable Gardens," Special Cir. 77, March 1942, Agr. Ext. Serv., Amherst, Mass.

"Registration, Labeling and Inspection of Commercial Fertilizers; 1941," Agr. Exp. Sta., Columbia, Mo., Bul. 449, July 1942, L. D. Haigh, E. W. Cowan, and V. B. Williams.

"Buying Fertilizers Wisely," Agr. Exp. Sta., Columbia, Mo., Cir. 227, Apr. 1942, L. D. Haigh and Wm. A. Albrecht.

"Growing Vegetables with Fertilizer in Water," Agr. Exp. Sta., New Brunswick, N. J., Bul. 694, June 1942, V. A. Tiedjens and L. G. Schermerhorn.

"Analyses of Commercial Fertilizers, Manures and Agricultural Lime, 1941," Agr. Exp. Sta., New Brunswick, N. J., Insp. Series 5, Dec. 1941, Charles S. Cathcart.

"More Effective Use of Fertilizers," Agr. Exp. Sta., New Brunswick, N. J., Cir. 420, Feb. 1942, Firman E. Bear.

"Use of Phosphatic Fertilizers on Alfalfa," Agr. Exp. Sta., State College, N. M., Bul. 289, Mar. 1942, D. A. Hinkle.

"Manure — A Wartime Fertilizer," Agr. Ext. Serv., Ithaca, N. Y., Bul. 486, Mar. 1942, R. B. Child.

"Fertilize Victory Wise," Agr. Ext. Serv., Ithaca, N. Y., Bul. 497, Apr. 1942, E. L. Worthen.

"Fertilizing Strawberries in North Carolina," Agr. Exp. Sta., Raleigh, N. C., Bul. 332, Mar. 1942, R. A. Lineberry and E. R. Collins.

"Fertilizer Sales by Grade in Order of Ton-

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 Agronomy or Soils Department in the various Experiment Stations in increasing numbers is compiling information on the tonnage of the fertilizer grades sold, and this month there are a number of these listed below. Space prevents going into detail on these, but a few interesting points will be mentioned. In Illinois by far the leading analysis was 2-12-6 with the next leading analyses, 0-12-12 and 3-12-12, only about one-third the tonnage each. Others included 0-8-24, 2-8-16, and 2-16-8, all 2,000 tons or more. Rock phosphate, 20% superphosphate, and sulfate of ammonia also sold in large quantities, the rock phosphate tonnage being estimated higher than all other materials tonnage combined. In 1937, 73% of the mixed fertilizer analyzed 20% or over of plant food; while in 1941, 92% contained more than 20% plant food.

In Indiana again the 2-12-6 was by far the most popular single analysis with 0-12-12 second in popularity followed by 20% superphosphate, 0-14-6, 0-8-24, 3-12-12, and 0-20-20. In Iowa 2-12-6 led, followed by 20% superphosphate, 3-14-6, 0-9-27, and 0-12-12. In Louisiana 4-8-4 was the most popular analysis followed by nitrate of soda, 6-10-7, 4-12-4, and 6-8-4. This State also publishes detailed information on the tonnage of analyses and materials used in each Parish. In North Carolina during the first six months of 1941 the leading grade was 3-8-3, followed by 3-8-5. There was then quite a drop in tonnage to the next popular grade which was the 4-8-4, and this was followed in turn by 3-10-6, 5-7-5, 2-10-6, and 3-8-6, all with 20,000 tons or more.

Bulletin 449 of the Missouri Experiment Station gives the registration, analysis, and tonnage of fertilizers in 1941. The most popular grade in this State was 0-20-0, followed by 2-12-2. There was quite a drop registered for the next grade, which was 2-12-6. This in turn was followed by 0-16-0, 2-12-4, 4-12-4, 4-16-4, 3-9-18, 0-45-0, 0-18-0, all with 1,000 tons or more. In 1934 20% of the fertilizer contained 20 or more units of plant food, while in 1941 this proportion had risen to nearly 47%. Unless otherwise noted, the above figures all refer to the fertilizer year 1940-41.

In Canada figures on the fertilizer trade for 1940-41 have been issued by the Canadian Department of Trade and Commerce. Detailed information on the tonnage of analyses sold by Province and exportation is given. The 2-12-6 is the most popular analysis, followed by 4-8-10, with a big drop to the 2-10-8, which is closely followed by 2-12-10. The 0-12-6 is the only other analysis selling more than 10,000 tons in Canada. These figures refer only to fertilizer. A large tonnage of superphosphate and a much smaller tonnage of ammonium phosphate, as well as other materials, also are sold. Ontario consumes more fertilizer than any other Province, followed by Quebec, with a big drop to New Brunswick, Nova Scotia, Prince Edward Island, and British Columbia, in order. The Prairie Provinces consume very little fertilizer.

to use soils unadapted for orchards, and the importance of proper soil management, including organic matter, liming, and fertilization, are explained. In general a complete fertilizer such as 3-12-6 or 5-10-5 is recommended, with additional nitrogen as needed to keep the tree in the condition desired.

¶ The Soil Conservation Service of the U. S. Department of Agriculture has issued an unusual publication on the management of a farm so as to reduce and control soil erosion, and at the same time have a practical and profitable enterprise. This is issued as Miscellaneous Publication No. 486 entitled "Team Work to Save Soil and Increase Production." It was written by P. A. Waring, a farmer in Bucks County, Pennsylvania. The text is written in a familiar style with the subject matter based on personal, practical experience. Numerous striking illustrations occur throughout the bulletin.

"The Productive Capacity of Semiarid Soils and the Present Emergency," Agr. Exp. Sta., Tucson, Ariz., Bul. 182, Mar. 1942, W. T. McGeorge.

"The Value of Soil Analyses as an Aid in Truck Crop Production in Ontario," Ont. Agr. Col., Guelph, Ont., Bul. 421, Apr. 1942, T. H. Jones, R. Goodwin-Wilson, and J. H. L. Truscott.

"Soil Fertility Level as It Influences Plant Nutrient Composition and Consumption," Agr. Exp. Sta., Lafayette, Ind., Bul. 468, Apr. 1942, Robert E. Lucas, George D. Scarseth, and Dale H. Sieling.

"Soil Conservation Districts in Maine," Agr. Ext. Serv., Orono, Maine, Cir. 153, Jan. 1942.

"Lining Missouri Soils," Agr. Exp. Sta., Columbia, Mo., Cir. 218, Dec. 1941, O. T. Coleman and A. W. Klemme.

"Soil Organic Matter," Agr. Exp. Sta., New Brunswick, N. J., Cir. 422, Apr. 1942, F. E. Bear, H. R. Cox, J. S. Joffe, J. W. Shive, H. B. Sprague, V. A. Tiedjens, and S. A. Waksman.

"Apple Soils and Their Management in South Jersey," Agr. Exp. Sta., New Brunswick, N. J., Cir. 425, April 1942, O. W. Davidson.

"Resting the Land for Future Gains," Agr. Exp. Sta., New Brunswick, N. J., Cir. 435, April 1942, H. R. Cox.

"Lime for New York Soils," Agr. Ext. Serv., Ithaca, N. Y., Bul. 488, April 1942, A. F. Gustafson.

"Conservation and Better Land Use for Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Bul. B-257, May 1942, Harley A. Daniel, Harry M. Elwell, and H. F. Murphy.

"Progress Report of Land Reclamation and Pasture Investigations on Abandoned and Scrubby Oak Areas in Central Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Mimeo. Cir. M-86, April 1942, Harry M. Elwell.

"Some Physical and Chemical Properties of the Principal Orchard Soils in the Eastern Panhandle of West Virginia," Agr. Exp. Sta., Morgantown, W. Va., Bul. 303, March 1942, G. M. Browning and R. H. Sudds.

"A Survey of Tobacco Soils in Wisconsin," Agr. Exp. Sta., Madison, Wis., Bul. 142, Jan. 1942, James Johnson and W. B. Ogden.

"Plowing Terraced Land," U. S. Dept. of Agr., Washington, D. C. Leaf. 214, Mar. 1942, E. G. Johnson.

"Soil Survey, McKenzie County, North Dakota," U. S. D. A., Washington, D. C., Series 1933, No. 37, Mar. 1942, M. J. Edwards and J. K. Ableiter.

"Soil Survey, Maverick County, Texas," U. S. D. A., Washington, D. C., Series 1936, No. 10, Jan. 1942, Howard M. Smith, R. M. Marshall, and I. C. Mowery.

"Teamwork to Save Soil and Increase Production," U. S. D. A. Washington, D. C., Misc. Pub. No. 486, May 1942, P. A. Waring.

"Save Your Soil," U. S. D. A. Washington, D. C., Cons. Folder No. 7.

"Grassed Waterways Are Safe Ways," U. S. D. A., Washington, D. C., Soil Cons. Ser. 1942.

Crops

¶ The greatly increased demand being made on American agriculture for meat and dairy production calls for the most efficient production that is possible if the desired quantities are to be obtained. One of the most important factors in efficient animal production is the proper utilization of pastures. To help farmers improve their pastures, Experiment Stations have been issuing a number of pasture bulletins, some of which are briefly summarized this month. The South Carolina Agricultural Extension Service has revised its Bulletin No. 99, "Permanent Pastures for South Carolina." This is a rather complete treatise of the subject and gives information on the management, fertilization, liming, seeding, improvement, and maintenance of pastures. When establishing a new pasture or improving an old one, liming is usually *nage, Jan. 1, 1940-June 30, 1940; July 1, 1940-Dec. 31, 1940; Jan. 1, 1941-June 30, 1941," Dept. of Agr., Raleigh, N. C.*

"Analyses of Commercial Fertilizers, Fall 1940-Spring 1941," Dept. of Agr., Raleigh, N. C., W. Kerr Scott, D. S. Coltrane.

"Crops Consume Nutrients," Col. of Agr., Columbus, Ohio, April 1942, John A. Slipher.

"Fertilizer Tonnage for West Virginia," Dept. of Agron. and Genetics, Col. of Agr., Morgantown, West Va.

"A Ten-Year Fertilizer Experiment on Tobacco," Agr. Exp. Sta., Madison, Wis., Res. Bul. 141, Dec. 1941, James Johnson and William B. Ogden.

Soils

¶ A survey of soil fertility and fertilizer practices in the truck crop section of Ontario has been made by T. H. Jones, R. Goodwin-Wilson, and J. H. L. Truscott. The results have been published as Bulletin No. 421 of the Ontario Department of Agriculture, entitled "The Value of Soil Analyses as an Aid in Truck Crop Production in Ontario." As a result of this rather extensive investigation, the authors came to the conclusion that soil analyses by the rapid test method can furnish reasonably accurate information on the nutrient status of the soil and the crop likely to be produced so far as the nutrients involved are concerned. They also feel that by the use of such tests growers will be able to fertilize more nearly according to the actual need of the soil and the crop under consideration, thereby greatly increasing the efficiency of fertilizer usage over present practices. Considerable detailed information on the nutrient levels of soils, fertilizer applied, and cropping conditions is given.

¶ Circular 218 of the Missouri Agricultural Experiment Station, entitled "Liming Missouri Soils," by O. T. Coleman and A. W. Klemme gives practical information on the lime removed by crops and that lost by leaching and erosion, the general lime requirements of soils in the various parts of the State, testing soils for lime requirements, the lime requirements of various crops, results from the use of lime, forms and fineness of lime, and its application. The authors call attention to the fact that lime will not substitute for other soil nutrients, but that fertilizers and lime supplement each other. They recommend that on soils low on organic matter which have not recently grown legumes or had an application of manure, fertilizer such as 4-16-4 or 4-12-4 should be used in addition to the required amounts of lime. On soils high in organic matter they say phosphate alone usually should be applied after liming. Where lime deficiency has been corrected and legumes have been grown frequently, fertilizer such as 0-20-10, 0-12-12, or 0-20-20 is recommended.

¶ The New Jersey Experiment Station has issued two bulletins on soil organic matter. The first, Circular 422, entitled "Soil Organic Matter," was prepared by a committee composed of Experiment Station officials. This publication is in the form of questions and answers and covers the information usually desired by farmers in connection with this important subject. The other publication, Circular 435, by H. R. Cox, is entitled "Resting the Land for Future Gains." This deals mostly with the use of green manure or cover crops and shows farmers in a practical way how they can grow these crops in their usual cropping system. It also discusses the feasibility of taking a year out on part of the farm to grow a green manure crop.

¶ Circular 425 of the New Jersey Agricultural Experiment Station, "Apple Soils and their Management in South Jersey," by O. W. Davidson, contains information of great value to every present and prospective fruit grower. In this short circular the author has presented practical information on the soil and fertility aspects of fruit growing. Much disappointment as well as financial loss could be avoided if all interested in fruit growing would read this circular before venturing into the enterprise. The importance of proper soil, the limitations involved in trying

Such land should be devoted to woodland or, where drainage is poor, possibly to ponds for growing wild life. Good practical information on a pasture program is given for the Southeast and the Corn Belt with much of the general information suitable for other areas. Pasture crops for the areas under consideration, ways of combating soil erosion, and examples of how to plan pasture areas in connection with contour farming are given.

¶ Much interest has been aroused in the growing of fish on the farm by articles in this magazine and others. These articles are based mostly on work conducted by the Alabama Experiment Station. The Station has now issued Bulletin 254, "Management of Farm Fish Ponds," by H. S. Swingle and E. V. Smith. The importance of proper food supply for the fish in the pond is brought out by striking photographs. Rather detailed information on the management of ponds from the viewpoint of species of fish that are suitable, the application of fertilizers, weed control, mosquito control, and harvesting the fish crop is given. Under fertilization it is recommended that 100 lbs. of 6-8-4 fertilizer plus 10 lbs. of nitrate of soda should be applied per acre of water. The application should usually be made about once a month, but this will depend on the amount of overflow and other conditions. The authors point out, however, that one or two applications a year are likely to be dissappointing since they do not supply enough nutrients to favor the growth of the algae and other microscopic plants which directly and indirectly furnish the food for the fish.

¶ Two bulletins dealing with the growing of vegetables in the Northeastern part of the country have recently appeared. The Connecticut Agricultural Experiment Station has issued Circular 150, "The Home Vegetable Garden," and the Vermont Agricultural Extension Service has issued Circular 109, "Vegetable Gardening in Vermont" by C. H. Blasberg. Both of these furnish practical information on the location of the garden, the use of manure, lime, and fertilizers, amount and kind of vegetables to plant, and pest and disease control. The Vermont publication gives more detailed information on many of these subjects than the Connecticut bulletin, but both publications have a great deal of valuable information for the small vegetable gardener. The advantage of using manure when it is available and the necessity of supplementing this with good applications of fertilizers are well brought out. Fertilizers in the 1-1-1 and the 1-2-2 ratio are given particular prominence, while the Connecticut bulletin also mentions the 1-2-2 or 1-3-1 ratios for heavy soils. Fertilizers such as 10-10-10, 7-7-7, 5-10-10, 8-16-16, 5-8-7, and 5-10-5 are suggested. The rate of application recommended is 20 to 50 pounds per thousand square feet. Information on top-dressing also is given.

"Vetch Varieties for Soil Improvement and Seed Production in Alabama," Agr. Exp. Sta., Auburn, Ala., Bul. 253, Mar. 1942, H. R. Albrecht.

"Management of Farm Fish Ponds," Agr. Exp. Sta., Auburn, Ala., Bul. 254, April 1942, H. S. Swingle and E. V. Smith.

"Edible Soybeans," Agr. Exp. Sta., Auburn, Ala., Bul. 255, April 1942, W. C. Sherman and H. R. Albrecht.

"Fifty-second Annual Report for the Year Ending June 30, 1941," Agr. Exp. Sta., Tucson, Ariz., Feb. 1, 1942.

"Wheat Production in California," University of Calif., Berkeley, Calif., Bul. 659, Dec. 1941, C. A. Suneson and F. N. Briggs.

"The Use of Annual Forages," Agr. Supplies Board, Ottawa, Canada, Sp. Pamph. 20, Feb. 1941, F. S. Nowosad and L. H. Newman.

"Barley in the Prairie Provinces," Agr. Supplies Board, Ottawa, Canada, Sp. Pamph. 62, Apr. 1942.

"Making Grass and Legume Silage without Preservatives," Agr. Supplies Board, Ottawa, Canada, Sp. Pamph. 66, P. O. Ripley.

"Sour Cherry Production in Colorado," Agr. Exp. Sta., Fort Collins, Col., Bul. 471, May 1942, L. R. Bryant and Robert Gardner.

"Rate and Date of Seeding Winter Wheat in Colorado," Agr. Exp. Sta., Fort Collins, Col., Bul. 472, June 1942, D. W. Robertson, J. F. Brandon, H. Fellows, O. H. Coleman, and J. J. Curtis.

one of the first things that needs to be done. Fertilization also is necessary. To get a quick start some complete fertilizer such as 4-12-4 at 300 to 600 lbs. per acre is recommended. After this an annual application of 200 lbs. of superphosphate and an application of 100 lbs. of muriate of potash every three or four years are suggested in order to maintain the pastures in good condition. Manure, when available, also is very good as a pasture fertilizer. It is pointed out that poor soil will not produce good pasture. Therefore, it is necessary to build up poor soils and maintain fertile soils by proper management practices.

¶ The South Carolina Extension Service has also issued a very helpful pamphlet on pastures, Circular 208, "New Permanent Pastures for South Carolina." The information is presented in diagrammatic form for quick reference. Each factor in producing or maintaining a good pasture is considered as a step, 12 in all being given. In connection with fertilization it is stated that one of the following treatments should be given: (1) 2,000 lbs. of limestone, 500 lbs. basic slag, 400 to 600 lbs. 4-12-4 or 6-12-6; (2) 1,500 lbs. basic slag, 75 lbs. muriate of potash; (3) 2,000 lbs. limestone, 400 lbs. 20% superphosphate, and 75 lbs. muriate of potash.

¶ Louisiana Experiment Station Bulletin 341, "Profitable Permanent Pastures for Dairy Cattle," by D. M. Seath, summarizes results of pasture investigations in that State and makes recommendations based on this work. It was found that a fertilized pasture permitted a 57% increase in the number of days grazed and a 58% increase in the cow days per acre over unfertilized pasture. There were a 64% increase in milk production per acre and a 44% increase in the net return per acre for the fertilized over the unfertilized pasture. This shows very clearly the value of proper fertilization. In this work 350 lbs. of 4-12-4 fertilizer were used in the fall and a top-dressing of 50 lbs. of nitrate of soda in the spring. Similar results in increased hay yield from fertilization also were obtained.

¶ In Pennsylvania a so-called triple-purpose pasture has been developed and is explained in Pennsylvania Extension Leaflet 78, entitled "Triple-Purpose Pastures," by F. V. Grau and J. B. R. Dickey. These intensively managed pastures may be used for grass silage or hay when not needed for pasturing, the reason why the system is called triple-purpose pasture. A mixture of grasses and legumes is seeded, and on fertile soil the normal fertilization of a small grain usually is considered sufficient to start the pasture. If the soil has not been manured recently or if it is not very fertile, 300 to 400 lbs. of 4-16-4 or 3-12-6 are recommended at seeding time. In addition there should be a top-dressing each year with manure and phosphate, or if no manure is available, with 300 lbs. of 0-14-6 or 0-20-10.

¶ Planting various crops in order to produce pasturage over a large portion of the year is covered in West Virginia Agricultural Extension Circular WS-2, entitled "Supplementary Pastures." It shows that by the use of small grains, sweet clover, lespedeza, alfalfa, Ladino clover, and Sudan grass to supplement the Kentucky bluegrass pasture, pasturage can be obtained over a seven-months period, whereas the ordinary pasture alone usually furnishes adequate grazing only in the spring and early summer.

¶ A general bulletin on pasture establishment and management, particularly from the viewpoint of soil conservation, is Farmers' Bulletin No. 1900 of the U. S. Department of Agriculture, entitled "Pastures to Hold and Enrich the Soil," by A. T. Semple and M. A. Hein. These authors point out the fallacy of taking very poor land and trying to make a pasture out of it.

N. Dak., Bul. 310, Mar. 1942, Harold Mattson.

"Protein and Quality in Hard Red Spring Wheat with Respect to Temperature and Rainfall," Agr. Exp. Sta., Fargo, N. Dak., Bul. 311, Mar. 1942, L. R. Waldron, R. H. Harris, T. E. Stoa, and L. D. Sibbitt.

"Growing Field Beans," Agr. Ext. Serv., Fargo, N. Dak., Sp. Cir. A-9, Mar. 1942.

"Better Pastures," Agr. Ext. Serv., Fargo, N. Dak., Sp. Cir. A-11, Mar. 1942.

"Grass Seeding," Agr. Ext. Serv., Fargo, N. Dak., Sp. Cir. A-12, Mar. 1942.

"Flax," Agr. Ext. Serv., Fargo, N. Dak., Sp. Cir. A-13, Mar. 1942.

"Grapes," Agr. Ext. Serv., Fargo, N. Dak., Sp. Cir. A-14, Apr. 1942.

"Soybeans," Agr. Ext. Serv., Fargo, N. Dak., Sp. Cir. A-15, Apr. 1942.

"Fruit Varieties for Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 627, May 1942, C. W. Ellenwood, Leon Havis, and Freeman S. Howlett.

"The Ohio Cooperative Corn Performance Tests," Agr. Exp. Sta., Wooster, Ohio, Sp. Cir. 64, Feb. 1942, G. H. Stringfield, R. D. Lewis, and H. L. Pfaff.

"Producing Seedlings of Eastern Red Cedar (Juniperus virginiana L.)," Agr. Exp. Sta., Stillwater, Okla., Bul. B-256, Apr. 1942, M. Afanasiev and M. Cress.

"The Chemical Composition of Atlas and Dwarf Yellow Milo Plants in Relation to Chinch Bug Resistance," Agr. Exp. Sta., Stillwater, Okla., Tech. Bul. T-12, Apr. 1942, J. E. Webster and V. G. Heller.

"Oklahoma Farm Wheat Improvement Program, Summary Report, 1937-1941, Inclusive," Agr. Exp. Sta., Stillwater, Okla., Misc. Pub. MP-6, May 1942, Horace S. Smith.

"Mung Beans for Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Cir. C-104, June 1942, Hi W. Staten.

"Growing Fall-Crop Irish Potatoes," Agr. Exp. Sta., Stillwater, Okla., Cir. C-102, June 1942, H. B. Cordner.

"Substitutes for Concord Grapes in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Cir. C-103, May 1942, Frank B. Cross and J. E. Webster.

"Triple-purpose Pastures," Agr. Ext. Serv., State College, Pa., Leaf. 78, Mar. 1942, Fred V. Grau and J. B. R. Dickey.

"Poultry Pastures," Agr. Ext. Serv., State College, Pa., Leaf. 79, Apr. 1942, Fred V. Grau.

"Permanent Pastures for South Carolina," Agr. Ext. Serv., Clemson, S. C., Apr. 1942.

"New Permanent Pastures for South Carolina," Agr. Ext. Serv., Clemson, S. C., Cir. 208, Apr. 1942, C. G. Peebles.

"Abstracts of Bulletins No. 596-609, Circulars No. 91-94, and Other Publications During 1941," Agr. Exp. Sta., College Station, Tex., Cir. 96, Apr. 1942, A. D. Jackson.

"Vegetable Gardening in Vermont," Agr. Ext. Serv., Burlington, Vt., Cir. 109, Mar. 1942, Charles H. Blasberg.

"Supplementary Pastures," Agr. Ext. Serv., Morgantown, W. Va., Cir. WS2, May 1942, F. W. Schaller and H. O. Henderson.

"Pea Wilts and Root Rots," Agr. Exp. Sta., Madison, Wis., Bul. 424, Feb. 1933, J. C. Walker and W. C. Snyder.

"Papaya Production in the United States," U. S. D. A., Washington, D. C., Cir. 633, Apr. 1942, Hamilton P. Traub, T. Ralph Robinson, and H. E. Stevens.

"Pure-seed Production of Egyptian-type Cotton," U. S. D. A., Washington, D. C., Cir. 646, Apr. 1942, R. H. Peebles.

"Hardiness and Productiveness of U. S. No. 5 Refugee Snap Bean in the Southern United States," U. S. D. A., Washington, D. C., Cir. 648, Apr. 1942, B. L. Wade.

"Connecticut Farm Handbook 1941," U. S. D. A., Washington, D. C.

"Kentucky Farm Handbook 1942," U. S. D. A., Washington, D. C.

"Investigations on the Cause and Control of Biennial Bearing of Apple Trees," U. S. D. A., Washington, D. C., Tech. Bul. 792, Mar. 1942, C. P. Harley, J. R. Magness, M. P. Masure, L. A. Fletcher and E. S. Degman.

"Relation of Weather and Its Distribution to Corn Yields," U. S. D. A., Washington, D. C., Bul. 806, Feb. 1941, Floyd E. Davis and George D. Harrell.

"How to Graze Blue Grama on Southwestern Ranges," U. S. D. A., Washington, D. C., Leaf. 215, Edward C. Crafts and George E. Glendening.

"The Home Fruit Garden in the East Central and Middle Atlantic States," U. S. D. A., Washington, D. C., Leaf. 218.

"Establishing and Managing Young Apple Orchards," U. S. D. A., Washington, D. C., Farmers' Bul. 1897, May 1942, J. R. Magness.

"Pastures to Hold and Enrich the Soil," U. S. D. A., Washington, D. C., Farmers' Bul. 1900, Mar. 1942, A. T. Semple and M. A. Hein.

"Production of Tomatoes for Canning and Manufacturing," U. S. D. A, Washington, D. C., Farmers' Bul. 1901, Mar. 1942, James H. Beattie, W. R. Beattie, and S. P. Doolittle.

"Varieties of Spring Wheat for the North Central States," U. S. D. A., Washington, D. C., Farmers' Bul. 1902, April 1942, J. Allen Clark.

"Ladino White Clover for the Northeastern States," U. S. D. A., Washington, D. C., Farmers' Bul. 1910, E. A. Hollowell.

"Security at the Grass Roots, A Report of Cooperative Extension Work in Agriculture and Home Economics, 1940-41," U. S. D. A., Washington, D. C.

"Boost Corn and Soybean Yields," U. S. D. A., Washington, D. C.

"Distribution of Roots of Certain Tree Species in Two Connecticut Soils," Agr. Exp. Sta., New Haven, Conn., Bul. 454, Jan. 1942, George Illichevsky Garin.

"Tobacco Substation at Windsor, Report for 1941," Agr. Exp. Sta., New Haven, Conn., Bul. 457, May 1942, P. J. Anderson and T. R. Swanback.

"The Home Vegetable Garden," Agr. Exp. Sta., New Haven, Conn., Cir. 150, Feb. 1942.

"Green Manure and Cover Crops," Agr. Ext. Serv., Newark, Del., Wartime Ext. Folder 1, July 1942, Claude E. Phillips and Eugene P. Brasher.

"A Year's Progress in Solving Farm Problems of Illinois, 1937-38," Agr. Exp. Sta., Urbana, Ill., 51st Ann. Rpt., March 1942, H. W. Mumford.

"Soybeans—A War Crop," Univ. of Ill., Urbana, Ill., Cir. 527, J. C. Hackleman and W. L. Burlison.

"What About Fertilizing Soybeans?" Agr. Ext. Serv., Urbana, Ill., AG1087, Apr. 1942, A. L. Lang and L. B. Miller.

"Research Solves Farm Problems," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., 54th Ann. Report, June 30, 1941, H. J. Reed.

"Soybean Varieties and Culture," Purdue Univ. Agron., Leaflet May 1942.

"Report on Agricultural Research for the Year Ending June 30, 1941," Part 1, Agr. Exp. Sta., Ames, Ia., R. E. Buchanan.

"Report on Agricultural Research for Year Ending June 30, 1941," Ia. Corn Research Inst., Ames, Ia., Sixth Ann. Rpt.

"The Iowa Farm Service Guide," Agr. Exp. Sta., Ames, Ia., Bul. P34, Oct. 1941, John A. Vieg.

"Vegetable Soybeans," Agr. Exp. Sta., Ames, Ia., Bul. P39, Feb. 1942, M. G. Weiss, C. P. Wilsie, B. Lowe, and P. M. Nelson.

"Victory Vegetable Garden," Agr. Exp. Sta., Ames, Ia., Bul. P40, Mar. 1942, E. S. Haber.

"Growing Potatoes in Iowa," Agr. Exp. Sta., Ames, Ia., Bul. P41, Mar. 1942, E. S. Haber.

"Profitable Permanent Pastures for Dairy Cattle," Agr. Exp. Sta., University, La., Bul. 341, Mar. 1942, D. M. Seath.

"Controlling Garden Insects and Diseases," Agr. Exp. Sta., Orono, Me., Ext. Cir. 162, June 1942.

"Recent Progress with Canning Crops in Maine," Agr. Exp. Sta., Orono, Me., Ext. Bul. 304, May 1942.

"Small Grain Production in the Lowland Region of Southeast Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 440, Jan. 1942, B. M. King.

"Growing Sorghum and Making Sorghum Sirup," Agr. Exp. Sta., Columbia, Mo., Cir. 235, May 1942, C. A. Helm and Robert Beasley.

"Strawberries in Nebraska," Agr. Exp. Sta., Lincoln, Neb., Cir. 11, Mar. 1942, C. C. Wiggans.

"Rubber From Rabbit Brush," Agr. Exp. Sta., Carson City, Nev., Bul. 157, Mar. 1942, S. B. Doten.

"Influence of Thiamin Additions on Germination and Growth of Certain Grasses and of White Clover," Agr. Exp. Sta., New Brunswick, N. J., Bul. 692, April 1942, G. H. Ahlgren.

"Corn Growing for High Yields and Low Costs Per Bushel," Agr. Exp. Sta., New Brunswick, N. J., Cir. 427, April 1942, Howard B. Sprague.

"Corn Hybrids for New Jersey," Agr. Exp. Sta., New Brunswick, N. J., Cir. 429, April 1942, Carlton S. Garrison.

"Strawberries for the Home Garden," Agr. Exp. Sta., New Brunswick, N. J., Cir. 436, April 1942, J. Harold Clark.

"High Quality Hay Production," Agr. Exp. Sta., New Brunswick, N. J., Cir. 440, May 1942, G. H. Ahlgren and Carl B. Bender.

"Fifty-Second Annual Report," 1940-1941, Agr. Exp. Sta., State College, N. M., Fabian Garcia.

"Hay for the Dairy Herd," Agr. Ext. Serv., Ithaca, N. Y., Bul. 479, Mar. 1942, E. S. Harrison and H. B. Hartwig.

"Emergency Hay Crops," Agr. Ext. Serv., Ithaca, N. Y., Bul. 481, Mar. 1942, George H. Serviss and John H. Barron.

"Cannery Peas," Agr. Ext. Serv., Ithaca, N. Y., Bul. 485, Mar. 1942, M. C. Bond, Charles Chupp, Hugh Glasgow, R. W. Leiby, G. L. McNew, C. B. Raymond, M. E. Robinson, and C. B. Sayre.

"Cannery Tomatoes," Agr. Ext. Serv., Ithaca, N. Y., Bul. 487, Apr. 1942, Charles Chupp, G. E. R. Hervey, T. E. LaMont, R. W. Leiby, G. L. McNew, M. E. Robinson, and C. B. Sayre.

"Soybeans," Agr. Ext. Serv., Ithaca, N. Y., Bul. 496, Apr. 1942, R. G. Wiggans, F. B. Morrison, and G. H. Serviss.

"Experiments with Field Beans," Agr. Exp. Sta., Ithaca, N. Y., Bul. 776, Feb. 1942, E. V. Hardenburg.

"Three Years' Operation of an Experimental Sugar Bush," Agr. Exp. Sta., Geneva, N. Y., Bul. 699, Jan. 1942, C. J. Tressler and W. I Zimmerman.

"Orchard Covers and Their Relation to Soil Conservation," Agr. Exp. Sta., Geneva, N. Y., Bul. 701, Mar. 1942, R. C. Collison and E. A. Carleton.

"Raspberry Growing in New York: Culture, Disease, and Insects," Agr. Exp. Sta., Geneva, N. Y., Cir. 153, May 1942, G. L. Slate, R. F. Suit, and F. G. Mundinger.

"Blackberries and Dewberries," Agr. Exp. Sta., Geneva, N. Y., Cir. 193, May 1942, George L. Slate.

"Grazing Investigations on the Northern Great Plains," Agr. Exp. Sta., Fargo, N. Dak., Bul. 308, Dec. 1941, J. T. Sarvis.

"Bounty Tomato in Standard Yield Trials in 1940 and 1941," Agr. Exp. Sta., Fargo,

fallow shows a rapid decrease in yield and quality demonstrates that the cover of spontaneous growth is the answer to the problem rather than simply allowing the land to remain idle.

Tests completed recently by the Department scientists show that certain weeds are more desirable than others as a fallow. It may not be good news to persons susceptible to hay fever, but ragweed is one of the weed species showing the best results. Horseweed is another. On the other hand, tobacco following lamb's quarter showed some reduction in yield over bare fallow.

In the same tests annual lespedeza has shown no advantage as a cover crop. Sweetclover, rabbit's foot clover, and wild peas have not always shown an advantage.

The general beneficial effect of the weed fallow, report the scientists, is getting the tobacco off to a quick start and a rapid and uniform growth of the plants from transplanting time to maturity. This in turn resulted in uniformly high market value per acre and average price per pound, which demonstrates that the tobacco meets current demands for most manufacturing purposes.

Cotton Contest Showed Value of Potash

A CONTEST, conducted in 1939 in Woodruff County, Arkansas, which is recognized as a splendid cotton-producing county, clearly demonstrated the value of potash in growing good cotton. Thirty-two boys, members of the Future Farmers of America and students in the Vocational Agriculture Departments of the high schools at Cotton Plant, Augusta, and McCrory, participated. Each participant used 400 pounds of 6-8-8 commercial fertilizer on an acre plot. No special cultivation was given the fertilized plot, the entire crop being cultivated at the same time. However, the plot was carefully staked off, so that there would be no difficulty in determining the weights when the picking began. An adjoining plot, also containing one acre, on which the regular fertilizer practices were followed, was marked for comparison.

Mr. Richardson, adviser and instructor, and Andrew J. Marsh, first prize winner in the contest.

Nine of the boys reported gains of more than 500 pounds of seed cotton per acre over similar plots which were fertilized in the regular manner. Records as to the number of visitors to the plots and the cotton weights were carefully kept. The first place winner showed an increase of 958 pounds.

Another interesting feature was the different types of soil used in the contest, some of the boys living on river bottom farms, others living in a small area which was severely hit by drought

"Greener Pastures," U. S. D. A., Washington, D. C.

"Guayule: A List of References," U. S. D. A., Washington, D. C., Soil Cons. Bib. No. 4, April 1942, Alan J. Blanchard.

"Facts Farmers Should Know About Soybeans," U. S. D. A., Washington, D. C., R. E. Uhland.

"Compilation of Soil Conservation and Domestic Allotment Act, as Amended, Agricultural Adjustment Act of 1938, as Amended, Federal Crop Insurance Act, as Amended, Sugar Act of 1937, as Amended, Laws and Executive Orders Concerning The Commodity Credit Corporation, Related Appropriation Items, and Miscellaneous Laws," U. S. D. A., Washington, D. C.

Economics

"Possibilities and Limitations of Cooperative Marketing," Agr. Exp. Sta., Berkeley, Calif., Cir. 298, Rev. Feb. 1942, H. E. Erdman.

"An Economic Classification of Land In Fifty-six Municipal Divisions, South Central Saskatchewan," Dom. Dept. of Agr., Ottawa, Canada, Pub. 728, Tech. Bul. 36, Oct. 1941, C. C. Spence and E. C. Hope.

"Land Use Classification in the Special Areas of Alberta and in Rosenheim and Acadia Valley," Dom. Dept. of Agr., Ottawa, Can., Pub. 731, Tech. Bul. 39, Feb. 1942, A. Stewart and W. D. Porter.

"Statistical Information Pertaining to the Marketing of Agricultural Products in Connecticut, 1941," State Dept. of Agr., Hartford, Conn., June 1942, Ann Bushman.

"Production Credit in Florida Citrus and Vegetable Areas," Agr. Exp. Sta., Gainesville, Fla., Bul. 367, Jan. 1942, J. Wayne Reitz.

"Indiana Crops and Livestock—Annual Crop Summary 1941," Agr. Exp. Sta., Lafayette, Ind., No. 195, Dec. 1941.

"Land-use Adjustments Needed on Farms in Deer Creek Township Cass County, Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 466, Feb. 1942, B. R. Hurt, E. C. Young, and Lynn Robertson.

"Interrelationship of Land Uses in Rural Massachusetts," Agr. Exp. Sta., Amherst, Mass., Bul. 387, Dec. 1941, David Rozman.

"Farm Management Aspects of the War," Agr. Exp. Sta., East Lansing, Mich., Bul. 182, Apr. 1942, J. C. Doneth and K. T. Wright.

"Measuring the Productive Value of Pastures," Univ. of Mo. Agr. Exp. Sta., Columbia, Mo., Bul. 443, May 1942, Homer J. L'Hote.

"Labor, Power, and Machinery on Small Farms in Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 628, June 1942, F. L. Morison and Ross V. Baumann.

"Farming Adjustments and Agricultural Conservation Programs in West Virginia," Agr. Exp. Sta., Morgantown, W. Va., Bul. 304, April 1942, F. D. Cornell, Jr., and C. W. Crickman.

"Financing Production of Food for Freedom," U. S. D. A., Misc. Pub. 488, Apr. 1942.

"Soybean Oil and the War," U. S. D. A., Washington, D. C., BAE-Ext. Flier—5.

"Parity Prices; What They are and How They are Calculated," U. S. D. A., Washington, D. C., June 30, 1942.

"World Corn Production and Trade," U. S. D. A., Washington, D. C., Foreign Agr. Rpt. 5, May 1942, Hally H. Conrad.

Ragweed Adds Quality In Tobacco Rotations

In the early days of this country planters soon found that tobacco grown on virgin soil produced larger yields of finer-textured leaf than that grown on older cultivated plots. Thus, to meet market demands, early settlers and their successors cleared forested areas until in time all the good land had been planted to tobacco.

As farming science developed, tobacco growers tried crop rotation, and used manures and fertilizers in an effort to maintain yield and quality. These practices did not prove satisfactory on all soils and with all crop combinations.

In recent years, scientists of the United States Department of Agriculture discovered that tobacco grown after a natural weed fallow and receiving the right kind of commercial fertilizer apparently possesses those characteristics observed in the early days when the crop was grown on virgin land. The fact that tobacco planted after a bare

Ladino Field Day

(*From page* 18)

Seeding can be made in oats or barley in the spring, and at least 300 pounds of a 4-12-4 fertilizer per acre should be used. Many farmers who are short on grass for next year are planning to take off their hay crops, plow the old hay sod, lime, and seed the triple-purpose mixture in the early part of August, without a nurse crop. We have found by experience that this seeding should be done in August, and in order to secure the best stands of Ladino, the deadline for seeding should be not much later than August 15.

Many growers have been hesitant in seeding the triple-purpose mixture on account of the presence of orchard grass in the mixture, for fear the orchard grass will become tough. But such is not the case, for if Ladino is cut at the proper time, usually the first week in June, the orchard grass will be in a green, succulent, tender stage. The orchard grass and meadow fescue are regarded as compatible grasses for seeding with Ladino clover. They can withstand the crowding effect of the rapidly growing Ladino and tend to hold or support the Ladino as it matures, thus preventing it from becoming prostrate on the ground or lodging. In seeding the triple-purpose mixture, it is advisable to seed the two grasses, orchard grass and meadow fescue, separate from the legume seed, due to the difference in the sizes of the seed. The legume seeds require shallower seeding than the grasses.

It has been our observation in the County that we can maintain Ladino clover if, after the first cutting season, we fertilize in the fall of each year with at least 300 pounds of 0-20-20 or 0-20-10 fertilizer. If manure is available, a winter application of six to eight tons is also recommended.

The Sterling Farms recently purchased a new and valuable piece of equipment known as the Haymaker. It is a five-foot implement that is attached to and trails the mowing machine. A pick-up attachment picks up the newly cut swath and puts it through two rollers set at a 32nd of an inch. These

The Haymaker, a new piece of equipment which makes hay in half the time, was demonstrated.

the previous year, and still others located where the land was of a rolling topography. No particular variety of cotton was required, and students were allowed to make their own selection as to the kind of cotton they would grow. There was a negligible amount of cotton blight on the plots fertilized with the 6-8-8.

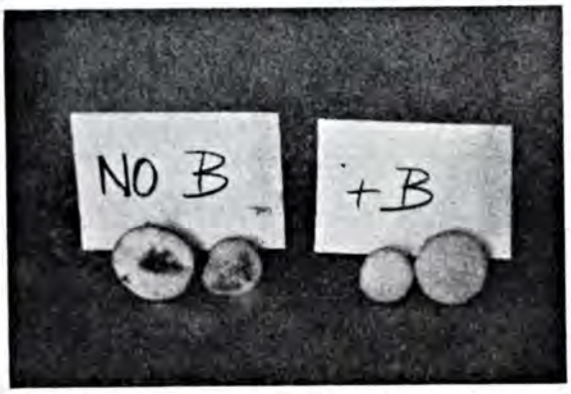
Selection of the winners was by points scored. A total of 85 points was possible, with the boy who won first place making 75 points. The first prize was $7.50, second $5.00, and third $2.50 to the boys ranking in that order, while the Vocational Agriculture Department of Cotton Plant High School was awarded a $15 soil-testing set for winning the sweepstakes.—*Justin Richardson.*

The Southeast Can Grow Clover and Alfalfa

(*From page* 16)

white Dutch clover, kudzu, and sericea-lespedeza."

Boron deficiency in turnips can be determined by examining the roots. If there is a boron deficiency, brown hearts will show when the turnips are cut open. If the deficiency is great, the turnip tops will curl.



Showing brown centers in turnips where no borax was used.

Borax may be applied to turnips or beets by either of three methods: In the drill, broadcast, or as a side-dressing. If it is applied in the drill, it should be done three weeks before the seeds are to be planted; if broadcast, the seeds may be planted immediately after application is made. In the third method, the borax is mixed with sand and put down beside the row and covered lightly.

Doctors Naftel, Ware, and Sommer warn farmers that an over-dose of borax may do considerable damage as it is very toxic to plants. This leads them to advise the use of no more than 15 to 20 pounds per acre. They advise that there is an ample supply of borax available through regular fertilizer dealers.

Fertility Program Makes a Wheat King

(*From page* 13)

form the raw plant-food fertility into merchantable grain and has stuck to it. While many of his neighbors were trying to solve their plant-food problems by acquiring new varieties with miraculous powers of performance on low plant-food supplies, Herb has been immune to the "Variety Change Complex" and has stayed with the old reliable. His main complaint is that where his nitrogen level is too high, the lodging of the wheat is often fatal to the young clover stands.

Although the application of this field judging score card to first the township contests, then the county contests, and last to the area may not have been perfect in every case, it has caused a lot of practical operators to see the relation of the fertility problem to production in a light that it has never been viewed before.

practice which merely releases some of the stock nitrogen without adding any, and which even invites a loss by run-off and leaching, cannot be continued long without harmful soil destruction. It is, nevertheless, an expedient measure, justifiable while the emergency exists.

In this article certain practices are suggested which are calculated to help growers to cope with an impending shortage of fertilizer nitrogen. Some of the practices suggested would be equally valuable any time, others are suggested solely as emergency measures.

The One-Mule Farmer Needs a New Machine

(*From page* 22)

exclusive of the time lost in turning at the ends of the rows and in servicing the machine. If the machine is operated by one man and one mule, this figure would represent either man-hours per acre or mule-hours per acre. The power, expressed in horsepower hours per acre (arithmetical results of multiplying horsepower by the time in hours required for one acre), will allow direct comparison to be made between two machines or between two methods. For example, one machine may require two horsepower and will cover one acre of land in one hour. A second machine may require one horsepower and take three hours to cover the acre. Although the first machine required twice as much horsepower as the second, the latter machine has the real advantage for the total amount of energy expended in covering the acre. The horsepower hours per acre being 2 x 1 or two horsepower hours per acre for the first machine and 1 x 3 or three horsepower hours per acre for the second machine. All calculations were made for a row spacing of 3½ feet.

Chart No. 1 gives the draft, labor, and power requirements of five methods of fertilizing and planting cotton seed, and one method for fertilizing and bedding for tobacco. With the exception of the experimental machine, these methods are all commonly used on North Carolina farms. This is the result of one year's study under one set of conditions.

Particular attention is called to the once-over machine, Method No. 1, which shows considerable saving in both labor and power because all operations are accomplished in one trip. The commercial two-mule, riding, once-over machine, Fig. 3 and Method No. 3, requires approximately two times as many mule-hours per acre and two times as much power as the walking, once-over machine.

Of particular significance is the fact that the draft of the walking, once-over is about the same as that required of each mule on the riding, once-over machine (138 and 263 lbs. respectively). This walking, once-over machine would, therefore, be economically superior to the two-mule, riding machine.

It has been estimated by Brody and Trowbridge[2] that a horse can efficiently pull 10 per cent of the body weight when walking at 2½ miles per hour. This is calculated on the basis of working every day 6 to 10 hours. A safe estimate for an average work animal in North Carolina would be about 150 pounds of draft where the mule is worked seasonally. The draft of 138 pounds for the once-over machine, would be within a safe limit. As a basis of comparison, it is interesting to note that this once-over machine, which does all the operations of planting in one trip, requires only 138 pounds of draft while the 7-inch turning plow, Method No. 4, required an average of 145 pounds to do the bedding operation alone.

[2] Bulletin No. 383, "Efficiency of Horses, Men and Motors," University of Missouri.

rollers crush the stems and lay them out in a swath. This crushing makes possible, with proper haying weather, rapid release of the moisture. John Dershimer, manager of the Sterling Farms, says, "It hastens hay-making and helps retain the natural green color of the hay." Ladino and alfalfa hay-making time, with proper weather, he advises, has been reduced from 96 to 48 hours by the use of this implement. Better color, quality, and less leaf shattering has been the result.

The Field Day at Sordoni's was an inspiration to visiting dairymen. They learned that to be a successful dairyman one must produce an abundance of high-class roughage. Those farmers who have followed the development of Sordoni's Sterling Farms during the past six years are enthusiastic about Ladino. They feel that Ladino is the answer to the dairyman's prayer for roughage of high quality, persistency, and yielding capacity, whether grown for grass-silage, hay, or pasture.

Conserve Nitrogen Now

(*From page* 12)

effective way of quickly meeting any shortage of nitrogen that this emergency may bring about. A little slower, but nevertheless equally important, means of meeting any shortage of nitrogen fertilizer is the greater use of adapted legumes. Those farms which are now producing good stands of alfalfa, sweet clover, or ordinary clovers in mixtures with grasses, need little or no nitrogen for corn and small grains. But, there are too many farms in the Northeast upon which a good stand of legumes is a rarity. Our most useful legumes require moderate to good drainage, plenty of lime, and a good supply of available mineral elements, chiefly potash and phosphate.

There are not many areas now under cultivation which have such poor drainage that alsike clover will not grow, if other conditions are right. There are a great many soils which are entirely too acid for legumes. More than half of the general farm soils and orchard soils which have been analyzed at the Pennsylvania Experiment Station are too acid to grow clover. In most instances, the strongly acid soils are deficient in available phosphate and potash. Acidity in soils tends to reduce the availability of phosphate even though phosphate is applied in soluble fertilizers.

To make these acid-deficient soils capable of growing legumes well, a soil improvement program is essential. Such a program calls for sufficient lime and the building up of the available mineral status by manure or mineral fertilizers or both. Sometimes much of the value of mineral fertilizers may be lost when applied to a dead soil. Failure to get a response may not signify that the minerals are not needed. It may mean that they are being fixed or otherwise rendered unavailable. It is seldom possible to take a strongly acid, biologically inactive soil and make it suitable for lime-loving legumes in one year. However, within two or three years, if active organic matter is added in crop residues or manure and sufficient mineral elements supplied, such a soil may be made suitable for the ordinary legumes.

Another suggestion that may serve as a temporary relief, if nitrogen shortage becomes acute, is aiding the release of soil nitrogen. Soils contain 1,500 to 3,000 pounds of total nitrogen in the surface soil. Most of this is quite resistant to bacterial attack. Liming, sufficient to make the soil nearly neutral, and cultivation to aid bacterial action and eliminate competition will help raise the level of nitrate concentration in the soil. Of course, such a to a soil conservation survey made by SCS technicians who helped him with his plans, had lost about three-fourths of the topsoil in most of the fields.

As Mr. Smith gazed over the sloping lands which are his, which are producing a living and an ever-better one, and as he pointed out the terraces, contour tillage, pasture improvement, ponds, and other practices which are rebuilding the topsoil and rooting it to the earth for the future welfare of his family and the community, there was a love of the land and a pride of accomplishment in his eyes which warmed the heart while the raw wind froze the skin.

The new land frontiers of the past century may be closed in this country; but while the land needs soil conservation, while there are man-handled farms to be brought back to a profitable system of agriculture, and while there are families like the Smiths, there'll always be a frontier in the United States.

The Daze Phase

(*From page* 5)

strong farm front at a time when enemies were lurking in nooks and crannies to gloat over this dispersal of a united people.

With the compromise enactment of certain alleviating appropriations for the continuance of localized aids aforesaid, there followed a temporary relaxing of the tension among our farm leaders and followers. If it had not passed, I fear we might have encountered some social troubles of great magnitude. And they would not have confined themselves to the ragged fringe of agriculture either. It is better to spend a few millions in a questionable way than to create conditions of unrest and discord.

Then next we had the wheat feed embroilment. Everybody knows about that and how farmers were rather divided on the issue, between upholding a paper parity principle inviolate on the one hand, and supplying excess grain to livestock during a critical storage season. This too has temporarily eased off with recent legislation. It may help to heal the scars in this case too.

But there is another deeper angle left to bother us. I refer to the division among farmers over the union labor principle and the invasion of half a dozen states by labor organizers who claim to offer a form of militant crusading beyond anything that the existing farm organizations have attempted.

There is nothing new at first glance in such claims. Rival farm organizations and rival political parties have indulged in it. But it is the first time on record that farm organization leadership as a whole has been threatened with an outside force of organized producers, often more skillful and aggressive than the farmers and fortified with ample financial reserves gained through methods denied to or never used by solicitors for farm organizations.

I have just said that farmers themselves are somewhat divided on this issue. By that I mean the backgrounds and platforms of certain farm organizations have in the past reflected different attitudes toward organized union labor.

We have had a minority of such farm groups who tried to keep step with union labor, who insisted that the objectives of farmers and workers were almost identical, who exchanged public speakers and held joint *political* rallies. This last emphasis is what I think is significant. The ties that bound them hitherto were largely political, vote-counting, lobbying, and checking the legislative ballots on mutual measures.

These studies indicate that many of the one-mule commercial machines could be modified to increase their efficiency. For example, if the manufacturer of the distributor used in Method No. 2 had equipped his machine with a planter, the draft, labor, and power would compare very favorably with the once-over machine. If the manufacturer of the distributor used in Method No. 4 had equipped his machine with bedding discs and a seed planter, the draft, labor, and power would compare favorably with the once-over machine. Method No. 5 is very inefficient, partially because it involves five operations and partially because the shovels that mix the fertilizer with the soil in the furrow require a large amount of power.

Method No. 6 gives the requirements for opening a furrow, which most farmers do regardless of the machine method used. This is necessary where the fertilizer is placed in a furrow under the seed, but has no advantage where the fertilizer is side-placed except that it may help to make a straight row.

Method No. 7 is for the once-over machine when used for fertilizing and bedding for sweet potatoes, tobacco, and other transplanted crops. The commercial distributor used in Method No. 2 and shown in Fig. 5 may be adjusted to throw up a bed desirable for transplanted crops. When properly adjusted, the power requirement would be approximately the same as for the once-over machine. The advantage for the once-over, over this machine, would be in the accurate side-placement of the fertilizer so that the plants may be set between the bands of fertilizer to avoid injury to the plants. The operations used in Method No. 5 for planting cotton would be the same as for transplanted crops with the exception that the planter would be omitted. This method would require approximately three times more labor and three times more power than the once-over.

Conclusion

These studies show that a once-over, side-placement machine can be built which will save labor and power, give more efficient use of fertilizer, give better stands and higher yields. The one-mule farmer should demand such a machine.

Clifton Smith Succeeds on Worn-out Farm

(*From page* 9)

hasn't kept Smith from giving attention to wildlife. Around his two ponds he has woody plantings and food plants which provide a home for game birds. Cane, blackberries, plums, and other food-bearing plants are included. As we walked across the nearby field two pheasants streaked away ahead of us. Quail are numerous.

When we interviewed him on a raw, windy November day with the ground freezing under our feet, we found him mowing a strip of hegari grown on the contour on a terraced field. Having been kept out of the field by wet weather he was bundled up and cutting the forage crop with a grim determination to save and use every bit of feed. And in spite of that, he stopped and talked about soil conservation and what it had helped him do.

"It's easier to tear a farm down than it is to build it up," he said. "The gullies are beginning to heal, the pastures are producing lots of feed, and I don't lose much soil from my grain and cornfields. It will be years before the farm is anywhere near as good as it used to be; but a man can bring it back, and it will make him a living while it's coming back."

And that is the story of how Smith has obtained profitable production from a farm which in 1936, according

JUSTICE

"One day," said the old countryman from the hills, who was on trial for murder, "when my rheumatism was pestering me, and my daughter had just eloped with a good-for-nothin' scalawag, and my barn had burned down and I lost both my mules, and my best old sow got the cholera and died, and I just heard they had foreclosed the mortgage and the sheriff was lookin' for me, I told my troubles to one of these here optimists, and he said: 'Cheer up, old top, the worst is yet to come!' So I shot him."

A famous and beautiful actress at a dinner party was placed beside a visiting African potentate. She exerted herself to the utmost to entertain her dusky partner. At the close of the dinner he sighed and said, "Madam, if only you were black and fat you would be irresistible!"

"Do you get a nervous feeling when your boy friend pets you?"

"Who, me? Of course not. He isn't nervous."

Way down in Georgia a traveling man found himself stranded for the night and in his rambles around town noticed there were two Baptist churches. He asked a colored man why there should be two churches of the same denomination.

"Well, boss, Ah'll tell you," said the informant. "Dey jus' can't agree. One of de churches believes dat Pharaoh's daughtah found Moses in de bullrushes. De odah church claims dat's what she sez!"

A maiden lady lived in the country with one maid. One morning the bell rang. The maid admitted the visitor, an evacuee officer arranging for homes for children evacuated from London, then rushed upstairs.

"Please mum," she blurted out breathlessly, "you've got to have two babies, and the man's downstairs!"

The track supervisor received the following note from one of his foremen:

"I'm sending in the accident report on Casey's foot, which he struck with the spike maul. Now, under 'Remarks,' do you want mine or Casey's?"

ROUTINE

"Well, well, Rastus, so you're in the Army now! What do you do?"

"Oh, Ah jes flings open dis here gun, den Ah shoves in a shell an a sack of powder, den Ah shets de gun an' pulls dis here string, an' den Ah yells: *'Hitler, count yo' sojers!'* "

The teacher had lectured on the various facets of communism, fascism and nazism. Then turning to the bright pupil, he said: "Johnny, what would you do with all these isms?"

"I'd make them all wasms!" came the prompt reply.

And then there was the student who wrote: "Virgin wool comes from the sheep that can run the fastest."

There has never been to any extent the slightest move on the part of farmers and union members to get together on common ground as human beings, parents and home-makers.

This needs proper emphasis at this time. There is an alarming distrust afoot. The inroads of the aforesaid unions seeking membership among farmers alarms the leaders of the pros and the cons alike. But they possess no natural alliance to defend themselves. Their meetings of protest are not convincing, and the feeling among some of the rank and file swings more toward favoring the antics of the union organizers than it does to support the old-line leaders.

The silence on the farm front is disturbing. You do not find many farmers who will say one thing or the other about the issue, not caring to be quoted, maybe fearful of ridicule for secretly joining up with John Lewis and his militant miners. Nobody has the proper answer or finds the right remedy for this disruptive situation.

Yet deep down inside us we know that if farm folks could forget the past mistakes of union leaders and find a sound method of mingling as families and parents and citizens with rank and file members of unions we might get a clearer picture of a united America—a producers' front that would stand the test.

BY this I hold that most of the issues that are being held up as inducements one way or the other are fictitious and unsafe. Our job now is to find means to reach and hold together the common folks who pay the taxes and buy the bonds and do the hard work and keep the organizations solvent.

Can we leave this to the leadership of either side? Can we proceed with the idea that union leaders are going to arrange mutual meetings with rural workers to discuss what each is doing in a humble way to save America? May we safely presume that farm leaders now busy with parity and synthetic rubber plans will set in motion meetings of the rank and file in places where labor and agriculture can join hands on issues they alike hold dear as Americans?

Of course there are areas where such a joint exchange of opinion would not be practical. But there are also sections where vast industrial plants are adjacent to productive farms. It is in such places that the experiment of unity between simple followers (rather than excited leaders) should be made. Until it is tried and found futile I will not give up my plea.

POLITICS and prejudice should not continue to bar the way for willing Americans of the farm and the forge. I am aware that many will disagree and say this is just another Utopian dream. Many believe that our first task is to produce skillfully within our own ranks and not worry any over social values of future problems.

There is some truth to their contention that our leisure time must be spent in relaxation and rest rather than trying to solve distressing perplexities. Every man to his job and the devil take the laggard or the dreamer!

Yet sometimes the future would be better and brighter and easier to live in, and filled with more accomplishment for humanity, if we gave a little time in the present to just such problems.

America was built on dreams and discoveries. I have faith that its future rests on the same strong foundation. If we don't do any of the dreaming and the inventing and the guessing, somebody or some powers having the foresight we lack may do it for us the hard way.

I'd rather risk my neck and whatever feeble reputation I have in vague surmises and vain experiments than to accept the dictum that we must leave things as they are and settle them "when the war is over."

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

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)
Of Course I'm Interested (Pastures, Canada)

Reprints

B-8 Commercial Fertilizers in Grape Growing
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
A-9 Shallow Soil Orchards Respond to Potash
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
CC-9 Minor Element Fertilization of Horticultural Crops
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
O-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podsols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
A-1-41 Better Pastures in North Alabama
B-1-41 Our Defense Against Soil Fertility Losses
C-1-41 Further Shifts in Grassland Farming?
E-2-41 Use Boron and Potash for Better Alfalfa
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
U-8-41 The Effect of Borax on Spinach and Sugar Beets
W-8-41 Cotton and Corn Response to Potash
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
CC-11-41 There's Enough Potash for National Defense
DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
EE-11-41 Cane Fruit Responds to High Potash
GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
JJ-12-41 Potash Demonstrations on Statewide Basis
A-1-42 Canadian Muck Lands Can Grow Vegetables
B-1-42 Growing Ladino Clover in the Northeast
C-1-42 Higher Analysis Fertilizers As Related to the Victory Program
D-2-42 Boron Deficiency on Long Island
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-3-42 High-grade Fertilizers Are More Profitable
J-4-42 Boron Stopped Fruit Cracking
L-4-42 Permanent Hay the Plant Food Way
M-4-42 Nutrient Availability—An Analysis
N-5-42 Soil Bank Investments Will Pay Dividends
O-5-42 Nutritional Information from Plant Tissue Tests
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
R-5-42 Legumes Will Furnish Needed Nitrogen
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa

THE AMERICAN POTASH INSTITUTE

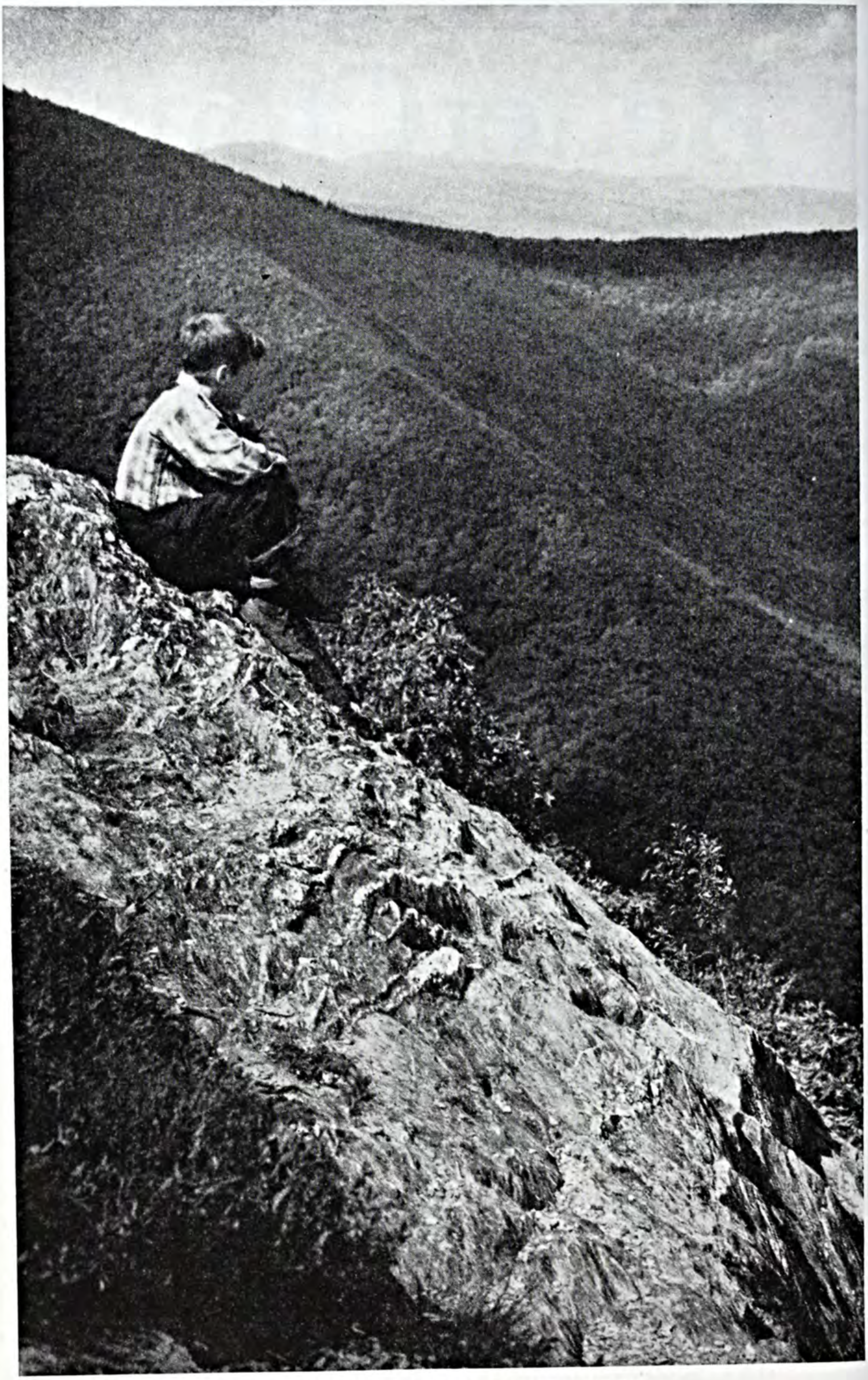
1155 16TH STREET, N. W. WASHINGTON, D. C.

Printed in U.S.A.

Better Crops with PLANT FOOD

October 1942 10 Cents

The Pocket Book of Agriculture



A GOOD PLACE TO DREAM OF THE FUTURE

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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

VOLUME XXVI NUMBER 8

Table of Contents, October 1942

out those sweaty rascals, or how Dad and old Uncle Jake manage to push the plow this year without those handy boys they have proudly donated to the Common Cause.

It all simmers down and sums up and jells together to this practical difference between the Government's war powers and the farmer's.

WITH the Army and the Navy and the Air Corps all the materials, equipment, and training is financed by taxpayers in a sort of cooperative public support.

With the farmer out there alone against the elements, rather fatigued and bewildered, and always short-handed, the only finance in sight worth counting comes from the earning power of the soil, right from the grass roots.

When the general or the admiral wants something badly, his Uncle Samuel can dig up the credit and no further questions asked, and no personal responsibility.

When the farmer needs a loan for seed or fertilizer or a new storage house or anything from a mule to a mower, his collateral is scanned and his deeds and chattels and abstracts and promissory notes go under the shrewd scrutiny of private or cooperative agencies.

They want to know all about his alfalfa and corn crops since he quit the eighth grade, and the rate of gain on his shotes for a decade (if he could afford such a luxury) plus the production power of all his kin, including his wife's relations.

When the armed forces want to build a smokeless powder plant or an air school or anything useful for total destruction, they deal with contractors and in-between agents who lather on their overhead as guarantees against pecuniary loss.

When the farmer reads in his journal or listens by radio and the Secretary and others tell him to go right after a certain crop goal—what happens? Well he talks it over very briefly with the Missus between milking time and cock-crow, and she buys herself a new pair of overalls and patches up his, and that's all there is to it, until harvest time.

He "allows" or "expects" or "hopes" or "calculates" to render unto Caesar all that belongs to the campaign, or else bust a gallus and donate his Sunday leisure trying to raise the ante.

You never find him hedging and postponing the fulfilment of his high purpose by asking that every neighbor and every milk hauler or trucker handling his stock become a bona fide, fully paid member of the same organization he belongs to.

He rises with the sun, puts in more licks of hard work for his age and health than any cross-section of civilians extant, but expects no bonus for overtime hours. All he honestly wants in return is a little appreciation and maybe a few sops of oratory and rhetoric that call him the "salt of the earth and the bulwark of democracy." Farmers have taken their pay in praise as often as preachers have taken theirs in cord wood and vegetables.

IT IRKS him now to find a goodly segment of the city folks fed up daily on caustic comment that reflects no credit on the producer of raw food, that holds the farmer up to criticism as responsible for the lion's share of the boost in the consumer's cost of living.

With October the month of political speech-making wherein divers candidates will plead for the votes of their constituents, the farmer is wondering what kind of a medley of contrary argument will be voiced in the land.

In stumping for urban support no doubt much hue and cry will be raised about rising food costs and ways and means to be followed by public power in forestalling inflation. It will prove easier for the candidates to be consistent if their districts are either all urban or all rural. But the guy who wants to be sent back to Washington from a mixed district of producers and consumers is going to be as busy as a tight-rope walker in a tornado.

Farmers will be watching the antics of candidates who cavort between the

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., OCTOBER 1942 No. 8

Let's understand—

The Farm Front

Jeff McDermid

BECAUSE the bread basket and the Corn Belt of America are so far removed from likely bombing forays, some folks have assumed that the farmers and stockmen of the fertile Midlands are unaware of war. Not only unaware and complacent, they affirm, but solely intent upon keeping the status quo in the cow country, harmony in the hog zone, and money in their jeans. Thus thinketh the critics.

That there may exist a beleaguered farm front with war risks and sacrifices sounds fantastic to those who seldom leave the pavements. What little they glean of trends and problems out in the plowlands comes from columnists or commentators, who revel in drivel about the farmer's callous indifference to the rising cost of food.

City citizens have witnessed brave displays of mechanical monsters and marvels as the big Army shows droned and clanked and boomed a chorus of conquest in rehearsal.

They perhaps overlooked the fact that among the Army's best mechanics and tank drivers, as well as in the Air Corps, are found boys who monkeyed with gas gadgets in field and furrow. They forget, or never realized, that the jeeps and motor guns are often operated by lads who got their training flat on their backs on the greasy floors of Pumpkin Center's implement and auto repair shop.

If they knew this, they would wonder maybe how the combines and the balers and the binders are getting along with-

Clover Pastures for The Coastal Plains

By R. E. Blaser

Florida Agricultural Experiment Station, Gainesville, Florida

GROWTH of pasture plants on many Coastal Plain soils is limited primarily by the low fertility level of the soil. The soils are primarily deficient in nitrogen, phosphorus, potassium, and calcium. Recent tests also show that certain of the minor elements may become limiting growth factors on some soils after lime and complete fertilizer have been supplied.

Nitrogenous fertilizers are the most expensive nutrients required for pastures, and plant growth is often limited primarily by the deficiency of this element in the soil. The best method of supplying nitrogen to pastures is through a legume program. Legumes, such as clover, possess root nodules which fix nitrogen from the air for themselves and also add nitrogen to the soil for associated grasses. The herbage of pastures which are made up of a mixture of grasses and legumes is higher in minerals, protein, and vitamins than herbage from grasses alone.

Legumes should also be used for pastures to aid nitrogen conservation in connection with the war effort.

The purpose of this writing is to discuss briefly methods used for growing and perpetuating clovers in Florida.

The Coastal Plain soils which are best adapted for growing clovers include low moist soils with six inches or more of dark surface soil, high in organic matter. The fine-textured soils are preferable to the coarse-textured soils. Soils in these categories have a higher base exchange and water-holding capacity than sandy soils low in organic matter. The most productive pasture soils in the Coastal Plain group in Florida include Bladen, Portsmouth, Plummer, St. Johns, and certain types in the Leon series.

The variety to plant depends primarily upon soil moisture conditions and to a limited extent on soil texture. Louisiana white and Persian clovers furnish best grazing on low moist soils which may be considered too wet for cultivated crops. These soils are generally high in organic matter. California bur, Black Medic, Crimson, Hubam, and other sweet clovers grow best on soil which is fair to well drained.

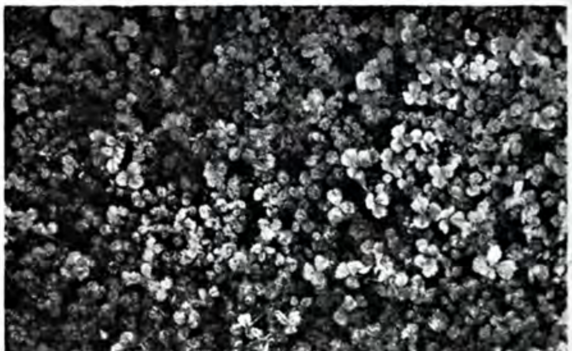
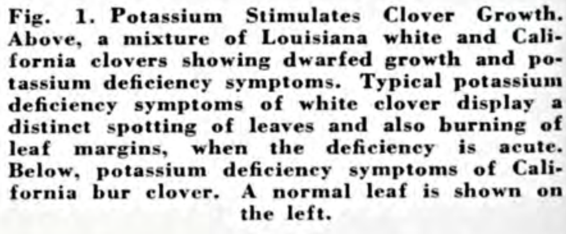


Fig. 1. Potassium Stimulates Clover Growth. Above, a mixture of Louisiana white and California clovers showing dwarfed growth and potassium deficiency symptoms. Typical potassium deficiency symptoms of white clover display a distinct spotting of leaves and also burning of leaf margins, when the deficiency is acute. Below, potassium deficiency symptoms of California bur clover. A normal leaf is shown on the left.



city ward halls and the country town meeting places. Your true statesman placed in such a perilous and ticklish spot will, if he is honest, defend the farmers from the barbs of unjust enmity that have accumulated. For it will be wiser and safer for this nation if hatred and misunderstanding be eliminated. Just because the farmer works in a barn

is no reason why he is the only one to be "stabilized." He also has certain costs and living expenses to meet at a time when the demand on him for quality standards of output are higher than ever.

In the heat of current discussion of food costs I talked with many farmers at the autumn fairs. They almost invariably told me that the shibboleth of "parity" that wavers back and forth and up and down on paper in official files holds relatively small concern with them.

For the most part they confessed that during the recent mad rush to harvest grain and silage and fruits and vegetables, it was a weary and a tiresome thing to think about parity. Few could name any figure offhand that represented parity for their own particular commodity at their own special location.

But in a broad, general way they believed that parity meant fair exchange value, and as such it did mean something. Of course it did, because that is just what the producer has been flirting with for two or three decades. He may not be so sure that the so-called base period from which parity is calculated is the golden age of agriculture, or that many vague imponderables and complexities surrounding the farm front have been taken into full consideration.

Farmers are nothing if not realists. When we got too far into the muddle of economics, they led us back on firm ground by raising the potent and critical question whether agriculture might not find itself saddled and bridled but rather spavined and limping for the race which will be run on the "dirt" track in 1943. Much depends on the rules of the game they are forced to follow.

IN THIS race for production goals next season, the general idea is that the "old gray mare ain't what she used to be." At least she isn't feeling her oats like she did last spring.

In general, the 1942 crop season has been unusually bountiful. Men have told me they raised the biggest yields per acre this past summer that they had ever known. The background for this was favorable weather and improved soil fertility.

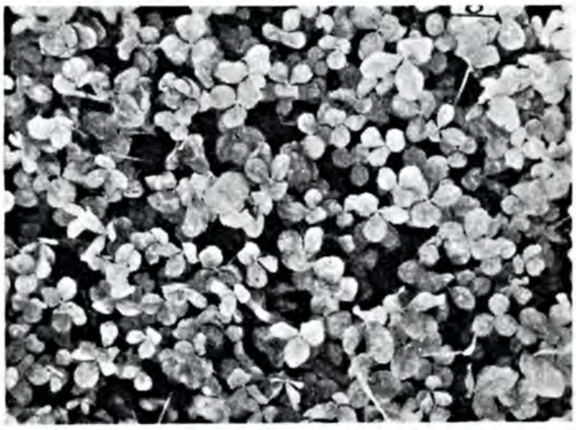
The wisdom of recent campaigns for balanced fertility throughout the Midwest has shown itself in a most critical hour. But the job in livestock production is not more than half done at harvest time. Judicious feeding and management are called for during the winter months, ceiling or no ceiling.

As winter approaches, I think more intently on what these fair-going farmers told me. In brief it sums up this way: The bounteous crops of 1942 were in a general way produced by elderly men, overworked housewives, juveniles, and imported city labor. The elderly men cannot be expected to do any better next year unless somebody injects them with mysterious elixir. The housewives have a limit on their stamina too, and the imported urban workers, no matter how willing, were at a handicap.

This leaves the juveniles. Boys of grade and high school age bore the brunt of it, assisted always by slack-clad farmerettes. The question is how soon and how fast will be the military call in beckoning the boys in their upper teens into armed services? As it stands now,

(*Turn to page* 44)

Fig. 3. Plant Adapted White Clover Strains. Above, Louisiana white clover is a tall, vigorous strain which seeds prolifically.



Ladino clover is a high-yielding clover but not satisfactory because of its poor seeding. The white clovers behave as perennials and fall annuals, thus good seed-producing varieties are essential.

New Zealand white clover (typical of Kent Wild) which produced inferior growth and is also a poor seeder.

and the leaf margins were brownish when potash deficiency in the soil was acute. The potassium-deficient leaves of California bur clover were yellowish and also had burned leaf margins, but leaf spotting was generally absent (Fig. 1).

The fertilizer practices on soils that have been fertilized before establishing clovers depend upon the fertilizer applied for previous crops. Fair to good clover growth may be anticipated without fertilization on heavily fertilized soils that have been used for truck crop production. However, these soils have generally been found to be high in phosphorus, thus the clovers responded primarily to lime and potash on these soils.

The Trifolium and Medicago-Melilotus or related clovers do not occur naturally on the Coastal Plain soils. To avoid failures it is thus necessary to inoculate all clover seed thoroughly (Fig. 2). Tests show that inoculation rates at five times the rate recommended for commercial inoculants give rapid nodulation and thus excellent stands and growth of clover the first year it is planted. The desirability of using heavy inoculation rates is substantiated by the good results which have also been obtained by farmers when following this technique.

The following inoculation technique has been recommended and used by farmers. Syrup is added to seed and mixed until all the seeds are coated. The proper culture is then added and mixed thoroughly, after which peanut or cotton-seed-meal is supplied until the seeds separate. If clovers requiring two kinds of culture are used as a seed mixture, they should be inoculated separately to concentrate the bacteria on the seed of its symbiotic host.

Prevailing soil moisture conditions during seeding time influence nodulation greatly. To insure good nodulation the soil should be moist and well packed before planting clovers. Plantings made in dry soil with prolonged dry periods have failed because of inferior nodulation. In Peninsular Florida clovers grow successfully if planted any time when the soil moisture conditions are favorable, within the period of October 15 to January 1.

If the clovers are planted during apparent favorable moisture periods and the soils turn very dry, it is advisable to reinoculate the clovers. Clovers that have already been planted may be reinoculated by sieving soil which has

Fig. 2. Thorough Inoculation and Proper Seeding Technique Insures Clover Stands and Growth. The luxuriant growths, California bur clover (left) and Louisiana white clover (right), were inoculated at five times the rate recommended for commercial culture. The areas showing poor growth had uninoculated seed. The good nodulation and growth may also be attributed to the favorable soil moisture when the clovers were seeded.

Hop and Hubam sweet seem to be widely adapted and Black Medic and Hubam sweet clover are more drought-resistant than other clovers. It is advisable to plant a mixture when it is not known which clovers are best suited to the environment in question.

The lime and fertilizer practices for establishing clovers depend upon the variety. The clovers may be divided into two groups from the standpoint of fertilizer requirements. The Medicago-Melilotus group (Black Medic, Hubam and other sweet clovers, and California bur) requires more calcium but less phosphorus than the Trifolium group (White, Crimson, Red, Hop, and Persian clovers). Since the Medicago-Melilotus clovers require more calcium than the Trifoliums, ground (Calcic) limestone has been more satisfactory than dolomitic limestone for this group. The Trifolium clovers may be fertilized with either dolomitic or calcic limestone at the rate of one ton per acre. White, Persian, and other Trifolium clovers treated with high calcic limestone have generally given as good or better growth than those which received dolomitic limestone. The varieties of either the Medicago-Melilotus or Trifolium groups were higher in calcium content when treated with ground limestone than when treated with dolomite.

Liming is also necessary because it improves nodulation. Without lime Medicago-Melilotus clovers were very poorly nodulated, but the nodulation of the Trifoliums was also improved greatly when lime was applied.[1] The Medicago-Melilotus clovers invariably fail in the absence of lime, and the Trifoliums fail on the more acid soils when lime is not applied. Lime has stimulated growth greatly on all soils tested with the exception of the Parkwood series, which is generally underlaid with marl. The element magnesium, supplied by dolomitic limestone, has not yet been found to be a limiting growth factor.

In addition to lime, clovers require phosphorus and potash. Four hundred to 600 pounds per acre of 0-14-10 or similar fertilizer has supplied the phosphorus and potassium needs satisfactorily. For Medicago-Melilotus clovers the P_2O_5 may be reduced if desired.

When phosphorus was omitted from the lime and fertilizer treatment, the clover plants were extremely dwarfed and purplish-green in color (Phosphorus-deficient). These plants were also low in phosphorus content when compared with plants that received phosphorus.

The omission of potash from the lime and fertilizer mixture resulted in potassium-deficiency symptoms and inferior growth. Potassium-deficient plants of white clover possessed spotted leaves

[1] Blaser, R. E., Volk, G. M., and Smith, F. B. The Yield, Composition, and Nodulation of Several Clover Varieties as Affected by Sources of Calcium and Phosphorus in Combination with Other Fertilizers on Several Soils. Soil Sci. Soc. of Amer., Proceedings 16, 1941.

TABLE 1.—THE CHEMICAL COMPOSITION OF CLOVERS IS IMPROVED GREATLY BY FREQUENT FERTILIZATION*

Lime and Fertilizer Treatment Pounds Per Acre—1939	Chemical Constituents in Per Cent of Dry Matter				
	Calcium	Phosphorus	Potassium	Magnesium	Protein
None	1.03	0.29	1.33	0.43	22.6
500 pounds ground limestone and 150 pounds 0–16–8	1.43	0.38	1.62	0.43	27.6
1,000 pounds ground limestone and 300 pounds 0–16–8	1.48	0.46	1.84	0.46	28.2

* All plots were fertilized uniformly with 1 ton dolomite and 600 pounds 0-16-8 fertilizer in October 1937.
NOTE: The soil was a virgin Leon fine sand.

soils and desirable on others. Two hundred to 400 pounds of 0-14-10 or similar fertilizer applied annually produced earlier grazing as well as more feed (Fig. 4). The herbage of clover which was fertilized annually was also higher in calcium, phosphorus, potassium, and nitrogen than the unfertilized clover (Table 1).

The best grazing management practices of clovers are not definitely known, but it appears that grazing in late winter or early spring should be withheld until the clovers are well started (two to four inches in height). Light grazing during June facilitates seeding for next fall's volunteer growth or for harvesting of a seed crop. In the fall the sods should be in a closely grazed condition so grasses do not compete with the volunteer clover plants and seedlings (Fig. 5).

In October 1940, a 10-acre area of carpet-grass pasture was divided into four pastures of two and one-half acres each. Two of the pastures were fertilized and seeded with a mixture of Louisiana white, Black Medic, and California bur clovers. Because of the dry season the clovers were not ready for grazing until April 1941. These two clover pastures produced an average of 330 pounds of beef per acre in 1941. In November

(*Turn to page* 41)

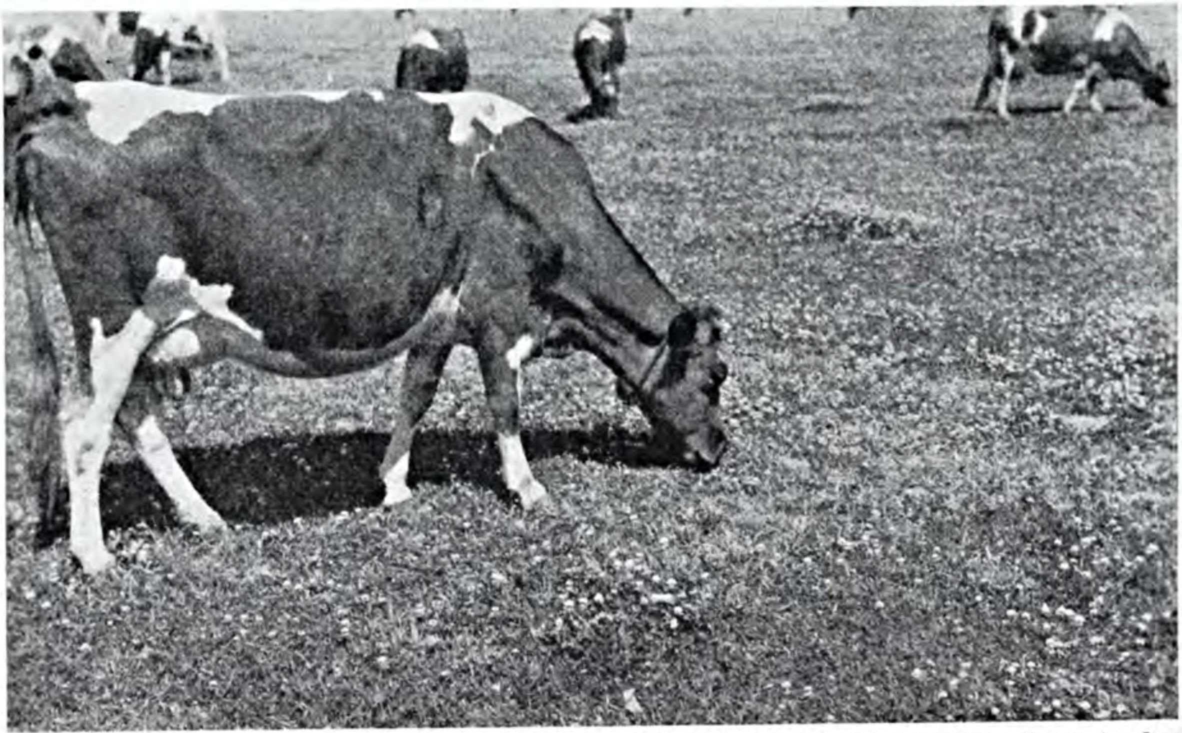


Fig. 5. Tall Grass Retards Clover Growth. Grasses should be in a closely grazed condition in the fall to avoid competition with the clover seedlings.

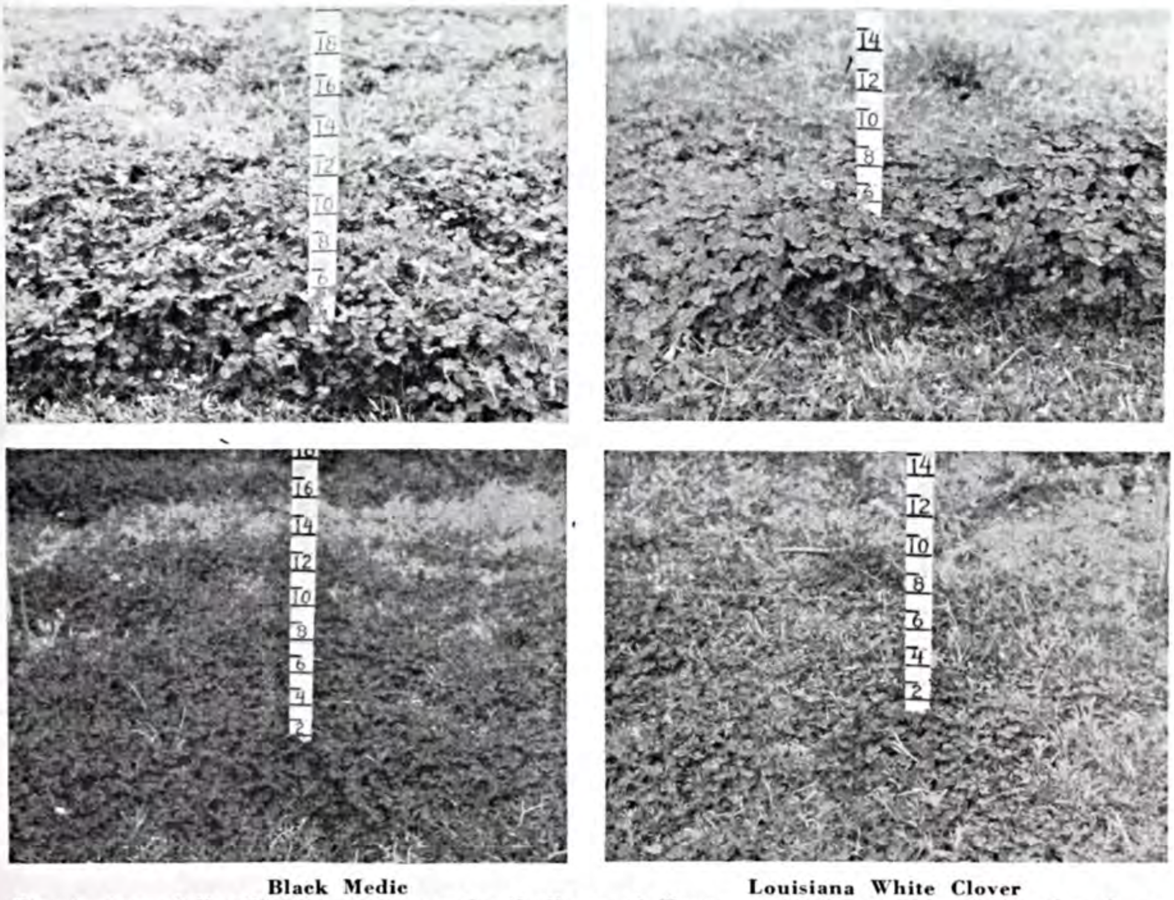
grown clovers and adding commercial culture. The fineness of the mixture aids dissemination so most of the seedlings are contacted with the culture. Such a mixture was broadcast from a truck during a rain at the rate of 500 pounds per acre on clover planted during a dry period. The resulting growth and nodulation of clovers was excellent (Fig. 6).

Clovers may be seeded on newly prepared seedbeds or on established grass sods. On newly prepared seedbeds best growth occurred when the seedbed was prepared well in advance of planting time to allow time for the soil to become firm. Surface broadcast seed planted during a rain or seeding with immediate rolling has given excellent growth.

Excellent stands and growth of clovers have been obtained on test plots and farms when seeded on established grass sods without disturbing the grasses. When this planting technique is followed, the grass should be closely grazed and the seed broadcast during a rain. Failure resulted when the grasses were not closely grazed.

Of the many clovers tested, white clover is the most important variety. Louisiana white and Ladino clovers produced higher yields than other clovers. Ladino is not recommended because it does not reseed itself satisfactorily. Strains of white clover from England and New Zealand were found to be dwarfed types and low in productivity (Fig. 3). Several white clover strains from the northern part of the United States were found more vigorous than the imported varieties, but these were inferior to Louisiana white. Recent tests also show that other clovers in a species group differ greatly in growth, characteristics, productivity, and behavior.

Clovers, like other crops, require certain definite fertilizer and management practices. Annual top-dressings of fertilizer have proved necessary on some



Black Medic **Louisiana White Clover**

Fig. 4. Annual Fertilization Increases the Earliness of Clovers. All clovers were fertilized with an initial treatment of one ton of lime and 600 pounds of 0-16-8 fertilizer. An application of 300 pounds 0-16-8 fertilizer applied in the subsequent October increased the early season yield of black medic and white clover greatly (above photographs). Typical clover growths without refertilization are shown in lower photographs. The pictures were taken in February.

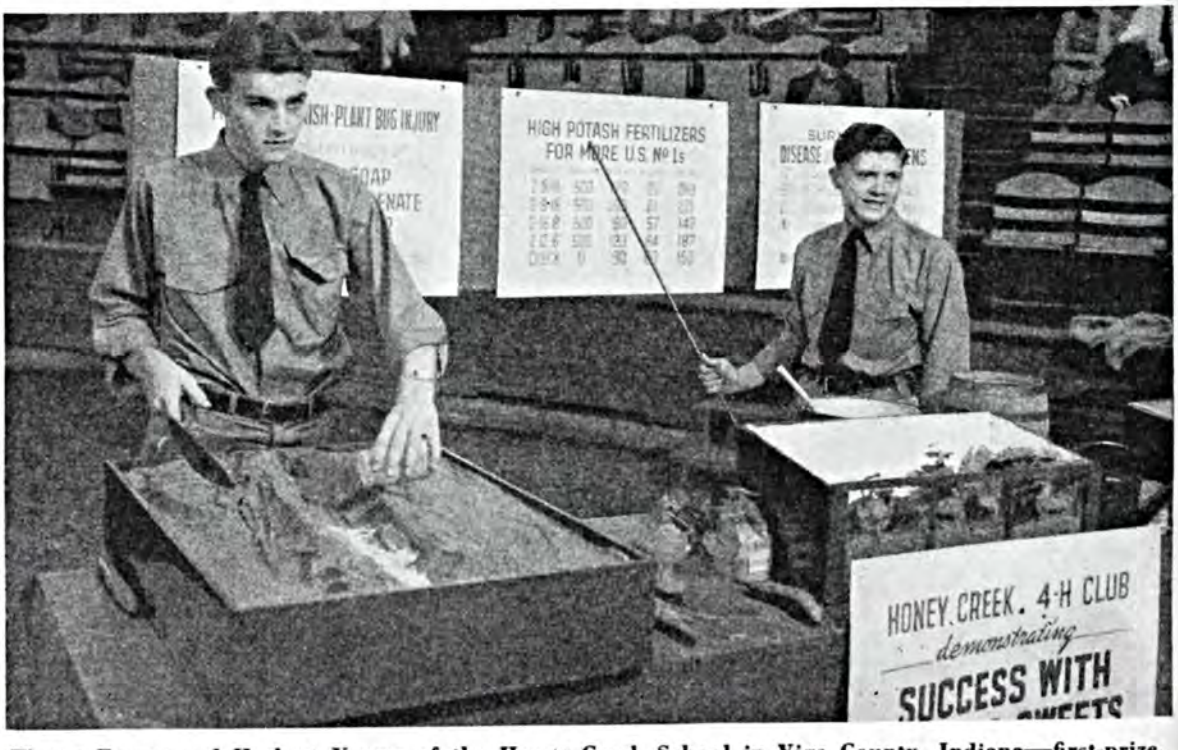
May, therefore, potatoes should be bedded early in April.

The old bed should be thoroughly cleaned and disinfected, sash and all, to help control black rot, wilt, and other diseases. A solution of formaldehyde, made by mixing one pint of formalin and one pint of water, should be used for disinfecting. It is advisable to repeat this treatment after 24 hours. Soil for the hotbed should be obtained from some place where sweet potatoes have never been grown. The upper six inches of the soil should be thrown away and only the subsoil used, as topsoil may be contaminated with sweet potato disease organisms.

Hotbeds may be either electrically or manure heated. The temperature in a manure-heated hotbed will rise to about 100° and five or six days later drop to 75° or 80°. The hotbed is then ready for planting.

Seed stocks saved from the previous crop should be sorted again before bedding. Any diseased or discarded seed should be destroyed and not carried out to the plant bed and scattered around. To kill all disease organisms, all seed stocks before bedding should be treated for 10 minutes in a solution consisting of 1 oz. corrosive sublimate to 8 gallons of water. The seed should be bedded firmly on the sand and spaced about one inch apart. This spacing provides ample room for developing strong, vigorous plants. After placing, the potatoes should be covered with sufficient clean, warm sand and watered thoroughly. Bedding should be done on warm, bright days and the temperature of the sand and water should be as near that of the sweet potatoes or hotbed as possible. Sweet potatoes should not be chilled as they are likely to rot. During the warmer part of the day the temperature may go as high as 90° to 95°, therefore the bed should be closely watched and ventilation given when needed to prevent further rise.

Growers have a tendency to over water, and if watering is necessary, it should be done in the morning on clear days so the foliage may be thoroughly dried before night. During the cool nights or days, added protection such as a sheet of Sisalkraft paper or blankets placed over the hotbed sash may be necessary, but under ordinary conditions a tight-fitting sash will conserve



Wayne Ennen and Herbert Young of the Honey Creek School in Vigo County, Indiana—first-prize, vegetable demonstration team at the Purdue 4-H Club Round-up, June 10, 1942. They won a trip to the Pittsburgh Junior Vegetable Growers National Meeting and Contest to be held in December, 1942. The boys were coached by Vocational Teacher John Turner and Assistant County Agent Howard Emme of Terre Haute, Indiana.

Insuring Success With Indiana Sweets

By Roscoe Fraser

Agricultural Extension Service, Purdue University, Lafayette, Indiana

THE sweet potato may be grown in almost any part of Indiana. The commercial acreage is located in the southwestern part of the State in the lower Wabash and White River Valleys. In this region between three and four thousand acres are grown with an annual production of more than 500,000 bushels.

Yields vary from less than 100 to 300 bushels per acre depending on fertilization and cultural methods. In a survey taken in the Terre Haute Fruit and Vegetable Growers' Association we found the following results:

> 50% of growers produced sweet potatoes; acreage—range ¼ to 5, average 2.1 acres; yield range, 60 to 300, average 140 bushels; fertilizer, 32% use some fertilizer, 68% use no fertilizer; average amount of fertilizer used, 280 pounds; 92% of growers have some wilt; 89% of growers have some black rot; 20% of growers have some insect injury; no growers use any treatment to prevent wilt and black rot; no growers use certified plants or seeds.

The sandy soils of this area are well adapted to sweet potato production and large yields of high quality potatoes can be obtained, but results from the survey taken in Honey Creek Township, Vigo County, as a cross-section of the industry show that there is a need for use of improved practices throughout the area. A demonstration put on by the Honey Creek 4-H Club, "Success with Indiana Sweets," shows how sweet potatoes can be more profitably grown in southwestern Indiana.

Most northern markets prefer the little or big stem Jersey varieties so these are grown to meet the market demands. A few moist type varieties such as Porto Rico and Nancy Hall are grown in farm gardens for local consumption. Clean, fertile, sandy soils with relatively high amounts of organic matter are preferred as these soils produce a high percentage of smooth, bright, uniform potatoes of superior quality. Heavier soils usually produce an excess of vine growth which retards maturity. While sweet potatoes are tolerant of acid soils, the most profitable yields are produced on fields slightly acid to neutral.

A definite planting rotation should be followed and sweet potatoes should not be grown more than once every four or five years in the rotation in order to help prevent disease infestation. A cover crop of rye planted in the fall and plowed under in the spring will add organic matter to the soil.

Good seed is essential. Many of the troubles experienced by growers are directly traceable to the seed stock used, method of bedding, or both. Only hill-selected seed, carefully picked at digging time and kept in clean containers under good storage conditions, should be used. When growers are forced to purchase seed, either certified stock or those known to be free from disease should be bedded. All seeds should be kept as dormant as possible until bedding.

The hotbed should be started early enough to allow about 30 days for plant growth. Most growers like to plant in the field during the early part of

Fig. 1. Onions on muckland in western New York. Heavy fertilization, including a high percentage of potash, on this well-decomposed muck produced a yield of 850 bushels of onions per acre.

Managing Mucks Includes Control of Blowing

By A. F. Gustafson

Cornell University, Ithaca, New York

ON THE basis of an inquiry conducted by the author in 1940, there are 25 million acres of organic soils in the United States.[1] Thirty-four states have varying acreages of these valuable soils. Each of 6 states has more than 2 million acres. These states are: Minnesota, 7; Michigan, 4; Louisiana, 3; Wisconsin, 2½; Florida, 2¼; and Washington, 2⅛ million acres. In addition, Alaska has immense acreages and Canada has more than 29 million acres of organic soils.

The muck soils of the United States occur in the glaciated area and on the Atlantic, Pacific, and Gulf coast lines and other poorly drained areas. Nearly 11 per cent of these organic soils are in cultivation, including hay and pasture. Vegetables occupy an important acreage. Among the leading vegetables are onions, potatoes, celery, cabbage, and carrots. Mint occupies large acreages in Michigan and Indiana. Hay crops and pastures also are grown on an important total area.

Relatively heavy expense has been incurred in clearing and draining organic soils. The muck farmer, therefore, has a rather large investment in his land. Gross returns per acre from the more productive mucklands are relatively high. As a result, these lands command a fairly high price. Moreover, many vegetable crops require large amounts of hand labor and a considerable investment in seed and fertilizer. A high grade of management is required, therefore, to produce large crops; and good salesmanship is necessary to dispose of the products advantageously.

[1] Soils and Soil Management, McGraw-Hill Book Co., Inc. 1941, p. 395.

the heat. As the season advances, more ventilation is needed until eventually the sashes are left off entirely so that the plants may be hardened off for field planting.

The soil should be well prepared before setting the plants. The ground should be plowed early, allowed to settle, and worked down until ready to apply the fertilizer and build the ridges.

The chunky type of sweet potato is preferred in most markets. Experimental work carried on elsewhere as well as repeated demonstrations in Indiana thoroughly indicate that fertilizers carrying a high percentage of potash produce the highest yields of the chunky sweets.

Recent yield-plot tests throughout the sweet potato region of southwestern Indiana carried out by the cooperative fertilizer trials show the results given in Table I.

These results indicate that fertilizers carrying two to three per cent nitrogen and potash in the ratio of two to one over phosphoric acid give best results. The past treatment and a soil analysis will determine somewhat the amount and analysis of fertilizer to use. The recommended practice is to apply 400 to 600 pounds of a fertilizer analyzing either 2-8-16 or 3-9-18. The fertilizer is applied in a row under a shallow to medium ridge built a few days before planting. The fertilizer can be applied with a corn planter and ridges made with a single bottom-breaking plow.

When pulling plants, those that show symptoms of disease or discoloration should be culled out and discarded. Another factor affecting yields is the length of the rooted stems. Results from twelve demonstration plots in southwestern Indiana are given in Table II.

(*Turn to page* 43)

TABLE I—HIGH POTASH FERTILIZERS FOR MORE U. S. NO. 1'S.

Comparative Yield of Sweet Potatoes with Different Amounts and Analyses of Fertilizers

Cooperator	Analysis	Pounds per acre	Bushels U. S. No. 1	Bushels U. S. No. 2	Total Yield
1	2- 8-16	500	179.5	89.5	269.0
	3- 9-18	500	160.0	61.0	221.0
	2-16- 8	500	90.0	57.0	147.0
	2-12- 6	500	123.5	64.0	187.5
2	2-16- 8	625	191.0	94.0	285.0
	3- 9-18	625	248.5	87.5	336.0
	Check	....	90.0	60.0	150.0
3	2- 8-16	800	176.7	75.8	252.5
	3- 9-18	800	170.5	63.1	233.6
	2-16- 8	800	151.5	56.8	208.3
	2-12- 6	800	151.5	66.3	217.8

TABLE II—LONGER ROOT STEMS INCREASE YIELDS

Rooted Stem	U. S. No. 1	U. S. No. 2	Total Yield	Percentage U. S. No. 1
1 inch	135.5	54.40	189.90	71.3
2 inch	129.31	56.11	185.42	69.7
3 inch	164.04	68.97	233.01	70.4

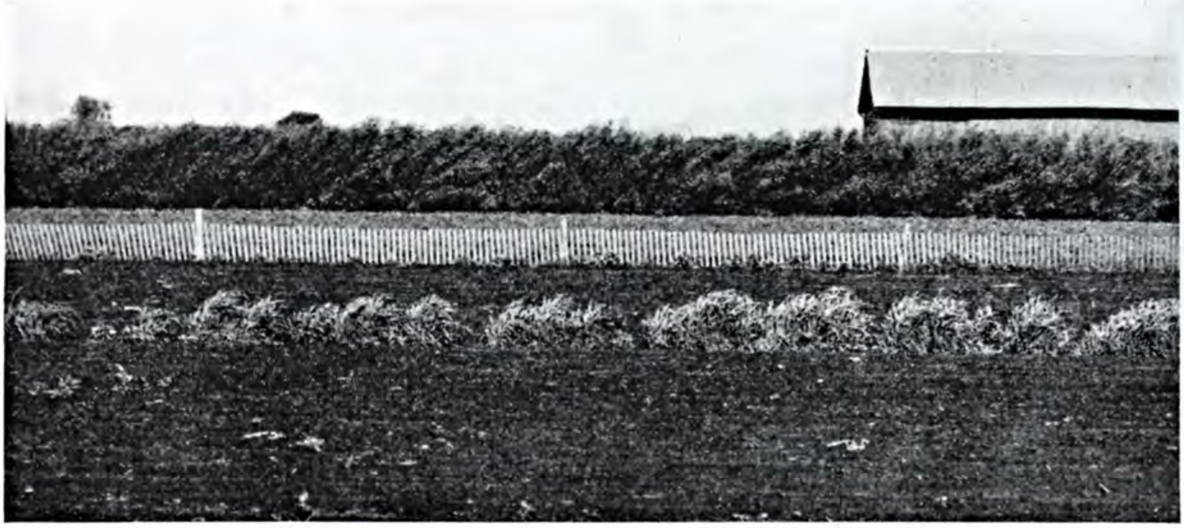


Fig. 3. This basket-willow windbreak has attained its normal height and is in a highly effective condition for checking wind velocity. The picket fence is of the half or 2-foot height. In the immediate foreground is a drill row of oats.

onions are particularly susceptible to injury immediately after coming up. Strong winds pick up bits of wood or sharp-cornered granules of muck and drive them against the plants. Once blowing begins after the onions are up, it is too late to protect them. A few hours of active abrasion are too much; the plants do not recover so as to produce even a fair yield. Another crop must be planted to obtain any return from the land. Other plants are susceptible in varying degrees to wind injury, and total losses from wind injury to crops on our mucklands are enormous. Because we shall have need for all the vegetables we can grow during the duration of this war, control of losses from wind injury is imperative.

What can be done to control the wind? "Surely the wind bloweth where it listeth," you say. Maybe so, but farmers themselves have worked out ways of controlling wind erosion on mucklands. It is only at fairly high velocities that winds possess destructive force. Reducing the velocity of the wind through the use of windbreaks is the major solution of this problem.

Various types of windbreaks are in use. One of the earliest was the willow tree. In time, however, these attained heights of 40 to 60 feet and corresponding width. Although fairly effective in checking the velocity of winds, such windbreaks wasted valuable land. Not only did the tree shade a wide strip, but the roots of the trees robbed the crops

Fig. 4. Snow-fence windbreaks and willow windbreaks at back and on right. Snow fence, however, is depended on over the main part of this large field of onions.

Fig. 2. Wind injury to onions. The onions in the foreground were "blown out." Lettuce has been seeded in the blown-out area.

Muck soils are generally much higher in nitrogen than are mineral, or so-called hard soils. From two to three per cent nitrogen is frequently carried by these organic soils. Their phosphorus content is one to three times that of mineral soils. In potash content, however, muck soils usually are relatively low. Many crops, therefore, require liberal applications of potash for the production of economically high yields. The calcium content and the reaction of these soils are highly variable. The reaction varies from below pH 4 to about pH 8. Liming is required for many crops on the more acid mucks. In contrast, strongly alkaline to neutral and very slightly acid mucks in Michigan receive considerable quantities of sulphur (usually applied for several crop years at one time) or 300 to 400 pounds of manganese sulphate per acre annually, for a wide range of crops. The other trace elements, copper, zinc, and boron, are needed under some conditions. Some areas in New York contain so much zinc that it kills the crop.[2] It seems best to make certain that a deficiency exists before any of the trace elements are applied, except for experimental areas. That deficiencies exist has, of course, been established in some areas.

[2] Staker, E. V., and Cummings, R. W.: The Influence of Zinc on the Productivity of Certain New York Peat Soils. Proc. Soil Sc. Amer., Vol. 6, 1941.

It has already been stated that for most crops muck soils are deficient in potash. Liberal applications of potash in the fertilizer are required to produce satisfactory yields. Most crops require a normal application of phosphorus. For most vegetables, nitrogen is not used on recently cleared mucks. For vegetables in general, fertilizer is applied in liberal amounts, from a few hundred pounds to 1,200 for onions and up to 2,000 pounds per acre for celery (Fig. 1).

Protecting Investment

The investment in fertilizer, lime, labor, and seed to get a crop started may be lost if adequate provision is not made to protect it against wind damage. Areas of old-cultivated muck that are much more than half a mile across generally may be subject to blowing under conditions that are favorable for it. Smaller areas, especially, if surrounded by trees or higher land, enjoy a measure of protection.

Among the vegetables that suffer from blowing, onions that are grown from seed, in contrast to those grown from sets, are especially vulnerable to injury by wind (Fig. 2). From the time the tiny seedlings emerge until they are large enough to protect themselves, they are very tender. These

C. T. Butler Watches Plants and Livestock

By L. O. Brackeen

Agricultural Extension Service, Auburn, Alabama

"PLANTS and livestock talk," says C. T. Butler, Master Farmer of New Hope, Alabama. "If you don't think so just watch them. I have learned by watching plants that my land is deficient in potash and phosphate. I have found that corn, following lespedeza, often needs potash and phosphate, or sometimes a complete fertilizer. By applying a mixture of 300 pounds of phosphate and 100 pounds of muriate of potash (equivalent to 400 pounds of 0-12-12½ fertilizer) I have increased corn production 20 to 25 bushels per acre following lespedeza."

Mr. Butler also fertilizes his permanent pastures. "I find the livestock relish the fertilized grasses more than the unfertilized and consequently make better growth," he says.

That he knows what he is talking about is indicated by the fact that he produces crimson clover for seed and grazing; hairy vetch for turning and seed production; soybeans for hay and seed; lespedeza sericea for hay, seed, and pasture; alfalfa for hay; cowpeas for hay and seed; and annual lespedeza for hay, seed, and semipermanent pasture. He puts up about 125 tons of corn and sorghum silage annually. He uses DPL 11-A cottonseed, Walkers Improved and Indian Chief corn, Hastings 100-bushel oats, and an improved variety of barley.

Native cows are bred to Shorthorn bulls for calf production, and a few mares are kept for producing colts. Mr. Butler keeps about 50 beef cows, 45 hogs, 75 sheep, 12 goats, 100 hens, 10 mules, and 4 horses. The mules are treated for "bots" and teeth are floated, sheep are treated for worms, hogs vaccinated, and cattle given blackleg treatment.

Another fact indicating that Mr. Butler is a most successful farmer is that his family has been named by the Alabama Extension Service and Progressive Farmer-Ruralist as a "Master Farmer Family."

"All nine tenant families on this farm live in improved homes, have washing machines, radios, sanitary toilets, and waste sinks and drains; eight have electricity, most of them have pressure cookers, and two have running water piped from a mountain-side spring," writes Mrs. Maude Alexander, home agent.

"Yes, and do not forget that they all have gardens and truck patches, and hogs, chickens, and cows for producing their home needs of meats, milk, eggs, and vegetables," adds J. B. Mitchell, farm agent. "They not only produce enough of these for home use but some for sale. In addition, each family, including the negro family with about 10 members, cans enough fruits and vegetables to last them through the seasons of the year when fresh fruits and vegetables are not available."

A visit to the Butler home, over the farm, and to some of the tenant homes confirmed, to our satisfaction, that the farm and home agents were correct when they stated that the Butlers and their tenants are doing an excellent job of farming.

"We certainly are proud of our tenants; they are so cooperative," said Mrs. Butler, as we sat upon the porch of the of moisture and plant nutrients. Farmers in western New York have been using the basket willow (Fig. 3) for some years. This willow, which attains a height of 10 to 15 feet, or slightly more, grows readily from slips and affords considerable protection in two or three years. Where the prevailing wind direction during the wind-injury period is southwest, the windbreaks are planted north and south. Wastage of land is controlled by cutting off the sides from time to time.

Farmers do not place dependence on the willow windbreak alone; it is often supplemented by other types. Prominent among these is the woven picket, or snow fence. On some newly cleared beds, this fence is used exclusively (Fig. 4). Snow fences along highways are used to cause drifting of snow, that is, the velocity of the wind is reduced to such extent that the wind drops the snow. In onion beds, however, it is essential to prevent the picking up of granules because drifting is highly undesirable. Not only do farmers wish to hold the soil in place, but the filling of ditches and the covering of roads with drifted muck results in the added expense of clearing them.

The snow fence has many advantages. It may be placed easily and quickly soon after onions or other sensitive crops are planted. It occupies no cropping space permanently. Moreover, the wind shifts somewhat in direction, and windbreaks at right angles to the main ones are needed. The snow fence serves this purpose admirably. When the onions are large enough to check blowing on the surface of the muck or when the blowing season has passed, the fences are easily rolled up and stored away.

In some areas, farmers lease or borrow snow fences from county or state highway authorities. If the highway superintendents do not have authority in all states to lease snow fences to farmers within their areas, such legal power should be granted them. Having such authority is essential during this emergency because of shortage of materials and labor for making snow fences for individual growers.

Fig. 5. Rows of oats help protect onions against blowing injury.

Newly started willow windbreaks during their growth may be supplemented with snow fence or a few rows of rye drilled immediately adjacent to the willows. A drill row or two of oats occasionally are used in the same way. Single drill rows of oats have recently been used between the rows of onions (Fig. 5). Up to 14 rows of onions were noted between the oat rows. Where oats are used, the snow fences

(*Turn to page* 39)

Growing Legumes For Nitrogen

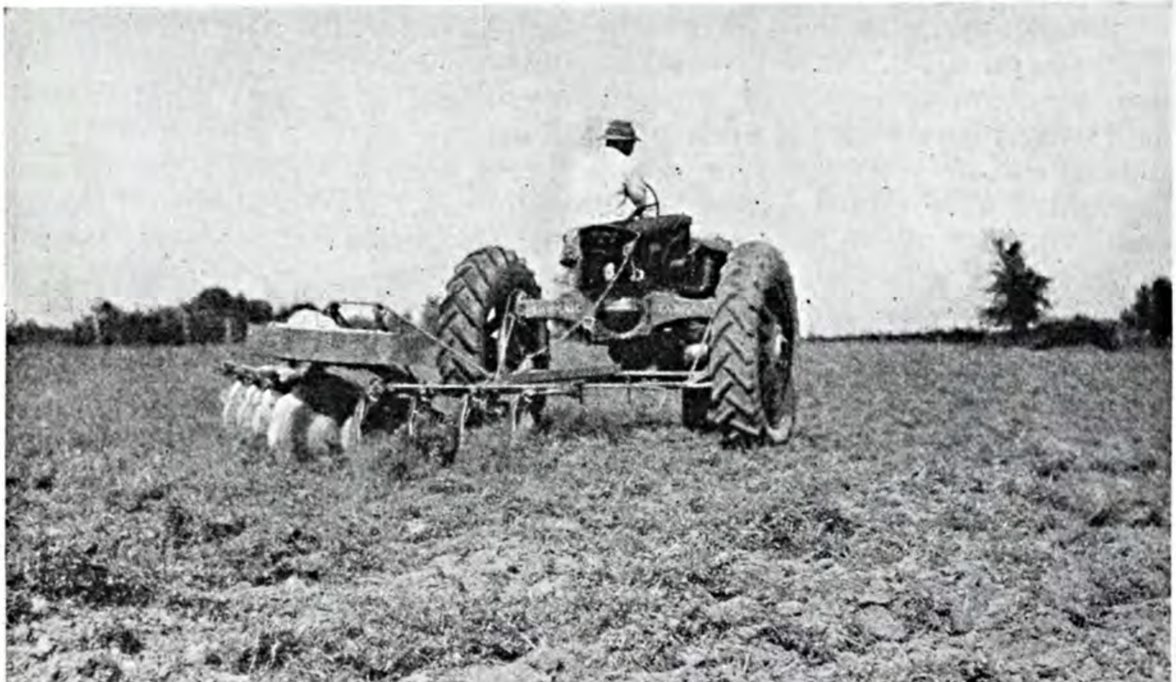
By G. R. Cobb

Salisbury, Maryland

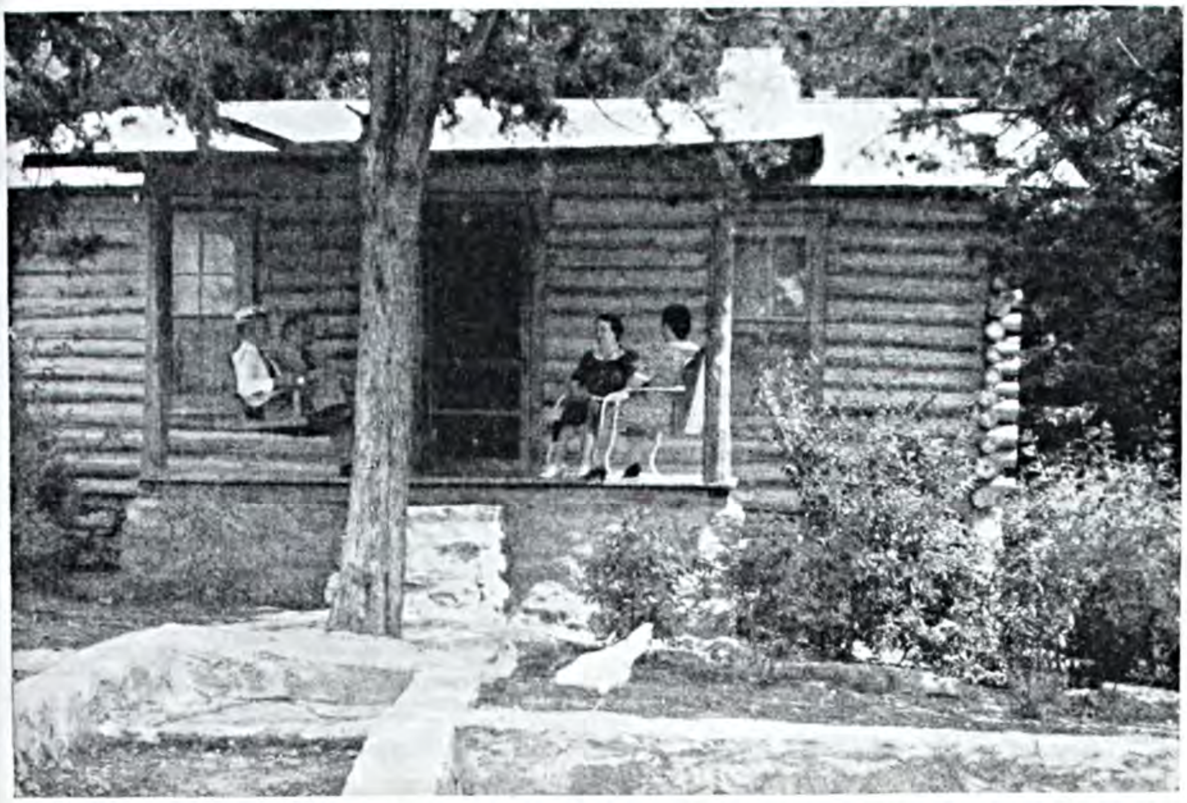
FARMERS faced with a shortage of "commercial" nitrogen are being urged to grow their own by seeding legumes. In far too many cases this is the only advice offered. It is a well-known fact that legumes in themselves have no power to take free nitrogen from the air, and unless the crop is properly handled, it may leave the soil poorer than before the crop was planted.

The benefits to be derived from legumes have been recognized since the world began, apparently, for the Romans knew that beans and vetches were the best preparation for a wheat crop. But it was not until comparatively recently, 1886, that the reasons why legumes benefited wheat and other crops were discovered. The early experiments of Boussingault, Saussure, Lawes and Gilbert and others were conflicting in that in some cases under controlled conditions no nitrogen was added to the soil while they all agreed that crops grown under other conditions contained more nitrogen than was contained in the soil and manure. In 1886, when Hellriegel and Wilfarth discovered that leguminous plants fix atmospheric nitrogen, the answer to the conflicting results was obtained.

From early writings one is impressed with the fact that the value of legumes was well known. In 1819, Frederick Butler advised that upon sowing flax, oats, or barley, you should sow clover as a fertilizing crop and stock down for two years; then, turn in the clover for wheat with one, two, or three ploughings, according to the soil or other cir-



Lespedeza worked into the soil preparatory to seeding a fall grain crop returns plant food to the soil.



Log home of Mr. and Mrs. Hugh Baker, tenant family on the Butler farm.

home of Mr. and Mrs. Baker, one of the nine tenant families on the farm. "Yes, and we are proud of you for being so good to us," responded Mr. Baker, who lives in a modern four-room log house which he constructed from logs cut on the farm.

While visiting with the Butlers and Bakers we were impressed with the way they work together for the good of each. We found that Mr. Butler has worked out a system whereby both landlord and tenants have plenty of work to do throughout the year. "We are doing something all the time. If we can't work in the field, we clean seed, bale hay, cut wood, repair houses, and make improvements," said Mr. Butler. "We have found that it pays big dividends to work throughout the year rather than have too many rest seasons," stated Mr. Baker. Landowner and tenant agree that it is best for both families that they have work throughout the year.

Mrs. Butler has found one objection; it is difficult for her to get odd jobs done around the house since Mr. Butler keeps the men folks so busy. She has partly solved this problem by working it out with the children to do some of the lighter work. The Butler boys and the children of the white tenant families work together in doing many of the jobs. When they have finished they are paid in cash, by free picture shows, or with other favors. "They like it," said Mrs. Butler.

Each family has its own crops, but usually work with others in producing and harvesting the crops. If something causes one to get behind with his crop, the others "fly in" and help him work it out.

The tenants work on the half-and-half basis. The landowner furnishes the workstock, farming tools, one-half the fertilizer, and one-half the ginning; the tenants furnish the labor, one-half the fertilizer, and one-half the ginning. When working in the pasture, planting and harvesting small grain, looking after the livestock, or working in Mr. Butler's crops, the tenants are paid daily wages.

Thus it can be said that plants and livestock talk and that real partnership between landlord and tenants pays on the farm of Mr. and Mrs. C. T. Butler and Sons—Charles, Jr., and John Ed—of Madison County, Alabama.

selves capable of converting the air nitrogen into food, but the work of making it suitable for them is carried out by micro-organisms known as bacteria which are found living in the wart-like excrescences upon their roots. The fact is well known that without the nitrogen-fixing bacteria, which live symbiotically with the plants, no free nitrogen can be gathered by the crop, thus the presence of these bacteria is necessary or the legume plant fails in its function as a 'nitrogen-raiser.'"

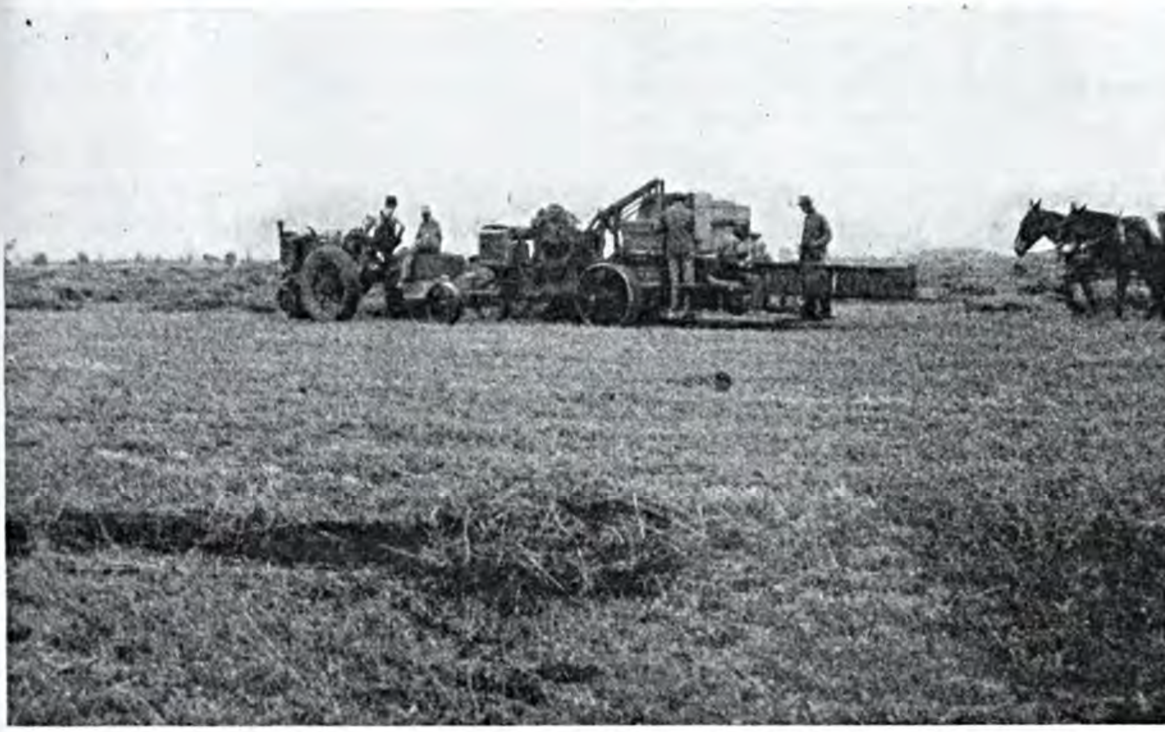
Not only is it true that legumes without the nitrogen-fixing bacteria have no power to take nitrogen from the air, but the fact remains that even when the soil is properly inoculated with the right bacteria, the plants may not gather any of the free nitrogen. Summarizing but a few of the references bearing on this point, clover and other legumes take available nitrogen from the soil in preference to the fixation of free nitrogen from the air; the latter is being drawn upon only to supplement the soil's supply and thus balance the plant-food ration. Again we read that with an abundance of available soil nitrogen constantly provided to fully balance the other essential elements or factors, there is little or no development of root tubercles and little or no fixation of free nitrogen. In his First Principles of Soil Fertility, Vivian states that it may be further said that so long as the leguminous plants procure in the form of nitrates all of the nitrogen they need, the nodules will not be formed. For that reason in a soil rich in nitrogen the root tubercles may not be found on the legumes even when the proper bacteria are present. Thus when grown on rich soils, legumes leave the soil poorer in nitrogen; but on poorer soils furnishing less than the normal amount of available nitrogen, the growing of legumes will enrich the soil in proportion to its poverty. As Dr. Cyril G. Hopkins expresses it, "To the soil that hath not shall be given, but from the soil that hath shall be taken away."

It has been claimed by Albrecht that legumes are nitrogen-fixers rather than soil-nitrogen consumers only when they are generously supplied with calcium and the other essential bases.

Reference was made to the fact that some believe that the roots and stubble alone will give as good results as the entire crop turned under, but proof is lacking. However, there is ample proof that if the crop be harvested and only the roots and stubble turned under, the soil may show a decrease rather than an increase in nitrogen. Even at its best the roots and stubble of a clover crop contain no more nitrogen than was taken from the soil, whereas, for each crop turned under in its entirety, there is added to the soil from 25 to 56 pounds of nitrogen.

Legumes are classed very often as "soil-improvers" when, as a matter of fact, if handled incorrectly, they are "soil-depleters" as evidenced by the following references: C. B. Williams states that the only constituent legumes can add to the soil when plowed in, other than what they took from the soil, is nitrogen. The crop when cut and removed from the land will not ordinarily add any more nitrogen to the soil than it removed from it. This being the case, legumes grown on land and removed for hay or for any other purpose can hardly be classed as soil-improving crops since under such a system the nitrogen supply of the soil will just about be maintained. However, there will be a loss of from 8 to 16 pounds of phosphoric acid and from 26 to 54 pounds of potassium from the available supplies of the soil for each ton of legume hay removed. From Scarseth we learn that for each bushel of soybeans there is removed from the soil 0.75 pound of phosphoric acid and 1.0 pound of potash, while Schuster states that if crops of soybeans are cut for hay, it will take 700 pounds of 7-6-14 fertilizer to replace the plant food removed. In other words, a crop of about three tons of soybean hay will remove 50 pounds of nitrogen, 40 pounds of phosphoric acid, and 100 pounds of potash which can be replaced by an application of

(*Turn to page* 40)



When a large crop of alfalfa is baled and sold from the farm, large amounts of plant food also leave the farm.

cumstances. If you use clover as a fertilizing crop, he continued, your lands will rise in value under every rotation and increase your revenue. The death of the clover leaves the land enriched by the decay and putrefaction of the roots. Apparently, others had a similar opinion relative to the value of clover on succeeding crops and as a soil-improver, for an article was written by Joseph Harris for the Genesee Farmer, 1863, in which he stated that in certain circumstances it may be better to plough under the clover instead of feeding it to the livestock on the farm. Ten years later he wrote that we should have to go back to the old-fashioned plan of ploughing under the clover.

Writing on European agriculture Henry Colman in 1846 states, "Of vegetable manures I have only to say that buckwheat and clover are often turned in by the plough and with acknowledged advantage." He added further that clover, which appears twice in the rotation on French farms, is to be considered as the only enriching crop. The French farmers understood very well the advantage of ploughing in a clover stubble, but for lands not very rich it was considered only as an aid and not as a principal manure. Relative to the value of the stubble George E. Waring, writing in 1870, emphasizes the fact that the same results as ploughing under the entire crop, especially in the case of clover, would obtain from the roots alone. These roots when ploughed under and allowed to decompose in the soil constitute an excellent manure, acting both chemically and mechanically. That the value of the roots and stubble is not as high as the entire crop will be discussed and refuted further along in this article.

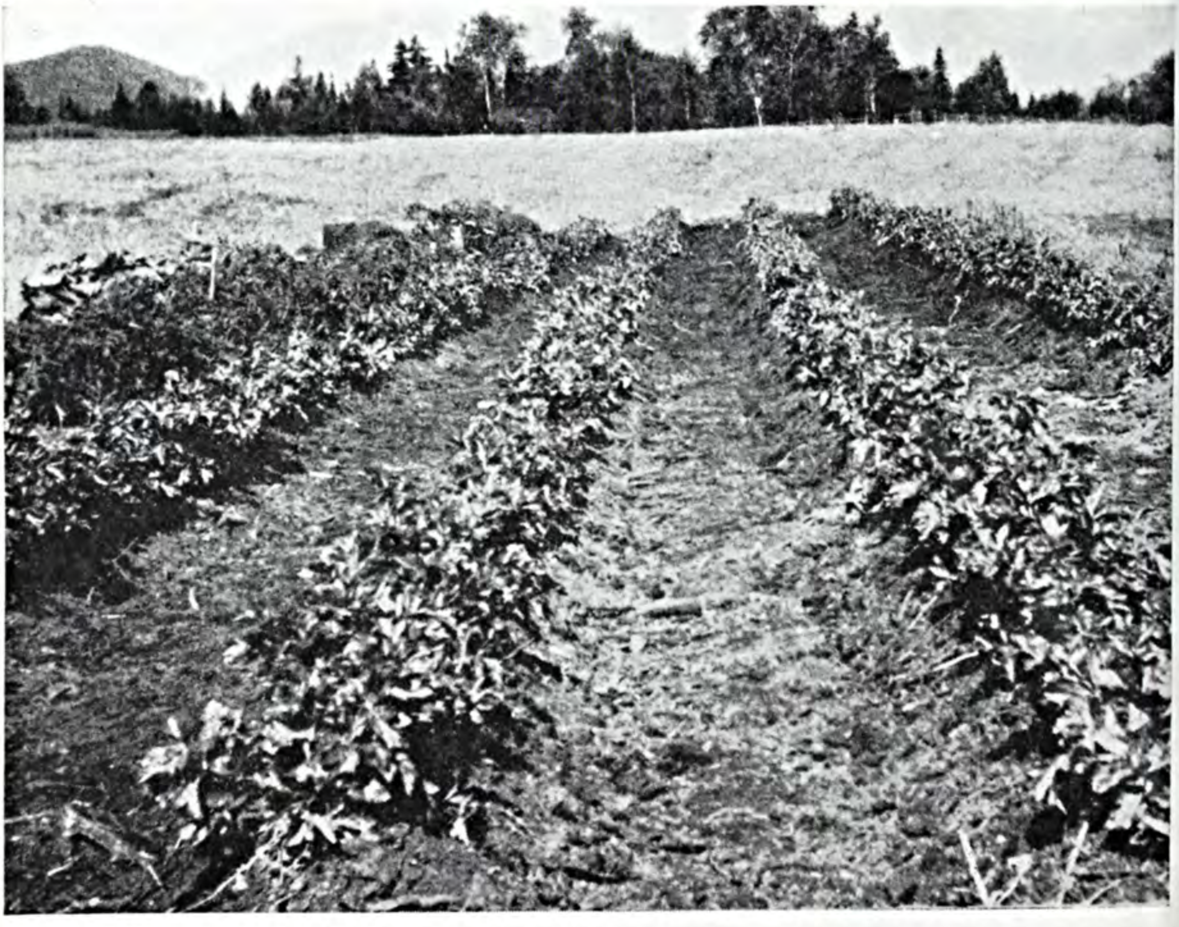
The discovery by Hellriegel and Wilfarth that legumes were able to take free nitrogen from the air only when certain bacteria were present has been accepted by all research workers and others. To mention but a few of the references—alfalfa, for example, is able to use the nitrogen from the air only when the nitrogen-fixing bacteria are present. These microscopic organisms commonly live in tubercles upon the roots of legume plants, and they have the power to take up free nitrogen and cause it to unite with other elements to form compounds which are utilized by the plant. Still another reference states that "these pod bearers are not them-

THE PRESSURE OF HARVEST WORK

PICTORIAL

A FARM BOY'S ROUTINE INCLUDES REGULAR AFTER-SCHOOL CHORES.

One is apt to think of Newfoundland as ice-bound, but here is proof of what can be done in the short growing season. Above, a good stand of vegetables; below, celery, well-fertilized with a 4-8-28 fertilizer.



EMPLOYS MANY HANDS AND DEVICES.

control that the run-off is *water*, not soil. The rotations with legumes give markedly increased yields of the cash crops, both per acre and per farm, even with reduced acreage planted to the cash crop. The sericea yields both hay and abundant seed. The kudzu yields hay and even when planted over gullies provides excellent grazing—and a red clay gully providing grazing for livestock is something to shout about! With increased yields of provender, livestock herds are being built up, the wise policy of first providing feed before getting the animals being followed. But above all is the over-all economic return—the farmer and his family kept on the land, his cash income increasing from year to year, his labor rewarded, his courage restored.

The enthusiasm and zeal of the men of the Soil Conservation Service are easily understood when one sees the results of their guidance. They are impressed but not appalled by the enormity of their task in trying to undo the ravages of nature uncontrolled for over 100 years under the one-crop system. While their personnel and funds are minute as compared to the number of farms in need of their help, they see their ideas spreading rapidly from farm to farm; for while farmer conservativeness is proverbial and the daily bread is his major concern, the farmers of the southern Piedmont are of the old stock that made America what it is. They have not lost their native intelligence nor faculty for observation and imitation nor spirit of determination.

They are worth keeping on the land!

Topsoil

"Topsoil would be guarded like the family jewels if farmers realized how much it is worth in crop production," says Lindley G. Cook, extension soil conservationist, Rutgers University, in commenting on tests held this year to determine what effect the depth of topsoil has on crop yields.

Potatoes were used as the crop for study, and tests were carried out on various Monmouth and Middlesex County farms by the New Jersey Agricultural Experiment Station and Research Division of the Soil Conservation Service, Cook reports. Yield comparisons were made between eroded and uneroded areas in the same field rather than between different farms or different fields.

In discussing results of the tests, Cook related that "potato yields were 8.6 per cent greater where topsoil is three to six inches in thickness than where the surface soil is less than three inches deep. And there was an increase of 9.4 per cent in yield where the surface soil is more than six inches deep as compared to a depth of three to six inches."

"By comparing 32 separately measured areas on four different farms, it was indicated that potato yields were 34 per cent greater where the topsoil is more than six inches in depth as compared to areas on the same farms where there is less than three inches of topsoil," he says. "The fact that potato yields are a full third higher where topsoil has not been washed or blown away shows that proper care of our topsoil is one of the best means of keeping up production for the war effort and after the war as well."

Erratum: In the article "The Southeast Can Grow Clover and Alfalfa" which appeared in the August-September issue of this magazine, the sentence at the top of page 16 should have read "Borax applied at the rate of 15 pounds per acre on Cecil sandy loam in Virginia. . . ." instead of "Borax applied at the rate of 15 pounds per acre on Cecil sandy loam in North Carolina. . . ."

The Editors Talk

Rebuilding The Old

The despair of the past yields to hope for the future when one views at close range the rebuilding of old, worn-out farms now taking place under the guidance of the Soil Conservation Service, as was our happy experience during a recent three-day field trip with the officials of that Agency through the Piedmont section of South Carolina and Georgia. Here the rolling hills and abundant rainfall, with open winters, have provided ideal conditions for soil erosion to bring about its tragic worst, washing away the topsoil, the Nation's most vital asset, and driving the farmers to steadily decreasing economic levels and finally off the land entirely. The result has been abandoned farms, left to nature to do her will at further devastation or rehabilitation as suited her whims, and abandoned farmers, eroded with labor and bankrupt, drifting to urban centers, leaving behind their agricultural skills, and taking with them only their desperate need for a livelihood. The bare red hills and deep gullies of these formerly and still potentially productive farm lands and the economic and human tragedies which they represent have long been a familiar sight to the traveler through those regions—sympathetic perhaps, appalled frequently, but impotent until the organization of the Soil Conservation Service in response to the Nation's demand that something be done about it.

Now, something *is* being done about it, and what is being done inspires and justifies the hope and confident expectancy that the land is going to be saved. It is *being* saved. Starting with the worst farms—not the best where the job would be the easiest—and by definition with the farmers frequently carrying mortgages—not the more prosperous with money in the bank—the farm is "planned" in terms of grades of soils, contours, waterways, wood supplies, etc. Then terraces are laid out or redesigned to deliver their water into natural waterways which are planted to soil-holding perennials, legumes such as lespedeza sericea and kudzu, depending on the slope—no longer onto the highways to wash them away! Contour strip farming, row-crops rotated with legumes, are substituted for the formerly exclusive cotton and corn; steeper slopes and gullies are covered with kudzu and other denuded areas with sericea; natural meadows and favorable slopes are set aside as permanent pastures; wood-lots are planted or cleared in terms of farm requirements; and the inevitable barren strips by wood-lots are planted to sericea as wild-life protection areas. These for the most part are measures which the individual farmer adopts for himself once the plan is supplied him.

What are the results—now abundantly obvious to the casual observer—for to provide contrast there are many, too many "control" farms, farms where this system has not yet been adopted? Observations are supplemented by the enthusiastic owner whose willing testimony leaves no room for doubt as to the great and increasing improvement in his economic status after the relatively short period of three to five years. Of most importance, erosion is placed under such higher than those not treated with boron. The heads of the boron-treated plants, while lower in percentage dry weight, were higher in actual weight of dry matter owing to the heads being larger than the plant not treated with boron.

A study of the tissues of normal and boron-deficient plants showed that boron deficiency produced a formation of gummy material between the cells in the pith. This material later became brown and seemed to be lignin-like in nature. This gumming started near the center of the stem and spread toward the outside. As the stem elongated, the pith was pulled apart along the line of this gummy material, resulting in cracking which frequently is seen on stems of boron-deficient cauliflower. At the time the gum developed, the cells greatly enlarged. Much the same thing happened in the tissues of the head, and also many cells in the actively growing sections died. The browning and gumming between the cells of the vascular or conducting tissue were very general except in the older tissues of the stem. The browning gradually filled in the spaces in the tissue, but the author believes that the number of bundles that were plugged in any section was too small to account for the death of the surrounding tissue because of inadequate transportation of materials. Symptoms of boron deficiency in the root were much the same as in the other parts of the plant, but a test for reducing sugars showed their presence in large amounts, indicating that there was transference of the sugar; in fact, there were greater than normal amounts of reducing sugars in the boron-deficient plants. The gumming undoubtedly interfered with normal transference of materials but certainly did not appear to prevent such transference.

"Soil and Crop Interrelations of Various Nitrogenous Fertilizers," Agr. Exp. Sta., New Haven, Conn., Bul. 458, May 1942, M. F. Morgan and H. G. M. Jacobson.

"Fertilizer Recommendations for Fall Seeded Grain Crops in 1942," Dept. of Agron., Mimeo. 33, Purdue University Agr. Exp. Sta., Purdue, Indiana.

"Field Tests of the Relative Effectiveness of Different Phosphate Fertilizers," Agr. Exp. Sta., Lexington, Ky., Bul. 420, Jan. 1942, George Roberts, J. F. Freeman, and Harold Miller.

"Fertilizer Needs of Alfalfa on New Hampshire Soils," Agr. Exp. Sta., Durham, N. H., Cir. 58, April 1942, Ford S. Prince, Paul T. Blood, Gordon P. Percival, and Paul N. Scripture.

"Fertility Needs of Dairy Farm Crops in the Connecticut Valley," Agr. Exp. Sta., Durham, N. H., Cir. 61, April 1942, Ford S. Prince, Paul T. Blood, and Gordon P. Percival.

"Inspection of Commercial Fertilizers for 1941," Agr. Exp. Sta., Durham, N. H., Bul. 336, Nov. 1941, T. O. Smith and H. A. Davis.

"Boron Nutrition of Cauliflower in Relation to Browning," Agr. Exp. Sta., Ithaca, N. Y., Bul. 778, April 1942, C. H. Dearborn.

"Wartime Fertilizers For Wheat and Other Fall-Sown Grain," Agr. Ext. Serv., Columbus, Ohio, 1942.

"The Application of Commercial Nitrogenous Fertilizers to Berks Silt Loam Soil is Profitable," Va. Polytechnic Institute, Blacksburg, Va., Bul. 337, March 1942, P. T. Gish.

"Fall Fertilizer Recommendations," Agr. Exp. Sta., Morgantown, W. Va., MWS-9, August 1942.

"Cooperative Manufacture and Distribution of Fertilizer by Small Regional Dry-Mix Plants," U. S. D. A., Washington, D. C., Cir. C-126, June 1941, John H. Lister.

Soils

¶ While it has been known that the mineral composition of crops will vary with the conditions under which they are grown, data as to the extent of these differences with the various crops growing at several levels of fertility in the field were generally lacking. Investigations conducted at Purdue University furnish interesting and significant information on the subject. These are reported by R. E. Lucas, G. D. Scarseth, and D. H. Sieling in Purdue University Agricultural Experiment Station Bulletin 468, "Soil Fertility Level As It Influences Plant Nutrient Composition and Consumption." Corn, soybeans, wheat, mixed hay, lespedeza, and oats growing on three different soils with several different fertilizer treatments were analyzed. Not all crops were grown on all soils nor were the fertilizer treatments the same in all cases. The grain and the straw or stover were

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

¶ A summary and analysis of some of the investigations being conducted on the growing of alfalfa in New Hampshire are reported by Ford S. Prince, Paul T. Blood, Gordon T. Percival, and Paul N. Scripture in New Hampshire Experiment Station Circular 58, "Fertilizer Needs of Alfalfa on New Hampshire Soil." This work was conducted on two farms over a period of several years. Potash appeared to be the first limiting factor since greatest increases in yield were obtained from this when the single fertilizer nutrients were applied. Best results were obtained, however, when potash and superphosphate were used together. When manure was not applied, nitrogen in the fertilizer also was beneficial. The use of lime was highly beneficial up to correcting soil acidity, but when additional lime was used, there was no additional benefit. The omission of potash from a complete fertilizer applied to alfalfa not only reduced yield but also caused the alfalfa to die out sooner and the stand was replaced with grass. This occurred even though manure had been applied. It is pointed out that if large amounts of manure are used, nitrogen in the fertilizer can be reduced, but large applications of potash and phosphoric acid will be needed if yields are to be maintained at a high level. A comparison of applying large amounts of fertilizer at planting time with smaller annual applications, so that in both cases the same total amount of plant food was applied, showed that over a two-year period best results are obtained with a large application at planting time. The authors feel that results on this point are not conclusive since the work was not conducted over a sufficient length of time to permit drawing any more than tentative conclusions.

¶ Investigations to determine the cause and remedy for browning, which was causing much trouble to cauliflower growers in New York State, showed that this difficulty was due to boron deficiency. This work is described by C. H. Dearborn in Cornell University Agricultural Experiment Station Bulletin 778 entitled "Boron Nutrition of Cauliflower in Relation to Browning." After preliminary work had shown that the difficulty was due to boron deficiency, detailed experiments and investigations were conducted. The external appearance of the head and leaves and the internal appearance of the head when boron is deficient are carefully described and illustrated. In greenhouse experiments, borax applied at rates from 5 to 25 pounds to the acre increased the yield over the no-borax treatment. All of the borax treatments increased the weight of the head about equally. It was found that the borax treatments also greatly increased the root growth of the cauliflower plant. While the fresh weight of the head was increased by borax treatments, the percentage dry matter in the head was higher in the plants that were deficient in boron, showing that carbohydrates apparently were being transferred to the head. Dry matter in the entire parts of the plant above ground was about the same with or without boron treatments, although the fresh weight of the boron-treated plant was 14.5%

in yield. The authors conclude from this that plant root density does not influence very much the amount of potash a plant can remove from the soil, and that the available potash supply of the soil depends mainly on weathering processes, aside from amounts supplied as fertilizer. The authors believe that when very small amounts of fertilizers are used, they should be high in phosphorus and low in potash, but as the application of fertilizer increases, the proportion of potash in the fertilizer should be increased.

Throughout the work there was an apparent tendency for calcium and magnesium to have a reciprocal relationship to potash content. Calculation shows a rather constant value for the sums of the three bases.

The authors compared their analyses with those reported by Morrison in his book, "Feeds and Feeding." They found that in general the nitrogen content of the non-legume was very similar in both cases, although the nitrogen content of legumes was found to be higher in the Purdue work. The phosphorus content usually was about the same in both cases. The potash content of the crop in the Purdue investigations usually was much lower than the values given by Morrison. It is assumed that his data were obtained some years ago when the fertility of the soils was higher, and consequently the crops had a higher potash content. The differences are taken to indicate the depletion in available potash content of soils in Indiana.

In summing up the work, the authors state that the hay crops are heavy feeders on potash. Corn and soybeans are heavy feeders on all three nutrients while the small grains are heavy consumers of phosphate. The authors believe the importance of magnesium in plant nutrition has not been given sufficient importance. On the Crosby soil, the common 2-1 PK ratio does not supply sufficient potash. When manure and residues are returned to the soil, a 1-1 ratio should be used; when they are not returned, 1-1.5 or 1-2 ratio would appear to be needed if high yields are to be obtained. On the Bedford soil, manure was particularly beneficial in increasing the potash content of crops, but the authors point out this would not be the case where potash was more limiting than it is on this soil. It is stated that the data show that about 70 per cent of the added phosphorus is recovered by crops in a four-year rotation on a limed soil, but only about 50 per cent of the phosphorus is recovered on unlimed soil.

¶ Practical information on the why and how of using lime has been prepared by the Extension Service in South Carolina and issued as Circular 218 of the Clemson Agricultural College Extension Service, "For Land's Sake Use Lime." The liberal use of charts and illustrations clearly shows farmers what benefits can be obtained from the proper use of lime. Information on when to apply lime, how to apply it, the amount to use under different conditions of soil and cropping, and its use in connection with the AAA program are covered. It is brought out that lime is not a cure-all and will not replace other good farming practices such as proper crop rotation and use of fertilizer. Similar information for Iowa farmers is given in Iowa Agricultural Extension Bulletin P45, Liming Iowa Soils, by B. J. Firkins.

"Studies on Plant Food Availability in Alkaline-Calcareous Soils: Seedling Tests and Soil Analysis," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 94, Aug. 15, 1942, W. T. McGeorge.

"Effect of Drought and Rainfall on Movement of Soil Nitrogen in Cecil Soils," Agr. Exp. Sta., Experiment, Ga., Cir. 137, July 1942, E. D. Matthews.

"Illinois Loess—Variations in its Properties and Distribution: a Pedologic Interpretation," Agr. Exp. Sta., Urbana, Ill., Bul. 490, July 1942, Guy D. Smith.

"Soil Fertility Level As It Influences Plant Nutrient Composition and Consumption," Agr. Exp. Sta., Lafayette, Indiana, Bul. 468, April 1942, Robert E. Lucas, George D. Scarseth, and Dale H. Sieling.

"Liming Iowa Soils," Agr. Exp. Sta., Ames, Iowa, Bul. P45 (New Series), May 1942, B. J. Firkins.

"Soil Survey of Iowa, Decatur County," Agr. Exp. Sta., Ames, Iowa, Soil Survey Report 80, May 1941, Roy W. Simonson.

analyzed separately, and the timothy, alsike, and red clovers making up the mixed hay also were analyzed separately.

It is impossible in this short review to give more than a few highlights of some of the great mass of data presented. In most cases, analyses were made for nitrogen, phosphorus, potassium, magnesium, and calcium, and frequently total and available nutrients in the soils on which the crops were grown were determined. Considerable variation in the mineral contents of the crops due to different fertilizer treatments and to different fertility levels of the various soils was found. It is pointed out that corn is a heavy user of plant nutrients; and if high yields are to be obtained, large amounts of nutrients, in a proper balance, must be made available to the crop. Both of these factors must be given consideration since a well-balanced nutrient at a low level will give satisfactory corn but low yield, and only if large amounts of properly balanced nutrients are present, can high yields of good quality crops be obtained. In general, the composition of the grain did not vary nearly as much as the composition of the stalks, this same relationship holding true for all crops which were analyzed separately for the seed part and the stalk.

The soybean analyses show that this crop makes even heavier demands on the nutrients of the soil than corn. The crop appears to have very good foraging powers which accounts for its ability to get along satisfactorily on soils of moderate or low fertility. The crop following the soybeans, however, will feel the effects of the foraging efficiency of soybeans, and thus other crops in the rotation suffer unless adequate provision is made to replace the nutrients removed by the soybeans.

In the hay analyses, an inter-relationship of the nutrients, which could be observed in all cases, was particularly marked. The nitrogen content of the hay was influenced by the fertility of the soil, the better soils having a higher nitrogen and consequently a higher protein content. When lime was used, the yields were increased, but the amount of potash being used was not sufficient under these conditions to permit the complete utilization of the phosphate applied. The authors state that when no lime is used the ratio of nutrients applied, which in this case was 2 parts of phosphoric acid to 1 part of potash, appeared to be satisfactory; but on liming, the increased crops produced made heavier demands on the potash in the soil with the result that the supply was soon exhausted and the crop produced was lower than normal in this nutrient. The following crops, of course, would suffer even more unless provision was made to increase potash supply in the soil. The timothy was a very efficient forager for potash, as indicated by the high content of this nutrient even when it was not applied. The crop following timothy, however, would feel the effects of this and suffer from a lack of available potash unless provision was made to replace the potash removed by the timothy.

In considering the results on the various soils, it appears from the data on analyses and yields that the full potentialities of the most fertile soil could not be realized unless more potash was used than had been the case in the experiments in question.

Data are presented on the apparent contribution by the soil from its reserve supply of nutrients. It is brought out that even depleted soils furnish certain amounts of nutrients. The net gain or loss in nutrients will depend, of course, on the amounts of nutrients applied, as compared to the amounts removed by the crop. Without any treatment, there was a net loss of both phosphate and potash. When fertilizer in a 2-1 PK ratio was used, either alone or with lime and manure, there was a net gain in phosphate but an increased net loss in the potash. The treatment stimulated yields to the extent that the crops removed much more potash than was added in the fertilizer, but the net loss in all treated cases usually was about the same regardless of variation creased when the potash was increased, although the calcium-magnesium ratio was not affected by potash fertilization. There was a slight tendency for the phosphorus to decrease with increased potash applications, although the variations were small. The sulphur and chlorine contents of the plant tended to increase as the potash was increased. In the case of sulphur this is not surprising since the potash was applied in the sulphate form except for that which was in the cottonseed-meal. The sulphur does not increase to nearly the same extent as does the potash content of the leaves with the increased application. There was a tendency for the nicotine and nitrogen to decrease as the potash increased. When light and dark colored leaves were analyzed, it was found that potash, phosphorus, and chlorine did not vary consistently, while the lighter leaves had a higher percentage of calcium, magnesium, and slightly higher sulphur than the dark leaves, the latter being higher in nicotine and nitrogen. The leaves in the upper part of the plant tended to be higher in phosphorus, sulphur, nitrogen, and nicotine, while the lower leaves in the plant were higher in calcium, magnesium, and potassium. Analyses of the soil for total and replaceable potash were made and it was found that with increasing potash applications, the replaceable and even the total potash were increased, and this was correlated with improved quality of the tobacco crop growing on the soil. Burn tests confirmed previous findings that any treated potash content of tobacco caused an increased fire-holding capacity.

The second article was a similar study but related to the effects of phosphorus on cigar tobacco. The P_2O_5 application varied from 40 pounds to 320 pounds per acre in four increments. Increasing the phosphorus application tended to increase yield, although the biggest increase usually occurred between the 40- and 80-pound treatments. The grade index of the tobacco was improved with increasing phosphorus applications up to 160 pounds P_2O_5 per acre, above which there usually was a falling off in grade index. Increasing the phosphorus fertilizer increased slightly but consistently the phosphorus content of the leaves. The calcium and sulphur also were increased since these were added in larger amounts when increased amounts of superphosphate were applied. The treatment also tended to increase the chlorine content of the leaves, while the potash and the nitrogen tended to decrease. The light colored leaves in this work tended to be higher in calcium, magnesium, potassium, sodium, and chlorine; they were lower in phosphorus, nicotine, and total nitrogen, while sulphur and manganese did not show any significant differences. Increasing the phosphorus content of the leaves had a deleterious effect on the burning quality.

The third section of the bulletin dealt with the course of mineral absorption by tobacco during its growth period. In this work cigar leaf, burley, and flue-cured tobacco were studied. Curves are given showing absorption of calcium, potassium, magnesium, phosphorus, sulphur, chlorine, iron, manganese, and nitrogen during the growing season. The data are then figured to a pound-per-acre basis. The figures among the types of tobacco and for the different years vary considerably. As general averages, however, it was found that around 125 pounds of calcium oxide were removed by cigar tobacco, around 70 pounds by the flue-cured tobacco, and 164 pounds for the burley tobacco. Magnesium oxide was removed to the extent of about 20 pounds by cigar tobacco, around 12 pounds for flue-cured tobacco, and almost 30 pounds for burley tobacco. The P_2O_5 varied greatly but averaged around 25 pounds for cigar tobacco, 15 pounds for flue-cured tobacco, and 16 pounds for burley. The K_2O removed by cigar tobacco was around 230 pounds, by flue-cured tobacco 50 pounds, and by burley tobacco 53 pounds. The acre yield for the cigar tobacco was around 1,900 pounds, for flue-cured tobacco 1,000 pounds, and for the burley 1,100 pounds.

"Soil Survey of Iowa Marion County," Agr. Exp. Sta., Ames, Iowa, Soil Survey Report 81, Nov. 1941, Roy W. Simonson and T. H. Benton.

"Soil Survey of Iowa Ida County," Agr. Exp. Sta., Ames, Iowa, Soil Survey Report 82, April 1942, Roy W. Simonson and T. H. Benton.

"Contour Strip Cropping," Agr. Ext. Serv., St. Paul, Minn., Ext. Folder 108, June 1942, M. A. Thorfinnson.

"Soils of Golden Valley County," Agr. Exp. Sta., Bozeman, Mont., Bul. 403, April 1942, L. F. Gieseker.

"Effect of Irrigation Waters and Cropping on the Nutrients and Exchangeable Bases of Desert Soils," Agr. Exp. Sta., State College, N. M., Tech. Bul. 292, May 1942, C. W. Botkin and E. C. Smith

"Soil and Field-Crop Management for Northwestern New York," Agr. Exp. Sta., Ithaca, N. Y., Bul. 777, March 1942, A. F. Gustafson.

"Studies Concerning the Supply of Available Potassium in Certain New York Orchard Soils," Agr. Exp. Sta., Ithaca, N. Y., Memoir 241, Dec. 1941, Walter Reuther.

"Defend Your Nation and Its Soil," Agr. Ext. Serv., Raleigh, N. C., Ext. Bull. 2 (War Series), May 1942, Earl Meacham.

"Are You Growing Gullies or Trees?" Agr. Ext. Serv., Raleigh, N. C., Ext. Cir. 255, June 1942.

"Percolation and Water Requirement Studies with Alfalfa by Means of Lysimeters in Oregon," Agr. Exp. Sta., Corvallis, Ore., Bul. 404, Feb. 1942, S. H. Hastings and H. K. Dean.

"For Land's Sake Use Lime," Agr. Ext. Serv., Clemson, S. C., Cir. 218, July 1942.

"A Survey of Tobacco Soils in Wisconsin," Agr. Exp. Sta., Madison, Wis., Res. Bul. 142, Jan. 1942, James Johnson and W. B. Ogden.

"Tree Shelterbelts or Windbreaks Helpful on the Northern Great Plains," U. S. D. A., Washington, D. C., C.S.C. Folder 12.

"Protection and Care of Farm Woods," U. S. D. A., Washington, D. C., C.S.C. Folder 13.

"Tree Planting to Stabilize Gullies and Stream Banks," U. S. D. A., Washington, D. C., C.S.C. Folder 14.

Crops

¶ In recent years considerable interest has developed in Ladino white clover, particularly in the Mid-Atlantic and New England States. It has been found to have great possibilities as a producer of large quantities of high-quality forage. It can be used successfully as a hay, silage, pasture, or cover crop, although it is not suitable in a lawn. In order to furnish information on this comparatively new crop, E. A. Hollowell has prepared U. S. Department of Agriculture Farmers' Bulletin No. 1910, "Ladino White Clover for the Northeastern States." He brings out that a high-producing crop such as Ladino clover makes very heavy demands on the mineral food supply of the soil. Lime usually will be needed to supply calcium and correct soil acidity. Phosphate fertilizers are usually needed, and potash also since most soils in this section are deficient in this nutrient. The best fertilizer to use will vary with soil, but as a general recommendation the author suggests 400 to 600 pounds of superphosphate per acre and if there is a potash deficiency, 200 pounds of muriate of potash per acre, or other fertilizers equivalent to these. Sometimes small amounts of nitrogen are needed in establishing a stand, although when it gets going, this legume, of course, fixes its nitrogen from the air. The bulletin also gives general cultural directions and makes suggestions on the utilization of the crop.

¶ A series of interesting and important investigations on tobacco in Canada is reported by G. M. Ward in Canadian Department of Agriculture Publication 729 entitled "Physiological Studies with the Tobacco Plant." Five distinct, but to some extent related, phases of the work are reported in a way to make up five sections in the bulletin. The first investigation dealt with effects of potassium on cigar tobacco. This involved detailed analyses of two crops of tobacco given three different rates of potash fertilization, the other nutrients being held constant, together with yield data and grade index over a five-year period. The three rates of potash application were 27, 100, and 200 pounds of K_2O per acre. Increasing the rate of application increased the yield only moderately, but increased the grade index used to measure quality much more markedly and much more consistently. The data on chemical analysis showed that increasing potash caused a corresponding increase in the content of this nutrient in the leaves. The calcium and magnesium in the leaves were de-

"Corn and Oats," Agr. Exp. Sta., State College, Miss., Bul. 368, June 1942, H. O. West.

"A Vegetable and Field Crop Seed Treatment Outline for Mississippi," Agr. Exp. Sta., State College, Miss., Cir. 105, May 1942, J. A. Pinckard.

"Handling Peach Trees After Winter Killing of Fruit Buds," Agr. Exp. Sta., Columbia, Missouri, Cir. 221, March 1942, T. J. Talbert.

"Home Flower Gardens," Agr. Exp. Sta., Columbia, Missouri, Cir. 223, March 1942, J. E. Smith.

"A Cytogenetic Study of Zea and Euchlaena," Agr. Exp. Sta., Columbia, Missouri, Res. Bul. 341, March 1942, Joseph G. O'Mara.

"Defend Our Soil with Grass," Agr. Ext. Serv., Lincoln, Neb., CC 47, 1942.

"Soybean Production in Nebraska," Agr. Exp. Sta., Lincoln, Neb., Bul. 339, April 1942, T. A. Kiesselbach and W. E. Lyness.

"The Relations of Vegetative Composition and Cattle Grazing on Nebraska Range Land," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 123, March 1942, T. E. Brinegar and F. D. Keim.

"Alfalfa Breeding," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 124, June 1942, H. M. Tysdal, T. A. Kiesselbach, and H. L. Westover.

"Bronco Grass (Bromus tectorum) on Nevada Ranges," Agr. Exp. Sta., Reno, Nevada, Bul. 159, April 1942, C. E. Fleming, M. A. Shipley, and M. R. Miller.

"Mobilize New Hampshire Forage Resources," Agr. Ext. Serv., Durham, N. H., Ext. Cir. 242, May 1942, J. L. Haddock, M. F. Abell, and L. A. Johnson.

"Pruning Grapevines," Agr. Exp. Sta., New Brunswick, N. J., Cir. 423, April 1942, H. J. Sofick and J. Harold Clark.

"Silage Without Molasses," Agr. Exp. Sta., New Brunswick, N. J., Cir. 439, April 1942, Carl B. Bender and Howard B. Sprague.

"Reseeding Practices for New Mexico Ranges," Agr. Exp. Sta., State College, N. M., Bul. 291, April 1942, J. O. Bridges.

"The Blueberry in New York," Agr. Exp. Sta., Geneva, N. Y., Cir. 189, Rev. 1942, G. L. Slate and R. C. Collison.

"The Control of Wind Erosion on Muck Lands," Agr. Ext. Serv., Ithaca, N. Y., Bul. 482, March 1942, A. F. Gustafson.

"Research and Farming 1941," Agr. Exp. Sta., Raleigh, N. C., A.R. 64.

"Herbaceous Perennials," Agr. Exp. Sta., Raleigh, N. C., Bul. 333, June 1942, G. O. Randall and J. G. Weaver.

"A Comparison of Legume Hays for Milk Production," Agr. Exp. Sta., Wooster, Ohio, Bul. 631, July 1942, C. C. Hayden.

"The Uneven Ripening of Concord Grapes: Chemical and Physiological Studies," Agr. Exp. Sta., Stillwater, Okla., Tech. Bul. T-13, June, 1942, James E. Webster and Frank B. Cross.

"A Study of Problems Relating to Production of Fall-Crop Irish Potatoes in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Bul. B-258, June 1942, H. B. Cordner.

"Feeding for Milk Production," Agr. Exp. Sta., Corvallis, Ore., Bul. 398, Oct. 1941, I. R. Jones and R. W. Morse.

"Farm Research in South Dakota," Agr. Exp. Sta., Brookings, S. D., 54th A. R., June 30, 1941.

"Fifty-Third Annual Report 1940," Agr. Exp. Sta., Knoxville, Tenn., A.R. 53, 1940.

"Feeding Values of Silages and Hays," Agr. Exp. Sta., Burlington, Vermont, Bul. 482, March 1942, O. M. Camburn, H. B. Ellenberger, and C. H. Jones.

"Soybeans for Oil," Agr. Ext. Serv., Blacksburg, Va., Cir. E-357, W. H. Byrne.

"Information for Virginia Fruit Growers 1942," Agr. Ext. Serv., Blacksburg, Va., Bul. 131, Rev. Feb. 1942.

"Peanut Leafspot and Leafhopper Control," Agr. Exp. Sta., Blacksburg, Va., Bul. 338, May 1942, Lawrence I. Miller.

"Vegetable Culture and Varieties for Wyoming," Agr. Exp. Sta., Laramie, Wyo., Bul. 250, April 1942, M. F. Babb and W. L. Quayle.

"Hybrid Corn in Wyoming, 1941," Agr. Exp. Sta., Laramie, Wyo., Bul. 251, April 1942, William A. Riedl and W. L. Quayle.

"The Native Persimmon," U.S.D.A., Washington, D. C., Farmers' Bul. 685, Rev. May 1942, W. F. Fletcher.

"Blackberry Growing," U. S. D. A., Washington, D. C., Farmers' Bul. 1399, Rev. May 1942, George M. Darrow.

"Hedge Plants for the Northern Great Plains," U. S. D. A., Washington, D. C., Farmers' Bul. 1898, June 1942, Thomas K. Killand.

"Production of Tomatoes for Canning and Manufacturing," U. S. D. A., Washington, D. C., Farmers' Bul. 1901, March 1942, James H. Beattie, W. R. Beattie, and S. P. Doolittle.

"Sugar-Beet Culture," U. S. D. A., Washington, D. C., Farmers' Bul. 1903, May 1942, Bion Tolman and Albert Murphy.

"Ladino White Clover for the Northeastern States," U. S. D. A., Washington, D. C., Farmers' Bul. 1910, 1942, E. A. Hollowell.

"The Home Fruit Garden in the Southeastern and Central Southern States," U. S. D. A., Washington, D. C., Leaf. 219, May 1942.

"The Home Fruit Garden in the Central Southwestern States," U. S. D. A., Washington, D. C., Leaf. 221, May 1942.

"The Home Fruit Garden in the Northern Great Plains, Northern Mountain and Intermountain States," U. S. D. A., Washington, D. C., Leaf. 222, June 1942.

"The Home Fruit Garden in the Pacific Coast States and Arizona," U. S. D. A., Washington, D. C., Leaf. 224, June 1942.

"Growing Field Beans in Humid Areas," U. S. D. A., Washington, D. C., Leaf. 223.

"Influence of Variety, Environment, and Fertility Level on the Chemical Composition of Soybean Seed," U. S. D. A., Washington, D. C., Tech. Bul. 787, May 1942, J. L. Cartter and T.-H. Hopper.

The fourth section of the bulletin dealt with carbohydrates in flue-cured tobacco. It was found that soluble sugars were directly related to the quality of the cured leaves, the highest sugar content giving a better quality leaf. During the curing process soluble sugars tended to increase and insoluble sugars to decrease. This work was conducted on flue-cured tobacco. The final article is a carbohydrate study on cigar tobacco. It was found that carbohydrates are not nearly so important in determining the quality of cigar tobacco as they are of flue-cured tobacco. This appears to be due to the fact that during fermentation the carbohydrates in the cigar tobacco leaves largely disappear. Detailed analytical data on all of the papers are given in the appendix of the bulletin.

"4-H Club Manual in Corn Production," Agr. Ext. Serv., Little Rock, Ark., Ext. Cir. 124, March 1942, Charles F. Simmons.

"Soybeans for Oil," Agr. Ext. Serv., Little Rock, Ark., Leaflet 23.

"Peanut Production in Arkansas," Agr. Ext. Serv., Little Rock, Ark., Leaflet 24.

"Grow a Victory Garden," Agr. Ext. Serv., Little Rock, Ark., Leaflet 27.

"Grow Sorghum for Syrup," Agr. Ext. Serv., Little Rock, Ark., Leaflet 31, 1942.

"Legume Seed Harvest Will Beat the Nitrogen Shortage and Save You Dollars," Agr. Ext. Serv., Little Rock, Ark., Leaflet 33.

"The San Joaquin Experimental Range," Agr. Exp. Sta., Berkeley, Calif., Bul. 663, April 1942, C. B. Hutchison and E. I. Kotok.

"Handling and Shipping Tests with New Potatoes From Kern County, California," Agr. Exp. Sta., Berkeley, Calif., Bul. 664, April 1942, W. R. Barger, G. B. Ramsey, R. I. Perry, and John H. MacGillivray.

"Irrigation Experiments with Pears and Apples," Agr. Exp. Sta., Berkeley, Calif., Bul. 667, May 1942, A. H. Hendrickson and F. J. Veihmeyer.

"Physiological Studies with the Tobacco Plant," D. C. D. A., Ottawa, Canada, Publ. 729, Tech. Bull. 37, February 1942, G. M. Ward.

"Alfalfa for Hay, Silage, and Pasture," D. C. D. A., Ottawa, Canada, Publ. 735, Farmers' Bul. 110, May 1942, J. M. Armstrong, F. S. Nowosad, and P. O. Ripley.

"Annual Report for the Year Ending October 31, 1941," Agr. Exp. Sta., New Haven, Conn., Bul. 452, April 1942.

"Causes, Effects and Control of Defoliation on Tomatoes," Agr. Exp. Sta., New Haven, Conn., Bul. 456, March 1942, James G. Horsfall and John W. Heuberger.

"Yankee Hybrid Summer Squash An Early Productive First Generation Cross," Agr. Exp. Sta., New Haven, Conn., Cir. 152, May 1942, Lawrence C. Curtis.

"1941 Annual Report Delaware Agricultural Extension Service," Agr. Ext. Serv., Newark, Del., Ext. Bul. 36, May 1942.

"Fifty-Third Annual Report for the Fiscal Year Ending June 30, 1941," Agr. Exp. Sta., Gainesville, Florida, A.R. 1941.

"1941 Report Florida Agricultural Extension Service," Agr. Ext. Serv., Gainesville, Fla., A-1941.

"Avocado Production in Florida," Agr. Ext. Serv., Gainesville, Fla., Bul. 112, April 1942, H. S. Wolfe, L. R. Toy, and A. L. Stahl; Revised by H. S. Wolfe.

"Papaya Culture in Florida," Agr. Ext. Serv., Gainesville, Fla., Bul. 113, June 1942, H. S. Wolfe and S. J. Lynch.

"High Lights in Agricultural Research in Idaho," Agr. Exp. Sta., Moscow, Idaho, Bul. 244, A.R. 1941.

"The Idared Apple," Agr. Exp. Sta., Moscow, Idaho, Cir. 84, April 1942, Leif Verner.

"Yield of Sweet Corn in Relation to Distance and Rate of Planting," Agr. Exp. Sta., Urbana, Ill., Bul. 487, May 1942, W. A. Huelsen.

"Tomato Growing—Ten Points for the Home Gardener," Agr. Ext. Serv., Urbana, Ill., Ve-1, Jan. 1942, Lee A. Somers.

"Soybean Varieties and Culture," Agr. Ext. Serv., Lafayette, Ind., Leaflet, May 1942.

"Strawberry Production in Southeastern Iowa as Influenced by Varieties, Fertilizers, and Cultural Practices," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 295, March 1942, Philip Minges, T. J. Maney, and B. S. Pickett.

"Grass Farming for Improving Depleted Soils," Agr. Exp. Sta., Lexington, Ky., Cir. 52, March 1942, S. J. Lowry and L. M. Caldwell.

"How to Plant Shade Trees," Agr. Ext. Serv., Lexington, Ky., Ext. Cir. 371, October 1941, N. R. Elliott.

"The Vegetable Garden Month by Month," Agr. Ext. Serv., Lexington, Ky., Ext. Cir. 376, Feb. 1942, John S. Gardner.

"Blooming Dates of Some Selected Hardy Perennials," Agr. Exp. Sta., Amherst, Mass., Bul. 392, April 1942, Harold S. Tiffany.

"Bay State, a Red Forcing Tomato Bred for Resistance to Leaf Mold," Agr. Exp. Sta., Amherst, Mass., Bul. 393, June 1942, E. F. Guba.

"The Composition and Nutritive Value of Potatoes with Special Emphasis on Vitamin C," Agr. Exp. Sta., Amherst, Mass., Bul. 390, March 1942, William B. Esselen, Jr., Mary E. Lyons, and Carl R. Fellers.

"Hay Crop Silage," Agr. Exp. Sta., St. Paul, Minn., Bul. 360, May 1942, N. N. Allen and J. B. Fitch.

"Influence of Flowering and Fruiting Upon Vegetative Growth and Tuber Yield in the Potato," Agr. Exp. Sta., St. Paul, Minn., Tech. Bul. 150, June 1942, W. L. Bartholdi.

"America Needs More Milk," Agr. Ext. Serv., St. Paul, Minn., Pamph, 94, Feb. 1942.

"An Economic Study of Land Utilization in Sussex County, Delaware," Agr. Exp. Sta., Newark, Del., Bul. 233, Oct. 1941, R. O. Bausman.

"Farm Rental Arrangements in Georiga," Agr. Exp. Sta., Experiment, Ga., Bul. 220, May 1942, J. C. Elrod, D. E. Young, and W. T. Fullilove.

"Organization and Efficiency of Dry-Land Wheat Farms in Eastern Idaho," Agr. Exp. Sta., Moscow, Idaho, Bul. 243, April 1942, Leo J. Fenske and Paul A. Eke.

"Effects of Crop Acreage Control Features of AAA on Feed Production in 11 Midwest States," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 298, April 1942, T. W. Schultz and O. H. Brownlee.

"Methods of Computing a Regression of Yield on Weather," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 302, June 1942, E. E. Houseman.

"Prices of Farm Products in Iowa, 1851-1940," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 303, May 1942, Norman V. Strand.

"Land-Tenure Classification and Areas in Kentucky," Agr. Exp. Sta., Lexington, Ky., Bul. 421, Jan. 1942, John H. Bondurant and Wendell C. Binkley.

"Farm Management on Central Maine Farms with Dairy Enterprises," Agr. Exp. Sta., Orono, Maine, Bul. 408, Jan. 1942, Emil Rauchenstein and Andrew E. Watson.

"Status and Trend of Agricultural Cooperation in Maryland," Agr. Exp. Sta., College Park, Md., Bul. 441, May 1941, P. R. Poffenberger, J. R. Ives, and S. H. DeVault.

"Acceptance of Approved Farming Practices Among Farmers of Dutch Descent," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 316, June 1942, Charles R. Hoffer.

"Southern Agriculture in a Changing World," Agr. Exp. Sta., State College, Miss., Sp. Cir., Feb. 1942, Clarence Dorman.

"An Economic Analysis of Farming in the Cedar Creek Soil Conservation Demonstration Area Franklin County, North Carolina 1935," Agr. Exp. Sta., Raleigh, N. C., Tech. Bul. 70, May 1942, R. E. L. Greene.

"Oklahoma Cotton in Wartime," Agr. Exp. Sta., Stillwater, Okla., Cir. C-105, July 1942, K. C. Davis and W. A. Williams.

"Marketing Central Oregon and Klamath Basin Late-crop Potatoes," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 400, Dec. 1941, D. B. DeLoach and Gordon R. Sitton.

Farm Soils

(A Book Review)

PROFESSOR Edmund L. Worthen of Cornell University has revised his well-known book on soils (Farm Soils, Their Management and Fertilization, by Edmund L. Worthen, John Wiley and Sons, Inc., New York, N. Y., Third Edition, 1941. $2.75.) The book is written primarily with the student of vocational agriculture in mind. The field covered is broad and remarkably complete for a high school course in soils and fertilizers. This fact makes the volume a good reference book for the student after he leaves the school and for farmers and their advisers.

The book is divided into twelve chapters, titled respectively: Selecting the Soil and Planning its Management; Growing the Crop; Controlling the Water Supply of the Soil; Tilling the Soil; Manuring; Liming; Fertilizing; Leguming and Green Manuring; Managing Field Soils; Managing Pasture Soils; Managing Garden, Greenhouse, and Lawn Soils; and Managing Fruit Soils. Each chapter is systematically arranged into general introductory remarks, operations, and general information, with suggestions for community studies, practice problems, and references at the end of the chapter. The sections of the chapter are further broken down into appropriate sub-sections.

The author has made every effort to present his subject matter from a practical viewpoint. Technical material has been kept to the minimum necessary to an understanding of the principles governing the application of the practices under consideration. It usually is given in the general information section of the chapter and is explained in a manner that should make it clear to anyone with a general education of high

"Growing Tobacco as a Source of Nicotine," U. S. D. A., Washington, D. C., Tech. Bul. 820, June 1942, J. E. McMurtrey, Jr., C. W. Bacon, and D. Ready.

"Medicinal Plants of Tropical and Subtropical Regions," U. S. D. A., Washington, D. C., Foreign Agr. Report 6, July 1942, A. F. Sievers and E. C. Higbee.

"Selected List of American Agricultural Books," U. S. D. A., Washington, D. C., Library List No. 1, June 1942.

Economics

¶ With publication of "Economic Study of Land Utilization in Sussex County, Delaware," R. O. Bausman has completed a detailed study of land utilization in the entire state of Delaware, similar studies for the other two counties in the State having been published previously. The publication on Sussex County is issued as Bulletin 233 of the Delaware Agricultural Experiment Station. Trends in the number and size of farms, in livestock number, and in acreages of various important crops are given. Dairying appears to be on the increase and milk sold has risen sharply since 1920, with butter production falling off during the same period. The number of swine and sheep in the county has decreased markedly. Chickens increased up to 1930 and fell off during the last 10 years. Acreages in wheat have fallen off sharply and corn, moderately. Alfalfa acreage increased up to 1930 but has fallen off considerably during the last 10 years. The acreage of annual legume hays, however, has increased and is holding its high position. Apple trees have fallen off in number and peaches, after having fallen sharply from 1900 to 1920, have remained at a low level. The acreage of vegetables has gone steadily upward.

About half the county is put in the lowest type of land, and very appropriately there are comparatively small acreages of crops grown on this land. Yields of crops are correlated with soil series and also with the general quality of land. As is to be expected, the efficiency of the farming usually was better on the good land than on the poor land. The author also gives considerable attention to the social aspect of land utilization.

¶ A survey and analysis of farm management practices in Central Maine have been made by Emil Rauchenstein and Andrew E. Watson. Their results are published in Maine Agricultural Experiment Station Bulletin 408 entitled "Farm Management on Central Maine Farms with Dairy Enterprises." The miscellaneous dairy farms had the highest labor income while the specialized dairy farms had the lowest, although there were some farms in this group with labor income of over $1,000. In general, those farms which diversified their enterprises so as to have income from crops as well as from the dairy were the most profitable. The supplementary sources of income were potatoes, sweet corn, canning peas, wood, and poultry. While fertilizers were commonly applied to cash crops on the farm, pastures and hay crops were largely neglected. Only 1.5% of the hay land and .4% of the pasture area were fertilized. The authors bring out the fact that farmers could well afford to try lime, phosphate, and potash on their hay and pasture land, especially in view of the assistance in meeting the cost of these treatments they can obtain under the Agricultural Conservation Program. Judging from work conducted in the State, the use of lime and fertilizer would increase the production of forage, and, what is more important, increase it during the summer when added feed is needed to help increase milk production during the time of year when it usually falls off. It is stated that applications of lime, phosphate, and potash usually stimulate White Dutch clover, and when this is present in the turf, it helps to make better summer and fall pastures.

"Agricultural Land Ownership and Operating Tenures in Casa Grande Valley," Agr. Exp. Sta., Tucson, Ariz., Bul. 175, Nov. 1941, Philip Greisinger and George W. Barr.

"Factors Affecting the Success of Farm Mortgage Loans in Western Canada," D. C. D. A., Ottawa, Canada, Publ. 733, Tech. Bul. 41, April 1942, S. C. Hudson.

they survive the winter. Any of these grains seeded thickly will supply the soil with valuable active organic matter and will take up and hold soluble plant nutrients against loss, and after plowing the roots will tend to hold the surface of the muck against blowing. From most standpoints, a fall grain that goes through the winter into the spring in a live condition is preferable to spring grains.

Wet soils do not blow, but wet soils are cold in the spring. The water-table, therefore, should not be too high. The windbreak method of control is probably preferable to using a high water-table. Heavy rolling of a well-drained soil before seeding may be helpful.

Conclusion

Windbreaks may be composed of trees, shrubs, grain, or slat or snow fences. Their primary purpose is to check the air movement to such extent that the wind cannot pick up and drive sharp muck granules or pieces of wood against tender crop plants with force. The windbreak plants grown should be adapted to the climatic and soil conditions of the area in which they are used, and the fences should be inexpensive and so built as not to require much labor for setting up, removing, and storing away. Onions and other vegetables on mucklands that are exposed to strong spring winds require protection at critical periods.

Growing Legumes For Nitrogen

(*From page* 22)

1,000 pounds of a 5-4-10 fertilizer. It is stated by Roberts that it will not take many crops of clover to so deplete the available mineral matter in the soil as to reduce production seriously unless some is added.

It is difficult to determine just how much nitrogen a legume gathers from the air and how much from the soil under ideal conditions. One authority assumes that two-thirds comes from the air, whereas, the Wisconsin Station estimates that only 14 per cent of the nitrogen contained in well-infected soybean plants is secured from the air. Another experimenter states that the amount of plant food which wheat under present systems of tillage secures from clover roots and stubble left in the soil has usually been exaggerated. It is probably true that the roots of clover contain about one-third of the nitrogen contained in the entire plant, but in the case of soybeans and cowpeas the amount of nitrogen in the roots is about one-tenth of the total amount in the plant.

When a crop such as clover, vetch, or cowpeas is turned under, the increase in the following crops may or may not be great enough to pay for the hay lost, according to the 1938 Yearbook of the U. S. Department of Agriculture. However, it should be taken into consideration that the green manure may have a marked effect on yields of subsequent crops for two or more years. This residual effect may be due in part to the improved mechanical condition of the soil and the gradual release of nitrogen as decay of the organic matter progresses, but other factors not yet understood are no doubt involved. Earlier writers agree with this opinion, that the beneficial action of clovers is due quite as much to their action on the physical condition of the soil as to the amount of available plant food which they bring to the land.

Based on the above discussion it is evident that legumes themselves are not nitrogen-raisers, and under some conditions they may decrease the nitrogen in the soil and leave it poorer than when the crop was planted. In any case if the crop is cut for hay or grazed, there is no gain in nitrogen but the amount is about maintained. On rich school standards. The author's many years' experience in extension work has given him an intimate knowledge of farmers' problems, providing an excellent background in preparing a book for use by those who are farming, or will farm in the near future. For those who have not had a course in chemistry, a section presenting the essential information needed to understand the necessary chemical phases of soils and fertilizers is included.

While Professor Worthen covers agriculture in all parts of the country, emphasis is placed on the agriculture of the Northeast, and the corn and wheat belts of the Midwest. He appears to have been rather conservative in presenting some of the newer ideas on fertilizer placement, and on soil and tissue testing as a guide to fertilizer needs. Considerable exception might be taken by some of the fertilizer suggestions of the author, but he repeatedly tells the reader to consult his local authorities for the latest information on fertilizer recommendations for any particular locality. An unusual number of cross references are given in the book, a procedure which is of great help and value in getting together information on a subject, all phases of which cannot well be considered in one place in a book.

Much attention is given to the proper use of manure, green manure, and cover crops, especially legumes. The fundamental importance of these in a system of soil management to maintain and build up the fertility of the soil fully warrants the repeated references to them. They are particularly timely in view of the present shortage of chemical nitrogenous fertilizers and the necessity of obtaining from the air as much nitrogen as practicable by the growing of leguminous crops.

Managing Mucks Includes Control of Blowing

(*From page* 17)

may be placed farther apart. The oats must be removed as soon as the danger of blowing is passed. Otherwise, a row of onions on each side will be delayed in growth and the yield reduced accordingly. Rye can be used, but it would have to be planned for and seeded the previous autumn.

Cedars and other evergreens have been used but, because of slow growth, these trees are less desirable than basket willow. The cottonwood has been used to a limited extent. It may be held down by cutting, but the cottonwood appears subject to the same objections as the tree type of willow.

Burlap has been used on snow or other fence. Because it essentially stops the wind, the burlap may cause drifting or the wind may cut out the muck under the fence. It is better in some areas to omit the burlap and place the snow fences closer together. Moreover, burlap is unlikely to be available during the war.

Newly cleared mucks usually undergo little blowing for a few years. With continuing breakdown of the coarser material and decomposition of the muck, blowing becomes more prevalent. After onions and other crops a winter cover of rye, wheat, oats or barley may be sown in time for a good fall growth. Such cover will protect the muck against blowing during any periods in winter when the muck is dry or bare and frozen. If time will permit spring growth before plowing, rye or wheat should be used because ordinary oats and barley are winter-killed. Even so, they would protect the soil against winter blowing. Winter oats or barley should be useful in the sections where

Fig. 6. Steers Make Excellent Gains on Clover Pasture. This pasture produced 330 pounds of beef the first year it was established. The clovers were seeded on an established carpet-grass pasture without disturbing the sod. The soil was fertilized and the seed was heavily inoculated and re-inoculated.

calcium, and one and one-half to three times as high in phosphorus, potassium, and protein. It is known that the chemical composition of plants is affected greatly by fertilization and growth stage. These relationships of chemical constituents of clover and carpet grass are given on the basis of fertilized plants harvested in a vegetative growth stage.

The good cattle gains on a clover-carpet grass pasture may also be attributed to the effect of clovers on the nitrogen content of the associated grasses. Table 2. The average protein content of carpet grass in the absence of clover during August was as low as 7.23% as compared to 9.89% protein in the presence of clover. Carpet grass is generally higher in protein in the spring, thus the increased protein content of carpet grass growing in association with clover is especially significant.

The grasses growing in association with clovers were stimulated greatly due to the nitrogen supplied to the soil by the clovers. Although clovers made most of their growth during the period of February to June, the effect of clover on stimulated grass growth was still evident in September and October. The

TABLE 2.—LIME AND FERTILIZER PRODUCE GOOD CLOVER GROWTH AND INCREASE THE PROTEIN CONTENT OF CARPET GRASS*

Fertilizer Treatment		Per cent Protein in Carpet Grass**	Clover Growth
1937	1939		
No Fertilizer	....	7.23	Very poor
600 lbs. 0–16–8	½ initial	8.19	Poor
1 ton lime and 600 lbs. 0–16–8	½ initial	9.48	Very good
1 ton lime and 600 lbs. 0–16–8	¼ initial	9.89	Very good

* Clover grew primarily during the period of February to May, 1940; Carpet grass was plucked for analysis on August 6, 1940.
** The mean differences are highly significant according to the "F" test.

soil the plants draw their nitrogen from the soil, thus depleting the soil of a large amount of this important element. Legumes not only may draw upon the nitrogen in the soil, but they are heavy feeders upon the minerals such as phosphorus and potassium. Bacteria will not thrive on soils of an acid nature, thus intimating that on acid soils lime should be applied.

It might be better on soils rich in nitrogen to seed a non-legume crop that will furnish more tonnage of green matter than legumes. Such a crop is field corn which contains, in a green state, 6 pounds of nitrogen, 2½ pounds of phosphoric acid, and 9 pounds of potash per ton. Two crops of corn can be secured from a field yearly. Yields of from 25 to 40 tons of green corn per acre are not uncommon. Domestic rye grass is another crop that can well be seeded on rich soil as due to its habit of growth it develops a large amount of roots and penetrates the soil to a considerable depth.

The following suggestions are offered as to the handling of clover or a perennial legume crop when seeded as a soil-improving crop: Turn under the entire crop or cut it early and let lie on the ground when a second crop will grow up through the first one, thus adding more weight of green matter to turn under; inoculate the seed so as to insure the presence of the proper bacteria; apply mineral fertilizer such as an 0-14-14 or similar analysis (under some conditions at seeding time it might be well to apply a small amount of nitrogen in addition to the minerals); if cut for hay and fed to livestock, be sure that the manure is properly handled and that it is returned to the land.

NUTRIENT CONTENT OF SOME LEGUME CROPS

Crop	Yield	Part of Crop	N lb.	P_2O_5 lb.	K_2O lb.	Total
Alfalfa	3 tons	All	140	35	135	310
Sweet Clover	5 tons	All	185	45	165	395
Red Clover	2 tons	All	80	20	70	170
Cow Peas	2 tons	All	125	25	90	240
Soy Beans	2 tons	All	100	30	60	190
Lespedeza	3 tons	All	130	30	70	230

NOTE: Legumes can obtain the greater part of their nitrogen from the air, but a large part of the lime, phosphorus, and potash required may need to be supplied in commercial fertilizer.

Clover Pastures for the Coastal Plains

(*From page* 10)

1941, these two clover pastures were refertilized with 300 pounds of 0-16-8 fertilizer but were not reseeded. Beef production this season is much higher than during the first year.

The vigorous clover growth of these pastures is shown in Figure 6.

The remaining two carpet-grass pastures were fertilized with 400 pounds per acre of an 8-8-5 fertilizer in the spring of 1941. These two carpet-grass pastures, without clover, produced an average of 118 pounds of beef per acre in 1941.

The high gains of steers grazing on the clover-carpet grass pasture may be attributed primarily to the quantity of feed produced (Fig. 7) and to the high calcium, phosphorus, protein, and vitamin content of clover as compared to carpet grass. The relative chemical composition of carpet grass and white clover shows that clovers are approximately three to four times as high in

In conclusion, we believe, if growers will pay more attention to these points, they will have more success with Indiana Sweets.

1. Grow sweets in clean, sandy, fertile soils.

2. Guard against wilt and black rot.

3. Grow Yellow Jersey Varieties.

4. Use plenty of potash for chunky sweets.

5. Follow a careful insect control program.

Much of the material for this demonstration is based upon Purdue University Extension Bulletin No. 204, "Sweet Potato Production."

The Farm Front

(*From page* 5)

the local boards will make final decisions, but what is the nature of the official orders they will receive on the question of drafting the remaining rural youth?

It's also true that contractors engaged in military projects like to hire competent farm boys, and this winter in many defense areas older men as well as youngsters will respond to the urgent call, reinforced by wages beyond the ken of any besides bonanza farming.

Another problem which will be more evident as time goes on is transportation —"hauling" as farmers call it.

Go out along any country road in the most productive farm sections and hunt for horses. Yes, there are a few, but mostly old ones. Possibly in the cattle country we might save the less valuable bull calves from the bologna market and turn them into patient oxen. The absurdity of such nonsense may later seem different, if this holocaust keeps on five or ten years. Even the deep South with its sturdy and dependable mule crop cannot escape the transportation dilemma.

If you take a census of the farm trucks, the light ones used for produce, the result will show two-thirds of them ten years old or older. Repair parts for those relics are hard enough to get in normal times. And you can't run on rims, either.

Agricultural truckers are already trying to curtail cross-hauling and needless competitive routing, and farmers are going to assemble stock for central pickups. It's not so tough a proposition perhaps with livestock hauling as it is with the more frequent and pressing transportation of perishables like milk, vegetables, and fruit. Milk especially stands out as a sore thumb in the outlook for successful delivery of dairy products from cow to consumer during the next two or three years.

There's just one crumb of comfort to us on this milk hauling problem. Measures are under way to cut out the farms of those slackers who never have and seldom will produce the quality wanted at the country receiving station. But it's a grim and grisly kind of retribution, awful close to home for comfort. Even Grade A milk may beg for a ride before it's over.

Transportation to get the throngs of defense workers to their jobs and home again is matched in the country zones by the threat of irregular deliveries to market of the nation's victuals and vitamins. In neither case do price ceilings play a fundamental part toward a true solution. Union wage scales on one hand and parity levels on the other also fail to answer the transportation bogy.

Given three years more, a major share of the present farm equipment inventory will be costly to maintain in working shape and often risky to operate as well. Add this up beside the hauling obstacles and you begin to wonder if Leon Henderson has the last word after all with his spiral theory.

Farmers hate and fear inflation too but frustration faces them first. They doubt their ability to keep up modern production volume and variety if they are obliged by stern circumstances to grass grown in association with clovers also maintained a much greener color than the grass grown in the absence of clovers. The fact that clover greatly improves the nitrogen content of the soil and the increased growth of carpet grass is shown in Figure 7.

In conclusion, the need of legumes for improving pastures should be emphasized. To grow pasture legumes fertilization, inoculation, seedbed preparation, date of seeding and fertilizing, management, and planting of adapted varieties are factors that must be carefully considered.

Pastures should receive as much consideration as field crops. Properly managed pastures are profitable pastures.

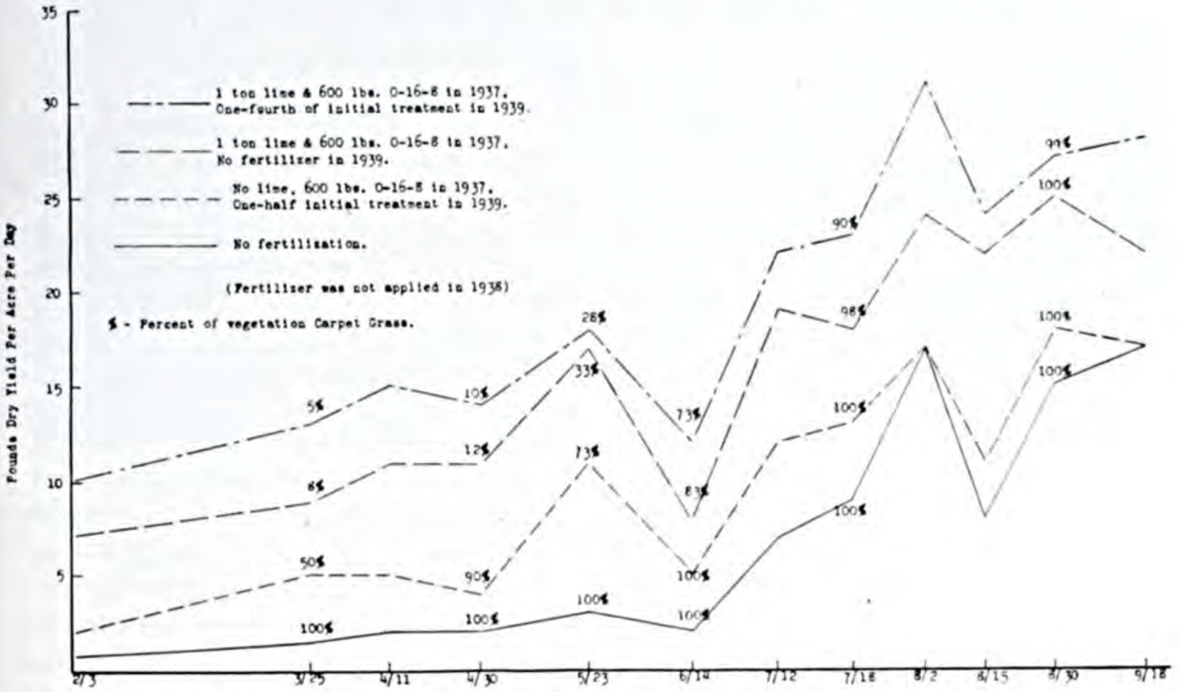


Fig. 7. Seasonal Growth Curves of a White Clover Carpet Grass Sward and Percentage of Carpet Grass When Variously Fertilized. Lime and fertilizer produced excellent clover growth and the yields were increased greatly by refertilization. Clovers stimulated the carpet grass growth greatly. First clippings were made on March 25 and growth curves were computed beginning with February 3.

Insuring Success With Indiana Sweets

(*From page* 13)

According to these yields one- and two-inch rooted stems showed very little difference while the longer rooted stems gave an increase of about 25 per cent over the short rooted stems.

The least time lost between pulling the plants and setting them in the soil means less setback and greater livability after the plants are in the field. When plants have to be transported to distant fields, their roots should be puddled in mud and water to protect them from drying out.

Of late years some troublesome insects have caused considerable damage to the newly planted crop by eating the foliage. Control in the field is expensive and unless an insecticide is properly applied to both sides of the leaf, it is of doubtful value. In order to control stem rot the practice of dipping the roots up to the first leaf in a solution of Spergon is recommended. This solution is made by combining 1½ oz. of Spergon with 1½ gallons of water. This treatment is effective, as proved by the Kansas Experiment Station.

When setting the plants, care should be taken not to set them too deep or too shallow. The use of a sharp stick or "puncher" will make planting much easier when planting by hand, or the plants may be set with a plant-setter where large acreages are grown.

The boys in Australia sent us this one. A mother Kangaroo had patiently scratched her stomach three times, but when the process was to be renewed a fourth time, she snatched two baby Kangaroos from her pouch, spanked them, and said: "How many times have I told you not to eat crackers in bed!"

He: "I never knew love was like this."

She: "Neither did I. I thought there were more chocolates and flowers to it."

Toastmaster (introducing the speaker): "I'm sure that Mr. Jones of the Soils and Fertilizer Department, will give you a pleasant half-hour. He is just full of his subject."

A young lady, with a touch of hay fever, took with her to a dinner party two handkerchiefs, one of which she stuck in her bosom. At dinner she began rummaging to right and left in her bosom for the fresh handkerchief. Engrossed in her search, she suddenly realized that conversation had ceased and people were watching her, fascinated.

In confusion, she murmured, "I know I had two when I came."

A bachelor is a man who never Mrs. anything.

CATASTROPHE

Lone chick, taking a look around the electric incubator full of unhatched eggs: "Well, it looks like I'll be an only child. Mother's blown a fuse."

Sufferer: "I wish I had some drops to cure this toothache."

Friend: "It's all a matter of the mind, not medicine. Yesterday I was feeling terrible. But when I went home my wife put her arms around me and kissed me, and consoled me, so that I soon felt better."

Sufferer: "You don't say. Is your wife at home, now?"

A young candidate for the navy was being put through a general knowledge test by a board of admirals.

"What kind of animals eat grass?" one of them asked.

The candidate fidgeted and stared out of the window, but said nothing. The question was repeated but he still remained dumb.

"Surely," said one of the examiners, kindly, "you can answer a simple question like that? I will repeat it. What kind of animals eat grass?"

"Animals!" gasped the boy, "I thought you said 'admirals'."

And then there was the cow which after jumping the barbed wire fence said, "I'm udderly ruined."

gear themselves to the moss-grown horse n' buggy days. This worries them more than parity prices.

It strikes me that when we holler at each other now about price relationships and advantages and disadvantages, it only gives aid and comfort to spies and enemies. The right track to follow is to direct energy toward helping solve the labor and transportation problems, so that whatever we can produce will be delivered without vexatious bottlenecks.

We've never raised crops during a war under such threats of a stall. Back in the last world war farmers used horsepower more than motorpower, and before it was over, they released some soldiers to come home at harvest time. Industrial wages at that time presented no such competition for the farm.

If folks won't accept farmers' word for what they are doing, then maybe it will be easier to show them what farmers aren't doing.

They are not neglecting the progressive technical side of their profession. The demonstrations and field tests as well as the more useful recommendations made by agricultural extension specialists are still taking deep root.

Unlike some other vocations, the farmer puts a vast amount of pride and enjoyment into producing food. Bumper crops which are not taken out without serious drain on the basic soil fertility remain to the farmer a joyous reward in themselves. To achieve skill in any task or to learn better and quicker ways of accomplishing age-old duties is yet a source of immense, quiet satisfaction to agricultural stewards.

Farmers are not becoming wild-eyed and radical, chasing after some false fetish or listening to agitators.

On the contrary they are minding their own business, being far more perplexed over routine inside the fences than outside. In my State the main assemblies since the war started have centered around getting data on means and methods of greater production, where local committeemen of the war boards were the leaders.

But the best way to drive farmers back into the arms of agitators is to give them the fishy eye of distrust and the malicious slings of criticism for being profiteers. Right now, when so much unfair mouthing is heard in this line, there are lurking organizers trying to capitalize on discontent and frustration so as to gather the farmers into their political pressure group.

Farmers are becoming more than ever a stay-at-home people. With labor extra scarce and work multiplied, plus the rubber famine, our farmers are bound to rely on their communities for more social and spiritual vigor without seeking it in larger and wider fields.

This simply means that unless city folks go out and meet them and talk over problems of the country heart-to-heart with them, a situation will be created that magnifies mistrust.

True, there are vocal leaders in high places and in centers of legislation who presume to represent the farmers and vouch for their opinions on sundry things. But my rule has been seldom to be satisfied that a certain attitude attributed to farmers was the right slant until I followed some grassy lane to interview some old rural friend.

His answers are always carefully weighed and given without heat or rancor, patiently and calmly, as customary with a man who is able to nurse a new-born lamb or kill a chicken hawk with the same casual eye for right and wrong.

Those who really get to know our rural people cannot sit idly by and hear anyone discredit them or ask them to bear the brunt of national adjustments. This is probably why I wrote this theme at this particular time.

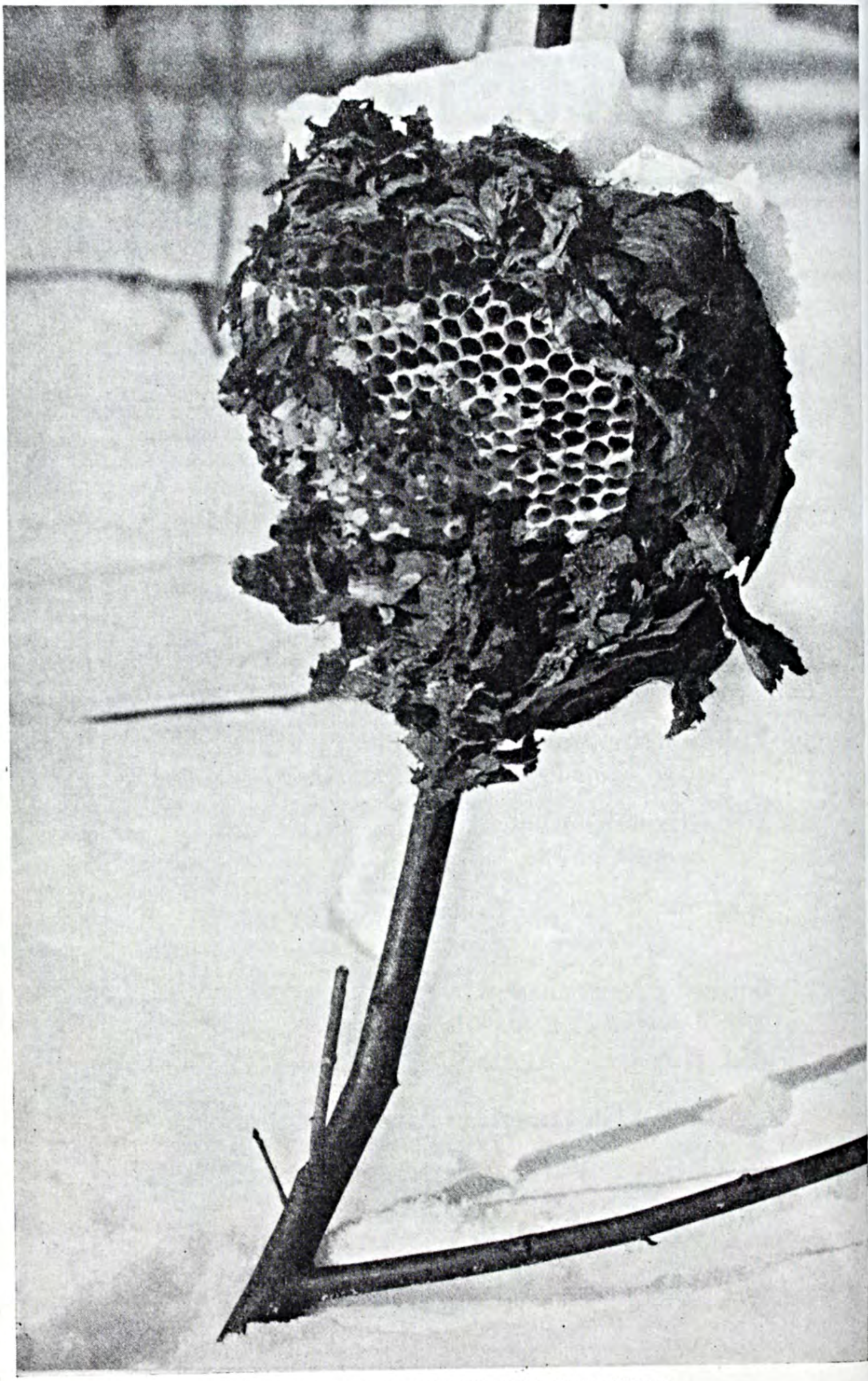
But I expect it's mostly wasted, like the preacher talking to crowds of saints while the sinners are absent. My traditional readers are not the ones who have cast the rocks at the ruralites. Yet let's shake hands all around on it because of similar sentiments and do our durndest to correct wrong impressions that foment class prejudice. If we all do it, the tide may turn.

Printed in U.S.A

Better Crops with PLANT FOOD

November 1942 10 Cents

The Pocket Book of Agriculture



NO TENANTS NOW—DUE TO FUEL RATIONING?

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI NUMBER 9

TABLE OF CONTENTS, NOVEMBER 1942

The American Potash Institute
Incorporated

American Chemical Society Building, 1155 16th Street, N. W., Washington, D. C.

J. W. TURRENTINE, *President*

amount of coffee and sugar, and to do without as much electric light, fuel oil, and gasoline as I know I am entitled to as a leading member of the arm-chair combat squad.

Yet I am more particularly anxious that my neighbor Jones get a lift out of this. He is not by any degree the moral philosopher that I am. Although he is a few years older, he has seemingly forgotten the mud he waded through right in front of his family ramshackle; the shameful old nag he had to curry off and hitch up with frayed harness twice a day; the length he allowed his matted locks to dangle as a boy; the dirty lamp chimneys around his house, and the huge oak logs he had to buck up in the wood-shed—or get something else in that same locality.

Despite those devilish backgrounds, he sets himself up as a constant and irritating critic of all current administrations, township, county, state, and nation. He scribbles long *bono publicos* in a bone-headed way to the "local distorter." They appear mixed up with the want-ads and the obituaries and make me snort worse than hay fever.

BY CONTRAST, I am quite resigned to rationing, because it is little enough for us to undergo when so many of the younger generation are paying the utmost price for any liberty we ever dished up to them.

For if worst comes to worser, I can run the reel backwards and relax once more amid those bucolic indoor winter diversions that were our chief solace and delight in days (and nights) of yore. A man like Jones lacks the courage and imagination to do likewise—although I often suspect his folks indulged in nothing more amusing than making faces at each other.

Families in my time were shut-ins compared with the gadabouts we see so little of in modern home circles. Ninety per cent of our time was either spent in the household environs or visiting with the neighbors close by us. Except for lodge nights and prayer meetings, everybody stayed around the hearth after the supper dishes were done.

I REMEMBER the first nickelodeon or movie house that opened in our town, using an old pool hall for its initial run. Even though the admission was only five cents, the program was so short that few wanted to invest that much, besides the energy it took to hike downtown again. The illustrated songs that one had to stand for at the end of each jumping, flickering, and spotty film produced such a low state of mind bordering on morbid frenzy as to thin out the customers.

Prior to that, the nearest we had come to public enjoyment of shadow pictures was when the husky twin evangelists hit their stride in our town, bringing along a full set of colored slides portraying the consequences of sin. These big twin preachers were the life of our hamlet for two months, and they were so masterful that their sermons and songs attracted the worst converts that the town boasted. They wore black sideburns and heavy gold watch chains, clerical bow ties and double-breasted swallow-tail coats. I won't give their denomination because even at this late and worldly period it might make some loyal devotee mad to know how easily those sky-pilots led the oldest members of rival pulpits into their seances.

Anyhow their weekly climax came with the baptism of previous grists of mourners. They had a big bathtub affair rigged up back of the rostrum and led the cringing victims down into it in their best underwear, to the tune of "Happy Day, Happy Day". We kids used to snuggle up on the carpet of the front aisle so as to watch the performance.

All went well enough until they tackled Burly Brown, the town drunkard, weighing nigh onto a fifth of a ton. When they doused him into the pool he hollered that it was an insult to surround him with so much water,

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., NOVEMBER, 1942 No. 9

Consider and give . . .

Thanks For A Little

Jeff McDermid

IT'S NICE to look back and count over the small things, which were really big things, that we used to be thankful for as winter set in around our hearthstones. Especially now, when we are so apt to be disdainful of what was then the keynote of comfort and the acme of perfection. In other words, what would amount to a stiff rationing of modern necessities to us in these high standard days would in our youth have been like those wondrous pages of Jules Verne—something to be marveled at and put aside as figments of the over-wrought imagination.

If I thought similar reading matter in reverse might do some good to the up-and-coming generation which is so surfeited with magic in ordinary life, then I would hand them my well-thumbed copies of Hoosier Schoolmaster and Mark Twain's Gilded Age.

However, I fear such gestures would unhappily be futile. The strata of our population that is doing the world's heavy work and bumptious bombing is not in any mood to scrape the bottom of old barrels or grope in dim crannies by candlelight. Their desire is to go forward with a firm stranglehold on the blessings of invention and discovery so as to open even broader and more glamorous vistas for their children and the great days ahead for liberty and democracy—or something equally stirring.

Yet this persistence of theirs for progress and the green light on full speedways need not deter me from doing a bit of homely philosophizing here in my own humble inglenook. For one thing, it is bound to put me in a better humor to part with my usual

Fig. 1.—Fertilization stimulates common lespedeza growth on a Leon fine sand, Gainesville, Florida. Left to right: no fertilizer; lime and potash; lime and superphosphate; superphosphate and potash; and 1,500 pounds lime with 450 pounds 0-16-8, all inoculated. Right: properly fertilized, but not inoculated.

Lespedeza Pastures For Florida

By R. E. Blaser

Florida Agricultural Experiment Station, Gainesville, Florida

THE utilization of legumes in pastures increases the quality and quantity of feed and serves as a cheap source of nitrogen. Coastal Plain soils are especially low in nitrogen, thus stressing the need of a legume-grass pasture.

Annual lespedezas are generally considered to be adapted especially to the heavier textured soils. Tests were started in 1938 to study the possibilities of growing them on sandy soils. Experiments were designed to study soil series, fertilization, inoculation, seeding date, and varieties as related to growth. These experiments disclose that certain varieties of lespedeza do grow satisfactorily in Florida, provided that suitable soils are chosen and the proper fertilization and seeding techniques pursued.

Annual lespedeza has volunteered in pastures and along roadsides on the heavy textured soils or soils underlaid with clay in western Florida for many years. It is thus thought that lespedeza is adapted especially to clay soils. Only sparse and occasional stands of lespedeza occur naturally on sandy soils of Peninsular Florida.

Lespedeza variety and fertilizer tests show that the low, imperfectly drained, sandy soils of the flat pinelands (Leon, Plummer, Bladen, Bayboro, Portsmouth, and St. Johns) are suitable from the standpoint of moisture for growing lespedeza. These sandy soils with five or more inches of a dark surface layer (high in organic matter) are especially desirable for growing lespedeza. The higher organic matter soils are preferable because they have a higher moisture-holding capacity, thus furnishing moisture during the critical dry period in May and June. Organic matter also enhances the base exchange capacity of soils which reduces leaching of minerals.

Tests show that annual lespedezas

and he spat and struggled so lively that the second twin had to drop his hymn book and dive in to save his brother from suffocation. Burly had the first twin down, you see. There was water everywhere in the church and the wall paper was splashed so bad they had to do the job over. Folks going by said they thought the dam had burst, and

those inside who heard Burly's remarks must have thought so, too.

That protracted spell of religious fervor was the neatest bit of wholesome entertainment we ever had in our town while I was a kid. No circus ever touched it for variety, and with a circus you had to pay admission or stay outside.

Because the Office of Defense Transportation promises us the greatest stay-at-home winter we have had in these parts since my youth, a review of what we innocents did with our homework in the long gone years may be of passing value.

I doubt if much of my category of diversions will be adopted owing to the existence of the telephone and the radio. This is a resonant and talkative age, and sound waves travel so much farther and are caught up so much more potently than they were when lung power and a favorable atmosphere were the mainstays of long distance communication.

Casual or light and the deep or purposeful reading were, of course, our chief amusement. Nowadays, I hesitate to risk my reputation as a keen observer by saying whether the lovers of fun and fiction exceed the ones who revel in theses and formulas. That is like saying that the frivolous outnumber the profound in our generation today. Just as I make up my mind about the matter I run against a snag.

For instance, my daughters know every movie star and radio band by heart, and they keep alive to the popular songs and modern dances. When they find I am at sea in that regard, they are apt to switch the talk to a statistical or mathematical problem, or discuss some abstruse text in physics or chemistry, and expect me to brighten up and take some part in the hefty discussion. Still finding me silent and reticent for very obvious reasons, they try again to make me feel comfortable and ask me if I care to argue the merits of certain tennis players or golf champions. I usually get out of the mess by excusing myself to finish another erudite essay on the state of the nation and what ails the world. (All good columnists need an educated family to do the reading while they are writing.)

Getting back to the old home circle, I confess none of us were systematic students in our leisure hours—at least only so far as brief preparation for school condemned a few juveniles to literary prisons, temporarily. Unlike my parents, who could recite long stanzas from McGuffey's Readers and speak pieces from Webster's Speller, I cannot recite even the names of the classroom texts I was doomed to study and forget. On the contrary my memory clings to the daring and delightful, the imaginative and inspirational, the romancers and the humorists, the travelers and adventurers. Their pages were perused with fervor and laid aside with deep reluctance as nine o'clock arrived and the last chunk was put into the stove and the clock was wound by a yawning father.

And pray, what manner of authors and characters were they who intrigued me, even as the gaudy hero-comics seem to fasten themselves upon the youngsters in this age of marvels? The

(*Turn to page* 43)

Lespedeza also made satisfactory growth when treated with one-half to one ton of basic slag and 36 pounds K_2O or with 500 pounds basic slag, 1,500 pounds of lime, and 36 pounds K_2O.

The best fertilizer treatment for perpetuating lespedeza is not yet known. Lespedeza treated with 1,500 pounds lime and 450 pounds of 0-16-8 fertilizer the initial year produced good growth in the two subsequent years when treated with 18 pounds K_2O or 225 pounds of 0-16-8 fertilizer. Potash should be applied every year on sandy soils. Recent results also show that the

Fig. 3.—Phosphorus-deficient plants and leaves as found when fertilized with a mixture of 1,500 pounds ground limestone and 36 pounds K_2O per acre are shown on the left and center of photograph, respectively. Normal growth resulted when 72 pounds of P_2O_5 per acre were supplied (right). Phosphorus-deficient lespedeza plants which occurred in the presence of potassium and calcium fertilizers on a Leon soil are dwarfed in size with short branching stems. The branching stems and leaves are clumped closely to the main stem in an erect position, as shown on left of photograph. Center shows phosphorus-deficient leaves which are dwarfed in size and vary from a very dull, dark green to a distinct purple and purplish green color. Low center shows a phosphorus-deficient leaf which is purplish in color and possesses dark purple mid-veins and petioles. Lower right shows normal leaves, which are light-green in color with white mid-veins. Without fertilization phosphorus deficiency occurred, but the leaves were yellow with purple veins and margins.

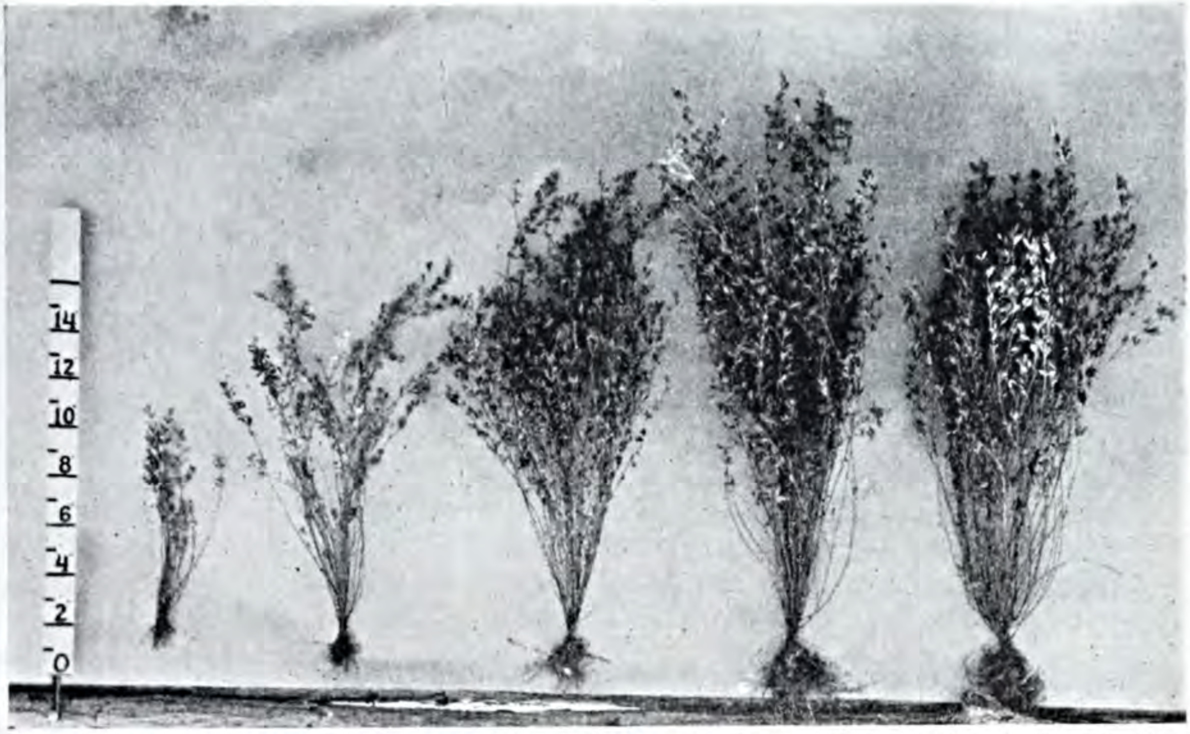


Fig. 2.—Kobe lespedeza growth with fertilizer mixtures on a Plummer fine sand, Orlando, Florida. Left to right: lime and superphosphate; lime and potash; superphosphate and potash; 1,500 pounds of ground limestone and 450 pounds 0-16-8; and 1 ton dolomitic limestone and 450 pounds 0-16-8.

generally fail on the well-drained sandy soils because of drought and injury due to nematodes.

Fertilizer tests were made with lespedeza on Leon fine sand at Largo, Gainesville, and Dinsmore; on Plummer fine sand at Orlando; and Bayboro fine sand at Gainesville. These tests were designed to study rates, mixtures, sources of fertilizers and also varieties, planting date, and inoculation on growth of lespedeza.

Typical lespedeza growth on two tests on sandy soils with several lime and fertilizer mixtures are shown in Figs. 1 and 2. Inferior stands and growth occurred on both soils without fertilization. The best growth of lespedeza was obtained when treated with 1,500 pounds of lime and 450 pounds of 0-16-8 fertilizer per acre.

When superphosphate was omitted from the lime and fertilizer mixture on the Leon fine sand near Gainesville, the lespedeza plants were dwarfed and had purplish green leaves with purplish veins. These phosphorus-deficiency symptoms are described in detail in Fig. 3. Without fertilization the lespedeza plants were also deficient in phosphorus, but the leaves were yellowish with purplish veins. The lack of phosphate fertilizer on stand and growth of lespedeza on the Plummer fine sandy soil near Orlando is shown in Fig. 4.

Potassium proved to be important on all soils studied. When a lime and superphosphate mixture was used without potash, the lespedeza plants were dwarfed and had mottled yellowish leaves with burned leaf edges (potassium-deficiency symptoms) as described in Fig. 5. The potassium-deficiency symptoms have occurred on all sandy soils studied.

Dolomitic limestone was used in place of ground high calcic limestone with the superphosphate-potash mixture on three soils. Either source of lime was found satisfactory, but the growth was somewhat superior when ground high calcic limestone was used.

Rock and colloidal phosphates applied at 3,000 pounds per acre with 36 pounds K_2O produced good lespedeza growth (Fig. 6). Tests show that rock or colloidal phosphates applied at the rate of 1,500 pounds per acre with one-half ton of lime and 36 pounds K_2O also produces good lespedeza growth.

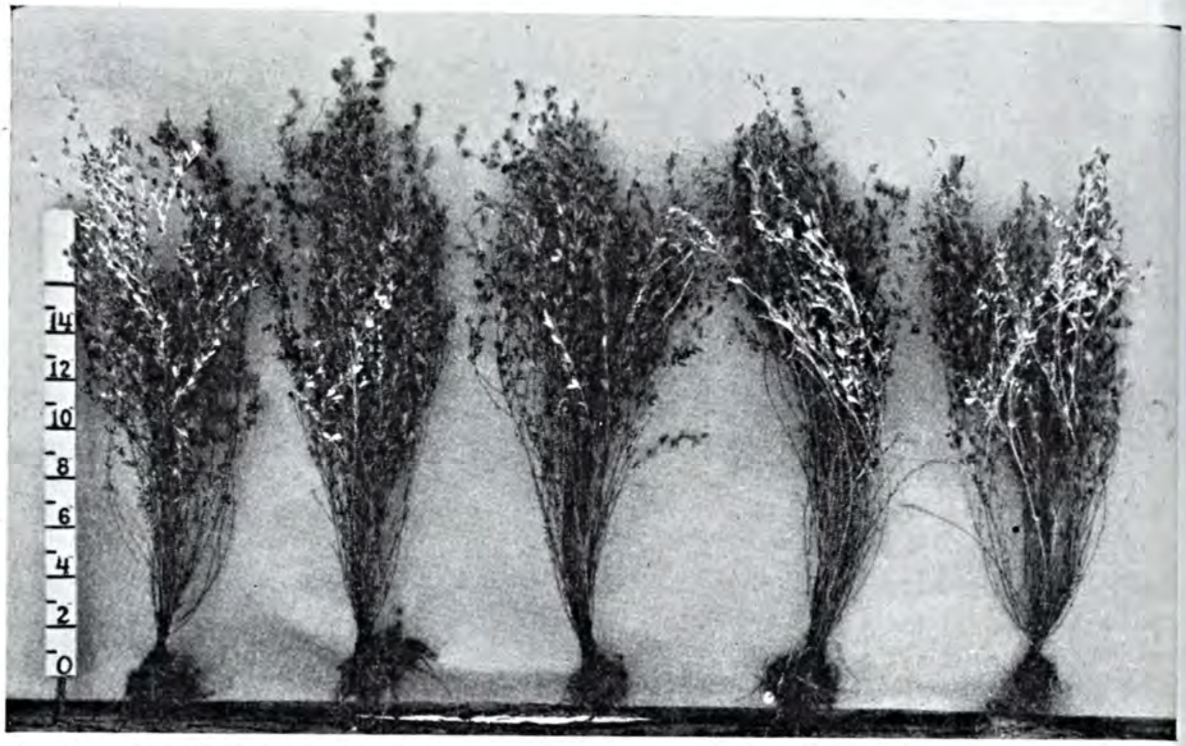


Fig. 6.—Lespedeza shows that high rates of rock phosphate, colloidal phosphate, or basic slag supply phosphorus and calcium needs. Kobe lespedeza plants typify fertilizer treatments:—left to right—(1) 1,500 pounds ground limestone and 450 pounds 0-16-8; (2) 4,500 pounds rock phosphate and potash; (3) 3,000 pounds rock phosphate and potash; (4) 3,000 pounds of colloidal phosphate and potash; and (5) 1,000 pounds basic slag and potash, all rates per acre. From Plummer soil series near Orlando, Florida.

the Leon fine sand, phosphorus stimulated nitrogen fixation, as evidenced by increases of phosphorus content of lespedeza and accompanying increases in nitrogen content.[1]

Four lespedeza varieties, namely, Kobe, Korean, Common, and Tenn. #76, were tested on several soils with various fertilizer mixtures. Common, Kobe, and Tenn. #76 made satisfactory growth and reseeded satisfactorily when grown for hay. Kobe lespedeza furnished higher yields than the other lespedeza varieties when grown for hay. Since Kobe does not tolerate as close grazing as Common, a 50/50 mixture

(*Turn to page* 41)

[1] Deficiency Symptoms and Chemical Composition of Lespedeza as Related to Fertilization, Jour. Amer. Soc. of Agron. 34:222-27, 1942, Blaser, R. E., Volk, G., and Stokes, W. E.

TABLE 1.—CHEMICAL COMPOSITION OF LESPEDEZA AS INFLUENCED BY LIME AND FERTILIZER MIXTURES DURING 1940

Leon Fine Sand, Gainesville, Florida

Fertilizer Applied, Lb./A.	Calcium Per cent	Phosphorus Per cent	Potassium Per cent	Protein Per cent
450# 0–16–8	.928	.154	.293	13.6
Lime and 450# 0–16–8	1.014	.175	.378	15.8
Lime and 75# Potash	1.071	.115	.354	12.3
Lime and 450# Superphosphate	.889	.200	.223	14.9
No Fertilizer	.571	.122	.311	11.5

Fertilizer and lime were applied in 1939.
Lime—1,500 pounds ground limestone per acre
Potash—(50% K_2O)
Superphosphate—(16% P_2O_5)
The mean differences for treatments in calcium, phosphorus, potassium, and nitrogen content are significant as computed by the "F" test of the analysis of variance method.

Fig. 4.—Balanced fertilization improves stand and growth of common lespedeza on a Plummer fine sand. Left: poor stand when treated with 1 ton of lime and 36 pounds K_2O. Right: treated with 1 ton lime and 450 pounds 0-16-8.

potash fertilizer in initial and subsequent applications of fertilizers might well be increased.

The use of fertilizers involves two primary objectives, namely, increased productivity and improved quality of forage. The latter is often more important than the former.

Although lespedeza is a legume and considered to be an excellent feed, its mineral and protein content were augmented greatly by fertilization. The chemical analysis of lespedeza grown with certain fertilizer mixtures on Leon and Plummer fine sands are given in Tables 1 and 2. Application of lime, superphosphate, and muriate of potash resulted in significant increases in calcium, phosphorus, and potassium content of lespedeza on both soil types. On

Fig. 5.—Potassium-deficient lespedeza plants and leaves as found when fertilized with a mixture of 1,500 pounds of lime and 72 pounds P_2O_5 per acre are shown in the upper left and center. Normal growth resulted when 36 pounds of K_2O per acre were supplied (upper right). Potassium-deficient plants were dwarfed in size; and the leaves were generally mottled and greenish-yellow in color, with subsequent burning or browning, starting at tips of leaflets (upper center). Gradual disappearance of chlorophyll and subsequent yellowing typify incipient potassium deficiency.

Corn on the Stroh Farm—that on the left was untreated, that on the right received fertilizer, hill-dropped.

six times greater where the 0-20-20 fertilizer was used, while on September 2 the differences were only two to three times as great. This held true also on the soil represented in Table 2. The plants on the soils without the soluble fertilizers came on slower and were later in maturing.

Comparing the results in these two tables near the end of July, which represents about the beginning of the reproductive or ear-forming stage, the differences in the total amount of plant growth, nitrogen, phosphorus, and potassium were relatively small. There was considerable similarity in growth and composition at this time. The Sparta field, treated with RL-0-20-20, on July 30 had dry matter 212,000, nitrogen 3,140, phosphorus 440, and potassium 2,350 in milligrams per plant. The Stroh farm, treated with 0-20-0, on July 23 had dry matter 175,000, nitrogen 3,810, phosphorus 470, and potassium 4,100 milligrams per plant. Up to this point, these two corn crops were approximately equal. The Sparta soil was very deficient in available potassium and the amount added by the fertilizer was apparently not sufficient to maintain a high content in the corn plant.

A further examination of these data near the first of September showed that the critical period for this corn came during August. The corn plants which late in July were nearly equal in growth and chemical composition were wide apart in these respects by the early part of September. On September 2 the Sparta plants (RL-0-20-20) had dry matter 335,800, nitrogen 3,640, phosphorus 510, and potassium 2,710 in milligrams per plant. Plants from the Stroh farm (0-20-0) on September 5 had dry matter 595,200, nitrogen 9,530, phosphorus 1,370, and potassium 6,220 in milligrams per plant. Apparently, the Sparta soil reserve was largely used by July 30 and the final yield was held down to 36 bushels, while on the Stroh farm, where the reserve of plant food was ample, the corn yield reached the 100-bushel mark.

Lack of reserve plant food at this critical time may be illustrated by another comparison on these two fields. The corn plants on the Sparta soil, treated with RL-0-20-20, by July 30 had taken up 86 per cent of the available nitrogen, phosphorus, and potas-

The Nutrition of the Corn Plant

By H. J. Snider

Illinois Agricultural Experiment Station, Urbana, Illinois

FERTILIZATION of the corn crop probably began with the American Indian when he put a dead fish in each hill of corn and produced a larger yield of grain by so doing. In the light of present-day knowledge, we must admit that this was a rather sound practice, although it was instituted by a race who had, at least temporarily, lost its power for material and spiritual advancement and, consequently, was at a low level of civilization. However, the race of people who has the ascendancy on the continent at the present time is still struggling with the problem of proper fertilization of the corn plant. One phase of the present-day problem is to try to make some of our thin land produce higher yields and to maintain a relatively high productive level on the more fertile soils.

In addition to producing enormous quantities of corn, the corn belt also produces large amounts of pork, beef, and other animal products. This means that a large proportion of the corn is fed on farms and another large portion goes on the cash grain market to be used in the making of various corn products. Whatever is the ultimate use of the grain, the fact remains that each year there is removed from corn-belt land large quantities of corn. Each bushel that leaves the farm takes along its toll of fertility of the soil. In addition, corn is a cultivated crop which exposes the land to destructive erosion for several months each year, which in turn also takes a toll of fertility.

More corn and corn of higher quality may be obtained from each acre and substantial profit may be made from such increase in yield and quality if careful consideration is given the management of the soil. The manner in which soil management affected the composition and growth of the corn plant during its growing and reproductive stages is shown in Tables 1 and 2. The soil represented in Table 1, Sparta Experiment Field, is one of relatively low productivity; that in Table 2, Stroh Farm, is of relatively high productivity. The values used in these tables are necessarily based on a small unit of weight, the milligram (mgm.). The relative smallness of the milligram may be illustrated by the fact that it requires 28,300 milligrams to make one ounce. However, when these data are used as a means of comparison, they may convey a rather vivid picture of the relative uptake of the three important plant-food elements at important and critical stages in the development of the plant.

Total amounts of nitrogen, phosphorus, and potassium taken up by the plant during the early growth up to June 30 were relatively small, although there were large variations in growth and plant composition where soluble fertilizers had been applied on both soils. Apparently, the soluble plant food in the fertilizers was very readily taken up by the young plants and this gave an early advantage in chemical composition and growth. The proportion of this early advantage, or the same ratio in growth and composition, was not held throughout the season. For example, in Table 1, June 23, the amounts of dry matter, nitrogen, phosphorus, and potassium were four to

Fig. 1.—Chippewa potatoes on Iron Age Farms, Grenloch, N. J., fertilized with 1,000 lbs. 5-10-10 by Hi-Lo band method.

Some Experiences in Applying Fertilizer

By S. D. Gray

Washington, D. C.

THE importance of proper application of fertilizer was first impressed upon my memory some 35 years ago. My father, a large tobacco grower and a liberal user of commercial fertilizer, pointed out to me several rows of tobacco to which no fertilizer had been applied and asked me to help him make a stand count. Where no fertilizer was applied, there was almost a perfect stand. On the balance of the field, even though replanted three times, there was scarcely an 80 per cent stand, and that irregular in growth. It was the common practice on most farms at that time to put the total amount of fertilizer in the row at the time the rows were bedded. I persuaded my father to compare this practice with (a) all fertilizer broadcast with grain drill and (b) two-thirds with drill and the balance in the row as ordinarily applied. The results were astounding. Broadcasting eliminated the need for replanting, but plants grew off slowly. Where part of the fertilizer was drilled and part placed in the row the stand was good and plants made more rapid growth and matured earlier. Thus this simple experiment marked the beginning of my interest in fertilizer application, an interest which subsequent experiences as a teacher and investigator have only tended to intensify.

Some years later while at the University of Puerto Rico as soils and crops instructor, further studies were inaugurated on sugar cane, tobacco, Guinea Grass, and Para Grass. The plan briefly was (a) all fertilizer plowed down in preparation of the soil, (b) half plowed down and half after plowing, and (c) all on the surface. In all sium, leaving only 14 per cent to be drawn upon for the ear-forming stage during August. Where superphosphate was added on the Stroh soil, by July 23 the corn plants had used only 40 per cent of the available nitrogen and phosphorus, and approximately 70 per cent of the available potassium. This left the corn with a relatively large reserve to draw on for the ear-forming stage. The success of the corn on the Stroh farm apparently lay in the fact that after the phosphorus deficiency in the soil was made up, there was a relatively large supply of nitrogen and potassium. It was this reserve, available during the ear-forming stage, that brought this corn yield up to a relatively high level.

These data indicate quite strongly that the Stroh soil may soon reach the point where a potash deficiency will limit the corn yields unless this element is supplied.

(*Turn to page* 42)

TABLE 1—TOTAL AMOUNTS FOUND IN CORN PLANTS FROM EARLY GROWTH TO MATURITY
MILLIGRAMS PER PLANT
Sparta Experiment Field 1941

Date of determinations	Soil treatment	Dry matter mgm	Nitrogen mgm	Phosphorus mgm	Potassium mgm
June 23	Residues	3,730	90	9	50
	Res. lime	3,770	130	13	30
	Res. L–0–20–20	18,150	510	50	340
July 30	Residues	57,600	960	130	580
	Res. lime	98,500	1,710	200	800
	Res. L–0–20–20	212,000	3,140	440	2,350
September 2	Residues	134,000	1,230	300	1,080
	Res. lime	250,000	1,910	370	1,750
	Res. L–0–20–20	335,800	3,640	510	2,710

Dry matter represents entire corn plant above ground.
0-20-20 put on 500 pounds per rotation; 200 pounds for each wheat crop, and 100 pounds for corn. All broadcast.

TABLE 2—TOTAL AMOUNTS FOUND IN CORN PLANTS FROM EARLY GROWTH TO MATURITY
MILLIGRAMS PER PLANT
Adolph Stroh Farm, McLean County 1941

Date of determinations	Soil treatment	lbs.	Dry matter mgm	Nitrogen mgm	Phosphorus mgm	Potassium mgm
June 30	None		9,040	300	20	420
	0–20–0	150	39,230	1,150	70	1,710
July 23	None		58,930	1,610	170	2,240
	0–20–0	150	164,450	3,220	310	4,230
	0–20–0	500	175,000	3,810	470	4,100
September 5	None		447,900	6,810	580	4,920
	0–20–0	150	562,800	8,040	860	5,970
	0–20–0	500	595,200	9,530	1,370	6,220

0-20-0 150 pounds hill-dropped at planting time.
0-20-0 500 pounds broadcast before planting time.
Dry matter represents entire corn plant above ground.

Fig. 3.—Excellent stand and growth resulted where nitrogen and potash were plowed under and all phosphorus mixed with soil in the row.

methods of application to the efficient use of potash. Results of official experiments in widely separated areas with varying amounts of potash and numerous crops had not been too encouraging. That many of the negative results of previous efforts to increase the potash content of fertilizers was due to lack of knowledge on how best to apply it has been convincingly shown by more recent experiments and by farm practice where improved methods of applying fertilizer have been employed. There can be no question but that the present interest and status of fertilizer application are attributed to the splendid work of the National Joint Committee on Fertilizer Application.

In my studies with potash, the standard recommended analyses, rates, and methods of application have been the basis in all studies. These have been compared with higher potash analyses, everything else being constant. Parallel to this, equivalent increases in potash have been superimposed on the basic treatment as pre-applications plowed down or disced into furrow slice and as deferred applications. Taken as a whole, this extra potash whether applied before or after planting has given better results than in mixed goods. While the results do not justify the conclusion that separate application of potash is always the best method, they do suggest the need for further studies on methods of application in order to increase the efficiency of all of the major elements in mixed fertilizers. Such studies are now in progress in many states and there is much evidence that present methods of application may soon be greatly modified.

Some recent work carried on in cooperation with the Pennsylvania Cooperative Potato Growers' Association was summarized by the writer in the January 1941 issue of "The Guide Post." Table 1 gives the average yields for the treatments employed for the four-year period, 1937-1940, on 12 farms representative of the important potato-growing areas in Pennsylvania.

Previous trials having shown that potato fertilizers in a 1:3:3 ratio by band method of application had generally out-yielded those in the 1:2:2 ratio, and because we desired information on the efficiency of both extra potash alone and extra phosphorus with potash when disced into the soil, the layout employed of these cases the best results came from plowing down half of the fertilizer, with the balance worked into the soil just before planting. Similar studies were made on turf seeding at the Arlington Experimental Farm in Virginia in 1916. Here it was quite clear that better rooting, greater drought resistance, and improved vigor attended all efforts to incorporate the fertilizer with the soil. These early studies resulted in general acceptance of the deep incorporation principle for turf fertilization, and perhaps in some degree the subsequent intensive pasture fertilization program.

During the five years, 1920-1925, when I was in charge of soils, crops, and farm management instruction at the State Institute of Applied Agriculture at Farmingdale, New York, my attention was directed largely to potatoes. Potato planting at that time involved two operations. First, the fertilizer was applied by use of the Eureka two-row distributor. Second, the potato planter followed, placing the seed in the marked rows and covering them. With this practice, poor stands were general except in years of abundant rainfall during the early growth period. Because of my interest in better instruction, as well as in growing better potatoes at the Institute, field and greenhouse studies were undertaken. The field work was a comparison of the standard practice described above with deep placement of three-fourths of the fertilizer with a disk drill and one-fourth in the usual way. The latter method was significantly better in all trials. In the greenhouse studies flats one foot deep and 30 inches wide were used. Fertilizer was applied at standard rate of application as follows: (1) all mixed with entire soil mass before filling flats, (2) all in row as in standard practice, (3) three-fourths mixed with soil and one-fourth in row and (4) all fertilizer in trenches five inches deep and five inches each side of row immediately after planting. While the differences in yield under controlled conditions were not large or of high significance, it was easily possible to rate the practices in the order of 3, 4, 1, 2.

From 1925 to date, my personal experiences with fertilizer application studies have been almost entirely in connection with my work as an agronomist for the potash industry. From the first, my attention was directed to the problem of studying the relation of

Fig. 2.—This poor stand and retarded growth of tomatoes resulted from row application of fertilizer.

Watch those hands!

Wartime Accidents Endanger Crops

By C. B. Sherman

U. S. Department of Agriculture, Washington, D. C.

ACCIDENTS on the farms loom as a potential menace to production. The danger intensifies as war conditions intensify. Our farmers have proved once again that they can top all records in growing crops. Harvests showed that better crops became best under the spur of war. But among the deterrents, an inevitable increase in farm accidents lurks ahead.

For at the same time that farmers are necessarily welcoming to their fields and orchards hundreds of inexperienced school boys, women used to working only in the farmhouses, and older, unsure people, their machinery and tools are growing old. Repair parts are hard to get, repair men are scarce, and speeded-up farm work on huge war crops means sleepiness and exhaustion, even among the reliable workers and the leading farmers themselves. Meanwhile, the growing lack of civilian doctors and public-health nurses heightens the potentialities of loss.

Besides the worry and family and medical expense that bad accidents bring in their trail, there is always the danger of a lost crop for lack of cultivation, or fertilizing, or spraying, or harvesting—at just the right time. Either a broken back or a badly broken instrument can bring a huge dent in a farm's contribution to Food for Freedom.

Farm accidents are all too frequent at best. Farmers are injured more often, relatively, than workers in other occupations, yet less is done about prevention and safety on farms than in mines and factories. If there are 4,500 accidental deaths among farm workers

TABLE 1.—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.

seemed logical. The results speak for themselves.

In 1942, band method of applying fertilizers to potatoes was compared with three-fourths plowed under and one-fourth in the row (banded) at planting time. Results of this work as well as a comparison of three much discussed potato analyses are presented in Tables 2 and 3.

TABLE 2.—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

* 800 lbs. plowed down, 200 lbs. in bands.

It is interesting to note that with all analyses where the standard method of application was used, the extra potash significantly increased the yield. The low yield for extra potash in Plot 4 is attributed to poor drainage on part of the plot.

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.

At the Hershey Estates at Hershey, Pennsylvania, B. A. Rockwell has conducted numerous experiments with potatoes, vegetable crops, alfalfa, and corn. His results, particularly on potatoes,

TABLE 3.—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

Note: Soybeans and 10 tons manure plowed down.

(*Turn to page* 38)

Boron in Agriculture

By E. M. Kitchen

New York, N. Y.

(Paper presented before Division of Fertilizer Chemistry, American Chemical Society, Buffalo, September 1942)

THE increased interest in the boron-deficiency work has resulted in symptoms of deficiency being described on 34 crops. Most of the intensive investigational work has taken place during the past six years. The early turnip, apple, and cauliflower tests were the forerunners of the table beet, tomato, sugar beet, flax, mangel, celery, cabbage, etc., and most recently of the legume tests with alfalfa outstanding. Red clover, crimson clover, and ladino clover are being checked for response to boron at the present time, but no published information from U. S. stations is yet available.

It does not seem necessary to review the earlier developments of boron deficiency since so much has been published and nearly everyone is familiar with the literature.

One of the important developments during recent years has been the legume crops. While the first work on alfalfa, in this country, was done in 1936, there was a lapse of three years before more work was published. In 1937, Willis and Piland (1) of North Carolina, and McLarty (2) of British Columbia, attributed "alfalfa yellows" to boron deficiency. They corrected the trouble with 5 to 10 pounds of borax per acre.

The symptoms given by the investigators (1, 2) were very similar. The later investigators have found the symptoms to be the same in all sections of the country and in Canada. The yellowing of the terminal growth, shortening of internodes, rosetting of terminal growth, and death of terminal buds are the characteristic symptoms of boron deficiency. The boron yellowing is generally confined to the upper portion of the plant. Potato leafhopper yellowing, according to Colwell and Lincoln (3), is hard to distinguish from boron deficiency yellowing as far as color is concerned. The leafhopper yellowing may give a streaked appearance in which the veins and mesophyll adjacent to them remain green. The yellowing may also take place at the distal portion of the leaf as a "V" in which the apex represents the point of feeding, and the sides are bound by veins extending to the edge of the leaf. In other cases the yellowing may be more uniform, and from this standpoint alone cannot be differentiated from the uniform yellowing of boron deficiency. There might also be a pronounced boron deficiency with little or no yellowing.

The distribution of discoloration is one of the most important factors for distinguishing between the two types of yellows. The leaves injured by leafhoppers occur at various heights on a given shoot, while the yellowing or reddening caused by boron deficiency is always confined to terminals. There is another type of yellowing associated with common leaf spot caused by Pseudopeziza medicaginis. This organism occurs as small, circular, dark brown spots on the lower leaves of the alfalfa, and if sufficiently severe, causes them to turn yellow and drop.

Alfalfa yellows has been worked with in several states and Canada. Ewen at Guelph, Ontario, and Dr. Stevenson at Ottawa have found borax to be very effective on alfalfa yellows. McLarty, Wilcox, and Woodbridge (2) in British Columbia, Willis and Piland (1) also Piland and Ireland (3) of North Carolina, Hendricks (4) of Tennessee, Grizzard and Matthews in one year, as figures suggest, this means one fatality a year to each 2,500 workers. The number of accidents that are not fatal to man but may be fatal to crops must be tremendous. One localized study indicates that there are about 14 accidents that cause loss of work to every fatality. Another study says 157 to every fatality. Other local studies bring results somewhere between these. More and better figures are needed and what these figures will be under wartime exigencies is yet to be recorded.

Too little is known about causes and costs. Such figures as are collected are not comparable so no national totals are satisfactory. Inadequate figures gleaned from workmen's compensation claims in various states usually make some effort to separate immediate causes from motivating causes. Apparently, the former rate has been in about this descending order of frequency in the past: falls, animals, struck by objects, machinery, automobiles, strains, cuts and bruises, diseases, and other infections. The miscellaneous group is always large. Back of these causes are unavoidable conditions, carelessness, defective farm equipment, vicious animals, sleepiness and exhaustion, and other difficulties in that order.

A uniform system of reporting the kind of farm accidents and attendant details is a dire need. The U. S. Department of Agriculture has worked out and issued a suggested form. A fall, for instance, is not a primary cause —it is one type of accident. A report of injuries caused by falling from a ladder often fails to state the condition of the ladder or whether it was carelessly placed.

Costs are beyond measurement at present. More information is needed before they can be even estimated with any degree of satisfaction. Even then, the intangible cost to society in anxiety, pain, and worry will never be known, and real costs must make some recognition of this phase.

From a merely monetary viewpoint, this one fact may be significant. Indemnities in farm accidents paid on the Pacific Coast showed these averages: $59 for a fall; hurt by farm animal, $39; machinery, $34; hurt from handling an object, $30; hand tools, $24.

Most figures on farm accidents are fragmentary. We need more. Then we need to study them to see what they mean and what to do about it.

Preventive measures should be dramatized. If prevention could be as exciting as the accidents themselves, if knots of people would gather swiftly to discuss eagerly every detail of proposed preventive measures as they do about a victim and how it happened, the menace of accidents might be speedily reduced. We don't see just how to do that vitalizing, but many agencies are diligently at work on prevention and the sum total of all their work is bound to tell.

The National Safety Council in 1942 sponsored the first National Safety Conference on home and farm accident problems. At the request of the President of the United States that it conduct "a concerted and intensified campaign against accidents" it is emphasizing the manifold needs connected with farm safety and is helping to get at

(*Turn to page* 40)

Is the ladder safely placed?

ton more an acre from a 30-pound-per-acre borax application. Midgley and Dunklee (7) found that on one soil type, mineral fertilizers without borax were ineffective for the production of alfalfa. In conjunction with borax, however, alfalfa yields doubled with practically all cuttings. When 40 pounds of borax per acre were applied, the yield was much superior to that secured when less was applied. Hutcheson and Cocke (6) in their tests at Williamsburg, Virginia, found that 10 pounds of borax at time of seeding in the fall of 1939 gave a marked increased yield from each of the five cuttings in 1940 and gave a total increase of 4,693 pounds of field-cured hay per acre. The spring seeding, with 10 pounds of borax per acre plus fertilizer, gave a total increase of 4,517 pounds of field-cured hay per acre for four cuttings. At Chatham, Virginia, borax was applied immediately following the first cutting at the rate of 15 pounds per acre and the second cutting was increased over 600 pounds per acre as against the check area.

Investigators have found consistent increases in hay fields from relatively small applications of borax.

Soil Types and Methods of Application

Soil types do not determine the occurrence of alfalfa yellows or response of alfalfa to borax applications. In general, the lighter soil types give a more consistent response to borax applications. However, the author saw yellows on alfalfa growing on delta soil in Tennessee and saw one of the worst cases of yellows on a Hachi River bottom soil. The Hachi soil responded very well to 20 pounds of borax per acre and yellows were eliminated.

The effect of borax applications on the seed set of alfalfa has been noted in New York, Vermont, Virginia, North Carolina, Tennessee, Alabama, and Canada. In 1940 Midgley and Dunklee (7) found that the borate-fertilized second crop of alfalfa, which had been allowed to go to seed, produced more than 35 times as much seed as the unborated check plot. Piland and Ireland (3) found where they had omitted the usual first cutting, blossoming occurred with little or no difference in the growth between the borax-treated and non-treated plot, except for yellows on the no-borax area. Later, it was observed that a good seed set was being obtained where the borax had been applied. A sample of seed from the borax treatment gave a germination count of 76%; hard seed, 24%.

Grizzard and Matthews (5) observed that the borax-treated areas at Williamsburg, Virginia, blossomed very profusely while the no-borax plots blossomed very sparingly. They believed this might have a bearing on the seed set of the crop and began work on it. They left strips across borax-treated and non-treated plots which were not cut at time of second cutting. During the blossoming period, 31 days, they had 7.14 inches of rain with an average daily temperature of 87°F. The no-borax plots did not yield any seed whatever while the 15 pounds of borax per acre plots gave from 109.7 to 132.2 pounds of seed per acre. Germination counts ranged from 71% to 75%; hard seed from 24% to 28%. The findings on seed set are of importance because it may now be possible to breed adapted strains for the various states with varied conditions. It may also be possible to obtain two cuttings of hay and one crop of seed each year. Further work is being done along these lines.

Methods of application for the small amounts of borax used are varied. Many farmers use the common cyclone hand seeder which may be set to deliver 20 pounds of borax per acre. Others mix the borax with 50 or 100 pounds of sand and broadcast it. Some fertilizer companies are putting out a special alfalfa mix that contains from 60 to 200 pounds of borax per ton. The mix is then used at time of seeding or as a topdresser. The bags are

(*Turn to page* 39)

(5) also Hutcheson and Cocke (6) of Virginia, Midgley and Dunklee (7) of Vermont, Powers (8) of Oregon, Colwell and Baker (9) of Idaho, Colwell and Lincoln (10) of New York, Donaldson (11) of Massachusetts, Brown and King (12) of Connecticut, Baur, Huber and Wheeting (13) of Washington, and Cook (14) of Michigan, have found borax to be very effective in controlling yellows.

Fewer Weeds and Increased Yields of Alfalfa

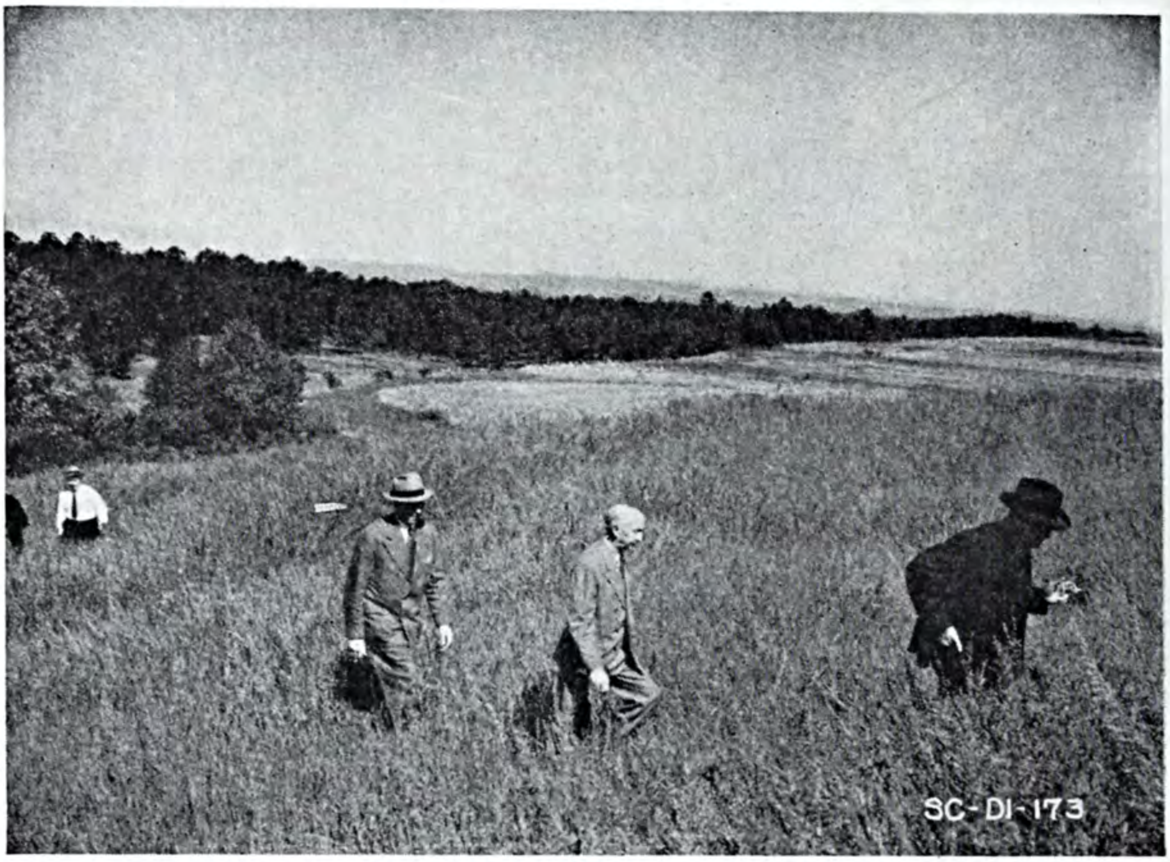
The rates of application of borax vary from 15 pounds per acre up to 40 pounds per acre. Colwell and Baker (9) found that around 40 pounds of borax gave good results on Idaho soils. In most of the eastern states the range of 15 to 30 pounds per acre seems to give the best results. The tolerance of alfalfa to borax is quite high. Several investigators have applied as much as 100 pounds per acre, in some cases more, without any toxicity.

One feature that has been noted is the fact that borax-treated plots have a much lower weed count than untreated areas. Hutcheson and Cocke (6) found that in dry seasons, when the yellows seem most severe, a heavy growth of crab grass and other late summer weeds crowd out and replace the weakened alfalfa plants. The author noticed this condition in North Carolina. The treated plots were free of weeds while the balance of the field was infested with crab grass and foxtails. Tests in Tennessee and other states bear out this fact quite well. Authorities believe that the healthy, thick growth does not allow weeds to become established and a "weed free" stand is maintained. It is not likely that the amount of borax used is toxic to the annual weeds.

Boron deficiency has a definite bearing on the life of the alfalfa fields. In the western states it is not unusual for a field of alfalfa to last 8 to 10 years and even more. This is not the case with most of the eastern states. Hendricks (4) finds that in the second or third year the alfalfa often seems to have a hard time surviving the hot, dry periods of late June, July, or August; it then grows slowly, the leaves turn yellow, and the summer showers seem to grow crab grass better than alfalfa. Hutcheson and Cocke (6) found that in the eastern section of Virginia, they could grow alfalfa producing high yields by using adapted seed, lime, and rather heavy applications of mineral fertilizer. These stands only persisted for short periods, usually being reduced to such an extent that they became uneconomical by the end of the second year. In tests at Chatham they found that the borax-treated areas gave vigorous growth, and good stands were being maintained, while the untreated areas were deteriorating rapidly and would appear to be too thin for profitable production during the third year of growth.

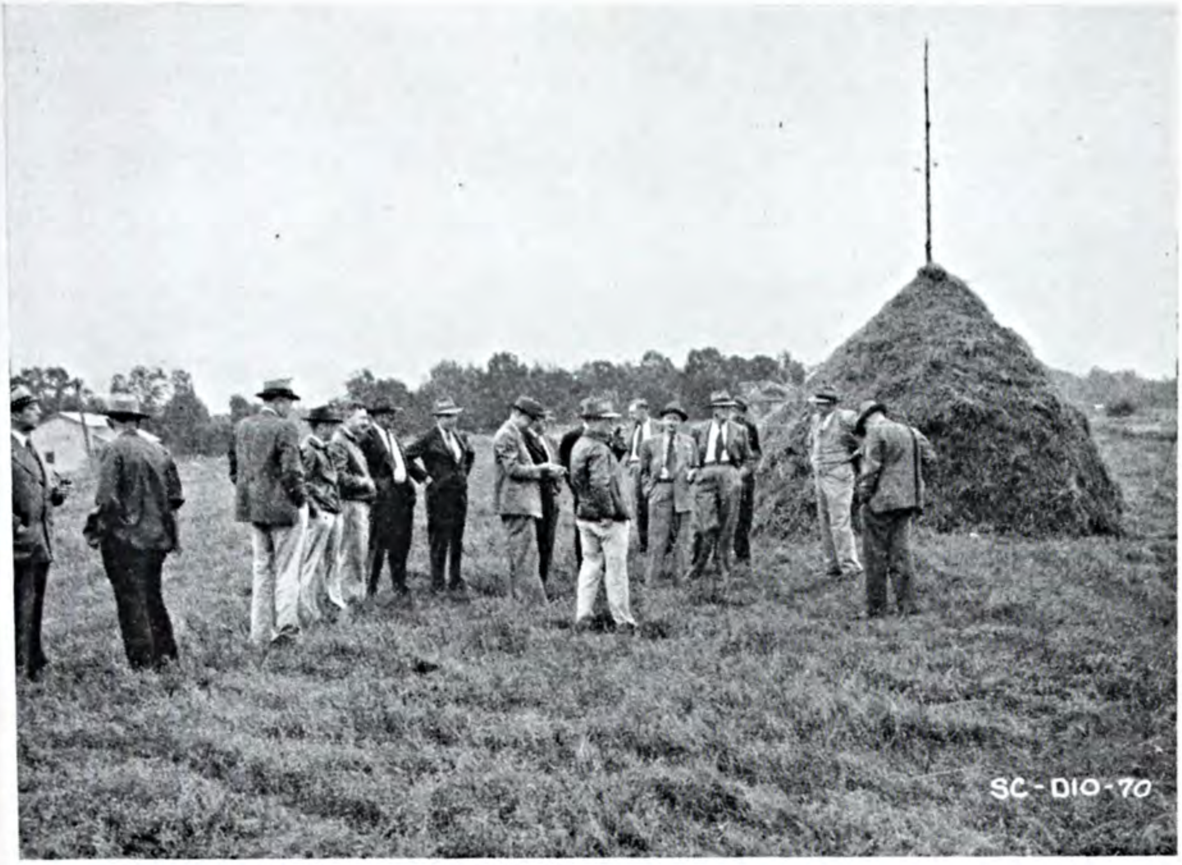
Increases in yields of alfalfa from borax applications have been reported from every state that has conducted tests. Colwell and Baker (9) of Idaho report that as a result of their tests they conclude that many of the soils in northern Idaho are deficient in boron for alfalfa, and that substantial increases in yields can be obtained by the addition of borax. Baur, Huber, and Wheeting (13) of Washington report that although yields varied in several fields because of different soil fertility and management practices, increases in yield were obtained on all plots that had received borax. The size or magnitude of the increases from borax applications were proportional to the severity of the deficiency. Greater increases in yields from additions of borax were generally obtained from fields in a comparatively high state of fertility than from applications to poorer soils, and the addition of borax to manured fields on boron-deficient soils increased growth materially when compared to manure applications alone.

Powers (8) of Oregon states there are 50,000 acres of alfalfa in the Willamette Valley that will yield ½ to 1



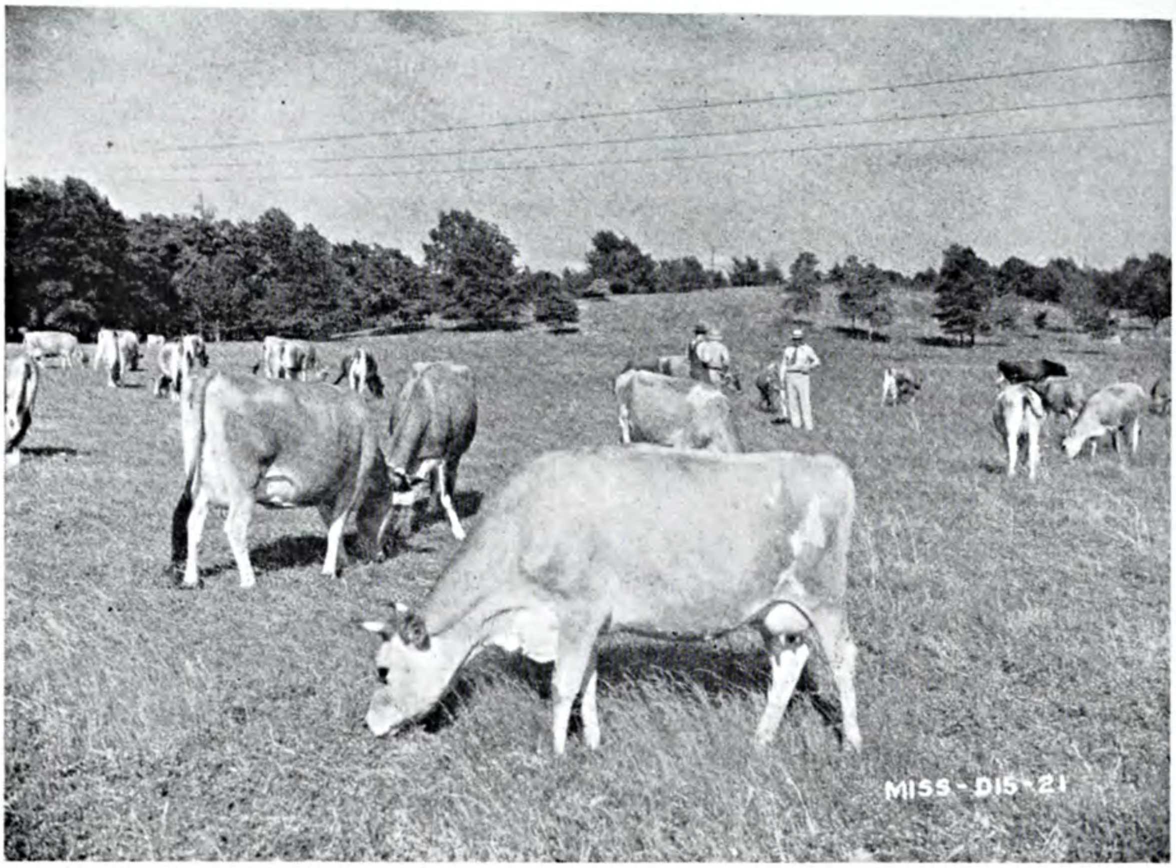
Above—Last year a good hay crop—this year seed will be harvested from this 3-year-old field of sericea lespedeza. Members of fertilizer group in foreground are: M. H. Lockwood, Eastern States Farmers' Exchange; Dr. J. W. Turrentine, American Potash Institute, and H. R. Smalley, National Fertilizer Association.

Below—An excellent crop of barley following a 2-year growth of annual lespedeza in a strip rotation of grain, lespedeza, and row crops. All rotated crop land is terraced, alternate strips between terraces being planted to cotton. In foreground, Remo Molinaroli and G. W. Boozer, work unit conservationists.



Above—This group of fertilizer and Soil Conservation Service officials early in October made a 2-day tour through South Carolina and Georgia to study the Soil Conservation district program. The group here is discussing the importance of annual lespedeza in a crop rotation and its value as hay crop.

Below—R. Y. Bailey, Dr. T. S. Buie, and Remo Molinaroli, all of the Soil Conservation Service, are here leading the discussions regarding this land which produced five bushels of corn per acre before it was planted to kudzu four years ago. It has been cut for hay this year with a yield of 218 bales from 16 acres.

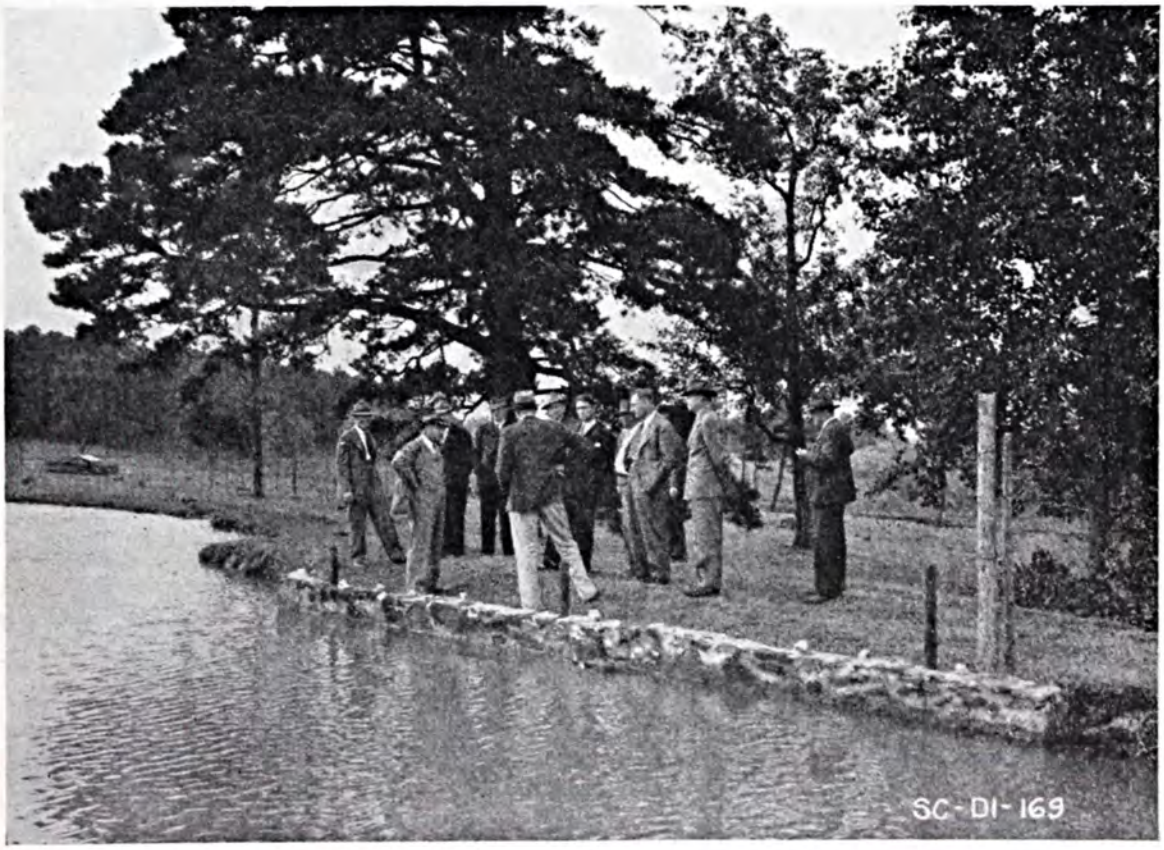


Above—More than 100 gallons of milk daily are sold from this purebred herd of Jersey cows on the farm of the Johnson Brothers, who are cooperators in the Northeast Mississippi Soil Conservation District. The pasture was improved by use of lime, fertilizer, and the proper seeding of legumes and grasses.

Below—Grazing kudzu is one of the most profitable and popular practices on the dairy farm of Asbury D. Wright, Gainesville, Ga. This three-year-old kudzu is growing on a worn-out portion of the farm which was formerly used for row crops. The luxuriant growth of this kudzu field is ample proof of its adaptability.

Above—More than a bale of cotton per acre will be harvested here following annual lespedeza in a strip rotation of legumes, grain, and row crops. Examining the cotton are: Leroy Donald, Barrett Company; H. R. Smalley, National Fertilizer Association; and Dr. T. S. Buie, Soil Conservation Service.

Below—Standing on the dam of a small farm pond, the fertilizer and Soil Conservation Service officials discuss the system developed for irrigating 35 acres of upland pasture with surplus water from the pond. Water is evenly distributed over pasture area through small channels constructed on the contour.



rationing, which would undoubtedly have been cumbersome, expensive, and generally confusing and unsatisfactory both to industry and the individual farmer.

In 1943 all fertilizer sales will be on the historical basis. This means that fertilizer sales will be based on the history of past use by each farmer, information which must be supplied to the fertilizer dealer, agent, or manufacturer on special forms that have been provided. In making sales on this basis, preference will in all cases be given to crops designated as "essential war crops" by the U. S. Department of Agriculture. Form 1 is to be used for distribution of fertilizer to farmers who are able to supply full historical data as to grades and quantity used in 1941-42. Form 2 is for use where historic cases will not serve because of change of acreage during the 1942-43 season, and Form 3 is for use in making application for straight nitrogen materials. All in all, everything possible has been done to facilitate fertilizer distribution for the achievement of production goals in our Victory Food Program.

Of interest and most reassuring at this time is a summary of the fertilizer situation by Dr. Frank W. Parker, Head of the Division of Soil and Fertilizer Investigations of the U. S. Department of Agriculture. In a talk before the American Society of Agronomy at St. Louis on September 12, 1942, he told visiting scientists that "American farmers will be able to get most of the fertilizer they need to meet crop production goals next year." He predicted that with a record demand for fertilizer due to the great increase in farm cash income, there would be adequate supplies of both phosphate and potash, but not enough nitrogen to meet their demand. It was his opinion, however, that there would be enough nitrogen for all essential requirements for authorized crop production goals.

While pointing out that the fertilizer situation is always subject to change due to the war, Dr. Parker concluded: "It now appears that American farmers will use more phosphate and potash than they have used in any previous year, and that nitrogen consumption, despite war conditions, is expected to be higher than in any year prior to 1941.

War Work

With every conscientious person evaluating his contribution to the war effort, it is of interest to note the check-up of a million and a half 4-H Club boys and girls on their 1942 work. The results as released by the U. S. Department of Agriculture are amazing and proof that agriculture has its Young America thoroughly aroused to meet the emergency with an "all-out" spirit.

Since their enrollment last April, 4-H Club members have produced 3,000,000 bushels of vegetables in Victory Gardens. They raised 6,500,000 chickens, 300,000 hogs, 85,000 dairy cows, 11,000,000 pounds of peanuts and soybeans, and large amounts of other needed crops and livestock in their club projects.

Club members collected 146,000 pounds of scrap metal from their own and neighboring farms, bought $6,000,000 worth of war bonds, canned 14,000,000 jars of food, helped repair and operate farm machinery, improved their own health, made clothing materials go farther, and helped in many other ways, the report shows.

Nearly 500,000 club members were active in local fire prevention groups. An equal number helped in other rural civilian defense activities, such as acting as air raid spotters. Thousands took first aid and home nursing training.

While some of these boys and girls may not enroll in club work next year, the additional year of age on others insures a greater and more effective effort during 1943. That they will prove a most important factor in the shortage of experienced farm labor is obvious.

The Editors Talk

Fertilizer Supplies

The fertilizer situation is far more encouraging today than it was six months or even a year ago. Drastic steps have been taken to guard our plant-food resources and to speed up production wherever feasible. Federal and state fertilizer specialists in cooperation with the War Production Board, Office of Price Administration, and the fertilizer industry have developed and put into operation plans to aid in making the most efficient use of essential plant foods and to insure their equitable distribution.

The basic provisions of the plans developed were published as War Production Board Conservation Order No. M-231, dated September 12, 1942. With the vastly increased military demand for chemical nitrogen for munitions and the unprecedented demand for production of essential crops, available supplies had to be conserved in the best public interest and to promote the national defense. The order, therefore, not only restricted the use of chemical nitrogen for each state, but established a list of fertilizer grades. Grades of fertilizer that will be available for farm use in 1943 will on the average supply less nitrogen than the average of all fertilizers sold last year. Where a particular grade was designated as available only for a particular crop, it was decreed that it should be sold or used only for the production of such crop.

In the opinion of the federal and state officials as well as industry, it is the consensus that the reduction of nitrogen thus effected would not seriously impair crop production. Particularly is this true where legume crops are grown under optimum fertility conditions with respect to lime, phosphorus, potash, and in some areas boron, the importance of which has been recognized and stressed by officials in charge of our national agricultural conservation programs. While the main objective of the official order was to make the limited supply of chemical nitrogen go around, it quite obviously also will result in effecting economy in manufacture and distribution as well as insure greater efficiency in use of the officially recommended grades.

Fortunately, for use on farm crops there will be available rather large supplies of organic nitrogen. Present indications are that upwards of 2,000,000 tons of vegetable meals will be available. Much of this no doubt will be used for stock feed, but it is believed that approximately 1,000,000 will find use as fertilizer. It should be emphasized that no restrictions have been placed on the ordinary sources of organic nitrogen, except that delivery of any mixed fertilizers, the nitrogen of which is entirely organic, is prohibited unless the nitrogen content is at least 3% and the total nitrogen, available phosphoric acid, and water-soluble potash content thereof is at least 14%.

The fertilizer industry has gone on record as approving the recommendations of the War Production Board and has pledged itself to distribute mixed fertilizers and nitrogen materials equitably among all fertilizer consumers. Their cooperation in this connection has therefore avoided the inevitable alternative government cases were obtained when fertilizers were used in connection with lime and when they were used without the addition of lime. The authors conclude that on the soil in western Virginia, lime and a complete fertilizer should be used until the rotation is well established. After several legumes have been turned under, then probably lime, phosphate, and potash will be sufficient.

"Fertilizer Shipments in Arkansas by Counties for the Fiscal Year Ending June 30, 1942," Department of Revenues, Little Rock, Arkansas.

"Commercial Fertilizer Sales As Reported to Date for the Quarter Ended June 30, 1942," Bureau of Chemistry, Department of Agriculture, Sacramento, California, Aug. 17, 1942.

"Vitamin B_1 Claim Unacceptable," Bureau of Chemistry, Department of Agriculture, Sacramento, California, Oct. 8, 1942.

"Agricultural Minerals Registrants to Date for Fiscal Year Ending June 30, 1943," Bureau of Chemistry, Department of Agriculture, Sacramento, California, Sept. 18, 1942.

"Commercial Fertilizers Registrants to Date for Fiscal Year Ending June 30, 1943," Bureau of Chemistry, Department of Agriculture, Sacramento, California, Sept. 18, 1942.

"Fertilizer Grades for Connecticut in 1943," Dept. of Agron., University of Conn., Storrs, Conn., Oct. 1942, J. S. Owens.

"Commercial Fertilizers," Univ. of Idaho, Moscow, Idaho, Def. Cir. 11, Jan. 1942, G. Orien Baker.

"Commercial Fertilizers in Kentucky in 1941," Agr. Exp. Sta., Lexington, Ky., Reg. Series, Bul. 30, June 1942.

"Fertilizer Recommendations for Maine 1942–43," Agr. Exp. Sta., Orono, Maine.

"Commercial Feeds, Fertilizers and Agricultural Liming Materials," Univ. of Maryland, College Park, Maryland, Aug. Issue 1942, No. 183, Control Series.

"Fertilizer Recommendations for Fall Seeded Grains 1942," Soil Science Dept., Michigan State College, East Lansing, Mich., Aug. 1942.

"Substitutes for Nitrogen Fertilizers in Orcharding," Agr. Exp. Sta., Columbia, Mo., Cir. 236, June 1942, A. E. Murneek and A. D. Hibbard.

"Wartime Fertilizers for New Jersey," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 452, Oct. 1942.

"Sale and Analysis of Commercial Fertilizers 1941," Dept. of Agr. and Markets, Albany, N. Y., Cir. 615.

"Report of Analyses of Commercial Fertilizers Sold in N. Y. State," Dept. of Agr. and Markets, Albany, N. Y., Bul. 337, Part I, March 1942.

"Report of Analyses of Samples of Lime Materials Used for Agricultural Purposes Sold in New York State July 1, 1940 to June 30, 1941," Dept. of Agr. and Markets, Albany, N. Y., Bul. 337, Part II, March 1942.

"County Fertilizer Data: Mixed Goods and Materials," July 1, 1941 through June 30, 1942, Dept. of Agr., Jackson, Miss.

"Fertilizer Recommendations for North Carolina 1943," Agr. Exp. Sta., State College Station, Raleigh, N. C., Cir. 130, Sept. 1942.

"Fertilizer Sales by Grade in Order of Tonnage, July 1, 1941-December 31, 1941," N. C. Dept. of Agr., Raleigh, N. C.

"Fertilizer Sales in Oklahoma by Counties, July 1, 1941-June 30, 1942," Okla. State Board of Agr., Feed & Fert. Dept., Oklahoma City, Okla.

"Field Test of Phosphate Fertilizers," Agr. Exp. Sta., State College, Pa., Bul. 423, March 1942, C. F. Noll and C. J. Irvin.

"The Orchard Fertility Problem During the War Emergency," Agr. Exp. Sta., State College, Pa., Bul. 431, August 1942.

"Fertilizers Sold in Pa. in 1941—Summary of Reports Sent by 45 Companies," Dept. of Agron., Pa. State College, State College, Pa.

"Inspection of Fertilizers," Agr. Exp. Sta., Rhode Island State College, Kingston, R. I., Annual Fert. Cir., March 1942.

"Shortage of Nitrogen Fertilizers," Agr. Exp. Sta., A. and M. College of Texas, College Station, Texas, 801 Progress Report, Sept. 26, 1942, E. B. Reynolds.

"Rotation and Fertilizer Experiments in Southwest Virginia," Agr. Exp. Sta., Blackburg, Va., Bul. 339, May 1942, W. R. Perkins, A. L. Grizzard, and T. B. Hutcheson.

"Virginia Field Crop Fertilizer Recommendations," Ext. Agron. Dept., Circular E-341 Revised, Sept. 1942.

"The Value of Liquid Manure as a Fertilizer for Pasture," Agr. Exp. Sta., State College of Washington, Pullman, Wash., Bul. 412, April 1942.

Soils

¶ There are two areas in Wisconsin devoted to the growing of cigar leaf tobacco. In order to obtain information on the status of soils on which the crop is grown, and to see whether differences in soil conditions could account for the higher prices usually paid for the tobacco grown in the northern area, soil samples and leaf samples were taken from a large number of representative fields, analyses were made, and results summarized. This work is presented by J. Johnson and W. B. Ogden in the Wisconsin Agricultural Experiment Station Research Bulletin 142 entitled "A Survey of Tobacco Soils in Wisconsin." It was found that

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

¶ With strict rationing of the limited supplies of nitrogen available and with fertilizers that are permitted to be manufactured and sold restricted to certain grades by the War Production Board, most Experiment Stations, after conferences with state agricultural officials and fertilizer manufacturers, have had to revise their fertilizer recommendations. Many of them have issued temporary recommendations designed to meet war conditions. The reduced nitrogen supply means this fertilizer will be used mainly on intensively grown crops while other crops will be expected to obtain their nitrogen from leguminous sods and green manures that are turned under. Great stress, therefore, is being made on the growing of legumes, and particularly on the use of lime, phosphate, and potash in proper amounts to assure the best possible growth of legumes and their greatest efficiency as nitrogen fixers. The fertilizer grades for the various crops usually are recommended with consideration of the fact that a legume must be turned under during the rotation. The limitation of permissible grades to certain approved analyses should work no hardship on farmers in most cases. In most states there is a sufficiently wide choice of analyses to meet the various requirements, and it is probable that a better adapted fertilizer is more likely to be used now than was the case in the past. The adequacy of our phosphate and potash supplies greatly simplifies problems as compared to what would prevail if all three of these nutrients were short in supply. The various publications are too numerous to be reviewed individually, but will be found listed each month as they appear.

¶ An interesting study of rotations and fertilizing systems in western Virginia is reported by W. R. Perkins, A. L. Grizzard, and T. B. Hutcheson in Virginia Agricultural Experiment Station Bulletin 339 entitled "Rotation and Fertilizer Experiments in Southwest Virginia." A three-year rotation of corn, wheat, and clover hay, in general, gave the best results. Substitution of barley for clover gave slightly lower yields of both corn and small grains. A five-year rotation consisting of corn, wheat one year each, and clover and timothy for three years also gave very good results and was considered to be adapted to beef cattle raising. The advantage of the short rotation course is the more frequent appearance of the legume. In the fertilization of the crops, best results usually were obtained from a complete fertilizer. Phosphorus was the first limiting element and nitrogen appeared to be the second limiting element, since potash, when used with phosphorus alone, frequently did not increase yield, while when potash was added to nitrogen and phosphorus, marked increases in yield were obtained, especially on corn and hay. While potash added to phosphorus alone did not increase yield, potash-deficiency symptoms began to appear on the phosphate alone plots as the experiment progressed. The authors conclude that the quickly available potash was being exhausted from this soil where no potash was applied in the fertilizer. Best results in practically all potash or other fertilizers containing chloride should be used if it is desired to improve the burn of the leaf. The use of manure and leguminous crops and the problems which arise when they are grown in tobacco rotations are briefly discussed.

¶ "Using Crop Residues for Soil Defense," U. S. Department of Agriculture Miscellaneous Publication 494, by F. L. Duley and J. C. Russel presents important and practical information on how farmers can protect their soils by comparatively simple methods. It is surprising how easy it is to utilize material and equipment on the farm in such a way as to protect the surface of the soil, and it is the surface where erosion and other soil losses begin. The information is presented by the authors in the form of excellent illustrations, charts, and short descriptive sections.

"Soil Management in Food Production," Univ. of Idaho, Moscow, Idaho, Def. Cir. 9, January 1942, G. Orien Baker.

"Observations and Studies on the Peat Deposits of Louisiana," Agr. Exp. Sta., La. State Univ. and A. and M. College, Baton Rouge, La., La. Bul. 343, May 1942, W. R. Dodson.

"What Farmers Say About Soil Conservation," Md. State Soil Conservation Com., Bul. 2, April 1942.

"Soil Survey Clinton County Michigan."—U.S.D.A. Washington, D. C., Series 1936, No. 12, February 1942, G. A. Johnsgard, T. E. Nivison, H. T. Rogers, R. L. Donahue, J. T. Stone, G. M. Welles, M. M. Striker, J. W. Moon, and Z. C. Foster.

"Wind Erosion Control," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Bul. 235, June 1942, M. A. Thorfinnson.

"The Development of Loessial Soils in Central United States as It Reflects Differences in Climate," Agr. Exp. Sta., Univ. of Missouri, Columbia, Mo., Res. Bul. 345, June 1942, Harvey B. Vanderford and W. A. Albrecht.

"Land Use Experience in Callaway County, Missouri," Agr. Exp. Sta., Univ. of Missouri, Columbia, Mo., Res. Bul. 346, June 1942, A. M. Meyers, Jr. and Conrad H. Hammar.

"Physical and Chemical Properties of Soil Profiles of the Scott, Fillmore, Butler, Crete, and Hastings Series," Agr. Exp. Sta., Univ. of Nebraska, Lincoln, Nebraska, Res. Bul. 126, June 1942, Henry W. Smith and H. F. Rhoades.

"Preventing Soil Losses During Fall, Winter, and Spring," Cornell Univ., Ithaca, N. Y., Bul. 515, June 1942, Warren C. Huff.

"The Effect of Soil Texture and Slope of Land on Productivity in Two North Dakota Counties," Agr. Exp. Sta., N. Dak. Agr. College, Fargo, N. Dak., Bul. 315, June 1942, W. M. Johnson and C. F. Bortfeld.

"Erosion on Vermont Permanent Pastures," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 483, March 1942, A. R. Midgley, C. V. Plath, and J. J. Mayernik.

"Using Crop Residues for Soil Defense," U.S.D.A., Washington, D. C., Misc. Pub. 494, Aug. 1942, F. L. Duley and J. C. Russel.

"Soluble Material of Soils in Relation to Their Classification and General Fertility," U.S.D.A., Washington, D. C., Tech. Bul. 813, June 1942, M. S. Anderson, Mary G. Keyes, and George W. Cromer.

Crops

¶ With the increased demand in recent years for long staple cotton, interest in the growing of Sea Island has revived. With war requirements making an even greater demand for long staple cotton, the growing of Sea Island assumes great importance as part of our war effort. Georgia Coastal Plain Experiment Station Bulletin 33, "The Growing of Sea Island Cotton in the Coastal Plain of Georgia," by J. G. Jenkins, therefore, is very timely. Great stress is put on the importance of good seed and proper varieties. In the fertilization of the crop, an analysis to 3-8-8 and a rate of 300 to 500 pounds per acre are given as a general recommendation. On new land 3-12-8 is suggested. Owing to the longer season needed to mature Sea Island cotton, particular attention must be given to potash fertilization in order to prevent defoliation of the plant before maturity. This problem is aggravated by the fact that most of the soils on which this crop is grown are deficient in potash. Where it is known that the soils are particularly deficient in this nutrient, or where the cotton has rusted in the past, it is suggested that additional applications of potash fertilizer be given as a topdressing. The bulletin also covers information on planting, the control of boll-weevil (a particularly important subject in connection with Sea Island cotton), harvesting, ginning, and marketing of the crop.

the soils in the northern tobacco growing area contained less clay, on the average, than the southern area soils. The higher content of clay is considered unfavorable due to reduction in available potash supply by absorption of this nutrient by the clay. The organic matter tended to be higher in the northern district, although in both sections there were fields where the organic matter was 6 to 7% by weight, a content considered to approach the undesirable range owing to possibility of excess nitrogen being furnished the crop late in the season by this organic matter. The northern soils tended to be less acid than those of the southern district although some areas in the northern district were very acid, and on such soils high quality tobacco was being produced. The authors ascribed this to the greater availability of potassium on such soils. The northern soils tended to be higher in total nitrogen, whereas, there was considerable variation in nitrate nitrogen. The authors bring out that if very heavy applications of manure are applied to supply nitrogen for tobacco, an unbalanced fertility condition is likely to develop in the soil because of insufficient potash, with quality and burn of the tobacco correspondingly reduced. The available phosphorus was higher in the northern area, but even here about 40% of the soil contained less than the 100 lbs. of available P_2O_5 considered the minimum desirable amount for tobacco. In the southern district, about 58% of the soils were below this figure. Some soils contained large enough amounts of phosphoric acid to approach what the authors believe to be the upper favorable limit, and on such soils neither phosphate fertilizers nor heavy manure applications are considered desirable without building up potash supplies. The authors believe that calcium and magnesium supplies in the soils do not present a problem. The chlorine content of many of the soils appeared to be higher than desirable for best quality tobacco. The remedy for this is given in the avoidance of heavy manure applications and of fertilizer carrying chlorine, coupled with the use of larger amounts of potash since this tends to overcome the undesirable effects of chlorine in the tobacco leaf.

The authors state that potassium is the most important nutrient in connection with the fertilization of tobacco owing to its great influence on quality. They believe that Wisconsin growers have not paid sufficient attention to the importance of this nutrient in growing their tobacco crops. The soils in the northern district, especially one area, tended to be higher in available potassium. Almost 60% of the soils in the southern areas showed less than 400 pounds of available potash per acre, which the authors feel is the minimum desirable amount. Since there is considerable variation in the desirable minimum due to other factors, such as chlorine content, clay content, and rainfall, they believe 70% of the soils in this district are too low in available potash to grow the best tobacco. It is believed the higher price paid for the tobacco in the northern area is due essentially to the greater amount of available potash present in the soils, and they point out that there is no fundamental reason why growers in the southern area should not be able to grow tobacco equally as good if sufficient care is given to the selection of the fields in which the tobacco is to be grown, and to its fertilization.

¶ Data on potash content of tobacco leaves and on the burn of the leaf showed that the leaf in the northern area was higher in potash and had better burn. The authors state that as a result of their work it would appear as though the leaf growing on the heavier soil type should contain at least 5% potash, whereas only about one-third of the crop contained more than 4% potash in the leaf. It is stated that the only practical way to increase the potash content of the leaf is to apply more potash to the soil, preferably by the use of potash fertilizers which may be supplemented with manure. No ash, it is advisable to broadcast and disk in deeply 100 pounds of muriate of potash per acre. Liming also is very beneficial on acid soil.

¶ Information and experimental data on the growing of corn and oats in the South have been compiled by H. O. West and issued as Mississippi Experiment Station Bulletin 368 entitled "Corn and Oats." A comparison is made of the amount of digestible nutrients produced, labor requirements, and other factors that are likely to enter into a decision as to which of the crops is preferable to grow. In connection with each crop, data on variety, method of seed bed preparation, date and rate of planting, kind and amount of fertilizer to use, time of application, cultivation, and harvesting are given. For the most part, the data from various experiment station sources are given with little or no interpretation.

¶ To help farmers in the efficient production of tomatoes for canning, J. H. Beattie, W. R. Beattie, and S. T. Doolittle have prepared U. S. Department of Agriculture Farmer's Bulletin 1901, "Production of Tomatoes for Canning and Manufacturing." General information on soils suitable for growing canning tomatoes, crop rotation, preparation of the soil, manuring, fertilizing, liming, best adapted varieties, obtaining plants, setting plants, transplanting solutions, irrigation, insect pests, diseases and their control, and grades of canning tomatoes are given. The authors point out that tomatoes can be grown on a wide variety of soils provided there is good drainage. For best results the soil should be fertile and in good condition. Crops such as tomatoes, potatoes, peppers, or eggplants which are closely related to the tomato should not be grown on the field for at least three years previous to growing tomatoes, since there is a possibility of carrying over diseases in this way. The use of manure is highly beneficial, but better results frequently are obtained when the manure is applied to the preceding crop rather than directly to the tomato crop. The fertilizer to use will vary with soil and cropping conditions, and local information should be obtained on best fertilizers for each individual farm. As a general guide, the authors point out that in New Jersey a leading grower turned under a winter cover crop of rye and made two 800-pound applications of 5-8-7 fertilizer. Another grower turned under a wheat cover crop with six tons of manure and used 1,000 pounds of 4-8-10 fertilizer. In Ohio a common application is to use 300 pounds of 0-12-12 fertilizer broadcast previous to setting the plants, and then at planting time applying additional 200 to 250 pounds of the same fertilizer by means of an attachment to the planter. In Indiana 400 to 600 pounds of fertilizer such as 2-16-8, 2-12-6, 2-8-16, 2-8-10, 3-12-12, or 0-12-12 are used with an additional side application of a nitrogen fertilizer if needed. This bulletin will be found very useful by all tomato growers.

"The Planting and Maintenance of Lawns," Agr. Exp. Sta., Ala. Polytechnic Institute, Auburn, Ala., Cir. 85, May 1942, D. G. Sturkie and H. S. Fisher.

"Serving Arkansas Agriculture," Agr. Exp. Sta., Univ. of Ark., Main Station, Fayetteville, Ark., Bul. 417, June 1942.

"Chemical Composition of Arkansas-Grown American Grapes," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 420, June 1942, Howard Reynolds and J. E. Vaile.

"Effects of Rootstock Upon Composition and Quality of Fruit of Concord, Campbell Early, and Moore Early Grapes," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 421, Howard Reynolds and J. E. Vaile.

"Plant More Winter Legumes," Agr. Ext. Serv., Univ. of Ark., Fayetteville, Ark., Leaf. 41, August 1942.

"Pastures for the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 27, June 1942, J. L. Stephens.

"Twenty-first Annual Report 1940-1941," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 32, July 1941.

"The Growing of Sea Island Cotton in the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 33, Jan. 1942, J. G. Jenkins.

"Peanut Production in the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 34, Jan. 1942, S. A. Parham.

"Forest Grazing and Beef Cattle Production

¶ The United States Department of Agriculture Yearbook for 1942 entitled "Keeping Livestock Healthy" is devoted to livestock diseases. This is the seventh in a series of Yearbooks, each exhaustively dealing with a particular phase of agriculture. It is a fitting companion to this notable series and fully comes up to the high standard set by the preceding volumes. From the fertilizer viewpoint, the chapter on nutritional diseases of farm animals by L. I. Madsen, is of particular interest. The effects of calcium, phosphorus, magnesium, salt, iodine, and other mineral deficiencies are discussed, and ways of preventing such diseases by means of proper fertilization are given. Another chapter on nutritional diseases of cattle by the same author considers potassium in addition to the above elements. It is pointed out that under ordinary practical diets, this nutrient will be supplied to animals in sufficient amount to meet their needs, but experimentally induced potassium deficiency is found to have an unfavorable effect on the animal.

¶ Four practical circulars dealing with the growing of various vegetable crops have been prepared by A. G. B. Bouquet. They are issued as Oregon Agricultural Extension Circulars 353, 369, 370, and 377, dealing respectively with Growing Carrots for Canning and Freezing; Muskmelons, Cantaloupes, and Miscellaneous Melons; Sweet Potatoes; and A Monthly Schedule of Suggested Operations in Growing Vegetables for Home Use. For carrots a fertilizer similar to 4-12-12 at 500 pounds or more per acre, with a minimum of 30 pounds of borax per acre also included, is recommended. For cantaloupes and melons, manure and fertilizer analyzing 3 to 4% nitrogen, 10 to 12% phosphoric acid, and 6 to 8% potash are recommended. For sweet potatoes, a fertilizer mixture approximately equivalent to a 4-10-15 fertilizer is suggested. In addition to information on fertilization, suggestions on soil adaptation, varieties, cultural practices, and diseases and their control are given. In the circular on the Monthly Schedule of Operations, general information on growing various crops is given but no specific fertilizer recommendations are included since these are given in publications devoted to the crop in question.

¶ Another excellent publication on vegetable growing is "The Home Vegetable Garden" by C. H. Nissley, New Jersey Agricultural Experiment Station Circular 428. Practical information on starting plants, fertilizing soil, cultivation, harvesting, and storage is given. Specific information for individual crops and helpful tables make this a valuable guide to those who wish to have a small vegetable garden. In addition to lime and manure, fertilizer such as 5-10-10 or 5-10-5 is suggested. Since this bulletin was written before the new war grades were put into effect, other similar grades would have to be used, those most likely fitting in with the recommendation being 4-10-10 and 4-12-8.

¶ "Soybean Varieties and Culture" is the title of a pamphlet prepared by the Agronomy Department of Purdue University and issued by the Indiana Agricultural Extension Service. Comparative yields produced by eleven different varieties tested at the Experiment Station, cultural directions, and descriptions of the varieties are given. In connection with fertilization, it is stated that soybeans respond to a high fertility level, although the response to direct fertilizer application is sometimes disappointing due to the fact that soybeans are easily damaged by fertilizer coming in contact with the seed. It is suggested that other crops grown in the rotation be given generous applications of manure and fertilizer so that the soybeans can benefit from the residual effects. On thin soils, plowing under 300 pounds of 0-20-20, or its equivalent, has given excellent results in recent investigations. It is stated that on land already plowed and low in available pot-

"Sweet Potatoes," Ext. Serv., Oregon State College, Corvallis, Ore., E. Cir. 370, August 1941, A. G. B. Bouquet.

"A Monthly Schedule of Suggested Operations in Growing Vegetables for Home Use," Ext. Serv., Oregon State College, Corvallis, Ore., E. Cir. 377, Nov. 1941, A. G. B. Bouquet.

"Trials of Annual Flowers," Agr. Exp. Sta., State College, Pa., Bul. 426, March 1942, E. I. Wilde, C. B. Link, and J. R. Culbert.

"Care of the Home Lawn—Fall Program," Agr. Ext. Serv., State College, Pa., Mimeo., 1942, Fred V. Grau.

"Report of the Puerto Rico Experiment Station 1940," U. S. D. A., Washington, D. C., May 1942.

"Factors in the Breeding of Cotton for Increased Oil and Nitrogen Content," Agr. Exp. Sta., Knoxville, Tenn., Cir. 79, April 1942, N. I. Hancock.

"A Strain of Nancy Hall Sweetpotato Selected for Color of Flesh," Agr. Exp. Sta., Knoxville, Tenn., Cir. 80, April 1942, N. D. Peacock, Arthur Meyer, and A. B. Strand.

"Fifty-fourth Annual Report 1941," Agr. Exp. Sta., College Station, Texas.

"Adaptability Studies with Bearded Iris in Texas," Agr. Exp. Sta., College Station, Texas, Bul. 615, August 1942, S. H. Yarnell.

"Bermuda Grass," Agr. Ext. Serv., College Station, Texas, E. Cir. C-176, (1942), John J. Ingalls.

"Grassland Maintenance in Vermont," Agr. Exp. Sta., Burlington, Vt., Bul. 484, April 1942, D. E. Dunklee and A. R. Midgley.

"The Conservation of Nutrients in Grass Silage. IV," Vt. Agr. Exp. Sta., Burlington, Vt., Bul. 485, April 1942, J. A. Newlander, H. B. Ellenberger, and C. H. Jones.

"Measuring the Yield of Nutrients of Experimental Pastures," Agr. Exp. Sta., Pullman, Wash., Bul. 411, April 1942, R. E. Hodgson, J. C. Knott, V. L. Miller, and F. B. Wolberg.

"Wisconsin Canning Pea Trials, 1937-1941," Agr. Exp. Sta., Madison, Wisc., Res. Bul. 144, May 1942, E. J. Delwiche.

"Fifty-first Annual Report of the University of Wyoming Agr. Exp. Sta., Laramie, Wyoming. 1940-1941.

"Range Forage Production in Relation to Time and Frequency of Harvesting," Agr. Exp. Sta., Laramie, Wyo., Bul. 253, June 1942, Robert Lang and O. K. Barnes.

"Keeping Livestock Healthy," Yearbook of Agriculture 1942, U. S. D. A., Washington, D. C.

"Dehydration of Fruits and Vegetables by Farmers' Cooperative Associations," Farm Credit Adm., U. S. D. A., Washington, D. C., W. C. No. 1, Aug. 1942, Harry C. Hensley.

"List of Available Publications of the U. S. Dept. of Agriculture," U. S. D. A., Washington, D. C., Mis. Publ. 60, Rev. Jan. 2, 1942.

"Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations 1941-42," U. S. D. A., Washington, D. C., Mis. Publ. 480, May 1942.

Economics

¶ Undoubtedly one of the gravest problems now facing farmers is labor. During the coming year in order to produce enough crops to meet the requirements of our country and our allies, and also to make a profit for themselves, it will be necessary for farmers to adopt every possible practice that will mean saving labor or getting the most out of the supply available. Brief practical hints on how to do this are given by E. Van Alstine and H. W. Riley, in Cornell Extension Bulletin 505 entitled "Save Labor in Growing Crops." The proper use and care of machinery, working the soil at the proper time, increasing yield and quality of crops by use of proper seed, liming and fertilization, proper cultivation, and control of weeds are suggested as ways of increasing the efficiency of the farm enterprise. In connection with the use of lime it is stated, "Many hours of labor are lost whenever a seeding is made on land too acid for the best possible growth of clover." Poor results from the use of manure and fertilizer also may be obtained if the soil is too acid. It is further stated, "Any deficiency in available phosphoric acid or potash wastes a farmer's time to the same extent that it decreases the growth of legumes. Insufficient legumes waste his time to the same extent that yields of corn and other non-legumes are lowered by lack of nitrogen. Proper fertilizing pays dividends in time as well as in yield."

¶ An interesting and complete discussion of tobacco in the United States has been prepared by Charles E. Gage in U. S. Department of Agriculture Circular 249 entitled "American Tobacco Types, Uses, and Markets." The characteristics of the various tobacco types, where and how they are grown, cured and used, amounts produced, marketing methods, and related information are given.

"Increasing Incomes and Conserving Resources on Cotton-Corn Farms in Marion County, Alabama," Agr. Exp. Sta., Auburn,

in the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Cir. 8, June 1942, H. H. Biswell, B. L. Southwell, J. W. Stevenson, and W. O. Shepherd.

"Winter Cover Crops," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 300, Aug. 1942, E. D. Alexander.

"Progress Report of Potato Research," Agr. Exp. Sta., Univ. of Idaho, Aberdeen Branch Station, Moscow, Idaho, Cir. 85, June 1942, J. E. Kraus and others.

"Influence of Cultural Factors on Alfalfa Seedling Infection by Pythium debaryanum Hesse," Agr. Exp. Sta., Univ. of Iowa, Ames, Iowa, Res. Bul. 296, March 1942, W. F. Buchholtz.

"Studies of the Production of Sweet Potatoes for Starch or Feed Purposes," Agr. Exp. Sta., Univ. of La., Baton Rouge, La., Bul. 348, June 1942, W. D. Kimbrough.

"Seed and Soil Treatment for the Control of Damping-Off," Agr. Exp. Sta., Univ. of La., Baton Rouge, La., Bul. 349, June 1942, L. H. Person and S. J. P. Chilton.

"Suggested Varieties, Dates for Planting, and Fertilizers for Truck Crops in South Louisiana," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., E. Cir. 231, Jan. 1942, G. L. Tiebout and A. C. Moreau.

"Winter Legumes," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., Agron Series No. 15, August 1942.

"Accumulating Soil Nitrogen by Manure and Cover Crops," Agr. Ext. Serv., Univ. of Md., College Park, Md., Cir. No. 139, Aug. 1942.

"Annual Report," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 388, Feb. 1942.

"Annual Report," Exp. Sta., State Board of Agr., Lansing, Mich., 1941.

"Winter Legumes for Nitrogen," Agr. Ext. Serv., Miss. State College, State Colleg, Miss., E. Leaf. 31, Aug. 1942, J. M. Weeks.

"Soybean Production in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 445, June 1942, B. M. King and Denver I. Allen.

"The Revegetation of Abandoned Cropland in the Cedar Creek Area, Boone and Callaway Counties, Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 344, June 1942, William B. Drew.

"Grass Silage in Wartime," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 234, May 1942, H. A. Herman and A. C. Ragsdale.

"Controlling Plant Diseases in the Home Garden," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 238, June 1942, C. M. Tucker.

"Filling the Silo with Corn or Sorghum," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 239, July 1942, J. E. Comfort.

"Fifty-fifth Annual Report of the Agr. Exp. Sta.," Univ. of Neb., Lincoln, Neb., 1941.

"Agricultural Research in Wartime," A. R. 1940-41 Agr. Exp. Sta., Univ. of Nevada., Reno, Nevada.

"Estimating the Value of Range Forage for Grazing Use by Means of an Animal-Unit-Month Factor Table," Agr. Exp. Sta., Univ. of Nevada, Reno, Nevada, Bul. 160, June 1942, Mark A. Shipley, C. E. Fleming, and Bryant S. Martineau.

"Feeding Experiments With Beef Cattle to Determine Nutritive Values of First, Second, and Third-Crop Alfalfa Hay," Agr. Exp. Sta., Univ. of Nevada, Reno, Nevada, Bul. 161, June 1942, F. B. Headley.

"The Home Vegetable Garden," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 428, April 1942, Charles H. Nissley.

"Growing Winter Barley in New Jersey," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 447, Aug. 1942, Carlton S. Garrison.

"Cottonseed Treatments in New Mexico," Agr. Exp. Sta., State College, N. M., Bul. 290, April 1942, Glen Staten.

"Sixty-first Annual Report, 1942," Agr. Exp. Sta., Geneva, N. Y.

"Dry-Bean Production in New York," Cornell Ext. Bulletin, Ithaca, N. Y., Bul. 489, April 1942, E. V. Hardenburg.

"Pastures for Pullets and Poults," Cornell Ext. Bulletin, Ithaca, N. Y., Bul. 502, May 1942, E. Y. Smith and G. H. Serviss.

"Wheat in Wartime Poultry Rations," Cornell Extension Bulletin, Ithaca, N. Y., Bul. 490, April 1942, E. I. Robertson.

"Growing Raspberries for Home Use," Cornell Ext. Bulletin, Ithaca, N. Y., E. Bul. 498, April 1942, M. B. Hoffman.

"Growing Strawberries for Home Use," Cornell Extension Bulletin, Ithaca, N. Y., Bul. 499, April 1942, A. Van Doren.

"Annual Report 1941," N. C. Agr. Ext. Serv., Raleigh, N. C.

"Progress of Agr. Research in Ohio 1938-1939," Ohio Agr. Exp. Sta., Wooster, Ohio, Bul. 617, Dec. 1940.

"Gladiolus and Dahlia Culture," Agr. Ext. Serv., Columbus, Ohio., Ext. Bul. 100, July 1941, Alex Laurie.

"Experiments with Greenhouse Tomatoes: Varieties, Cultural Methods, and Relationship Between Yield and Vegetative Vigor," Agr. Exp. Sta., Okla. A. and M. College, Stillwater, Okla., E. Bul. B-260, Sept. 1942, F. A. Romshe.

"Propagation of Trees and Shrubs by Seed," Agr. Exp. Sta., Okla. A. and M. College, Stillwater, Okla., E. Cir. C-106, M. Afanasiev.

"Feeding Dairy Cows on Pasture," Ext. Serv., Oregon State College, Corvallis, Ore., E. Bul. 592, April 1942, H. P. Ewalt and R. W. Morse.

"Growing Carrots for Canning and Freezing," Ext. Serv., Oregon State College, Corvallis, Ore., E. Cir. 363, March 1941, A. G. B. Bouquet.

"Muskmelons, Cantaloupes, and Miscellaneous Melons," Ext. Serv., Oregon State College, Corvallis, Ore., E. Cir. 369, May 1941, A. G. B. Bouquet.

Farms Solve Sugar Problem

AT A TIME of sugar rationing many low-income farm people who are taking part in the rehabilitation program of the Department of Agriculture are producing most of their own food including, wherever possible, sorghum, maple syrup, or honey.

Many Southern farmers use a home syrup mill, powered by a mule, to squeeze the juice from sorghum stalks. They boil down the juice in kettles and store it in jugs. This home-made "sweetening," richer in iron content than refined white sugar, tastes good on the traditional hot cakes and Southern biscuit. But it is used also with home-grown, whole-grain cereals, in canning, and in making pies, cakes, cookies, candy, jams, and preserves.

Small cooperative mills, intended for making syrup for home use, have been established in many Southern communities with the aid of loans from the Farm Security Administration. About 25 acres of cane or 100 acres of sorghum provide juice for one mill of this type, shared by the group. The season lasts two to three months, and a few farmers, working together, provide the labor.

In other regions, the chief home-produced sweetening used by farm families is maple syrup, which contains considerable calcium.

Beekeeping is practical for some farm families. FSA loans have enabled a number of small farmers to buy a few hives to get started. Three to five hives will keep a family supplied with honey.

Some Experiences in Applying Fertilizer

(*From page* 17)

show much the same trend as has been reported in this paper. Of equal interest are his studies on alfalfa. In his elaborate experiment with this crop, the highest yields have been where all lime and mineral fertilizers were plowed down. These plots after four years are in perfect health and vigor, while the plots not so treated are rapidly declining.

The field experiments on fertilizer applications inaugurated and supervised by my associates and myself have been widely scattered in the 13 Northeastern states. They have covered a considerable number of the row-planted crops, and more recently have been used in extensive studies on alfalfa and orchard cover crops. In the main, the results from these studies have been most encouraging. They have led to extensive,

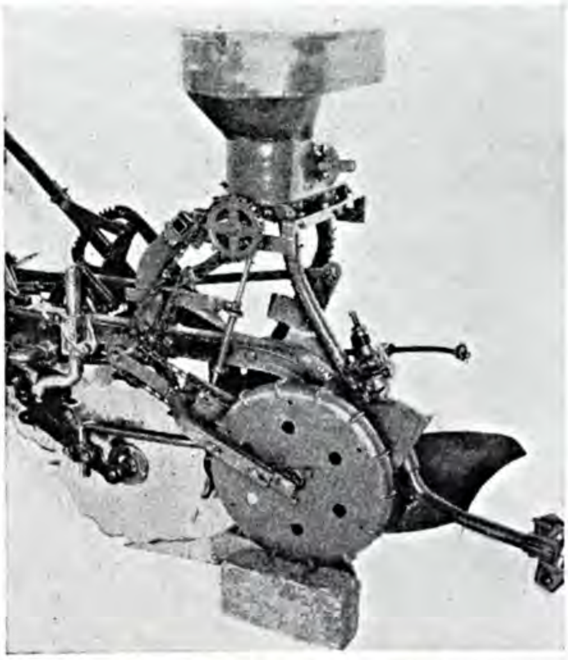


Fig. 4.—This fertilizer attachment for placing fertilizer on furrow bottom was designed for experimental work and is not in production at the present time.

Ala., Bul. 256, June 1942, Ben T. Lanham, Jr. and William F. Lagrone.

"Livestock and Forestry Enterprises on Farms in the Ozark Region," Agr. Exp. Sta., Fayetteville, Ark., Bul. 419, June 1942, W. T. Wilson and J. W. Reid.

"Statistical Investigation of a Sample Survey for Obtaining Farm Facts," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 304, June 1942, Raymond J. Jessen.

"Cotton Marketing Practices in Selected Local Markets in Louisiana," Agr. Exp. Sta., Baton Rouge, La., Bul. 345, May, 1942, H. W. Little and Roy A. Ballinger.

"Fruit and Vegetable Cooperatives in Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 317, June 1942, G. N. Motts.

"Economic Aspects of Recreational Land Use in the Lake of the Ozarks Area," Agr. Exp. Sta., Columbia, Mo., Bul. 448, June 1942, J. Roger Snipe and Conrad H. Hammar.

"Reducing the Cost of Producing Dairy and Poultry Products in Missouri," Agr. Exp. Sta., Columbia, Mo., Cir. 237, June 1942, B. H. Frame.

"New Jersey Prices of Hired Farm Labor, Feedstuffs, Fertilizer Materials and Seeds and Their Index Numbers 1910-1941," N. J. Dept. of Agr., Trenton, N. J., Cir. 334, May 1942, D. T. Pitt and Lewis P. Hoagland.

"Wartime Organization," N. Y. State Ext. Serv., Ithaca, N. Y., Bul. 492, April 1942.

"Save Labor in Growing Crops," Cornell Ext. Bulletin, Ithaca, N. Y., Bul. 505, May 1942, E. Van Alstine and H. W. Riley.

"Effects of Currency Depreciation on Prices, Production, and Foreign Trade, 1929 to 1937," Agr. Exp. Sta., Ithaca, N. Y., Memoir 242, April 1942, Claudius Van Der Merwe.

"Types of Farming in Western North Carolina," Agr. Ext. Serv., Raleigh, N. C., E. Cir. 259, June 1942, C. D. Thomas.

"Characteristics and Cost of Short-Term Farm Loans Made by Ohio Country Banks," Agr. Exp. Sta., Wooster, Ohio, Bul. 633, Sept. 1942, P. S. Eckert and J. I. Falconer.

"Management of Public Land in North Dakota," Agr. Exp. Sta., State College Station, Fargo, N. Dak., Bul. 312, May 1942, Morris H. Taylor and Raymond J. Penn.

"Wheat and Flax Prices Received by Farmers in North Central and North Eastern South Dakota, 1890-1940," Agr. Exp. Sta., South Dakota State College, Brookings, South Dak., Cir. 37, March 1942, Weber H. Peterson.

"The Influence of Tenure Status Upon Rural Life in Eastern South Dakota," Agr. Exp. Sta., South Dakota State College, Brookings, S. D., Cir. 39, May 1942, Walter L. Slocum.

"Farm Families of Two Vermont Counties, Their Incomes and Expenditures," Vt. Agr. Exp. Sta., Burlington, Vt., Bul. 490, June 1942, Marianne Muse.

"Vermont Crop and Livestock Review Season of 1941," Vt. Dept. of Agr., Montpelier, Vt., Bul 57.

"Economic Conditions and Problems of Agriculture in the Yakima Valley, Washington, Part IV. Hop Farming," Agr. Exp. Sta., Pullman, Wash., Bul. 414, July 1942, Harold F. Hollands, Edgar B. Hurd, and Ben H. Pubols.

"The Marketing of Washington Apples in Los Angeles, California, Part II. Retail Distribution," Agr. Exp. Sta., Pullman, Wash., Bul. 415, July 1942, Mark T. Buchanan and E. F. Dummeier.

"American Tobacco Types, Uses, and Markets," U. S. D. A., Washington, D. C., Cir. 249, June 1942, Charles E. Gage.

"Peanuts—Acreage, Production, and Disposition 1909-1940," U. S. D. A., Washington, D. C., July 1942.

"Cottonseed: Marketing Spreads Between Price Received by Farmers and Value of Products at Crushing Mills," U. S. D. A., Washington, D. C., July 1942.

"Evaluation Study of the Neighborhood Leader System Berkshire and Essex Counties, Massachusetts, May 1942," U. S. D. A., Washington, D. C., E. Ser. Cir. 386, July 1942, Fred P. Frutchey and James W. Dayton.

"Check List of Standards for Farm Products Formulated by the Agricultural Marketing Administration," U. S. D. A., Washington, D. C., August 1942.

"ACAA in Brief," U. S. D. A., Washington, D. C., ACAA-1, July 1942.

"Conservation is a War Weapon," U. S. D. A., Washington, D. C., ACAA-2.

"Strength is in the Land," U. S. D. A., Washington, D. C., G-114, (1942).

"To Win the War," U. S. D. A., Washington, D. C., G-115, (1942).

"The Americas—Lands of Promise," U. S. D. A., Washington, D. C., G-116, July 1942.

"Farm Organization and Financial Returns in the Lower Powder River Valley, Baker County, Oregon," Agr. Exp. Sta., Corvallis, Ore., Bul. 406, March 1942, George B. Davis and D. Curtis Mumford.

"Land Settlement in the Willamette Valley with Special Reference to Benton County, Oregon," Agr. Exp. Sta., Corvallis, Ore., Bul. 407, June 1942, Vernon W. Baker and D. Curtis Mumford.

"Dairy Farm Management and Costs in Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 421, Feb. 1942, W. L. Barr.

"Quarter Century of Agricultural Changes in Southwestern Knox County, Tenn.," Agr. Exp. Sta., Knoxville, Tenn., Mon. 135, April 10, 1942, H. J. Bonser, R. G. Milk, and C. E. Allred.

"Studies in Vermont Dairy Farming," Agr. Exp. Sta., Burlington, Vt., Bul. 479, June 1941, S. W. Williams.

"The 9th Annual Report of the Farm Credit Administration 1941," U. S. D. A., Washington, D. C.

ter Crops with Plant Food Magazine. June 1941, page 17.

(9) Colwell, W. E. and Baker, G. O. *Borax for Alfalfa in Northern Idaho.* Reprinted from Better Crops with Plant Food Magazine. March 1939, page 9.

(10) Colwell, W. E. and Lincoln, C. *A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa.* Reprinted from Jour. Amer. Soc. Agron. Vol. 34, No. 5, May 1942.

(11) Donaldson, R. W. *Use Boron and Potash for Better Alfalfa.* Reprinted from Better Crops with Plant Food Magazine. February 1941, page 9.

(12) Brown, B. A. and King, A. *Soil Conditions Under Which Alfalfa Responded to Boron.* Reprinted from Soil Sci. Soc. Amer. Proc. 1939, Vol. 4.

(13) Baur, K., Huber, G. A., and Wheeting L. C. *Boron Deficiency of Alfalfa in Western Washington.* Wash. Agric. Exp. Sta. Bul. 396, February 1941.

(14) Cook, R. L. *Boron Deficiency in Michigan Soils.* Reprinted from Soil Sci. Soc. Amer. Proc. Vol. II, 1937, p. 375-382.

Wartime Accidents Endanger Crops

(*From page* 19)

them. The Agricultural Extension forces are waging a special fire-preventing and fire-fighting campaign. The F.S.A. has vivified accident prevention among its clients through movies and demonstrations. The American Red Cross gives an instructor training course in home and farm accident prevention; these instructors should carry the word in many directions. Manufacturers of farm equipment have standardized and redesigned machine parts to make them safer. Safety garments are coming on the market. And now, an agricultural Interdepartmental Safety Committee is at work on accidents as a definite part of National Defense and war production. Its colorful leaflet, "Watch Your Step," is known far and wide.

Insurance goes hand in hand with prevention. The problem is definitely twofold: How to prevent and alleviate; how to compensate or indemnify. As more precise information is available, is collected, and is analyzed, the ready practicability of farm-accident insurance is bound to be improved. The subject is admittedly complex, but the Department of Agriculture is working on it and will surely find the way. The reason farmers do not use compensation insurance widely is also twofold; the nature of farm business makes it largely a family enterprise with only seasonal outside help and the prevailing minimum premium rates are relatively high. A plan is needed that will give the farm family and the occasional hired hands some protection against the results of accidents and give it at a cost that is commensurate with earnings for the specified period.

But to show up in the war crops this year and next, prevention is the thing. When it comes to crops, farmers need to be reminded to look carefully to the safety of their equipment and how it is used, to their methods of cultivating, harvesting, and storing. These are such everyday matters that each farm family thinks nothing will happen to them—until father gets the fall and the broken collar bone. Then who will cut the corn? Will he be well in time to store the crop? Who will we get to do it if he isn't? Suddenly these are burning questions in the family, and the answers may determine the family's contribution to total supplies.

cooperative studies with state agronomists and crop experts, some results having already appeared in the official publications. But most of all, perhaps, they have convinced me that only by continuous research can we ever hope to effect changes in practices that will insure the maximum efficiency from fertilizer use.

Continuous exposure to the problem of crop fertilization during the past 35 years and extensive personal study of methods of application have led to certain fairly definite conclusions. These are presented for whatever value they may have.

1. Improved methods of application have increased greatly the efficiency of fertilizers used.

2. Greater uniformity in plans for experiments are needed in studying any one crop.

3. Response of crops to specific methods of application is greatly influenced by soil class.

4. Methods of application as related to the ratio as well as concentration of N and K need further study.

5. More information is needed on deep placement of fertilizers by both the plow down and band methods, separately and in combination.

6. Further research on starter solutions is desirable.

Boron in Agriculture

(*From page* 22)

usually tagged so the farmer will not use the fertilizer on other crops that might be sensitive to borax.

Borax may be applied at almost any time of the year. Application at time of seeding is usually recommended by authorities. With an established stand an early spring application will generally give good results. Many farmers apply borax after the first cutting and, if rainfall is optimum, get good response even on the second cutting.

The work on red clover, crimson clover, ladino, and lespedeza has not progressed to the point that alfalfa tests have, but it is thought that likely some published information will be available on some of these crops by the fall of 1943.

BIBLIOGRAPHY

(1) Willis, L. G. and Piland, J. R. *A Response of Alfalfa to Borax*. Reprinted from Jour. Amer. Soc. Agron. Vol. 30, No. 1, January 1937.

(2) McLarty, H. R., Wilcox, J. C., and Woodbridge, C. G. *A Yellowing of Alfalfa due to Boron Deficiency*. Reprinted from Sci. Agric. 17:8, April 1937.

(3) Piland, J. R. and Ireland, C. F. *Application of Borax Produces Seed Set in Alfalfa*. Reprinted from Jour. Amer. Soc. Agron. Vol. 33, No. 10, October 1941.

(4) Hendricks, H. E. *Borax Helps Prevent Alfalfa Yellows in Tennessee*. Reprinted from Better Crops with Plant Food Magazine, December 1941, page 10.

(5) Grizzard, A. L. and Matthews, E. M. *The Effect of Boron on Seed Production of Alfalfa*. Reprinted from Jour. Amer. Soc. Agron. Vol. 34, No. 4, April 1942.

(6) Hutcheson, T. B. and Cocke, R. P. *Effects of Boron on Yield and Duration of Alfalfa*. Va. Agr. Exp. Sta. Bul. 336, August 1941.

(7) Midgley, A. R. and Dunklee, R. E. *Synthetic Wood Ashes Require Boron*. Reprinted from Better Crops with Plant Food Magazine. May 1941, page 6.

(8) Powers, W. L. *Boron—A Minor Plant Nutrient of Major Importance*. Reprinted from Bet-

Korean lespedeza germinated satisfactorily, but did not make satisfactory growth (Fig. 7).

Although uninoculated lespedeza did not fail on some of the soils tested, the growth was augmented greatly during the first year when the seed was inoculated (Figs. 1 and 7). The second season's growth of lespedeza on inoculated and uninoculated plots did not differ greatly.

Lespedeza should be planted in February or March on closely grazed sods or on firm seed beds (Fig. 8). It may be planted as late as June on newly prepared seed beds where grass competition will not retard the growth of the lespedeza seedlings. Rolling to pack the soil on newly prepared seed beds is desirable.

Little is known about the best grazing management practices of annual lespedeza. Good stands and growth of lespedeza were obtained on two experimental lespedeza-carpet grass pastures when grazing was delayed until the lespedeza reached a height of four inches. These two pastures have been grazed rotationally.

Preliminary results show that lespedeza increases the productivity and quality of forage as exemplified by increased carrying capacity and cattle gains when compared with carpet grass pastures.

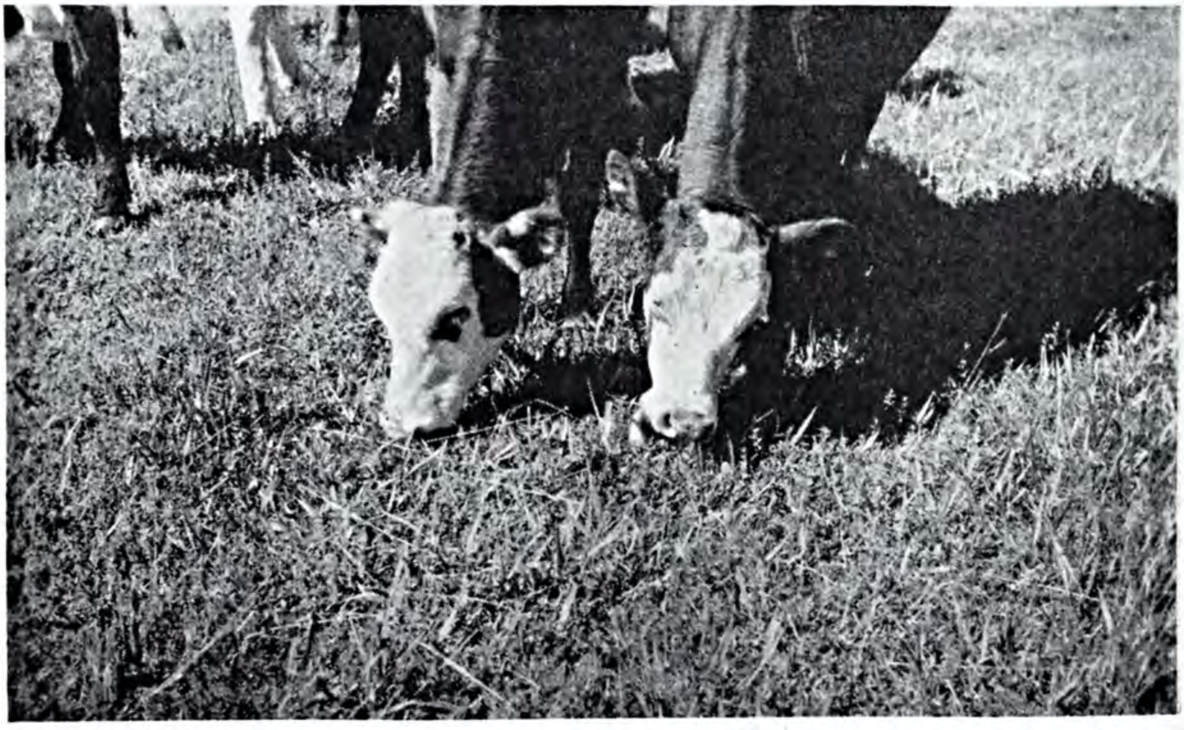


Fig. 8.—A lespedeza-carpet grass pasture grazed by grade heifers. One ton of lime and 450 pounds 0-16-8 fertilizer were applied in early March and seeded two weeks later with a mixture of inoculated common and Kobe lespedeza seed. The closely grazed carpet grass did not retard lespedeza.

The Nutrition of the Corn Plant

(*From page* 13)

Corn yields on the Sparta field on October 19 were: residues, 2 bushels; residues-lime, 12 bushels; and residues-lime-0-20-20, 36 bushels an acre. The yields on the Stroh farm on October 15 were: no treatment, 84 bushels; superphosphate hill-dropped, 104 bushels; and superphosphate broadcast, 100 bushels an acre.

Differences in fertility levels of these two soils may be further illustrated by the chemical composition. At Sparta

Danger lurks all along the way—familiar but unrecognized danger—and until it has been throttled by care, in the aggregate it threatens daily the big crops now confidently expected throughout the war years.

Lespedeza Pastures For Florida

(*From page* 10)

TABLE 2.—THE EFFECT OF LIME AND FERTILIZER MIXTURES AND SOURCES OF LIME ON THE CHEMICAL COMPOSITION OF LESPEDEZA ON A PLUMMER SOIL, ORLANDO, FLA., 1941

Soil Treatment Pounds per Acre	Chemical Constituents, Per cent Dry Basis**			
	Calcium	Phosphorus	Potassium	Protein
450# 0–16–8	1.080	0.210	0.620	14.5
Lime and 450# 0–16–8	1.462	0.169	0.610	12.5
Lime and 75# Muriate of Potash	1.182	0.129	0.720	12.0
Lime and 450# Superphosphate	1.316	0.182	0.328	12.4
Lime and 450# 0–16–16	1.233	0.197	0.693	14.8
Dolomite and 450# 0–16–8	1.140	0.201	0.518	12.6

Lime—ground limestone (93% Ca CO_3) applied at ¾ tons per acre.
Dolomite—(36% Mg CO_3 56% Ca CO_3)
** The mean differences for treatments in calcium, phosphorus, and potassium are significant as computed by the analysis of variance method.

of Common and Kobe lespedeza at the rate of 15 to 25 pounds per acre is recommended for pastures. The Kobe furnishes feed primarily during the first year, and Common volunteers during subsequent years.

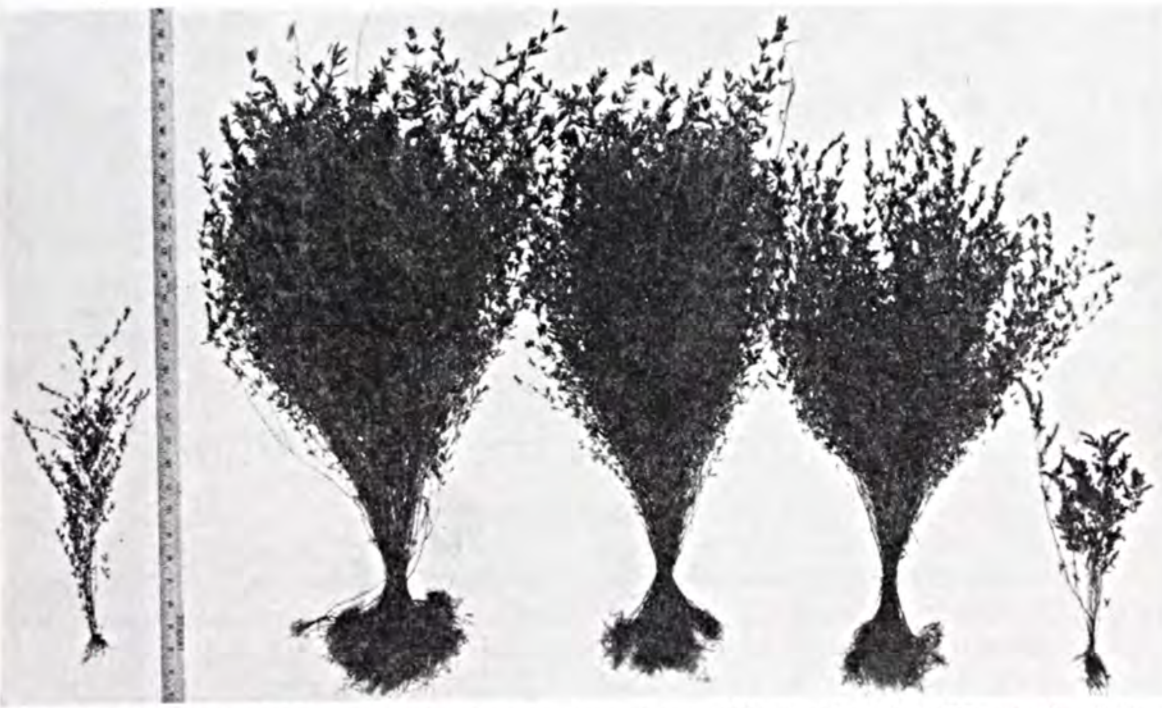


Fig. 7.—Lespedeza variety and inoculation are important. All treated with 1,500 pounds of lime and 450 pounds 0-16-8. Left to right: Kobe not inoculated, Kobe inoculated, Tennessee 76, Common, and Korean.

other and lighter documents. My four boyhood favorites were the African adventures of that wild gorilla hunter, Paul du Challau, quickly followed by Don Quixote and his windmills (with Sancho Panza), then the winsome and skeptical Alice of Wonderland fame, and of course, good old Black Beauty.

I know you all follow me quite well as I become an addict to G. A. Henty, whose startling list of boy heroes lived the pages of romantic history. I know you probably do not follow me when I turn the pages of Doc Talmadge's Earth Girdled. That was one of those subscription books hawked from door to door in the nineties, but it had some horrific pictures in it just the same.

THEN of course there were family games to get our minds in tune with social contacts. Playing cards were a problem at our house because the situation was a sort of cross between my Mother's Methodism and Father's carefree army life. Which is to say, my fancy for poker or whist got little impetus at our social hour.

This paucity of perspicacity with cards lingers to this very day, causing my wife to gibe me for my ace trumping proclivities—but she calls it by a shorter and uglier word.

Returning to the game festivals again, my Father was a checker addict, specialist or stylist, or whatever one might call a whiz-dinger. He never graduated upward to the noble game of chess, but he tried to awaken my flagging zeal sometimes with certain ancient lap-board pastimes harking back to log-cabin leisure.

That is, he patiently sawed out and planed down a few square pine boards and marked them off. He raided Mother's sewing box for buttons. The result was known as "fox and geese" and "nine-men-morris." All I recall was that in the former game a big overcoat button was the fox and several white panty buttons were the geese. Maybe some of the handicraft experts and parlor game revivers in the 4-H Club contingent could dig up those old rules for us. As no metal or rubber is required for either of such innocent hour-wasters, it's worth thinking about.

Of course, the mystic ouija boards had their innings in our lamp-lit parlors too. Next to attending a regular spiritualistic meeting, these solemn and silent periods of breathlessness were a mid-Victorian substitute for the gory and ghastly radio horror dramas. When we combined the ouija program with a little hard cider and a choice lot of Uncle Solomon's weirdest graveyard and lonely house spook tales we couldn't make our hair lay flat with a curry comb and brush for a week.

Then when all else paled and we became surfeited with each other, somebody would seek solace amid the pile of double-exposure prints and shaded eyepiece known as stereoscopic views. Uncle Sol had contributed a nifty extra set lately, known as a Trip Through Hades, and Father's precious glimpses of corpses strewn on the best battlefields of the Civil War, highlighted with the hanging of the Lincoln conspirators in three views—these are memories that keep us awake even today.

TWO other reminders occur linked closely with the topic of home lighting. They were the magic lantern diversion, silhouettes, and shadow pictures. The former thing was a smelly and somewhat dangerous contraption given to small boys on Christmas with vivid colored glass slides for projection against one of Mother's bed sheets hung on the wall. The same sheet was also good for the finale of guessing who was which behind it, or making divers animals and other imitations with clawing fingers and fists.

This as I said brings me to discuss the filling and cleaning of lamps and barn lanterns. It may happen again under oil rationing, so let's get onto the technique. Not from me, however, as I cannot bear to go into it that far.

If you had to carry a coal-oil lamp

the untreated soil was quite acid, pH 4.5, and when limed the pH was 6.5 with a very low total nitrogen content of 1,300 pounds an acre (two million pounds). On June 1 the nitrate or available nitrogen on untreated soil was 20 pounds, on treated soil 160 pounds. The soluble phosphorus was 14 pounds and the available potassium was 90 pounds. The Stroh untreated soil was acid, pH 5.2, and contained 3,800 pounds total nitrogen. Twenty pounds of soluble phosphorus and 300 pounds of available potassium were found to an acre. This soil was low in phosphorus and relatively high in nitrogen and potassium. The area had been cultivated at intervals during the previous season (1940) to kill out Canada thistles. Nitrate or available nitrogen on June 1 was 90 pounds an acre; outside this area the amount was 40 pounds an acre. There was ample nitrate-nitrogen without excess.

On this field, Mr. Stroh has a rotation of corn-corn-oats with a seeding of red clover-timothy in the oats which remains three years and is moderately pastured. The cornstalk growth is plowed under each year which aids materially in keeping up the organic matter supply of the soil.

The Sparta field rotation is corn-soybeans-wheat-wheat. Sweet clover is seeded in each wheat crop and plowed under for green manure. Cornstalks, wheat straw, and soybean chaff are returned to the soil in order to add organic matter and to improve the physical condition of the soil.

Apparently, the soil on the Stroh farm has reached the point where it is much in need of additional phosphorus, a condition typical of a large part of the corn belt. These chemical results leave no doubt that this soil is approaching or has reached the point where additional potash is needed if 100-bushel corn yields are to be maintained. With the increasing difficulty of growing legumes on these acid soils, the time is at hand for liming and possibly the use of commercial nitrogen when a rotation is used which does not allow for sufficient legume nitrogen.

The Sparta soil (Cisne silt loam) with the extremely low total nitrogen (1,300 pounds) and a deficiency of organic matter has also a great handicap in an unfavorable physical condition. This kind of soil requires unusually careful management in order to build up a reserve of plant food and maintain satisfactory and profitable crop yields.

Thanks For A Little

(*From page* 5)

list is short because our investment in books was small; but no doubt they are familiar comrades of other fellows of my period, so those winter-night companions will bear a brief recital here.

Not a few of them have survived the age of fables in which they were born, to remain the best amusement of lads in this era when fairy tales come true. Others perchance have lost some of their glamour owing to their unfamiliar backgrounds.

My earliest recollections of trying to read center upon one of those heavy gilded tomes known as the Family Parallel Bible, with wood-cuts by Gustave Dore. I liked the nickel clasps particularly because I could snap them just like the ponderous old parson in our church services—and the book weighed about ten pounds and I usually got my scriptures in a very humble position indeed, flat on my belly across a sea of flowery ingrain carpet. I have it on my shelf now, but the last time I opened it, I am afraid, was to fill in two births and an obituary in our "family record."

By fits and starts I graduated to

FAR ENOUGH

"It is high time," said the reformer, "that we had a moral awakening. Let us gird our loins. Let us take off our coats. Let us bare our arms. Let us—"

"Hold on, now!" exclaimed a tall, thin woman near the platform. "If this is to be a moral awakening, don't you dare to take off another thing!"

Mother: "Now, Junior, be a good boy and say 'Ah-h-h,' so the doctor can get his finger out of your mouth."

"Do you act toward your wife as you did before you married her?"

"Exactly. I remember how I used to act when I first fell in love. I used to stand in front and look at her house almost afraid to go in. Now I do the same thing some nights."

Have you heard about the salesman who started on a shoestring? He worked up until he got his face slapped.

Try this one eating a cracker: A skunk sat on a stump. The skunk thunk the stump stunk, and the stump thunk the skunk stunk.

Corny jokes about sentries still go on and on, and here's one that emanates from Camp Blanding, Florida. The vigilant sentry shouts, as usual, "Halt, who goes there?" Back comes the answer: "Hell, you wouldn't know me—I just got here."

"I wouldn't want to marry a widow and be a second-hand husband."

"Well, it's better than being her first husband."

Gob: "How are you this evening, honey?"

Girl: "All right, but lonely."

Gob: "Good and lonely?"

Girl: "No, just lonely."

Gob: "I'll be right over."

Sergeant: "What's your name?"

Draftee: "Quitz Jones, sir."

Sergeant: "Where didja get a name like that?"

Draftee: "Well, sir, it was like this. When I was born, my dad came in and took one look at me and said to mom, 'Dear, let's call it Quitz!'"

The chaplain preached a forceful sermon on the Ten Commandments, sending one private away in a serious mood.

He eventually brightened up. "Anyway," he said, "I never have made a graven image!"

A floor walker, tired of his job, gave it up and joined the police force. Several months later, a friend asked him how he liked being a policeman. "Well," he replied, "the pay and hours are good, but what I like the best of all is that the customer is always wrong."

Everybody loves to find fault; it gives a feeling of superiority.

upstairs each night and study in a frosty room heated only with a bulging stovepipe heat reservoir known as a "drum," maybe you'd get the same idea of the value of snapping on a switch. But if you had to fit in wicks, soap and polish the narrow chimneys without dropping the last one in the house, and keep the bowls filled with oily fuel from a can with a potato on the spout—then I guess you'd quit cussing the daylight out of the public service utilities.

I AM aware that some districts of our good land still adhere to such illumination. The stable lantern is still in use here and there on back roads, and those who have them better keep them to use when the auto headlight is seen no more upon our nightly peregrinations.

Lastly, but not least, came the advent of Thanksgiving. Here we can set it down right away that the only real difference existing between Then and Now respecting that festive occasion lies in the way things were cooked and what they were cooked upon and with—not by any means in the way they were eaten and relished. Folks today like good eatables and consume them in the fashion common since Adam and the apple core, but fuel and stoves have much changed.

Our folks used to ramble on about the old Dutch ovens and the open fireplace spits and turners for roasts. In my day only ancient grandmas in remote areas still baked bread and cooked their dinners over open fires. Ours was the heyday of the cast-iron wood ranges, which meant working up a good appetite for victuals in the adjacent chip-strewn wood-shed.

They had back reservoirs for hot water which had to be kept filled. Their usual fire-box dimensions were small and hence the kids like me were busy hacking up poplar and oak and elm into suitable sizes to fit neatly beneath the circular lids. Polishing the surfaces of those wood-eating monsters was also a common chore. Draft handles must be regulated and creosote dripping around the chimney pieces added nothing to the adornment of the cook room walls. Lugging in the front-room base-burner also recalls highly argumentative conversation and weary legs and aching arms, all of which I have discussed with relish in former essays.

You just didn't step to the phone and call for a gallonage of oil or a ton or so of Pocahontas. No, siree, it was a late summer and early fall task to roam the farm wood-lot and fell the least desirable specimens for working up into fuel. It was a twice and thrice-warming business, that of providing fuel for former festive meals.

Neither did we worry over any scarcity of fats and oils at the grocery. Hog butchering time came handily just before the Thanksgiving and Christmas meals were prepared. Our supplies of lard and scrapple and other greasy tidbits were enough to give modern folks the dyspepsia.

YET when all is said and done I suppose few of us would care to hark back to the self-sufficing days, even if the harking business were pleasant and easy. But it isn't easy. After you have got a dog used to sleeping on a pillow in the best parlor chair, that hound won't want to stay very long out in the kennel. I'm like that, too, and so are you, old-timer, or else you are a rival of Munchausen.

The point I want to leave with you is this—that it won't do to fight each other over what there is left of the nicest and coziest nooks and situations. We'll have to be like the old old-timers when a stranger knocked at the door—haul him in and feed him on what there is left "down cellar in the teacup" and provide him with a shake-down somewhere in the corner.

They did it because America was worth a few discomforts and privations compared to the humility and slavery they had seen abroad. I reckon it's worth it now.

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

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)
Of Course I'm Interested (Pastures, Canada)

Reprints

B-8 Commercial Fertilizers in Grape Growing
K-8 Safeguard Fertility of Orchard Soils
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
A-9 Shallow Soil Orchards Respond to Potash
N-9 Problems of Feeding Cigarleaf Tobacco
R-9 Fertilizer Freight Costs
T-9 Fertilizing Potatoes in New England
CC-9 Minor Element Fertilization of Horticultural Crops
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
M-4-40 Ladino Clover "Sells" Itself
O-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podsols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
LL-12-40 Tripping Alfalfa
A-1-41 Better Pastures in North Alabama
B-1-41 Our Defense Against Soil Fertility Losses
C-1-41 Further Shifts in Grassland Farming?
D-1-41 How, Where, When Apply Fertilizers?
E-2-41 Use Boron and Potash for Better Alfalfa
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
U-8-41 The Effect of Borax on Spinach and Sugar Beets
V-8-41 Organic Matter Conceptions and Misconceptions
W-8-41 Cotton and Corn Response to Potash
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
CC-11-41 There's Enough Potash for National Defense
DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
EE-11-41 Cane Fruit Responds to High Potash
FF-12-41 A Five-year Program for Corn—Livestock
GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
JJ-12-41 Potash Demonstrations on Statewide Basis
A-1-42 Canadian Muck Lands Can Grow Vegetables
B-1-42 Growing Ladino Clover in the Northeast
C-1-42 Higher Analysis Fertilizers As Related to the Victory Program
D-2-42 Boron Deficiency on Long Island
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-3-42 High-grade Fertilizers Are More Profitable
J-4-42 Boron Stopped Fruit Cracking
L-4-42 Permanent Hay the Plant Food Way
M-4-42 Nutrient Availability—An Analysis
N-5-42 Soil Bank Investments Will Pay Dividends
O-5-42 Nutritional Information from Plant Tissue Tests
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
R-5-42 Legumes Will Furnish Needed Nitrogen
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa

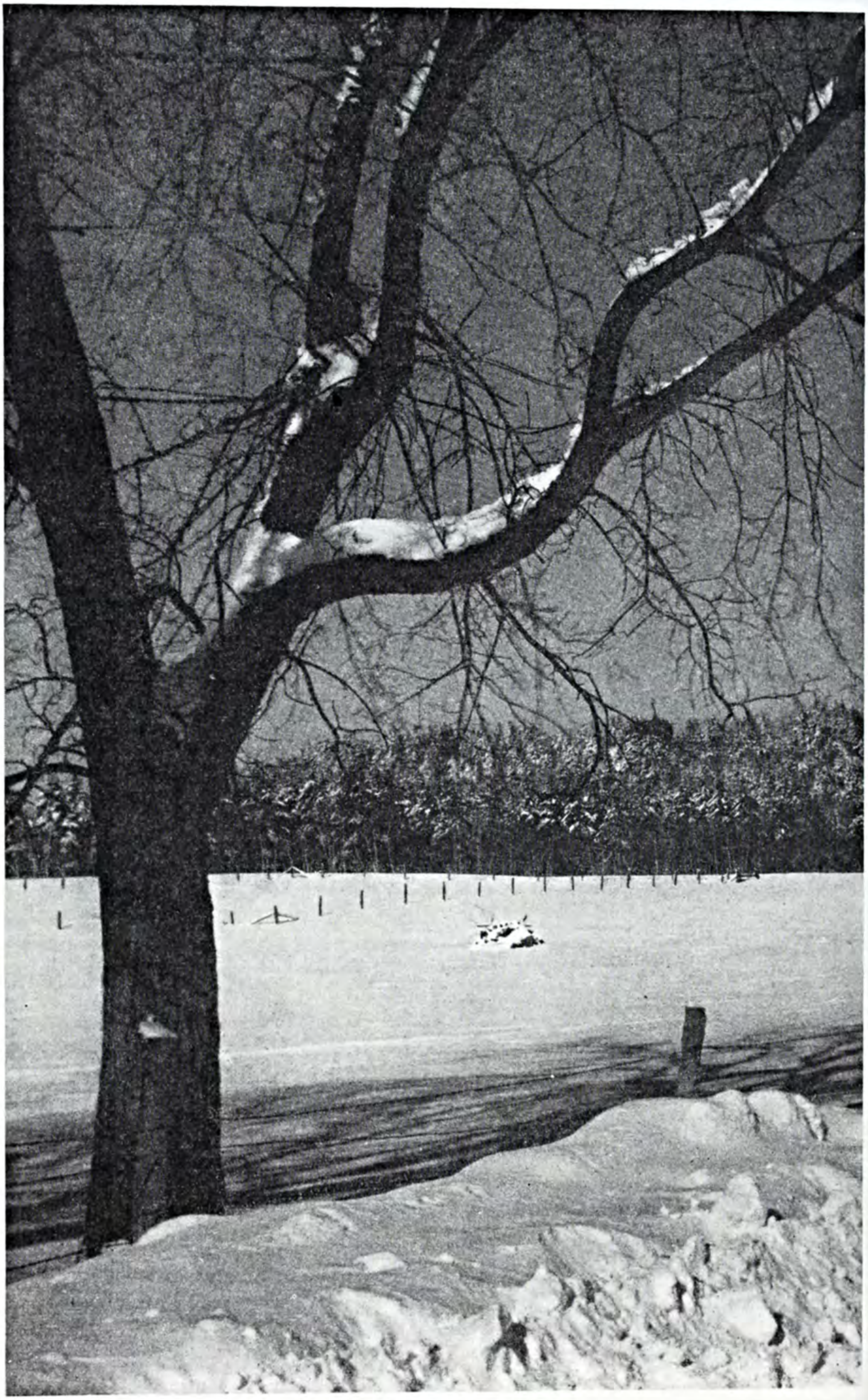
THE AMERICAN POTASH INSTITUTE

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

Better Crops with PLANT FOOD

December 1942 10 Cents

The Pocket Book of Agriculture



SILENT NIGHT

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XXVI NUMBER 10

TABLE OF CONTENTS, DECEMBER 1942

stockings. "They feel like wearing garden hose," says my daughter, "and look like a crocodile's hind leg!"

"That's next to nothing," I says in consolation. "Look at the bottoms of my pants. They resemble the fringed termination of Daniel Boone's all-weather outing suit, but I'm right proud to go primitive like our old heroes did. It's not only democratic as the dickens, but it's just like being at some masquerade party every day. No doubt as soon as we get the point system established on clothing, I shall limit myself to the utmost economy and finally wind up like our original aborigines—in loin cloth and turkey feathers. When that time comes, my idea is they should furlough some of the soldiers and let us deprived folks go over with the Injun outfits on. Europeans have heard so much about wild red men from the pulp magazines that they would scatter on sight."

"Anyhow, you might at least comb your hair, what there is of it, because neatness is not taboo as far as I know," she returned with feminine scorn. "You aren't deprived of being decent. It's better to be deprived than depraved anyhow," she said. "But you have to be careful because only one little letter stands between one word and the other. Remember your failings," she said. "Be true to your New England conscience. That's one thing they can't operate on."

"I'M not so sure about that either," I answered. "As long as the old scrap metal drive lasts, my conscience is in some danger of being mistook for an outcast relic and wind up in the junk yard."

"Speaking of your conscience," says my daughter, "I've lost my eyelash curler and that empty tooth-paste tube. Whattum I going to do?"

"It's an eye for an eye and a tooth for a tooth these days, dear heart," was my reply. "Those are Churchill's own words and we've got to stand firm against folderols." So she flounced out, hunting for the something to use instead of her favorite cold cream.

In my zeal to warm up to the cold topic assigned me, I shall pass by the kitchen door, where Ma is trying to tease a lumpy mass into a tasty dessert without enough sugar and spice. It is dangerous and foolhardy to enter that delicate domain without the makings of a meal in your pocket.

Nonchalantly, I sneak into my study sanctum to indulge in full-time worrying without outside competition. But the facts of life stare me in the face, even in this rookery. My old typewriter runs on one cylinder and makes as much noise as the farm bloc, and needs repair worse than a 1920 binder. But what slows me up most is the general crisis in situations.

IT has come to such a pass that I cannot strike a key without writing War or Bombs or Rations or Victory. The government has never actually issued a ban against utilizing some of my old means and methods of essay production. But the gentle public now grown berserk demands opinions, reviews, forecasts, and summaries dealing with the global combat—and what I know of the globe and the habits of its inhabitants in tropic seas and desert sands is only an echo of high school examinations.

I don't know an ornithopter from a helicopter; my ideas of the Garand rifle are as remote as Einstein's theory; and because I was in Class 4-A in 1917, I am unable to toss an iron hat onto the community scrap heap or call Irvin York "buddy." I cannot make you feel the thrill of sighting the Statue of Liberty for the first time from the outer harbor, as I have always been a naturalized inmate. If I had the imagination and the iron nerve of some of the loquacious columnists, I should fare better on reduced rations of rhetoric.

You can see at once what a fix I am in. I cannot resign because the federal treasury needs my donation next month, and the vast, panting public is

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXVI WASHINGTON, D. C., DECEMBER, 1942 No. 10

It's Holiday Season, so . . .

"The Same to You!"

Jeff McDermid

OUR TOWN, beleaguered and bewildered, has dug in for the duration. So as to make things clear in all this murk, I shall begin to retail our woes—(which is about all they retail now anyway.) I shall start at my own hearthstone.

"Ah, ha," you exclaim, "that's a pretty way to usher in the holiday season, reciting a mess of misery." "On the contrary," I reply, "misery loves company, and that's the only kind of company we can afford since my wife's relations all got A cards." (One of the war's compensations, by the way.)

"You see," I explain further, "being resigned to deprivation and content with makeshifts is a mark of civic pride and personal courage. They have done it for three years in Germany and France and England, and we've gotta prove to them how well we can take it too. The country that can deny itself the most in the shortest time is going to win. You ought to be thinking up more go-withouts and stop grouching."

"Well," the 'tother feller said, "that would be all right with me if they really stinted us on what is stintable. But how about them two items like cheese and gas," he says. "They are both very plentiful here in the Midwest, simply boiling over you might say; and yet we get rooked on cheddars and ethyl beyond all rhyme or reason."

"Now think patriotic for once," I come back. "Don't you realize they are cutting on gas to save rubber and holding back on cheese to save beer?"

Returning to my own crisis, I might begin with a review of the plight which my women folks are in when they look at their limbs encased in substitute

Wartime Contribution of the American Potash Industry

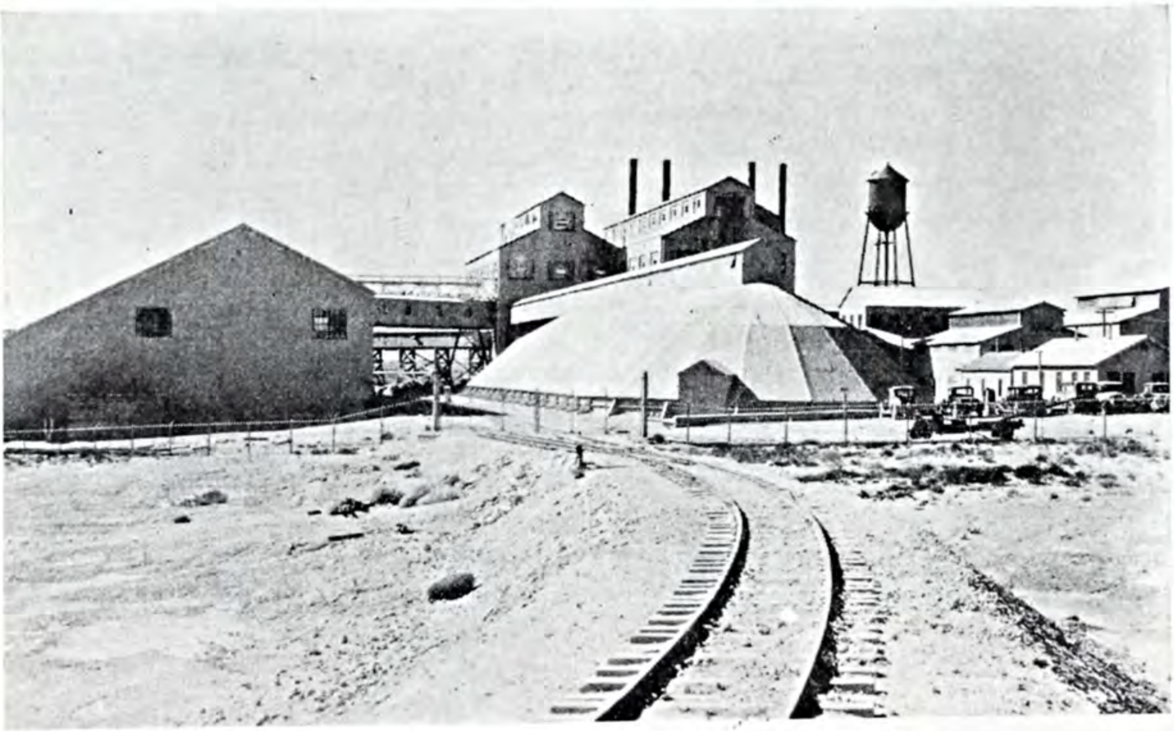
By Dr. J. W. Turrentine

Washington, D. C.

THE story of potash in North America has been told many times. It covers 30 years and is made up of many chapters, some of vision, hope, and success interspersed with others that deal with disappointments and heartaches. There is not one chapter, however, that deals with despair, for throughout the 30-year period there persisted a small group of legislators, scientists, and industrialists who remained steadfast in their faith that America would have a potash industry of sufficient dimensions, at least, to sever the ties of dependence on European sources of supplies. The story of how that independence has been achieved is often referred to as the romance of the American potash industry.

The current chapter deals with the industry's task of supplying potash salts called for by the war effort. The requirements of the war effort have been expanding month by month, both in tonnage and variety of potash salts, calling for an industry that must remain in a high state of mobility if its performance is to keep pace with that of the nation it serves. The process of expansion, however, is now ending due to the scarcity of essential materials of construction.

The present situation is a vivid contrast to that existing in 1914 and the succeeding four years of war. When war was declared in 1914, this country was totally dependent on the German potash monopoly for all potash salts, with scarcely the vestige of an industry



Storage facilities of potash mine and refinery of the U. S. Potash Company.

looking my way for inspiration. But writers are restricted by custom to a card-index of topics, beginning with Armaments and ending with Zones. Anything else is venial triviality, and suspected of being unpardonable lust for the outlawed Status Quo.

However, I have a slight ray of hope left. Gas stations may turn into livery stables in a couple of years, if there is enough leather and horse-flesh available. Thereupon, I shall trot out more of my erstwhile essays on nostalgia, in-

cluding the ancient moss-grown watering trough, the clanking blacksmith shop, the smelly harness store, and the joy of holding hands on a winter night on a hay-rack ride. Indeed that welcome era may transform me from a belated observer to an authoritative expert, much in demand where the listening is rapt and the victuals varied. When that time comes, I will feel as much at home as Claude Wickard at a hog-raiser's banquet.

Night illumination in Our Town was once confined to a glimmer at the gas stations to cheer some wayfarer out of fuel; a faint twinkle at the hotel and pool palace to entertain the convivial; and a murky glow in one corner of the calaboose for those who became too hilarious. Every mercantile spot was usually quite dark.

But lately you find most of the stores showing a faint, flickering light back in the rear where the boss is perched on a stool at the littered oak desk. Step in and ask him if his business is so fast that he is behind on his ledgers, and he'll probably throw something at you.

"See that hook where we used to file the sales slips and freight invoices? What dy'e 'spose jams it so full now? Nothing less than government orders, regulations, and priority memoranda. When I began the hardware business forty years ago, all the alphabet rigmarole we kept in mind was IOU, COD, and PDQ. But now we have ODT, WPB, OPA, AMA, BLS, NLRB, ICC, and Harry Hopkins!

"Today I go after something and find my shelves almost empty of galvanized ware, and then I dig open a government envelope and read that after January 1 we ain't goin' to get a single item of galvanized stock, except garbage cans, fire shovels, and wash tubs and boilers; and then, only half of what we sold during the depression. And there won't be any more stainless steel cutlery and coffee pots either."

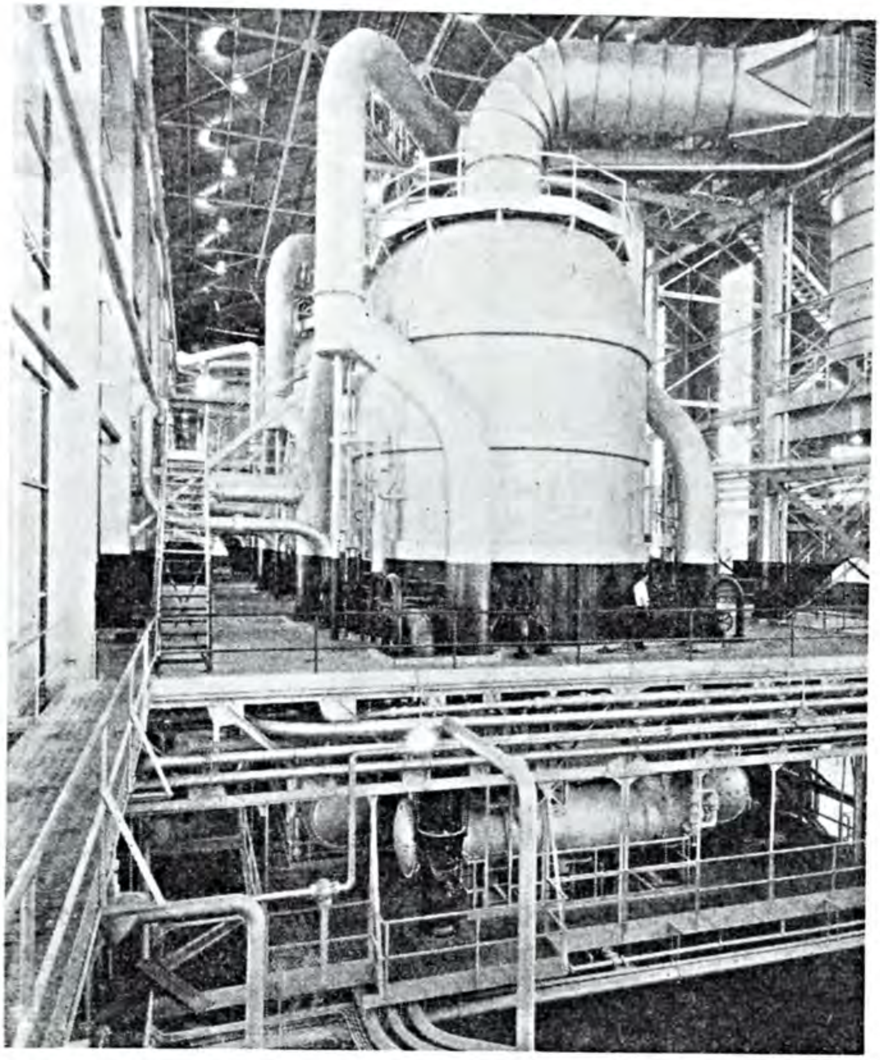
"But, my good friend," I say in a futile attempt to soothe him, "the general orders restricting travel are apt to keep your customers trading right at home. It wasn't so long ago I heard country merchants complain about farmers driving to the larger places for supplies."

His reply is soon coming. "It might have helped us some if this gas-saving business had started before I lost my clerks to a defense plant and got swamped with red tape and them business-bustin' bulletins. It's got so that half my stock is froze stiff and the other half is all gone. But I got me a new set of lead pencils and a gallon of red ink, so I'm all set to figure my deficit down to the last dollar, and then give my note to the bank to settle my income taxes."

"Well, anyhow, it might be worse if we got conquered and starved out," is my hackneyed comment.

"Look here, Jeff," says the hardware man, "don't get any of us mercantile

(*Turn to page* 44)



Evaporator unit in the plant of American Potash and Chemical Corporation.

progress made: The 1914 price of \$35 per ton now has its analog in the current price of \$25 per ton. Thus, there has been the equivalent of a \$10 reduction in the price of muriate. On the unit basis, the 1910-14 price was 71.4 cents; the current discount price of 60 per cent muriate is 47.1 cents, a reduction of 24.3 cents per unit K_2O. In 1914, the highest grade of that era was 50 per cent muriate; some 90 per cent of the total muriate of potash now being produced is of the 60 per cent grade, corresponding to some 97 per cent KCl

still been importing a considerable percentage of our potash requirements. What was not so generally known was that we had been exporting a substantial proportion of our production, which could and would be diverted back immediately into the domestic market; that we had large expansions in production capacity underway; that we had great reserves of unrefined run-of-mine salts readily available to more than equal any deficit in the refined salts that might develop; and that production of potassium sulfate, formerly largely imported, could and would be promptly expanded.

This forecast of 1939 has now been realized by two years of demonstrated performance (Figure 1). The contrast between the two crises, while dramatically illustrated by price stability, contains other features that illustrate the

which approaches the ultimate of refinement. Thus, there has been a 10 per cent increase in plant-food content. Involved also is a corresponding decrease in delivery costs. In 1914 domestic consumption approximated 250,000 tons K_2O a year. In 1942, it is estimated, we shall need some 580,000 K_2O; for in addition to the requirements of the continental United States, the domestic industry has assumed the task of supplying those of Puerto Rico, Hawaii, Canada, Cuba, and our "good neighbors" to the south. Since 1914 there has been an increase in demand of some 320,000 tons K_2O. Current production capacity in refined salts exceeds 600,000 tons K_2O. Thus, since 1914, refining capacity has increased from nothing to this figure, approximating a million tons of materials; in addition there is a demonstrated capacof its own. In consequence, the price soared from $35 to as high as $500 per ton of 50 per cent muriate. Fortunately, however, in 1911 surveys had been inaugurated by the federal Departments of Agriculture and the Interior to determine what we had in the way of raw materials from which potash could be extracted. All of the potential sources—minerals, natural brines, marine and dry-land plants, and industrial wastes—to which public attention was called by these surveys were promptly placed under exploitation and made to yield their quota to the wholly inadequate supply. By 1918, therefore, we were producing 20 per cent of our pre-war consumption which, with cautious use, engendered by the high prices persisting for the four-year period, enabled us to survive without serious disaster.

That experience taught several lessons which, learned by some, were ignored, tragically enough, by industrialists in other lines who have assumed the task of supplying the essential needs of the American public. Those lessons were and are:

1. The wisdom of foresight and planning.
2. The folly of relying on foreign sources of essential commodities, raw materials or finished products, however orderly their delivery and reliable they may appear to be.
3. The necessity of inaugurating technological research well in advance of an emergency, however remote, and keeping abreast of the most advanced techniques. If considerations of early profits on funds so expended are a deterrent to private initiative, the problems whose solutions are vital to our economic and social security must be assigned to the excellent research organizations endowed by the taxpayer and with staffs inspired by zeal for public service.

Modern mucking machine in operation in the mining of potash.

Potash research was inaugurated in 1911 and has continued up to the present time. The interval prior to 1914 was too brief to permit the development of techniques on which to establish competitive industries. In consequence, with the resumption of imports in 1919, 74 out of a total of 77 war emergency production units were forced to go out of business.

But research did not stop! Therefore, in 1939 when the second World War began and potash imports were again suspended, the interested public was told that national requirements would be taken care of by the domestic industry. In verification, there was no increase in price, nor has there been one since in the preferred standard grade of 60 per cent muriate.

Considerable skepticism greeted this statement when first made in 1939, for up to September of that year we had

Crystallizing house and evaporator buildings of American Potash and Chemical Corporation.

of Searles Lake and Salduro Marsh and the by-products, cement dust and distillery waste, were utilized as sources of potash during the first World War.

While steadily increasing their capacities, the major producers have added other chemicals to their list of products and thus effected diversification and full utilization of the constituents of their raw materials. Outstanding in this respect is the American Potash and Chemical Corporation with a list of products that includes potassium chloride of some 98 per cent purity designed for the fertilizer trade and a product further refined for the chemical trade, as well as potassium sulfate, sodium sulfate, sodium carbonate, sodium borate decahydrate, sodium metaborate, boric acid, bromine, potassium, sodium, and ammonium bromides, and lithium salts. The recovery of tungsten is now undergoing study.

The potash ores of the Carlsbad area are too free from impurities to admit of such an array of products; yet under production are potassium chloride of several degrees of purity and crystal size, potassium sulfate, sulfate of potash-magnesia, potassium hydroxide, potassium chlorate, and magnesium chloride.

As recently as 1938 we still imported 65,000 long tons of potassium sulfate from Europe. At that time we already had some production from the interaction of potassium chloride and sulfuric acid. This conversion was promoted by the Potash Company of America in collaboration with producers of salt cake, potassium chloride being substituted for sodium chloride in that manufacture. Later the American Potash and Chemical Corporation entered upon this production through the interaction of potassium chloride and burkeite, another practical application of the phase rule. In 1939 this company announced its willingness to expand initial production to provide the essential requirements of agriculture, and proceeded to do so. This was followed in short order by the completion of the refinery of the International Minerals and Chemical Corporation with the production of potassium sulfate from langbeinite (a natural potassium-magnesium sulfate) by interaction with potassium chloride. As the result of these activities, keen apprehension as to the adequacy of wartime supplies of this form of potash so essential

(*Turn to page* 41)

ity to produce and deliver over 40,000 tons K_2O in run-of-mine salts of 22 per cent or better K_2O content. Finally, since 1914, imports have declined from 100 per cent of our requirements to the current vanishing point.

The first major company to establish itself was the American Trona Corporation, now the American Potash and Chemical Corporation, which as early as World War I produced potassium chloride from the brine of Searles Lake, Calif. Since that time, through dint of continuous and persistent research, it has undergone development after development, added product after product from that highly complex brine which is the raw material processed, to its present state of constituting one of the outstanding chemical achievements of this country. Here is to be found phase-rule chemistry in its most intricate form applied on the plant-wide scale and mechanized with the greatest precision.

Following the discovery in 1926 of subterranean deposits of high-grade potash salts underlying an area near Carlsbad, N. Mex., the United States Potash Company entered that field and thus became the American pioneer in the mining and refining of a raw material from such a source. Its mine was equipped with the latest mechanical devices and its refinery in accordance with the best technology then developed. Thus was realized for the first time the dream of an American potash industry similar to that of Europe, long recognized as the ideal.

Then followed in the same field the Potash Company of America with a mine thoroughly mechanized and a refinery built to apply the flotation process, the first industrial application to a water-soluble ore of the familiar flotation principles. This was followed in turn by the mine and refinery of the former Union Potash and Chemical Corporation, now amalgamated with the International Minerals and Chemical Corporation, again with a mechanized mine and a refinery employing flotation methods, in part at least. These four are the major factors of the American potash industry.

Intermediate in scale of production is the plant of Bonneville, Ltd., near Wendover, Utah, where the raw material is a brine found in the clay stratum underlying the salt crust covering the Bonneville Flats or Salduro Marsh of the Salt Lake Basin. Here solar evaporation is employed to yield a mixture of crystalline sodium and potassium chlorides, subsequently separated by flotation. Minor sources are the incinerator ash of U. S. Industrial Chemicals, Inc., of Baltimore, whose raw material is the evaporated and burned distillery waste from molasses fermentation, and the fractionally precipitated cement dust of the North American Portland Cement Company at Hagerstown, Md. The natural brines

Heavy equipment for removing potash salts from large stock piles in storage, American Potash and Chemical Corporation.

trouble was associated with low ash and silica content of the straw. The work of Welton (12) indicated the same effect of nitrogen, but his study showed lodging more closely correlated with low lignin content than with low ash or silica. Davidson and Phillips (5), on the other hand, concluded from their work with nitrogen-induced lodging in wheat that high and not low lignin content is the cause of lodging.

It has been observed by Tubbs (11) that when potash is limited, wheat tends to lodge, especially in wet weather. He concludes that potassium is essential to the production of an efficient mechanical tissue. However, Purvis (9) studied the structure of the stems of a grass (Dactylis glomerata) and formed the opinion that potassium does not effect an anatomical strengthening of the stem, but that its effect is more probably attributable to a change in physiological condition or chemical composition.

Lodging has been frequently observed in small grains growing on the soils of heavy texture in the Missouri River bottoms. The lodging usually occurs on the heavy, dark-colored clay soils. These soils are presumably well supplied with potassium, but because of the nature of the clay minerals that compose a rather large portion of the soil mass and the high calcium content, there is a possibility that the potassium present is fixed in a difficultly available state. Preliminary field trials were carried out for the purpose of finding whether or not the use of potassic fertilizers would remedy the cause of lodging. As a consequence of the observations by Tubbs, Welton, and others and the clay texture of the soils, it was considered advisable to lay out plots in which the treatments consisted of varying levels of potassium added as muriate (60% K_2O). In addition to the potash, some of the plots received phosphorus as "treble phosphate" (45% P_2O_5). The treatments are shown in Table 1.

In the fall of 1940 the plots were seeded to wheat, an extensive crop on the heavy alluvial soils along the Missouri River, but because poor stands were obtained, the plots were planted to oats the following spring. Contrary to expectation, the oats on the high-potash plots lodged badly, while those receiving no additional potash stood up well. An analysis of the straw and of the soil was made in an attempt to explain the reason for the lodging.

TABLE 1.—TOTAL N, AND EXCHANGEABLE CA AND K IN SOILS AS AFFECTED BY ADDITIONS OF KCL, WITH AND WITHOUT ADDED PHOSPHORUS

Plot	Treatment per acre	Clay soil			Sandy soil		
		Total N %	Exch. Ca mg./100gm. soil	Exch. K mg./100gm. soil	Total N %	Exch. Ca mg./100gm. soil	Exch. K mg./100gm. soil
1	400 lbs. KCl 150 lbs. P_2O_5 (45%)	.22	529.1	72.3	.16	325.6	44.1
2	400 lbs. KCl	.22	507.2	61.5	.18	339.3	80.3
3	200 lbs. KCl 150 lbs. P_2O_5 (45%)	.21	499.8	59.2	.16	323.2	55.3
4	No treatment	.21	509.8	65.2	.15	316.2	21.9
5	200 lbs. KCl	.21	516.0	64.7	.18	490.6	58.5

Weak stems in soybeans, like lodging of oats, may be induced experimentally under variable nutrient levels. Left to right, moderate to excessive potassium; above, high calcium; below, low calcium.

A Preliminary Study Of Lodging of Oats

By H. E. Hampton

Agricultural Experiment Station, College Station, Texas

AS TIME goes on, more and more evidence is accumulating to point to the relation between nutrient balance in the soil on the one hand and plant composition and resistance to disease and insects on the other. Certain other plant reactions, such as lodging in small grains, have likewise been associated with the nutrient levels in the soil.

The possible significance of the calcium-potassium ratio in the soil has been suggested by Albrecht (1) as an aid in a better understanding of plants in relation to soil development and soil fertility. A survey of orchard practices and mealybug injury to apple trees in Virginia has led Schoene (10) to the conclusion that increased insect damage follows a slight deficiency of potash in proportion to nitrogen following several applications of nitrogenous fertilizers in an attempt to improve fruit color.

It is generally accepted that lodging of cereals is caused by nitrogenous over-nutrition, although the actual role of the nitrogen in this connection is not well known. Davidson and LeClerc (4) found that applications of sodium nitrate caused lodging of cereals. This

The Place of Boron In Growing Truck

By A. G. B. Bouquet

Oregon State College, Corvallis, Ore.

CERTAIN plant-food elements, such as boron, have usually been classified as being of minor value because of the relatively small amounts of them used by plants and because, until recently, but little was known of their function in growing agricultural crops.

It is particularly interesting to note, therefore, that probably no single plant-food element has received as much attention in recent years as one of these so-called minor elements, namely boron. Given but little consideration a few years ago, boron has now taken a place among plant-food elements as being highly important and essential to the normal plant growth of many economic crops. This is especially true with vegetable crops. Moreover, the number of crops for which boron is now considered an essential element covers a wide range. The list includes apples, alfalfa, apricots, avocados, barley, beans, beets, blueberries, broad beans, cabbage, carrots, cauliflower, celery, citrus fruits, corn, cotton, cloves, cucumbers, currants, grapes, gloxinias, hops, kohlrabi, legumes, lentils, lettuce, lilies, oats, onions, pecans, peaches, peas, prunes, potatoes, radishes, rice, rutabagas, sorghum, soybeans, spinach, strawberries, sugar beets, sugar cane, sunflowers, swedes, sweet potatoes, tobacco, tomatoes, turnips, walnuts, and wheat. All of these crops at some time or other have received attention to a greater or less extent in the relation of boron to their growth.

More investigations have been made with sugar beets and the use of boron in growing them than any other single crop. In fact it was the publication in 1931 by Brandenburg, a German investigator who discovered the heart-rot disease of sugar beets to be due to boron deficiency, which initiated a widespread interest in the possible relation of boron to other plants and their disorders. A standard application in Germany for sugar beet heart-rot was the use of borsuperphosphate, using 5 parts of borax and 95 parts by weight of 18 per cent superphosphate.

World-wide Interest

Some 13 countries of the world have participated in investigations of boron in sugar beet production, including Belgium, Canada, Czechoslovakia, Finland, France, Germany, Great Britain, Italy, the Netherlands, Russia, Sweden, Switzerland, and the United States. Others that have conducted investigations with boron in its relation to crop production include Australia, New Zealand, Africa, Brazil, Hawaii, India, and Poland.

According to Purvis (1), one of the earliest investigators of the use of boron in this country, areas in the United States reporting boron-deficiency symptoms include states widely scattered over the country as a whole, but particularly centered along the Atlantic seaboard, around the Great Lakes, and in the Pacific Northwest. These states include Alabama, Connecticut, Florida, Idaho, Indiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oregon, Rhode Island, South Carolina, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

The soil on each plot is not entirely uniform; one end of each plot contains a larger proportion of sand than the other. For this reason two samples of plant material and two of soil were taken from each plot and analyzed separately. That this separation was justified is shown by the results of the analysis.

TABLE 2.—PLANT CONTENTS OF TOTAL N, CA, K, AND LIGNIN IN RELATION TO KCL ADDED WITH AND WITHOUT ADDED PHOSPHORUS

Plot	Treatment per acre	Clay soil				Sandy soil			
		Total N %	Ca %	K %	Lignin %	Total N %	Ca %	K %	Lignin %
1	400 lbs. KCl 150 lbs. P_2O_5 (45%)	.44	.20	3.23	25.5	.60	.14	2.88	24.7
2	400 lbs. KCl	.53	.17	3.44	24.6	.67	.19	2.93	24.2
3	200 lbs. KCl 150 lbs. P_2O_5 (45%)	.50	.22	2.33	32.4	.45	.14	2.96	31.6
4	No treatment	.53	.23	2.41	33.5	.53	.18	1.84	34.1
5	200 lbs. KCl	.49	.19	2.31	34.0	.41	.18	2.74	34.5

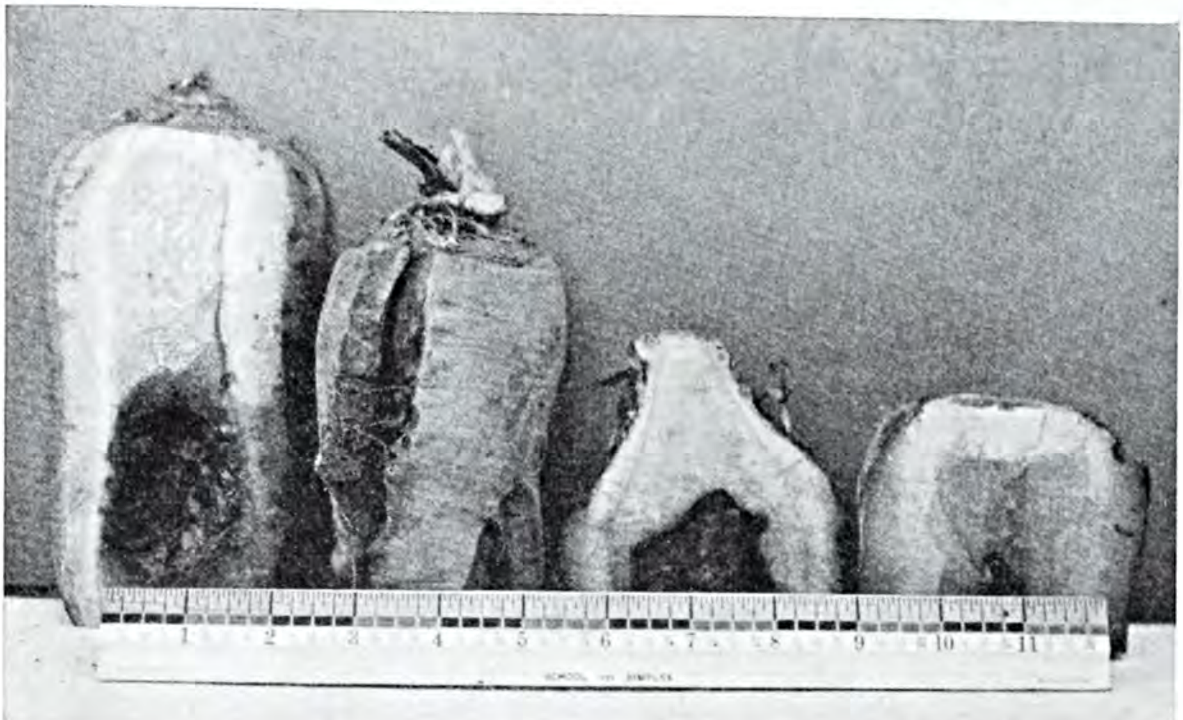
The soils and oat stems were analyzed for total nitrogen by the method of Kjeldahl-Gunning-Arnold as modified by Murneek and Heinze (8). Finely ground samples of the plant material were digested by the wet ashing method (6), and calcium and potassium determined in the digested samples by the methods described by Kolthoff and Sandell (7). The same methods were used for the determination of calcium and potassium in the ammonium acetate leachate of the soil samples. A modification of the method proposed by Crampton and Maynard (2) was used for the estimation of the lignin content of the plant material.

From the results of the soil analyses given in Table 1, it will be seen that the heavier soils contain more total nitrogen, exchangeable calcium, and in general, more exchangeable potassium. Neither the applied potash nor the added phosphate influenced the total nitrogen. In the clay soils, there was little relation between replaceable soil potassium and potash added; however, the relationship was much more evident in the sandy soils. The clay soils are evidently well saturated with bases and the potassium supplied was presumably fixed in a non-replaceable form. The lighter soils, on the other hand, are not fully saturated and have less ability to fix potassium, therefore, they show an increase in exchangeable potassium with larger amounts of potash added.

The results of the plant analyses are given in Table 2. With the exception of the oats from the sandy soils receiving high applications of potash, the treatments had no significant effect on the plant content of total nitrogen. The samples from the sandy soils of Plots 1 and 2 contained nearly 18 per cent more nitrogen than oats from the other plots, and in addition, these were the only samples that showed damage from rust and smut.

The percentages of calcium and potassium in the plant samples followed very closely the ability of the soils to supply these elements. This relationship was particularly evident in the case of potassium. The close relation-

(*Turn to page* 40)



There may be an interior breakdown as well as exterior canker when a deficiency of boron exists.

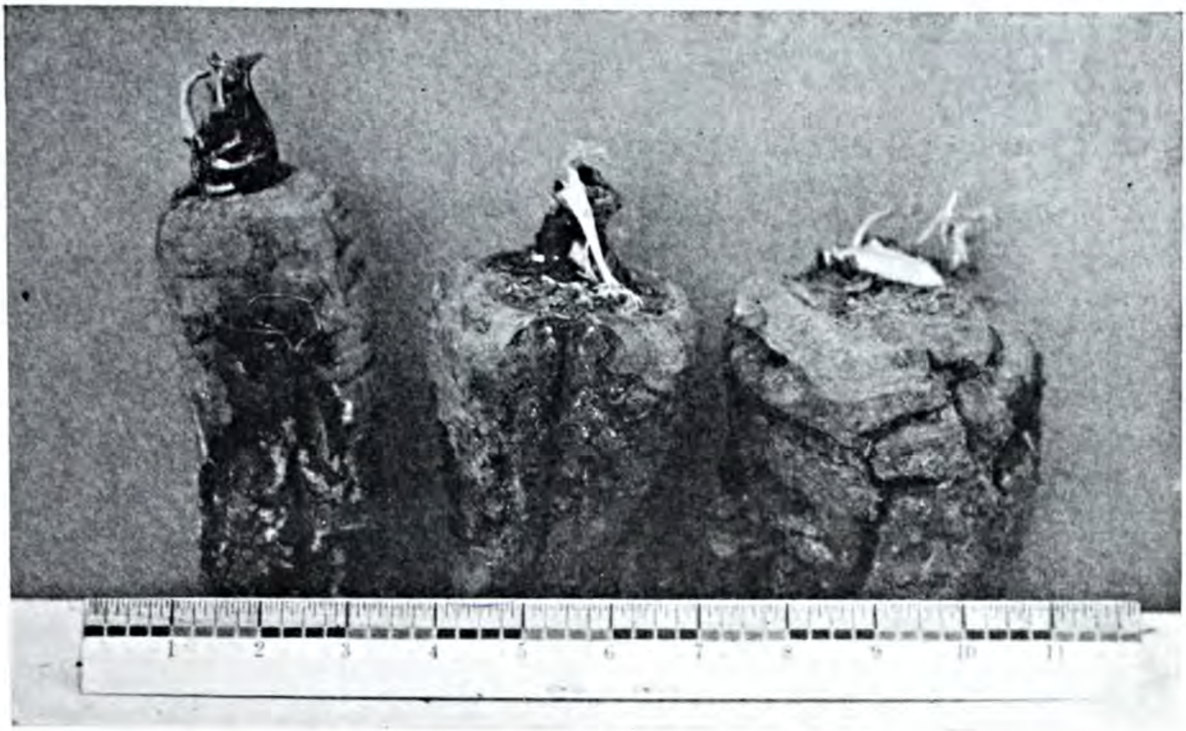
1936, Zimmerley and Parker of the Virginia Truck Experiment Station corrected boron deficiency on celery by an application of borax at the rate of 10 pounds per acre.

In the latter part of 1937, W. L. Powers, Soil Scientist at Oregon State College, conducted some greenhouse experiments showing that 30 pounds of borax prevented beet canker. Field trials were conducted by Powers and the author in 1938 and a report was presented in Oregon Station Circular of Information 195. These constituted the first field trials in the use of boron for the control of canker of table beets. Since that time practically every field of table beets in Oregon grown for canning has received applications of boron.

Almost all beet growers are familiar with the symptoms of canker of the beet, sometimes called internal breakdown, internal black-spot, dry rot, girdle, etc. Several years before the use of boron in this regard was known, this malady was photographed and described by the Oregon State College Department of Horticulture. In most beet plants affected by boron deficiency there is a relatively prostrate or downward hang of the leaves and a dead or injured growing point.

Beets have been canned in Oregon to the extent of over 300,000 cases annually, and therefore the use of borax for this crop is important. Losses due to beet canker have possibly averaged from 8 to 10 per cent per year, although in individual fields the losses have been considerably higher. Evidently the beet has an unusually high requirement for boron, or, in other words, the plant has a high degree of susceptibility to injury from boron deficiency compared with other crops. Since the value of boron for beets has been established, particular attention has been paid to the amount of borax to be applied and the method of placement.

In contrast to the comparatively small amounts of borax advised in the early years of experimentation along these lines, it is now felt that if a fertilizer in which boron is to be added is broadcast over the beet area, it will be advisable to apply 500 pounds or so of the fertilizer together with 50 pounds of borax. If the fertilizer is side-dressed, the amount would not ordinarily exceed 200 to 300 pounds with 30 to 40 pounds of borax.



Boron deficiency in carrots may cause both canker and exterior splitting.

Vegetable crops mentioned in these states as having been investigated in their relation to boron include beets, broccoli, cabbage, carrots, cauliflower, celery, corn, eggplant, kale, lettuce, mustard, peppers, radishes, rutabagas, spinach, sweet potatoes, tomatoes, and turnips.

By far the greater number of investigations of the value of boron in growing vegetables has taken place within the last five or six years. This is true not only in the United States but also in other countries.

One of the earliest investigators was an Englishwoman, K. Warrington (2), who reported in 1923 on the relation of boron to the growing of broad beans. This investigator has since reported briefly on the requirement of boron in growing carrots. Diseases in sugar beets were studied on a basis of boron deficiency in Sweden, France, Belgium, and Ireland in 1935, and it was found in Sweden that addition of boron to the soil increased the yield and sugar content of the beets. The Belgian Institute for Beet Improvement carried out a program of study on boron deficiency in beets in 1935, and similar work was carried out in Ireland. In the United States boron deficiency in sugar beets was fairly well established in Michigan in 1932.

In 1929 Johnston and Dore (3) published in "Plant Physiology" on the subject of "The Influence of Boron on Chemical Composition and Growth of Tomato Plants," but thus far there has been little, if any, boron used in growing this vegetable.

In August 1935, Purvis and Ruprecht (4) of the Florida Agricultural Experiment Station published a press bulletin on "Borax as a Fertilizer for Celery," and 10 pounds of borax per acre were advised. Again in 1937 (5) these authors published the first bulletin on boron deficiency of a vegetable crop. This was a progress report on the use of boron in prevention of celery stem-crack.

In the spring of 1936, the Department of Vegetable Crops of Oregon State College sent S. E. Fish of Eugene 10 pounds of borax for his celery, and a like amount was also sent Henry Oman, a celery grower of Milwaukie, Oregon. Both of these growers who had complained of celery stem-crack have been regular users of borax since that time. At about the same time, in

Nitrogen for Crops From Winter Legumes

By W. F. Watkins

U. S. Department of Agriculture, Washington, D. C.

NITROGEN long has been recognized as an essential plant-food element in crop production. In war time, the use of chemical nitrogen is equally important but more difficult to obtain for growing crops because of the amount needed for military purposes. Fortunately, the nitrogen needed to maintain agricultural production can be obtained from two sources, that available for use in commercial fertilizers and the amount that can be obtained by growing legumes. In view of this situation, it is desirable to review some of the literature containing information on the effect of nitrogen from these two sources on crop production.

The agricultural economy of the Southeastern States is closely tied up with the use of nitrogen to maintain crop production. This area consumes from 60 to 70 per cent of the nitrogenous fertilizer used in the United States. The soils in this area are not only low in nitrogen content, but it is not possible to build up and maintain the soil nitrogen content comparable to the nitrogen content of the Central Corn Belt soils. The accompanying figure shows the average 1935-39 consumption of nitrogen in commercial fertilizers by States. On the other hand, the systems of farming and adapted legumes in the Southeast present a problem different from other sections of the country. The seasons are long and it is possible to grow cash, soil-depleting crops during the summer, and a soil-building legume during the fall and early spring. To date, the use of winter legumes has not been sufficiently extensive to make a major contribution to the agricultural economy of the area. Has this been due to the ineffectiveness of these legumes in obtaining satisfactory crop yields, the economies of growing legumes, the lack of income, or to other factors?

The area most seriously affected from a shortage of nitrogen fertilizer stretches from the fertile delta of the Mississippi River through the Coastal Plain and Piedmont sections of the Southeast, and north into Virginia. In this same area, winter legumes such as Austrian peas, hairy and common vetch, and crimson clover generally can be grown.

Dependent Upon Soil Management

Throughout this area, cotton is the principal cash crop for a large rural population with few acres of cropland per person. The farms are small, with less than one-half the land in cultivation, and the area has been farmed for many decades. The virgin fertility has been depleted and much of the original surface soil has been washed away. The crops produced depend on a soil-management program that supplies the elements of fertility, rather than the reserve that may be in the soil.

The most important fertility element throughout the area is nitrogen. State experiment stations have conducted many experiments comparing the effect of winter legumes and commercial nitrogen on the yield of cotton, corn, and other crops. In the following paragraphs some brief summaries of the results obtained are presented, including the effect on single crops and all crops in the cropping system.

The average winter legume crop contains 50 to 100 pounds of nitrogen per

In Wisconsin (6) no toxicity has been found in the use of larger amounts of borax broadcast to the extent of 80 to 100 pounds per acre, especially in alkaline soils. One hundred pounds were applied in Wisconsin in 1939 and 1940, 1½ inches to the side of the row on the same level as the seed, and the recommendations in that State are to the effect that 60 pounds broadcast is a safe amount. Apparently, in the Wisconsin experiments there was little difference in the choice of efficiency between broadcasting and side applications where 60 pounds per acre were used. This State also reports that 40 pounds of borax on a beet field lasted two years, but 20 pounds per acre for two years was insufficient. In other words, the larger amount of borax had a longer effect.

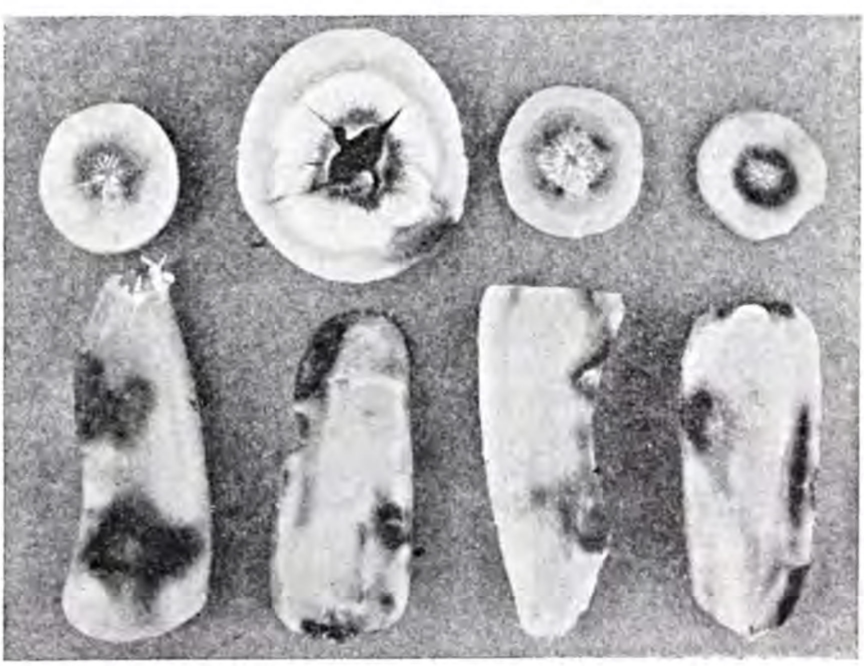
Based on his investigations, W. L. Powers (7) opines that boron-deficient soils should receive boron every two or three years. It was further mentioned in the Midwest investigations that a grower could get reasonably good control of canker by a single top-dressing at the side in mid-July, the data given being as follows: 83.7 per cent black spot in untreated soil, 5 per cent from the use of 20 pounds in July, 1.4 per cent from the use of 40 pounds, and no injury from the use of 60 pounds.

It is likewise interesting that in testing the susceptibility of different varieties of beets to canker, it was found in Wisconsin that there was a marked difference in susceptibility. The Good-for-All variety showed considerable black-spot injury where, on the same land, the Detroit Dark Red was practically free from injury. Such findings have also been confirmed by field and greenhouse experiments at Corvallis and Eugene, Oregon.

It has been stated that the factors contributing to beet canker are these: First, the beet has a higher boron content than many other vegetable crops; second, little if any manure has been used on beet ground; third, in correcting the reaction of the soil, increased liming has brought increased percentage of injury; and fourth, some soils have experienced moisture deficiencies. Other reasons given for boron deficiency are the present-day use of pure synthetic fertilizers and the problems of soils and their leaching.

Before proceeding to a discussion of symptoms of other vegetable crops for which boron is now used, the values of boron for vegetables might be enumerated as follows: Elasticity given to cell membranes, increased resistance to damage from drought, improvement of conducting tissues, inducement of normal leaves, prevention of stem cracks and hollow areas in roots, likewise in preventing discoloration of flowers such as cauliflower and in correcting miscellaneous characters of mal-

(*Turn to page* 37)



Other indications of boron deficiency in carrots are black spot and water core.

vetch crop failed. During the three previous years a good growth had been incorporated in the soil; and in 1928, with an 18-inch spacing, the corn yielded 34.6 bushels, an increase of 21.7 bushels for the legume. In the same year the increase in corn yield from 200 pounds of nitrate of soda was 12.1 bushels, and from 400 pounds of nitrate of soda was 23.9 bushels. The average increase in yield of seed cotton, where legumes were turned under in 1925 to 1927, was 224 pounds per acre.

In Alabama experiments, the application of superphosphate and lime increased the yield of winter legumes. In a three-year rotation, crop yields were only slightly increased with phosphate and potash, without legumes; but with legumes, the yields were increased by 293 pounds of seed cotton and 11 bushels of corn per acre.

The following table shows the yield of seed cotton and corn with different sources and amounts of nitrogen.

The rotation of cotton-vetch-corn, with 225 pounds of nitrate of soda on the cotton, increased the yield of seed cotton 673 pounds, and corn 23.4 bushels per acre. It is possible that vetch turned under for the cotton would have given profitable yields, but in actual practice only a limited acreage can be planted and turned under at the proper time.

The successful growing of cotton on average Georgia soils, according to experiments, requires that it be supplied with 30 to 36 pounds of nitrogen, 32 to 48 pounds of phosphoric acid, and 24 to 36 pounds of potash per acre. The supplies of nitrogen may be obtained from commercial fertilizer or legumes. Twelve years' results at the Coastal Plains Experiment Station, Tifton, Georgia, gave an average yield of corn of 47.3 bushels, and of seed cotton of 1,303 pounds, with no nitrogen fertilizer and winter legumes; and a yield of corn of 48.0 bushels, and of seed cotton of 1,410 pounds, with a complete fertilizer containing nitrogen.

(*Turn to page* 34)

Average Annual Yields of Seed Cotton and Corn Produced in Various Cropping Systems, 1930–1935

Cropping System[1]	One acre of cotton and one acre of corn					
	Yields per acre		Value of crops less cost of fertilizer and legume[2]	Increase over cotton-corn. No nitrogen	Cost of increase	
	Seed cotton	Corn			Cotton per pound lint	Corn per bushel
	Lbs.	Bus.	$	$	¢	¢
Cotton—Corn. No Nitrogen	795	16.3	36.36	....	....	....
Cotton—Corn. 36 lbs. Nitrogen to each	1,325	31.9	61.82	25.46	2.1	24
Cotton—Vetch—Corn. No Commercial Nitrogen	1,008	34.4[3]	55.96	19.60	....	14
Cotton—Vetch—Corn. 36 lbs. Nitrogen to Cotton	1,468	39.7[4]	74.61	38.25	1.7	11

[1] 600 pounds of 0-10-4 were applied annually to each plot; where vetch was grown, this fertilizer was applied in the fall.

[2] The seed cotton was valued at 4 cents per pound, the corn at 75 cents per bushel, superphosphate at $16 per ton, muriate of potash at $33, nitrate of soda at $33, and vetch at $2.50 per acre.

[3] Average green weight of vetch turned under was 7,810 pounds per acre.

[4] Average green weight of vetch turned under was 10,475 pounds per acre.

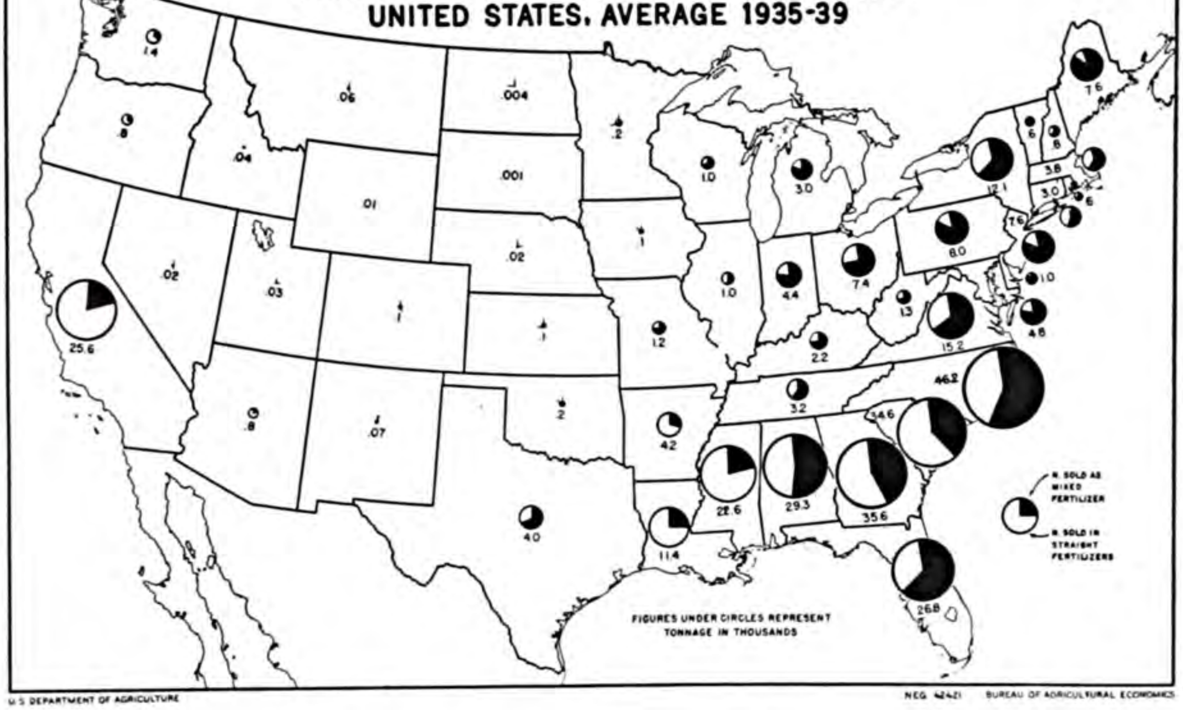
acre, and maximum cotton yields are usually obtained with 45 to 50 pounds of commercial nitrogen. In the Mississippi Experiment Station Report for 1940, "Cotton receiving its nitrogen from winter legumes and its phosphorus and potash from 400 pounds of 0-8-4 produced almost identical yields with cotton receiving 400 pounds of 6-8-4 with no winter legumes."

Soil Treatment	Yield of seed cotton per acre (6-yr. Av.)
400 pounds 6–8–4	1,252 lbs.
Hairy Vetch, plus 400 pounds 0–8–4	1,305 lbs.
Austrian Peas, plus 400 pounds 0–8–4	1,244 lbs.
Crimson Clover, plus 400 pounds 0–8–4	1,213 lbs.

16.9 bushels, and the yield with 30 pounds of nitrogen has been 31.4 bushels—an increase of 14.5 bushels, or about 1 bushel of corn for every 2 pounds of nitrogen.

Experiments dating back to 1896 on different sources of nitrogen have received major emphasis in Alabama. Particular emphasis has been placed on the influence of winter legumes on the yield of succeeding crops, the residual effect of legumes, and the influence of fertilizers, especially phosphate, potash, and lime on the yield of legumes.

Ten-year results on cotton and corn grown continuously gave average yields, without legumes, of 349 pounds of seed cotton and 8.2 bushels of corn; and yields, with legumes, of 1,041 pounds of seed cotton and 19.4 bushels of corn —an increase of 692 pounds of seed cotton and 11.2 bushels of corn. In a three-year rotation of corn, cotton, and



AMOUNT OF NITROGEN CONSUMED IN THE UNITED STATES, AVERAGE 1935-39

U.S. DEPARTMENT OF AGRICULTURE NEG. 42421 BUREAU OF AGRICULTURAL ECONOMICS

On Mississippi upland soils, fertilization also is necessary for corn yields large enough to be economical. The value of winter legumes has not been satisfactory because of poor stands obtained; hence, the nitrogen was not supplied. The 6-year average yield of corn with no fertilizer has been only

oats, each plot received the same application of phosphate and potash. Where legumes were included in the rotation, the yield of seed cotton per acre was increased 397 pounds, and corn, 24.2 bushels.

The residual effect of turning under vetch was obtained in 1928 when the

Barley yields on Marathon silt loam were nearly 49 bus. per acre without fertilizer, 66 bus. with phosphate alone, and about 69 with both phosphate and potash. On this soil, which is better drained and more suitable for barley than the Spencer type, smaller applications of fertilizer sufficed to bring about maximum yields.

On the basis of these trials with barley as a test crop, the best recommendations that can be made at present are 250 lbs. per acre of 0-20-10 or 0-20-20 for Spencer silt loam and 125 lbs. per acre for Marathon silt loam, or the equivalent in fertilizer of other analyses. It may be necessary to modify these recommendations as more data accumulate.

Phosphate and Potash Help Crops in Door County

Seventeen years of research at the Peninsular experiment farm near Sturgeon Bay have indicated that crops respond to phosphate and potash in addition to manure.

The soils on this farm, as in many sections of Door county, are shallow, being underlain by limestone at depths ranging from 7 inches up. This allows them to dry out rapidly, and drought usually prevents any extremely sharp increase in yields from fertilizer.

Nevertheless, the response is enough so that the better treatments do pay out, particularly if the fertilizer is purchased at reasonable prices and the crops efficiently fed to good livestock. Fertilizer has another advantage in making it possible to use the crops and rotations which conserve the soil—and that is a critical matter when there is only a shallow layer of soil which needs to be held as cover for the underlying rock.

These are the findings of A. R. Albert, made on land which is manured once in each five-year rotation consisting of corn, oats, and three years of alfalfa:

1. Superphosphate is the most effective and profitable fertilizer for the shallow soils.

2. Potash further increases yields when used along with superphosphate.

3. Raw rock phosphate helps very little, and probably is not a wise investment on the non-acid or slightly acid soils.

4. Ground limestone is of no value on non-acid soils where it is only 20 inches or less down to limestone bedrock.

On the basis of these findings, Albert recommends 200 to 250 lbs. per acre of 0-20-20 or 0-20-10, to be applied with a grain-fertilizer drill at the time small grain and legume seeding are sown. If the fields have been well manured, and experience shows that legumes thrive on them, it may be satisfactory to modify this program by using superphosphate alone.

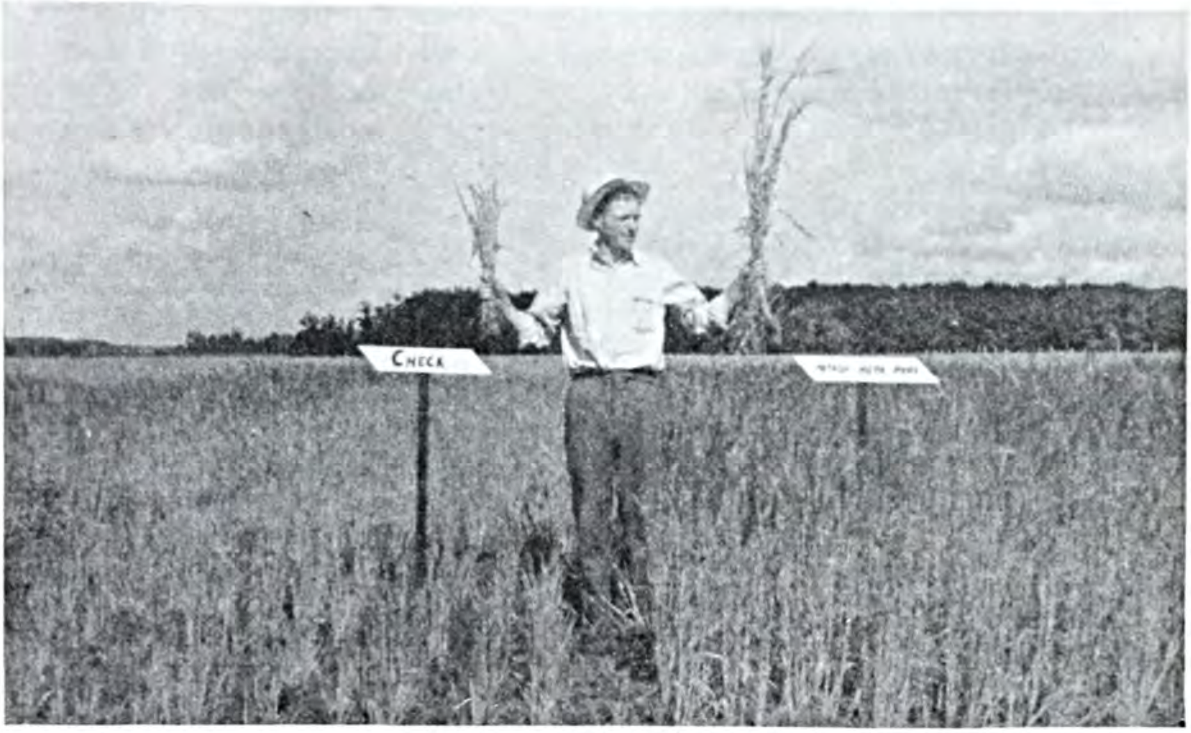
Sugar beets responded very well to heavy fertilizer applications in Fond du Lac and Kenosha counties in 1940, K. C. Berger and E. Truog found.

The fact that rainfall was plentiful last year no doubt helped fertilizer produce outstanding results which would not be equalled in a dry season. Nevertheless it is wise to be consistently liberal with fertilizer for cash crops which are capable of yielding a high return. Such a practice not only stands a chance of "paying out" very well the first year, but also puts the land in shape to produce excellent crop yields for several years to come.

Fertilizer trials were carried out in cooperation with the Menominee Sugar Co. and the Superior Sugar Refining Co. on a Superior clay loam at Fond du Lac and Carrington silt loam near Kenosha. The Superior soil was fertile and high in lime, while the Carrington silt loam was less fertile and somewhat acid.

Applying 100 or 200 lbs. of 3-12-12 fertilizer per acre at the side of the seed produced a good response, but did not bring about maximum yields. Broadcasting 500 lbs. of potash to the acre, in addition to using a side-row application,

(*Turn to page* 33)



Fertilizer made the difference on this barley. Left, no fertilizer; right, phosphate, and potash in the form of 100 lbs. of potassium metaphosphate per acre.

Scientists Say . . .

By G. E. Langdon

University of Wisconsin, Madison, Wis.

SOIL scientists at the University of Wisconsin record many findings of interest to growers in their annual report.*

Many fields are in critical need of phosphate in the silt loam areas of Wood and Marathon counties, as well as in the nearby Marathon silt loam sections, according to indications found by L. B. Nelson and A. R. Albert. Lack of potash on these lands generally is less serious, but nevertheless important.

Soil samples collected by F. L. Musbach and Nelson on many of these farms showed the available phosphorus commonly is at the extremely low level of about 10 lbs. per acre, while the available potassium usually ranges from 120 to 130 lbs.

Nelson and Albert carried out fertilizer trials directly on some of these farms in 1940 using barley as a test crop.

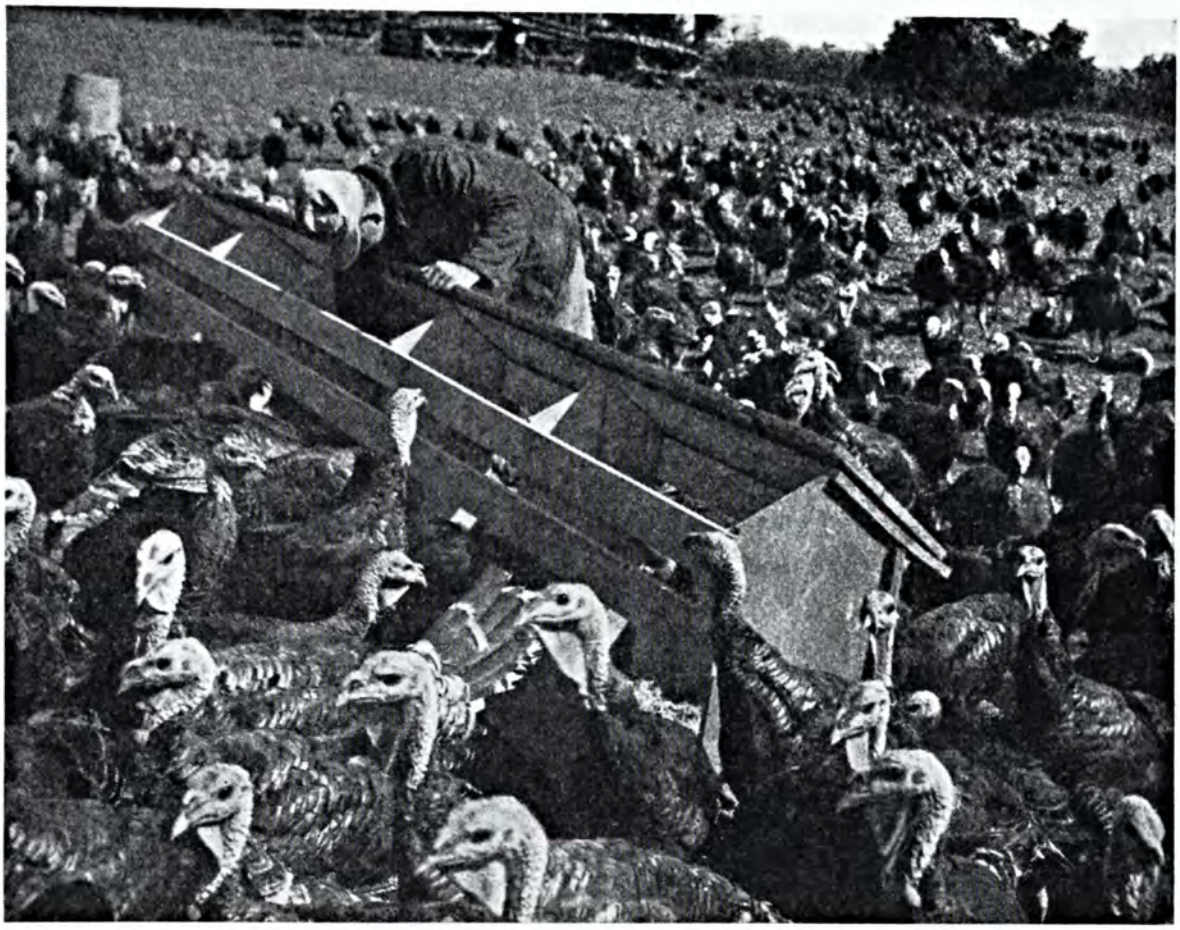
On level Spencer silt loam, barley responded remarkably to fertilizer. Whereas the yield was less than 21 bus. per acre without fertilizer, it was about 50 bus. with 289 lbs. of 20% superphosphate and 71 lbs. 50% muriate of potash per acre. Minor elements such as boron, magnesium, and manganese were of no benefit.

On the rolling phase of Spencer silt loam, unfertilized barley yielded 25 bus. per acre. Phosphate alone increased yields by 10 bus., potash alone increased them by 5 bus., and the two together increased yields about 15 bus.

* "What's New in Farm Science." Annual Report of the Agricultural Experiment Station, University of Wisconsin, 1941.

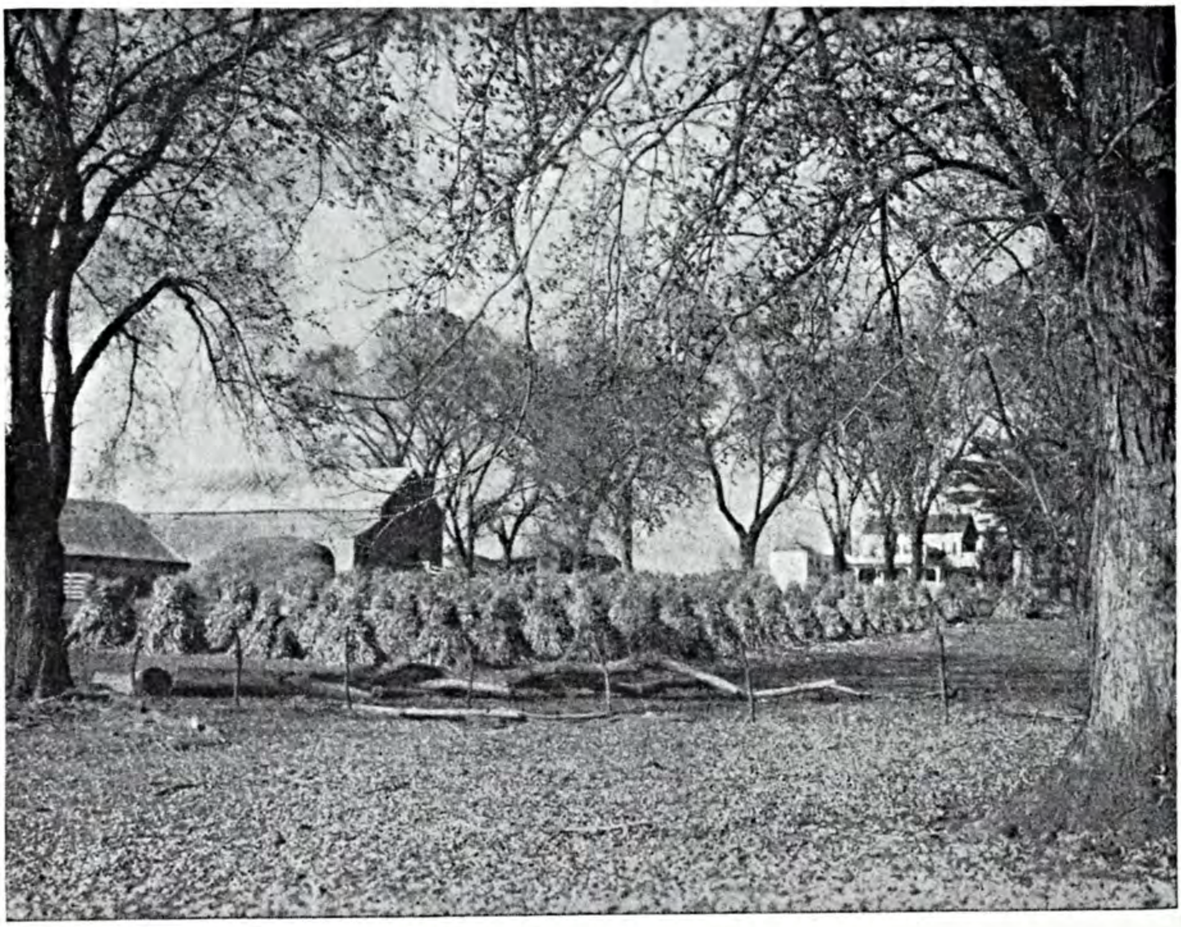
WINTER

PICTORIAL

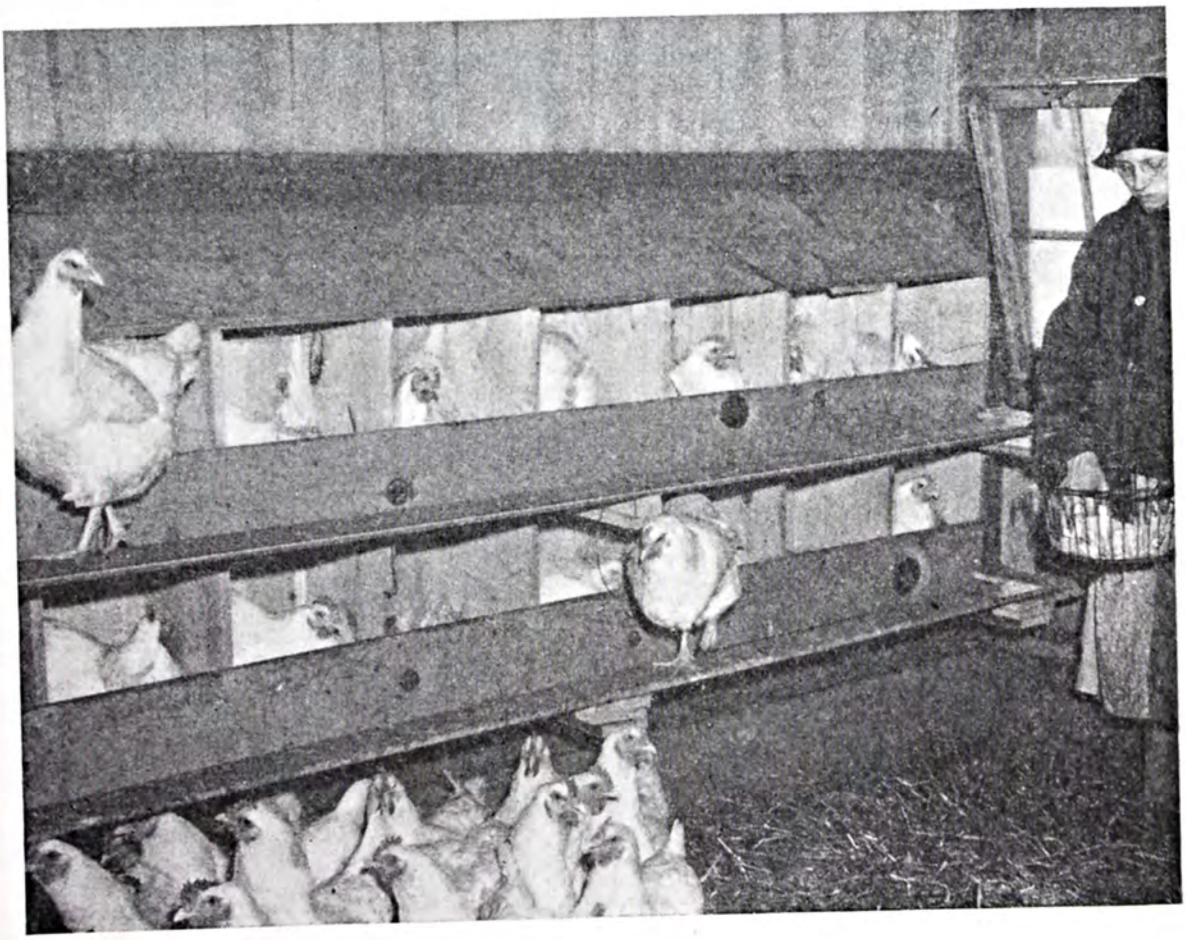


Above: More than 1,600 turkeys were on range on the Harry Satchell farm in Henry County, Iowa, when this picture was taken.

Below: To save work this Lee County, Iowa, farmer shocked his corn handy to the feed lot.



CHORES



number of grades to those considered best suited to needs consistent with supplies of materials available. It has seen the greatest compaign for the growing of legumes for forage and as winter cover crops ever staged in North America. Some of these changes were troublesome, many very sound under any conditions.

Agriculture in 1942 has had many problems with which to contend. It met them with courage and resourcefulness. Its efforts have been successful and have been rewarded as well deserved. The reward is not only in the good financial return, but in the sense of a difficult job well done. Agriculture is in a good position to meet the greater demands and the more difficult problems appearing over the horizon of the coming year.

Legume Resources

Elsewhere in this issue we are privileged to publish an article entitled "Nitrogen for Crop Production from Winter Legumes." The author, Mr. W. F. Watkins of the U. S. Department of Agriculture, has made a significant study of the potentialities of legumes as related to the present nitrogen shortage and we are confident his message will be widely read and appreciated.

In the agricultural economy of the United States, nitrogen has from the first been closely tied up with crop production. Of all the essential nutrients it is the most difficult to supply and control. It is subject to ready losses from leaching and erosion. Crops use it in large amounts, and in the form of commercial fertilizers, it has always been the most costly of the major plant foods. Despite these handicaps, its recognized importance in soil humus and crop production makes it a constant challenge to the scientist and farmer in their efforts to maintain an adequate and continuous supply.

Faced now with a shortage of commercial nitrogen because of the diversion of vast quantities for munitions manufacture, greater stress than ever is being placed on the growing of legumes. Legumes can fix nitrogen from the air, but important as may be their contribution when grown under ideal conditions, their limitations must be recognized. The amount of nitrogen which legume bacteria can fix depends upon a number of factors. First, of course, is the necessity of having a good growth of the crop. This will require proper soil moisture, drainage, aeration and adequate supplies of calcium, potash, magnesium, phosphorus, boron, and other nutrients, proper inoculation, and necessarily a type of crop adapted to the section in which it is to be grown. While all of the nutrients are of equal importance qualitatively, since the plant will not grow well if any one is lacking, potash assumes particular significance quantitatively since the plants contain more of this than of the other nutrients. Assuming ideal conditions, alfalfa, for example, is capable of fixing up to 250 pounds of nitrogen per acre. The large growing clovers and soybeans fix only about half and the vetches, field peas, and beans from one-fifth to one-fourth as much as alfalfa.

Furthermore, whether or not a legume crop when innoculated with the right kind of bacteria makes its maximum contribution of nitrogen to the soil supply depends upon the fertility level of the soil and what part of the plant growth is plowed under. It is known that in soils already high in nitrogen, little or none is fixed; while fixation processes are at their best under low nitrogen levels and where the soils have been generously supplied with lime, phosphorus, and potash. In evaluating the benefits of legumes grown under favorable conditions, it should be remembered that only about one-third of the nitrogen is in the roots and two-thirds in the tops. It is quite obvious, therefore, that the amount of nitrogen supplied and the residual effects of subsequent crops will depend on the proportion of the plant growth returned to the soil.

The Editors Talk

Agriculture 1942

Agriculture in 1942 was called upon to make far-reaching adjustments in line with the war needs of the United Nations. In the United States, this meant many changes in the agricultural plans and programs from a peacetime, or at most a national defense concept, to a war basis. In Canada, it meant the intensification of a war program already under way.

Farmers were called upon to make shifts in crop acreages and even in the crops they had planned to grow. In the United States, the crop programs already drawn up by the Department of Agriculture were revised after Pearl Harbor and called for greatly increased agricultural production. This did not apply to all agricultural products, but was directed mainly at the edible oil crops such as peanuts, soybeans, flax, dairy and animal products, which in turn called for increased forage production, vegetables to take care of greatly increased domestic needs, and canning crops to take care of the needs of the armed forces and of the United Nations. With large stocks of wheat in both Canada and the United States, any increase in wheat production was discouraged, as was also the production of short staple cotton. The production of long staple cotton was encouraged, as this was urgently needed in certain military and commercial lines. A slight increase in tobacco acreage was called for to take care of the expected increase in demand.

Farmers met the demands made on them, increasing the acreages of the desired crops and holding down the other crops. They met increasing shortages of labor by improving their practices, by using more fertilizers than ever before, and all the machinery they could get. The whole family got out in the fields and worked; white collar workers from the city helped the best they could in many places; factory workers and school children were given time off to help with the harvest; and weather on the whole was favorable. As a result, North America had the highest agricultural production in its history.

Along with good yields farmers received high prices for their products. Their income was the highest in history. The costs of the materials they had to buy for living and production also went up, but not so fast as the prices they got for their crops. As a result, farmers are in the best financial condition they have been since the twenties, possibly since the last war. According to reports, they are using their improved income wisely, reducing debts and putting themselves in sound financial condition. Fortunately, they have not forgotten the headaches following their speculative land buying during the boom of the last war.

1942 has witnessed marked changes in the agricultural picture. It has seen the AAA program change almost over-night from crop restriction to crop expansion. It has seen the imposition of restrictions in the use of nitrogen fertilizers, necessitated by curtailed imports and military demands. It has seen the inauguration of a control over fertilizer manufacture that will eliminate the too large tonnage of low analysis fertilizers that were used in the past and reduce the *of Agron., Univ. of Ill., Urbana, Ill., Nov. 3, 1942, F. C. Bauer.*

"Recommendations of the Approved Grades of Fertilizer for Ky.," Agr. Exp. Sta., Lexington, Ky., Sept. 1942.

"Fertilizer Results with Tung Trees and Recommended Cultural Methods," Agr. Exp. Sta., University Station, Baton Rouge, La., Bul. 352, Aug. 1942, W. D. Kimbrough, Julian C. Miller, and W. F. Wilson.

"The Mixed Goods Fertilizer Situation," Agr. Ext. Serv., University Station, Baton Rouge, La., Oct. 1942, R. A. Wasson.

"Wartime Recommendations on the Use of Commercial Fertilizer," Agr. Exp. Sta., Columbia, Mo., Cir. 242, Sept. 1942, O. T. Coleman and A. W. Klemme.

"Water Solutions of Ordinary Mixed Fertilizers for Use in Starting and Side-Dressing Plants," Agr. Exp. Sta., New Brunswick, N. J., Cir. 449, Sept. 1942, Arthur L. Prince and Victor A. Tiedjens.

"Fertilizer Sales by Grade in Order of Tonnage Jan. 1, 1942-June 30, 1942," N. C. Dept. of Agr., Raleigh, N. C.

"Farm Management Demonstrations Using Potash," Agr. Ext. Serv., Raleigh, N. C., 1942, H. B. James.

"Fertilizer Grades for Rhode Island for 1943," Agr. Ext. Serv., Kingston, R. I., Nov. 1942.

"Summary of Fertilizers, Fertilizer Materials, and Customers' Mixtures Sold in S. C.," Clemson Agr. Col., Clemson, S. C., Oct. 1, 1942.

"Wartime Crop Fertilization in Tennessee," Agr. Ext. Serv., Knoxville, Tenn., Pub. 265, Oct. 1942, H. E. Hendricks.

"Germination of Cottonseed as Affected by Soil Disturbance and Machine Placement of Fertilizer," Agr. Exp. Sta., College Station, Texas, Bul. 616, Aug. 1942, H. P. Smith, M. H. Byrom, and H. F. Morris.

"Phosphate Reserves of Utah," Agr. Exp. Sta., Logan, Utah, Bul. 304, Oct. 1942, Rev. Est. by J. Stewart Williams and Alvin M. Hanson.

"Fertilizer Grades for Vermont in 1943," Agr. Ext. Serv., Burlington, Vt., Nov. 1942.

"Plant-Growth Regulators," U. S. D. A., Washington, D. C., Misc. Pub. 495, 1942, John W. Mitchell and Ruby R. Rice.

Soils

¶ The management of orchard soil during the war period, so as to maintain the productivity and thriftiness of orchards, is discussed in a very practical manner in Pennsylvania Agricultural Experiment Station Bulletin 431, entitled "The Orchard Fertility Problem During the War Emergency." It was prepared by the Pomology Staff of the Experiment Station. The key to the solution of this problem appears to be the maintenance of soil conditions in orchards so as to permit a good legume cover to be grown on the soil. Experiments conducted over long periods of years are quoted showing that when good legume covers are kept on the orchards, it is possible to get along without using any commercial nitrogen fertilizer and still have good trees and good yields. In many cases, the trees grown with a legume cover but no nitrogen fertilizer would out-yield trees that received nitrogen fertilizer without a legume cover crop under them. The authors bring out repeatedly that lime, phosphate, and potash must be used in adequate quantities if good legume covers are to be kept on the orchards. Lime should be applied according to the acidity and lime requirement of the soil. Superphosphate applications of 200 to 400 lbs. per acre are suggested, and the recommendation for potash calls for 50 to 200 lbs. of muriate of potash or sulfate of potash. The management of the orchard provides for cutting the legume crop or harrowing at proper times, so as to prevent undue competition between the trees and the cover crop for soil moisture and nutrients. Such management combined with proper liming and fertilization would appear to offer a practical solution to the orchard fertility problem, not only during the war-emergency period but as a general practice.

"Rainfall and Runoff in the Upper Santa Cruz River Drainage Basin," Agr. Exp. Sta., Tucson, Ariz., T. Bul. 95, Sept. 1, 1942, Harold C. Schwalen.

"Good Soil Management Is Essential for High Wartime Production," Agr. Ext. Serv., Urbana, Ill., E. Cir. 535.

"The Pixley Area California—Soil Survey," U. S. D. A., Washington, D. C., Series 1935, No. 23, April 1942, R. Earl Storie, Bruce C. Owen, M. H. Layton, A. C. Anderson, W. J. Leighty, and C. C. Nikiforoff.

"Albany and Schenectady Counties New York—Soil Survey," U. S. D. A., Washington, D. C., Series 1936, No. 16, May 1942, Clarence Lounsbury, Robert Wildermuth, W. E. Benson, and D. F. Kinsman.

"Newport and Bristol Counties Rhode Island —Soil Survey," U. S. D. A., Washington,

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

¶ Again this month there are a number of publications issued by experiment stations revising their former fertilizer recommendations to bring them in line with the grades authorized by the Government to be sold. These publications are too numerous to review individually but will be found listed below.

¶ An interesting report of farm records on 85 demonstration farms scattered throughout North Carolina has been prepared by H. B. James and is issued as an unnumbered mimeographed pamphlet of the Farm Management Department of the North Carolina Agricultural Extension Service. This is entitled "Farm Management Demonstrations Using Potash, 1942." It is in the nature of a progress report since this large and significant program is intended to run for a number of years. The records kept by the farmers include a complete inventory, all expenses and receipts, crop production records, and related information. The data are grouped by farms in the eastern part of the State, in the Piedmont section, and in the mountains. Farms in all sections grew tobacco, corn, grain, hay, and soil-improving crops, while cotton was not grown in the mountain section and peanuts were grown only in the eastern section. In the eastern and mountain sections more acres were devoted to corn than any other single crop. In the Piedmont small grains occupied first place. The mountain farms had on an average about one unit less of livestock. Yields in the three sections of the State did not vary as much as might be expected. Cotton yielded more in the eastern than in the Piedmont section. Tobacco yields were higher from the mountain sections, mainly due to the type grown there. The mountain section also produced a somewhat higher average yield of corn. The farms in the eastern part of the State had more than double the receipts of the farms in the mountain area, with the Piedmont section intermediate. Expenses were somewhat in the same proportion. The labor income varied tremendously, being $1,300 in the eastern part of the State and minus $19 in the mountain section. The crop returns per acre were $54 in the eastern part of the State, $25 in the Piedmont, and $12 in the mountain section. On all of the farms, for the fertilization of legumes or cover crop, 10% of each field did not receive potash while the other 90% did receive potash; and the entire field was given appropriate applications of lime and phosphate. It is stated that on most farms potash produced an outstanding visible improvement in the growth of soybeans, and differences could be observed also on wheat, oats, barley, and lespedeza. The value and influence of such demonstration farms, not only in the immediate vicinity but in surrounding areas, are discussed and shown to be considerable.

"Fertilizer Recommendations for Alabama in 1943," Dept. of Agron. & Soils, Agr. Exp. Sta., Auburn, Alabama.

"Fertilizer, Feed, Lime, and Seed Report, Jan.-June 1942," State Board of Agr., Dover, Delaware.

"Fertilizers and Limestone for Permanent Pastures," Agr. Exp. Sta., Experiment, Ga., Press Bul. 514, Sept. 25, 1942, O. E. Sell.

"Nitrogen Problems in the Midwest," Dept.

peanuts. Based on investigations conducted at the Station, a fertilizer such as 2-10-4 or 2-10-6 at 200 to 400 lbs. per acre is recommended for the peanuts if the preceding crop was not heavily fertilized. This fertilization will help replace some of the plant food taken out by the crop, although when peanuts follow a crop that was heavily fertilized, the peanuts frequently will not respond very much to the fertilizer given. It is brought out that crops following harvested peanuts often suffer severely from potash deficiency. Therefore, unless high potash fertilizers are used for peanuts, the crop following the peanuts should receive a higher than normal potash fertilization. Information on planting, cultivation, harvesting, and diseases also is included in this publication.

"Sixty-seventh Annual Report of the Ontario Agricultural College and Experimental Farm 1941," Guelph, Ont., 1942.

"Annual Report State Board of Agriculture 1941-1942," Dover, Delaware, Sept. 1942.

"Fifty-fourth Annual Report Georgia Experiment Station," Experiment, Ga., 1942.

"How to Grow Tobacco Plants," Agr. Ext. Serv., Athens, Ga., Cir. 302, Nov. 1942, E. C. Westbrook.

"Crimson Clover for Pasture," Agr. Exp. Sta., Experiment, Ga., Press Bul. 512, Sept. 8, 1942, O. E. Sell.

"Italian Rye Grass for Pastures," Agr. Exp. Sta., Experiment, Ga., Press Bul. 513, Sept. 14, 1942, O. E. Sell.

"Emergency Crops for Dairy Cows," Agr. Ext. Serv., Hawaii, E. Cir. 140, Jan. 1942, J. C. Ripperton.

"Fifty-fourth Annual Report," Agr. Exp. Sta., Lexington, Ky., 1941.

"Annual Report of the Maine Extension Service," Univ. of Me., Orono, Me., E. Bul. 309, Nov. 1942.

"Smooth Bromegrass in Missouri," Agr. Exp. Sta., Columbia, Mo., Cir. 243, Sept. 1942, E. Marion Brown.

"Irrigation of Seed and Canning Peas in the Gallatin Valley, Montana," Agr. Exp. Sta., Bozeman, Mont., Bul. 405, Aug. 1942, O. W. Monson.

"Sweet Potato Investigations in New Jersey," Agr. Exp. Sta., New Brunswick, N. J., Bul. 697, Sept. 1942, V. A. Tiedjens and L. G. Schermerhorn.

"Produce Your Own Nitrogen," Agr. Ext. Serv., New Brunswick, N. J., E. Bul. 232, Aug. 1942, H. R. Cox.

"Better Pasture and Hay Crops," Agr. Exp. Sta., New Brunswick, N. J., Cir. 448, Aug. 1942, Gilbert H. Ahlgren and Claude Eby.

"The Vitamin C Content of New York State Vegetables," Agr. Exp. Sta., Geneva, N. Y., Cir. 196, Sept. 1, 1942, D. K. Tressler.

"Forest Grazing and Beef Cattle Production in the Coastal Plain of North Carolina," Agr. Exp. Sta., State College Station, Raleigh, N. C., E. Bul. 334, March 1942, H. H. Biswell and J. E. Foster.

"Growing Ornamental Greenhouse Crops in Gravel Culture," Agr. Exp. Sta., Wooster, Ohio, Bul. 634, Oct. 1942, D. C. Kiplinger and Alex Laurie.

"Tomato Growing and Preparing for Market," Fed. Coop. Ext. Serv., Corvallis, Ore., E. Cir. 372, July 1941, A. G. B. Bouquet.

"Plan the Vegetable Garden," Agr. Ext. Serv., State College, Penn., Leaflet 73, March 1941, Jesse M. Huffington.

"Agronomy Handbook for South Carolina," Ext. Agron. Div., Clemson, S. C., Bul. 104, Aug. 1942.

"Orchard Management," Agr. Ext. Serv., College Station, Texas, E. Bul. B-73, Rev. 1942, J. F. Rosborough and Cameron Smith.

"Making Grass Silage Without Molasses or Phosphoric Acid," Agr. Ext. Serv., Burlington, Vt., Brieflet 632, June 1942.

"A Hand Book of Agronomy," Ext. Agron. Dept., Blacksburg, Va., Bul. 97, Rev. June 1942.

"Classification of Wheat Varieties Grown in the United States in 1939," U. S. D. A., Washington, D. C., T. Bul. 795, June 1942, J. Allen Clark and B. B. Bayles.

"Effects of Partial Defoliation at Transplanting Time on Subsequent Growth and Yield of Lettuce, Cauliflower, Celery, Peppers, and Onions," U. S. D. A., Washington, D. C., T. Bul. 829, Aug. 1942, James E. Kraus.

"Winter Legumes for Green Manure in the Cotton Belt," U. S. D. A., Washington, D. C., F. Bul. 1663, Rev. May 1942, Roland McKee and A. D. McNair.

"Care of Damaged Shade Trees," U. S. D. A., Washington, D. C., F. Bul. 1896, May 1942, Rush P. Marshall.

"Distribution of the Varieties and Classes of Wheat in the United States in 1939," U. S. D. A., Washington, D. C., Cir. 634, Aug. 1942, J. Allen Clark and K. S. Quisenberry.

"Irrigation of Sugar Beets Grown for Seed," U. S. D. A., Washintgon, D. C., Cir. 658, Aug. 1942, Charles Price and M. R. Huberty.

Economics

¶ Records of farm accounts furnish valuable information on types of farming that are likely to be most profitable, and provide clues to factors influencing the profitableness of the enterprise. Data of this type are summarized in Illinois Agricultural Experiment Station Bul-

D. C., Series 1936, No. 18, August 1942, A. E. Shearin, S. V. Madison, and W. S. Colvin.

"The Virgin River Valley Area Utah-Arizona—Soil Survey," U. S. D. A., Washington, D. C., Series 1936, No. 13, March 1942, F. O. Youngs, O. F. Bartholomew, D. S. Jennings, LeMoyne Wilson, I. D. Zobell, M. H. Wallace, J. E. Fletcher, and William Baugh.

"Effect of Mulches and Surface Conditions on the Water Relations and Erosion of Muskingum Soils," U. S. D. A., Washington, D. C., T. Bul. 825, July 1942, Harold L. Borst and Russell Woodburn.

"Wartime Farming on the Northern Great Plains," U. S. D. A., Washington, D. C., Misc. Pub. 497, June 1942, Harry L. Carr.

Crops

¶ The influence of different fertilizer combinations on yield and longevity of the stand, on hay land, and on yield of silage corn are shown by Ford S. Prince, Paul T. Blood, and Gordon P. Percival in New Hampshire Agricultural Experiment Station Circular 61, "Fertility Needs of Dairy Farm Crops in the Connecticut Valley." Preliminary work in this area indicated the importance of potash in maintaining good yields of legumes. Additional work was inaugurated with silage corn, with the most significant increases in yield being produced by manure and superphosphate. The corn was followed by a mixed clover and timothy hay crop in which again the potash produced the greatest increase in yield, although best results usually were obtained with the combination of phosphate, potash, lime, and nitrogen. It was very noticeable that the clover persisted on the plots receiving potash but disappeared on all the other plots. The authors raised the question as to whether the persistence of clover on these plots was due to a prolongation of the life of plants or whether conditions were made favorable for the germination of seed which had been lying dormant in the soil. They seem inclined to believe that the former explained a large part of this persistence of the clover. In the work reported, potash gave the greatest net profit per dollar invested, but the greatest total net profit per acre came from the complete fertilizer treatment. In another set of plots on the same field, potash increased yield a little over a ton per acre per year, while phosphate increased yield only a little more than a tenth of a ton per acre. When the two were used together, however, the yield was increased two and one-third tons per acre per year. Thus, the lime and phosphate together increased the yield more than the sum of the increases of each one alone. The authors emphasize that owing to the importance of potash on these soils and the fact that manure can add considerable potash, great care should be taken in conserving manure. Under the best of conditions, however, there are bound to be losses, and the manure probably would not supply enough potash to meet the needs of the soil. They say, therefore, that the manure should be supplemented with potash in the same way farmers have learned to supplement the manure with phosphate. In conclusion, they state that the persistence of red clover in the stand can be used as an indication of the sufficiency of potash applications. If the clover soon dies out, it is a pretty sure indication that insufficient potash is being used.

¶ Information on the growing of peanuts in Southern Georgia is given by S. A. Parham in Georgia Coastal Plain Experiment Station Bulletin 34, entitled "Peanut Production in the Coastal Plain of Georgia." This publication brings out some of the peculiarities surrounding the fertilization of the peanut crop. The author states that peanuts do not respond as well to fertilization as other crops, which is rather remarkable considering the large amounts of plant food removed from the soil by peanuts. The crop, when harvested for nuts, has a reputation for being hard on the land, a reputation that is fully justified unless proper steps are taken to replace the nutrients by fertilization. This fertilization should involve applying nutrients for the peanut crop and higher than normal amounts for the crop following

When 12 soil samples were saturated with water and frozen 10 times over a period of one to two days, eight of them showed an increase in available potassium. One was affected very little, and the other three showed decreases.

This trial indicated there is no consistent relationship between the soil type and the effect of freezing and thawing. For example, a Miami silt loam pasture soil showed the largest increase, calculated to be 155 lbs. of available potassium per acre; but a rich garden soil of the same type lost the largest amount—170 lbs. per acre.

Apparently there is a tendency for freezing and thawing to increase the available potassium in most soils of moderately low fertility, as well as those to which potash fertilizer has been applied in moderate amounts. On the other hand, those with an extremely high level of available potassium may have part of it converted into a fixed form. These indications support a theory some scientists have advanced—namely, that the available potassium in soil tends to move toward a certain "equilibrium level."

Experiments with soil samples limed at the extremely heavy rate of 10 tons per acre showed that lime alone tends to slow up the liberation of potassium by freezing, and in some cases to result in a decrease of available potassium. However, applying muriate of potash along with the lime apparently allows fixed potassium to be liberated somewhat more freely.

Trials on certain clay samples treated with various salts before freezing indicated an excess of calcium chloride or sodium chloride slows down the release of fixed potassium, while the opposite is true of ammonium chloride and ammonium acetate.

These laboratory experiments in soil science must be supplemented with further research to determine whether the findings need to be considered in farm soil-building programs. At present there seems to be no reason for modifying well-established fertilization practices.

The fact that nature apparently has provided a mechanism to keep the available potassium content of soil from approaching zero is a reassuring one, but it does not mean the supply will remain at a high enough level for profitable crop production. On the contrary, the evidence of fertilization trials is that in Wisconsin the use of liberal potash applications is becoming more necessary and profitable as our farm land becomes older in terms of cropping history.

Nitrogen for Crops from Winter Legumes

(*From page* 20)

Results of experiments in Georgia covering five years, on six soil types representative of large areas of the Cotton Belt, show that "no-nitrogen" plots, treated with 0-6-3 fertilizer, produced 555 pounds of seed cotton, only 97 pounds more than the unfertilized plots. Increasing the nitrogen content of the fertilizer to 16, 32, and 48 pounds of nitrogen per acre, increased yields to 733, 967, and 1,011 pounds per acre, respectively. In four similar experiments on different soil types in Georgia and South Carolina, fertilizer containing 16 pounds of nitrogen gave an increase of 214 pounds of seed cotton over no-nitrogen. Thirty-two pounds of nitrogen produced an additional 222 pounds, or a total yield of 991 pounds; and 48 pounds increased the yield by 54 pounds more, or a total of 1,045 pounds of seed cotton per acre.

The results on four soils in the Coastal Plain and Piedmont section of South Carolina show the yield is in almost direct relation to the amount of letin 491, "Twelve Years of Farm Accounts In Illinois," by P. E. Johnston and H. C. M. Case. The records cover the period 1926 to 1937 on farms in eight of the nine agricultural areas into which the State is divided. Nearly 17,000 records were analyzed in this work. The period covered years of agricultural prosperity and years of intense agricultural depression. The farms studied undoubtedly were better than the average farms in the State from the viewpoint of the operator, and the practices followed. Over the State as a whole, the average annual cash balance of receipts over expenditures of the farms varied from $958 in 1932 to $2,445 in 1929 with net income per acre on the cash basis of $1.43 in 1932 and $7.50 in 1929. These figures do not take into consideration changes in inventory which cause much wider differences. Cash expenditures per farm varied widely with prosperity of the year, amounting to $1,494 in 1933 and $3,424 in 1937. These wide differences in money expended by farmers show the influence of agricultural prosperity on the general level of prosperity of the country. The authors have analyzed the data in various ways, and the results are presented in tables and charts. Their findings are too numerous to give in detail here, but warrant careful study and consideration by farmers and their advisers.

"Labor and Power Needs on Crops in Bulloch County, Ga.," Ga. Exp. Sta., Experiment, Ga., Cir. 139, Oct. 1942, W. E. Hendrix and W. T. Fullilove.

"Annual Summary of Fruit and Vegetable Unloads in Honolulu 1941," Agr. Ext. Serv., Univ. of Hawaii, Honolulu, T. H., E. Cir. 146, April 1942.

"Twelve Years of Farm Accounts in Illinois," Agr. Exp. Sta., Urbana, Ill., Bul. 491, P. E. Johnston and H. C. M. Case.

"Marketing the Illinois Peach Crop," Agr. Exp. Sta., Urbana, Ill., Bul. 492, Sept. 1942, V. A. Ekstrom.

"Standards and Procedure for Classification and Valuation of Land for Assessment Purposes," Agr. Exp. Sta., Bozeman, Mont., Bul. 404, June 1942, H. H. Lord, S. W. Voelker, and L. F. Gieseker.

"Sugar Beet Costs and Management in Irrigated Sections of Western Nebraska," Agr. Exp. Sta., Lincoln, Neb., Bul. 341, May 1942, George H. Lambrecht and Walter L. Ruden.

"Variations in Flue-Cured Tobacco Prices," Agr. Exp. Sta., Raleigh, N. C., T. Bul. 69, May 1942, S. L. Clement.

"Income Parity for Agriculture—Part I—Farm Income," U. S. D. A., Washington, D. C., July 1942.

"The Agricultural Resources of Madagascar," U. S. D. A., Washington, D. C., For. Agr. Rpt. 7, Aug. 1942, Bertha Merdian.

"Farm Parity Prices and the War," U. S. D. A., Washington, D. C., The Farmer and the War—2, 1942.

"State and Local Government Finance in Wartime," U. S. D. A., Washington, D. C., The Farmer and the War—No. 4, 1942.

"Controlling Corn and Hog Supplies and Prices," U. S. D. A., Washington, D. C., T. Bul. 826, June 1942, Geoffrey Shepherd.

"War and Farm Work," U. S. D. A., Washington, D. C., Misc. Pub. 492, May 1942, Robert C. Tetro and Martin R. Cooper.

Scientists Say . . .

(*From page* 22)

increased yields by 2 tons per acre at Fond du Lac and 9 tons at Kenosha.

Best yields of all resulted with 200 lbs. of 3-12-12 drilled at the side of the row plus broadcast of 500 lbs. muriate of potash, 500 lbs. 20% superphosphate, and 25 lbs. borax. Such treatment increased yields 52% above the unfertilized check plots at Fond du Lac and 116% at Kenosha.

That alternate freezing and thawing usually converts some of the "fixed" potassium in soil to an available form, but in some soils has the opposite effect, is a finding made by L. O. Fine, T. A. Bailey, and E. Truog.

This investigation was prompted largely by the observation that some soils apparently contain more available potassium in the spring than during the previous fall.

frequently cannot turn more than half his acreage with a good growth of legumes. The top growth of legumes, however, adds large quantities of organic matter to the soil; being green, it decomposes quickly under normal climatic conditions, but this organic matter increases the water-holding capacity of the soils, reducing surface run-off. The use of tractor power on farms is helping to overcome the problem of turning legumes in the short period available. In a diversified type of farming a number of crops are grown. This reduces the peak labor and power requirements on the farm, especially during the spring period.

What about the acreage of winter legumes in the Southern and East Central States where they are generally adapted?

Winter-legume Acreage

The acreage of winter legumes should have some relation to the acreage of intertilled crops which are normally grown on about 50 million acres in this area. The total acreage of winter legumes in this area has not exceeded four million acres in any one year. Since only a percentage of the acreage can be turned in the spring in time to plant crops, all of the intertilled crops cannot be followed by winter legumes. A committee of specialists in the Department of Agriculture have established some long-time goals for winter legumes in these States as follows:

	1,000 acres
Mississippi	2,285
Alabama	1,964
Georgia	2,260
South Carolina	918
North Carolina	1,129
Florida	82
Louisiana	922
Arkansas	1,244

This represents a five-fold increase in the acreage of winter legumes. This may seem excessive, but (1) they are in line with what is considered good farm practice, (2) they conform to recommendations of State College Agronomists, (3) they are in line with soil conservation farm plans being developed in Soil Conservation Districts, and (4) they are in line with recommendations made by county planning committees. These goals are too extreme to be attained in one or two years. In the present war effort, unusually good progress will be made since many sources of commercial nitrogen have other war uses and the supply of commercial nitrogen is considerably less than the unrestricted demands.

There is also a need for increasing the acreage of winter non-legumes, principally small grains, in this area. In the war effort, with limited supplies of commercial nitrogen, this cannot be successfully attained since spring top-dressing of small grains with nitrogen fertilizer is essential to obtain reasonably high yields. In fact, in many areas of these Southern States it is not worthwhile to plant small grains if top-dressing of commercial nitrogen is not available.

The bulk of the Austrian pea and vetch seed used in these Southern States has been produced in the Pacific Northwest. Crimson clover, adapted to the northern part of the area, is successfully produced close to the source of demand. Considering the time of harvest, the marketing and transportation problems, and time involved, considerable quantities of the seed cannot reach the area sufficiently early to be planted at the most desirable time.

The importance of nitrogen from commercial nitrogen or winter legumes cannot be over-emphasized. It is necessary to obtain desired crop yields, maintain soil fertility, and prevent further soil erosion. Both sources of nitrogen are essential in a diversified system of farming. In the present war effort, legumes can be used to supplement the supply of commercial nitrogen. The acreage should be still further increased in the post-war period to increase the productivity and economy of the area.

nitrogen applied. The use of higher levels of nitrogen on cotton on the Coastal Plain soils of South Carolina gave more profitable returns; on the Piedmont soils, there is also a gradual increase in yield with increased amounts of nitrogen, but the variations are not so wide.

On Cecil sandy loam in South Carolina the average yield of seed cotton, 1928-1940, where Austrian Peas were grown with applications of phosphoric acid and potash, was 2,324 pounds per acre; where only rye was grown, the average yield was only 1,414 pounds. The addition of 24 pounds of nitrogen on the plots growing Austrian Peas increased the yield only 202 pounds. The no-cover-crop area, side-dressed with 200 pounds of nitrate of soda, did not produce as much cotton as the winter-legume plot without side-dressing.

Soil Treatment and Nitrogen Availability

These data show that good soil treatment favorable for growing winter legumes is a very profitable farm practice from the standpoint of increasing crop yields and maintenance of soil fertility. The use of nitrogen is the principal soil treatment essential in maintaining high yields of cotton and corn from the Delta soils of the Mississippi to the Coastal Plain and Piedmont soils of Alabama, Georgia, and South Carolina. This nitrogen can be obtained from soil-building legumes or commercial fertilizer.

Some other factors must be considered in determining the sources of nitrogen for crop production. These include the cost of the nitrogen, the farm practices, the cropping system, the availability of supplies, and the type of farming.

Let us examine some of the farm problems in connection with supplying the nitrogen needed for crop production. Nitrogen in commercial fertilizers has been readily available. The cost varies, depending on the price of fertilizer, but is a cash expenditure. With fertilizer at $30 per ton, a 400-pound application could cost $6 per acre and a 600-pound application $9 per acre. In general, the cost will range from $6 to $10 per acre. The cost of applying fertilizer is not of major importance and is considered an essential farm practice. Using commercial sources of nitrogen fits into a continuous cotton-growing economy. When the cotton is picked in the fall, no field work is necessary until preparation of the land for cotton the following spring. The soil is exposed to the ravages of nature during these months and many pounds of plant food may be leached away and tons of soil washed from the sloping fields.

The growing of legumes as a source of nitrogen presents many different problems. The winter legumes must be planted in the fall, immediately after cotton picking. The seed costs $2 or $3 per acre, depending on the price and kind of legume sown. The successful growing of legumes requires the normal applications of phosphoric acid and potash, adding another $4 or $5 to the cash cost, making the total cash cost from $6.50 to $8 per acre. Financing a winter-legume program means making loans nearly a year in advance of harvesting of the cash crop, whereas financing of nitrogenous fertilizer is only from spring to fall.

The legumes grow during the winter and spring, utilizing available plant foods in the soil, and prevent the surface soil from washing down the slope, filling terrace channels, or washing completely from the field. When legumes are grown, the plans for the next year must be made in the fall, fitting into a long-time cropping system. Where the operators of land change from year to year, the plans are not made until winter or just before field work begins in the spring.

Legumes make a dense top growth which must be turned under just before crop planting. Such turning requires more power than the mere breaking of cotton stubble. The average farmer cial borax, and similar results have been obtained when the same amount was applied to the sides of the rows. Cracked-stem is apparently widespread all over the United States.

We come now to a vegetable, the carrot, which thus far has had comparatively little attention in its relation to boron. The canning pack of carrots in Oregon is important, frequently amounting to between 250,000 and 300,000 cases. Due to increased consumption of this vegetable, it is likewise an important market crop and is used to a minor extent in preservation by freezing. Apparently, the carrot is menaced today by the maladies common to other root crops, including beets, rutabagas, turnips, and mangels.

Boron and Carrots

K. Warrington (9) reports having observed internal breakdown of carrots, noting that symptoms were visible not only in the food and water conducting areas of the roots but also in the leaves of the plant. Warrington concluded that carrots must be added to the list of plants for which boron is an essential constituent. However, there appears to be little evidence at the present time that the internal blackening is controllable by such methods as have been used with the other root crops. Dark centers in rutabagas and turnips have been reported in a number of cases, while brown heart of swedes has been controlled in New Zealand and elsewhere by the application of 20 or more pounds of borax per acre. In carrots, the breakdown assumes symptoms of exterior canker, interior darkening, and watery cores. In some extreme cases the entire central portion of the carrot is hollow. In some cases which the Oregon Experiment Station has investigated, there is considerable similarity in the breakdown of these roots to that found in the other roots already mentioned.

The rutabaga has been investigated all over the world in regard to a study of the browning of the roots and the use of boron to counteract the trouble. With as few as 5 to 10 pounds of borax per acre, there has been a notable decrease of plants affected with brown or hollow heart. For turnips, the symptoms are virtually the same, and similar treatment would be recommended. Chandler shows that turnips have a rough surface when grown without boron, while healthy roots have a smooth surface.

Outstanding symptoms of boron deficiency expressed in spinach have not been observed at Oregon State College, but definitely higher yields per acre have been obtained with the application of 20 to 30 pounds of borax combined with the fertilizer that may be used for the crop.

A lettuce disease due to boron deficiency has shown up in the Salinas Valley in California in recent years, manifesting itself in a malformation of the leaves and the spotting and browning of the leaf tips. On soils where any one crop is affected by boron deficiency, it is recommended that borax be applied at the rate of not more than 10 pounds per acre for such a crop as lettuce.

Vegetables Sensitive to Boron

Vegetable crops have been classified by Purvis and Hanna according to their tolerance to applied borax as determined by field and greenhouse studies. Contrasting the relative sensitiveness of various vegetables, snap beans and cucumbers are very sensitive and should have on the average no more than five pounds of borax per acre. Also in the sensitive group are listed celery, muskmelons, peas, potatoes, squash, and watermelons. Those that are rated tolerant with the possible application of 30 pounds of borax per acre to correct any ailment are cabbage, carrots, corn, eggplant, kale, lettuce, onions, peppers, radishes, spinach, and sweet potatoes. Crops that are rated very tolerant and for which up to 50 pounds of borax are applied per acre include beets, cauliflower, mustard, tomatoes, and turnips.

The Place of Boron in Growing Truck

(*From page* 17)

nutrition which are exemplified in various individual crops discussed herewith.

Another crop for which boron is commercially used in Oregon is broccoli, an important crop for freezing. In 1939 over 1,000,000 pounds of this vegetable were frozen in Washington and Oregon out of a total of some 2,700,000 pounds for the United States. The symptoms of boron deficiency in broccoli are mostly cracks or splits on the underside of the petiole or stem, the leaves are very brittle, and the buds may turn brown and fall off. The use of borax in a commercial fertilizer is a standard practice in growing this crop at the present time in Oregon.

Another member of the cabbage tribe for which boron is used extensively is brussels sprouts, frozen in 1940 in the Northwest to the extent of over 500,000 pounds, which amount was about two-thirds of the national crop preserved in this manner. Symptoms of boron deficiency in brussels sprouts do not show as rapidly as on broccoli according to Chandler (8), but there are swellings on the stems, outside leaves may be curled outward and distorted, the leaves at the base of the plant fall off, and the sprouts are usually smaller. Commercial growers of sprouts in Oregon are likewise including borax in their commercial fertilizer mix.

Cabbage shows symptoms of boron deficiency in internal browning of the pith and also in certain malnutrition characters of the leaves. According to Wisconsin observations, Golden Acre is considerably more susceptible to internal pith browning than Ballhead or Hollander.

Cauliflower is not only an important crop for local market and for shipment, but it is also frozen in the Northwest to the extent of 566,000 pounds in 1940. The two outstanding symptoms of deficiency of boron in cauliflower are: First, the watery or brown stem which is oftentimes hollow; second, the discoloration of the curd or head. In his studies, however, Chandler of Maine could find no relation between boron-deficiency symptoms and hollow stems. As little as five and six pounds of borax per acre have been used in New York State to successfully control the brown discoloration and rot of cauliflower heads, which have caused serious damage to this crop. In Oregon 25 pounds of borax per acre are being included in the fertilizer mix distributed by some vegetable freezing firms.

In the case of celery, some of the early work with this vegetable has already been mentioned by the Oregon Experiment Station in sending trial amounts of borax to growers some five or six years ago. Apparently, celery has a higher tolerance for boron than many other plants, but there have been some severe cases of stem-crack in Oregon, so much so that now the application of borax is included in the fertilizer program in almost every area where celery is grown. In the Lake Labish area alone in recent years 3,000 pounds or more of this material have been applied annually.

Results From Boron Applications

In Denmark borax was used for the control of heart and dry rot of celery, and in Great Britain cracked-stem has been controlled by boron applications. In Massachusetts in 1936 several crops of celery were practically ruined by a condition of boron deficiency in certain soils, whereas the 1937 crops on the same lands were saved by boron applications. Excellent yields and high grades have been obtained by the broadcasting of 30 pounds of commer-

(4) Purvis, E. R. and Ruprecht, R. W. *Borax as a Fertilizer for Celery.* Fla. Agr. Exp. Sta. Press Bul. 478.

(5) Purvis, E. R. and Ruprecht, R. W. *Cracked Stem of Celery.* Fla. Agr. Exp. Sta. Bul. 307.

(6) *What's New in Farm Science.* Wis. Ag. Exp. Sta. Bul. 451, 1941.

(7) Powers, W. L. *Boron in Relation to Soil Fertility in the Pacific Northwest.* Soil Sci. Amer. Proc. 1939, Vol. 4.

(8) Chandler, F. B. *Boron Deficiency Symptoms in Some Plants of the Cabbage Family.* Maine Agr. Exp. Sta. Bul. 402.

(9) Warrington, K. *The Growth and Anatomical Structure of the Carrot as Affected by Boron Deficiency.* Ann. App. Biol. 27:pp. 176-183, 1940.

(10) Cook, R. L. and Millar, C. E. *The Effect of Borax on Spinach and Sugar Beets.* Better Crops With Plant Food. Vol. XXV, No. 7.

A Preliminary Study of Lodging of Oats in Missouri

(*From page* 13)

ship between the potassium and the lignin content of the samples is shown in Table 2.

Plant composition reflects very closely the mineral balance in the soil. The results of these determinations further suggest the influence of nutrient balance on plant behavior. Previous workers have reported the beneficial effects of potassium in strengthening the stems of grasses and cereals. Apparently all of these reports, however, were based upon observations of cultures in which adequate supplies of the element were compared with distinct deficiencies. It is known that nitrogen is very beneficial when the supply is in harmony with that of the other plant nutrients, but harmful effects invariably result from nitrogenous over-nutrition. Only when present in the plant in excessive amounts has nitrogen been associated with lodging of cereals. Is it not reasonable to expect that in comparison with potassium-starved plants, the plants grown with an adequate supply of potassium would show a better-balanced composition and have stronger plant tissues? If an over-supply of nitrogen is harmful to plant tissues, it is reasonable to suppose that an excess of potassium might result in various symptoms of this unbalanced condition. The results of this investigation suggest such a possibility, and substantiate the observations of Dassonville (3) that the stems of grasses growing in cultures high in potash were weak and the plants lodged. His conclusions were discounted by later workers, but, perhaps, whereas they were comparing low with adequate amounts of potassium, Dassonville was comparing a deficient with an excessive supply of the element.

In light of the conflicting conclusions of Welton on the one hand and Davidson and Phillips on the other, the lignin contents of the oat stems were estimated for comparison. The results were like those of Welton, in that he found excessive nitrogen associated with low lignin content and lodging, whereas the results presented here indicate that high potassium, low lignin, and lodging are apparently associated.

Lignin may be found to play a more important role in the plant than has heretofore been assigned to it. The amount of lignin present per unit weight of plant material may prove a primary factor in determining resistance to disease and insects, and to lodging.

Crampton (2) has suggested that the determination of lignin in forages might be a better index of their feeding value than a report on the crude fiber fraction which he has found to be relatively digestible. The apparent influence of the nutritive balance on the lignin content of plants has been suggested.

Inasmuch as this investigation was undertaken merely as a "direction pointer", only those determinations considered absolutely essential were car-

It is important to give attention to methods of application when borax is used singly or in combination with other fertilizers. The amount of borax used per acre is one-fifth to one-tenth that of the average fertilizer, which means that there must be efficient distribution of the material to make it useful for the crop in question.

In contrasting broadcasting fertilizer and applying it as a side-dressing to the row, it should be remembered that one pound of fertilizer comes in contact with 400 pounds of soil where drilled, against one pound to 6,000 pounds broadcast and disked. It is evident, then, that when but 20 or 30 pounds of borax per acre are broadcast, there is 15 times less the concentration of fertilizer per pound of soil than in the case of the side-dressing.

Methods of Application

Methods of application of borax which have been suggested and used are as follows:

(1) Broadcast with fertilizer, using up to 50 pounds of borax per acre or possibly even more, though above that amount experimental caution should be used.

(2) Applied alongside the row 1½ to 2 inches away at seed level and at the time of seeding, using from 20 to 50 pounds of borax per acre, depending on the vegetable being grown.

(3) Used alone with no fertilizer, in which case it should preferably be mixed with sand or fine soil in the proportion of 85 pounds of filler to 15 pounds of borax per acre to make sufficient bulk and to obtain even distribution of the comparatively small amount of borax. A cyclone type of grass seed hand sower may be used.

(4) Applied in solution as boric acid solution, in which case it may be used (a) as a spray with or without insecticides or fungicides, or (b) in the barrel of a plant-setting machine.

In general, applications of borax should be made in the early life of the plant, preferably at or before seeding time or at or before plant-setting time. These early applications are particularly desirable if the crop is to depend on natural rainfall.

It seems somewhat uncertain as to the actual causes of breakdown in certain plants, such as beets, which are suffering from lack of boron.

In discussing the work of Brandenburg, Dennis and Dennis report that boron is not translocated from old to new portions of a plant but that a constant supply is necessary at all times. Brandenburg found that when the source of boron supply was interrupted the new leaves of sugar beets were very low in content of boron, while the older leaves, formed while the supply of boron was plentiful, retained the normal amount of boron. He reported that new leaves, formed under inadequate supply of soil boron, soon developed symptoms of boron deficiency.

Cook and Millar (10) in their recent publication on the effect of borax on spinach and sugar beets, state that the fact that boron once fixed within a plant is not readily translocated to other portions of the plant or to the new tissue makes the problem of fertilization with boron more interesting and important. It also makes it more difficult and probably accounts for the fact that the appearance of boron deficiency symptoms seems to have some correlation with weather conditions.

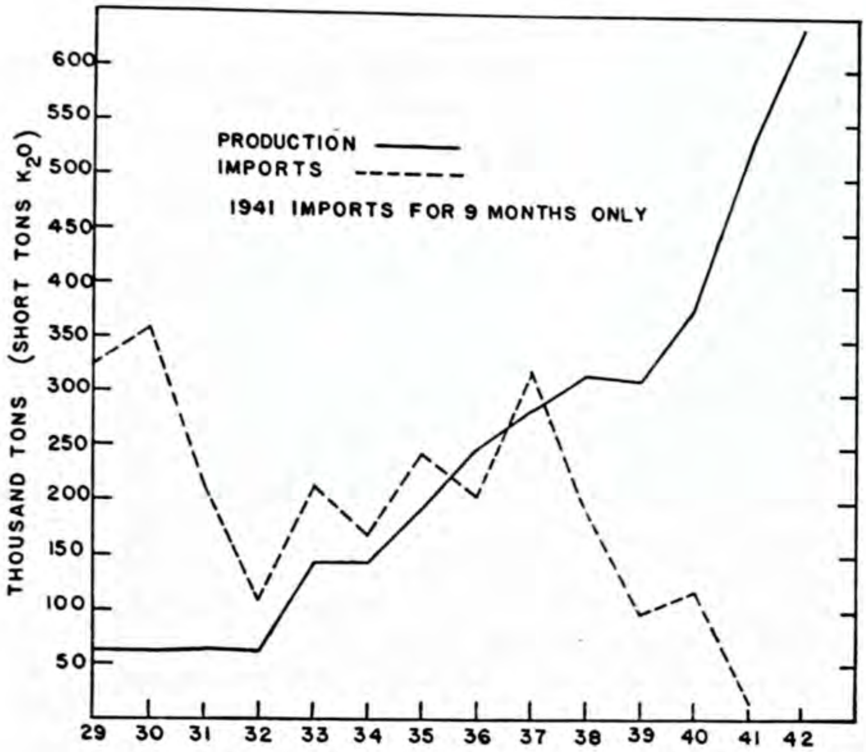
There is no doubt that within a few years the accumulation of widespread investigations will furnish much valuable information to growers of vegetables as to the actual functions of boron and the most useful ways of applying it to the soil.

Literature Cited

(1) Purvis, E. L. *The Present Status of Boron in American Agriculture.* Soil Sci. Soc. of Amer. Proc. 1939, Vol. 4.

(2) Warrington, K. *The Effect of Boric Acid and Borax on the Broad Bean and Other Plants.* Ann. Bot. (London) 37:629-672, 1923.

(3) Johnston, E. S. and Dore, W. H. *The Influence of Boron on Chemical Composition and Growth of Tomato Plants.* Pl. Physiol. 4:31, 1929.



its future permanence as an essential farm adjunct.

Then, there is the demand for a greatly increased production of vegetable oils — cottonseed, peanut, soybean, linseed, and tung; the current adequacy of potash supplies makes possible its use in the optimum amounts called for by the latest experimental data. The byproduct seed cakes or meals are available as concentrates for supplemental feeds in the livestock and dairy industries, both undergoing expansion.

plant food essential to agriculture, the outstanding wartime contribution of the potash industry is to make possible the great expansion in certain specified lines of agriculture production called for by the Government. Foremost is food for Americans, now in a position to enjoy three full meals a day. Superimposed is food for our armies and for the United Nations, to be expanded to include food for the peoples of occupied countries when freed from their oppressors. Included are food crops susceptible of preserving and concentrating, which, if grown intensively and produced profitably, must be scientifically fertilized. Meat and dairy products are emphasized; if produced with optimum efficiency, they call for high-quality nutritive herbage (legumes and grasses) which can best be grown on properly fertilized fields and pastures. For legumes lime, phosphate, and potash are the major requirements; the nitrogen fixed by them is sufficient for their own use and for the grasses grown with them. The great value of the fertilized legume-grass pasture is being so widely demonstrated by federal and state soil conservation and other agencies as to warrant the prediction of

The current nitrogen shortage can be neutralized to a considerable degree by the turning under, in whole or in part, of nitrogen-fixing legumes grown in rotation or, as in the South, as winter cover crops. In addition to the 30-pound per acre nitrogen equivalent which they have been shown to yield, are the collateral profits from plant-food mobilization, soil conditioning, and prevention of soil erosion and soil leaching. The advice of the slogans, "Grow your own nitrogen" and "Grow your own organics", would be futile were it not for the present adequacy of potash supplies for such farm practices, since the high potash requirement of legumes is now generally recognized. The programs of the Soil Conservation Service for which potash is required—illustrated for example, by the current requirement of 100,000 tons of 0-14-14 fertilizer—can continue without interruption. In short, the wartime contribution of adequate potash supplies is completely meeting the requirements of a vast food program and is in contrast to those derangements and deprivations, both agronomic and ecoried out. More complete and better controlled experiments are now under way that should throw more light on the relationship between potassium and the other nutrients, particularly the potassium-calcium balance and its influence on growth, composition, and behavior of the soybean plant.

The investigation reported here and the results of certain of the field experiments of the Missouri Agricultural Experiment Station * are indicating that many soils may be adequately supplied with potassium at the present levels of calcium, phosphorus, and nitrogen, and if potassic fertilizers are applied crop injury in some form may result. However, if soils are so managed that their supply of calcium, phosphorus, and nitrogen is considerably increased, potassium will undoubtedly then become the limiting factor. The present trend in Missouri and other states toward the increased use of lime, phosphates, and green manures, will in time result in a need for potassic fertilizers even on soils now apparently well-supplied with this element.

References

1. Albrecht, W. A. *Calcium-Potassium-Phosphorus Relation as a Possible Factor in Ecological Array of Plants.* Jour. Amer. Soc. Agron. 32:411-418, 1940.
2. Crampton, E. W., and Maynard, L. A. *The Relation of Cellulose Lignin Content to the Nutritive Value of Animal Feeds.* Jour. Nutrition, Vol. 15, No. 4, 1938.
3. Dassonville. Revue Generale de Botanique, 10. 1898.
4. Davidson, J., and LeClerc. *Effect of Various Inorganic Nitrogen Compounds Applied at Different Stages of Growth on the Yield, Composition and Quality of Wheat.* Jour. Agr. Res. 23:55, 1923.
5. Davidson, J., and Phillips, M. *Lignin as a Possible Factor in Lodging of Cereals.* Sci. 72:401, 1930.
6. Gieseking, J. E., Snider, H. J., and Getz, C. A. *Destruction of Organic Matter in Plant Material by the Use of Nitric and Perchloric Acids.* Ind. and Eng. Chem., Anal. Ed. 7:185, 1935.
7. Kolthoff, T. M., and Sandell, E. B. *Textbook of Quantitative Inorganic Analysis.* Macmillan Company, New York. 1937.
8. Murneek, A. E., and Heinze, P. H. *Speed and Accuracy in Determination of Total Nitrogen.* Mo. Agr. Exp. Sta. Bul. 261, 1937.
9. Purvis, O. N. *The Effect of Potassium Salts on the Anatomy of Dactylis Glomerata.* Jour. Agr. Sci. 9:338, 1919.
10. Schoene, W. J. *Plant Food and Mealybug Injury.* Jour. Econ. Ent. 34:271, 1941.
11. Tubbs, F. R. *Physiological Studies in Plant Nutrition. II. The Effect of Manurial Deficiency Upon the Mechanical Strength of Straw.* Ann. Bot. 44:147, 1930.
12. Welton, F. A. *Lodging in Wheat and Oats.* Bot. Gaz. 85:121, 1928.

* Unpublished data.

Wartime Contribution of the American Potash Industry

(*From page* 10)

in the growing of quality tobacco promptly subsided.

Likewise the interruption of European exports deprived us of our accustomed source of agricultural water-soluble "magnesia", magnesium sulfate and sulfate of potash-magnesia, both of German origin. This situation was adjusted by the last named company in the production of "washed langbeinite", an acceptable substitute for the formerly popular sulfate of potash-magnesia.

Since the major use of potash is as a

The Same to You

(*From page* 5)

fellers wrong. It's like this: last week I went to visit my son in the air school barracks. I didn't see much wrong with the grub, but you oughta heard the soldiers cuss about their meals—also about lots of other discomforts in camp life. They'll do it every time, but just let any geezer start something against this country or the old flag and all heck will bust loose! That's me every time! I'm proud of this country and happy to be an American. I'm strong for all this freedom we have, includin' the freedom to speak what's on your mind and vote the way you think. I'm an American first and a storekeeper second. But I'm goin' to stick to this old shop that my Daddy started during the Spanish war—that is, I will if the bank will give me credit until I can sell that last box of tacks!"

Over at the red brick hotel with its Victorian mansard roof and dormer windows, one finds a blinking night clerk playing cribbage with the porter. We hand him three dollars and are ushered to the bridal chamber, where they keep that picture of the Stag at Bay hanging over the feather bed.

Down-stairs the cocktail lounge is rather empty of hangers-on and drinkers-down, reminding us of the old novel of our boyhood days, Ten Nights in a Bar Room.

"I'm not fretting about keeping enough liquids in stock," says the pimple-faced dispenser, "but it worries me about getting rid of it. Before gas was rationed all the boys would rush in from miles around to celebrate the latest newspaper victory, and they hung to it until the Tom and Jerry was consumed. But this year I guess they'll stay home and swig up some of that apple jack derived from a bumper crop of pippins flavored with codling moths."

"I see you opened up the old sample room," is my comment. "I thought the salesmen were off the road for keeps."

"Drummers will travel by bus and railroad now, and that means a lot of them will stay here overnight and lay out their stock awhile. They uster hurry in with their cars, park down at the curb near the stores, and grab a lunch at the Bon-Ton Cafe. Inside of an hour if business was brisk they was on their way out to the next town. What's one man's meat is another man's poison. The gas men don't like this situation, but from now on during the duration this Inn is in, believe me, as far as bed and board goes. I've sent for a brand new, red-covered railway guide and will keep it on the tobacco counter tied with string to the cigar lighter. It ain't been years since we had one of them red books around. We've took down the state road map and the file of tourist folders, 'cause it's goodnight to the summer trade. In their place, I put up a war zone atlas and a county directory."

Just to pass my patronage around a bit, I saunter down to the Bon-Ton Cafe, that erstwhile busy spot redolent of cabbage and sauerkraut flavored with onions and bacon fat. Although the heady aroma lingers still, the customers are scarce as new tires. The chap who takes my order also officiates at the kitchen range, so it is some time before I get a chance to put the bee on him about the doughnut demand.

IN answer to my query, a pained expression flits across his red face. He wipes a slight tear from one eye, which may be onion juice or sentiment, and replies:

"Too much government!" Before I can run through the alphabet signals to detect his grievance, he supplies the answer.

"This joint has always been a one-man and a one-girl service spot, plus the cook. Now I'm all alone, with five times the book work to do just to please the blamed bureaucrats. Believe it or nomic, which constituted the potash problem of 1914-18.

In the chemical field the wartime contribution to national independence, security, and comfort likewise has been marked with outstanding success.

Salts of potassium used in the chemical and industrial fields for the most part are derived from the chloride as the primary product. A high standard of purity is required; and to meet it, the American Potash and Chemical Corporation re-refined its high-grade muriate and thus became the first domestic source of a chemical grade of potassium chloride. Subsequently, the bulk product of the United States Potash Company was found to meet these standards and thereupon became a second source of supply. While the bulk product of the Potash Company of America is of equal percentage purity, the minute content of iron oxide to which it owes its pink color is a deterrent to its general acceptance in the chemical trade. An additional refining unit is being used by this company to give a product from which this impurity has been eliminated. Here again, the supply situation is excellent.

The advent of war in 1939, therefore, found us prepared to contribute to the emergency ample supplies of chemical grades of potassium chloride, which were susceptible to expansion. The extent of this expansion is illustrated by comparing the record of 1938, the last normal prewar year, with that of 1941. In 1938 domestic deliveries of potassium chloride to chemical industries amounted to 25,000 tons KCl and in 1941 to 83,000 tons. Imports of potash chemicals during the first nine months of 1941 amounted to only 162 long tons, exclusive of bitartrate, a by-product of the wine industry. In 1938, we imported in excess of 6,000 long tons of the chlorate and perchlorate alone. With the cessation of imports, expansion in this field received effective attention.

These chemicals and their derivatives enter into innumerable peacetime applications and into the every-day lives of most of us. It suffices to mention only the chlorates, essential constituents of the modern match.

Expansion in production to supply these normal peacetime uses had to be further increased to provide for military requirements. Among the compounds officially listed as of military importance are potassium bromide, chloride, chlorate, perchlorate, dichromate, chrome sulfate, hydroxide, nitrate, and sulfate. When their specific uses can be discussed publicly, it is to be hoped that the desirability of maintaining these manufactures as permanent sources of essential chemicals in accordance with the lessons taught by two world wars will be stressed. Quoting from "The Mineral Industry during 1940": "From the standpoint of the present emergency, perhaps one of the most gratifying developments in recent years has been the establishment of facilities for the production of essential potash chemical compounds in quantities sufficient to satisfy domestic needs."

From the former problem of what to do with our surpluses, we have changed overnight to how to make out with inadequacies. Priorities, allocations, rationing, pricefixing, and other devices to regulate supplies with maximum benefit to the war effort and minimum derangement of private lives are the order of the day.

By contrast with a situation affecting what superficially appears to be most other commodities, potash is conspicuous as an outstanding exception. To date, federal war agencies have taken the position that only minor problems exist with respect to potash supplies and publicly have expressed gratification in that fact. Official satisfaction must be multiplied many times by that of the agricultural public whose operations in this emergency are not being disrupted as they were in World War I. Foresight born of that experience has resulted in this present state of adequacy of potash supplies from our own mines and refineries. Equal foresight must be exercised if that state of independence is to be perpetuated.

An elderly couple enter a magistrate's office.

Man: "I want to get married."

Magistrate: "How old are you?"

Man: "72."

Magistrate: "Why are you marrying?"

Man: "Well, I've saved up some money, so I'd like to marry and have an heir."

Woman: "I've saved up some money too, and want to marry and have an heir."

Magistrate (aside to clerk): "These people are sure more heir minded than heir conditioned."

"Jimmy, stand up and face your seat."

"Gee, teacher, I ain't no contortionist."

"Daddy, what is a mole?"

"It's a kind of wart on a person's skin."

"Do they crawl around?"

"No."

"Then that ain't a mole on your neck, is it?"

"Today I met a girl who had never been kissed."

"I would like to meet her."

"You're too late now."

Now that rubber and gasoline and time are all getting scarcer and scarcer, many a man will have to give up golf. But he can still use the words.

Lecturer: "Potts was a great man. At his death three towns were named after him—Pottstown, Pottsville, and Chambersburg."

Customer: "Gimme a tablet."

Drug Clerk: "What kind of a tablet?"

Customer: "A yellow tablet."

Drug Clerk: "But what's the matter with you?"

Customer: "I want to write a letter."

Chaplain: "My man, I will allow you five minutes of grace before the electrocution."

Condemned Man: "Fine, bring her in."

The lady wished her servant to be pleased with her new place. "You'll have a very easy time of it here," she said sweetly, "as we have no children to annoy you."

"Oh," said the colored girl generously, "I'se very fond of chilluns, so don't restrict yo'se'f on my account, miss."

HOW TRUE

First Flapper: I wouldn't wear a one-piece bathing suit; they're too immodest.

Second Ditto: I haven't much of a shape either.

CLASSIFIED AD—1942 STYLE

Owner of 1940 Ford would like to correspond with widow who owns two tires. Object, matrimony. Send picture of tires.

not, starting December 1, we have had to keep daily records of all the raw materials we bought and everything we served. Every morning I have to weigh the sugar before filling the bowls, and then weigh it again at night. The same goes for coffee, salt, baking powder, eggs, meat, soap powder, floor wax, and garbage, too. Yesterday I served only ten customers all day and spent the rest of the time washing dishes and doing my home work on them confounded inventories. I can't figure out what economic value Mr. Byrnes or Mr. Nelson sees in checking the ingredients that go through such a hole in the wall as this!" Here he broke down and staggered out of sight behind the thumb-printed kitchen door.

As neither his food nor his demeanor tended to prompt appetite or digestion, I left my meal untasted and wended my way down to the grist mill, where I was sure to meet some of my understandable cronies among the rural gentry.

And I did. For standing there in the brown stone doorway, through which generations of plowmen had taken their toll to mill, was Abner, the Upright. Tall and powerful for his seventy-odd summers of production, this sage of the soil usually kept a better balance than any of the folks in Our Town, regardless of party or parity.

"SO far most of my friends on this day have spoken discouraging words about the discord on the Home Front, Abner, and I finally hiked down this way to see if anybody had a seasonal thought or two, like the old times when we called cheerio to all and sundry at the approach of Christmas."

Abner threw back his broad shoulders, never bent by plowing or musket toting in the Spanish war, and replied softly:

"Jeff, old-timer, I'm glad you asked me that. I just got back from a big pow-wow of farm leaders and spokesmen who spend much time worrying about Washington," he said. "Maybe some of the things they said and some of the demands they made on the administration were sound and progressive, and perhaps if they hadn't hollered and kicked, we would not be in as good shape as we are to begin the battle again when the sap flows. In my own simple manner of speaking," said Abner, "it strikes me us farmers on the whole is getting a pretty fair shake. Of course, lots of our best boys are in Bataan and Bizerte just when we need 'em most. But gosh ding it, Jeff, that goes for all the sons of all the mothers and fathers around this bailiwick, and I bet you if they had begun fighting this war by a manifesto which barred the barn-yard boys, our granger gang would have raised more hell than Hitler. In every scrap since Valley Forge, it's been the farmers who prized liberty the most."

HE paused to lift a couple of heavy grain sacks back into the trailer, and then resumed:

"Since they woke up to the food shortage and the labor problem, our farm boys have been put in a special classification, either II-C or III-C. Henderson says we can keep on usin' all the gasoline and oil we reasonably need, and that makes us the favored customers of the gasoline alley lads.

"We have plenty of fuel wood on most of our farms and preserves and canned goods galore, in spite of all the yawp about sugar rations. Take it from me, rural America is set to stand a longer siege than any other section of the country. They can keep their shins toasted and their bellies full anyhow. We can eat, we can sleep, we can travel moderately, we can keep warm and dry—and our financial condition at present average prices is the best it has been since we kept cool with Coolidge. But now, Jeff, if you'll call this an interview and not misquote me, I'll drive on home and trim the tree. Best wishes and more of 'em!"

"And the Same to You," I called after him as he rattled off toward his homestead in the hills.

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

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
What You Sow This Fall (Canada)
Home-grown Grains for Profitable Hogs (Canada)
What About Clover? (Canada)
Of Course I'm Interested (Pastures, Canada)

Reprints

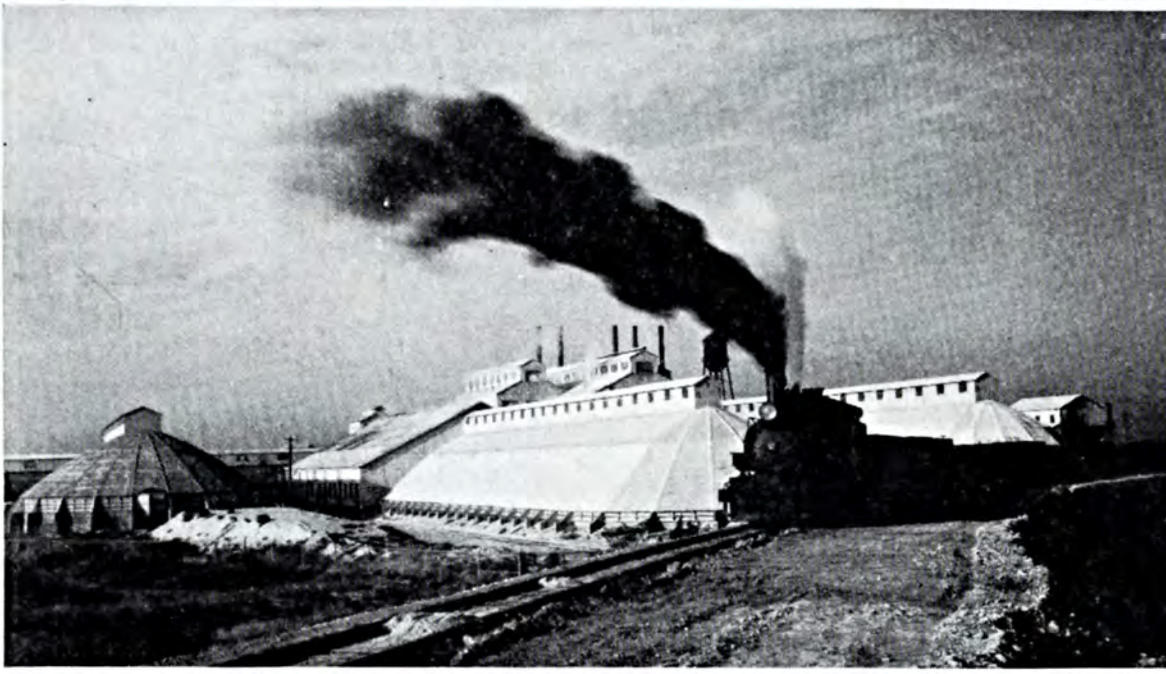
B-8 Commercial Fertilizers in Grape Growing
K-8 Safeguard Fertility of Orchard Soils
T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
II-8 Balanced Fertilizers Make Fine Oranges
MM-8 How to Fertilize Cotton in Georgia
A-9 Shallow Soil Orchards Respond to Potash
N-9 Problems of Feeding Cigarleaf Tobacco
R-9 Fertilizer Freight Costs
T-9 Fertilizing Potatoes in New England
CC-9 Minor Element Fertilization of Horticultural Crops
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
PP-9 After Peanuts, Cotton Needs Potash
UU-9 Oregon Beets and Celery Need Boron
A-2-40 Balanced Fertilization For Apple Orchards
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
H-3-40 Fertilizing Tobacco for More Profit
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
M-4-40 Ladino Clover "Sells" Itself
O-5-40 Legumes Are Making A Grassland Possible
Q-5-40 Potash Deficiency in New England
S-5-40 What Is the Matter with Your Soil?
T-6-40 3 in 1 Fertilization for Orchards
AA-8-40 Celery—Boston Style
CC-10-40 Building Better Soils
EE-11-40 Research in Potash Since Liebig
GG-11-40 Raw Materials For the Apple Crop
II-12-40 Podsols and Potash
JJ-12-40 Fertilizer in Relation to Diseases in Roses
LL-12-40 Tripping Alfalfa
A-1-41 Better Pastures in North Alabama
E-2-41 Use Boron and Potash for Better Alfalfa
I-3-41 Soil and Plant-tissue Tests as Aids in Determining Fertilizer Needs
K-4-41 The Nutrition of Muck Crops
L-4-41 The Champlain Valley Improves Its Apples
Q-6-41 Plant's Contents Show Its Nutrient Needs
R-6-41 A Balanced Diet for Nursery Stock
S-6-41 Boron—A Minor Plant Nutrient of Major Importance
U-8-41 The Effect of Borax on Spinach and Sugar Beets
W-8-41 Cotton and Corn Response to Potash
Y-9-41 Ladino Clover Makes Good Poultry Pasture
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
DD-11-41 J. T. Brown Rebuilt a Worn-out Farm
EE-11-41 Cane Fruit Responds to High Potash
FF-12-41 A Five-year Program for Corn—Livestock
GG-12-41 Borax Helps Prevent Alfalfa Yellows in Tennessee
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
JJ-12-41 Potash Demonstrations on Statewide Basis
A-1-42 Canadian Muck Lands Can Grow Vegetables
B-1-42 Growing Ladino Clover in the Northeast
C-1-42 Higher Analysis Fertilizers As Related to the Victory Program
D-2-42 Boron Deficiency on Long Island
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-3-42 High-grade Fertilizers Are More Profitable
J-4-42 Boron Stopped Fruit Cracking
L-4-42 Permanent Hay the Plant Food Way
M-4-42 Nutrient Availability—An Analysis
N-5-42 Soil Bank Investments Will Pay Dividends
O-5-42 Nutritional Information from Plant Tissue Tests
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
R-5-42 Legumes Will Furnish Needed Nitrogen
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
U-6-42 Water, Fertilizer and Good Farming
V-6-42 Some Soil Problems of the Piedmont
W-8-42 Ladino Field Day
X-8-42 Conserve Nitrogen Now
Y-8-42 The Southeast Can Grow Clover and Alfalfa

THE AMERICAN POTASH INSTITUTE

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

MOTION PICTURES

EDUCATIONAL FILMS AVAILABLE



One of the American potash plants which has made this country independent of foreign sources of this essential plant food.

POTASH PRODUCTION IN AMERICA

A 16mm., silent, color film depicting the location and formation of American potash deposits and scenes of mining and refining of potash in California and New Mexico.

Running time, 40 min. (on 400-ft. reels).

Other 16MM. COLOR FILMS AVAILABLE

- Potash in Southern Agriculture
- In the Clover
- Bringing Citrus Quality to Market
- Machine Placement of Fertilizer
- Potash from Soil to Plant
- Potash Deficiency in Grapes and Prunes
- New Soils from Old
- Ladino Clover Pastures

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.

1155 Sixteenth Street Washington, D. C.

Printed in U.S.A.