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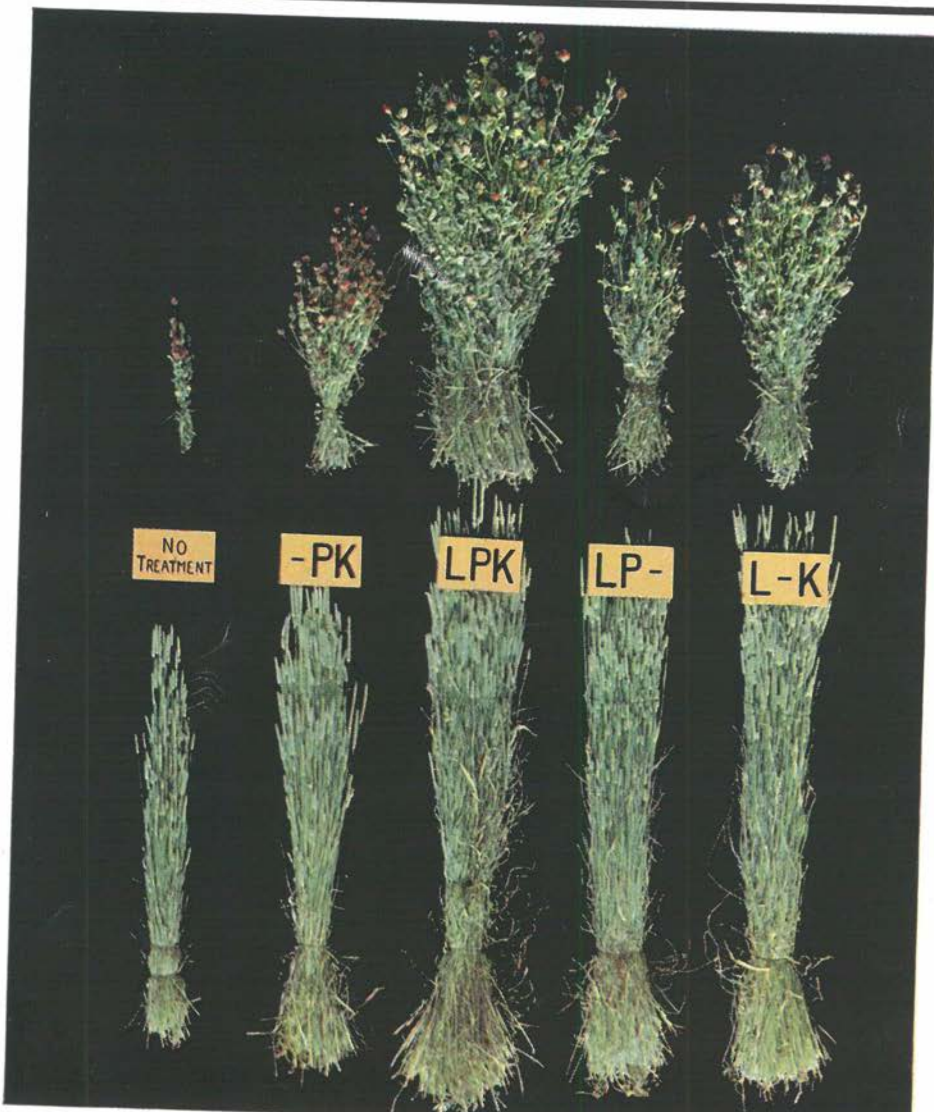

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

SANTFORD MARTIN, JR., *Editor*

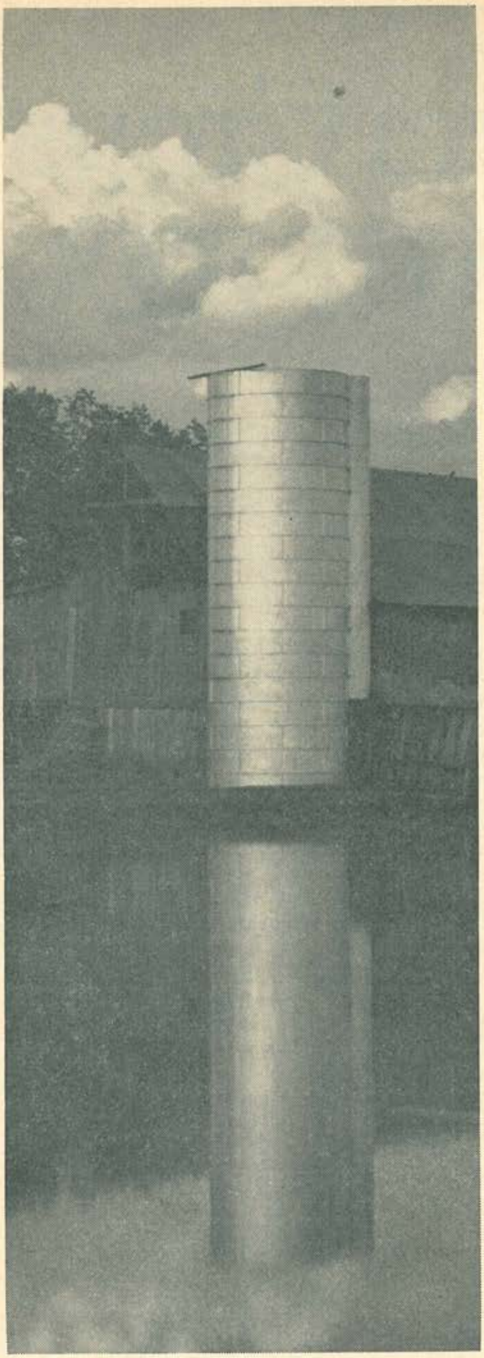
Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XLI MARCH 1957 NO. 3

ON THE COVER THIS MONTH . . .

. . . We see the proportion of legumes (top) to timothy (bottom) that resulted from five differently treated experimental plots by the University of Illinois at its Toledo Soil Experimental Field. They were all seeded to a mixture of alfalfa, red clover, alsike, and timothy in the 1955-56 seasons, which favored more grass growth and timothy than usual. Under such conditions, applying adequate lime, phosphate, and potassium determines the final proportion of legumes in hay or pastures.

In the center pair (LPK), lime, phosphate, and potash were added as needed, enabling the alfalfa and legumes to compete successfully with the timothy. On untreated soil, few legumes survived, with timothy very stunted. On the other three plots, lacking either lime, potash, or phosphate, both yields and legume ratios were reduced. Here, again, we see the fate of legumes in mixed seedings with grasses often depends on the mineral supply.



Bountiful Reflections...

CONTENTS FOR THIS ISSUE

Better Crops with PLANT FOOD

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VOL. XLI WASHINGTON, D. C., MARCH 1957 No. 3

In our farming it's always

Forward March

Jeff McDermid

(ELWOOD R. MCINTYRE)

LET'S pause before the plow and the seeder start the spring overture of 1957. Seventy years ago the congressional agriculture committee favorably reported a measure to grant federal aid in modest amounts to several state experiment stations already making initial efforts—pioneered by the North Carolina station a quarter of a century earlier.

This move, they argued, was necessary because of "the decay of agriculture in the older states, the deterioration of the soils in the first settled group of states, the rapid absorption of public lands, and the increasing competition of Russia and India in the food markets of the world."

Today we are faced with equally pressing and perplexing problems. On one hand, we have severe drought and prospects of loss in many areas of the West and Southwest, giving us a water resource problem which is a greater hazard than the "decay of agriculture" mentioned in earlier days. Today, we also try every device within reason to export more of our basic surplus cash crops—cotton, wheat, tobacco—while major nations of the world with which we trade give their farmers high incentives to expand production, including strong import restrictions and controls. Changes in methods have been the rule in agriculture—from pioneer farmers adopting early facts discovered by state-federal experimentation to huge, complex technical progress being made by both public and private investigators. What has been so remarkably, successfully begun can never be halted and abandoned in any broad, general way—although failures will occur in the wake of drought and flood.

Look at a few of these outstanding changes that can never be erased. Figures given by Lowell Hardin and Dr. V. W. Ruttan, of Purdue University, show tremendous growth from the pre-war period through last year. Using 1947-49 as the base period from which to calculate, the following growth speaks for itself:

	1935-39	1947-49	1956
Total farm output	75	100	112
Fertilizer used	39	100	160
Man hours all farm work	122	100	83
Farm output per man hour	63	100	135

Contrast conditions today with the era when experiment stations received congressional sanction. Back in the first settlements of the Northeast and, to some extent, along the southern tidewater, farm families had little idea of acquiring cash wealth which they could spend for gadgets and equipment—and an occasional luxury.

FROM LITTLE REGARD FOR THE SOIL . . .

The colonial scene and the pioneer era afterwards accepted each farm as a real end unto itself, for the most part. Just a few crude tools and raw materials were all they asked their stores to supply them. To be sure, they looked abroad for enough export trade to keep them happy exploring and conquering new lands—but it never gave them headaches and nightmares or moved them to seek government action, aside from the tariff.

For them life was not easy, but the land supported a healthy and independent people. No far-flung commercial networks of industry gave them ideas of having more consumers to feed and better and faster tools with which to work. Fully 80 per cent of the American population in the early 1800's called the farm its home and workplace.

Before 1840, however, many farms showed fainting spells in their productivity. Boys soon found it paid to enter mercantile, industrial, and professional careers. As the legislators said much later, "the lack of a decent regard for the soil" was often the primary cause of it all. Rich, virgin land of the seaboard and beyond bred multitudes of folks who later found it profitable to quit coaxing life back into the hardpan to jump the fence to greener pastures.

Along with this, we had thousands leaving the stone-quarry farms of New England to seek deep, mellow, easily worked midwestern prairies. Here, too often, they engaged in "mining" soil minerals without restoring any, and so the action by the solons of 1886 affected them as well. For them, agricultural experiment was not too late, albeit long delayed.

Some foolishly imagine the bigger part of the adventure in farming is over. They say the wild country is mostly gone—some of it into better conditions and some of it into worse. Since the rise of skillful experiment stations, we often shrug our shoulders and look askance at further land development. We say virtually all the land worth while under a profit system is already yielding up many times what we thought it could.

But—unless we take heed and organize to conserve our land, we may eventually begin a form of homesteading again on acres hitherto devoted to mountain goats and lizards. We should also ask ourselves how long we must dodge drought and lose costly harvests before students of sound water conservation, aided by legislatures, will help us banish that dry wrinkled bogey from the agricultural horizon.

Our leading farm statesmen in cooperative studies refuse to be halted in their faithful search for a distant goal, even though the picture seems mixed in spots. Basically, it stems from the courageous belief that our country is growing in population and resources, that our farms must do likewise or be a fifth wheel on the wagon of progress.

. . . TO A POT BOILING WITH NEW IDEAS

Take what Michigan farm folks have stated in their recent "blueprint for rural progress." They agree that 50 per cent of our farms produce 90 per cent of our food. What can be done to increase the productivity of the other 50 per cent, they ask? Should conservation efforts be confined to the good land? In Michigan, as in many other states, 90 per cent of the land is in soil conservation districts. How can the work of these districts be made more effective?

Technology of a superior sort has resulted in higher yields per acre, it is pointed out. Yet the basic fertility of many soils of Michigan and other state soils has been declining. The Michigan folks say that a 10- to 15-year gap exists between research findings and widespread application of new practices. No doubt, if present knowledge of good management methods were applied to all agricultural land, that gap could be cut 50 per cent.

Many states suggest three times the lime now used could be applied profitably. Fertilizer application could profitably increase several times the present 100-pound per acre average per year, Michigan farmers say. Improved cultural practices, more organic matter to reduce erosion losses by wind and water, reforestation, and more "rested" acres in legumes and grasses are among the key proposals made where farmers organize to agitate.

And by "agitation," we mean keeping the pot boiling with new ideas that will make the land a stronger asset with which to face liabilities.

Remember, we have something in the nature of an allied force today that was absolutely lacking when the congressmen of the 1880's decided to help agriculture find better ways of working. It's no small matter, this circle of allies and cooperators we enjoy today.

Whenever groups of determined self-help farmers assemble to make decisions and chart courses, locally or statewide, they can rely thoroughly on associations, foundations, institutes, corporations and grants-in-aid systems—set up by directly interested commercial and industrial contributors. Nothing like it has ever been seen in the world for a mutual progressive principle. We mustn't confuse them with "cartels" and "monopolies" operating so often in international trade. Unlike these selfish movements to channel or restrict commerce, the united forces we speak of are bound closely to the welfare of the farmer, depending more or less on his success and achievements.

These sturdy, well-prepared allies of agriculture move in on request with results of study, experience and research, augmenting the public services of our colleges and experimental farms. They often begin where station research must leave off. They have the skill and resources to underwrite and encourage hundreds of big and little projects in progress. They do so not only for the sake of profitable farming and sound land management, but to keep their own employees busy, eager to invent and anxious to prosper.

Hence, taking it all together—federal, state, and local public agencies, plus farm organizations and corporate cooperators—we can whistle as we work, well aware that common sense and science wins. This is the month of planting intentions. Its slogan is, "Forward, March!"

NOW WE NEED TO KNOW . . . HOW CROPS GROW

SCIENTISTS have done much work on how to grow crops. Now many of our agricultural leaders say that what we need to know is how crops grow. There are gaping holes in our knowledge of the basic characteristics of plants and their growth.

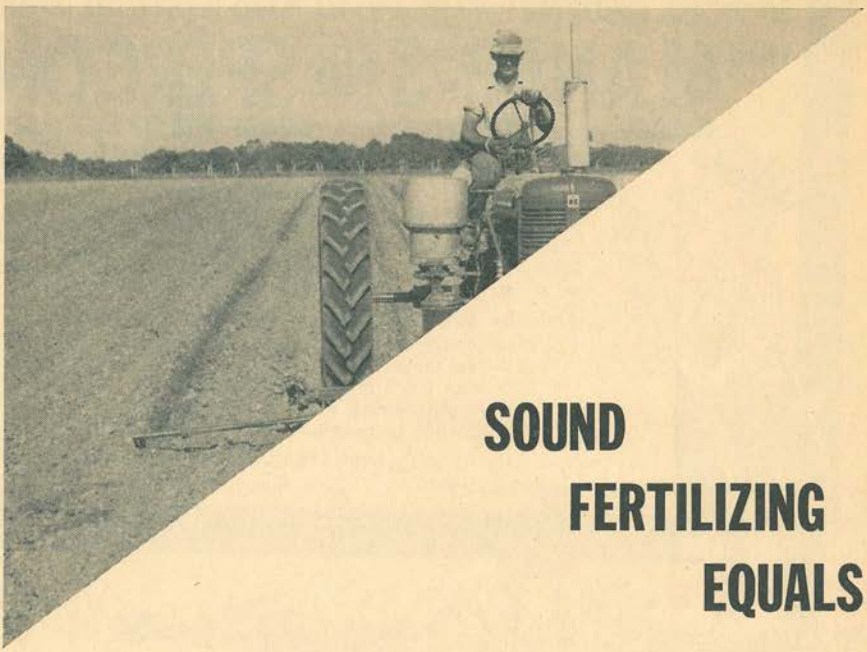
For example: Why are plants resistant to disease? What we can do with fertilizers, chemicals for weed and insect control, and water will depend on what we learn about plants.

This situation also exists in the field of livestock. There are many basic questions to be answered in genetics, animal nutrition, and disease control. What part does nutrition play in development of good flavor and tender beef? How much depends on heredity?

What we are accomplishing today rests on basic knowledge we learned in years past.

To prove the point: a news story from London reported successful use of a predatory fungus to destroy plant pests that may save British spud farmers some $5 million a year. The original investigations of the microscopic organisms were made 20 years ago in the USDA Research Center at Beltsville, Md.

Our present surplus problem has given us additional time to do basic research. Accomplishments 20 years from now may depend on fundamental facts we discover in our agricultural college laboratories this year.



SOUND FERTILIZING EQUALS

THROUGH PROPERLY FERTILIZING THREE CROPS . . .

By P. J. Bergeaux and Ralph L. Wehunt

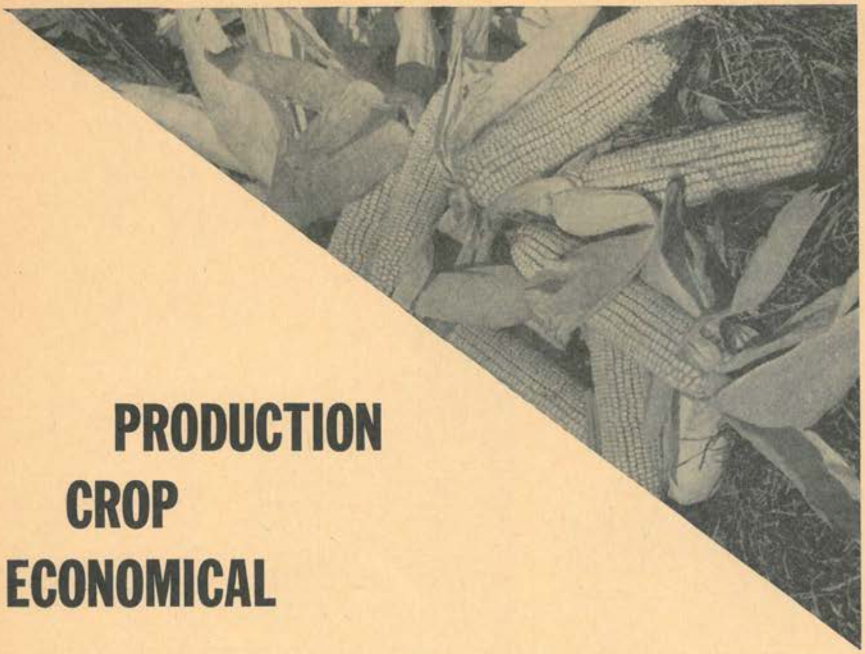
Extension Agronomists • University of Georgia

Today's fertilizer dollar goes further than ever before.

Fertilizer prices—in terms of plant nutrient content—have advanced less than 10 per cent since 1939. At the same time, prices of all production items have more than doubled in the same period.

The same amount of plant nutrients required to produce $1.00 worth of farm products in 1939 will produce $2.60 worth of farm products today. Thus—while he receives more than two and a half times as much for his farm products as he did in 1939—today's farmer pays less than 10 per cent more for the fertilizer it takes to produce them.

Efficient use of fertilizer has helped lower the living costs of all people and increase profits received by farmers. Although Georgia farmers have made phenomenal progress in employing fertilizer know-how to increase crop production, many farmers still have their crops on a semi-starvation plant nutrient diet. Some are using only a third or half as much fertilizer as research has shown to be most profitable.



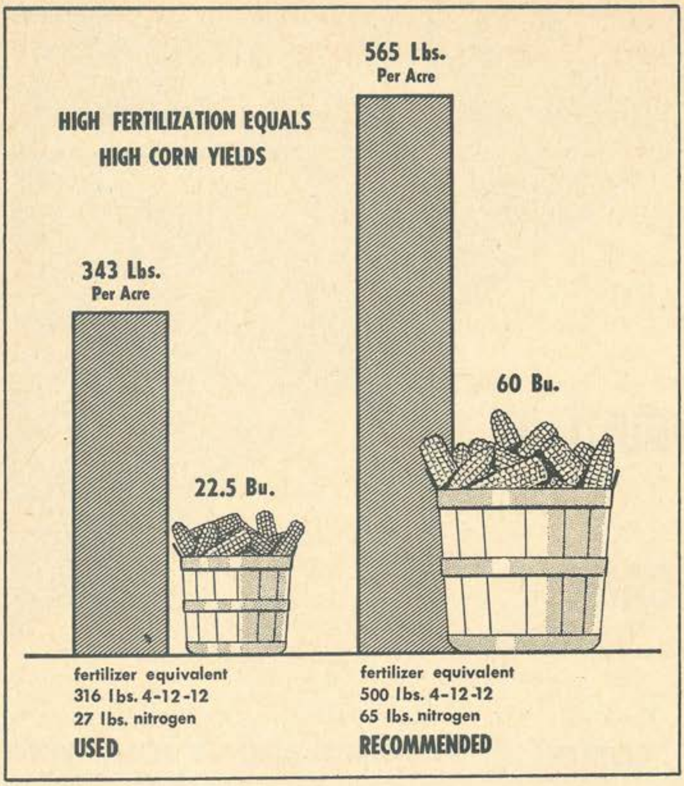
PRODUCTION
CROP
ECONOMICAL

. . . CORN . . . COTTON . . . PASTURES, AND BY FOLLOWING OTHER CULTURAL PRACTICES, GEORGIA FARMERS MIGHT INCREASE THEIR INCOME BY OVER $200 MILLION A YEAR

Three hundred thousand tons of lime were used by Georgia farmers in 1955. But it is estimated over two million tons of lime should be used annually. Inadequate use of lime is restricting crop production in the state. To obtain maximum benefit from applied mixed fertilizer and nitrogen, soil acidity must be corrected with lime. A high percentage of Georgia soils are too acid for optimum crop production and efficient fertilizer utilization. The desired pH range for most cultivated and forage crops is 6.0 to 6.5.

Judicious use of lime is the foundation to a prosperous Georgia agriculture. "Lime and then fertilize" is a good theme for farmers to adopt in promoting a sound soil fertility program. Planting crops on acid soils is an uneconomical practice. A soil test is the best means of determining the lime requirement of soils.

Soil test data show about 50 per cent of the soils in the state are low in phosphate and potash. South Georgia soils are generally lower in potash than phosphate whereas the reverse situation exists



If recommended practices were followed, estimated yields would almost double.

HIGH FERTILIZING EQUALS HIGH . . .

for North Georgia soils. These results show many farmers are not using adequate phosphate and potassium for successful crop production.

Commercial nitrogen occupies a key position in Georgia agriculture. Crop production, except for legumes, is closely related to the quantity of nitrogen supplied to the soil. No other element shows such an immediate beneficial effect on crop growth in Georgia. The importance of nitrogen in crop production is well recognized by agronomists. But many Georgia farmers still are using inadequate amounts of nitrogen for profitable crop production. This fact is illustrated in Table II.

Research has shown that, with a sound fertility program and proper adjustments in time of application, little or no difference in crop yield is obtained between various nitrogen carriers. Therefore, the source to use will depend largely on cost per pound of nitrogen plus cost and convenience of application.

The average state yield of cotton and corn in 1956 was estimated to be 336 pounds lint and 24 bushels per acre, respectively. Although these yields are much lower than those obtained by experiment stations and better farmers, they represent a significant improvement over previous years. The cotton yield is 84 pounds above the 10-year (1945-54) average production of 252 pounds, and the corn yield is 8.8 bushels greater than the 10-year average production of 15.2 bushels. In addition to low per acre yields of corn and cotton in Georgia, it is estimated the average gain of beef per acre is only 100 pounds. How do these figures compare with yields obtained by experiment stations and leading farmers in the state?

Corn: During the period 1953-55, Dr. H. D. Morris conducted a variety-rate of fertilization experiment in Athens, Georgia.

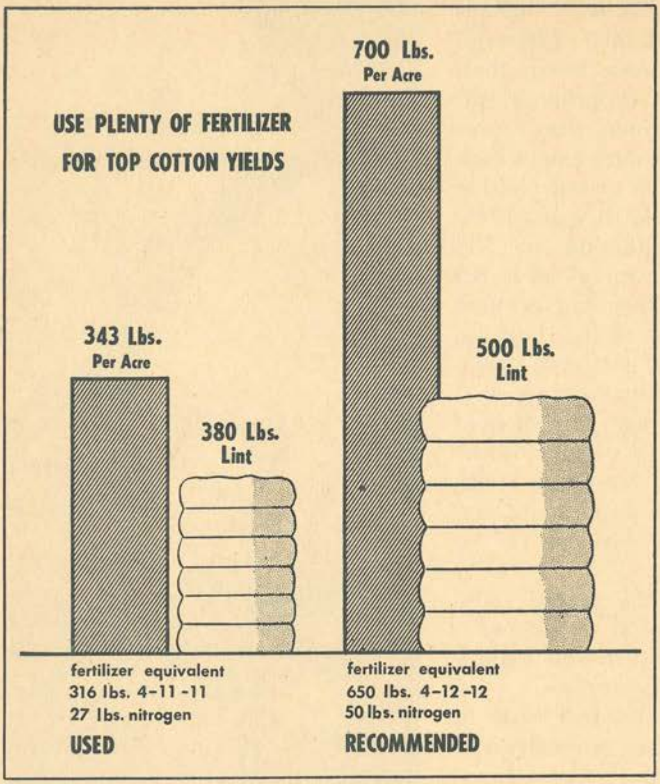
The results of this test show it pays to fertilize corn properly. The yields were almost three times

CORN YIELDS

greater on the high- than on the no-fertilizer treatment. But the net income was about six times greater at the high rate of fertilization than where no fertilizer was applied. This increased income was due to the low cost of production which resulted from increased yields on the high fertility treatment. This experiment proves proper use of fertilizer is one of the best tools available to reduce costs of corn production. These data also emphasize high-yielding hybrids should be used to receive maximum benefit from applied fertilizer.

Are such experimental results practical and can they be applied

to the average farm? Yield results obtained from the 100 and 1000 Bushel Corn Clubs in Georgia in-



Average fertilization often under half what research shows most profitable.

USE PLENTY OF FERTILIZER FOR TOP . . .

dicate such findings are applicable to the average farm.

These farmers have produced high corn yields by following recommended practices.

The 100 Bushel Club members in 109 counties during the period 1951-55 produced an average yield of 118 bushels per acre at a cost per bushel of $0.61 with a net income of $89.00. To accomplish this high yield and income, the average club member used the equivalent of 547 pounds 4-11-11 fertilizer and 55 pounds nitrogen sidedressing per acre. They grew this corn under almost every climatic and soil condition in the state.

But the average Georgia farmer during the period 1951-55 produced only 16.5 bushels and made only $1.00 net profit per acre. It is estimated that he used only 301 pounds 4-10-9 fertilizer equivalent and 24 pounds nitrogen sidedressing.

The 100 Bushel Club farmers have clearly demonstrated the value of fertilizer for producing high corn yields and net profits. The difference between $1.00 and $89.00 net profit per acre speaks for itself.

Fertilization was not the only

key to the high yields obtained by the 100 Bushel Club members. Sufficient plants per acre of recommended hybrids were used to take advantage of the high fertilization. Other approved cultural practices such as land preparation and insect control were also used.

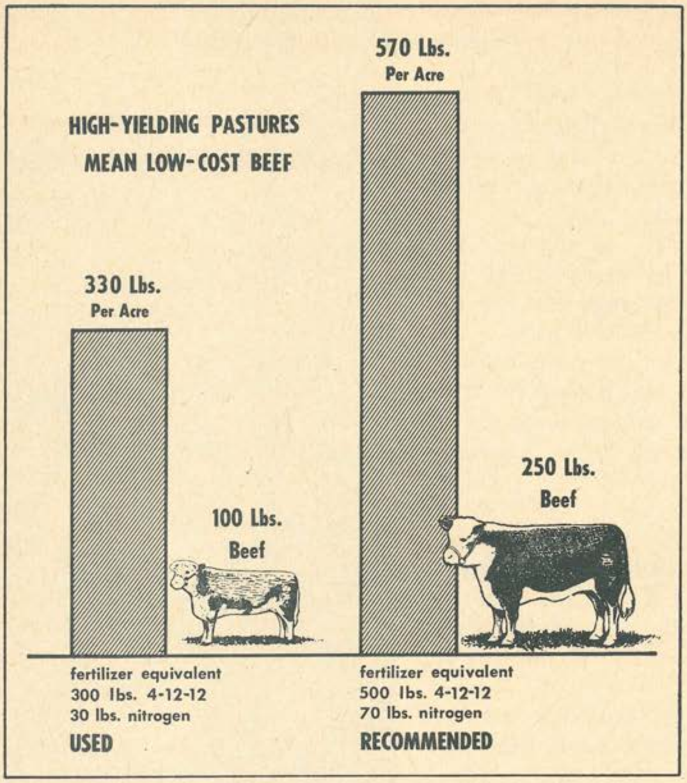
These results emphasize the large spread between yields obtained by the average and by the better farmers in the state. Although every farmer cannot average a yield of 100 bushels of corn per acre, these comparisons reveal room for considerable improvement in methods of corn production now practiced by the average Georgia farmer. The 100 Bushel Corn Club members have clearly shown high corn yields can be obtained in all areas of the state by following approved production practices.

A market is available for increased corn produced in the state.

COTTON YIELDS

It is estimated 20 million bushels of corn were imported into Georgia in 1955 for broiler feed alone. At \$1.15 per bushel, this means \$23 million went out of the state. By proper fertilization and by following other approved cultural practices, economical corn yields can be made in Georgia. Farmers will then receive greater profits and the feed mills can stop importing corn.

Cotton: For many years cotton has been the main cash crop in Georgia. Consequently, it has received more fertilizer than most other crops. Many farmers still do not use adequate fertilizer for the most economical production of cotton. Compare the fertilizer rates



Following recommendations would more than double estimated beef pounds.

HIGH YIELDING PASTURES MEAN . . .

used by the 2,903 farmers who have participated in the 5-Acre Cotton Contest since 1950 to fertilizer applications made by the average Georgia cotton farmer.

Farmers in the 5-Acre Cotton Contest have shown high yields and income are almost directly proportional to the fertilizer applied and to the number of poisonings per acre. The general fertilizer recommendation for cotton in Georgia is 500 to 800 pounds 4-12-12 or 5-10-15 fertilizer at planting and 40 to 60 pounds nitrogen side-dressing per acre. This recommendation closely parallels the amount of fertilizer used by the contest farmers who produced average yields of one and a half to two and a half bales of cotton per acre.

It should be explained yields in the 5-Acre Cotton Contest were usually obtained on better than average soils with large amounts of manure and cover crops used in some cases. The high yields obtained by the 5-Acre Contest farmers, however, are still very significant. These farmers have proved adequate fertilization is a major factor toward achieving high cotton yields. Soil tests will greatly aid cotton farmers in determining the correct amount and analysis of fertilizer to use.

Pastures: Pastures and hays constitute the most neglected segment of the soil fertility program in Georgia. The potential for fertilizer use on pasture and hay crops is tremendous. According to a 1955 county agent survey, only 300 pounds 4-12-12 fertilizer and 30 pounds nitrogen topdressing were used on improved pastures. Thousands of unimproved pasture acres did not receive any fertilizer. The average beef production on improved pastures is estimated to be 100 pounds per acre. This production is very low compared to beef gains as high as 600 pounds per acre made on Georgia Experiment Station farms.

Coastal Bermuda is one of the most efficient grasses in fertilizer utilization.

Dr. G. W. Burton, Georgia Coastal Plain Experiment Station,

LOW-COST BEEF

recommends a 4:1:2 ratio of nitrogen, phosphate, and potash for Coastal Bermuda production where 400 pounds of nitrogen per acre are applied annually. In other words, when 400 pounds of nitrogen are used, 1000 pounds of 0-10-20 fertilizer should also be applied for best utilization of the nitrogen and high Coastal Bermuda grass production. Dr. Burton's research indicates about 500 pounds of 0-10-20 fertilizer and 200 pounds nitrogen topdressing are the most economical level of fertilization for Coastal Bermuda production under average conditions in the Coastal Plain. For the Piedmont, general fertilizer recommendations are: 400-600 pounds of 4-12-12 and 80-150 pounds nitrogen topdressing.

The best method to offset low beef prices is to reduce production costs. This can be done by increasing the carrying capacity of pastures through adequate fertilization and use of high-yielding grasses and legumes.

Summary

An attempt has been made to point out the importance of following College of Agriculture fertilizer and lime recommendations to produce economical crop yields. The difference between the amount of lime and fertilizer used by the average Georgia farmer and the amount recommended is very large. If farmers had fertilized their crops according to the 1956 recommendations of the College of Agriculture, the potential for increased fertilizer use and farmer income on cotton, corn, and pastures is shown in Table VII.

The best way to obtain efficient production is to lower the cost per pound or per bushel by increasing the yield per acre. Through efficient use of fertilizer, farmers can

TABLES—ON SOIL SAMPLES, FERTILIZER USAGE ON CORN, COTTON, PASTURES

Table I. The Percentage of Soil Samples Falling into Certain Reaction (pH) Ranges in the Six Major Soil Provinces of Georgia

Soil Provinces	Total Samples	pH Ranges 1954–55*				
		Below 5.0	5.0 5.4	5.5 5.9	6.0 6.4	6.5 Above
Limestone Valley	3,492	2	18	36	23	20
Mountain	2,007	4	26	33	20	17
Piedmont	9,895	1	10	35	37	13
Upper Coastal Plain	3,242	2	20	41	28	9
Middle Coastal Plain	8,199	5	38	41	12	3
Lower Coastal Plain	3,742	12	42	36	8	2
Average	30,577	4	26	37	21	11

* Summary prepared by Soil Testing Work Group.

Table II. Estimated Rates of Nitrogen Used in 1955 by Average Georgia Farmer Compared to Amount Recommended by College of Agriculture

Crop	Pounds Nitrogen Used Per Acre by Average Georgia Farmer in 1955*			Rate of Nitrogen Recommended by College of Agriculture		
	At Planting	Side- or Top-dressed	Total	At Planting	Side- or Top-dressed	Total
Cotton	17**	25	42	20–32	40–60	60– 92
Corn	13	27	40	12–20	48–80	60–100
Oats	11	25	36	12–20	40–48	52– 68
Wheat	12	22	34	12–20	40–48	52– 68

* Estimated by county agents.
** Values expressed in pounds per acre.

cut their cost of production and share the benefits with all people. By properly fertilizing three crops —corn, cotton, and pastures—and by following other good cultural practices, it has been estimated Georgia farmers could increase their income by over $200 million annually.

A *4-Step Program*—of soil testing, adequate use of lime, proper use of mixed fertilizer and recommended applications of nitrogen—will greatly assist each farmer in obtaining his share of the $200 million potential income.

Table III. Corn Variety—Rate of Fertilization Experiment
Athens, Georgia
H. D. Morris

Average of 3 years' results (1953-1955)

Variety	No Fertilizer	250 lbs. 5–10–10+ 12.5 lbs. Nitrogen	500 lbs. 5–10–10+ 25 lbs. Nitrogen	1000 lbs. 5–10–10+ 50 lbs. Nitrogen
	Yield—Bushels Per Acre			
Open-pollinated	10.5	22.0	28.4	35.7
Dixie 22	22.0	37.1	48.9	60.7
	Net Income per acre over Production Costs			
Open-pollinated	−$3.54	$ 0.78	$ 2.22	$ 5.09
Dixie 22	$6.59	$18.91	$27.09	$35.60

Corn valued at $1.25 per bushel. Fertilizer cost based on 4-12-12 @ $44.00 per ton and nitrogen @ 12½¢ per pound. At highest level of fertilization, fertilizer costs figured on basis of 500 lbs. 10-10-10 plus 50 lbs. nitrogen. Half of nitrogen applied as sidedressing.

Adapted hybrids responded to increased fertilization all 3 years; open-pollinated variety did not respond to fertilization during extremely dry year (1953) and only up to 500-lb. rate during moderately dry year (1954).

Table IV. Per Acre Results of the Georgia 100 Bushel Corn Club
1951-1955

Fertilizer		Lbs. Nitrogen Sidedressing	Stalks	Yield	Cost Per Bushel	Income
Amount	Analysis					
547	4–11–11	55	12,377	118	$0.61	$89.00
Average Corn Yield and Fertilization 1951–1955						
301	4–9.5–9	24	6,500	16.5	$1.50	$ 1.00

Table V. Summary of 5-Acre Cotton Contest

(6-year average 1950-1955 by W. H. Sell)
2903 Farms Included

Yield per acre	Fertilization lbs. 4–12–12 per acre	Nitrogen Sidedressing lbs. per acre	Number of Poisonings per acre	Return for Labor Management and Use of Land and Equipment per acre
¾ Bale*	316**	27**	3	$83.00
1 Bale	450	29	5	111.00
1½ Bales	500	36	6	173.00
2 Bales	700	35	7	234.00
2½ Bales	850	51	8.5	295.00

* Average yield for State in 1955.
** Estimated amounts used—County Agent Survey.

Table VI. Production and Return from Coastal Bermuda Growing on a Tifton Sandy Loam Mowed Five Times

Year	Lbs. N per acre per year	Tons of hay per acre	Per cent Protein dry basis	Production cost per ton	Return per acre Hay-$25/Ton
1952*	0	1.8**	7.48	4.00	37.80
	100	5.1	10.12	8.68	83.23
	200	6.7	12.11	10.22	99.03
	400	8.7	14.71	12.94	104.92
	800	9.1	16.88	19.75	47.77
1953***	0	1.9**	6.76	4.00	39.90
	100	5.5	9.15	8.34	91.63
	200	7.6	10.96	9.50	117.80
	400	10.8	12.95	11.18	149.26
	800	12.1	15.20	15.83	110.96

* Rainfall from April 1 to October 31, 86% of normal.
** Only 1 ton/A/year can be expected on average without fertilizer giving return of $21.00/A.
*** Rainfall from April 1 to October 31, 133% of normal.

Table VII.

Crop	Additional Fertilizer Above That Used (in tons of 4–12–12)	Additional Nitrogen Above That Used	Possible Increased Farmer Income Above Extra Fertilizer Costs
Cotton	97,000	10,400	$ 24,920,000
Corn	257,140	54,384	$125,775,000
Pastures	400,000	40,000	$ 50,856,000
Totals	754,140	104,784	$201,551,000

Cotton calculated at $.32 per lb. lint, corn at $1.50 per bu., and beef at $.16 per lb.
In 1955, Georgia consumed 1,299,654 tons of fertilizer including nitrogen top- and sidedressing.

◄◄◄

FOR THE HIGHEST RETURN . . . PER DOLLAR

RANCHERS should apply fertilizers to their best rangelands for the highest return per dollar spent.

Too often ranchers put fertilizer on thin soils or rocky ground and then are disappointed because forage production is not increased substantially, reports a University of California range researcher.

Rangelands that respond best to fertilizers are abandoned grain fields, range pastures with soil several feet deep and not too heavily wooded, or pastures where livestock can feed during the critical winter period, according to Alfred H. Murphy, superintendent of the University's Hopland Field Station in Mendocino county.

Studies at this range research station show that the costs of fertilizer applications vary considerably with the method used. And the method is limited by the terrain, accessibility, soil condition, and time of application.

In tests of both ground and air rigs on the Hopland research range, Murphy found that more areas were missed with ground rigs. Also, rough ground was hard on the equipment, which is designed for cultivated ground.

If the ground was wet, as it is during much of the winter, the soil often could not support equipment. When the equipment could get on the ground, it tore up the soil so badly that it offset any advantage derived from the fertilizer.

On rough terrain, particularly larger acreages, airplane applications also proved more economical, said Murphy. Prices can vary from one to four cents per pound of fertilizer applied, depending on the distance from the air strip to the range area being fertilized.

A plane generally carries between 1,000 and 1,400 pounds of material per flight and will spread a strip from 25 to 40 feet wide, depending on flying altitude. The lower the plane can fly, the less the opportunity for wind to blow the fertilizer away from the area to be treated, said Murphy. However, pelleted fertilizers are less blown away by wind than powdery types.

Another cost-cutting possibility is to use as high an analysis of fertilizer as is available, since flying costs are figured on a per pound basis.

The irregular topography and scattered trees on the land often cut down the pilot's visibility. Pre-fertilizer planning will help ranchers get more complete coverage of their rangelands at the lowest costs.

A SYSTEM FOR RECORDING

An efficient data file is important to research . . . like this card system used in soil fertility work . . . providing space . . .

- **For actual data**
- **For statistical analysis**
- **For field plan**
- **For soil tests**
- **For supplementary data**

BY J. F. DAVIS • SOIL FERTILITY RESEARCH

MICHIGAN STATE COLLEGE

AN efficient data file is an important part of any research program. Unless an adequate compilation system is followed, data and notes from an experiment are often recorded at random on loose sheets of paper or note pads. These can easily be lost or misplaced, which increases the difficulty in preparing the final evaluation of the experiment.

The following system was initiated in the Soil Science Department at Michigan State University in an attempt to improve efficiency in compiling the data obtained from the soil fertility research work. The data are recorded on 8½ by 11 inch cards as illustrated in Figure 1.

On the front of the card, spaces are provided for recording: 1) the crop; 2) the year; 3) year the experiment was initiated; 4) file number; 5) nature of research; 6) location including the name of the cooperator, phone number, address, county, township and legal description of the farm; 7) soil type; 8) plot size; 9) number of replications; 10) crop variety; 11) planting date; 12) harvest date; 13) size of harvest area in square feet; 14) row spacing; 15) seed

SOIL FERTILITY DATA

Dr. J. F. Davis, head of Soil Fertility Research at Michigan State College since 1955, is a native of that state, having earned his Ph.D. at Michigan State in 1943. Since then, he has become recognized as one of the leading authorities on muck soils.

calibration; 16) basic fertilizer, including the number of pounds per acre and the placement used; 17) minor elements; 18) the conversion factor to convert pounds per plot to the appropriate unit of measure per acre.

Lines are provided for 26 treatments identified by capital letters with their mean yield values. Blanks for the least significant differences at the 5% and 1% levels are included.

Space is provided for recording soil test data for nine samples. These include spaces for recording the extracting solution and pH, nitrogen, phosphorus, and potassium test results. This leaves blanks for two other tests. Spaces are provided for personnel, including the particular department and the various cooperating agencies. An area is set aside for recording the spray and dust treatments. Approximately one third of a page is devoted to remarks.

The spacing between the lines on the front part of the card is $\frac{3}{16}$ inch.

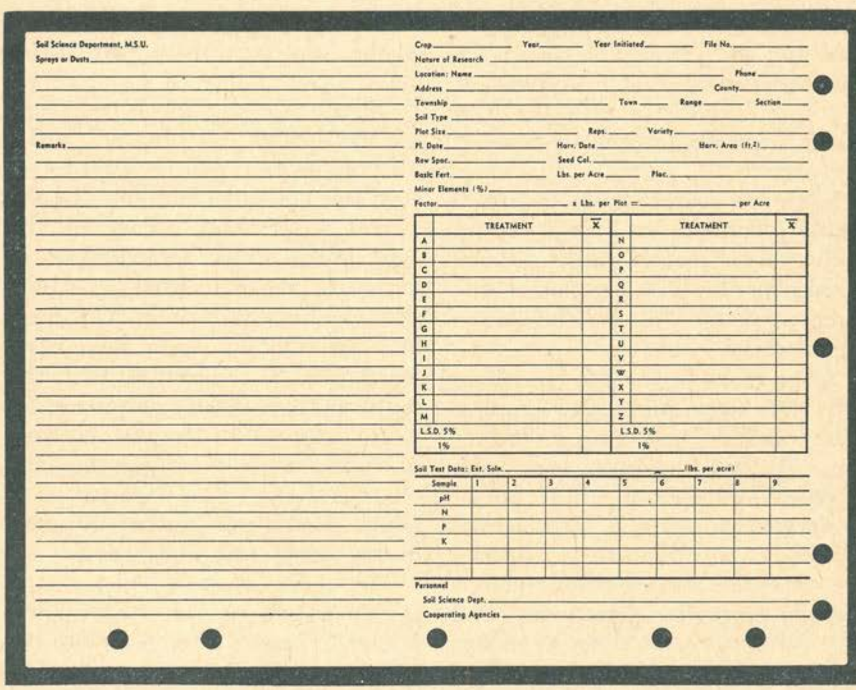
On the reverse side of the card are 833 spaces, $\frac{3}{16}''$ by $\frac{1}{2}''$. This side of the card can be used to record the field plot outline. In the upper right hand corner of the card is an arrow arrangement to designate the directions in which the experimental area has been laid out. On the lower right hand margin is a suggestion that the plots and replications be numbered either from south to north or west to east so as to encourage the various members of the department to adopt a uniform system in numbering plots and replications.

The cards are punched to fit all standard two or three ring notebooks. There is a hinge line to the left of center of the page between the treatment table and the remarks portion for fitting this card into an eight inch size notebook.

The procedure suggested in using the cards is as follows: When the experiment is laid out, all available data are recorded in the various blanks provided for this purpose. The field plot outline with appropriate measurements is drawn on the reverse side of the sheet with no attempt made to draw it to scale. This card is carried into the field and all notes taken throughout the season are recorded in the appropriate spaces. After the final data from the experiment are obtained the card is referred to a central office where the data are analyzed.

If a simple analysis of variance is all that is required, the final analyses of variance tables are typed on the reverse side of the sheet. The original copy is then returned to the man in charge of this particular experiment and the typed copy filed in a common file. If there is not room on the reverse side of the card for all of the data that might be obtained from an experiment, it is convenient to clip two cards together or to put the additional data on a regular 8½ x 11 inch typing paper and staple it to the original card.

If additional copies of the data are needed to send to cooperating agencies, a copy of the typed card can be easily duplicated on one of several duplicating machines that are now available. One of the



Soil Science Department, M.S.U.

Sprays or Dusts

Remarks

Crop ___ Year ___ Year Initiated ___ File No. ___
Nature of Research ___
Location: Name ___ Phone ___
Address ___ County ___
Township ___ Town ___ Range ___ Section ___
Soil Type ___
Plot Size ___ Reps. ___ Variety ___
Pl. Date ___ Harv. Date ___ Harv. Area (ft.2) ___
Row Spac. ___ Seed Col. ___
Basic Fert. ___ Lbs. per Acre ___ Plac. ___
Minor Elements (%) ___
Factor ___ x Lbs. per Plot = ___ per Acre

	TREATMENT	$\overline{X}$		TREATMENT	$\overline{X}$
A			N		
B			O		
C			P		
D			Q		
E			R		
F			S		
G			T		
H			U		
I			V		
J			W		
K			X		
L			Y		
M			Z		
L.S.D. 5%			L.S.D. 5%		
1%			1%		

Soil Test Data: Ext. Soln. ___ (lbs. per acre)

Sample	1	2	3	4	5	6	7	8	9
pH									
N									
P									
K									

Personnel
Soil Science Dept. ___
Cooperating Agencies ___

Fig. 1—An efficient data file is an important part of any research program. Here is the front side of the 8½ x 11 file card used in soil fertility research work at Michigan State College. Reduced as it is, you can see the space provided for the actual data, statistical analysis, field plan, soil tests, and supplementary data. The back of the card contains 833 spaces for recording the field plot outline.

most convenient types for this purpose uses a dry process in the copying procedure.

To further facilitate filing, cards can be printed on various color stock and as many as twelve different kinds of stock may be available. One color may be used for a certain crop or a series of crops such as small grains, root crops, beans, legumes, non-legumes, and so forth.

The cost per card after the plate has been prepared is from three to four cents when purchased in lots of one thousand.

This system has been developed over the past four years by members of the Soil Science Department at Michigan State University. It has proved to be very convenient and has improved efficiency in processing data from field experiments.

Revisions required to adopt these cards to specific situations can easily be made.

Authorized for publication by the Michigan Agricultural Experiment Station, Michigan State University, as Journal Article No. 2018.

A 23 FOR 1 RETURN

When nitrogen and phosphate levels are kept high the acre value of burley tobacco can be increased, even though yields are only slightly affected. For instance, on a soil well supplied with nitrogen and phosphate, but low in potash, an application of 150 pounds of potash increased the income $283 per acre even though the yield was increased only about 100 pounds. This was an increase in crop value of $23.58 for each dollar spent on potash.

Kentucky Bankers Association

At Morrow Plots

Fertilizers Revive Worn Out Soils

On Nation's Oldest Soil Experiment Plot

A plot of land planted to corn ever since 1876 and receiving no plant-food treatment until 1955, produced 113 bushels per acre this year. This high yield was made on one of the famed University of Illinois Morrow plots, the oldest soil experiment plots in America.

The 1956 corn yields show that low yields caused by continuous cropping of corn were due to loss of plant-food nutrients and not to the changes in the physical conditions of the soil, M. B. Russell, head of the agronomy department at the University, points out.

Changes have taken place in the physical condition of the plots which have been in continuous corn. Organic matter is lower and the soil is harder to work than on plots in a corn-oats-meadow rotation. But Russell says these changes in physical condition have not been a major factor affecting yields when enough plant food has been supplied.

Altogether, four different treatments were used on the corn section of the Morrow plots this year. They were:

1. Continuous corn plot with no treatment since 1876 yielded 29 bushels per acre.

2. Continuous corn with no treatment until 1955, then treated in 1955

Record corn yields on the University of Illinois Morrow plots followed the same pattern experienced by many farmers as they harvested their 1956 crop. A. L. Lang and L. B. Miller, members of the committee in charge of the Nation's oldest soil experiment plots, had to do some careful piling to get all the corn from the top treated plot in the basket. Yields for the treatments shown on opposite page, from left to right, were: none since 1876, 29 bushels per acre; manure-lime-phosphate treatment since 1904, 96 bushels per acre; continuous corn with no treatment 1876 to 1955, then lime, nitrogen, phosphate, and potash 113 bushels; manure-lime-phosphate since 1904 plus nitrogen, phosphate, and potash in 1955 and 1956, 128 bushels per acre. (Ill. Agr. Extension Service Photo)

and 1956 with lime, nitrogen, phosphate, and potash. This plot yielded 113 bushels per acre.

3. Continuous corn plot with manure-lime-phosphate treatment since 1904 yielded 96 bushels per acre.

4. Continuous corn with manure-lime-phosphate treatment plus extra nitrogen, potash, and phosphate in 1955 and 1956. This plot yielded 128 bushels per acre.

The startling recovery of yields made on the Morrow plots can't be expected on all kinds of soils, say the Illinois agronomists. A soil with good natural physical qualities such as found in central Illinois can be expected to recover much like the Morrow plots. But there are many worn out soils in Illinois that can't be rejuvenated with heavy plant-food applications as was done here.

The total amounts of plant food per acre added in 1955 and 1956 to the previously untreated plot were five tons of lime, 400 pounds of nitrogen, 190 pounds of phosphate, and 130 pounds of potash. It is not suggested that these are practical applications. They were designed to completely remove plant-food deficiencies. . . . *Extension Editorial Office, College of of Agriculture, University of Illinois, Urbana, Illinois.*

NOT ENOUGH . . . FOR MAXIMUM PROFITS

TWO Indiana agronomists report that most farmers are not applying enough fertilizer for maximum profits, even with today's grain prices.

A. J. Ohlrogge and Paul R. Robbins, of Purdue University's agronomy staff, say that many farmers on highly productive, non-erosive soils have not yet moved to heavy fertilization and the more intensive rotations which fertilization makes possible. The agronomists' statement was summarized by the Middle West Soil Improvement Committee.

"Even with lower grain prices," says their statement, "many of these farmers have a real opportunity to boost profits by intensification of rotations and heavier fertilization, especially with nitrogen."

The added profits that come with heavier fertilizer use, says the Middle West Soil Improvement Committee, can provide farmers with the cash to buy and enjoy modern home conveniences which they and their families desire. These profits can help finance the purchase of improved machinery and other labor-saving equipment.

4-H YOUTH . . . GROWS 203 BUSHELS PER ACRE

A 17-year-old Brooks County youth has produced what may be Georgia's all-time record for a corn yield. Danny Strickland harvested 203 bushels of corn per acre from a 4-H project patch.

Danny is no new-comer to Georgia's 100-Bushel Corn Club circles. His yields for three consecutive years prior to 1956 were 134, 132, and 149 bushels. He made 68 bushels per acre in 1952, first year he carried a corn project. This marks the fourth year he has won the corn growing championship in his county and area. And he has been Southcentral district champion three years.

Young Strickland has earned more than $1,000 in awards with his corn and livestock projects, and still has another year of active club work ahead of him. One of his goals is to produce over 100 bushels of corn per acre this year and become a five-year member of the Georgia 100-Bushel Club.

Danny's 1956 yield was checked and double-checked by J. Frank McGill, Extension Agronomist. Studying corn records back to 1925, J. R. Johnson, agronomist project leader for the state, says the 203-bushel yield is a record.

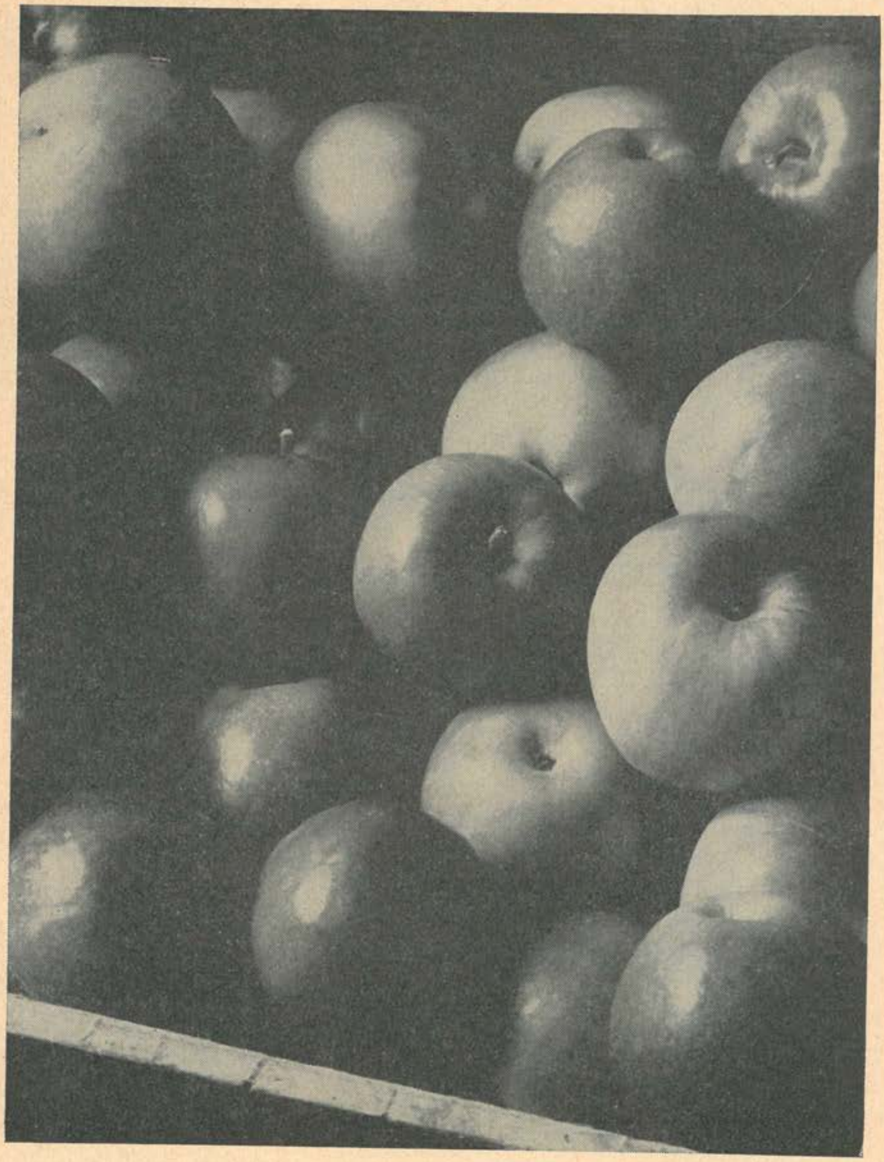
Key to Danny's corn growing ability has been his cultural practices. He applies fertilizer in rows 36 inches apart, then plants two rows of corn between the rows of fertilizer. The rows of corn are only 18 inches apart—about half the normal distance. With stalks about 14 inches apart in the drill, he has about 22,500 plants per acre.

While Danny has contributed a lot of know-how to growing corn in Georgia, McGill says his close row spacing is not practical for the average farmer on average soil. The agronomist points out that this corn crop was on good bottom land—and that weather and moisture conditions were "just right." Had it been just a little dry, McGill believes there would have been trouble with that thick spacing.

For this champion grower, the corn season starts in January. He begins by cutting stalks from the previous year with a rotary mower. He then applies a ton of compost per acre. Next step is subsoiling the land—14 inches deep, four feet apart. Late in February he harrows the land and plants the corn—a good hybrid.

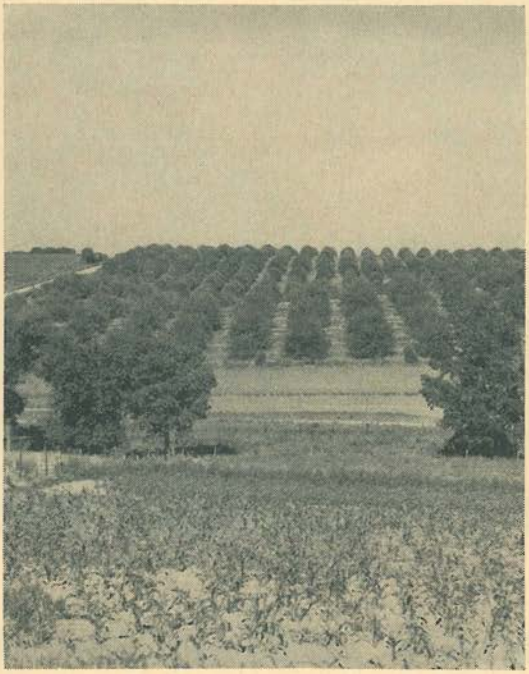
At planting time he uses *900 pounds of 6-12-12 fourteen inches deep in bands 36 inches apart.* Cultivation consists of plowing out the middles around April 15, and again ten days later. The corn was sidedressed last spring at the second cultivation (67 pounds of nitrogen and 200 pounds of 6-12-12). Fifteen days later Dan used another 25 pounds of N and 75 pounds of muriate of potash.

RED, RIPE APPLES . . .



. . . DON'T JUST HAPPEN

FROM THE NURSERY . . .



THROUGH leaf analysis surveys and
horticulturists have concluded "it is no
alone' program for fertilizing Massachus
suggests the nitrogen and potassium need

Potential bushel yield of tree	Appr	
	Nitrogen required	Pot re
	Pounds N	Pour
Less than 15	0.66	
15–25	0.66–1.00	1.
More than 25	1.33–2.00	2.

They also recommend for these fertiliz
the spread of branches. When materials
it may be necessary to increase the rate
response as the band application.

Magnesium requirements for orchard sc
sufficient dolomitic lime to maintain a soil
limed in the past, it may also be nece
prevent occurrence of magnesium defici

And boron, they say, should be applie
with borax being the most common mate
tree vary with age and size from approx
¾ lb. on medium age and size trees, and
case, they suggest, should the rate of one

THEY REQUIRE WISE FAR

ɔther experimental evidence, Massachusetts
longer possible to recommend a 'nitrogen
etts apple orchards." The following table
ed for trees of different ages:

ɔximate amounts per tree

ıssium uired	5–10–10	8–16–16
ds K_2O	Pounds	Pounds
.3	13	8
–2.0	13–20	8–12
–4.3	26–40	16–25

s to be put on by band application under
re broadcast over the whole orchard floor,
application in order to get the same tree

can best be met, they report, by applying
H of 6.0 to 6.5. On orchards inadequately
ary to apply magnesium sulfate sprays to
cy.
to orchard soils every three to five years—
al. Recommended rates of application per
ately ¼ lb. of borax on young trees, ½ to
to 1 lb. on large or mature trees. In no
pplication of borax exceed 50 lbs. per acre.

. . . TO THE FRUIT

ING, CAREFUL HARVESTING

TO BE PROCESSED INTO GOOD FOOD . . .

Boron deficiency showed up in a large percentage of apples harvested in 1956. You can correct this . . . Let's start today.—From *Fruit Notes,* N. C. Agricultural Extension Service.

. . . FOR THE MODERN-DAY MARKET

The Editors Talk

OF FOODS AND FASHIONS

With the average family spending about one-fourth of its income on food, agricultural research is devoting more and more time to the *quality* of the finished product.

Among its latest recommendations to the U. S. Department of Agriculture, the Vegetable Research and Marketing Advisory Committee gave top priority to two areas:

- **"Expanded studies on genetics and breeding of vegetable varieties resistant to insects, nematodes and diseases, *with better eating and commercial qualities.*"**

- **"Research leading to development and improvement of farm machines for producing, farm handling, and storing commercial vegetable crops."**

Two examples of research toward such quality are the food processing studies now underway at the Geneva Experiment Station in New York and the potato trash remover recently developed by the Florida Agricultural Experiment Station.

Supermarkets and many crossroads stores today cater to a buying public that judges its food largely by looks and tastes. You might almost say by fashion—by its aroma, its color, its texture, its general appearance. But these terms are too general for the food scientist.

So, the Geneva Station is working to reduce them to factors that science can measure quickly, accurately, eliminating guesswork, personal likes and dislikes. Much work is being done to develop equipment and methods for measuring objectively the various factors that go to make up *quality*.

And the Florida Station developed its potato trash remover to enable the harvester to work faster without slowing up the packinghouse.

Though such research directly benefits the farmer and processor, the real beneficiary is the consumer—the busy, child-loaded housewife, the tired, Friday-evening-shopper husband searching the markets for foods that smell good, look tasty and nutritious, something worth spending one-fourth their income for.

LIME...

ITS PLACEMENT AND PENETRATION

IN SOILS

• In humid regions, lime is constantly lost from upper to lower layers of soil and in the drainage water.

• Slow but certain downward movement of soluble lime containing compounds means we can reduce the acidity of soils below where lime is mechanically placed.

• Since subsoils are usually less acid than topsoils and since the roots of most plants do not penetrate very deeply, we can place lime most effectively in the upper few inches of soil.

LIMING soils is an old, much discussed subject. In fact, it is so hoary, many impatient people exclaim: "The only point to talk about is how to stimulate a greater use of lime."

Most so-called agriculturalists, including the writer, will quickly agree that more lime should be added to acid soils. There is plenty of evidence it is a sound fertility practice—and that it pays.

This article deals with placement and penetration of lime in soils. Fertilizer placement has long been studied, and for several crops precise positions have been recommended. In the case of lime, getting it on a field somewhere within its borders seems too often to be the only objective.

By B. A. Brown[1]

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Storrs Agricultural

Experiment Station

•

Connecticut

Years ago, nearly everyone assumed lime was spread quite evenly *after* plowing and mixed with the upper 2 to 4 inches of soil with a harrow of some kind. Two modern practices have changed this general pattern: 1. Truck spreading has become common, and because of better traction, the operators prefer spreading the lime *before* the land is plowed; 2. Acutely angled disk harrows, drawn by tractors in high speed, tend to bury lime, drilled after plowing, in bands several inches below the surface.

What happens to lime spread on the surface before plowing? That will depend on the angle of the furrow slice as the land is plowed. With upright (90°) furrows, the lime may be quite evenly distributed in depth through the tilled layer; with flat, completely turned over furrows, most of the lime will be at the bottom of the plowed part of the soil; even in the case of the most common, (450°) partially overlapping furrows, there is likely to be less lime in the upper 2 or 3 inches of soil than in the lower levels.

There are many other questions about placement of lime. A common one is: "If lime is spread on the surface several months or a year before plowing, will it not have moved downward enough so

[1] Agronomist—Storrs (Connecticut) Agricultural Experiment Station. Much credit should be given to R. I. Munsell, A. V. King, R. F. Holt, and John Scarchuk for their work on liming problems.

that most or all of the plow-layer is decreased in acidity?"

The answer is an emphatic "No!" Little, if any lime, either in the form of chemically fine hydrated lime, or the relatively coarse ground limestone, is carried downward, *in those forms*, by water, frost action, and small animals. Before moving much from where it is placed by men and machines, particles of limestone must disintegrate to chemical fineness (molecules of calcium carbonate, $CaCO_3$) and then react with other chemical liming compounds.

Although magnesium carbonate ($MgCO_3$) and magnesium hydroxide [$Mg(OH)_2$] are found along with calcium in many liming materials, their chemical behavior is quite similar to comparable calcium compounds. This discussion will, therefore, deal only with reactions involving calcium.

The most common acid in soils is carbonic acid (H_2CO_3), which may react with either calcium carbonate or calcium hydroxide [$Ca(OH)_2$] to form calcium bicarbonate [$Ca(HCO_3)_2$]. Some of the calcium (Ca) from the soluble calcium bicarbonate may displace or exchange with the acid, hydrogen (H) ions which predominate on the surfaces of the very small, active particles of acid soils. The extent to which hydrogen is displaced by calcium will depend on the concentration of calcium bicarbonate in the soil solution and on the span of time it is maintained. In turn, the concentration will depend on the rate of liming, on the amount of hydrogen to be displaced, and on the amount of leaching rains which will dilute and carry downward any soil solution.

Hydrated lime [$Ca(OH)_2$], though chemically fine when applied, is not very soluble in that form. So it, too, must react with carbonic acid before it is very effective in counteracting soil acidity. Nevertheless, hydrated lime acts much more quickly than limestone because it is already in extremely small individual particles. In a few months or a year, however, equal amounts of calcium from either ground limestone or hydrated lime will replace about the same number of hydrogen ions and penetrate to the same depths below where it was mechanically placed in the soil.

Lime Movement

For two reasons, lime materials applied to the surface react much more slowly than those mixed with the soil: (1.) It comes into contact with much less soil and carbonated water; (2.) The soil solution, at or near the surface, soon becomes saturated with calcium bicarbonate and further formation of that active chemical compound must await its dilution, either by exchange of calcium with hydrogen or by additional water from rain.

As rain falls, the surface-layer of soil becomes filled with diluted solution, and some of it gravitates downward. As soon as the soil solution moves downward, it comes into contact with soil previously unexposed to active lime compounds from the surface liming. Thus, the acidity of another thin layer of soil is decreased and in this process the concentration of calcium bicarbonate is reduced, thereby permitting more to be formed.

The source of calcium to form more calcium bicarbonate may be calcium carbonate and hydrated lime, if any of those compounds remain in the soil—or some of the calcium on the very fine soil particles may be taken for the purpose and replaced by hydrogen. Except when frozen or very dry, the latter process is occurring constantly in unlimed soils, and on limed soils after any added lime is exhausted. The more calcium replaced by hydrogen, the more acid the soil. Eventually the surface film of soil will be largely acid because there is no source of calcium above it. Lower layers will become richer in calcium and less acid as long as there is exchangeable calcium higher up.

In view of these facts, it is obvious the more lime placed at any given level in a soil, the greater the movement of calcium containing compounds to lower levels. For the same amounts of applied lime, the downward movements from where it is placed will, in time, be greater if it is concentrated in a thin layer of soil than if mixed with more soil. For example, limestone at one ton on the surface reduced the acidity of the third inch after five years, but if that ton had been mixed with the upper three inches of the same soil, all of it would have been needed to replace the hydrogen in that zone and little would have been available at any one time for forming mobile calcium bicarbonate.

Should Lime Be Plowed Under?

Another common question is whether part of the lime should be plowed under and part added and disked in after plowing. The answer to this question will depend chiefly on the acidity and character of the soil and subsoil, on the total amount of the lime to be used, and on the root system of the crop. If we assume the soil has been limed and tilled a few times in recent years, it is probable the plow-layer is quite uniformly low in acidity, and the acidity of the upper subsoil has been somewhat decreased by the downward movement of soluble lime compounds from the topsoil.

If the soil has never been limed or not limed for a long time, the subsoil is likely to be less acid than that nearer the surface. In both of these situations, only that part of the lime *not* needed to raise the pH of the upper three or four inches to about 6.5, should be plowed under. If light or "fractional" liming is planned, the nearer the surface the lime is placed, the more effective it will be. The truth of the last statement has been demonstrated for deep-rooted alfalfa; near-surface liming would be even more effective for shallow-rooted crops.

Evidence from other experiment stations indicates root development occurs to a greater extent in the limed layers of strongly acid soils. Some increases in yields have usually resulted from such increased amounts and distributions of the root systems. It is to be expected, therefore, that the best growth of some plants will be obtained from placing some lime in strongly acid subsoils, even if all of the plow-layer has been limed to low acidity (about pH 6.5).

It should be emphasized, however, that using less lime in the topsoil so some can be placed in or on the subsoil is likely to be a disappointing practice. It should also be kept in mind that, in humid regions, the slow but certain downward movement of soluble lime compounds will, in time, reduce the acidity of the lower layers of soil. How much and how rapidly such changes will be for any given soil and climate will depend on the amount of lime applied on the surface of permanent grassland or mixed with the plow-layer of tilled fields.

The preceding statements will be substantiated by some data obtained in long-time liming experiments at the Storrs (Connecticut) Agricultural Experiment Station. There, many lime penetration experiments have been conducted on glaciated fine sandy loam soils, which naturally have much more organic matter, exchange capacity, and acidity near the surface than at lower levels. The annual precipitation in Connecticut averages about 45 inches, with February and June having the least—slightly over 3 inches; and July and August the most—approximately 4.25 inches. Soils are usually frozen most of the time in December, January, and February.

It may be noted in Table I that limestone at 4 tons, mixed with the plow-layer 18 years before sampling, had not affected very much the acidity of the subsoil. On the other hand, all of the heavier applications had increased the pH values down through the 25-30″ level. It is also readily apparent that the changes in all horizons increased with increases in rates of liming. Since the plow-layer of all limed plots was more acid at the time of sampling than *any* of the subsoil-layers, all future applications of lime should be disked in *after* plowing.

In the first few years of that experiment the subsoil was unaffected by the lime added to the plow-layer, yet deep-rooted alfalfa grew very well. Why? Because, as is usually the case, none of the subsoil-layers were strongly acid (below pH 5.8), as shown in the no-lime column of Table I.

In Table II are the pH values of soil samples from widely vary-

Table I—Reactions (pH) at Various Depths 18 Years After a Tilled Soil Was Limed at Different Rates *

Depth (Inches)	Limestone applied and mixed with plow layer from 1914 to 1919 (tons per acre). 0	4.0	5.5	7.0	8.5	10.0
0–8	5.2	5.8	6.1	6.1	6.3	6.2
9–12	5.8	6.0	6.3	6.3	6.6	6.6
13–18	6.2	6.2	6.5	6.6	6.8	6.9
19–24	6.3	6.2	6.5	6.6	6.8	6.9
25–30	6.3	6.2	6.5	6.5	6.6	6.9
31–36	6.4	6.2	6.4	6.5	6.6	6.7

* Alfalfa was the crop grown on the *limed* plots in most of the years under consideration. The pH values in the "O" lime column were obtained by testing soil samples taken from adjacent, unlimed, grassed roadways.

ing surface limings 2, 5, 9, and 23 years after application on long untilled grassland. It is readily apparent that, two years after liming, even the 8-ton rate had not affected the acidity below the second inch, and 16 tons below the fourth inch. These data illustrate the futility of either liming very heavily on the surface or waiting for surface-applied lime to become evenly distributed through the plow-layer.

On the other hand, the pH values obtained nine years after liming show either 4 or 8 tons had decreased the acidity to a depth of 12 inches, and 16 to 18 tons probably to 24 inches.

The values found 23 years after the limestone was added are about the same at all levels for all rates below 8 tons. Those data afford unmistakable evidence that lime had gradually moved from higher

Table II—Effects of Surface Liming at Several Rates on the pH Values of the Soil at Various Depths After Different Lapses of Time[1]

Depth (Inches)	Tons of limestone per acre[2] 0	1	2	4	8	16
		A. Two years after liming.				
1	5.7	6.0	6.5	7.1	7.2	7.5
2	5.5	5.4	5.7	6.1	5.9	6.5
3	5.4	5.2	5.5	5.4	5.4	6.1
4	5.3	5.2	5.5	5.5	5.3	5.8
5	...	5.2	5.5	5.3	5.2	5.6
		B. Five years after liming.				
1	5.5	5.9	6.3	6.6	7.4	7.6
2	5.5	5.8	6.2	6.5	7.2	7.6
3	5.5	5.6	5.9	6.2	6.9	7.4
4	5.4	5.4	5.6	5.8	6.5	7.0
5	5.4	5.4	5.5	5.6	6.1	6.6
6	5.5	5.5	5.5	5.6	5.9	6.2
		C. Nine years after liming.[3]				
0–6	5.5	5.6	5.9	6.2	6.8	7.2
7–12	5.4	5.5	5.5	5.7	5.9	6.1
13–18	5.8	5.8	5.7	5.8	5.9	6.1
19–24	5.7	5.8	5.8	5.8	5.8	6.0
25–30	5.9	6.0	5.8	5.8	5.7	5.9
		D. 23 Years after liming.[3]				
0–6	5.5	5.5	5.6	5.5	5.9	6.8
7–12	5.7	5.7	5.8	5.9	6.2	6.8
13–18	5.9	5.9	5.9	5.9	6.2	6.6
19–24	5.9	6.0	5.9	5.9	6.1 –	6.5
25–30	6.0	6.1	6.0	5.9	6.1	6.3

[1] All pH values are averages of three replicate plots.

[2] The entire area of this long-untilled grassland had received limestone at one ton per acre four years previous to beginning this experiment.

[3] The values at the greatest depths to which liming had caused definite increases in pH are underlined.

[4] To save space, only the average values of several 1-, 2-, or 3-inch layers with small differences are given in the 9- and 23-year sections of this table.

Table III—Comparison of pH Values at Various Depths From the Same Amounts of Limestone Applied at Different Times on the Surface of Long Untilled Grassland [1]

Depth (Inches)	Tons of limestone per acre		
	None	4 in 1930	1 in 1930, 1934, 1944 and 1951
1	5.6	5.4	6.1
2	5.5	5.5	5.9
3	5.5	5.6	5.8
4	5.5	5.7	5.8
5	5.5	5.8	5.7
6	5.6	5.8	5.7
7–12 [2]	5.7	5.9	5.8
13–18 [2]	5.9	5.9	5.9
19–30 [2]	6.0	5.9	6.0

[1] All pH values are averages of 3 or more replicate plots.
[2] Averages of 2 or 3 layers with only small differences in pH values.

to lower levels, and that most of it had finally been leached from the upper 30 inches of the 1-, 2-, and 4-ton plots. The 8- and especially the 16-ton plots still showed marked effects of the treatments applied a generation before!

Another question usually asked is: "Which is better practice—to lime heavily and infrequently or lightly every few years?"

Evidence on this question is presented in Table III. There, the pH values in 1953 from the plots which received limestone at four tons in 1930, only, are compared with those where limestone was added at one ton in each of four widely separated years: 1930, 1934, 1944, and 1951.

The data show that in 1953 the upper 3 inches were much less acid where the limestone was added at intervals than all at once in 1930. The average difference was 0.4 pH. Below the third inch there were very small differences, but what differences there were indicate that the large single application had reduced the acidity of the lower levels more than the periodically added limestone.

For most crops, the acidity of the soil near the surface is more important than that of the subsoil. Moreover, it is probable that less lime will be lost by leaching if smaller amounts are added at one time. However, where it is important to reduce the acidity and supply calcium and magnesium below the level of placement, dolomitic limes at high rates, either at one time or within a few years, may be expected to give the desired results.

Summary

In humid regions lime is being constantly lost from upper to lower layers of soil and in the drainage water.

This slow but certain downward movement of soluble lime containing compounds means that it is possible to reduce the acidity of

soils below where lime is mechanically placed.

Subsoils are usually less acid than topsoils, and since the roots of most plants do not penetrate very deeply, it is concluded that the most effective placement of lime is in the upper few inches of soil.

The data on which many of the statements in this article are based were published in *Soil Science Society of America*, Proceedings 1, 3, 20.

◄◄◄

GREEDY GRASSES EAT OVER THEIR SHARE

HOW much potash do grasses need for economical growth? That's the question being asked by researchers at VPI Agricultural Experiment Station, who are engaged in some basic studies aimed at helping the farmer get more from his fertilizer dollar.

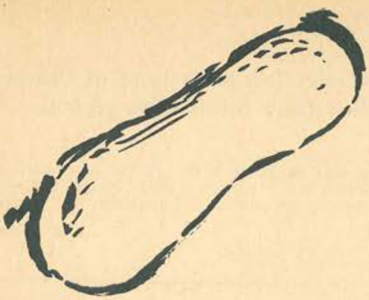
Coleman Y. Ward, assistant agronomist at the Station, says there is a question as to whether grasses actually need all the potash they absorb. They often show little response to potash fertilizers, but absorb large amounts of the potash from the soil. In contrast, legumes such as *alfalfa and ladino clover give large growth responses to potash fertilizers, but do not absorb potash at the high rate which grasses do.*

The results of studies to date indicate that orchard grass takes up more potash than it actually needs. Orchard grass has been found to absorb up to 5 percent of its weight as potash, yet in so doing did not make appreciably higher yields than orchard grass on lower levels of potash where only 1.5 to 2 percent of its weight as potash was absorbed.

Ward explains that ladino clover is often penalized when grown with orchard grass (or any grass) because the grass begins growth earlier in the spring and absorbs large amounts of potash. By the time the clover resumes its growth, the potash available may be inadequate for good clover growth.

Thus, clover has two strikes against it from the very outset of the growing season. First, there is an inadequate or diminished supply of potash needed for normal growth. Second, since the clover is weakened and resumes growth later in the season, the tall-growing grasses are even more successful in their competition for light, water, and other nutrients.

Ward says these results support field studies of similar findings and have far-reaching practical application. Basic studies are being continued on the potash needs of grass-legume mixtures, and they may someday lead to better management practices.



PEANUT

By B. E. Grant

FOLLOWING most of the recommendations modern science has given him, W. G. Tarkington of Bertie County, North Carolina, produced a prize-winning crop of peanuts—4040 pounds on one measured acre, with 8 per cent moisture and 1 per cent foreign matter.

For this yield, he was declared county champion peanut producer for 1956—and also qualified for membership in the North Carolina Two-Ton Peanut Club, sponsored by the N. C. Peanut Producers Association.

Tarkington is a member of the Woodard Adult Farmers Peanut Club, organized and supervised by A. T. Hicks, agricultural teacher of the Windsor High School. This club consisted last year of 18 members, each trying to see how many peanuts he could produce on one measured acre by following recommended practices. Their aim was to qualify for membership in the Two-Ton Peanut Club.

Fig. 1. Good field of N. C. 2 peanuts in Bertie County, North Carolina, where W. G. Tarkington grew 4040 lbs. on one acre, using 200 lbs. of 60% muriate of potash, 400 lbs. of lime, and 400 lbs. of 0-9-27.

FARMER USES FINDINGS TO PRODUCE PRIZE CROP

Agricultural Extension Service • N. C. State College

Tarkington was the only member whose yield was high enough to qualify for this distinction, though the other members averaged 27 bags per acre, with bags averaging 110 pounds each or totaling 2,990 pounds per acre. This is about double the normal average county yield.

Following most of the practices recommended by the N. C. Agricultural Experiment Station, Tarkington grew his peanuts in a three-year rotation with tobacco and corn. The corn crop on this land in 1955 was fertilized with 600 pounds of 5-10-10 at planting and sidedressed with 500 pounds of 20-0-20.

Other county peanut farmers who have used additional potash in the rotation to the crop that precedes peanuts report higher peanut yields by following this practice. Though this amount of additional potash to the preceding crop is usually considered sufficient for the peanuts, soil tests indicated a need for more potash. So, being out to win, Tarkington mixed 200 pounds of 60 per cent muriate of potash with 400 pounds of 0-9-27, plowing it all in before planting.

An estimated 90-bushel yield of corn was produced on this land in 1955, using Dixie 82, a recommended hybrid.

The peanut crop was planted to the N. C. 2 variety on May 8 in 3 ft. rows and 6 to 8 inches in the drill. This variety was developed by Dr. W. C. Gregory of the N. C. Agricultural Experiment Station. In 1954, sixteen Bertie farmers reported an average of 366 pounds more peanuts per acre with this variety than with the farm stock which they were using.

Fig. 2. Applying landplaster on top of row to supply calcium to developing pods.

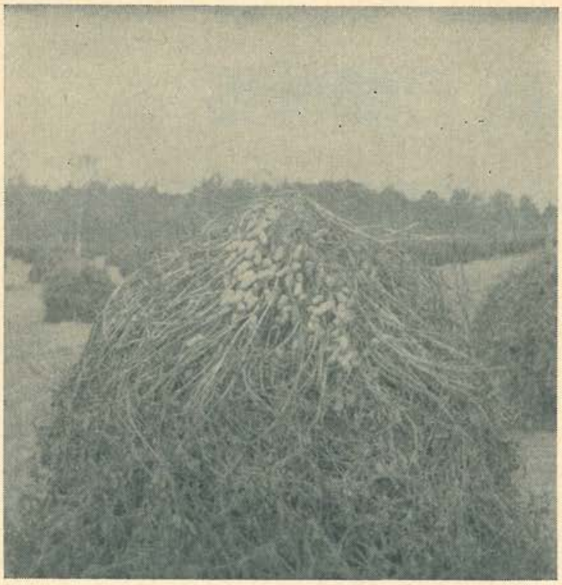


Fig. 3. N. C. 2 peanuts, close-up, show a healthy crop after proper management and efficient use of plant food.

With research and farm demonstrations showing better stands from seed peanuts treated with Arason, Tarkington and other farmers are now having their seed peanuts treated with this material. The stand obtained was almost perfect. The soil type was a Ruston Fine Sandy Loam—a type recognized as good peanut soil.

The peanuts were cultivated shallow and flat every week. The rotary hoe was used for the first three cultivations, reducing the hoe work needed. Tarkington had 18 acres in peanuts, which he, his wife, and three small children chopped in 2¾ days. And he agrees with the statement common among peanut farmers that you can't grow a good crop of peanuts and grass on the land at the same time.

Furthermore, Tarkington believes in flat cultivation, with the idea that deep ridge cultivation increases the loss from Southern Stem Rot.

An application of 400 pounds of land plaster was made at the early blooming stage as recommended by the soil test, and the crop was dusted three times with copper-sulfur, using 15 pounds for the first application, 20 for the second, and 25 for the third application. Bertie farmers have found this to be a paying practice, normally resulting in about 300 pounds more peanuts per acre.

The crop was dug during the second week in October. Peanuts properly dusted for leaf spot control require a week to ten days longer to mature than undusted

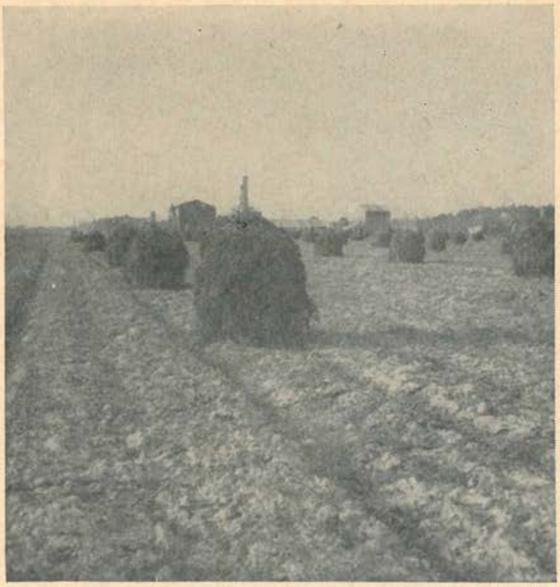


Fig. 4. N. C. 2 peanuts lined in rows of orderly stacks symbolize the efficient farming Tarkington and his fellow Peanut Club members do as they follow recommended practices.

peanuts, since they retain the leaves better and do not shed the nuts as badly. Picked on November 19, Tarkington's prize-winning peanut crop yielded 37 bags that sold for $14.82 per hundred pounds.

On his entire 18 acres of peanuts, he produced 462 bags, at an average of 2,823 pounds per acre.

After digging the peanuts, Tarkington seeded the land to rye for a cover crop which furnishes some grazing and prevents the soil from blowing away during the strong March winds.

A. T. Hicks reports members of the Woodard Adult Farmers Club are very interested in the peanut contest and have added one member to the club for 1957. They also plan an Adult Farmers Corn Contest in 1957.

In former years, many peanut growers have wondered why peanuts apparently do not respond to fertilizer treatments and other management practices like other crops. The N. C. Agricultural Experiment Station is answering many of these questions through a stepped up research program at a new peanut station in Lewiston and at other locations over the peanut growing area.

The N. C. Agricultural Extension Service and other agricultural agencies are conducting intensive educational programs to get these improved practices adopted by North Carolina farmers.

And as more and more farmers adopt these practices, the average yields prove that science put into practice pays off. ◄◄◄

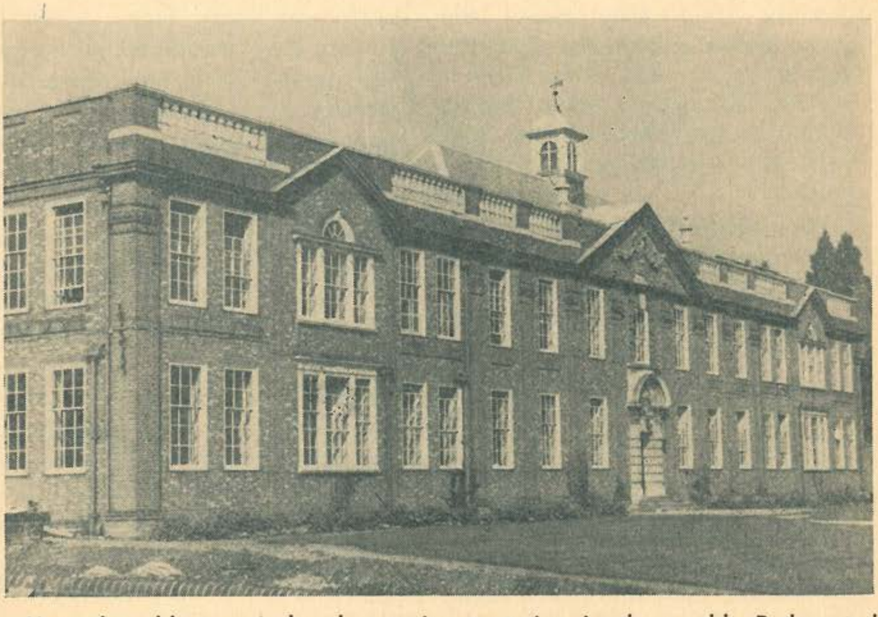
SCIENCE AT WORK

By Anthony Dell • British Information Services

IT is over one hundred years since Sir John Lawes began his experiments into the nutrient needs of cereals, roots, and grass on the home farm at his Manor of Rothamsted at Harpenden, England. The results obtained, showing the value of superphosphate, sulphate of ammonia, nitrate of soda, and potash fertilizers, have revolutionized farming both in Britain and overseas.

Without the use of chemical fertilizers as a supplement to farmyard manure, it is questionable whether the world could feed its present population.

Since the general acceptance of the early teachings of Rothamsted, the work there has developed in many directions. Visitors to the Experimental Station today will find a long range of laboratories, library and offices facing Harpenden Common, and behind them



Here the oldest agricultural experiment station in the world—Rothamsted Experimental Station—operates in the community of Harpenden, England. Since its early teachings, the work has grown in many directions.

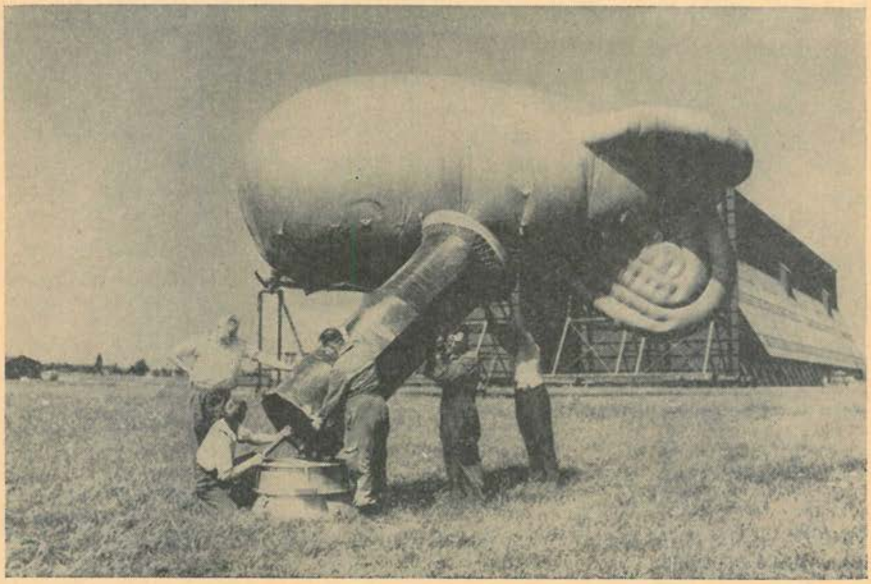
FOR THE FARMER

AT THE WORLD'S OLDEST EXPERIMENT STATION

more laboratories, glass houses, and the experimental farm.

Of the 600 acres farmed at Rothamsted, all land suitable for field experiments is utilized for that purpose. There are fields which give a striking demonstration of fertilizer effects on the common farm crops; long-period rotation experiments of 20 to 30 years' standing which test modern fertilizer and soil fertility problems using the latest statistical designs; and, finally, short-period experiments, mainly connected with the control of plant disease in the field, which follow the ordinary rotation round the farm.

Although primarily concerned with crop experiments, the farm is stocked with cattle and sheep to consume the grass and fodder crops. These animals are not experimental except that sheep are used to evaluate the produce of differently manured grass plots.



Station scientists prepare an insect trap for trip to the upper atmosphere. When it descends, the trapped insects are studied to determine how different weather conditions cause their deposit on crops and affect their number.

There are now 15 departments at the Experimental Station, in addition to the Commonwealth Bureau of Soil Science, which abstracts scientific publications on that subject from all over the world and acts as a clearing-house for information.

Investigations by Rothamsted scientists are not limited to problems in home agriculture—they are wide-ranging and encompass problems met in the Commonwealth and elsewhere overseas. Advisory visits are frequent. As examples, in 1955 two of the staff visited West Africa—one to advise on swollen shoot disease of cocoa, the other to discuss evaporation problems that will arise in connection with the Volta River hydroelectric project. A third visited Swaziland, Basutoland, and the Sudan to advise on problems of soil survey.

In the past, the Physics Department has measured the benefit of ordinary cultivation operations normally regarded as indispensable in good farming practice and has found the essential aspect of such operations is weed control. Current experiments of a similar kind are attempting to measure the value of deep plowing.

Clearly related research on soil structure is attempting to explain how structure is built up in the field by suitable crops, or by addition of soil conditioners; to devise methods of measuring soil structure; and to find out from field experiments whether improved structure leads to improved yields.

Soil water has long been a major interest of the Department. After early work had clarified ideas on the nature of the equilibrium conditions of water in soil, water in movement in the soil is now being studied, both as a problem in permeability, and as a problem in water supply to transpiring crops. It has now reached the stage at which adequate estimated water use by crops can be made from weather data, and the study is being used as a basis for control of irrigation operations.

Part of the work of the Chemistry Department deals with ways for improving the efficiency of fertilizers. The work includes investigations on methods, rates, and times of application to crops and also tests of alternative chemical forms of nitrogen and phosphorus fertilizers. Experiments have shown the increases in yield obtained by placement of phosphorus and potassium fertilizers were double those resulting from broadcast applications. No such advantage has been obtained with nitrogen fertilizers.

Soil studies in which use is made of radio-tracer techniques form a logical counterpart to the work, and special attention is given to fertilizer and organic manure residues in the soil. In experiments on a slightly calcareous soil, the phosphorus and potassium residues that have accumulated in the soil from dressings of fertilizers have supplied measurable amounts of nutrients to plants for many years after the last application.

The fertilizer residues in the soil can be detected by simple methods of analysis, but more precise and fundamental methods of assessing them are being developed.

Other problems that have a bearing on soil fertility such as denitrification, fumigation, and deficiencies in trace elements (copper, manganese) are also the subject of study.

For many years the Soil Microbiology Department has studied the nodules produced by bacteria on the roots of leguminous plants, such as clover and lucerne, which collect nitrogen from the air in the soil. This subject is most important in districts where the soil is lacking in nitrogen compounds.

Nodules are not always effective in fixing nitrogen. Failure to do so may be due to the strain of bacteria; some strains produce nodules that fix little or no nitrogen. When soils contain only such strains, they need to be replaced by inoculation with effective strains, raising the problem of competition in the soil between the effective strain introduced by inoculation and the "wild" ineffective bacteria.

It is possible to select effective strains for inoculation that can survive this competition.

Ineffective nodules can also be produced by normally effective strains of bacteria on plants that carry certain innate and inherited characters. Hereditary characters may also influence the number of nodules produced and the age of the seedling at which they first appear.

The method by which the plant exercises this control over the formation of nodules is being investigated. The formation and effectiveness of the nodules is influenced not only by characters inherent in the bacterial strain and in the host plants, but also by cultural conditions that affect healthy growth of the crop.

Some further examples of the work carried on at Rothamsted during the past year show its wide variety. The Botany Department studies the rate of absorption of nutrients from leaf sprays and the powers of survival of wild oats. The possible eradication of bracken through an attack on its enzymes is being investigated by the Biochemistry Department.

Mycologists in the Plant Pathology Department are studying, among other things, a mosaic disease of legumes in Nigeria and potato blight. Activities tend constantly to extend. ◄◄◄

TWO TONS PER COW . . . IN A GRAZING SEASON

AN average cow will eat the equivalent of two tons of dried grass during the grazing season. That much feed removes from the soil the amount of plant food contained in 550 lbs. of sulfate of ammonia, 230 lbs. of 20% superphosphate, 185 lbs of 50% muriate of potash and 50 lbs. of hydrated lime. Some of this plant food is returned in the form of manure but much of it must be replaced if the pasture is to continue in a high state of productivity.

C. E. Phillips, Delaware Agricultural Extension Service

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	....
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	28.2	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	78.1	244.0	148.0	204.0	17.45	52.60	....
1954	33.6	51.1	130.0	229.0	142.0	212.0	17.35	60.30	....
1955	32.3	53.1	94.2	177.0	131.0	198.0	17.65	44.60	....
1956									
March	31.64	....	134.0	209.0	120.0	197.0	16.15	46.80	....
April	32.50	....	172.0	217.0	132.0	203.0	16.25	46.90	....
May	31.96	54.0	219.0	231.0	139.0	200.0	16.15	47.30	....
June	32.29	51.0	265.2	290.5	142.0	193.0	15.05	47.40	....
July	32.36	48.0	311.4	348.7	143.0	190.0	14.85	49.00	....
August	31.13	50.1	140.0	217.8	145.0	193.0	15.25	51.00	....
September	32.50	53.4	100.0	191.0	143.0	195.0	15.95	47.60	....
October	31.94	53.0	80.4	194.0	119.0	198.0	16.75	54.10	....
November	31.88	47.9	91.8	203.5	121.0	205.0	17.15	59.20	....
December	30.99	61.0	91.2	241.0	122.0	207.0	17.95	59.90	....
1957									
January	30.21	52.7	93.6	257.0	123.0	209.0	18.15	60.40	....
February	30.16	34.0	84.6	260.1	119.0	207.0	17.15	58.60	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
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	112	278	231	231	147	233	239
1954	270	511	187	261	221	240	146	267	223
1955	260	531	135	202	204	224	149	198	233
1956									
March	255	...	192	238	187	223	136	208	214
April	262	...	247	247	206	230	137	208	202
May	258	540	314	263	217	226	136	210	239
June	260	510	389	331	221	218	127	210	345
July	261	480	455	397	223	215	125	217	351
August	251	501	201	248	226	218	128	226	230
September	262	534	143	218	223	221	134	211	243
October	258	530	115	221	185	224	141	240	252
November	257	479	132	232	188	232	145	263	274
December	250	610	131	274	190	234	151	266	266
1957									
January	244	527	134	293	192	236	153	268	220
February	243	340	121	296	185	234	150	260	225

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
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	....	....	.410	.793	15.25	.200
1954	.895	....	....	.405	.791	15.27	.200
1955	.895	....	....	.394	.771	14.79	.177
1956							
March	.895	....	....	.380	.735	14.00	.193
April	.895	....	....	.380	.735	14.00	.193
May	.895	....	....	.380	.735	14.00	.193
June	.895	....	....	.360	.720	13.45	.177
July	.895	....	....	.380	.735	14.00	.177
August	.895	....	....	.380	.735	14.00	.177
September	.895	....	....	.380	.735	14.00	.177
October	.895	....	....	.380	.735	14.00	.177
November	.895	....	....	.380	.735	14.00	.177
December	.895	....	....	.380	.735	14.00	.177
1957							
January	.895	....	....	.380	.735	14.00	.177
February	.895	....	....	.380	.735	14.00	.177
Index Numbers (1910-14 = 100)							
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	167	...	...	72	83	63	83
1955	167	...	...	70	81	61	82
1956							
March	167	...	...	69	77	58	82
April	167	...	...	69	77	58	82
May	167	...	...	69	77	58	82
June	167	...	...	66	76	56	80
July	167	...	...	69	77	58	80
August	167	...	...	69	77	58	80
September	167	...	...	69	77	58	80
October	167	...	...	69	77	58	80
November	167	...	...	69	77	58	80
December	167	...	...	69	77	58	80
1957							
January	167	...	...	69	77	58	80
February	167	...	...	69	77	58	80

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
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	3.07	2.20	11.50	11.63	9.72	9.85
1955	2.98	2.11	9.97	12.01	6.96	6.91
1956						
March	2.98	2.12	8.30	11.89	5.92	5.92
April	2.98	2.12	8.31	11.66	5.77	5.71
May	2.98	1.70	8.67	11.80	6.60	6.37
June	2.98	1.56	8.72	11.29	6.37	6.23
July	2.98	1.56	9.37	10.89	6.80	6.37
August	2.98	1.56	9.99	11.26	6.53	6.37
September	2.98	1.56	9.10	11.28	6.68	6.68
October	2.90	1.56	9.11	11.35	7.53	6.86
November	2.88	1.56	9.41	11.58	6.07	6.37
December	2.88	1.56	9.47	11.80	6.61	6.07
1957						
January	2.88	1.56	9.60	11.80	6.98	6.68
February	2.88	1.56	9.32	11.89	7.28	7.28

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish, scrap	Tankage	High grade ground blood
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	114	77	329	330	288	280
1955	111	74	285	340	207	196
1956						
March	111	74	237	337	176	168
April	111	74	237	330	171	162
May	111	60	248	334	196	181
June	111	55	249	320	189	177
July	111	55	268	308	202	181
August	111	55	285	319	194	181
September	111	55	260	320	198	190
October	108	55	260	322	223	195
November	107	55	269	328	180	181
December	107	55	271	334	196	172
1957						
January	107	55	274	334	207	190
February	107	55	267	337	216	207

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	Potash²**
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	120	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	249	263	248	142	95	311	167	76
1955	237	262	249	134	92	255	167	74
1956								
March	228	261	254	130	92	222	167	72
April	235	261	257	130	92	219	167	72
May	242	264	257	128	85	236	167	72
June	247	264	257	126	82	231	167	70
July	244	266	257	128	82	242	167	72
August	237	267	259	128	82	246	167	72
September	236	266	259	128	82	239	167	72
October	234	265	259	128	81	252	167	72
November	234	267	261	126	80	234	167	72
December	237	268	261	127	80	244	167	72
1957								
January	238	269	263	128	80	251	167	72
February	234	271	263	128	80	253	167	72

* 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.

**** 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, Soil, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizer and Lime Sales in Arkansas, 1951-1955," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Rpt. Series 59, Oct. 1956, D. A. Hinkle.

"Fertilizers for Various Crops," Dept. of Agr., Ottawa, Ont., Can., Pub. 870, Rev. Nov. 1956.

"Fertilizer Recommendations for Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 285, Rev. July 1956, F. W. Smith.

"Major Soils of Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 336, July 1956, O. W. Bidwell.

"Sources of Nitrogen for Sugarcane Production," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 205, Nov. 1956, T. E. Ashley, I. E. Stokes, and W. B. Andrews.

"Fertilizer Recommendations for Montana," Agr. Ext. Serv., Mont. State College, Bozeman, Mont., Cir. 262, June 1956, A. F. Shaw and M. G. Klages.

"Soil and Crop Factors for Fertilizer Recommendations, 1957," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-282, Nov. 1956.

"Grain Sorghum Fertilizer Trials, High Plains of Texas, 1955," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1905, Nov. 1956, E. L. Thaxton, Jr. and H. J. Walker.

"Effects of Fertilizers on Corn Yields in the Lower Rio Grande Valley, 1956," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1913, Dec. 1956, C. A. Burleson and G. W. Otey.

"Fertilizing Commercial Vegetable Crops in Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Bul. 212, Rev. Jan. 1957, F. H. Scott and A. V. Watts.

"Penetration of Topdressed Phosphate in the Soil as Influenced by Source, Rate, and Time of Application and by Irrigation," Agr. Exp. Sta., Va. Polytechnic Institute, Blacksburg, Va., Tech. Bul. 125, Oct. 1956, J. A. Lutz, Jr., C. I. Rich, and S. S. Obenshain.

"Lime and Fertilizer Distribution Practices in the Eastern Panhandle of West Virginia," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 390, June 1956, N. Nybroten and J. H. Clarke.

Soils

"Some Properties of a Soil Having a High Percentage of Replaceable Potassium: Field and Laboratory Studies on Comparative Value of Soil Conditioners," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Rpt. 132, June 1956, W. T. McGeorge, J. L. Abbott, and E. L. Breazeale.

"Soil Survey of York County," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., Rpt. 19, D. W. Hoffman and N. R. Richards.

"Organizational Problems in Developing the small Watersheds of Minnesota," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Sta. Bul. 437, Jan. 1957, V. C. Herrick and P. M. Raup.

"Soil Erosion on Long Island—Its Control," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 968, Sept. 1956.

"Effects of Acreage-Allotment Programs, 1954 and 1955, a Summary Report," USDA, Wash., D. C., Prod. Res. Rpt. 3, June 1956.

"Stubble Mulch and Other Cultural Practices for Moisture Conservation and Wheat Production at the Wheatland Conservation Experiment Station, Cherokee, Okla., 1942-1951," USDA, Wash., D. C., Prod. Res. Rpt. 6, Oct. 1956, H. A. Daniel, M. B. Cox, and H. M. Elwell.

"The Soil Bank's Conservation Reserve, a Profitable Way to Build for the Future," USDA, Wash., D. C., Jan. 1957.

Crops

"Research in Progress on the Agronomy South Farm, Effect of Five Legumes and Five Grass Species on Performance of Pasture Mixtures," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1716, Aug. 1956.

"Research in Progress on the Agronomy South Farm, Breeding Corn Adapted for High Planting Rates," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1718, Aug. 1956.

"Summary of Illinois Spring Oat Variety Demonstrations, 1956," Agr. Exp. Sta., Univ.

of Ill., Urbana, Ill., AG1725, Oct. 1956, J. W. Pendleton, W. O. Scott, and E. C. Spurrier.

"Sudangrass, an Excellent Emergency Pasture," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Cir. 420, Rev. June 1956.

"Minnesota X-Tra Yield Corn Contest, Corn Yield Records for 1955," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Soil Series 43, Jan. 1956, H. E. Jones and C. A. Simkins.

"Cabbage for Market," Agr Ext. Serv., Miss. State College, State College, Miss., Pub. 334, June 1956, K. H. Buckley.

"Foundation Shrubs," Agr. Ext. Serv., Miss. State College, State College, Miss., Pub. 336, June 1956, H. J. Smith.

"Snap and Bush-Pole Beans for Market," Agr. Ext. Serv., Miss. State College, State College, Miss., Pub. 335, June 1956, K. H. Buckley.

"Cotton Varieties in Missouri," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 654, April 1955, N. Brown and W. J. Murphy.

"Missouri Hybrid Popcorn Yield Trials for 1955," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 671, June 1956, C. O. Grogan and M. S. Zuber.

"Sudan Grass in Missouri," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 659, Jan. 1956, W. J. Murphy.

"Lahontan, a New Variety of Alfalfa," Agr. Exp. Sta., Univ. of Nev., Reno, Nev., Cir. of Inf., March 1956, O. F. Smith.

"Bitter Flavor in Carrots, II. Progress Report on Field and Storage Experiments," Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., Bul. 774, March 1956, J. D. Atkin.

"Propagating Fruit Trees," Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., Bul. 773, March 1956, K. D. Brase.

"Oats and Field Peas for Silage," Agr. Ext. Serv., N. Dak. Agr. College, Fargo, N. Dak., Cir. A-248, April 1956, R. B. Widdifield.

"Soybean Production in North Dakota," Agr. Ext. Serv., N. Dak. Agr. College, Fargo, N. Dak., Cir. A-250, April 1956, R. B. Widdifield, R. E. Bothun, and T. E. Stoa.

"Your Lawn, It Can Be Beautiful," Agr. Ext. Serv., N. Dak. Agr. College, Fargo, N. Dak., Cir. A-244, March 1956, H. A. Graves and D. G. Hoag.

"The Composition of Sorghum Forages at Various Stages of Maturity and Effects of Weathering," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-484, Nov. 1956, J. Webster and F. Davies.

"Sixty-Eighth Annual Report of the Tennessee Agricultural Experiment Station, 1955," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn.

"Grow Better Crops with Minimum Tillage," Agr. Ext. Serv., Utah State Agr. College, Logan, Utah, Lflt. 4, Jan. 1956, P. D. Christensen.

"Home Lawns for Utah," Agr. Ext. Serv., Utah State Agr. College, Logan, Utah, Ext. Lflt. 1, Jan. 1955, L. A. Jensen.

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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.

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

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Department of Visual Instruction, Oregon State College, Corvallis, Oregon.

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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.

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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

- **3-1-56 Potash in Agriculture**
- **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**
- **T-4-46 Potash Losses on the Dairy Farm**
- **Y-5-46 Learn Hunger Signs of Crops**
- **TT-11-47 How Different Plant Nutrients Influence Plant Growth**
- **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**
- **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**
- **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**
- **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**
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- **K-2-54 Soil and Plant Analyses Increase Fertilizer Efficiency**
- **R-3-54 Soil Fertility (Basis for High Crop Production)**
- **U-4-54 Nutrient Balance Affects Corn Yield and Stalk Strength**
- **CC-6-54 Fertility Increases Efficiency of Soil Moisture**
- **EE-8-54 Red Apples Require Balanced Nutrition**
- **FF-8-54 Apply Fertilizers in Fall For Old Alfalfa, Grass Pasture and Timothy-Brome Fields**
- **JJ-10-54 Principles Involved in Soil Testing**
- **LL-10-54 Relation of Fertilizer to Quality and Yield of Flue-cured Tobacco**
- **MM-10-54 Longer Life for Ladino**
- **SS-11-54 Foliar Application of Plant Nutrients to Vegetable Crops**
- **YY-12-54 Physical Condition of the Soil Affects Fertilizer Utilization**
- **A-1-55 Potash-Deficiency Symptoms**
- **C-1-55 Summary of Ten Years' Work with Complete Fertilizers on Sugar Cane**
- **D-1-55 Nitrogen Use Accentuates Need for Minerals**
- **G-2-55 Seven Steps to Good Cotton**
- **L-3-55 Soybean Production in the Southern States**
- **P-3-55 N-P-K for Deciduous Fruit Trees**
- **S-4-55 Greener Pastures Mean Better Living**
- **U-4-55 Fertilizer Recommendations—Burley Tobacco**
- **V-4-55 Planned Nutrition for Canning Tomatoes**
- **W-5-55 The Production of Sugar Beets on Organic Soils**
- **X-5-55 What Is Happening to Our Citrus Soils?**
- **Y-5-55 Pasture Improvement Through Renovation**
- **Z-5-55 Azalea Fertilization**
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- **A-1-56 Why More Alfalfa?**
- **B-1-56 Certain Practices Are Important for Successful Pecan Production**
- **C-1-56 A Successful Corn Crop on the Same Land Every Year Is a Possibility**
- **D-2-56 Give Fertilizers A Chance**
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THE AMERICAN POTASH INSTITUTE

1102 16th STREET, N. W. **WASHINGTON 6, D. C.**

Analysis of the creature known as woman as seen through the eyes of the chemist:

Symbol: Wo

Accepted Atomic Weight: 120.

Physical Properties: Boils at nothing and freezes at any minute. Melts when properly treated. Very bitter if not well used.

Occurrence: Found wherever man exists.

Chemical Properties: Possesses great affinity for gold, silver, platinum, and precious stones. Violent reaction if left alone. Able to absorb great amount of food matter. Turns green when placed beside a better looking specimen.

Uses: Highly ornamental, useful as a tonic in acceleration of low spirits and an equalizer in the distribution of wealth. Is probably the most effective income-reducing agent known.

Caution: Highly explosive in inexperienced hands.

* * *

Two Scotchmen bet a shilling on which could hold his breath the longer. There was a double funeral.

* * *

Sonny Boy: Mama, daddy wouldn't murder anybody, would he?

Mother: Why certainly not, sonny, what makes you think he would?

S. B.: Well, I just heard him down in the cellar saying, "Let's kill the other two, George."

An Indian girl left her parents' tepee and went to an adjoining village. After a sojourn of several months she returned to her old home.

As she entered the tepee she raised her hand and said: "How!"

"Ugh," replied her father, "me know how. Who?"

* * *

The night watchman heard strange noises in one of the darkened front offices. Deciding to investigate, he approached the room and called, "Who's there? Come out with your hands raised so I can see who you is. If you don't I'll come in and see who you was."

* * *

"They must have a girl's ball team in the harem."

"What makes you think so?"

"I just heard one of the girls ask the sultan if she was in tomorrow's line-up."

* * *

"What sort of golfer is Brown?"

"Not bad—not bad at all. He shoots in the low damns and hells."

* * *

Census Taker: "How many bushels of corn did you raise last year?"

Backwoodsman: "Didn't bushel it—bottled it."

PUNCH FOR THE MONTH: Men who do not object to fat women in slacks are said to be the fellows who take a broad view of life.

Better Crops with PLANT FOOD

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