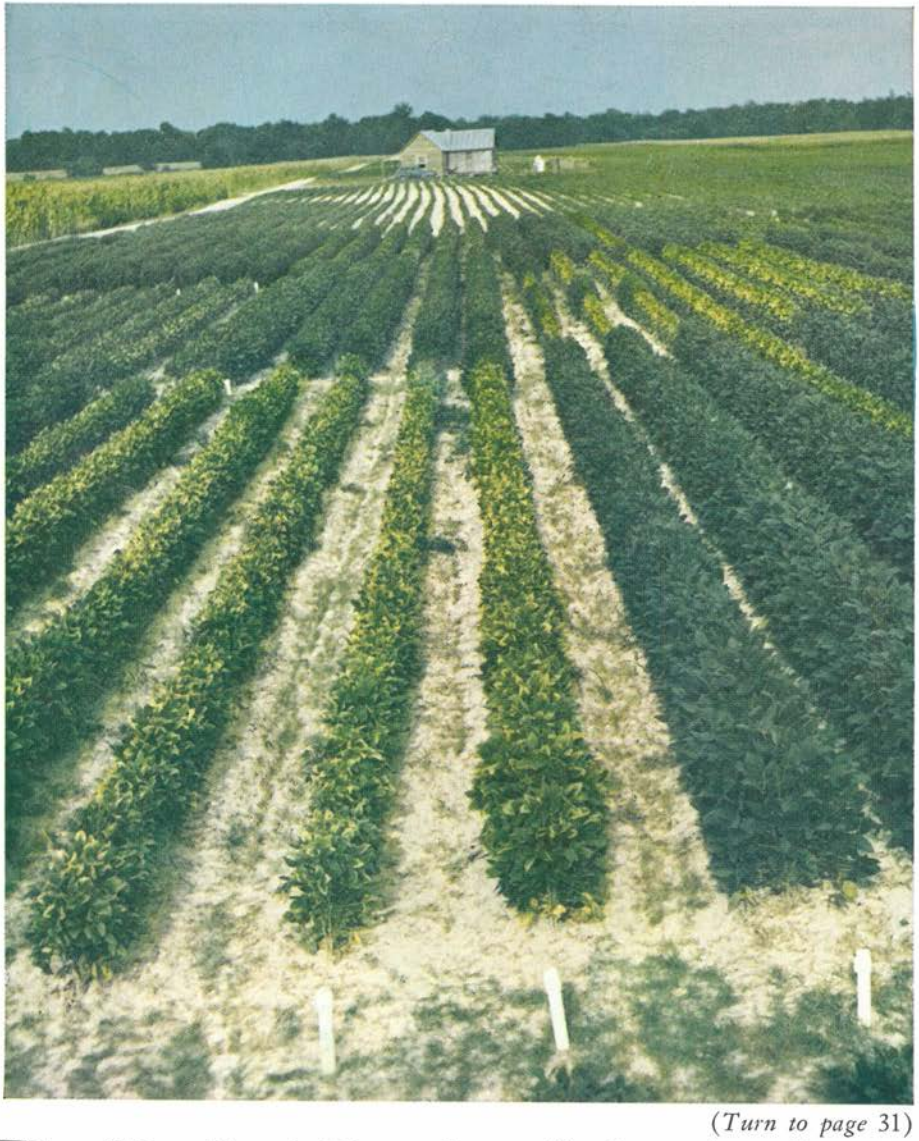
Better Crops WITH PLANT FOOD

March 1955 10 Cents



(*Turn to page* 31)

The Pocket Book of Agriculture

PAY DIRT

for pottery or pumpkins

In 1862, when John W. Searles, a prospector, staked mining claims on Searles Lake in California's Mojave Desert, he little knew he had discovered the richest natural deposit of *diversified* chemicals the world has ever known. In ensuing years triumphs in chemical engineering have enabled American Potash and Chemical Corporation to win from this vast dry lake bed millions of tons of basic chemicals vital to twentieth century life . . . POTASH, one of the three plant foods necessary to maintain our agricultural economy, BORAX, BORIC ACID, SODA ASH, SALT CAKE, BROMINE and LITHIUM CARBONATE used in the manufacture of glassware, ceramics, paper, enamelware and a countless array of consumer products. Constant improvement of the company's manufacturing processes at Trona, coupled with enlarged and modern research and development facilities, guarantee you a uniform and high quality source of supply.

American Potash & Chemical Corporation

TRONA
INDUSTRIAL AND AGRICULTURAL CHEMICALS
ESTON CHEMICALS

Offices • 3030 West Sixth Street, Los Angeles 54, California
• 99 Park Avenue, New York 16, New York
• 214 Walton Building, Atlanta 3, Georgia
Plants • Trona and Los Angeles, California

• BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM & BROMINE CHEMICALS
and a diversified line of specialized AGRICULTURAL, REFRIGERANT and INDUSTRIAL CHEMICALS

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIX NO. 3

Table of Contents, March 1955

The American Potash Institute, Inc.

1102 16th Street, N. W., Washington 6, D. C.

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

A Budding Scientist

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1102 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIX WASHINGTON, D. C., MARCH 1955 No. 3

It's Time Again for . . .

Spring Meanderings

Jeff McDermid

(E. R. McINTYRE)

THIS is the blissful time of the year when young folks turn to love and elderly citizens resume backward looks at the vanished past, repeating incidents and memories which time and the river have long since passed by. Perhaps both youth and age are a trifle "pixillated" by the same fairy wand. Perhaps there is no beauteous realm of heart's desire to which youth gravitates and age recalls. Yet this scribe doesn't think so. If these dreams and memories were merely fragments and figments lining the skies of make-believe, mankind would not be furnished with the power to love and the ability to remember.

I've often wondered about these mental quirks of our elders as I listened to Dad and Mother and my graying uncles dwell on some insignificant things as they gazed out of the window with faded eyes focused on some distant scene far beyond my own conception. It was not because I mistrusted their judgment or grew weary of anecdotes which had no counterpart in my experience. Perhaps we know the governing reason for this silent retrospection. Aged folks who have no great duties left to perform, or no hours and dates to keep up with, or no special power of talent or entertainment to make their environment pleasurable—such are apt to enjoy tapping gently on the closed door of other days.

They retain a glowing sense of happy pride and thankfulness concerning those who walked with them along the dim but still roseate pathways of youth.

This is no glorified standard they have erected to display parents who bore titles of temporary honor, or had wealth or great intellects, or occupied places of leadership, or were credited with deeds of valor. Instead of that, our reveries are a calling back to mind very simple and homey surroundings—parents of no special gift or outstanding ability save those that helped to start the earliest settlements, and finally left a quiet calm behind them as they passed on into remote and lonely silence.

This eternal silence need never dismay or trouble us, who have a certain faith that modern materialism and mechanical explanations never shake or overcome. Faith tells us that there is a warm and vital realm of the spirit —a sort of echo of loves and memories —the place where our youth has gone and where old friends congregate. To those who demand proof and grim substance before they allow themselves any faith, our answer is that all great achievements were built on faith and confidence. If this is essential for everyday productions, why is it not useful in the noblest aspirations of the mind?

ANOTHER answer to the upholders of modern skepticism, a few phrases are worth recalling from a talk given by Lindsley F. Kimball, Vice-president of Rockefeller Foundation: "I sometimes think we have been aging but not maturing. We have more information but not necessarily more wisdom. We have miracles of communication, but not always more understanding. We have more gadgets, but hardly more ethics. If we appeal to law and see it fail, we turn to science and then to money."

Behind this belief is the direction we must take to get the real strength we all possess through love and memories.

But thereupon you may rightly inquire of yourself as to how many there will be to remember you amid old-time recollections. Will you leave something worth the remembering, something little perhaps but still enduring?

For a proper answer to that question we all so often use, let's jot down a new definition of "an artist" given lately by the celebrated novelist, William Faulkner:

"By artist, I mean, of course, everyone who has tried to create something which was not here before him, with no other tools and materials than the non-commercial ones of the human spirit; who has tried to carve, no matter how crudely, on the wall of that final oblivion, in the tongue of the human spirit, *Kilroy was here.*"

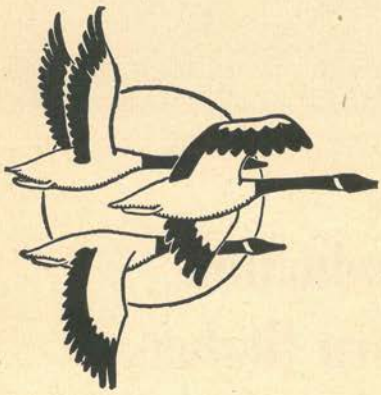
To meet that requirement might seem hard and almost impossible, were it not for the assurance that what is really enduring lies in the realm of the human spirit. That would include many simple but courageous souls who were unknown much beyond their local sphere, but whose memory is kept green and lovely in the eyes of old people smilingly focused on the remote and distant past.

YES, indeed, that same old blustering, carefree, conniving "Kilroy." How he is recalled by those who knew him! How your uncle laughs and slaps his thigh at mention of Kilroy's name. Or maybe someone remembers him because he was rough, with gentle ways about him in times of trouble. Or he put his big mitt on your shoulder and urged you to get that education, or join that church, or marry that girl; and how he said that every man owed it to the world and his friends to prepare himself to do the very best he can. Yes, any man of that kind can know he has created something in the realm of the spirit that was not there before him.

Another example of our meaning comes in the wake of the demise of a well-known man in our town who had reached 81 with none of the crotchety and unreasonable attitudes so often assumed by the extra-elderly. A local

writer spoke of him thus:

"There are men who live in a community for a long time and who leave little or no impression upon it. There are others who by the force of personality become an integral part of the life of a community, a necessary element of it. We look upon them as we look upon some stately building or a lovely prospect on a beautiful body of water. We accept them. They have always been with us. We grow to look upon them as having an eternal life. We cannot imagine our daily lives without them. Then suddenly in



the newspaper we are confronted with their obituary, and we then realize what they have meant to us and what a void their passing leaves."

Now you might expect to learn that such a person our friend described was perhaps a city official or a society leader or someone much acclaimed in the world of art. Yet such was hardly the case. This much-loved person worked for more than 60 years as a clerk in a clothing store. Not for that, however, was his name revered. His achievements were modest and quiet ones, mainly in the realm of vocal music as a teacher and as a chum and lover of children, by whom he was affectionately known by three generations.

I have always thought that the closer a person comes to the affairs and hopes common to the everyday household, a person who really lives broadly and humanely in the ordinary routes of travel and labor, and who seeks no special acclaim or public tribute may end his days with a warm and comforting sense of having made the most of time, of youth, and of love. Of such it can be truly said "the only injury he ever did us was when he left us."

That's the reason so many of us simpler souls prefer to get our reading entertainment from the lives and doings of mortals of no great moment, like ourselves and our forebears. We enjoy casting our favorite dramas in the wavering light of the fireplace, the long reaches of the public road, the inns and cozy spots where mankind is wont to go in and gabble, or the country store or smithy (more lately the village garage.) For here is actually where the decisions of a democratic people happen to be made, despite what some tell us to the effect that all wisdom and progress stem from the members of Congress whose pay should be increased that we may have a guarantee of lofty leadership.

BECAUSE so many of us fail to look ahead to gain the solace we require, and remain fearful and mistrustful of the next event we face—because of this growing habit of mind, we tend to turn backwards again to the nearly vanished era of quaint serenity. If we can't get comfort trying to imagine what science in its omnipotent power will bring us, we often do get a brief recess through scanning scenes on the road we have come.

Magazines have taken it up. So have the motion picture studios. Even some of the comics dress their characters in the styles of a century ago. Advertising copy men cater to the contrast of the pioneer's innocent ignorance versus the technical profundity of our modern life. Old type faces of the kind that announced the election of Andrew Jackson or the exhibit of the white elephant by P. T. Barnum

(*Turn to page* 50)

Fig. 1. Part of a 600-acre field of Ogden soybeans growing in the Delta area of Mississippi. A good yield is assured with this excellent stand and weed-free condition. The middles of these 38-inch rows are completely shaded.

Soybean Production in the Southern States

By Edgar E. Hartwig[1]

Stoneville, Mississippi

THE position of soybeans as a crop in the Southern States has improved appreciably in the past 10 years. In the 11 Southeastern States, acreage of beans planted for harvest has increased from 986,000 acres in 1943 to 2,323,000 in 1952. Much of this acreage increase can be attributed to better returns resulting from higher yields per acre, brought about by growers putting into practice the knowledge gained from research developments during this period. In 1943 the average yield per acre was 9.1 bushels, while in 1952 it was 15.6 bushels.

This average yield is still below the national average. However, as more growers utilize improved varieties and production practices, the yield relationship of the Southern States should equal or surpass that for the Nation. Yields of 35 to 40 bushels per acre have been produced rather consistently by some of the better growers in the major production areas of the South.

To produce a high yield it is necessary to have good stands of an adapted variety, planted at the correct time and kept free from weeds. Proper fertilization is essential in nearly all production areas of the South outside of

[1] Research Agronomist, Field Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture, in cooperation with the Delta Branch Experiment Station, Stoneville, Mississippi, and Coordinator of the U. S. Regional Soybean Laboratory research program conducted in cooperation with the Southeastern States.

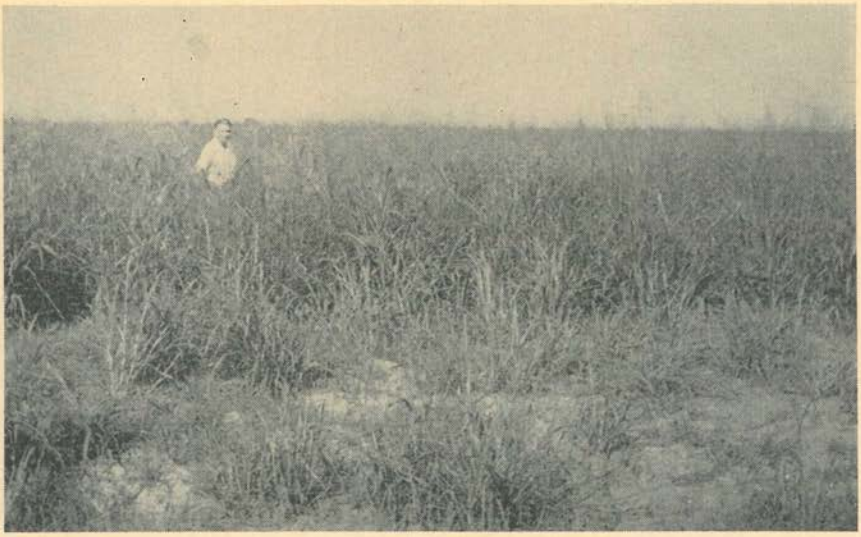


Fig. 2. A common combination in the Delta area of Mississippi—Johnson grass and soybeans. Satisfactory soybean yields are not to be expected with this combination.

the Mississippi Delta.

When soybeans were grown primarily as a hay crop, they gained the reputation of being a crop that could be grown without fertilization. It is true that soybeans when properly nodulated have not responded to nitrogen fertilization in most areas of the South. However, experimental plots on Coastal Plain and Piedmont soils from North Carolina to Louisiana have shown excellent yield responses from applications of lime, phosphate, and potash.

At Baton Rouge, Louisiana, over a 3-year period, an average yield of 21 bushels per acre was obtained without fertilization. The same variety grown in the same field, with adequate lime, phosphate, and potash, produced 35 bushels per acre. In North Carolina, the average yield of unfertilized beans in several experiments was 22.0 bushels; those receiving lime alone produced 24.8 bushels; those receiving 0-40-80 alone produced 27.2 bushels, while those receiving 0-40-80 plus lime produced 34.4 bushels. These results emphasize the need for a complete fertilization program.

Excellent responses to phosphate and potash have also been obtained on the prairie soils of Arkansas. No yield increases have been obtained from fertilization in the Delta area of Mississippi. In general, on most soils where cotton yields are increased by phosphate or potash fertilizers, soybean yields also are increased by these fertilizers.

Although soybeans can be planted over a relatively long period in the South, they do have an optimum period during which they will give best results. In general, there is a tendency to plant too early. At Stoneville, Mississippi, highest yields are obtained from plantings made from about May 1 to May 25. Yields from planting varieties such as Ogden or Roanoke around June 1 have usually exceeded the plantings made April 10. Other advantages of May plantings over April plantings that were found in the Stoneville experiments were more rapid emergence and faster early growth. More rapid emergence gets beans off to a start ahead of weeds. During the first six weeks after emergence, the beans from May 1 plantings made 50 per cent more growth than those planted April 10. This rapid growth aids in weed control. The yield of

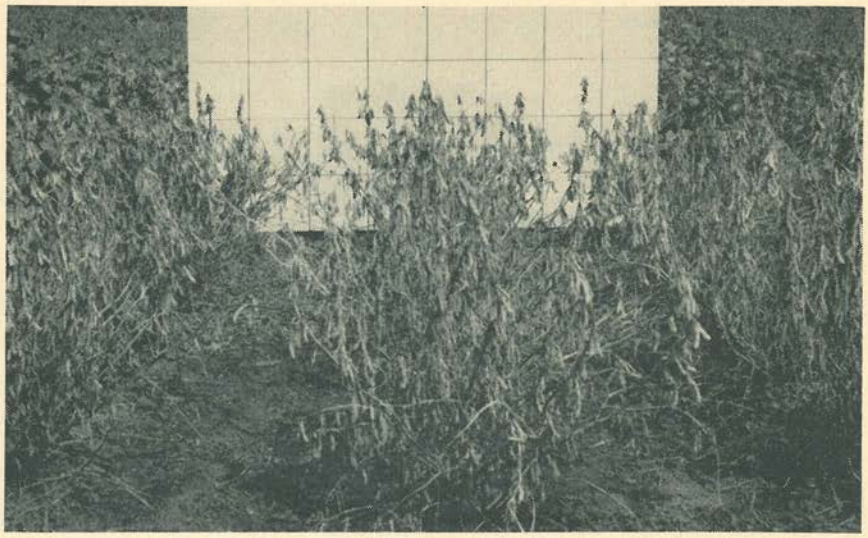


Fig. 3. Dorman soybeans grown on the heavy clay soil at the Delta Branch Experiment Station, Stoneville, Mississippi, yielding 55 bushels per acre. Dorman has a 5-year average yield of 43.5 bushels per acre on this soil at Stoneville.

adapted varieties, such as Ogden and Roanoke, when planted June 20 at Stoneville, has averaged 85 per cent of that of the early May planting.

In west Florida, highest yields have been obtained from plantings made from June 1 to June 15. Consequently, soybeans can very satisfactorily follow white potatoes, small grain, lupines, or crimson clover in those areas where sufficient moisture is available for seedbed preparation and germination of soybeans. If soybeans are to follow a winter crop, it is important to prepare a seedbed as soon as possible after the winter crop is harvested.

On the heavy Delta soils, care must be taken in seedbed preparation so as not to lose the surface moisture necessary for seed germination. Many growers prefer to plant in early April, as they believe they have greater assurance of obtaining a stand in early plantings than in later ones. However, good stands can be obtained from May plantings. The higher yields and better weed control from later plantings justify giving greater attention to seedbed preparation.

Planting after a rain so that seed will germinate immediately has many advantages over placing seed in dry soil and waiting for a rain to bring them up. A good stand is usually assured if seed is placed in warm, moist soil. In most areas, a stand of 9-12 plants per foot is nearly optimum. A somewhat thinner stand will give very nearly the same yields but will require more attention in the seedling stage to keep free from weeds. A thicker stand will be more subject to lodging, particularly with good growing conditions.

A field free from weeds will usually give higher seed yields and will be harvested with greater ease than a weedy field. Planting good quality seed under conditions giving rapid emergence and rapid early growth are important aids in weed control. A rotary hoe or a weeder gives good results in removing weed seedlings from young soybeans.

Of the varieties adapted to the South, Ogden is most widely grown. Ogden gives high yields of seed with a good oil content. Its moderate height makes it easy to combine. Its heavy foliage helps appreciably in keeping down

late season grasses and weeds. In areas with dry falls, such as in the Delta area of Mississippi, the acreage of Ogden should not exceed that which may be harvested during a 2-week period following maturity because of its tendency to shatter. The Ogden selections, Dortchsoy 2 and Hale Ogden 2, have given results similar to those from Ogden. The Ogden variety is considered a late variety in southeastern Missouri, a mid-season variety in the Delta section of Mississippi, and an early variety in the Gulf Coast area. At Stoneville, Ogden has an average maturity date of October 10.

In 1952, the Dorman variety was released as an earlier variety to be grown along with Ogden. Dorman is approximately 18 days earlier than Ogden and gives comparable seed yields where it is adapted. Dorman has given good results on the heavy clay soils of the Mississippi Delta from southeast Missouri to northeast Louisiana, on the bottom lands of the Arkansas river in Oklahoma, and in eastern Virginia. Dorman produces good quality seed with high oil content and holds its seed very well after maturity. Dorman has heavy foliage comparable to Ogden, which other early varieties have not had.

Fig. 4. A crack developing in the Sharkey clay soil at Stoneville, Mississippi. With conditions such as this existing in 1952 and 1953 when summer rainfall was approximately one third of normal, top yields of 48 bushels per acre were obtained in 1952 and 46 bushels per acre in 1953. The high yields suggest that the soybean plants utilized the soil moisture to a depth of at least 42 inches. Winter rainfall is usually adequate to replenish the soil moisture.

Dortchsoy 67 is another new, early variety, approximately five days later than Dorman. In tests conducted during the past three years, Dortchsoy 67

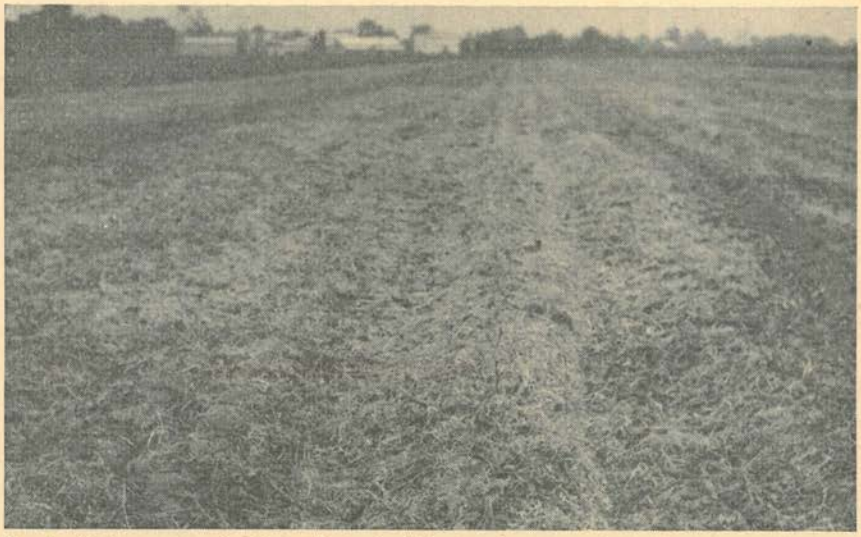


Fig. 5. Soybean straw shredded with a shredding attachment on the combine. This straw can be easily turned under and cannot be burned readily. A common practice in many areas is to burn the soybean straw after combining. Most Southern soils need this organic matter.

has produced yields comparable to Dorman but it is more subject to shattering.

Clark, Wabash, and Perry are primarily adapted to southern Indiana and Illinois and south-central Missouri, but can be grown along with later maturing varieties in the northern part of the Southern region. In the Delta section of Mississippi, the yields from Wabash or Perry have averaged only 75 to 80 per cent of the yields from Ogden. They give less complete ground cover, and consequently in years with sufficient moisture, fields will become very grassy before harvest. If grown too far south, these varieties will have poor seed quality. Perry matures 10-14 days earlier than Dorman.

Roanoke matures approximately two weeks later than Ogden and grows 6 to 8 inches taller. Roanoke gives good yields of high quality seed. It has the highest oil content of any variety grown in the United States. Roanoke will usually give higher yields than Ogden on the Upper Coastal Plain and Piedmont soils. On these soils, its added height is also an advantage.

The Jackson variety was released in 1953, and limited quantities of seed were available for 1954 planting. Jackson is similar in maturity to Roanoke, is slightly taller, stands better, and has given slightly higher seed yields. The added height of Jackson makes it very well adapted for growing after oats or lupines in south Alabama, Georgia, and west Florida.

Another variety of Roanoke maturity is Dortchsoy 31. This variety is somewhat shorter than Ogden and has averaged approximately one per cent lower in oil content than Roanoke. In the Delta section of Mississippi and Louisiana, Dortchsoy 31 has proved to be very susceptible to the leaf disease target spot, which has reduced its seed yield appreciably. Dortchsoy 31 is rather short for production after oats or lupines in south Alabama, Georgia, and west Florida.

Another new, superior variety is Lee. Lee averages five days later than Ogden and is superior to Ogden in seed holding, disease resistance, and seed yield. It is adapted to much of the same area where Ogden is now grown. Its superiority in seed holding will eliminate losses frequently experienced from shattering. Lee is resistant to the most

(*Turn to page* 48)

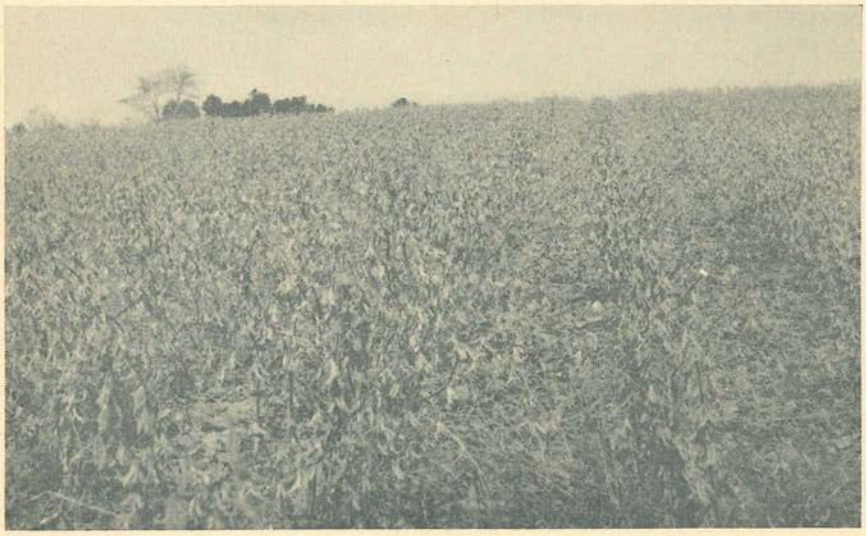


Fig. 6. A field of Lee soybeans growing on a Piedmont soil in Georgia.

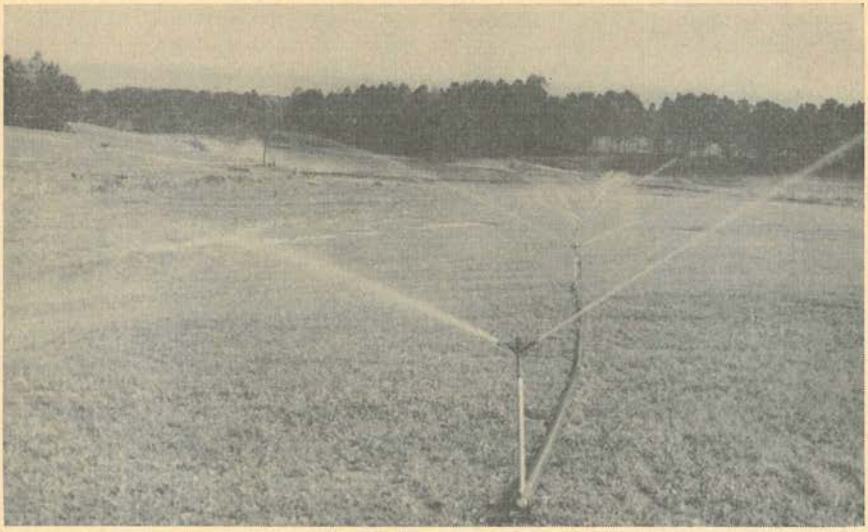


Fig. 1. The use of sprinkler irrigation systems on pastures is becoming increasingly popular in the Southeast. In an experiment at the Lower Coastal Plain Substation, Camden, Alabama, irrigation of a well-fertilized white clover-Dallis grass-fescue mixture increased beef production more than 200 pounds per acre per year.

Possibilities and Limitations of Irrigation in the Southeast

By Coyt Wilson

Assistant Director, Agricultural Experiment Station, Alabama Polytechnic Institute, Auburn, Alabama

PEOPLE who are concerned with irrigation are likely to fall into one of two sharply defined groups. They either believe it is the panacea for all the farmer's problems or they believe it is an impractical dream that at best serves as a mental crutch for those who want a simple explanation for short crops and low yields. The man who attempts to steer a course between these two extremes is likely to be opposed by both groups. Each side seems to have adopted the idea that "He who is not for us is against us."

Such attitudes are understandable. The farmer and all others who are financially interested in farming have had a rough time with falling prices, acreage restrictions, and dry weather for the last several years. A man who has watched his crops wither and fail for lack of water is naturally short-tempered with anyone who tells him that supplemental irrigation would not have solved all of his problems. On the other hand, there are those who have a deep-seated suspicion of all new ideas. They are the kind of people who said that the automobile would never replace the horse.

Let us take an objective look at supplemental irrigation. There is a need for careful evaluation of all available information, for clarification of questions that cannot be answered at the present time, and for starting as much

research as possible on the phases where our information is inadequate.

We have good information on the distribution of rainfall at specified points during past years. These records show that although we have abundant total rainfall in the Southeast, we are plagued with poor distribution. In every year there is at least one drought during which less than a half inch of rain falls during a two-week period and droughts of four weeks' duration are not uncommon (6). Obviously, we cannot hope to obtain maximum returns from improved farm practices because our yield potential is limited by a lack of water.

It is generally believed that the addition of water during dry weather will increase crop yields. Such a belief can be misleading. Yields of crops are limited by many factors and maximum yields cannot be obtained until all of these are removed. Many of these limiting factors could be removed much easier than the lack of water, but they are still present on many farms. Drought has been blamed for many a corn failure when actually the failure was due to a lack of nitrogen. Irrigation will not solve the problems of the farmer who fails to do the best possible job in all other aspects of farm management.

There is abundant evidence that the possible returns from irrigation are high enough to justify the practice on any farm where neither the size of operation nor managerial ability of the operator is a limiting factor. In experiments with horticultural crops at the API Agricultural Experiment Station covering the 11-year period 1938 to 1948, irrigation increased the value of spring crops an average of $74.81 per acre, the value of summer crops $16.78, and the value of fall crops $125.55 per acre when good management practices were followed (6). The Mississippi Agricultural Experiment Station reported that in 1951 the value of irrigated snap beans was $584.77 per acre as compared with $191.36 per acre without irrigation (1). Returns of similar magnitude have been reported for other horticultural crops by the Florida Agricultural Experiment Station (5).

Responses of corn and cotton to irrigation vary from slight to very large. In the dry year of 1952, irrigated corn produced 54 bushels per acre as compared with a yield of one bushel per acre for non-irrigated corn. However, in 1953 rainfall was adequate during the period of April to July and supplemental irrigation failed to increase yields. On both irrigated and non-irrigated plots, the yield was approximately 75 bushels per acre.[1] Other studies at Tallassee, Alabama, and State College, Mississippi, show that the response of corn to irrigation is greatest when (a) the amount of rainfall is limited or the distribution is poor, (b) there are 10 to 15 thousand plants per acre, and (c) 160 to 180 pounds of nitrogen are applied per acre (2 and 4).

Experiments on cotton irrigation have been reported from Mississippi (2) and Missouri (7). These results, together with unpublished data from the Alabama Agricultural Experiment Station, show that the response of cotton during 1952 and 1953 varied from an increase of 2,044 pounds of seed cotton per acre to an actual decrease of 275 pounds of seed cotton per acre. The average increase of 11 tests reported was 662 pounds per acre.

Irrigation research on pastures has been reported from Mississippi and Tennessee. Irrigated pastures respond to irrigation, providing as much as 41% more grazing days per acre per year (3). The total herbage produced by summer pasture during the period May to October may be as much as 4½ times that produced without irrigation (2). Beef production at the Lower Coastal Plain Substation, Camden, Alabama, has been increased more than 200 pounds per acre per year as a result of irrigating a white clover-Dallis grass-fescue pas-

(*Turn to page* 44)

[1] Unpublished data from the API Agricultural Experiment Station.

The Pacemaker Club Grows More Corn

By H. R. Lathrope

Lafayette, Indiana

FOUR hundred and forty people gathered in the Methodist Church recreation room in Pontiac, Illinois, on the evening of November 18, 1954, to see 90 farmers graduate from the Pacemaker postgraduate course in corn production. This group of 90 farmers organized to study more profitable corn production under the tutelage of "Professor" Steve Turner and Dr. Jerry Lyons of the Turner Fertilizer Service. It is the only one of its kind operating with private capital. The group planned and worked during the year to secure facts rather than sensational yields. It has followed an intelligent and systematic approach to a difficult problem.

Livingston county farmers have been growing corn for years. Their fathers and grandfathers produced corn in the county since before the Civil War. All during this time they have had the help of their colleges and universities and the press. They also have had assistance from farm advisers and the help given on radio and TV.

The 2,500 Livingston county farmers have had hybrid corn and up-to-date machinery and equipment. Good roads are everywhere. But 70 per cent of the land is operated by tenants. The level fields, once fertile and in good tilth, are still black and deep. But the corn yields, in spite of all the help, still average around 50 bushels per acre and oats yield around 30 bushels. Good stands of legumes are hard to find. Soils are acid, and from 3 to 5 tons

Fig. 1. Check plots like this were left on every Pacemaker farm. Signs were donated by the Fairbury, Illinois, Press. Unfertilized corn yielded 90 bushels; fertilized, 115 bushels.

Fig. 2. Pacemaker Club speakers during the year—(left to right) Dr. E. H. Tyner, A. C. Kamm, Dr. G. N. Hoffer, Warren Garst, and H. R. Lathrope.

of limestone are required to sweeten sour soils to a pH of 6.8 and to provide the crops with an available supply of calcium and magnesium. Constantly rising prices of machinery, labor, seed, and other overhead have narrowed the margins of profit for both tenant and landlord as well as for the farm owner-operator. Machinery men have had to extend credit to farmers because there is not the ready cash to pay for new equipment needed to replace worn-out plows, combines, tractors, and corn pickers.

Solving the Problem

Along came Professor Steve Turner. Lets call him Professor because he is an educator. Professor Steve saw the warning signals ahead. He saw the decline in farm prices and the rapid rise in costs. The narrowing margins of profits for these 2,500 Livingston county men do not present a pretty picture. But Professor Steve is a thinker and a "doer." He is a man with foresight and vision. He wants everyone in Livingston county to have a better life and he will fight hard for them. Professor Steve knows that wider margins of profit mean more money in the bank, better homes, better schools, better churches, better hospitals, and more boys and girls with college education. He knows, too, that the better life is not in sight for these Livingston county men when they produce only 50 bushels of corn and 30 bushels of oats per acre.

Professor Steve planned and counseled and thought the problem through. He needed help, so he went to Purdue, to Missouri, and finally to Urbana where he found a liberal-minded college-trained farm lad with courage and a likable personality, and who like himself had a strong desire to improve the lot of farmers.

Dr. Jerry Lyons, farm-trained and a great teacher at Urbana, knows that soil tilth is important and that large amounts of nitrogen, phosphorus, potash, and lime are needed to replace that which has been cropped out of the soil and sold during the past 100 years. He has seen the miserably poor yields of crops and he has also seen the desire on the part of farmers to do a better job and to have more money left at the end of the year.

Professor Steve and Dr. Jerry are a great combination and they are quick

to sense a situation. These men know that corn population per acre is mighty important, that weeds are competitors for plant foods, and that cutworms, wireworms, cornborers, and earworms steal profits from the pockets of hard-working farmers. Realizing that the once deep, black soil with good tilth has been robbed of its fertility, they are determined to help replenish the plant food that has been sapped from the soil with continuous cropping.

They were appalled when they discovered that less than $10 per acre was being spent annually to partially put back the minerals removed by crops. Under the present cropping system $15 to $20 worth of minerals was being sold off the farm from every acre each year. Farmers in the county know that corn yields can be increased with applications of plant foods; at least they have read about it and heard about the practice. But to prompt men to action is a difficult job. Getting men to farm as well as they know how is a big task. It was Teddy Roosevelt who once said, "The resistance of the human mind to new ideas is marvelous."

With no thought of trying to prove or disprove anything, but with a plan that would challenge the interest and thinking of hundreds of men, Professor Steve and Dr. Jerry with the help of a dozen others during the spring of 1954 set out to bring the Livingston county situation to the attention of farmers and businessmen. Businessmen and farm leaders were quick to pitch in and help. College men, farm advisers, teachers of agriculture, and the press likewise were prompt to offer assistance. An organization was formed and a few simple rules were outlined by the committee members. The plan to increase Livingston county corn production was launched. A plan to improve the lot of farmers and businessmen was born. The organization was called the Livingston County Pacemaker Club.

Businessmen saw the possibilities and the value of mobilizing the 2,500 farmers of the county. These businessmen visualized an increased income of from 15 to 50 bushels or more corn per acre, amounting to $25 to $75 more per acre on the 250,000 acres. Farmers, keen in crop production, figured that if the job could be done, they could realize perhaps $3,000 to $6,000 or more per year from their labors and an added

Fig. 3. First annual meeting, Livingston County Pacemaker Club, Pontiac, Illinois, November 18, 1954.

extra income of perhaps $100,000 or more of new wealth in a lifetime if they followed the better practices. Somehow the Pacemaker plan was just what they had been wanting, and nearly 100 joined up quickly. Farmers, like all other men, find more enjoyment and profit by doing things in a group.

Committeemen were chosen in each of 23 communities in the county. These committeemen were to help farmers whose fields were to become the laboratories in this great new movement. The Moose Hall in Pontiac was chosen for the classroom. Professor Steve and Dr. Jerry were to be the teachers. There were no books to buy, no fees, no tuition, and no regulations. "Enroll and do everything that you can to lower the cost of producing corn and widen the margins of profit" was the goal.

Soils were tested. Inventories of the available supplies of plant food in the soil were taken. Fertilizer prescriptions were written and nitrogen, phosphorus, potash, and lime were purchased and applied in amounts shown on the prescriptions. Figure how much corn you want per acre and, knowing how much plant food a 100-bushel crop removes, you can quite accurately tell how much N, P, and K you need to supply to make up the difference between what is in the soil and what the crop requires. If you want a dozen chicks, you must set at least of dozen eggs. These Pacemakers wanted 100 bushels of corn or more per acre and they were anxious to follow the Pacemaker prescription plan because it seemed logical and practical.

Of course, these men of the soil of Livingston county knew that their operating costs would be about the same whether they applied fertilizer or not. Taxes, interest, rent, labor, machinery, insecticides, weedicides, plowing, discing, harrowing, planting, cultivating, and harvesting costs would be about $43 per acre. Figuring nitrogen at 15 cents per lb., phosphorus at 9 cents, and potash at 6 cents, these men knew that 100 bushels of corn per acre would remove about 160 lbs. N, 60 lbs. P, and 125 lbs. K., or about $36 worth of minerals per acre per year. The Pacemaker plan was a way that these men had to accurately and in a common-sense way put back part

(*Turn to page* 41)

Fig. 4. Pacemakers who testified at the first annual meeting on "What the Pacemaker Club means to me." Back row: N. M. LaRochelle, Chatsworth, Illinois, merchant; Don Kramer, Fairbury, newspaper man; Dale Rich, Graymont, banker. Front row: Ollie Myers, Lexington, vo-ag teacher; Reid Tombaugh, Pontiac, farm manager; Stanley Brown, Long Point, farmer.

Using Soil Tests to Predict a Probable Response From Fertilizer Application

By J. W. Fitts[1]

A MAJORITY of the laboratories testing soils in the United States classify the results as very low, low, medium, high, and very high in reports sent to persons submitting the samples. Frequently, different meanings are associated with these classes, but this should be expected since the objectives of soil testing programs vary. Some laboratories class soils which will not require fertilizers containing that element as high or very high. Soils requiring only a maintenance application are classed as medium, but the low or very low soils need larger amounts of fertilizer. Other laboratories regard the high classification as the one at which optimum production is attained and recommend the addition of maintenance fertilizers on these soils. Heavier applications of fertilizer, of course, are recommended for the lower classes. No doubt, differences in the concepts may be associated with testing programs in regions where soils inherently are fertile as compared to regions where virgin soils are low in some of the nutrient elements.

Evaluating the fertility status of a soil is different from predicting the response to applications of fertilizer or lime. A difference in soil fertility may be found between a field on which corn yields about 20 bushels per acre compared to one yielding 80 bushels per acre. This does not indicate the response, however, that may be obtained from adding fertilizers to each. Likewise, testing soil samples taken from old rotation or fertility plots may show a difference in the level of phosphorus, potassium, or other nutrient elements. The yields of crops in one rotation may be calculated as a percentage of the yields of another rotation, but these calculations do not necessarily indicate the response that might be obtained from application of lime or fertilizer to each.

Soil Test Interpretation

The interpretation of soil test results and making recommendations on use of lime and fertilizers are important and difficult phases of a soil testing program. Preparing guide sheets for recommendations based on correlation studies presents many problems. Of course, the interpretations can be no better than the research data upon which they are based. Many factors influence the results obtained in field studies and a poor correlation with soil tests may not be entirely the fault of the soil testing procedure but also may be due to poor field data.

Although the soil tests may indicate the fertility status of the soil, the predictions on crop response to lime and fertilizer application must be made in terms of crop productivity of which fertility is only one part. Nevertheless, the plant is the best agent for determining the amount of an element that is available in a given soil under given conditions, and plant growth should be used as the basis for formulating predictions of response to fertilizer and lime.

[1] Professor of Agronomy, North Carolina State College and Director of Soil Testing Division, N. C. Department of Agriculture, Raleigh, N. C.

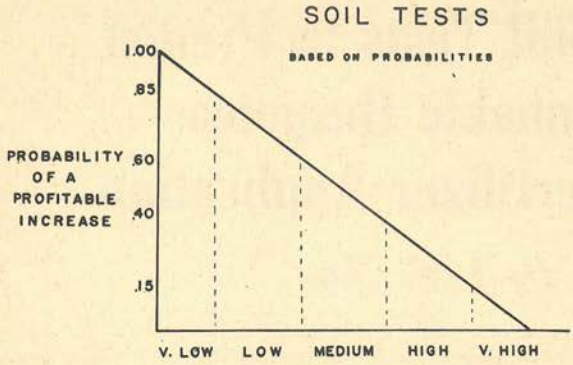


Fig. 1. The probability of getting a profitable yield from fertilization. Empirical diagram.

Probability Approach

Factors other than fertility greatly influence plant growth. For example, temperature and moisture are important factors in the release of nitrogen and phosphorus from organic matter. It is difficult, if not impossible, to separate fertility from climatic factors that influence plant growth when the availability and absorption of nutrients may be directly or indirectly influenced by these same factors.

For the prediction of lime and fertilizer response, a "probability" approach is suggested. An empirical diagrammatic presentation is shown in Fig. 1.

The probability of obtaining a profitable increase in yield for a given fertilizer treatment is plotted against soil test results. The probability is actually the percentage of fields giving a profitable response. The quantity of crop increase to be profitable may be variable with variations in fertilizer materials, methods of application, and price of farm products. Nevertheless, a quantity which will be profitable under a majority of conditions can be selected.

On fields where the probability is greater than 0.86 (86% or 86 times out of 100) for getting a profitable increase from fertilization, the soil test could be classed as very low. The low range might be from 0.61 to 0.85, medium from 0.41 to 0.60, high from 0.16 to

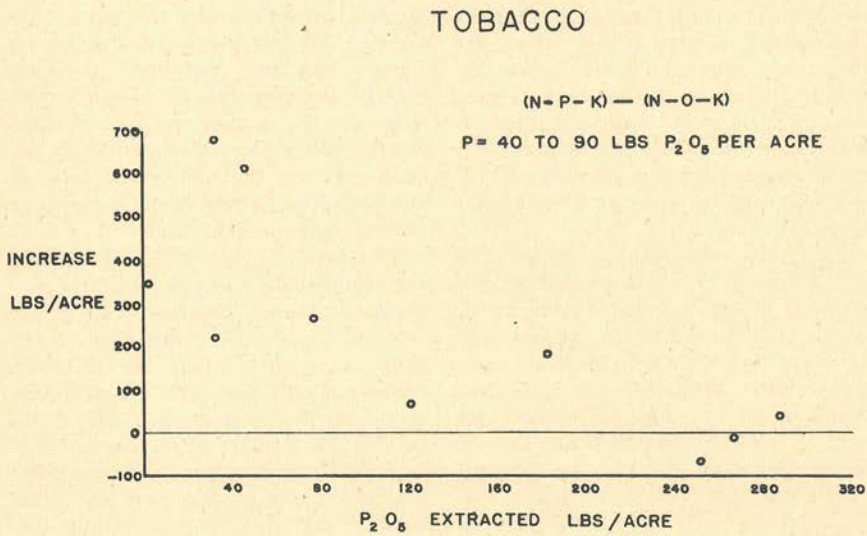


Fig. 2. The response to phosphate by flue-cured tobacco on soils of different phosphorus levels. (Unpublished data of W. G. Woltz, N. C. State College).

0.40, and very high less than 0.15. These are only suggested ranges and will not fit all crops or conditions. Before selecting ranges for probability or soil test readings, the available data should first be plotted. From the chart the probability of a response or lack of response in reference to a given confidence limit at various soil fertility levels can be determined. The probability curve in Fig. 1 is illustrated as a straight line; actually it may not be except possibly in the central portion. The probabilities and soil test ranges selected for each class will determine the shape of the curve. These should be determined, of course, from the data available.

In many instances it may not be possible to make five class separations. This is illustrated in Figs. 2, 3, and 4 taken from soil test results on field experiments in North Carolina (1, 3, 5). Not more than three separations, low, medium, and high, should be made for any of the crops. The cotton data (Fig. 3) could be grouped as very low, low, and medium. Under most conditions it is doubtful if it is feasible to make more than three separations. Climatic conditions, as well as other factors, will influence the results. In "good" years all classes may shift upward and in poor years, downward. A large number of field experiments in a wide range of conditions would be necessary to make five or more class separations.

Another problem frequently encountered is that a majority of experiments are conducted on soils known to be low in fertility, leaving only a few if any results for calibration in the high or very high ranges.

The ranges for the classes will vary with different soils and crops and separate charts will have to be prepared for each crop or soil or group of crops or soils. For some crops there may not be a sufficient number of field studies to permit three or more class separations and it might be desirable to make only two, those likely to respond and those not likely to respond. Different groupings can be made, of course, depending upon the meaning given to the very low and to the very high classifications.

The influence of different soil regions can be seen in Fig. 4. The fields located in the Piedmont region of North Carolina are indicated by an X and the circles indicate fields in the Coastal Plains section. Obviously different ranges for low, medium, and high should be established for corn in the two regions. Fortunately, the ranges for several crops in the same soil region may be similar as indicated in Figs. 2

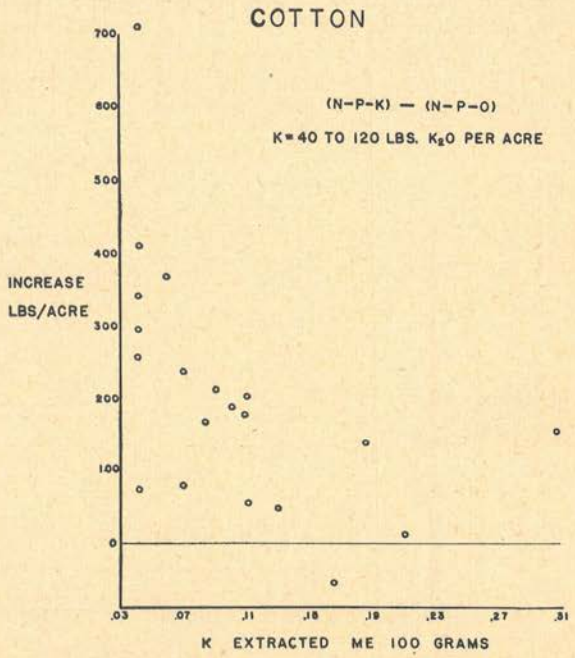


Fig. 3. The response to potash by cotton on soils of different potassium levels. (Data by W. L. Nelson and C. D. Welch, N. C. State College).

and 4, comparing corn and tobacco in the coastal plains.

In the probability approach, the low classes should be reserved for conditions where the chances of getting a profitable increase are overwhelmingly in favor of a farmer obtaining a profitable increase from the fertilizer recommended. The amount of increase from the application of fertilizer on two different fields in the same soil test class probably will not be the same because factors other than fertility will influence the result, but the chances are that both increases will be profitable. A good illustration of this variability is shown in the response of cotton (Fig. 3) to potash on soils having 0.04 m.e. of potassium. The increase yield varies from about 80 lbs. to over 700 lbs. per acre.

On fields testing in the high classes, the odds are against receiving a profitable increase from fertilization for the average farmer. This does not preclude the possibility of getting one, however, when all other factors influencing the crop yield are optimum.

The 150-lb.-per-acre increase in cotton (Fig. 3) on a soil having over 0.3 m.e. potassium per 100 grams soil was on a high yielding field. The better farmers are more apt to get profitable response at higher soil test levels than the average farmer. The recommended fertilizer rate should be that which has been found to be optimum in field tests and may differ at each of the levels. Lesser amounts of fertilizer are likely to be profitable, too, but the chances of getting profitable returns from heavier quantities decrease rapidly in the same class.

Extraction solutions and testing techniques obviously will influence the classes and the probability of predicting responses to fertilizer accurately. Procedures which most consistently place the results in the correct class should be selected.

Soil Sampling and Characterization of the Profile

Regardless of the accuracy of the analyses or of careful calibration procedures for interpretation, the results will be meaningless if the soil sample is poorly taken. The depth at which the sample should be taken is very important. Without question, the nature of the soil profile below the plow layer

(*Turn to page* 40)

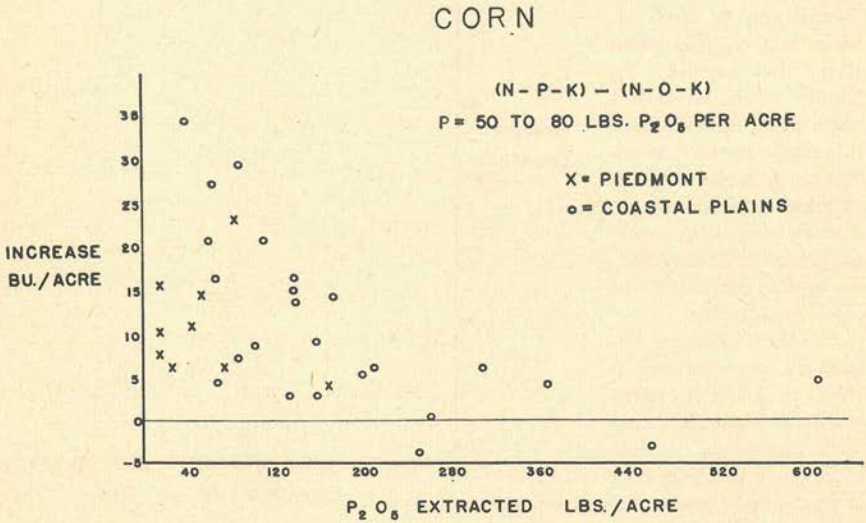


Fig. 4. The response to phosphate by corn on soils of different phosphorus levels. (Data from B. A. Krantz and W. V. Chandler, N. C. State College).

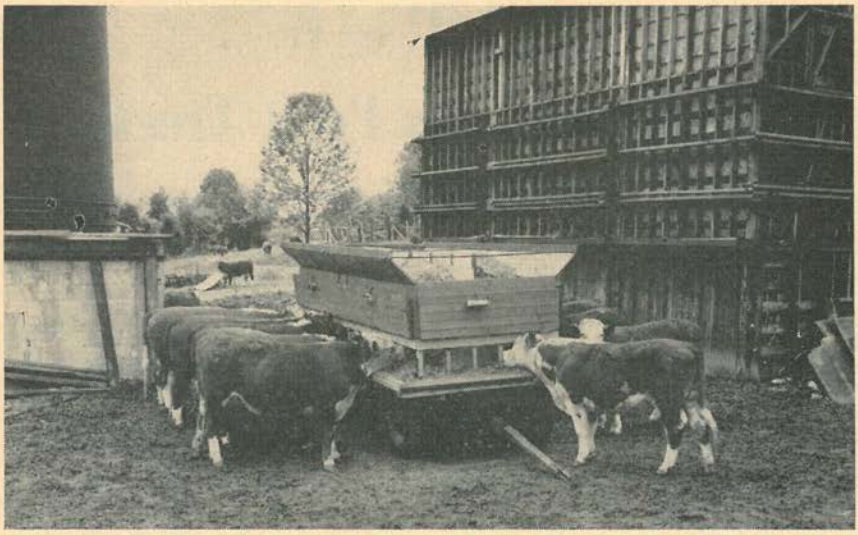


Fig. 1. This self-feeder wagon for use with chopped green feed was built by Robert Barnhardt, Fiddler's Creek Farm, Titusville, New Jersey.

Zero Grazing

By M. A. Sprague

Department of Farm Crops, Rutgers University, New Brunswick, New Jersey

"ZERO" grazing has come to mean feeding cattle entirely in a feed lot. It may involve either the feeding of stored roughages or cut green grass called soilage. Green grass is superior to preserved forages for feed, and cattle do equally well whether grazing or fed chopped material in bunkers.

Like all other items in the management of a farm, the choice of either pasture or soiling as methods of harvesting green grass must fit the individual farm. Some New Jersey farmers may wish to use both systems. Certainly certain fields are either too steep or stony and rough or wet to permit the use of heavy machinery, while others are inaccessible to cattle from the barn area. Some areas frequently have good soil and with intelligent use of lime and fertilizer will produce well as pasture. On the other hand, some New Jersey farms have been cut up badly by busy highways. It is far easier to pull a wagonload of chopped grass across traffic than to drive a herd of cows.

Soilage crops are not new. When farm labor was plentiful and cheap they were commonplace. Power machinery in replacing labor has again suggested soiling as a method of harvest. The choice appears to be largely one of economics tempered by risk. Fencing is far cheaper than machinery, paved feed lots, and bunkers. Pasture management saves labor, manure, and the risks of inclement weather and machinery breakdown. On the other hand, harvest with a mower is more complete and wastes less of the forage crops than grazing, thereby giving apparent increases in returns per acre. Complete dependence upon chopped green feed necessitates duplication of field equipment in the event of breakdown and

(*Turn to page* 47)

N—P—K for Deciduous Fruit Trees

By M. E. McCollam

San Jose, California

THE purpose for fertilizer use on fruit trees is, of course, primarily to increase the yield of good marketable fruit. This is accomplished if the fertilizer causes improvement in growth and leaf surface, and in vigor of fruit wood on the tree. Any nutrient element applied to the orchard will have this effect on the trees if it is in deficient supply in the soil, whether it be nitrogen, phosphorus, potassium or any one of the others essential for plant development. A tree well-supplied with all of the essential nutrients has a good chance to be a productive tree if other good orchard practices are followed.

However, there are many factors that, if they exist in an orchard, may call "two strikes" against it. The use of fertilizer in such situations will only be a "foul ball." It cannot be expected to cure *all* the orchard ailments existent before its application.

Fig. 1. This almond tree in Butte County, California, shows severe potassium deficiency. Note the extent of defoliation, exposing branches.

Badly diseased trees are poor subjects for fertilizer use.

Trees with badly damaged root systems, caused by drought, poor drainage, or pest and disease attacks, are also poor subjects.

The presence of too much "alkali" in the soil or excessive quantities of boron or lime, damages fruit trees so that they cannot make effective use of fertilizers.

Such factors as these must be given attention and corrected, if possible, before greatest profit from fertilizers can be realized.

Although all essential nutrient elements must be available to fruit trees, only the so-called major elements, nitrogen, phosphorus, and potassium, will be considered here.

Nitrogen Fertilization

Over a long period of years the application of nitrogen fertilizer has produced responses on fruit trees. Nitrogen has been generally recommended throughout the West as an effective fertilizer in most orchard situations. The more commonly used nitrogen fertilizers for orchards, their content of nitrogen, and their approximate current price per ton appear in Table I.

The answer often given to the question of which form of nitrogen to use in the orchard has been to use the cheapest form—not the cheapest per ton, of course, but the cheapest per unit of nitrogen. However, in addition to

TABLE I.—NITROGEN CONTENT AND APPROXIMATE CURRENT PRICE OF NITROGEN-BEARING FERTILIZERS USED IN ORCHARDS*

Material	% N	Price per ton LCL at plant
Ammonium sulfate	20.5	$65.00
Ammonium nitrate	33.5	$104.00
Anhydrous ammonia	82.0	$210.00 [1]
Ammonia solution	20.0	$51.00
Calcium nitrate	15.5	$64.00
Ammonium phosphate-sulfate (16–20)	16.0	$91.60
Mixed fertilizer (10–10–5)	10.0	$71.70
Urea	45.0	$163.40

* Prices vary slightly in different localities. Carload prices are somewhat lower.

[1] Applied in irrigation water.

this consideration of price, certain other facts surrounding the various materials must be kept in mind.

Long-continued use of ammonium sulfate may cause unfavorable soil acidity and water-penetration troubles. On the other hand, ammonia forms of nitrogen are less likely to leach through open soil than nitrate forms and thus nitrogen loss is less likely.

Fig. 2. A pear tree, Santa Clara Valley, California, in the last stage of potassium deficiency. Note the almost entire absence of renewal growth.

Anhydrous ammonia and ammonia solutions are sold with the service of application, which appeals to many growers.

Ammonium phosphate-sulfate, like some of the other materials also, has a content of two major plant nutrients—

Fig. 3. Potassium-deficiency symptoms on peach leaves as found on some sandy soils of the San Joaquin Valley, California. Right—normal leaf; left—curled and scorched leaves, typical when there is a deficiency of potassium.

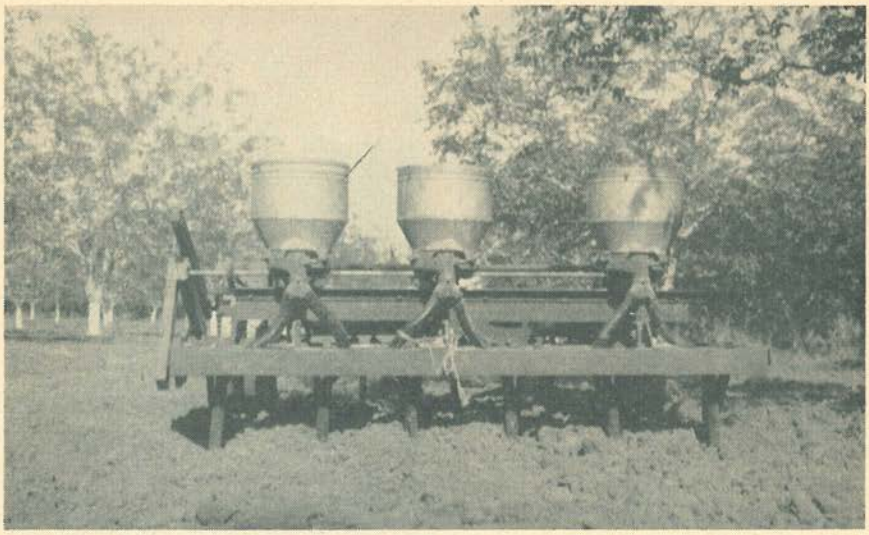


Fig. 4. Drill for deep placement of fertilizer in orchards. The frame is specially built. Fertilizer attachments are standard manufactured equipment.

in this case 20 per cent phosphoric acid as well as 16 per cent nitrogen. The other nutrient elements may be of direct value on cover crops grown in the orchard to maintain good physical condition of the soil and to increase water penetration.

So with other nitrogen-bearing materials, they may have properties aside from price that add or detract from their value in certain situations.

If the amounts of commercial nitrogen recommended for deciduous orchards by various authorities were to be averaged and set down as a general recommendation, it would be a figure of around one pound of nitrogen per tree (five lbs. sulfate of ammonia, three lbs. ammonium nitrate, or amounts of other materials according to N-content). There are many important deviations from this rate of nitrogen application depending upon various situations of soil, tree condition, size of trees, and the particular kind of fruit tree being grown.

To mention a few of these situations, mature apple trees or walnut trees may require two pounds of nitrogen per tree or even more. On some soils replenishment of nitrogen supply by cover-cropping may reduce commercial nitrogen requirements considerably. Very old cherry trees may require up to four pounds of nitrogen per tree. In California, the tendency is to recommend a minimum of nitrogen for the apricot, and if the tree shows good growth and vigor, to omit nitrogen entirely at least until need becomes apparent.

The most commonly practiced method of applying nitrogen materials in the dry form to orchard soils is scattering or broadcasting on the surface. With this method most of the fertilizer falls under the spread of the branches. This has proved an effective method of applying nitrogen in orchards. Anhydrous ammonia and the liquid solutions of nitrogen are applied to the soils of deciduous orchards by means of drills which open up a series of furrows and spout these nitrogen materials directly into the soil. These nitrogen materials are well-suited for application through irrigation systems, but this method is not usually suitable for deciduous fruits, since irrigation time and the best time for nitrogen application often do not coincide. However, when an application of nitrogen is made after fruit set-

(*Turn to page* 43)

Soil Testing Moves Ahead in Arkansas

By R. L. Beacher

Agronomy Department, Arkansas Agricultural Experiment Station,
Fayetteville, Arkansas

THE past year has been a record one in the expansion of Arkansas' soil testing program. A new branch laboratory was constructed at Marianna for the eastern section of the State; the 100,000th soil sample was processed in the spring; nearly 16,000 samples were processed at the main laboratory during the three-month period January-March 1954, over double the highest number tested during any previous quarter; and an outlying fertilizer test program included 55 experiments in 30 counties on all major crops and soil regions for the purpose of correlating soil test data with crop response to fertilizer treatments.

How the Program Operates

All samples are processed free of charge other than mailing costs, since the program has been supported by a fertilizer tonnage tax initiated in 1953. Samples may be collected by county agents and assistants, Soil Conservation Service, Farmers Home Administration, vocational agriculture and other government workers, or farmers themselves. After collection, the samples must be submitted to the county agent offices and the information sheets completed with the agent's signature. Samples are then mailed to one of the two laboratories, where they are processed and three copies of results returned to the county agent. He gives one to the farmer along with any necessary explanations, keeps one on file, and may give the third copy to any other agency

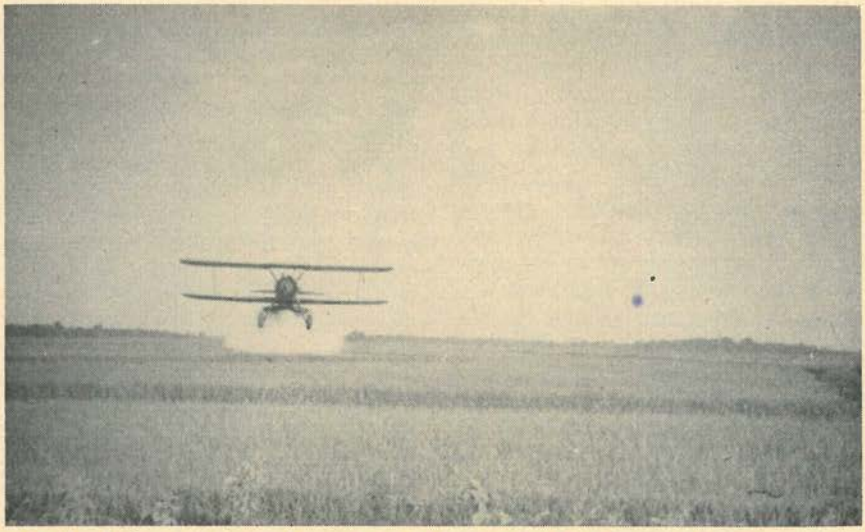


Fig. 1. Applying nitrogen and potash on rice after soil tests and symptoms show deficiencies.

involved. Agents are encouraged to map the accumulated soil tests for farms within their counties to provide useful information in determining general fertilizer and other soil requirements for the various soil types within the county. Soil test results and recommendations for the entire State are tabulated on punch cards at the Fayetteville laboratory and annually summarized to provide pertinent information to the fertilizer industry, agricultural workers, and interested farmers.

Sample Processing and Recommendations

Both the main and branch laboratory are equipped to process a minimum of 200 samples per day, testing for pH, phosphorus, total organic matter, exchangeable hydrogen, potassium, calcium, and magnesium. During rush periods in the spring more than 450 samples have been tested daily. A pH meter is used for measuring pH and exchangeable hydrogen, a flame spectrophotometer for potassium and calcium, and magnesium, phosphorus, and organic matter are estimated by modifications of conventional colorimetric methods. Other constituents such as soluble iron, aluminum, manganese, sulfates, boron, nitrates, and ammonia are occasionally determined for research or special problem samples. The laboratory supervisor and assistant make the fertilizer recommendations for three future crop years on each sample, and comments on other sound soil improvement practices may be added where the need is indicated. Fertilizer recommendations are given in terms of pounds N, P_2O_5, and K_2O under the crop, and pounds N sidedressing or topdressing. A simple explanation of the fertilizer recommendations is given on back of the result sheet, to help the farmer choose the fertilizer combination which meets the nutrient requirement.

Fertilizer recommendations are designed to balance the major soil nutrients at an adequate level for good growth of all plants, with secondary consideration given to various crop requirements. A typical recommendation for cotton on a soil classified as very low in N, P_2O_5, and K_2O would call for the application of 80 lbs. N, 60 lbs. P_2O_5, and 60 lbs. K_2O. If a maximum fertilizer recommendation is desired where irrigation is possible, farmers are advised to double the nitrogen and increase the phosphorus and potash by 1½ times.

Outlying Field Tests

Both laboratories operate a field fertilizer testing program in conjunction with the soil testing service. The sites are chosen, through arrangement with county agents, on fields which are typical of major soil types within a county. Tests are simple, randomized block comparisons of various fertilizer combinations and rates, applied with specially designed belt-type distributors mounted on a small tractor which can be readily transported with a pick-up truck and light trailer. Soil samples are collected from the test sites before, during, and after the cropping season for correlation with crop response to treatments. Such tests not only provide essential information as a basis for fertilizer recommendations, but also serve as useful demonstration plots for county agent use. Plant tissue tests for nitrates, phosphorus, and potash have given reliable indications of soil deficiencies and fertilizer treatments where used in conjunction with soil tests, but their use on controlled experimental plots has demonstrated numerous complicating factors which must be considered in the interpretation of tissue test results.

Soil Test Summaries

Approximately 110,000 samples have been processed during the past seven years, and results of 75,000 of these have been tabulated by counties and soil regions in the State according to

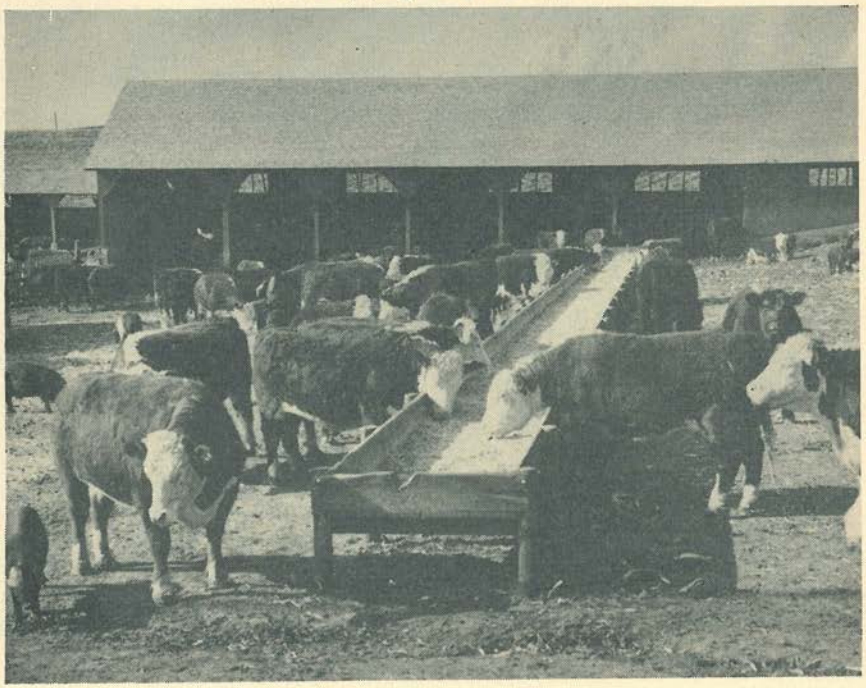
(*Turn to page* 47)

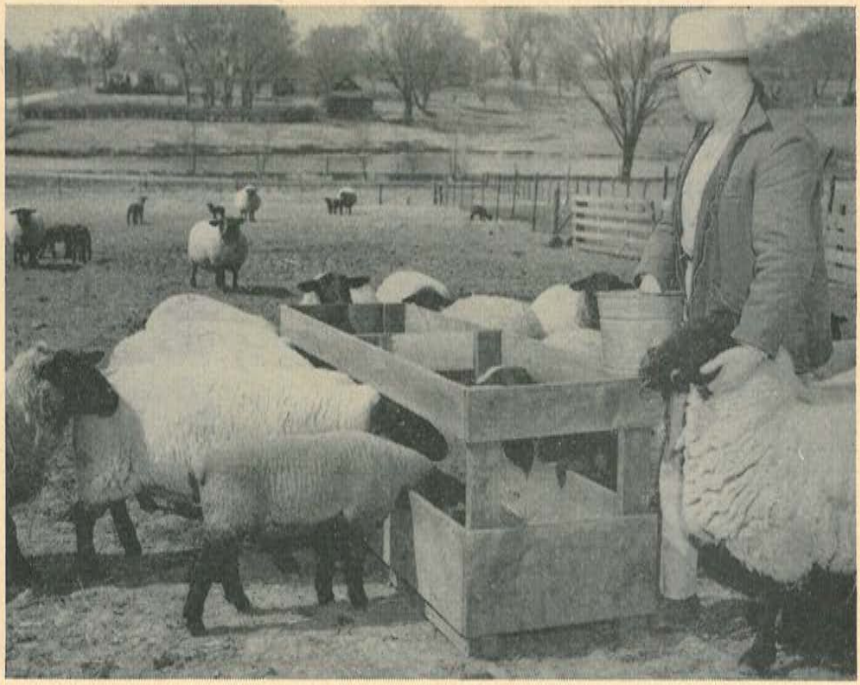
PICTORIAL

Boohoo!

Above: Won over by tempting morsel.

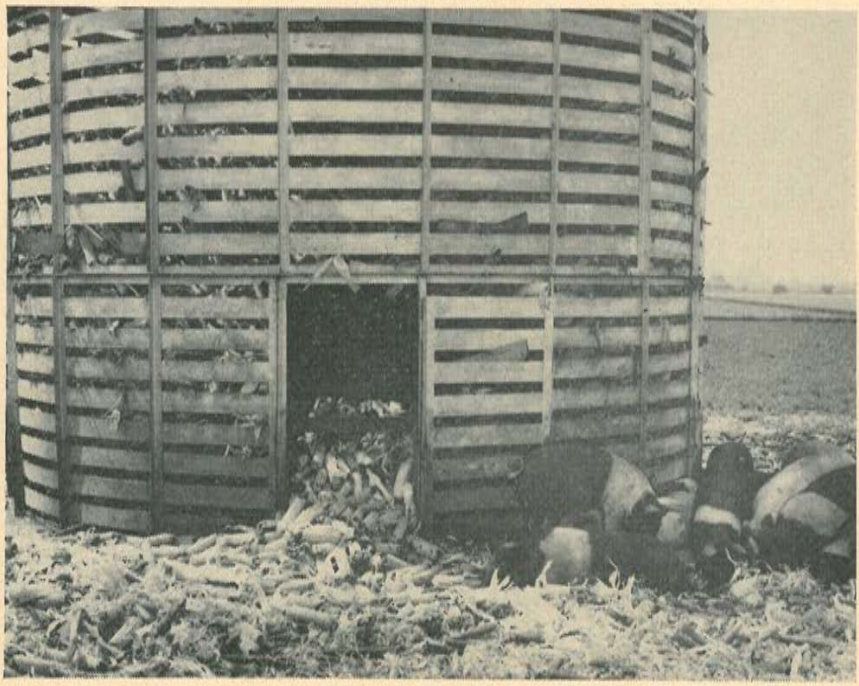
Below: Enjoying food at long table.

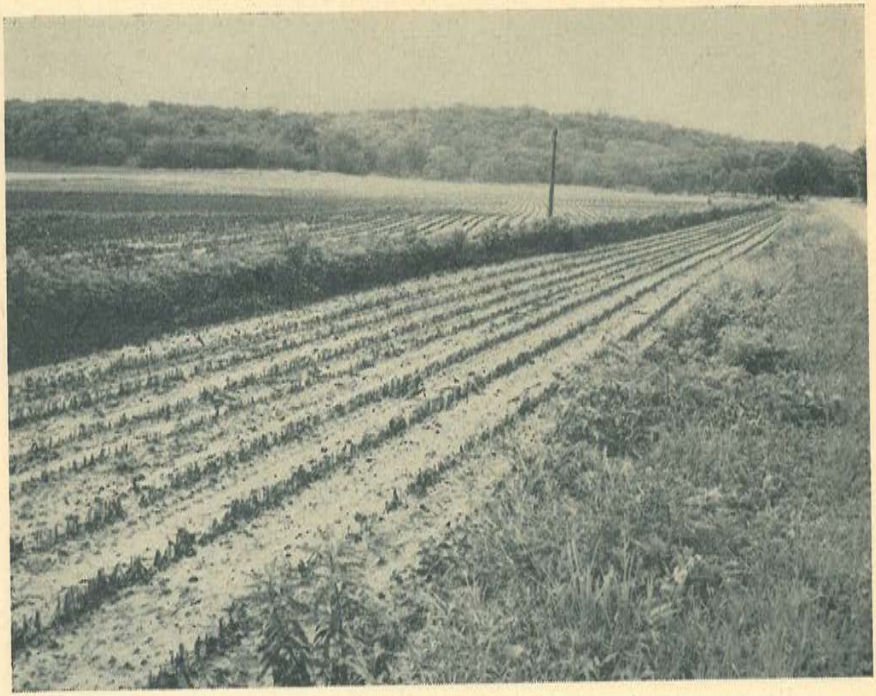




Above: The pet waits for a handout.

Below: No handouts necessary here.





Up and Down the Long Rows

The Editors Talk

What About Fertilizer-Pesticide Mixtures

Incorporation of pesticidal chemicals in fertilizer for the dual purpose of pest control and crop nutrition has received attention of research workers for 25 or more years. With the development of highly potent organic pesticides following World War II, interest in their possibilities was intensified. While early work dealt mostly with mixtures of solid materials, nitrogen fertilization of fruit crops, notably apples, has recently been combined with pest control by adding urea to foliage sprays. Research is in progress also on control of weeds by adding herbicides to topdressing applications of dry as well as liquid fertilizers.

As of June 1954, use of one or more kinds of fertilizer-pesticide mixtures was recommended or approved in 26 states. In the descending order of frequency on the state basis, the principal compounds recommended for inclusion in fertilizers for control of soil insects are aldrin, heptachlor, chlordane, dieldrin, and DDT. For these compounds the recommendations cover more than 25 kinds of insects and upwards of 35 crops.

Estimated consumption of fertilizer-pesticide mixtures in the United States and territories for the year ended June 30, 1953, was 87,000 tons. On the basis of information obtained from state officials and industry, it appears that during 1953-54 solid fertilizer-pesticide mixtures of various kinds were manufactured in 33 states and Puerto Rico by at least 113 or approximately 13% of all companies manufacturing fertilizer in the United States and territories.

The use of such mixtures is not without its problems in the agronomic, entomologic, regulatory control, and manufacturing phases of the subject. Many of these problems have been solved only partially or not at all. Because of this situation, manufacturers have been reluctant to go all out for fertilizer-pesticide mixtures. Even so, considerable quantities have been used in some areas, and the rapidity with which the practice is extending into other areas justifies the expectation that the demand will assume still larger proportions.

Research or industry specialists wishing to familiarize themselves with the field of fertilizer-pesticide mixtures should read the article by K. D. Jacob, Head, Fertilizer and Agricultural Lime Section, Soil and Water Conservation Research Branch, U. S. Department of Agriculture, entitled "Status and Problems of Fertilizer-Pesticide Mixtures," published in Agricultural & Food Chemistry, Vol. 2, No. 19, Page 970, September 15, 1954.

Despite the complexities of preparing and regulating these mixtures, it is the expressed opinion of Mr. Jacob that so long as their use affords a convenient,

economical, and reasonably satisfactory way of combining crop fertilization with pest control, the demand for them will continue, and likely in increasing volume.

It is important, therefore, writes Mr. Jacob, that research be expanded on the many problems of their production, distribution, and utilization. Increased effort should be directed toward the development of equipment for applying the pesticide separately from, but simultaneously with, the fertilizer whereby the rates of application of the two materials can be regulated independently of each other. Use of such equipment, now under development by at least one company, would eliminate a major problem of combinaction fertilizer-pesticide applications if universally employed.

Our Cover Picture

The scene from which the cover illustration of this issue was made was a soybean experiment located on Norfolk sandy loam soil low in available nutrients, particularly potash. According to "Soybean Production in North Carolina," North Carolina Extension Circular No. 381 published in March 1954, the plot in the left foreground with plants yellowing around the edges of the leaves received lime and phosphate but no potash. Yield was 5 bushels per acre. The plot in the right foreground received recommended rates of lime, phosphate, and potash. Result was a yield of 32 bushels per acre. In the same experiment, soybeans receiving potash and lime but no phosphate yielded 20 bushels per acre; with potash and phosphate but without lime, 22 bushels per acre. The photograph was made by the North Carolina Agricultural Experiment Station.

Signs of potash starvation show up quickly on soybean plants. A yellow mottling of the leaves appears first; then the chlorosis forms a continuous band along the sides and tip ends. In advanced stages, the chlorosis extends inward and the margins of the leaves fire to a medium brown color. The centers may still be green after the margins are completely dead. There will be a downward cupping, and after the dead tissue falls out, the leaves will have a ragged appearance. Lack of potash results in wrinkled and misshapen seeds. Delayed ripening and slow defoliation are other late symptoms of potash deficiency on soybeans.

Concerning the fertilization of soybeans, North Carolina Circular No. 381 quoted above says that the most profitable fertilization is based on the level of fertility of the soil as shown by a soil test. The phosphate application should range from 0 to 40 pounds of P_2O_5, and the potash should range from 0 to 80 pounds of K_2O.

"On the basis of soil samples received, the most common fertilizer needed would be medium in phosphate and high in potash, such as 400 pounds 0-10-20 or 300 pounds 0-9-27. You don't usually get a yield increase from fertilizer on soybeans following heavily fertilized crops or on soils with very high phosphate and potash levels. A summary of the soil samples submitted for soybeans shows: Phosphate level 29% low or very low, 38% medium or high, 33% very high; potash level 66% low or very low, 27% medium or high, 7% very high."

Concerning method of applying the fertilizer, the Circular states that row application can be mixed with the soil with 1 inch of fertilizer-free soil between the fertilizer and the seed or the fertilizer placed in bands 2 to 3 inches to each side and 1 inch below the seed where suitable equipment is available.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.1	163.0	304.0	166.0	211.0	19.50	69.30	....
1952.....	34.6	49.9	198.0	338.0	153.0	209.0	19.95	69.60	....
1953.....	32.3	52.2	79.7	251.0	148.0	204.0	17.45	52.60	
1954									
March.....	31.05	27.3	53.2	252.0	144.0	209.0	18.35	50.50	....
April.....	31.57	....	70.2	268.0	145.0	206.0	18.05	50.80	....
May.....	32.17	58.0	134.0	263.0	147.0	200.0	17.05	51.40	....
June.....	32.31	53.0	151.0	270.0	149.0	191.0	15.65	51.40	....
July.....	32.18	52.7	149.0	302 0	150.0	200.0	15.15	54.00	....
August.....	34.00	48.2	141.0	259.0	153.0	203.0	16.45	61.30	....
September...	34 55	53.0	116.0	236.0	153.0	207.0	17.25	61.60	....
October.....	34.67	53.6	93.2	212.0	145.0	208.0	17.55	60.20	....
November...	33.17	52.0	109.0	216.0	137.0	212.0	18.15	59.40	....
December....	32.67	50.0	105.0	254.0	139.0	212.0	18.55	59.60	....
January.....	32.51	42.4	113.0	283.0	140.0	214.0	18.75	56.80	....
February.....	31.69	36.8	117.0	297.0	140.0	213.0	18.55	55.20	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1928.....	145	200	76	134	131	113	95	152	147
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	128
1931.....	46	82	66	83	50	44	73	40	107
1932.....	52	105	55	62	50	43	52	46	100
1933.....	82	130	118	79	81	84	68	57	90
1934.....	100	213	64	91	127	96	111	146	94
1935.....	90	184	85	80	102	94	63	135	116
1936.....	100	236	164	106	163	116	94	148	108
1937.....	68	204	76	89	81	109	74	87	114
1938.....	69	196	80	79	76	64	57	97	96
1939.....	73	154	100	84	88	78	67	94	98
1940.....	80	160	78	97	96	77	64	96	122
1941.....	137	264	116	105	117	107	82	211	138
1942.....	153	369	168	134	143	124	91	202	178
1943.....	160	405	188	235	174	154	125	231	270
1944.....	167	420	214	216	170	160	139	234	236
1945.....	181	366	205	232	198	170	127	227	240
1946.....	263	382	178	248	212	209	141	319	217
1947.....	257	380	232	248	336	259	148	381	262
1948.....	245	482	222	253	201	226	155	298	253
1949.....	231	459	184	244	193	213	139	192	232
1950.....	323	517	132	197	238	226	141	384	211
1951.....	306	512	233	346	259	239	164	307	269
1952.....	279	499	284	385	238	236	168	309	274
1953.....	260	522	114	286	231	231	147	233	240
1954									
March.....	250	273	76	287	224	236	155	224	246
April.....	255	...	101	305	226	233	152	225	225
May.....	259	580	192	300	229	226	144	228	279
June.....	261	530	217	308	232	216	132	228	200
July.....	260	527	214	344	234	226	128	239	243
August.....	274	482	202	295	238	230	139	272	223
September...	279	530	166	269	238	234	145	273	170
October.....	280	536	134	241	226	235	148	267	191
November...	268	520	156	246	213	240	153	263	237
December....	263	500	151	289	217	240	156	264	216
January	262	424	162	322	218	242	158	252	263
February....	256	368	168	338	218	241	156	245	258

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports [2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports [2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952	.849	3.98	5.47	.401	.793	15.25	.200
1953	.878	....	....	....	.793	15.25	.200
1954							
March	.895	....	....	.430	.827	16 00	.210
April	.895	....	....	.430	.827	16.00	.210
May	.895	....	....	.430	.827	16.00	.210
June	.895	....	....	.359	.710	13.45	.174
July	.895	....	....	.388	.765	14.75	.184
August	.895	....	....	.388	.765	14.75	.184
September	.895	....	....	.388	.765	14.75	.184
October	.895	....	....	.388	.765	14.75	.184
November	.895	....	....	.388	.765	14.75	.184
December	.895	....	....	.405	.825	16.00	.193
January	.895	....	....	.405	.825	16.00	.193
February	.895	....	....	.405	.825	16.00	.193
Index Numbers (1910-14 = 100)							
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952	158	110	112	72	83	63	83
1953	164	...	...	73	83	63	83
1954							
March	167	...	...	76	87	66	85
April	167	...	...	76	87	66	85
May	167	...	...	76	87	66	85
June	167	...	...	66	75	56	79
July	167	...	...	70	80	61	81
August	167	...	...	70	80	61	81
September	167	...	...	70	80	61	81
October	167	...	...	70	80	61	81
November	167	...	...	70	80	61	81
December	167	...	...	72	87	66	83
January	167	...	...	72	87	66	83
February	167	...	...	72	87	66	83

Wholesale Prices of Ammoniates **

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952	3.34	2.09	13.95	11.27	9.72	9.16
1953	3.26	2.27	11.04	11.19	7.39	7.09
1954						
March	3.09	2.22	11.35	11.70	9.59	10.20
April	3.09	2.22	11.63	12.15	10.32	10.55
May	3.09	2.22	11.40	12.15	11.47	10.74
June	3.09	2.18	10.76	12.15	10.09	9.87
July	3.09	2.18	11.12	11.28	10.02	9.87
August	3.09	2.18	12.37	11.19	9.83	11.19
September	3.09	2.18	11.51	10.85	9.78	10.09
October	3.01	2.18	11.55	11.26	9.64	9.94
November	2.98	2.18	11.85	11.78	8.80	9.23
December	2.98	2.18	11.98	12.41	8.50	8.35
January	2.98	2.18	12.00	12.35	8.32	8.32
February	2.98	2.18	11.16	12.23	8.50	8.50
Index Numbers (1910-14 = 100)						
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952	125	74	399	319	288	260
1953	122	80	315	317	219	201
1954						
March	115	78	324	331	285	290
April	115	78	332	344	306	300
May	115	78	326	344	340	305
June	115	76	307	344	299	280
July	115	76	318	320	297	280
August	115	76	353	317	292	317
September	115	76	329	307	290	287
October	112	76	330	319	286	282
November	111	76	339	334	261	262
December	111	76	342	352	252	237
January	111	76	343	350	247	236
February	111	76	319	346	252	241

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1928	148	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	130	127	86	56	130	102	77
1942	159	149	144	93	57	161	112	77
1943	193	165	151	94	57	160	117	77
1944	197	174	152	96	57	174	120	76
1945	207	180	154	97	57	175	121	76
1946	236	197	177	107	62	240	125	75
1947	276	231	222	130	74	362	139	72
1948	287	250	241	134	89	314	143	70
1949	250	240	226	137	99	319	144	70
1950	258	246	232	132	89	314	142	72
1951	302	271	258	139	93	331	152	76
1952	288	273	251	144	98	333	158	76
1953	258	262	247	139	100	269	164	77
1954								
March	256	264	250	143	96	307	167	80
April	257	265	250	145	96	323	167	80
May	258	267	250	147	96	338	167	80
June	248	265	248	141	95	311	167	69
July	247	263	248	142	95	310	167	74
August	251	264	248	143	95	319	167	74
September	246	263	248	142	95	308	167	74
October	242	262	248	141	94	308	167	74
November	244	262	248	140	93	301	167	74
December	239	261	245	140	93	300	167	77
January	244	264	248	140	93	297	167	77
February	245	264	248	139	93	291	167	77

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

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

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

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] Potash salts quoted F.O.B. mines; manure salts since June 1941; other carriers since June 1947. Beginning June 1954, muriate of potash quoted on both mine and port basis.

**** Where range of prices for fertilizer material is quoted, average figure is used. The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period.**

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

"Planning a Liquid Manure System," Agr. Exp. Sta., Univ. of Calif., Davis, Calif., Lflt. 39, Oct. 1954, J. B. Dobie.

"Copper Oxide as a Source of Fertilizer Copper for Plants Growing on Everglades Organic Soils," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 552, Oct. 1954, W. T. Forsee, Jr., T. C. Erwin, and A. E. Kretschmer, Jr.

"Using Sawdust in the Garden," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 378, Aug. 1954, R. Sheldrake, Jr. and E. F. Savage.

"Liquid Fertilizers," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Lflt. 368, Feb. 1954, A. J. Ohlrogge and G. F. Warren.

"Fertilizer Experiments with Corn and Grain Sorghum in Nebraska, 1954," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 42, Dec. 1954, G. W. Lowrey, P. L. Ehlers, and F. V. Pumphrey.

"Fertilizer Experiments on Native Subirrigated Meadows in Nebraska," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 43, Jan. 1955, E. M. Brouse, P. L. Ehlers, and G. Viehmeyer.

"Fertilizer Sales by Grades in Order of Tonnage, January 1, 1954-June 30, 1954," State Dept. of Agr., Raleigh, N. C.

"Fertilizing Ohio Farms," Agr. Exp. Sta., Ohio State Univ., Columbus, Ohio, Ext. Bul. 346, Jan. 1955, E. Jones.

"Distribution of Fertilizer in Oklahoma Counties by Grades and Material for the Period, Second Quarter, October 1, 1954 to January 1, 1955," State Dept. of Agr., Oklahoma City, Okla.

"Fertilizer Consumption in Oklahoma 1953-54," State Dept. of Agr., Oklahoma City, Okla.

"Distribution of Fertilizer in South Carolina Counties by Grades and Materials (tons) for the Period July 1 through December 31, 1954," Clemson Agr. College, Clemson, S. C., Jan. 1955, B. D. Cloaninger.

"Fertilizer Recommendations for the West Cross Timbers," Agr. Ext. Serv., Tex. A. & M. College, College Station, Tex., L-221, 1955, M. K. Thornton, B. Hancock, and B. C. Langley.

"Fertilizer Recommendations for the Gulf Coast Prairie," Agr. Ext. Serv., Tex. A. & M. College, College Station, Tex., L-224, 1955, M. K. Thornton, B. Hancock, and J. C. Smith.

"Fertilizer Recommendations for the East Texas Timbers," Agr. Ext. Serv., Tex. A. & M. College, College Station, Tex., L-228, 1955.

"Nitrogen Requirements of Coastal Bermudagrass Under Supplemental Irrigation at College Station," Agr. Exp. Sta., Tex A. & M. College, College Station, Tex., Prog. Rpt. 1731, Nov. 1954, F. L. Fisher and A. G. Caldwell.

"Grain Sorghum Fertilizer Trial, Amarillo Experiment Station, 1954," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1745, Jan. 1955, K. B. Porter.

"Effects of Fertilizer on Oat, Wheat and Barley Grain Yields at the Blackland Station, 1954," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1746, Jan. 1955, R. P. Bates.

"Fertilizer Recommendations for Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Bul. 183, Jan. 1955.

"1952-'53 Annual Fertilizer and Lime Report," State Dept. of Agr., Charleston, W. Va., Bul. (N. S.) 78, Oct. 1953.

"Fertilizer and Lime Report, July 1, 1953 to June 30, 1954," State Dept. of Agr., Charleston, W. Va., Bul. (N. S.) 81.

"1954—Results of Fertilizer Demonstrations on Corn," College of Agr., Univ. of Wis., Madison, Wis., C. J. Chapman.

"1954—Results of 10-10-10 Pasture Demonstrations," College of Agr., Univ. of Wis., Madison, Wis., C. J. Chapman.

"1954 Results of Fertilizer Demonstrations on Small Grain and Hay," College of Agr., Univ. of Wis., Madison, Wis., C. J. Chapman.

"Fertilizer Use and Crop Yields in the United States," USDA, Wash., D. C., Agr. Handbook 68, Dec. 1954.

Soils

"Soil Associations of Dade County, Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-77, Aug. 1954, R. G. Leighty, M. H. Gallatin, J. L. Malcolm, and F. B. Smith.

"Subsoiling," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Lflt. 370, June 1954, C. L. Hill and R. M. Lien.

"Liming Soils for Better Farming," Agr.

Ext. Serv., Okla. A. & M. College, Stillwater, Okla., Cir. 625, W. Chaffin.

"Relation of Soils, Rainfall and Grazing Management to Vegetation—Western Edwards Plateau of Texas," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Bul. 786, Nov. 1954, G. W. Thomas and V. A. Young.

"Corrugation Irrigation," Soil Cons. Service, USDA, Wash., D. C., Lflt. 343, Dec. 1953, W. R. Stanley.

"Land Leveling for Irrigation," USDA, Wash., D. C., Lflt. 371, Oct. 1954, J. G. Bamesberger.

"Agricultural Conservation Program Handbook for 1955 for: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wyoming," USDA, Wash., D. C., 1955.

"Agricultural Conservation Program, Summary for 1953," USDA, Wash., D. C., Dec. 1954.

Crops

"Growing Better Citrus Nursery Trees," Agr. Exp. Sta., Univ. of Calif., Riverside, Calif., Lflt. 38, Oct. 1954, K. W. Opitz and J. C. Johnston.

"Report of the Minister of Agriculture for the Year Ending March 31, 1954," Dept. of Agr., Toronto, Ontario, Canada.

"Field Corn and Sweet Corn Report for 1954, Mount Carmel, Connecticut," Agr. Exp. Sta., New Haven, Conn., Prog. Rpt. G1, Feb. 1955, D. F. Jones, H. T. Stinson, A. P. Munson, and C. C. Renshaw.

"Some Honey Plants of Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 548, Sept. 1954, L. E. Arnold.

"Production of Vegetable Plants in Seedbeds on Sandy Soil," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 550, Oct. 1954, D. S. Burgis.

"Growing Grain Sorghum," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 291, July 1954, J. R. Johnson, J. F. McGill, and W. H. Gurley.

"Fall Field Day Report of the Fort Hays Branch Station, Hays, Kansas, for 1953-54," Agr. Exp. Sta., Kansas State College, Manhattan, Kans., Cir. 315, Sept. 1954.

"Effect of Kind of Pasture on the Yield of TDN and on Persistency of Milk Production of Milk Cows," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 609, March 1954, D. M. Seath, C. A. Lassiter, G. M. Bastin, and R. F. Elliott.

"A Preliminary Report of Tests Conducted by the Red River Valley Agricultural Experiment Station, 1954," Agr. Exp. Sta., La. State Univ., Baton Rouge, La.

"Annual Report of the Director of the Maine Extension Service for the Year Ending June 30, 1954," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Ext. Bul. 438, Oct. 1954.

"New Garden Chrysanthemums, Wenonah and Vulcan," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 25, Jan. 1955, R. A. Phillips and R. E. Widmer.

"Varieties of Farm Crops, 1955," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 22, Dec. 1954.

"Increasing Size and Color of Fruit," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 622, May 1954, A. E. Murneek.

"Evaluation of Lima Bean Varieties for Dehydration," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 751, Dec. 1954, H. D. Brown, G. Peters, and W. A. Gould.

"Acre Yields of Beef from Corn and Meadow Crops," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 753, Jan. 1955, E. W. Klosterman and L. E. Kunkle.

"Smooth Brome," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Lflt. 8, Jan. 1955, R. A. Chessmore and J. R. Harlan.

"Pasture Grazing Trials on Various Land Types," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-445, Jan. 1955, J. Q. Lynd, W. C. Elder, and T. Totusek.

"Producing and Dehydrating Sweet Potatoes for Livestock Feed," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-447, Jan. 1955, F. B. Cross.

"Pasture and Range Judging," Agr. Ext. Serv., Okla. A. & M. College, Stillwater, Okla., Cir. 557, C. E. Bunch, R. E. Chiles, and E. Roberts.

"Side-oats Grama Grass Variety Test on the Blackland Station, 1952-54," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1740, Dec. 1954, E. D. Cook and W. R. Parmer.

"Sudan Variety Test on the Blackland Experiment Station, 1952-54," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1742, Jan. 1955, E. D. Cook and W. R. Parmer.

"Small Grain Variety Tests at the Blackland Station, 1949-54," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1747, Jan. 1955, R. P. Bates, J. W. Collier, and I. M. Atkins.

"Hard-end of the Bartlett Pear and its Possible Association with Various Water Relationships of the Fruit and Leaves," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Tech. Bul. 15, Oct. 1954, W. B. Ackley.

"Tests With Beans 1953," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 248, Sept. 1954, C. B. Harston.

"Washington State Annual Crop Report 1954," State Dept. of Agr., Olympia, Wash.

"Horticulture in the State of Washington,"

State Dept. of Agr., Olympia, Wash.

"Western Washington Horticultural Crops," State Dept. of Agr., Olympia, Wash., Jan. 1955.

"Twenty-First Biennial Report, October 1, 1952 to September 30, 1954," State Dept. of Agr., Olympia, Wash.

"Natural Brush Cover on Palouse Farms," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 249, Aug. 1954.

"Spring Oats Trials in West Virginia 1949-1953," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Cir. 93, June 1954, C. Veatch.

"Supplement to Wisconsin Corn Hybrids, Yield Results, New Hybrids, Cultural Problems," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 476, Jan. 1954, N. P. Neal and A. M. Strommen.

"Lespedezas for Quail and Good Land Use," USDA, Wash., D. C., Lflt. 373, Nov. 1954, V. E. Davison.

"The Multiflora Rose," USDA, Wash., D. C., Lflt. 374, Dec. 1954, W. L. Anderson and F. C. Edminster.

"Our Forest Resources, What They Are and What They Mean to Us," USDA, Wash., D. C., Agr. Inf. Bul. 131, Nov. 1954, C. E. Randall.

"Seeding Rangelands in Utah, Nevada, Southern Idaho and Western Wyoming," USDA, Wash., D. C., Agr. Handbook 71, Jan. 1955, A. P. Plummer, A. C. Hull, Jr., G. Stewart, and J. H. Robertson.

"1954 Report of Cooperative Extension Work in Agriculture and Home Economcis," USDA, Wash., D. C., Oct. 1954.

Economics

"1953 Agricultural Statistics for Arkansas, Crop Reporting Service," State Dept. of Agr., Little Rock, Ark., Rpt. Series 43, Aug. 1954.

"The Agricultural Outlook for Canada 1955," Dept. of Agr., Ottawa, Ontario, Canada.

"Crop, Livestock and Marketing Review for 1953," State Dept. of Agr., Hartford, Conn., Bul. 130, Dec. 1954.

"Resource Productivity and Returns on 160-Acre Farms in North-Central Iowa, (A Production Function Study of Marginal Returns on Farms with Fixed Plants)," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. 412, July 1954, E. O. Heady.

"An Economic Study of Negro Owner-Operated Farms in Jefferson Davis County, Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 523, July 1954, V. J. Mack.

"Cost of Producing Apples and Pears in the Hood River Valley, Oregon, Progress Report VII," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Cir. of Inf. 545, Sept. 1954, D. C. Mumford and A. E. Irish.

"Effects of 1954 Acreage Restrictions on Crop Production in Southeastern Pennsylvania," Agr. Exp. Sta., Pa. State Univ., State College, Pa., Prog. Rpt. 128, Dec. 1954, G. E. Brandow and E. W. Learn.

"Pennsylvania Crop and Livestock Report 1953," State Dept. of Agr., Harrisburg, Pa., Gen. Bul. 656, Sept.-Oct. 1954.

"Is Your Dairy Farm in Balance?" Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Farm Econ. Cir. 1, July 1954, L. H. Keller, F. M. DeFriese, and T. J. Whatley.

"Increasing Net Returns on a Tennessee Farm," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Farm Econ. Cir. 3, July 1954, T. J. Whatley, L. H. Keller, and F. M. DeFriese.

"Labor Used in Crop Production in Tennessee, 1953," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Farm Econ. Cir. 5, Aug. 1954, W. P. Ranney.

"The Texas Farm Population, 1954," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1738, Dec. 1954, W. G. Adkins and R. L. Skrabanek.

"Wisconsin Agriculture in Mid-Century," State Dept. of Agr., Madison, Wis., Bul. 325, 1955.

"The Demand and Price Structure for Selected Vegetables," USDA, Wash., D. C., Tech. Bul. 1105, Dec. 1954, D. M. Shuffett.

"The Forest Resources of New Hampshire," USDA, Wash., D. C., Forest Resource Rpt. 8, 1954.

"Analytical Tools for Measuring Demand," USDA, Wash., D. C., Agr. Handbook 64, Jan. 1954, R. J. Foote and K. A. Fox.

"Federal Legislation, Rulings, and Regulations Affecting the State Agricultural Experiment Station," Agr. Res. Serv., USDA, Wash., D. C., Misc. Pub. 515, Rev. Nov. 1954.

"Wholesale Prices of Fresh Fruits and Vegetables and Auction Prices of Fresh Fruits at New York City and Chicago and F. O. B. Prices at Leading Shipping Points, by Months, 1953," USDA, Wash., D. C., Statistical Bul. 149, Nov. 1954, L. V. Walsh.

"Grassland in Organization of Dairy Farms in Northeastern Pennsylvania," Agr. Exp. Sta., Pa. State Univ., State College, Pa., Bul. 583, Sept. 1954, K. H. Myers and J. K. Pasto.

"The Balance Sheet of Agriculture 1954," USDA, Wash. D. C., Agr. Inf. Bul. 134, Aug. 1954, F. L. Garlock, L. A. Jones, R. W. Bierman, and W. H. Scofield.

Shake and shake the catsup bottle;
None'll come, and then a lot'll.

Girls who close their eyes while kissing
Substitute the guy who's missing.

Using Soil Tests to Predict a Probable Response

(*From page* 20)

will influence the growth of plants and the eventual yield that will be obtained. Aside from the plow layer, however, the fertility conditions of the soil profile do not change materially from one year to another under most farming conditions. Neither phosphate nor lime moves much in the soil and they usually accumulate in the first few inches. When broadcast on the surface, as on permanent pastures, lime and phosphate accumulate in the upper two or three inches. Unpublished soil sampling data by C. D. Welch at North Carolina (4) show that the greatest accumulation of lime and phosphate is in the upper three inches of soil with a gradual decrease to plow depth or slightly below as related to lime and fertilizer practices and frequency of soil disturbance.

Application of phosphate from time to time may build up phosphorus in the plow zone. Taking a sample below the zone where phosphate has accumulated in the soil may show a deficiency of phosphorus, but the addition of phosphate to the upper portion which already may be high is not likely to result in much crop response.

Routine soil tests are concerned largely with testing the soil zone which reflects past management practices relative to fertility and lime. This zone may show an accumulation of an element over the virgin soil condition if heavy applications of fertilizer or lime have been applied periodically. It may also show a decrease where fertilizer practices have been inadequate. In the calibration of the tests for making recommendations for fertilizer and lime use, it is essential that the characteristics of the soil in the plant root zone are known. It probably will be necessary to increase the phosphorus status of the plow zone to a higher level for optimum results on soils that are low in available phosphorus in the subsoil, as compared to soils that are high. In the latter instance, only enough phosphate to start the plant may be necessary, but when the subsoil contains very little available phosphorus, the plant will have to rely largely on added phosphate in the plow zone. The same situation exists with respect to liming soils that have either acid or neutral subsoils.

With this type of a soil evaluation program, all of the major soils of an area must be characterized relative to the fertility status. The availability of various nutrient elements in the soil below plow depth and extending to root depth (or the upper few feet) should be determined. The nature of the clays in the soil profile may be readily estimated by determining the cation-anion ratio and pH values (2). General maps can be prepared showing the characterization of the lower profile relative to nutrient availability and to acidity. This eliminates the necessity of getting subsoil samples in routine analyses. These maps will be of great value in making fertilizer and lime recommendations in a soil testing program. It is essential, of course, for the person submitting a sample to give the location of the area from which it was taken. Sometime in the future, characterization of soils for fertility purposes might be included with soil survey reports.

Increasing the Fertility Levels in Soils

There are several problems relative to the interpretation of tests made on soil samples taken from the plow zone. One of these involves determination of the optimum level to which to build and amounts required to maintain an element such as phosphorus in this zone. Fixation capacity, nature of the roots of crops to be grown, climatic conditions, as well as other factors must be considered in answering this prob-

lem. The efficiency of applied nutrients in such a program of soil fertility building would need to be compared with the usual methods of application. Several probability curves and charts will have to be prepared for interpretation of soil test results where numerous crops and soil conditions are involved. Nevertheless, as more of this type of information is obtained, the accuracy of prediction will increase also.

In the future it may be found desirable to extend the plow zone to greater depths in order to give a greater feeding zone for plant roots. Characterization of soils relative to fixing capacities and characterization of crops to rooting habits will be very important in such an undertaking. On some soils deep application of a large quantity of fertilizer such as phosphate once every four or five years may be sufficient. If these practices are followed, it would be necessary to alter the depth of soil sampling for testing.

In general, the results of testing soil samples taken from the plow zone where fertilizers and lime will be incorporated and considered together with the characterization of the lower profile will serve as a very useful tool in a good soil management program. The chance of getting a profitable increase from a given fertilizer practice is important information to any farmer.

Literature Cited

1. Krantz, B. A. and Chandler, W. V. N. C. Agr. Exp. Sta. Bul. 366 (revised). (1954.)
2. Mehlich, A. Jour. Assoc. Official Agric. Chem. 36, No. 2. (1953.)
3. Nelson, W. L. and Welsh, C. D. Annual Agronomy report on cotton fertility studies.
4. Welch, C. D. N. C. Agric. Dept., unpublished data.
5. Woltz, W. G. N. C. Agric. Exp. Sta., unpublished data.

The Pacemaker Club Grows More Corn

(*From page* 16)

of what they had been taking out each year. For a trial run they bought and applied $25.57 worth of fertilizer, on the average, for each acre the first year. This plant food was in the form of mixed fertilizers, as well as nitrogen, phosphorus and potash alone. Some Pacemakers had the good fortune of being able to use Uran 32, the fabulous nitrogen solution which was applied at the fast rate of 250 acres per day with 100 to 150 lbs. of actual nitrogen per acre.

Educational Meetings

Professor Steve and Dr. Jerry enlisted the help and support of farm leaders and educators for speaking programs the second Thursday of each month from April to November. An average attendance of more than 200 per meeting was registered, and these were no captive audiences. There were no enrollments and men could leave if they wished, but none did and all seats were occupied and standing room was frequently at a premium. Community tours were held in each of the 23 communities. Speakers at the monthly meetings were all new to the Pacemakers and included Dr. Ed Tyner, Dr. Kermit Berger, Dr. G. N. Hoffer, A. C. Kamm, Roswell Garst, and the writer. A banner 2 feet by 30 feet bearing the slogan "The Beaten Path Is for the Beaten Man" was displayed in the Moose Hall at every meeting.

The Pacemakers are living their part of the slogan. They set out to learn about corn production, and learn they did. Perhaps these 90 men and their committeemen have learned more about corn production in 1954 than in all their previous experience in growing corn. They have opened up new vistas for themselves and their fellow farmers, and they have dared to look

over the horizon. They are truly blazing new trials in the commonplace job of corn production.

Lower Production Costs

With an expenditure of $25.57 per acre (average) for nitrogen, phosphorus, and potash, corn yields averaged about 110 bushels per acre. This yield is about 60 bushels over the county average and is welcome news for everyone. With corn at $1.50 per bushel this means about $90 worth of new wealth for every $25.57 spent for fertilizer. That is almost $4 for every $1—a good return from the increased yields over county averages. And this increase was obtained in six months' time—May to October.

What these Pacemakers did, anyone else can do. There are no secrets. Businessmen and farmers would rather have increases from corn production than a new industry in the county. Pacemakers believe that they cannot afford deficiencies in their crops. They used tissue tests to make sure they had fertilized right. The diagnostic approach will help materially in avoiding plant deficiencies next year. These men do not want the corn plant to stop producing for lack of materials during the summer. Pacemakers plan to become Master Craftsmen in the job of corn production, and corn production has become the most important subject of their conversation whenever they meet.

Everybody in Livingston county is happy about the Pacemakers' success. Pacemakers learned how to do the job the best way—by doing. They have gained valuable know-how, but the end is not yet in sight for them or their partners. They had heard about increased profits from corn production, but now they have proved it to themselves and they know full well that it can be done. There is nothing so convincing as being self-assured that the plan is right. They have faith in themselves and they have faith in what they can do in the future. Pacemakers speaking at the annual roundup at Pontiac reported that the Pacemaker Program is the most profitable demonstration of what can be done. "It is a vital approach," said one. "It will mean more money, more credit, and a better chance for everyone in Livingston county," said another. "The value of the program is in appreciation of its possibilities and its approach, rather than in this year's results," said a ruddy-faced Pacemaker. These farmers have found a way to reduce costs of corn production from around $1.35 per bushel to less than 75 cents and with less work.

The Future

Ninety Pacemakers, less than one per cent of Livingston county farmers, cannot do the job alone. The program can never rest with these 90 men. The program must roll forward and roll fast if the goals are to be reached. But the information about the Pacemakers is spreading like wildfire, not only in Livingston county but to every other corn-producing county in the USA. Two hundred years ago Washington and Jefferson knew the value of lime for the land and talked and wrote about it for better crop production. Only 15 per cent of Indiana hog raisers follow the most modern practices for better hog production. News of better practices travels slowly.

But the Pacemaker program is different. It is built on a common-sense approach to the problem. Pacemakers are not cajoled, urged, begged, nor pleaded with to join up or conform to regulations. Leading educators who have appraised the Pacemaker program have called it "The most outstanding and effective adult educational program in the Nation." The program is a bold step forward and if adopted by all Livingston county farmers and by others in the Corn Belt it will have a tremendous impact for good on the social, economic, educational, and physical development of the Nation.

N—P—K for Deciduous Fruit Trees

(*From page* 24)

ting, the method of applying in the irrigation water may work out very well.

It is important to have a sufficient supply of nitrogen available to the tree for fruit setting and for the spring flush of new growth. Fertilizing is commonly done in late winter or early spring. Nitrate forms of nitrogen should not be applied much before bloom on early blooming fruit crops, since there is danger of loss of nitrogen from the leaching action of rainfall. Less leaching loss is likely when ammonia forms of nitrogen are used, and these materials may be applied earlier.

In recent years there has been a growing interest in the application of nitrogen, phosphorus, and potassium to the leaves of plants in the form of foliar sprays. The urea form of nitrogen has been used successfully on some fruit trees, particularly the apple, to accomplish nitrogen nutrition. Thus far, however, it appears that repeated foliar sprays are necessary to get enough nitrogen into the tree, and the main usefulness of the method is as a supplemental application following the main application to the soil.

Phosphorus Fertilization

Deciduous fruit trees are seldom deficient in phosphorus, and appear to get enough from the soil even though soil tests show very small amounts of available phosphorus.

A phosphorus fertilizer very often is recommended as an orchard cover crop fertilizer, however. For instance, in eastern Washington, 30 pounds of phosphoric acid (P_2O_5) per acre are favored for legume cover crops in apples and pears.

Phosphorus deficiency has recently been recognized on lemon trees in southern California, and substantial improvement in trees and fruit yield has resulted from heavy applications of phosphorus fertilizer. It is not improbable that cases of phosphorus deficiency will be found in deciduous orchards as our orchard lands become older.

Potassium Fertilization

The study of nutritional problems with fruit trees by means of chemical analysis of leaves has brought to light many instances of low levels of potassium in California orchards. Usually these low levels are accompanied by characteristic symptoms on the tree, such as smaller leaves, folded or curled leaves, browning or scorch at tips and along margins of leaves, dieback of branches, and reduced fruit size.

Low levels of potassium in fruit trees may be due to several causes such as:

1. Low level of potassium in soil.
2. Inadequate supplying power of soil for potassium. (This may be due to high fixing power of soil for potassium or high calcium and magnesium levels in soil or a combination of both.)
3. Restricted volume of soil in which tree roots can pick up plant nutrients. (May be due to shallow hard-

TABLE II.—REMOVAL OF MAJOR NUTRIENTS FROM THE SOIL BY FRUIT CROPS (FRUIT ONLY)*

Crop	Yield per acre tons	Removal of major nutrients (per acre)		
		N lbs.	P_2O_5 lbs.	K_2O lbs.
Apples	15	30	10	45
Apricots	10	38	14	60
Peaches	12	30	20	94
Pears	14	25	9	37
Prunes	10	36	13	60
Cherries	5	22	7	28

* Source: "Commercial Fertilizers Agricultural Minerals," 1930, Special Publication No. 104, Calif. State Dept. Agriculture.

pan or impervious clay layer.)

4. Poor drainage, high water table, or drought during extended periods, causing damage to tree roots.
5. High sodium content in soil.

Thus far potassium deficiency has been recognized in California orchards on prunes, apricots, pears, peaches and almonds. Occasionally, walnuts also exhibit typical potassium-deficiency symptoms.

In cases of severe potassium deficiency it is quite often difficult to get enough of this nutrient into the tree to cause the desired improvement, unless a relatively large amount per tree is applied. Very satisfactory recovery has been accomplished on all of the orchard crops mentioned with applications of 20 to 30 pounds sulfate of potash per tree (muriate of potash in some situations). This one heavy solution will usually supply enough potassium for five or more years and causes much more rapid improvement than smaller yearly applications.

The methods of application found to be effective are broadcasting on top of the ground under the spread of the branches, or in two or three furrows plowed out along the tree rows. These furrows should be located not too close to the trees nor should they be much beyond the spread of the tree, and they should be just deep enough so that the potash will not be too much disturbed by subsequent cultivation in the orchard. It is usually suggested that the broadcast method be used on lighter types of soil, and the furrow method on clay and adobe types.

The best time to apply potassium fertilizers is in the fall and winter months to overcome potassium deficiency. Usually, if delayed until spring the full effect of the fertilizer will not be seen until the following year. A considerable build-up of potassium is necessary in a deficient tree before improvement in leaf and fruit takes place.

To sum up the situation of major nutrient fertilization in deciduous orchards, we may say that the need for nitrogen is of primary importance and this need is recognized and is being fairly well supplied. The use of more nitrogen together with potash in orchards which show medium to low levels of potassium appears to be a practice which will command the attention of orchardists who are interested in greater production of fruit of highest market value.

Although phosphorus now appears to be needed the least as a direct application in deciduous orchards, deficiencies of this nutrient may appear as the needs for nitrogen and potassium are more adequately supplied.

Possibilities and Limitations of Irrigation . . .

(*From page* 12)

ture fertilized with 1,500 pounds per acre of 0-16-8 per year.[1] An experiment started in 1951 at Lewisburg, Tennessee, showed a net return of $99.68 per acre per year from irrigating orchard grass-ladino clover that was grazed with dairy cattle. The Mississippi Agricultural Experiment Station has reported that the yield of sorghum silage was increased from 36,078 to 46,199 pounds per acre by irrigation, while the yield of corn silage was increased from 14,661 to 31,765 pounds per acre.

In addition to these easily measured benefits, irrigation also results in improved pastures by maintaining stands of clover during dry summers, increasing succulence and palatability, and by making possible the establishment of early stands of annual crops, such as crimson clover and ryegrass.

The Southeastern States have a diversified agriculture, with row crops and pasture and forage crops being grown on most farms. It appears,

[1] Unpublished data from the API Agricultural Experiment Station.

therefore, that irrigation could be profitable practically every year on most farms. The question is, why is it not more widely used? Although specific answers to this question would vary from farm to farm, it is possible to group under a few generalizations several of the most important limitations.

Lack of water probably is the most important factor. It has been estimated that less than 15% of the farms in this area are accessible to streams of sufficient size to permit irrigation. Even on these farms the right of individuals to use the water from these streams for irrigation purposes is questionable. In general, water laws in the Southeast are based on the doctrine of the riparian rights according to which each individual land-owner along a stream is entitled to have the stream flow by his land undiminished in quality or quantity, but with the qualification that each proprietor is entitled to the reasonable use of water for domestic agricultural and manufacturing purposes. In view of this doctrine, it would be unwise for a farmer to make heavy investments in irrigation equipment and to depend upon a source of water that might be denied by court action without looking into the question of whether irrigation may be considered a reasonable use.

Farm ponds offer a means of storing runoff water for use at a time when rainfall is deficient. About one third of our total rainfall, or almost 20 inches per year, is classified as runoff water. In theory it should be possible to impound this water for use as needed. In practice there are certain limitations to the development of farm ponds for irrigation purposes. Water is lost from ponds by seepage and by evaporation. Losses of water by seepage may vary from less than 10 inches in the heavy clays of the Alabama Black Belt to as much as 95 inches per year in the Piedmont area. Losses of as much as 46 inches per year by evaporation have been recorded. Therefore, if ponds are to be used for storing water for irrigation, they must be deep in order to minimize losses from seepage and evaporation or they must be constructed where springs or small streams provide for continual replacement.

The third possible source of water for irrigation purposes is underground water.[2] In the limestone valleys, water collects in solution channels in the underground limestone. In some instances these channels are large enough to provide a flow of several hundred gallons per minute. On the other hand, it is possible to sink a shaft several hundred feet deep without encountering a solution channel. In the Lower Coastal Plain, portions of the Black Belt, and portions of the Upper Coastal Plain, there are underlying water-bearing strata, or aquifers, that when tapped may yield a continuing supply of water. In the Piedmont area and throughout most of the Upper Coastal Plain as well as the Appalachian Plateau area, wells are an uncertain source of water because of the absence of aquifers affording high yields and large solution channels. The possibility of wells for irrigation purposes in certain areas should not be minimized. There is a "rule of thumb" that states that a flow of 10 gallons per minute is sufficient to irrigate one acre in the humid Southeast. Thus a flow of only 150 gallons per minute would be sufficient to take care of 15 acres, particularly if it were pumped into a reservoir and redistributed to the land. It should be emphasized, however, that we have no way of knowing what effect the widespread use of such wells might have on the water table. Based on experience from several states, it could be assumed that the water table would drop. However, information on the relationship between rate of use and the depletion of the underground water resources is lacking.

The lack of adequate operating capital has restricted, and continues to restrict, the use of irrigation on many farms. The initial cost of an irrigation

[2] The writer is indebted to L. G. Brackeen of the Alabama State Department of Agriculture and Industries for assistance in summarizing information on underground water resources.

system ranges from 75 to 125 dollars per acre. The average farmer with about 50 acres of row crop and pasture land may be faced with the prospect of investing more in one practice than he has been accustomed to getting from the sale of all his farm produce in an entire year. The recent action of the Federal Government in making capital available for such investments should be helpful in overcoming this problem.

Finally, the use of irrigation on farms in the Southeast is restricted by the fact that it represents a radical departure from established farm practices. It is likely to create new problems or to intensify old problems for the operator. For example, the use of adequate fertilizers becomes a must if a farmer adds irrigation to his farming program. Diseases are likely to be more important on clovers irrigated during the hot summer months or on crimson clover and small grains that are planted early and irrigated in order to obtain stands. Irrigation of cotton may result in a growth so rank that it becomes difficult to use ground sprayers or dusters for insect control. Boll rot may cause heavy losses unless the cotton is defoliated. The questions of when to apply water and the rate at which it should be applied require the use of research information that the farmer may not have taken the trouble to acquire. Where water is limited, the grower is likely to be faced with the necessity of deciding which of his crops will give him the greatest return for irrigation. Since labor is likely to be limited on most farms, it becomes necessary to plan operations in advance in order that irrigation schedules may be maintained. All of these things emphasize the need for an educational program that will assist the farmer by bringing to his attention the information that is available and for helping him to apply it to his own peculiar conditions.

There are still many questions about irrigation, answers to which will depend upon additional research, and it is reasonable to expect that still more questions will arise. Adding irrigation to other production practices may make it desirable to change methods of applying fertilizer, spacing plants, or other management practices. There is a need for a careful evaluation of the cost and return of irrigating various crops. Since the returns are likely to vary with the method of utilizing the crop, the problem can become extremely complex. For example, the answer to the question of whether an irrigated acre should be planted to permanent pasture, a temporary grazing crop, a silage crop, a grain crop, or a hay crop may depend on whether the acre is to be used for dairy cattle, beef cattle, or hogs. The economics of various methods of applying water should be studied. Although sprinkler irrigation is most adaptable and can be used over wider areas than any other type of system, the possibility of flood or furrow irrigation should not be overlooked. In addition to these kinds of questions, there is a need for a careful evaluation of our underground water resources and for the development of a long range plan for the use of water for domestic, industrial, and agricultural purposes.

Irrigation offers an excellent opportunity for increasing agricultural income in the Southeast. The extent to which it is finally used will depend to a large extent upon the research and educational programs that are developed by agricultural agencies, industry, and government. The job is too big for any one group. It will require the cooperation of all of us.

Literature Cited

(1) Campbell, John A. Irrigation for vegetable crops. Mississippi Agr. Exp. Sta. Cir. 180. 1953.

(2) Crop response to irrigation in Mississippi. Mississippi Agr. Exp. Sta. Cir. 180. 1953.

(3) Ewing, John A. Irrigated pasture for dairy cows. Tenn. Agr. Exp. Sta. Bul. 216. 1950.

(4) Lund, Zane F., Weaver, Homer A., and Pearson, R. W. The response of corn

to variations in nitrogen moisture and plant population levels at Tallassee, Alabama. Research Report No. 266, Agricultural Research Service, Beltsville, Maryland.

(5) Nettles, V. F., Jamison, F. S., and James, B. E. Irrigation and other cultural studies with cabbage, sweet corn, snap beans, onions, tomatoes, and cucumbers. Fla. Agr. Exp. Sta. Bul. 494. 1952.

(6) Ware, L. M., and Johnson, W. A. Value of irrigation with different fertility treatments for vegetable crops. Alabama Agr. Exp. Sta. Bul. 276. 1950.

(7) Whitt, D. M. Effects of supplemental water on field crops. Missouri Agr. Exp. Sta. Cir. 180. 1953.

Zero Grazing

(*From page* 21)

careful maintenance of other equipment required for the operation.

Different crops can be utilized effectively for soiling and will in some cases increase acre returns. These will usually involve annuals, however, which increase costs of production when compared with perennial crops.

It would appear that on most New Jersey farms green forage for a long while to come will still be fed as pasture. However, in some special cases certain fields on the farm may best be utilized for soiling crops. The risks are still too great at this time to suggest complete dependence upon machinery for all of the harvesting operations on the great majority of livestock farms.

The New Jersey Grassland Committee has recognized this opportunity for efficient utilization of green grass. Studies have been under way at the Dairy Research Farm for the past two years, under the supervision of Bruce R. Poulton, testing the efficiency of feeding dairy cows in this manner. Further, a self-feeding wagon has been built by Professor Mark E. Singley of the Agricultural Engineering Department for the purpose of eliminating labor of handling the chopped feed. Initial tests indicate that chopped forage can be blown directly into the wagon in the field after which the wagon is hauled to the feeding area, opened, and left until the next feeding. The results of these researches will determine where and how soiling crops can be effectively fitted into 20th century grassland farming.

Soil Testing Moves Ahead

(*From page* 26)

soil nutrient levels. The punch card data include a description of the sample area by acreage, type, texture, drainage, color, and erosion, as well as the test results, future crop, and fertilizer recommendations, permitting various types of summaries depending upon the information desired. The general need for lime is becoming evident over all areas of the State, approximately 50% of all tested soils falling below pH 5.5 and another 25% between pH 5.5 and 6.0. The gradual trend toward increased consumption of N, P_2O_5, and K_2O in a 1:1:1 ratio is supported by soil test data from all areas. Most of the upland soils known to be very low in phosphorus are also sufficiently low in nitrogen and potash to justify the use of fertilizer nutrients in a 1:1:1 ratio rather than the 1:2:1 or 1:3:1 ratios common in the past. An additional extensive need for the 1:1:1 ratio is becoming more evident in cotton areas which have been receiving nitrogen alone or high potash ratios in the past.

Phosphate fertilizers apparently have been unprofitably applied on many other delta soils which require only nitrogen and/or potash for maintenance of optimum production. Magnesium needs are approaching high proportions in certain large soil regions,

and field observations are more frequently indicating possible sulfur shortages, necessitating more extensive field and soil tests to evaluate these essential elements. Trace mineral combinations are continually included in most outlying fertilizer tests, but have not indicated beneficial results under consistent circumstances to justify their inclusion in routine soil test measurements.

Soil testing services have expanded rapidly in most states in recent years, and in nearly all cases the expansion originated in direct requests of farm groups and organizations. Relatively large numbers of farmers have had the opportunity of following soil test recommendations, and opinion surveys in this State have indicated a general acceptance of periodic soil tests as an essential phase of any sound farming operation. Questionnaires returned from a group of more than 100 farmers who had soil tests in one county indicated that 90% attempted to follow the recommendations, 85% said the recommended fertilizer grades and rates differed from what they had used in the past, 45% felt that their production was increased despite the drought, 80% said they were unable to determine the full value of fertilization because of insufficient moisture, 99% wanted the soil testing service continued, and 85% said they had encouraged their neighbors to have fields tested.

Soybean Production in the Southern States

(*From page* 10)

common leaf disease found in the Southern States, bacterial pustule, to which all other major varieties are susceptible. Losses of 7 to 15 per cent have been measured for this disease and resistant varieties are the only practical means of controlling it. Lee is also resistant to several of the other major soybean diseases occurring in the Southern area.

In any area, a combination of two or three varieties will lengthen the harvest period and permit harvesting of a greater acreage per combine. For example, a Mississippi Delta farmer would be limited to 250 acres per 12-

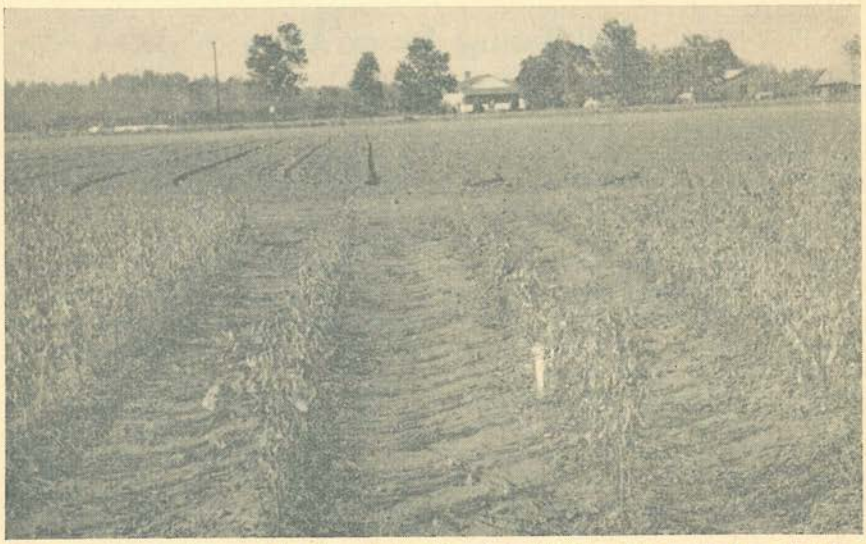


Fig. 7. Jackson soybeans at the West Florida Experiment Station which received no fertilizer. These beans produced 1.8 bushels per acre.

foot combine if he were growing only Ogden. If he would distribute his acreage among Dorman, Ogden, and Roanoke, for which the average maturity dates are September 20, October 10, and October 25, he could increase his acreage per combine to 600. Weather hazards are also distributed by planting varieties differing in maturity.

Other varieties of soybeans are available, but in general they have given lower seed yields or have had lower oil content than varieties of comparable maturity described.

Several leaf-eating insects may cause trouble with soybean production. Some of these are the bean leaf beetle, the legume caterpillar, corn earworm, green clover worm, and fall army worm. Most of these insects may appear through August or September. They can be controlled with timely application of insecticides such as toxaphene, DDT, Dieldrin, or others that may be recommended by State Experiment Stations.

As adjustments are made in cotton acreages, soybeans will be considered as an alternative crop. In the humid areas, soybeans will fit in very well. On lighter, more drouthy soils of central Georgia and South Carolina, observations suggest that early June plantings will withstand late summer drouths much better than early May plantings. On these soils, fertilization is a "must." On the upland soils of Oklahoma and Texas, soybeans should be planted with caution because of moisture limitations. However, yields of 20-25 bushels per acre have been obtained at Lubbock, Texas, from mid-June plantings receiving a pre-planting irrigation.

Earlier it was mentioned that soybeans could produce their own nitrogen if properly nodulated. Inoculation is a "must" where soybeans are being grown on land for the first time.

Several points have been mentioned as being essential to profitable soybean production. These included an adapted variety, correct planting date, and proper fertilization. These practices used together have a much greater value than any one alone, as can be illustrated by using soybean production in the State of Florida as an example. Only 10 years ago soybeans were not considered adapted, but these conclusions had been based upon plantings

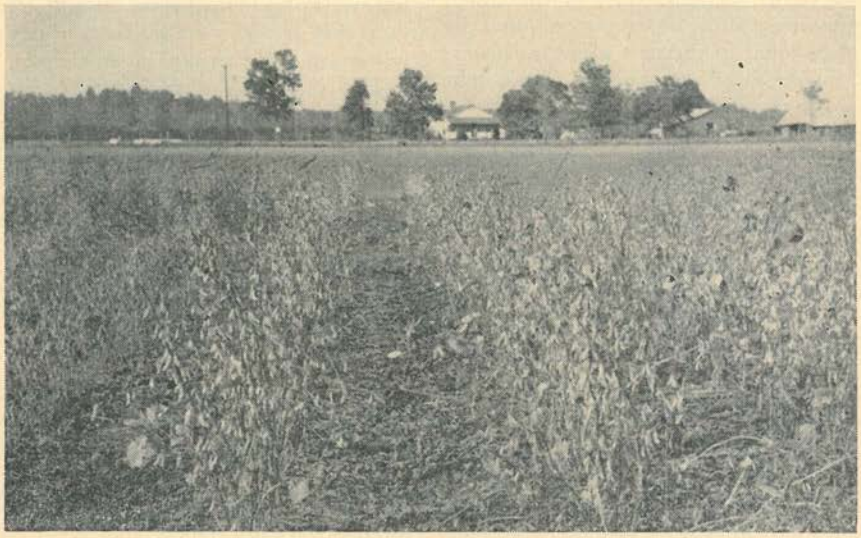


Fig. 8. Jackson soybeans grown under the same conditions as those in Fig. 7, but receiving lime, phosphate, and potash. This plot produced 30 bushels per acre.

made in early April and without adequate fertilizer or insect control. In 1952, Florida harvested a 12,000-acre crop with an average yield of 20 bushels per acre. Nearly all of these beans were fertilized with phosphate and potash and were planted in early June.

As seed of the improved varieties, Dorman, Lee, and Jackson, becomes readily available and is planted at the optimum time with adequate fertilization, average yields for the Southern States are expected to be above the national average.

Spring Meanderings

(*From page* 5)

are used widely on covers, title heads, and commercial posters.

If all these symptoms of nostalgia and a love of the best of the past have the right effect, they may bring us back with a thud to the solid earth and its realities. After all, machines never replace the human spirit, while youth and love remain among us.

A lot of us prone to lean on the past for much comfort are told to heed the up-and-coming school of practitioners who point out the error of getting into a past-tense rut. In a way they are right. Obviously, it is best to remember that all this history and tradition we so much admire would not have been possible had the ones responsible for it spent their time mooning and fussing over the milestones and relics of former times. Most of the things that we think were so good and inspirational in the past came into being because there were active people who lived vividly in the present. Few of those history-makers, even the founders of small hamlets and agricultural improvements, had very much time to dwell on vanished events.

Yet on the other hand, precedent and past experiences rule the activities and decisions that animate our lawyers and our best scientists. These people are obliged to study the past and know what has been done and discovered and discarded.

Historians and economists are also great dependers upon what has been significant and purposeful and productive in years gone by; and their profession also finds and removes stumbling blocks which tripped up our ancestors so that we may not repeat the same old blunders again.

It seems to simmer down to this: when we make good use of the past to formulate better theories and safeguard our ventures, we are using old times to nourish the new times. But when we stick to the chimney corner and insist that the old days were the best days, and that we are utterly lost without the old time-honored environment, then we have reached a sad state of ingrowing emotion.

Losing touch can turn out to be a continual nightmare. Lately I overheard the chat of a couple of loungers in a "poorman's club." One was a retired railroader and the other a contractor who thought he had made enough dough to keep him going without studying blueprints. Each day they met at the refreshment resort to while away the tedium of idleness.

The railroader got a little amusement out of fishing sometimes. The contractor said his afternoons were spent napping or slapping down the cards at solitaire. Neither had any hobbies and one of them said: "My wife and I don't go places any more, but she has her knitting and crocheting, while I watch the clock and wonder when the mail man will arrive."

Of course it's not fair to draw a contrast between retired fellows like them and the octogenarian careers of notables such as Albert Schweitzer, Winston Churchill, and the late Liberty Hyde Bailey. The richness of their life backgrounds and the depth and range of their intellects and accomplishments are

not things you can use to measure the moods of the common run of us.

But it is something to fortify youth with ere "those days draw nigh in which thou shalt say 'I have no pleasure in them.'" We can impress youth today with the "residual effect" of good cultural education or technical training. They may regard such an opportunity merely as a magic talisman to open the glittering gates of success at jobs where formal education is a requisite. (And today the lot of the untrained, hapless individual is at a lower ebb than it was in the Middle Ages. Only the rare person with astounding talent can break through the ironclad academic barrier erected around golden opportunity.)

The best insurance there is against the doldrums and inertia of approaching age lies in the rewards that come from organized education. Not just for the contents of the textbooks or the discussions of the seminar or the dignity of degrees—but mainly for acquiring associates and companions and "familiars" who speak a kindred tongue and share similar backgrounds.

IN other words, memory links together the lives of such disciplined persons. It enables them to share mutual achievements. That stirs them up and affords keener incentives to make the past a moving force instead of an old and faded picture on the wall.

Regrets pursue the lot of too many untrained people. When it seems almost too late, they recall what they lost when they might have studied and absorbed new cultures and seasoned groundwork in the vast range of human knowledge. Once in a blue moon this same regret comes to fellows who centered themselves upon a specialist career—and later learn that education may also be lopsided and leave one with no entertaining diversified interests

The restricted specialist is sometimes as sadly marooned on the island of old age as the guy who never got much

farther than the three R's. As we all know too well, no exact rule may be set down. He who discounts the character of the individual as a force either way is missing the mark entirely. And when true character shows up the brightest is when the adverse conditions of old age try to nudge him off the work list.

Recently I got a fine thought from an old associate who is not ready to live on memories only—splendid as the power to remember always seems to be. He testified that the panic of quitting no longer held him in thrall. One day he suddenly realized that nature's governing plan ends with the sure proposition that folks must gradually grow old. But the governing plan decrees that men may reach well into the seventh and eighth decades of service and useful living. Nature could have closed down the factory to put aside its discards at 40 or 45 years instead. Since the governing plan permits and seems to welcome the continuance of useful work beyond 65, a fellow who acts as though it should have ditched him 20 years before is a ninny.

He laughs off that old wheeze that "you can't teach an old hound new tricks." "Why, bless my soul," he shouts, "I have worked for a living 45 years, held down a good job, kept a roof over my head, reared a family, and managed to get along without public charity." Then he slyly concludes: "If there are any more tricks in that bag which I haven't had to use a good many troublesome times to escape evils and mistakes—then I'd like to see them work!"

So we once more greet the fresh and promising springtime. Again we delight in seeing the young couples planning the future and listening to the recollections of many days of yore. Bright dreams and vivid memories combine to lift us. For they are like the eternal burgeoning of spring's assurance—plainly telling us that the sweetest aspirations of the human spirit never die.

FREE LOAN OF EDUCATIONAL FILMS

The American Potash Institute will be pleased to loan to educational organizations, agricultural advisory groups, responsible farm associations, and members of the fertilizer trade the motion pictures listed below. This service is free except for shipping charges.

FILMS (ALL 16 MM. AND IN COLOR)

The Plant Speaks Thru Deficiency Symptoms (Sound, running time 25 min. on 800-ft. reel.)

The Plant Speaks, Soil Tests Tell Us Why (Sound, running time 10 min. on 400-ft. reel.)

The Plant Speaks Thru Tissue Tests (Sound, running time 14 min. on 400-ft. reel.)

The Plant Speaks Thru Leaf Analysis (Sound, running time 18 min. on 800-ft. reel.)

Save That Soil (Sound, running time 28 min. on 1200-ft. reel.)

Borax From Desert to Farm (Sound, running time 25 min. on 1200-ft. reel.)

Potash Production in America (Sound, running time 25 min. on 800-ft. reel.)

In the Clover (Sound, running time 25 min. on 800-ft. reel.)

In Canada: The Plant Speaks Thru Deficiency Symptoms
The Plant Speaks, Soil Tests Tell Us Why
The Plant Speaks Thru Tissue Tests
The Plant Speaks Thru Leaf Analysis
Borax From Desert to Farm
Potash Production in America

DISTRIBUTORS

Northeast: Educational Film Library, Syracuse University, Syracuse 10, N. Y.

Southeast: Vocational Film Library, Department of Agricultural Education, North Carolina State College, Raleigh, North Carolina.

Lower Mississippi Valley and Southwest: Bureau of Film Service, Department of Educational Extension, Oklahoma A & M College, Stillwater, Oklahoma.

Midwest: Visual Aid Service, University Extension, University of Illinois, Champaign, Illinois.

West: Department of Visual Education, University of California, Berkeley 4, California.
Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.
Department of Visual Instruction, Oregon State College, Corvallis, Oregon.
Bureau of Visual Teaching, State College of Washington, Pullman, Washington.

Canada: National Film Board, Ottawa, Ontario.

For the Province of Ontario: Distribution Services, Ontario Agricultural College, Guelph, Ontario.

IMPORTANT

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

Request bookings from your nearest distributor.

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.

Reprints

28-12-45 Better Corn (Midwest) (Circular)
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What is the Matter with Your Soil?
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
A-1-44 What's in That Fertilizer Bag?
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—The Aristocrat
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
T-4-47 Fertilizer Practices for Profitable Tobacco
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
R-4-48 Needs of the Corn Crop
X-6-48 Applying Fertilizers in Solution
AA-6-48 The Chemical Composition of Agricultural Potash Salts
GG-10-48 Starved Plants Show Their Hunger
SS-12-49 Fertilizing Vegetable Crops
BB-8-50 Trends in Soil Management of Peach Orchards
I-2-51 Soil Treatment Improves Soybeans
X-8-51 Orchard Fertilization Ground and Foliage
BB-10-51 Healthy Plants Must Be Well Nourished
II-12-51 Pasture Improvement With 10-10-10 Fertilizer
KK-12-51 Potassium in Animal Nutrition
A-1-52 Research Points the Way to Higher Levels of Peanut Production
H-3-52 The Relative Merits of Inorganic & Organic Sources of Plant Nutrients
O-4-52 Tomato Production for the Canning Industry
Y-10-52 The Nutrition of Muck Crops
CC-12-52 The Leaf Analysis Approach to Crop Nutrition
I-2-53 Sericea Is a Good Drought Crop
J-3-53 Balanced Nutrition Improves Winter Wheat Root Survival
K-3-53 Kudzu Keeps Growing During Droughts
N-4-53 Coastal Bermuda—A Triple-threat Grass on the Cattleman's Team
P-4-53 Learning How to Make Profits from Sweet Potatoes
S-5-53 More Cotton on Less Land
T-5-53 Trefoil Is Different
W-6-53 The Development of the American Potash Industry
DD-10-53 Sampling Soils for Chemical Tests
FF-10-53 Testing and Reclaiming Alkali Soils
II-11-53 The Importance of Legumes in Dairy Pastures
JJ-11-53 Boron—Important to Crops
MM-12-53 White Birch Helps Restore Potash-Deficient Forest Soils
D-1-54 Relation of Potash and Phosphate to Cold Injury of Moore Pecans
K-2-54 Soil and Plant Analyses Increase Fertilizer Efficiency
R-3-54 Soil Fertility (Basis for High Crop Production)
S-4-54 So You Want to Grow Alfalfa?
T-4-54 The Fertilization & Liming of Pennsylvania Fruit Soils
U-4-54 Nutrient Balance Affects Corn Yield and Stalk Strength
BB-6-54 Potash Pays on Forage in New England
CC-6-54 Fertility Increases Efficiency of Soil Moisture
DD-6-54 Surveying California Citrus with Leaf Analysis
EE-8-54 Red Apples Require Balanced Nutrition
FF-8-54 Apply Fertilizers in Fall For Old Alfalfa, Grass Pasture and Timothy-Brome Fields
GG-8-54 Effect of Boron on Beets and Crops Which Follow
II-8-54 Early and Delayed Grazing of Alfalfa Orchardgrass and Ladino Clover
JJ-10-54 Principles Involved in Soil Testing
KK-10-54 Peas for Canning or Freezing in New York State
LL-10-54 Relation of Fertilizer to Quality and Yield of Flue-cured Tobacco
MM-10-54 Longer Life for Ladino
PP-11-54 Fertilizers Increase Yield and Protein Content of Corn Forage in Illinois
QQ-11-54 Soil Tests Are Influenced by Field Conditions and Sampling Methods
SS-11-54 Foliar Application of Plant Nutrients to Vegetable Crops
TT-11-54 Leaf Rust Reaction in Relation to Wheat Fertilization in Indiana
UU-12-54 Alfalfa in Mixtures for Pasture, Silage, and Hay
VV-12-54 Potassium Affects Growth of Stocks
WW-12-54 Agriculture—(from the Chemical Viewpoint)
XX-12-54 Systematic Soil Testing Points the Way
YY-12-54 Physical Condition of the Soil Affects Fertilizer Utilization
ZZ-12-54 Economical Use of Fertilizer in North Carolina
A-1-55 Potash-Deficiency Symptoms
B-1-55 The Net Worth of Soils in the Northeast
C-1-55 Summary of Ten Years' Work with Complete Fertilizers on Sugar Cane
D-1-55 Nitrogen Use Accentuates Need for Minerals
E-1-55 Guides to the Management of Illinois Soils
F-1-55 The Soil Profile's Contribution to Plant Growth

THE AMERICAN POTASH INSTITUTE
1102 16th STREET, N. W. WASHINGTON 6, D. C.

Once upon a time a beautiful girl was walking through the woods when she came upon a poor little frog who spoke as follows:

"Lady, once upon a time I was a handsome prince but a big black witch turned me into a frog."

"Oh, that's too bad," said the beautiful girl. "Is there anything I can do to help you?"

"Yes, indeed," replied the frog. "If you will take me home with you and put me on your pillow I will be saved."

So the beautiful girl took the poor little frog home with her, and the next morning, when she awoke, there beside her was a handsome young prince. And do you know, to this day her mother doesn't believe that story.

* * *

A negro was in court, charged with having cut another negro to pieces. The defendant on being asked by the judge to give his side of the story, said:

"Your Honor, I did not cut him to pieces. I only stuck my knife in him once, then walked around him."

* * *

The daughter, high school age, was chattering in her mother's direction at supper table. "She's going steady, Mama. *Steady*. She's only 15, but George must be 19. They're gone, Mama. Real gone. I guess she's *wearing his pin*. He's . . ."

Father dropped his fork with a clatter. "What PIN?" he roared. "You don't mean his *diaper* pin?"

The poor stork—he's always getting blamed for a lot of things some other bird is responsible for.

* * *

"They tell me that you pushed a wheelbarrow down the street last night right after our company party. Is that right?" asked the boss.

"Yes, sir. I was pretty well crocked," admitted the wage slave.

"Well, how do you think I feel over the possible loss of prestige that your actions may have brought upon our business?" asked the boss.

"I never thought to ask you, Boss. You rode in the wheelbarrow."

* * *

William says there is only one thing wrong with the younger generation—a lot of us don't belong to it.

* * *

1st gal: "What's a military objective, Clarabelle?"

Second ditto: "Just walk past those soldiers on the corner. You'll find out."

* * *

An oldtimer in a small Alabama town was standing on a street corner watching ominous black clouds gathering in the west when a stranger standing next to him remarked, "I don't like to say it but those clouds look exactly like some we had back in Texas one time just before a tornado struck."

"Was it a bad'un?" the native asked.

"Bad?" the Texan replied. "How you figger I come to be in Alabama?"

Better Crops with PLANT FOOD

IF NOT DELIVERED, return to

AMERICAN POTASH INSTITUTE, INC.
1102—16th St., N. W., Washington 6, D. C.
RETURN POSTAGE GUARANTEED

Sec. 34.66, P. L. & R.
U. S. POSTAGE
PAID
Washington, D. C.
Permit No. 2283

THE POCKET BOOK OF AGRICULTURE