Better Crops WITH PLANT FOOD

February 1956

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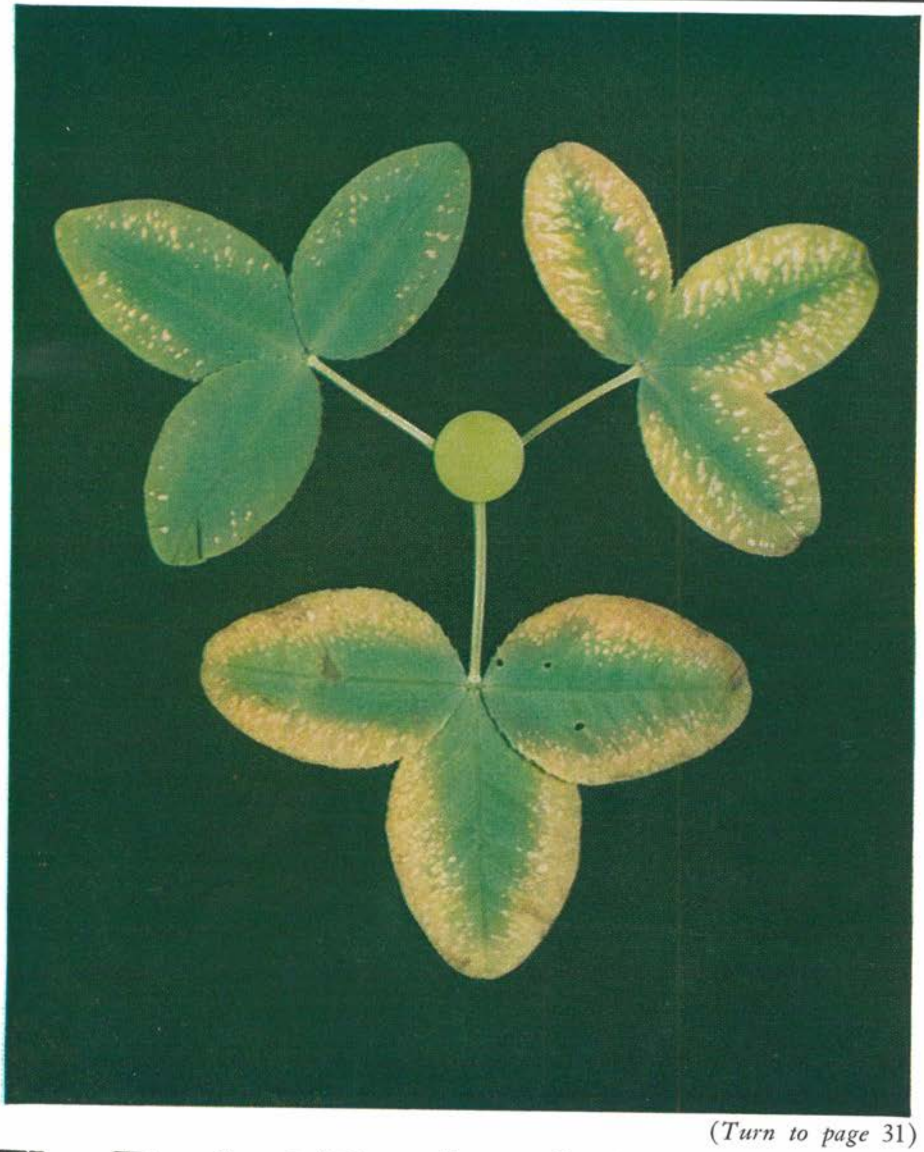

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The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

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

VOLUME XL NO. 2

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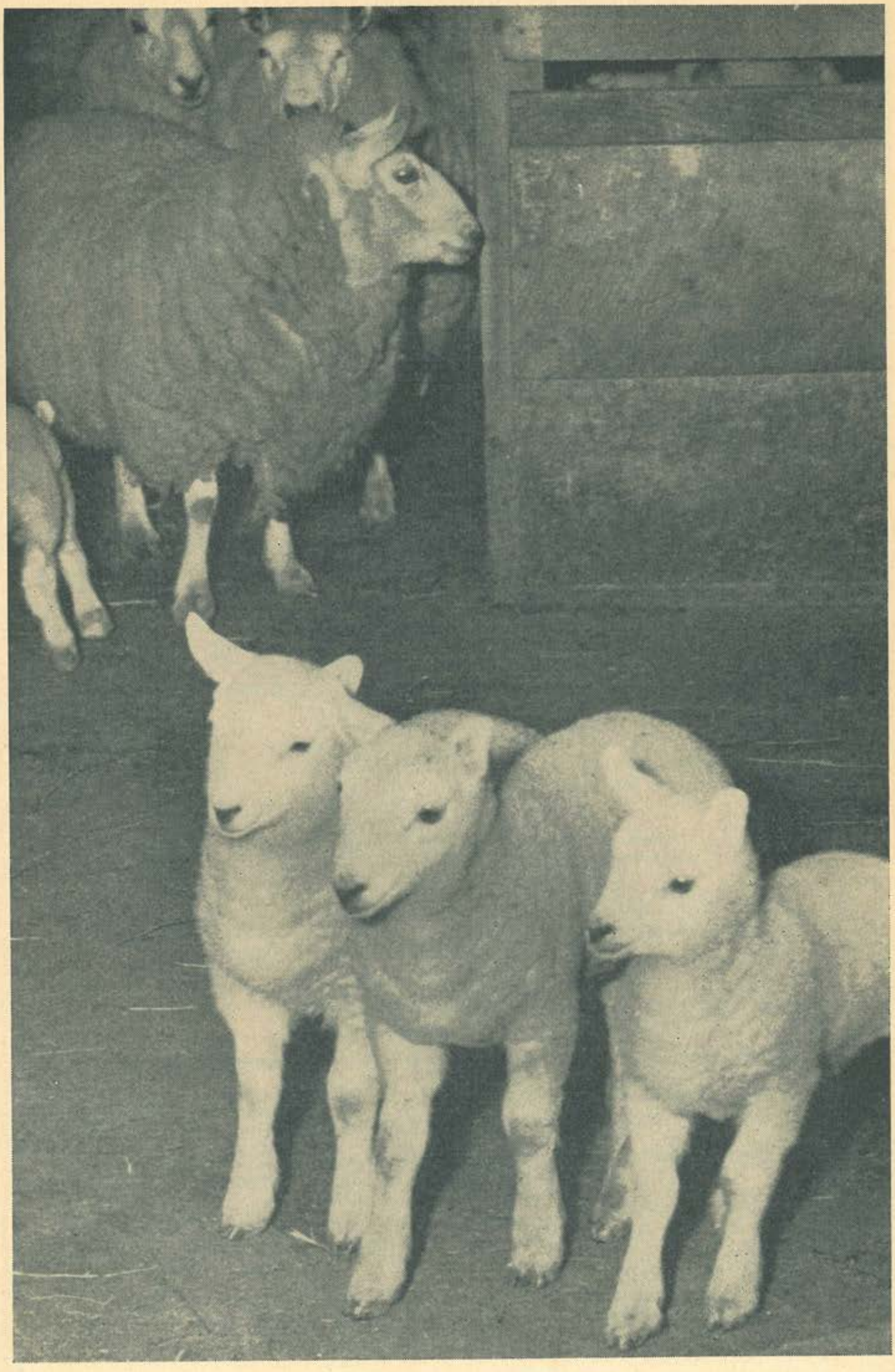

Deciding What to Do Next

Better Crops with PLANT FOOD

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VOL. XL WASHINGTON, D. C., FEBRUARY 1956 No. 2

Let's recall the . . .

Heyday in Hops

Jeff McDermid

(ELWOOD R. MCINTYRE)

CULTURE of that aromatic ingredient of beer, the hop, or *Humulus lupulus,* has gradually moved westward from Bavaria, Belgium, and Britain—all mighty beer-loving lands—to become almost permanently located in four of our far western states—Washington, Oregon, California, and Idaho. One not too well informed might surmise that where the beer is made there also must the hops be grown. If that were true then we should have hop cones raised abundantly in Wisconsin, New York, New Jersey, Pennsylvania, and Missouri. That's where 80 per cent of the country's annual brew of almost 100 million barrels is made.

The answer is that transportation of the dried hop cones has become a relatively simple matter—much simpler than finding a climate, soil, and grower organization suitable to profitable commercial hop yards and packers. Growers have organized to stabilize an industry which has ruined unprepared and hysterical farmers in regions back east of the Mississippi, in their frantic search for some cash crop to alleviate the cost-price pinch through more diversification.

It is a short review of that boom and bust decade in the nineteenth century that prompts us to write about hop culture at this time. Today the growers in the four major hop states are holding down somewhat on new plantings, at least they are not going to overplant even in the face of an avalanche of beer barrels poured into 12-ounce bottles and tins. Partly for this reason and partly because of a late spring and cool growing season, the estimated hop production in 1955 at about 37 million pounds was 15 per cent below 1954 and 30 per cent under the 10-year average.

Regardless of our private opinions about beverages—which is not the question we raise here—it is evident that the farmer has a good steady customer in the brewer. Authorities better posted on beer than I am, despite my native habitat, declare that the average 31-gallon barrel of brew takes about 44 pounds of farm products in the making. This includes 29 pounds of malt from 36 pounds of barley, 8 pounds of corn products, 2½ pounds of brewing sugar and syrup, 2 pounds of rice, 1½ pounds of hops, and 2 pounds more of miscellaneous grains. Of the sugar, almost all of it comes from corn and a trifle from cane or beets.

The malt supplies most of the nutrients; the corn and rice add their own food value and help make the beverage "light." The tangy flavor comes from the hops, and cultured yeast furnishes the fermentation and the "sparkle."

BUT of all the necessary ingredients supplied by the farmer, the quality and grade of the barley and the soundness and aroma of the hops seem to rank first. Corn, rice, and other grains used for beer are regular market products that find their way into the brewery with less particular specifications than the primary malt and hops which are the foundation of the best braumeister's art. Much attention has been paid by college plant breeders to the production of newer and better varieties and strains of malting barley. Similarly in recent years the hop vine and its cones have come in for specialized effort, made easier because of the restricted locale where the bulk of the harvest is centered.

But it has not always been thus. We propose to give a glimpse of the period about 90 years ago when hops had their heyday and farmers plunged in on a tremendous scale to grow the fabulous vine—with no special skill or acquired knowledge as a rule, and with all their future put to soak in a barrel of beer.

New York and Wisconsin farmers were bitten especially hard by the hop craze of the late sixties and early seventies. In the Empire state the leading hop centers of the time were in Madison and Schoharie counties. In the Badger state the fever went highest on the medium light soils of Columbia, Sauk, Richland, and Racine counties. Central Michigan harbored not a few pretentious hop vineyards as well.

In the season of 1867 the hop crop of central Europe was said to be about 40 million pounds in excess of actual demand. The bulk of their exports over and above the amount brewed at home went to England and the United States. But this is getting a trifle ahead of our story, because the zeal for hop culture began a few seasons before that. Any incentive was not encouraged by the government, you can bet, but came from speculative ardor and the assurance that beer was here to stay as a staple gargle in the "poor man's club."

I CAN'T say whether we had wide-awake consuls and overseas market scouts in those days like we have now. If we did boast a few of them, they were too busy in diplomatic society to find out how madly the British and Bavarian farmers were planting hops and send home a fair warning. All the dope our growers got was in the private market columns sent out from metropolitan centers, some of them being none too trustworthy. So Uncle Sam couldn't be blamed for butting into the farmer's business affairs, either with a happy incentive payment or a loan on hops or with useful worldwide market analyses. Evidently the farmer can overdo production without federal assistance just as well as he can be backed by a Commodity Credit Corportation.

So it is not surprising to see the scads of special advertising inserted in the local newspapers catering to the needs of the hop gentry. For instance, the Dickinson supply store at Kilbourn

City in Columbia county, Wisconsin, had quite a big display spread with blackface type stating H-asten O-n to P-rocure S-upplies. The G. J. Hanson Company announced that they had imported large amounts of genuine Dundee 1½-pound sacking and some Scotch kiln cloth to be sold cheap. They were also manufacturers of "the celebrated hop press."

Kilbourn City was and still is the entrance depot to the somewhat famous Wisconsin Dells. Today it bears the post-office name of Wisconsin Dells and

is primarily a dairy center. In the Mirror newspaper of that era, Editor Alanson Holly, wrote a fulsome editorial about the prominence of that region as a hop-growing center.

"Kilbourn City is the greatest primary hop market in the United States, and perhaps the world," he wrote. "The producers who ship here raised one fourth of the hops of the nation and one third of that raised in Wisconsin."

His claim was that in the fall of 1867 more than 22,000 bales of 100 pounds each raised in that area were shipped out from the Kilbourn depot. Receipts from this volume of hops amounted to more than two million dollars, it was believed. Many recruits to the hop mania sought helpful advice from growers and shippers in Kilbourn and Baraboo. As the spring of 1868 opened, very few signs of winterkilling were seen in the country round about and insects had not emerged to damage the coming crop.

Editor Holly kept his head quite well for a progressive citizen placed in the vortex of a great expansion. While he boasted and beamed over the fortunate situation of his native heath, he also issued some sound advice, as seen here: "Our advice to growers is to operate within their own incomes and keep out of debt. Have as great a variety of other crops as well, so that if hops fail, other resources will be at hand. Remember we have stiff competition in hops from Canadian farms and nearby Michigan, as well as constant threat of imports of hops from England."

Just a few issues later on, the regular market report and forecast printed in the local paper stated there was little or no improvement in the trade. Brewers were buying only when they found a bargain. It said that many eastern hop yards were being plowed up in the face of the biggest hop crop in history. The current quotations carried by the reporter listed "Wisconsins" at 20 to 25 cents per pound for common to fair hops; choice to fancy for 35 to 40 cents. New York state common to fair were 10 to 15 cents; choice to fancy for 30 to 35 cents. Imported Belgians were quoted at 20 to 25 cents; choice Bavarians at 25 to 30 cents.

BY July 1868, the weather turned dry and hot. Lice were reported on many vines, mainly on the male vines. A hop louse cure was taken from the Country Gentleman—consisting of equal parts of land plaster (gypsum) and slaked lime. Growers feared a failure on top of the dwindling current market offerings. Their dilemma did not keep them from watching the new types of hop picker machine trials. The trials took place at a farm near the village of Newport, since long gone to decay and almost forgotten.

Mr. Holly came to bat with a story of the trials. He said that the Dean machine was a total loss. It was merely a sort of hand rake. His comment was that the time spent in mangling the vines and hops, picking about

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Give Fertilizers a Chance

By Wallace A. Micheltree

Soils Department, Rutgers University, New Brunswick, New Jersey

"I KNOW of no pursuit in which more real and important service can be rendered to any country than by improving its agriculture . . . ," so said George Washington in a letter to Sir John Sinclair on July 20, 1794.

Farming is a profession, the object of which is to create economically as much salable produce as possible per unit of operation. All farming stems back to some form of crop production on the soil. Soil is one of the essential natural resources. The management of this soil is a basis upon which all agricultural production rests.

Soil is a very living thing and like animals, it can be weak or strong. Soils, like men, differ in their ability to accomplish things. All soils are fragile and must be handled with care.

Most soil management operations are performed with a view of obliterating differences and putting all soils on an equal producing basis. Soils have a certain perseverance and resist change. They are very old, and during the thousands and millions of years through which they have been developing they have obtained certain equilibriums which sometimes are difficult to change. These equilibriums constitute the personality of the soil.

Matching the Crop and the Soil

Certain crops such as alfalfa and tomatoes will not do well in wet soils. This is because they are sensitive to oxygen. The lack of oxygen in wet soils limits their effective root systems to the shallow surface areas. This change affects the nutrient-absorbing capacity of the plant and makes the plant subject to drought damage should dry weather desiccate this normally wet soil.

Aflalfa is a perennial and must exist in the soil during winter months. When a wet soil containing free water freezes, it must expand or heave. This tears the root system and damages the crop.

Shallow-rooted crops such as snap beans do not thrive on droughty soils, since they do not have the inherent abilty to produce deep extensive root systems to exploit large volumes of soil for water.

On either wet or droughty soils, management meets head-on with one of its critical decisions. Shall the crop be matched to the soil or shall the soil be matched to the crop? If the soil is to be matched to the crop—which most people think of first—what can be done to obliterate the difference between either the wet or dry soil and a well-drained soil of good water-holding capacity? Fertilizer and lime obviously are not going to put these fields on an equal producing basis since oxygen or water are the limiting factors. What next can be considered? On the wet field—drainage! If drainage is to be considered then what kind of drainage? What type of wetness is present in the field? Can it be drained economically? Probably any field can be drained but will the cost be commensurate with the returns? Once drainage is installed, the costs and decisions of maintenance must be considered. It may be a better bet to match the crop to the soil even if the farmer must learn to grow and market an unfamiliar crop. In any event it is going to take more decisions and a smarter farmer to use

Fig. 1. Farmers on tour inspect various soil conditions which alter the capabilities of a piece of land. Matching the crop and the soil is one of the cardinal principles of soil management. ***Picture courtesy of H. R. Slayback, Extension Soil Conservationist, Rutgers University.***

the wet soil successfully.

In the case of the droughty soil, equally difficult decisions must be made. The water-holding capacity of this soil is one of the natural equilibriums and very little can be done to it that will permanently and economically improve it. Supplemental irrigation must be resorted to when non-drought-resistant crops are grown. The management decisions with irrigation are never-ending, and improper decisions can be disastrous. The countryman using irrigation must have a very sound understanding of the fundamentals of soils, water, and plant growth.

The farmer working either the wet or droughty soil is going to have more decisons and work than the man on the ideal soil regardless of whether he uses drainage, irrigation, or crop selection.

Annual Increment of Organic Matter

"It (Cow Pea) is very productive, excellent food for man and beast, awaits without loss our leisure for gathering, and shades the ground very closely through the hottest months of the year. This with the loosening of the soil, I take to be the chief means by which the pea improves the soil. We know that the sun in our cloudless climate is the most powerful destroyer of naked ground. . . ." Thomas Jefferson, March 23, 1798.

Soil is a living thing. Organic matter is the food for growth. A soil must be teeming with microorganisms and their populations must grow and thrive. The by-products of this growth are the essential materials of a soil. Nitrogen, phosphorus, potassium, the various minor elements, and organic acids are all needed. With the high yields being produced today, it is impossible to expect organic matter decomposition to furnish sufficient N.P.K. and in some cases minor elements. This is not serious in itself since these can all be added in fertilizer form. The problem comes, however, when farmers begin to believe that the entire value of organic matter lies in the nitrogen and mineral release. Actually the important part of organic matter decomposition is the formation of organic acids of which there is no other source. The entire

Fig. 2. This drawing of poor soil structure shows why roots are retarded in their growth. Slow-growing roots struggling through a compacted soil do not acquire sufficient nutrients or moisture for maximum growth. ***Picture courtesy of R. B. Alderfer, Soils Department, Rutgers University.***

role of organic acids has not been completely worked out. It is known, however, that certain of them stabilize the soil aggregate.

Aggregation and its accompanying arrangement or structure is the anatomy of a soil. It is only by the virtue of aggregation that air and water can enter and leave the soil. Aggregation is one thing and stable aggregation is another. It is possible for a soil to aggregate without organic matter but it is highly improbable that the aggregate will stabilize without certain of the organic acids. An unstabilized aggregate will immediately burst into its separate fractions when struck by a rain drop, plow, cultivator, or tractor tire. When it does blow apart it moves downward in the soil, plugging up the pore spaces which exist below. A stabilized aggregate may change its shape somewhat upon impact but does not disintegrate.

Fig. 3. With good soil structure a root can ramble through a large expanse of soil, keeping its growing tip in an atmosphere of air and moisture, utilizing nutrients and water to its greatest advantage. ***Picture courtesy of R. B. Alderfer, Soils Department, Rutgers University.***

The subsoil is aggregated but stabilized to a much lesser degree because the organic acids are for the most part retained in the upper regions. The subsoil, on the other hand, is not required to be as highly stabilized since it should not be exposed.

The organic acids also contribute to the cation exchange capacity of a soil. This allows for a greater exchangeable storage of nutrients and a more desirable release rate to the growing plant.

The organic matter level of a soil is another of these natural equilibriums and, therefore, resists being permanently changed. In a field from which the topsoil has been eroded and the farming operation has turned subsoil up, the organic matter content has been lowered by dilution and significant increases can be obtained, without too much effort, up to the equilibrium where difficulty is again encountered. Since any rise above the equilibrium level is temporary, annual increments of organic matter are necessary to maintain the artificially higher level. The high level in itself is not of major importance, but the fact that frequent additions must be used to maintain this level gives the soil a constant supply of fresh organic matter for food which in turn becomes organic acids.

Soils that are in poor aggregate stability do not have nutrients as their first limiting factor, but instead air and water. It is difficult for a farmer to understand this entire chain of events unless he is approached from a fundamental and basic direction and is on a speaking acquaintance with aggregation and organic matter decomposition. It entails more management for a farmer to arrange for organic matter increments each year than it does for him to forget them entirely and think only in terms of nutrition and fertilizer applications. He must be persuaded by fundamental reasoning so that he can justify to himself how he will get greater returns per dollar invested. This management operation does not pay its full returns the first year it is employed. It actually pays greater interest each year in increased yields and a lesser number of perplexing problems the following years.

Rotation

"The ambition for broad acres leads to poor farming, even with men of energy. I scarcely ever knew a mammoth farm to sustain itself; much less to return a profit upon the outlay. I have more than once known a man to spend a respectable fortune upon one; fail and leave it; and then some man of modest aims get a small fraction of the ground and make a good living upon it. Mammoth farms are like tools or weapons, which are too heavy to be handled. Ere long they are thrown aside at a great loss," said Abraham Lincoln at the Wisconsin State Agricultural Society's Annual Fair in Milwaukee, September 30, 1859.

Consider a very intensively cultivated soil. In early spring it is plowed and fitted. During these operations a number of aggregates are broken. The field is then planted and subsequently cultivated several times. These operations break a number of other aggregates. The fact that the field is in a cultivated crop means that a large portion of the soil is directly exposed to the weather. Sun and beating rains break another given number of aggregates. If irriga-

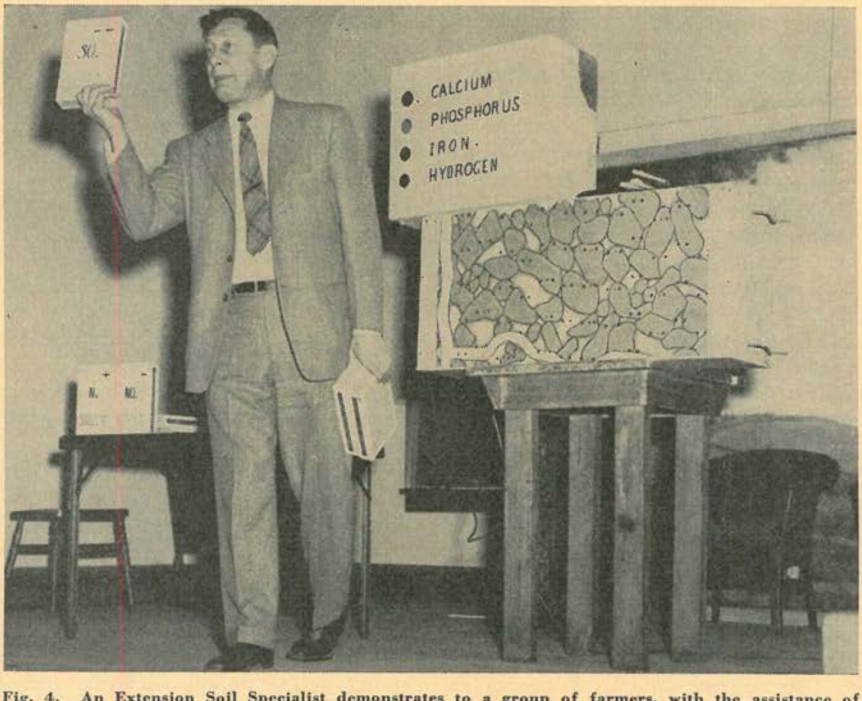

Fig. 4. An Extension Soil Specialist demonstrates to a group of farmers, with the assistance of teaching aids, how soil structure, air, water, pH levels, and nutrients all tie up to create a favorable media for root growth, which is necessary for top yields. ***Picture courtesy of R. E. Gardner, Associate Agricultural Agent, Salem County, New Jersey.***

tion is employed, even a greater number will be broken. The process of harvesting the crop breaks a number of aggregates. If this happens to be a short-season vegetable crop this entire procedure again takes place this same summer during the second cropping season. The field is farmed relatively late in the fall and no cover crop is established—the field lays bare and more aggregates may be broken by the weather. If it is a poorly drained soil and free water exists in the pore spaces, freezing and thawing will increase dispersion, but in a well-drained soil, remaining at or near field capacity, the freezing action will reform many of the broken aggregates.

When the aggregate was broken its separate fractions began to sift down through the soil. The downward movement of rain and irrigation water accelerated its travel. The soil resembles a nest of screens—screening out the coarsest separates at the top and allowing the fines to move a greater distance downward.

During the winter months when reaggregation is taking place the broken aggregates are not just patched together since they have become so widely separated. Instead, new aggregates have to be formed from parts of several old ones. These aggregates are formed but not stabilized because this is during cold weather and the organic acid activity is at a low ebb.

The first nice day in late winter this field is again plowed and the same process starts all over again. Since the aggregates that were broken last year have not been stabilized, they immediately go to pieces again probably during the plowing and fitting operation, plus some being broken that had not been broken last year. Consequently, the soil approaches the next winter period with all of last year's broken aggregates rebroken, plus a new crop from the past growing season.

After several seasons of this action taking place, the soil is found to have many less stable aggregates, smaller pore spaces and, since the fines have been collecting at the bottom of the plowed area, the formation of a plow sole has begun. Water now enters this soil much more slowly, giving it a greater chance to run off. This runoff reduces the effective moisture recharge of the soil profile during the growing season and increases the erosion hazard. The water that does enter the soil moves downward more slowly, excluding the air for longer periods of time, hence starving the plant roots for oxygen.

Now what if a cover crop were used each winter on this field? The same process would be taking place except more slowly. The broken aggregates could not be mended by late winter when plowing and fitting begin and since they will be dispersed before the plowed-down organic matter can decompose during the summer they will not be mended or stabilized. What would happen is that the decomposing organic matter during the summer months would strengthen those aggregates which were still intact, causing them to better resist breaking in the future. The effect of the cover crop roots "wiring" the soil together has a significant stabilizing effect. Some aggregates are broken each year under a cover-cropping program. The same effect is taking place but more slowly.

Now consider a rotation, a crop sequence containing a sod on this field. After several years of cultivation the sod is introduced to effect a rest for the soil. If the sod is established during the fall, the soil goes through its winter aggregating period; then the following summer it is not disturbed. None of the unstabilized aggregates are broken; instead the decaying organic matter stabilizes these new aggregates. The sod is allowed to remain through the next winter and is plowed under the following spring. Using this practice the soil has been permitted to set for about 18 months. It has gone through two reaggregating periods and one period of stabilization. The interval between

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Fertilizer Statistics from the 1954 Census of Agriculture

By A. L. Mehring, Staff Specialist

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Washington, D. C.

THE 1954 census of agriculture is the first survey by the Bureau of the Census to include data on the use of fertilizers by crops, and the first to give any information whatever on fertilizer usage since 1939. Usage by six principal crop classifications was obtained for every county in the United States. Preliminary results for the last of the 3,067 counties were published about the middle of December 1955. Leaflets for separate counties or States may be purchased from the U. S. Bureau of the Census for 10 cents each. Final results will be published before the end of this year in 33 books. Each book will contain all the county data for one State or group of States. When available they may be purchased from the Superintendent of Documents, Washington 25, D. C.

Total Fertilizer Usage

Comparable census data are available for 1929, 1939, and 1954, on the total number of farms, the number that used fertilizer, the acreage of harvested cropland, and the total tons of fertilizer consumed. These data, or information derived from them, have been summarized in Table I by regions.

The 1954 results are subject to revision, and slight changes are expected in the final figures. No error, however, is likely to affect significantly the data in Table I.

Census enumerators visited every farm, but figures on fertilizer usage were collected only on every fifth one. Thus the results given here are estimates based on a 20% sample. On a regional basis the errors will not be more than about 1%.

Enumerators were instructed to exclude gypsum and animal manures, but to include phosphate rock under fertilizer. Data for liming materials are given separately in the reports. Every parcel of land from which produce worth $150 or more was sold, or of three acres or more on which agricultural products were raised, was considered a farm.

Changes in the number of farms using fertilizer from 1929 to 1954 were relatively small in the Middle Atlantic Region. In the Central and Western Regions many more farmers were using fertilizer in 1954, but in New England and the South Atlantic Region considerably less. A part at least of the decrease is due to the smaller number of farms now existing in these regions, as compared with formerly. Although the number of farms using fertilizer in the South Atlantic States was smaller, the percentage of the total number of farms in this region that used fertilizer was larger.

Consumption of fertilizer was larger in 1954 in every region than in either of the previous years shown, and in some regions remarkably so. For instance, the Mountain States used 13 times as much in 1954 as in 1939 and 36 times as much as in 1929.

TABLE I.—USE OF FERTILIZER (INCLUDING MIXTURES AND STRAIGHT MATERIALS) IN AGRICULTURE, AND ITS COST, 1929, 1939, AND 1954.[1]

Region	Year	Farms that used fertilizer	Fertilizer			Portion of the total	Fertilizer cost [2]		
			Total used	Rates per			Total	Average per farm using it	Average per ton
				Farm using it	Harvested acre	Number of farms using fertilizer			
		Number	*Tons*	*Tons*	*Pounds*	*Per Cent*	*Dollars*	*Dollars*	*Dollars*
New England	1929	68,318	345,303	5.1	189	54.7	15,413,246	226	44.64
	1939	62,932	290,612	4.6	171	46.6	9,990,907	159	34.38
	1954	37,195	364,716	9.8	297	45.4	21,446,891	577	58.80
Middle Atlantic	1929	206,325	798,433	3.9	97	57.7	30,202,326	134	37.83
	1939	202,095	854,968	4.2	111	58.1	22,674,297	112	26.52
	1954	235,008	1,773,072	7.5	239	64.4	90,885,357	388	51.26
South Atlantic	1929	808,199	3,707,305	4.6	292	76.4	119,238,902	147	32.16
	1939	797,827	3,245,545	4.1	246	78.3	88,359,431	111	27.22
	1954	623,140	5,154,845	8.3	512	82.9	242,642,109	389	47.07
East North Central	1929	318,594	773,057	2.4	27	33.0	29,283,692	83	37.88
	1939	364,377	842,974	2.3	30	36.2	23,460,096	64	27.83
	1954	571,512	4,077,471	7.1	137	71.6	229,354,544	401	56.25
West North Central	1929	56,419	106,332	1.9	1.5	5.1	4,471,581	66	42.05
	1939	56,906	100,058	1.8	1.8	5.2	2,982,001	52	29.80
	1954	412,552	2,144,191	5.2	32	45.6	162,957,750	395	76.00
East South Central	1929	529,175	1,185,827	2.2	94	49.8	40,093,966	76	33.81
	1939	590,460	1,083,946	1.8	85	57.7	28,702,396	49	26.48
	1954	623,611	2,775,113	4.5	281	79.0	136,269,280	219	49.10

Table I. Continued:

USE OF FERTILIZER (INCLUDING MIXTURES AND STRAIGHT MATERIALS) IN AGRICULTURE, AND ITS COST, 1929, 1939, AND 1954.[1]

Region	Year	Farms that used fertilizer	Fertilizer			Portion of the total	Fertilizer cost [2]		
			Total used	Rates per			Total	Average per farm using it	Average per ton
				Farm using it	Harvested acre	Number of farms using fertilizer			
		Number	*Tons*	*Tons*	*Pounds*	*Per Cent*	*Dollars*	*Dollars*	*Dollars*
West South Central	1929	219,773	431,855	2.0	15	19.9	15,719,081	71	36.40
	1939	196,103	282,933	1.4	11	20.3	8,690,222	44	30.71
	1954	281,617	1,255,214	4.5	57	42.2	78,580,230	279	62.60
Mountain	1929	3,824	10,272	2.7	0.9	1.6	630,169	108	61.35
	1939	18,344	28,783	1.6	3.1	7.7	1,289,631	70	44.81
	1954	49,521	374,136	7.6	3.3	27.5	32,444,834	655	86.72
Pacific	1929	28,919	176,638	6.1	27	11.0	16,005,710	384	90.61
	1939	47,987	274,007	5.7	42	17.4	9,778,978	204	35.69
	1954	92,223	1,122,559	12.2	141	38.0	89,116,605	966	79.39
United States	1929	2,239,546	7,535,022	3.4	42	35.6	271,058,673	117	35.97
	1939	2,337,031	7,003,826	3.0	44	38.3	195,927,959	84	27.97
	1954	2,926,379	19,041,317	6.5	112	61.2	1,083,697,600	370	56.91

[1] Computed from data published by the U. S. Bureau of the Census: 1929, Census of Agriculture, 1930; 1939, Census of Agriculture, 1940; preliminary report of 1954 Census of Agriculture, 1955.

[2] The cost data for 1929 include manure and liming materials. The total of these materials in that year probably did not exceed $20,000,000 for the entire country.

The average usage per farm in 1954 was 6.5 tons or about double what it was in the earlier census years. The rate per farm in 1954 was above the U. S. average in all States on both coasts but below average in most of the Central States. The number of tons used per farm was higher in the Atlantic States due to heavy rates of application per acre, in the Mountain and Pacific States because of the large size of many ranches, and in the West because the large ranches used most of the fertilizer.

The highest average rate of application per acre of harvested cropland for any region was 512 pounds in the South Atlantic States. The highest average rates for individual States was 1,092 pounds per acre for Florida and 604 pounds for New Jersey. The lowest were 0.7 pounds for Montana and 1.5 for Wyoming. California used, on the average, 196 pounds per acre, which exceeds the averages of all States except those in the South Atlantic and East South Central regions and most of the New England and Middle Atlantic States.

Fertilizer Cost

The total cost of commercial fertilizer in each region is shown in Table I for three census years. In 1954 farmers spent over a billion dollars for fertilizer or about 5½ times as much as in 1939. The average expenditure per farm using fertilizer was $370.

The average fertilizer in 1929, 1939, and 1954 contained 17.84, 19.98, and 26.10%, respectively, of total primary nutrients (N, P_2O_5, and K_2O). Average costs per unit of plant food (1% of a ton) were therefore $2.02, $1.40 and $2.18. Inasmuch as the purchasing power of the dollar in 1954 was only about half what it was in 1939 these values indicate a continued decline in the relative cost of fertilizer in the past 25 years. A considerable part of this lowering of cost to the farmer has been brought about simply by raising the average plant-food content of the fertilizers used. The remainder is due in part to technological advances.

Usage by Crops

The present census gives a breakdown of fertilizer consumption by six different crop categories. Nearly every county report includes data for fertilizer used on:

- Hay and cropland pasture
- Other pasture
- Fruits, vegetables, and potatoes
- Two important fertilizer-consuming crops of that region
- Other crops

Thus corn is included as a separate classification for every State except a few in the far west and wheat for nearly all States that grow it in significant quantities. The census provides separate data for cotton and tobacco only for those States where these crops are most extensively grown. Fortunately, the Crop Reporting Board, U. S. Department of Agriculture, has data upon which to base a reasonable estimate of fertilizer usage on cotton and tobacco for those States where the census did not give a figure.

In Table II are summaries of census data, supplemented by estimates, where a sound basis for making them was available. For a few States where corn and wheat are relatively unimportant crops, estimates were based on data in Table 17 of U. S. Department of Agriculture Handbook 68 and on rates of application in the 1954 census for the closest State with similar conditions.

Tobacco shows by far the heaviest application rates of any crop included in Table II, with an average of 1,316 pounds of fertilizer per harvested acre. Only 1.5% of the entire tobacco crop was grown without commercial fertilizer in 1954.

Fruits, vegetables, and potatoes are also heavily fertilized. The average rates of application and the portions of the crops fertilized, however, are lowered considerably in some States by inclusion of acreages of wild blueber-

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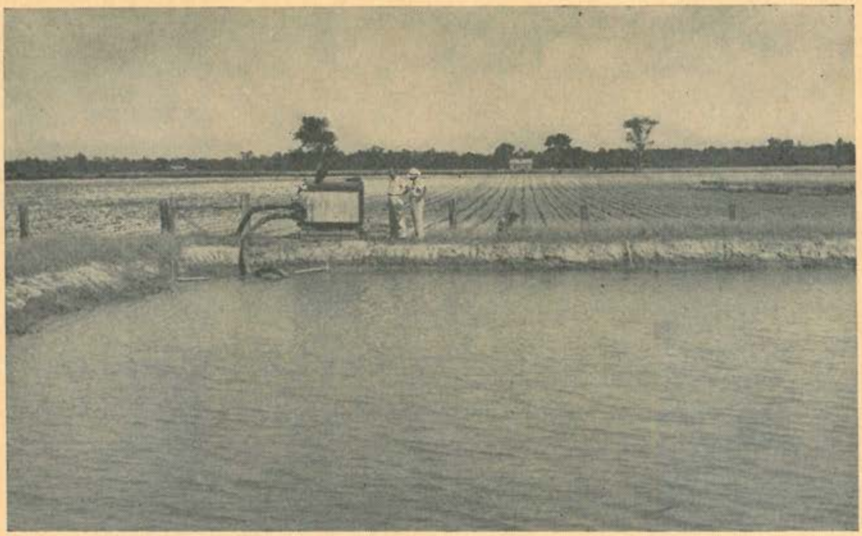

Fig. 1. Dug ponds frequently can be used as sources of water for irrigation.

Supplemental Irrigation in South Carolina

By H. P. Lynn

Agricultural Engineering Department, Clemson Agricultural College, Clemson, South Carolina

DURING the past two years, South Carolina farmers have shown more interest in irrigation than ever before because of severe and prolonged droughts which resulted in parched fields and pastures.

The Need for Irrigation

Despite South Carolina's annual rainfall of 45 to 55 inches per year, crops often suffer from droughts because of the poor rainfall distribution during the growing season. A detailed study made by A. L. King, Meteorologist in Charge, Weather Bureau Office, Memphis, Tennessee, of rainfall data for a period of 82 years, 1872 to 1954, during the crop growing season, March 20 to September 15, revealed the following information on droughts of the so-called mid-South humid areas.

"For the 82-year period, data for the growing season ending in early September show:

- 1 drought of 103 days duration
- 2 other droughts more than 2 months in length
- 5 droughts between 1½ and 2 months long
- 32 droughts between 1 and 1½ months long, and
- 198 droughts of 14 days to less than 1 month long.

During the 82 years, there were only 3 years when no droughts occurred during the growing season; only 7 years with less than a total of 30 drought days; and only 34 years with less than 60 days. In other words, in about 6 years out of 10 we may expect to have a total of 60 or more drought days during the season."

Mr. King defines a drought as 14 or more consecutive days with less than .25 inch of rain on any one day, and the number of drought days in the season is the sum of the days in the various drought periods.

Weather Bureau reports from Columbia, South Carolina, show there were 6 periods of from 20 to 30 days during growing seasons for a 10-year period beginning in 1935 and ending in 1945 when the total rainfall was only a trace or less. While no official summary since 1945 is available, it is a well-established fact farmers have suffered severe losses from droughts at least 3 of the past 4 years. In 1954, the entire State was declared a drought disaster area.

A summary of the above rainfall data indicates that in about 6 out of every 10 years irrigation could be used to an advantage.

Many farmers who want irrigation systems can't have them because of inadequate water supply. Approximately 30,000 gallons of water are required to apply one inch of water on one acre of land. It is recommended that enough water be applied to supply the crops need for a period of 7 to 10 days. Many times the amount needed will be more than one inch per application depending on crop grown, soil type, stage of growth, temperature, humidity, and wind conditions. If large acreages are to be irrigated, a good water supply is a "must."

A very small percentage of the farms in South Carolina have a stream conveniently located, with an adequate water supply for year-round irrigation needs. A stream being considered as a source of water for irrigation should be measured during the dry periods, and accurate records kept as to flow. When the need for water is greatest, the stream flow is usually at its minimum. A stream in South Carolina that normally flowed several hundred gallons per minute dried up this summer for the first time in 67 years.

A few farmers have been able to irrigate small acreages from runoff ponds and ponds fed by small streams. Generally, almost all the farm ponds

Fig. 2. This tobacco has not been irrigated.

are too small. A farmer should be able to count on 12 to 15 acre inches of water for each acre he intends to irrigate. (Acre inch=water one inch deep over one acre). The exception to this rule is peach farmers who irrigate one or two times during the critical growth stage.

Dug ponds, adaptable to many farms in the coastal plains area of South Carolina, are being used and offer possibilities as another source of water for livestock and irrigation of small acreages. A dug pond is essentially a shallow well with a large storage capacity. The depth of these ponds varies from 7 to 25 feet depending on the depth of the water-bearing strata below the earth's surface. The size excavation needed for adequate water will depend on the strata's ability to yield water. These ponds are usually located in areas most likely to yield water, such as depressions and low swampy areas. Many of these ponds have yielded an abundance of water with a quick recovery after pumping, while others have yielded small quantities of water and recovered very slowly. Farmers should weigh the cost and maintenance of this type water source against the cost of a drilled well.

Shallow wells, or sand points as they are sometimes called, offer another potential water supply for the irrigation of plantbeds and gardens. Often times two or more wells of this type are tied together into a single pump which yields enough water to replenish a pond.

Deep wells in the coastal plains area of South Carolina will perhaps prove to be the most satisfactory and reliable source of water for the irrigation of large acres. Wells, 5 inches to 12 inches in diameter, drilled to a depth of 80 to 800 feet and yielding from 200 up to 1800 gallons per minute are being used for irrigation. The water, in a few cases, rises close enough to the surface of the ground to permit the use of conventional type irrigation pumps instead of turbine pumps.

Economics of Irrigation and Increased Yields

Whether or not irrigation will pay is just a matter of cold economic facts. It costs about $125 per acre to install a system, varying of course on the size system. This is exclusive of the cost of the water source. Depreciating this

Fig. 3. Irrigated tobacco. Compare with that in Fig. 2.

equipment over a 15-year period, including interest on investment, taxes, fuel, labor, and yearly maintenance, the cost of irrigating a crop four or five times, applying 1½ inches of water each time, will be in the neighborhood of $20 to $30 per acre a year. The chances are that many farmers will find irrigation a paying proposition, particularly on high value crops such as tobacco, peaches, cucumbers, melons, and other truck crops.

Result demonstrations on the irrigation of flue-cured tobacco have been conducted by the Clemson College Extension Service since 1951. In all four years, very significant yield increases were obtained:

Year	No Irrig. lbs./A	Irrig. lbs./A	Inc. Yield lbs./A
1951	1207	1334	127
1952	737	1225.5	488.5
1953	1555	2014.0	459
1954	1231	1616	385

Irrigation not only increased the yield of tobacco but also increased the quality which was reflected in a higher price per pound and increased value per acre:

Year	No Irrig. Price/lb.	Irrig. Price/lb.	Inc. Net Value/A
	(*cents*)	(*cents*)	(*dollars*)
1951	40.8	47.3	177.82
1952	40.5	54.2	367.85
1953	54.3	57.8	319.37
1954	45.3	58.5	257.70

These demonstrations were arranged on a crop unit-basis, and adjoining tobacco crops that were similar as to soil type, time of transplanting, fertilization, and cultivation were used as checks. Both the check and the irrigated crops were handled the same in the field and through curing. The interesting thing is, of course, with the purchase cost being about $125 per acre, the whole system could have been paid for in each of the four years with the increased net value of the irrigated tobacco over the non-irrigated.

W. P. Law and C. M. Lund, Agricultural Engineers, South Carolina Agricultural Experiment Station, conducted experiments on cotton irrigation in 1953 that bring out the following facts: Two applications of water, applied when cotton was wilted, increased yields of seed cotton about a half bale per acre. Besides increasing yields, the engineers found that irrigation also increased the average staple length one sixteenth of an inch and the oil content of the seed about 10 per cent. The extent of this increase will depend largely upon weather conditions. Where conditions are favorable for irrigation, Law and Lund estimated that a half-bale increase per acre will return from two to four times the total cost of irrigation.

In 1952, result demonstrations in Chester County showed a yield of 828 pounds of lint cotton for irrigated cotton as compared to a yield of 500 pounds of lint cotton for non-irrigated cotton on the farm.

An 8-year summary of corn irrigation tests at Clemson College, 1946-1953, showed an average increase of about 41 bushels per year.

W. N. Henderson, Greenwood County, conducted an interesting demonstration on his farm in 1952. He staked off two separate fields of corn, 16 acres and 12 acres. Half of the 12-acre field was irrigated twice. The other portion was not irrigated. The 16-acre field was irrigated four times during the growing season. Only 8.3 bushels of corn were produced on each acre of non-irrigated corn, while 73 bushels per acre were harvested from the portion of corn irrigated two times. The 16 acres irrigated four times yielded 110.6 bushels per acre.

Irrigation result demonstrations on cantaloupes during the fall of 1954 showed a yield of 264 bushels for the irrigated cantaloupes as compared to

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Fertility — Lime Status of Mississippi Soils as Indicated by Soil Tests

By L. E. Gholston

Extension Agronomy Department, Mississippi State College
State College, Mississippi

THE primary purpose of a soil-testing program is to provide a means whereby field crop fertility research results can be carried to individual farms in terms of specific lime and fertilizer requirements for each field and crop. By taking an inventory of the plant-food content of the soil the farmer can use the right kind and amount of lime and fertilizer on each field for a given crop, thus insuring a more efficient fertilization program.

The purpose of this article is to present the general fertility and lime status of Mississippi soils as indicated by summarized soil test data for the period 1950-54. Also, the intensity of soil sample collection as practiced by farmers is compared with recommended procedure. Frequency at which soil samples are received at the laboratory is recorded so that farmers can be informed about seasonal peak testing periods and instructed to avoid them whenever possible, to allow faster and more efficient service.

It may be noted from Table I that during the period 1950-54 the soil-testing laboratory analyzed 97,856 soil samples representing 573,309 acres of cropland for 15,175 Mississippi farmers. During this time an average of 58 farmers weekly received individualized service from the soil-testing program regarding proper fertilization of crops.

Of the samples tested, 35% were from pastures, 31% from cotton land, 15% from corn land, 9% from truck cropland, and 11% from land for other crops. The percentage for pastures includes 24% for permanent pasture, 8% for temporary grazing crops, 1% for lespedeza, 1% for sorghum, and 1% for alfalfa meadows. Samples received from cotton fields represented the largest number from a single specific cropland classification.

TABLE I.—NUMBER OF SOIL SAMPLES TESTED, FARMERS ASSISTED WITH FERTILIZATION PROGRAM, AND TOTAL ACREAGE OF LAND TESTED DURING FIVE-YEAR PERIOD.

Fiscal year	Total samples	Total farms	Total acres
1950–51......	14,000	2,862	79,156
1951–52......	16,575	2,723	87,710
1952–53......	13,610	2,267	81,687
1953–54......	25,221	3,955	170,588
1954–55......	28,450	3,368	154,168
Total.........	97,856	15,175	573,309
Mean.........	19,571	3,035	114,660

Soil Acidity and Lime Requirement

With regard to acidity, 4% of the soil samples tested were very strongly acid in reaction, having pH values of 4.9 or less; 27% were medium in acidity with pH values of 5.0 to 5.4; 37% were moderately acid with pH values of 5.5 to 5.9; 29% were slightly acid with pH values from 6.0 to 6.9; and

PERCENTAGE OF SOIL SAMPLES TESTED DURING FIVE YEAR PERIOD 1950-54 WHICH SHOW NEED FOR APPLICATION OF LIME TO THE SOIL FOR ALL CROPS AND FOR LEGUMES.

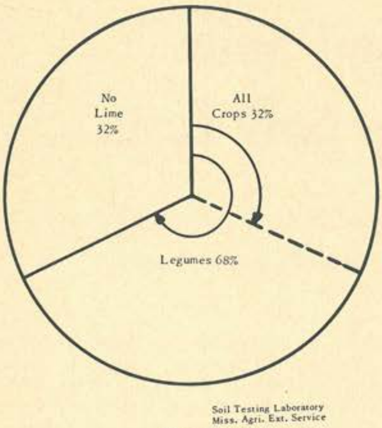

Fig. 1.

3% were neutral to alkaline in reaction with pH values of 7.0 or above.

Generally, Mississippi farmers are using considerable amounts of commercial fertilizers in crop production. However, much of this fertilizer has not been used and still can not be used most efficiently because so many of the soils are too sour or acid to obtain maximum returns from applied nitrogen, phosphorus, and potash.

Figure 1 shows that 32% of the cropland in the State needs some lime for all crops, and for legumes, an additional 36% need lime. Lime is recommended for all crops if the pH is below 5.5 and for legumes if below 6.0. No lime was required for crops on 32% of the soils tested. Data presented in Figure 2 show that the lime requirement of 85% of the soils was 4,000 pounds an acre or less.

During the fiscal year 1954, 28,450 samples were analyzed from 154,168 acres of cropland. The use of lime was recommended on 54% of the acreage. Rate per acre, number of acres, and total tonnage of lime recommended may be observed in Table II.

TABLE II.—RATE PER ACRE, ACREAGE, AND TOTAL TONNAGE OF LIME RECOMMENDED FOR USE ON 54% OF MISSISSIPPI CROPLAND TESTED IN 1954 (28,450 SAMPLES).

Rate/A	Per cent	Number acres	Tons lime
1 Ton	27%	22,478	22,478
1½ Tons	44%	36,630	54,945
2 Tons	21%	17,483	34,966
2½ Tons	4%	3,330	8,325
3 Tons	2%	1,664	4,992
3½ Tons	1%	833	2,916
4 Tons	1%	833	3,332
Total		83,251	121,954

Available Phosphorus and Exchangeable Potassium

Second only to nitrogen, phosphorus is the most deficient element in Mississippi soils. Of the soil samples analyzed during this period, 64% were low in available phosphorus, 18% medium, and 18% high. Phosphorus (P_2O_5) levels of five soil areas within the State are shown in Figure 3.

During the same period, over one half of the soil samples tested low in exchangeable potassium. Low as applied here means 0.2 of a me. of exchangeable potassium per 100 grams of soil or 156 pounds or less an acre.

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PERCENTAGE OF SOIL SAMPLES TESTED DURING FIVE YEAR PERIOD 1950-54 THAT OCCUR IN VARIOUS LIME REQUIREMENT GROUPS

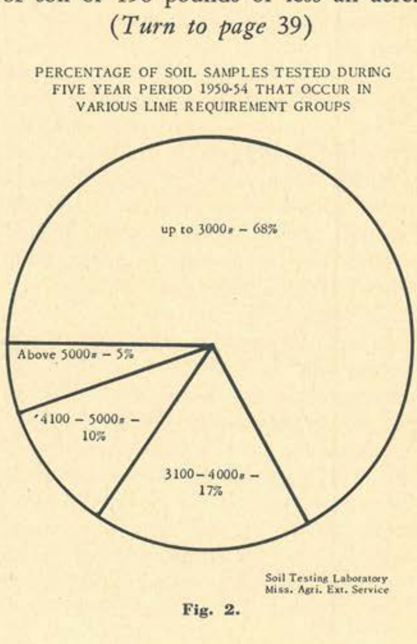

Fig. 2.

Plant-food Content of Crops—Guide to Rotation Fertilization

By F. L. Bentz, Jr.

Agronomy Department, University of Maryland, College Park, Maryland

ONE approach to the problem of determining how much fertilizer should be used in a particular rotation is to estimate the amount of plant food removed by the crops in that rotation and, after making allowances for fixation of phosphorus and perhaps potash, to use these figures as a guide to crop needs. Of course, it is also necessary to consider how much plant food is added in the form of manure and green manure or cover crops. This approach is, admittedly, incomplete. It fails to take into account plant food which becomes available from soil minerals or organic matter. It does, however, provide a rough means of estimating fertilizer needs and a means of determining whether fertilizer applications balance the plant food removed.

Let us look at a rotation common to Maryland and many other states—corn, wheat, red clover hay. It is now common practice to pick the corn and leave the fodder on the field, so we will consider only the plant food removed by the grain and cob. Both wheat grain and straw are removed from the field when interseeded to red clover, so we will consider the entire crop. Table I shows the plant food removed by this rotation based on yields which are slightly above average.

Since red clover manufactures its own nitrogen and does not require any of this element from commercial fer-

Fig. 1. Good farming methods, including proper liming and fertilizing, crop rotation and contour farming, provide good yields and control erosion on this Maryland farm.

TABLE I.—PLANT FOOD REMOVED BY A ROTATION OF CORN, WHEAT, HAY

Crop and yield	Pounds per acre removed		
	N	P_2O_5	K_2O
Corn—60 bu. grain per acre	52	21	13
Wheat—25 bu. grain per acre	31	15	8
1.25 tons straw per acre	14	4	22
Red clover—2 tons hay per acre	(75)	14	76
Total (excluding clover nitrogen)	97	54	119

tilizer, the figures for nitrogen have been put in parentheses to indicate that these figures are not to be included in the total amount removed by the rotation.

Table II shows how the average diary farmer might fertilize this rotation, assuming that he plowed under a grass sod and applied manure.

If the plant food applied is compared with the plant food removed it is apparent that this farmer has added sufficient nitrogen (N), about twice as much phosphate (P_2O_5) as removed, and has not added enough potash (K_2O). Since phosphorus is fixed by the soil in forms unavailable to plants, it is necessary to add two or three times as much phosphate as actually required. Perhaps, therefore, this farmer could use extra phosphorus. He definitely needs more potash, so one way to balance his fertilizer program would be to broadcast 300 to 350 lbs. per acre of 0-10-20 before planting corn or he might prefer to apply this fertilizer as a topdressing to the clover crop.

Now let's look at a rotation of corn, barley, and three years of alfalfa in which the farmer needs high production per acre. Let's again assume that only the corn grain is removed, and that both barley grain and straw are removed. (Table III).

Here again the figures for nitrogen removed by alfalfa have been placed in parentheses to indicate that this crop manufactures its own nitrogen and that the farmer does not have to supply it.

Attention should be directed to the

TABLE II.—FERTILIZATION OF A CORN, WHEAT, HAY ROTATION

Source of plant food	Pounds per acre applied		
	N	P_2O_5	K_2O
Clover-grass sod turned under*	40	?	?
6 tons manure per acre**	30	18	15
300 lbs./A 5-10-5 planter application for corn	15	30	15
300 lbs./A 5-10-5 drilled for wheat	15	30	15
No fertilizer for hay	....	....	....
Total	100	93	45

* Only nitrogen is estimated for the clover-grass sod because good estimates of phosphorus and potash are not available.

** C. E. Phillips, Agronomy Department, University of Delaware, estimates that this amount of plant food from manure becomes available to crops. It does not represent the total plant-food content of manure.

Fig. 2. Small grains show differences in response to different fertilizer treatments. Plant Research Farm, University of Maryland.

very large amounts of potash removed by the alfalfa in this rotation. It is quite possible that low potash fertilization and high potash removal by alfalfa may account for short life of some alfalfa stands.

Let's assume that the farmer has no manure available for use on the fields in this rotation. To meet plant-food needs he might fertilize as shown in Table IV.

Comparing plant food applied with plant food removed, this fertilization program approximately meets the needs of the rotation. The amount of nitrogen applied is slightly less than that removed but extra nitrogen will be supplied by soil organic matter. Twice as much phosphorus has been applied as is removed. On some soils where phosphate fixation is high, the amount of phosphate applied may have to be greater, but in many cases this program should be suitable. Potash applications balance crop removals.

One of the first questions that will be asked by the farmer is how the high

(*Turn to page* 44)

TABLE III.—PLANT FOOD REMOVED BY A ROTATION OF CORN, BARLEY, AND THREE YEARS OF ALFALFA

Crop and yield	Pounds per acre removed		
	N	P_2O_5	K_2O
Corn—100 bu. grain per acre	86	36	21
Barley— 40 bu. grain per acre	35	16	12
1.25 tons straw per acre	13	5	34
Alfalfa—3.5 tons hay per acre	(160)	33	165
Alfalfa—3.5 tons hay per acre	(160)	33	165
Alfalfa—3.5 tons hay per acre	(160)	33	165
Total (excluding alfalfa nitrogen)	134	156	562

The Low-potash Soils in Adirondack Forests[1]

By Laurence C. Walker

School of Forestry, University of Georgia, Athens, Georgia

DEEP sandy soils, such as those found in the glacial outwash plains of New York's Adirondack Mountains, have long been noted for having very small amounts of available potash. Professors S. O. Heiberg and D. P. White of the College of Forestry at Syracuse found the soil in many localities to be too low in potash even for normal growth of several conifer species.

This is of particular interest since, prior to clearing these easily tilled and level "sand plains" for agriculture by early settlers, virgin spruce, pine and hemlock forests were there. When new ground was first broken, the soil produced good crops; and for a long time fertility was maintained by release of nutrients stored in the forest humus. But after a hundred years of cultivation with little if any fertilization, the fields were depleted of natural fertility and abandoned as sub-marginal. Vast expanses of deserted and eroded lands were eventually planted with pine and spruce trees.

Deficiency Symptoms and Native Plants

It was in these plantations that the Syracuse professors noted the symptoms of potash deficiency. After that, the signs—slow growth and small chlorotic needles which drop off prematurely—were found in native white pines of the region, too. Other malformations indicative of low-potash levels were subsequently noted for gray birch, black cherry, red maple, and several herbs.

In contrast, jack pine and Scotch pine show no potash-deficiency symptoms and are apparently not very demanding of the soil for this nutrient. These latter species, however, were found by Professor Earl Stone of Cornell to exhibit signs of magnesium starvation.

Even the quality of native vegetation is experiencing a declining transformation. After abandonment for cultivated crops and hayfields, poverty grass takes over, and then *Polytrichum* moss encroaches. Other less-demanding mosses and lichens next invade the areas, and finally there is no vegetation. Erosion follows and presents a despairing scene (Fig. 1).

Soils Described

Influenced by native vegetation, these light-textured (89% sand, 6% silt, 5% clay) acid soils of the Hinckley series develop weak to medium podzol characteristics. Under the brownish black surface soil lies brown coarse sand which is rather homogeneous in color and texture to a depth of 3 feet. Below that point there is a gradual transition through light yellow brown to gray. These prehistoric sand deposits were washed down from the slopes in melting glacier streams and sorted in prehistoric lakes which, of course, have been drained for thousands of years. Although they often exceed 30 feet in depth, occasional outcrops

[1] Much of this material is from a Ph.D. thesis prepared at the State University of New York, College of Forestry in 1953. Acknowledgment is made to Professors D. P. White and S. O. Heiberg, under whom the author studied.

Fig. 1. An abandoned field showing sparse cover in transition to bare land. Scotch pine plantations are in the background.

of Grenville limestone and metamorphosed igneous rocks occur.

Since the total potash present is quite sufficient—from 1½ to 2½%—it seems apparent that basic nutrients, like potash, are leached about as rapidly as released by mineral and organic matter decomposition except for that small portion retained in the organic matter of the surface soil. The slow rate of silicate soil breakdown and the great loss to drainage water certainly contribute to the potash-deficiency problem. Some potash is, of course, absorbed from lower soil horizons by plant roots before lost to streams or percolated past the root zone. Translocated to above-ground tissues, it is again released in soluble form in the surface soil following decomposition of these tissues.

Exchangeable potash in the plow horizon (upper 6 to 8 inches) in the plains ranges from 4.9 to 20.8 ppm. and averages 9 ppm. The potash content diminishes to 2 ppm. in the upper *B* horizon and remains constant to the B_3 at about 4 feet. Figure 2 illustrates this decrease of available potash and

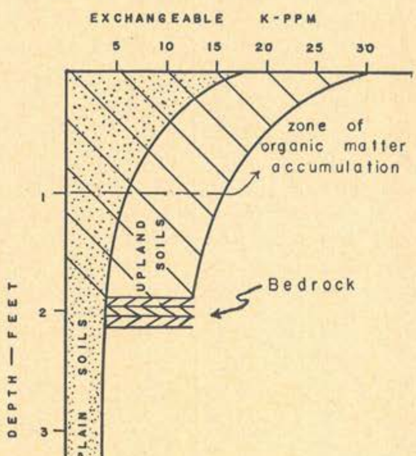

Fig. 2. Decrease of exchangeable potash with depth in columns of a deep sandy outwash-derived soil and a shallow upland soil.

contrasts it with the amount of the nutrient in an upland soil adjacent to a sand plain.

These upland soils, which occur intermittently among the plains, consist of a shallow mantle of unstratified glacial drift. Clay, sand, gravel, and boulders are intermingled with soil material previously on the area. Often called "coarse till" because of the large stones present, these soils are mapped in the Gloucester series. They contain from 25 to 158 ppm. exchangeable potash.

When fertilized with 200 pounds per acre of 60% muriate of potash, the content in the plow horizon is greatly improved. From 24 to 83 ppm. become readily available to plants in these outwash sands. Usually fertilization increases the exchangeable potash content threefold, according to our analyses. In this area, soils with less than 20 ppm. exchangeable potash may be expected to produce deficient trees of the demanding species.

Total nitrogen in the surface soil of unreforested plains is about 0.12%. Only a trace of acid-soluble phosphorus is found in the plow layer and upper *B* horizon. At lower depths in the profile, phosphorus concentrations increase to 12 ppm. Soluble calcium is also minimal in the surface horizon.

In contrast, the nitrogen content of the plow zone in neighboring till soils measures over 0.20% (Fig. 3), while

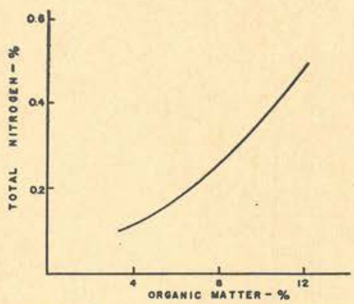

Fig. 3. Low nitrogen levels also accompany low organic matter levels in potash-deficient soils.

phosphorus is well above the trace level—as high as 11 ppm.

The pH of unreforested soils is about 5.4 in the plow zone and increases slightly with depth to a maximum of 6.2 in the B_3 horizon. In contrast, pH values for adjoining upland soils increase to over 7.5 for the *B* horizon.

Organic matter percentages of the sand plain plow layers have a wide range—from 3.8 to 6.3. The average for the locales sampled is about 4.2%. Where wind erosion occurs, considerably less is found; while for some till soils nearby, organic matter measures over 8%.

The high of 6.3% organic matter for the sand plains occurs in a depression a few feet lower than the remainder of a relatively level field. Nutrient analyses also show high levels for this area; potash content, for instance, is 16 ppm. One might attribute this to drainage of nutrients and decomposition of an overburden of fertile soil from higher elevations into the area. The increased fertility results in more abundant and rapid turnover of ground cover which, upon decomposition, raises the organic matter content in the surface soil.

Considering organic matter as largely colloidal in nature, it seems apparent why the relationship between the content of that material and available potash exists (Fig. 4). Exchangeable

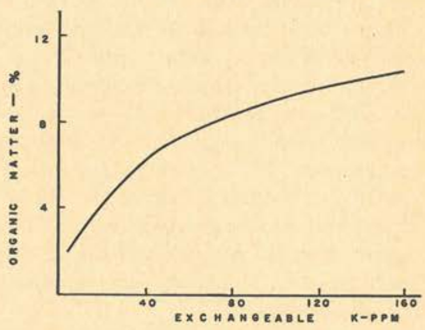

Fig. 4. Exchangeable potash is directly related to the amount of organic matter in plow horizons of sand plains soils.

potash is absorbed in ionic form on the minute colloidal particles in the soil. The amount of mineral colloidal matter in coarse sandy soils is too small

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PICTORIAL

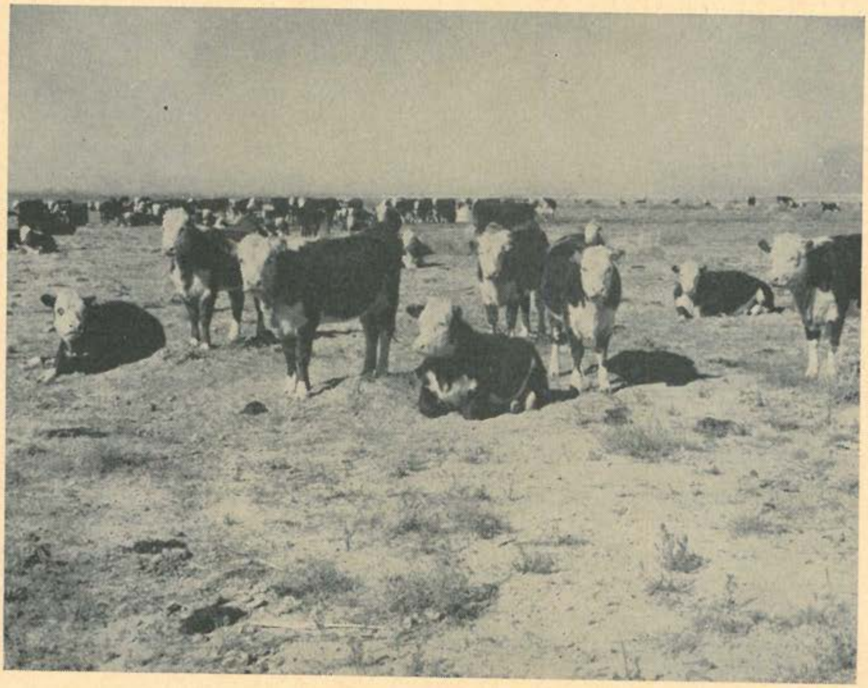
"Setting the Table" for the New Crop

Above: Clearing off rough pasture land, Lee County, Iowa.

Below: Hampshires hogging down a section of cornfield.

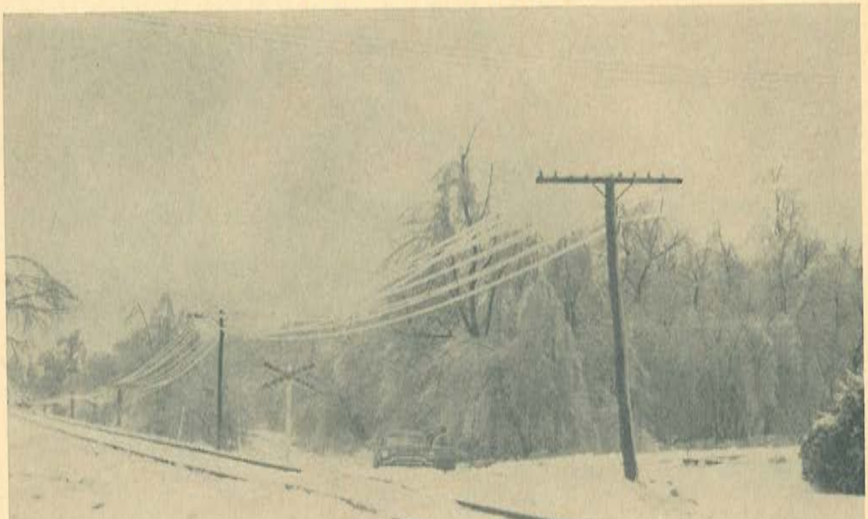
Above: Texas longhorns on game refuge near Valentine, Nebraska.

Below: Whitefaces now graze where the longhorns used to roam.



Above: Beneficent snow.

Below: Destructive ice.



The Editors Talk

Our Cover Picture

Our cover this month depicts progressive stages of potash-deficiency symptoms on alsike clover. These symptoms are similar to the signs of potash starvation shown by other clovers and alfalfa—first the chlorosis which appears as small dots around the edges of the leaves, then spreads over the entire leaf margin, killing the tissue and causing the leaf to scorch and shrivel.

Alsike, a comparatively new crop in this country, has been cultivated in Sweden since the tenth century. Linnaeus, finding it in Alsike Parish, thought it was a hybrid between red and white clovers and called it *Trifolium hybridum*. It was introduced into England in 1834 and from there to this country in 1839.

Like other legumes, alsike clover is a heavy feeder on potash. It does well on nearly all kinds of soils with abundant moisture, but does best on the heavier soils. Alsike requires a cool climate and is very cold-resistant. It is grown extensively north of the Ohio River, west to the Great Plains, and in Idaho and the Northwest. Almost none is grown in the South or the dry areas.

Alsike makes a finer quality of hay than red clover because it is finer stemmed and because it is not hairy it is freer of dust. However, it usually is seeded with timothy or with timothy and red clover for hay and good pasture.

Less Fertilizer—More Often

Agronomists of the U. S. Department of Agriculture have found that a more efficient production can be obtained from high-yielding grass-legume mixtures grown for pasture and forage by using fertilizers prepared to meet plant needs, and perhaps by making limited applications more frequently. Studies by the Agricultural Research Service and several eastern State experiment stations on typical eastern soils have shown that fertilizers containing a high percentage of potash do a better job than the commonly-used superphosphate fertilizers applied in the same amounts.

Soils in the Middle Atlantic and New England States are low in native potash. Yet tests have shown that such high-producing mixtures as bromegrass-alfalfa and orchardgrass-ladino clover will annually remove from 100 to 150 pounds of potash per acre from the land compared to only 20 to 40 pounds of phosphate. On eastern soils these grass-legume mixtures respond well to fertilizers with a nitrogen-phosphate-potash ratio of 0-10-20; in other words using one portion of phosphate to two of potash.

The agronomists believe the tendency of plants to absorb more potash than they need when it is abundant indicates that several applications of fertilizer during the year instead of the usual single application of a large amount might be the most efficient way to use potash. Making more frequent applications of this plant food also would help minimize its tendency to leach away. However, further research is needed to determine whether benefits in increased production would justify the expense of making two or three applications of fertilizer a year. In many cases labor and time for making the extra applications would be important factors of consideration. Where both could be provided, the "split" applications undoubtedly will come into more and more use.

Teamwork

"Teamwork in Building Southern Agriculture" was the theme uppermost in the minds of some 1,500 agricultural specialists when they got together in Atlanta, Georgia, February 6-8. The occasion was the 53rd Annual Convention of the Association of Southern Agricultural Workers. In 15 sectionalized discussion groups, interested listeners were brought up to date on new research, extension methods, and other developments in behalf of the South's progress.

Perhaps "teamwork" was best emphasized in the first big general session of the convention by H. McKinley Conway, Jr., able speaker, editor, and publisher of Manufacturers Record, Atlanta. Mr. Conway told his audience that any group which promotes agricultural progress in the South also contributes to its industrial advancement. Conversely, industrial development is the long-term solution to the farm problem in the South. It has been estimated that within the next 10 years some 3,000 multimillion dollar plants and thousands of smaller ones will be added in the South's industrialization program.

One speaker called farms "open-air factories." With such a group of research workers, overseers, and salesmen of improved methods as the Southern Agricultural Workers, plus the cooperation with other industries, the steady progress of Southern agriculture is assured.

Elected as officers to serve for the ensuing year were: President—W. M. Fifield, Director, Agricultural Experiment Station, University of Florida, Gainesville, Florida; Vice-President—L. S. Ellis, Dean, College of Agriculture, Director of the Experiment Station, and Director of Agricultural Extension, University of Arkansas, Fayetteville, Arkansas; Secretary-Treasurer—C. E. Kemmerly, Jr., Agricultural Extension Service, Louisiana State University, Baton Rouge, Louisiana.

"Today we are standing on the threshold of what may be the most revolutionary development of all time in agriculture—the harnessing of the atom for a variety of new peacetime uses. Will nuclear research make it possible to speed up the growth of plant life in such a way that more than one crop may be harvested each season? Will it make possible mutations and other livestock breeding advances which will completely change our present marketing cycles? Steers finished in much less time than is now required? The answer to all of these questions may be yes. No man today could safely predict the limitations on atomic developments. Rain-making may become a normal part of crop production. Deserts may bloom.

"These are exciting times. I can't think of a better place to spend the next quarter-century than on an American farm."—*Ezra Taft Benson, Secretary of Agriculture.*

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	51.4	123.0	216.0	143.0	214.0	17.35	60.30	....
1955									
February	31.69	36.8	117.0	297.0	140.0	213.0	18.55	55.20	....
March	31.87	....	118.0	310.0	136.0	212.0	18.25	53.40	....
April	31.93	....	217.0	315.0	136.0	209.0	17.65	53.40	....
May	31.51	46.0	223.0	315.0	140.0	213.0	17.45	53.10	....
June	31.43	39.5	121.0	392.0	140.0	206.0	16.35	52.00	....
July	32.11	38.0	88.0	279.0	140.0	197.0	15.25	54.00	....
August	32.74	50.6	75.2	179.0	130.0	190.0	15.25	50.10	....
September	33.77	51.5	71.3	142.0	124.0	192.0	15.55	43.70	....
October	32.83	55.0	72.3	144.0	114.0	194.0	15.75	43.50	....
November	32.42	52.5	82.9	168.0	109.0	194.0	16.05	44.30	....
December	31.19	57.2	80.7	203.0	115.0	195.0	16.55	45.00	....
1956									
January	30.67	51.3	99.4	199.0	116.0	195.0	16.55	45.50	....

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	240
1954	270	514	176	246	223	242	146	267	228
1955									
February	256	368	168	338	218	241	156	245	258
March	257	...	169	353	212	240	154	237	262
April	258	...	311	359	212	236	149	237	270
May	154	460	320	359	218	241	147	235	308
June	253	395	174	435	218	233	138	231	230
July	259	380	126	318	218	223	128	239	223
August	264	506	108	204	202	215	128	222	211
September	272	515	102	162	193	217	131	194	230
October	265	550	104	164	178	219	133	193	223
November	261	525	119	191	170	219	135	196	231
December	252	572	118	231	179	221	139	200	231
1956									
January	247	513	143	227	181	221	139	202	244

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							
February	.895	....	....	.405	.825	16.00	.193
March	.895	....	....	.405	.825	16.00	.193
April	.895	....	....	.405	.825	16.00	.193
May	.895	....	....	.405	.825	16.00	.193
June	.895	....	....	.360	.720	13.45	.175
July	.895	....	....	.390	.735	14.00	.193
August	.895	....	....	.390	.735	14.00	.193
September	.895	....	....	.390	.735	14.00	.193
October	.895	....	....	.390	.735	14.00	.193
November	.895	....	....	.390	.735	14.00	.193
December	.895	....	....	.390	.735	14.00	.193
1956							
January	.895	....	....	.390	.735	14.00	.193

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
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							
February	167	...	...	72	87	66	83
March	167	...	...	72	87	66	83
April	167	...	...	72	87	66	83
May	167	...	...	72	87	66	83
June	167	...	...	66	76	56	80
July	167	...	...	70	77	58	82
August	167	...	...	70	77	58	82
September	167	...	...	70	77	58	82
October	167	...	...	70	77	58	82
November	167	...	...	70	77	58	82
December	167	...	...	70	77	58	82
1956							
January	167	...	...	70	77	58	82

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						
February	2.98	2.18	11.16	12.23	8.50	8.50
March	2.98	2.18	10.47	12.45	7.82	7.82
April	2.98	2.18	9.90	12.41	6.68	6.23
May	2.98	2.16	9.97	11.92	6.19	6.25
June	2.98	2.02	9.91	11.55	6.23	5.92
July	2.98	2.02	10.01	9.43	6.68	7.14
August	2.98	2.07	9.88	11.12	7.04	6.86
September	2.98	2.05	9.29	11.60	6.75	6.53
October	2.98	2.07	9.17	13.01	7.47	7.16
November	2.98	2.07	8.71	13.10	6.14	6.23
December	2.98	2.12	9.21	12.93	5.66	6.00
1956						
January	2.98	2.12	9.43	12.75	5.58	5.58

Index Numbers (1910-14 = 100)

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						
February	111	76	319	346	252	241
March	111	76	299	353	232	222
April	111	76	283	352	198	177
May	111	76	285	338	184	178
June	111	71	283	327	185	168
July	111	71	286	267	198	203
August	111	73	282	315	209	195
September	111	72	265	329	200	186
October	111	73	262	369	222	203
November	111	73	249	371	182	177
December	111	74	263	366	168	170
1956						
January	111	74	269	361	166	159

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
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	264	248	142	95	311	167	76
1955								
February	245	264	248	139	93	291	167	77
March	244	265	248	137	93	275	167	77
April	247	265	248	135	93	252	167	77
May	244	263	248	134	93	243	167	77
June	243	263	248	131	90	242	167	70
July	237	262	248	132	90	240	167	74
August	233	260	248	133	91	252	167	74
September	235	259	250	132	91	244	167	74
October	230	261	250	134	91	259	167	74
November	225	259	250	131	91	235	167	74
December	223	259	250	132	92	232	167	74
1956								
January	226	259	252	132	92	232	167	74

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

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

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

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

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

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

REVIEWS

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

Fertilizers

"Availability of Phosphate Fertilizer Materials in Calcareous Soils in Colorado," Agr. Exp. Sta., Colo. A. & M. College, Fort Collins, Colo., Tech. Bul. 58, Nov. 1955, W. R. Schmehl, S. R. Olsen, R. Gardner, S. D. Romsdal, and R. Kunkel.

"Fertilizers for Louisiana Crops," Agr. Ext. Serv., La. State Univ., Baton Rouge, La., Ext. Pub. 1192, Oct. 1955, W. J. Peevy.

"Plant Food Removal by Feed Crops," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 98, May 1955, F. L. Bentz.

"Fertilizer and Planting Practices for Maryland Tobacco," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 111, June 1955, C. G. McKee, O. E. Street, and J. H. Hoyert.

"Small Grain Fertilizer Experiments, Southeast Missouri, 1953-55," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo.

"Commercial Fertilizer Results with Spring Small Grains 1955," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 47, Oct. 1955, G. W. Lowrey, R. A. Olson, and P. L. Ehlers.

"Investigations of the Role of Starter Solutions in Flue-Cured Tobacco Production," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Tech. Bul. 112, July 1955, T. B. Hutcheson, Jr. and W. G. Woltz.

"North Carolina Fertilizer Report for 1954-1955," State Dept. of Agr., Raleigh, N. C., No. 142, Dec. 1955.

"Fertilizing Ohio Farms," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Ext. Bul. 346, Rev. May 1955, E. Jones.

"Methods of Applying Fertilizer for Efficient Use," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., B-253, M. K. Thornton.

"Effect of Fertilizers on the Yield, Grade and Headweight of Lettuce," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1828, Nov. 1955, R. T. Correa and G. Otey.

"Sewage Sludge for Soil Improvement," USDA, Wash., D. C., Cir. 972, Nov. 1955, M. S. Anderson.

Soils

"Maintaining and Improving Soil Tilth," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 106, May 1955, E. Strickling.

"Techniques for Determining the Nutrient Status of Soils and Crops," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 780, June 1955, W. J. Hanna and E. R. Purvis.

"Soils and Soil Associations of New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Ext. Bul. 930, May 1955, M. G. Cline.

"Irrigated Pastures for South Texas," Agr. Ext. Serv., Tex. A. & M. College, College Station, Tex., B-819, E. M. Trew and C. S. Hoveland.

"Subsoiling in Virginia and Other States," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 659, June 1955.

"Agricultural Conservation Program Handbook for 1956 for: Alabama, Arizona, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming, National Bulletin," USDA, Wash., D. C.

Crops

"Ornamental Plants for Low-Elevation Desert Areas of Southern California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 750, March 1955, M. E. Mathias, W. Metcalf, M. H. Kimball, R. S. Ayers, C. L. Hemstreet, and D. D. Halsey.

"Range Experimental Farm, Manyberries, Alberta, Progress Report 1948-1953," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., Sept. 1955.

"Illustration Stations Division, Central Experimental Farm, Ottawa, Progress Report 1948-1953," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., Sept. 1955.

"Field Husbandry, Soils and Agricultural Engineering Division, Central Experimental Farm, Ottawa, Progress Report 1949-1953," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., June 1955.

"Planning Farm Home Grounds," Dept. of Agr., Ottawa, Ont., Can., Pub. 959, Oct. 1955, R. W. Oliver.

"Pasture for Poultry," Dept. of Agr., Ot-

tawa, Ont., Can., Pub. 771, Rev. Aug. 1955, H. S. Gutteridge and F. S. Nowosad.

"State Board of Agriculture, Annual Report, 1954-1955, Issued for Quarter Ended September 30, 1955," State Board of Agr., Dover, Del., Vol. 45, No. 3, J. L. Clough.

"Ornamental Hedges for Florida," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Bul. 162, Nov. 1955, H. Mowry and R. D. Dickey.

"Tung Oil Industry in Florida," State Dept. of Agr., Tallahassee, Fla., Bul. 11, Sept. 1955, D. W. Hadsell.

"Landscape Plants for Florida Homes," State Dept. of Agr., Tallahassee, Fla., Bul. 106, April 1955, J. V. Watkins.

"Propagation of Ornamental Plants by Layering," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 141, Sept. 1955, T. J. Sheehan and J. N. Joiner.

"New Varieties and Selected Strains of Peanuts," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Bul. N. S. 11, Nov. 1955, B. B. Higgins and W. K. Bailey.

"Production of Georgia Easter Lily Bulbs," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Bul. 590, June 1955, R. A. Bowden.

"Hawaii Agricultural Experiment Station, Report for the Biennium Ending June 30, 1954," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, May 1955.

"1955 Experiment Station Results, Fall Seeded Wheat, Barley, Oats," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 329, Aug. 1955, A. L. Clapp.

"Growing Alfalfa," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 92, May 1955, T. S. Ronningen.

"Pasture and Hay Seedings for Maryland," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 94, May 1955, C. P. Ellington, A. O. Kuhn, T. S. Ronningen, and A. M. Decker.

"A Guide for Improving Cropping Systems on Dairy and Livestock Farms," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 95, May 1955, C. P. Ellington and A. O. Kuhn.

"Rotations and Cropping Systems for Feed Production," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 96, May 1955, A. O. Kuhn.

"Some Goals in Crop Production," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 97, May 1955, A. O. Kuhn.

"Oat Production in Maryland," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 99, May 1955, R. G. Rothgeb and J. L. Newcomer.

"Soybean Production in Maryland," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 100, May 1955, R. C. Leffel, J. L. Newcomer, and G. W. Barber.

"Growing Corn in Maryland," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 102, May 1955, R. G. Rothgeb, F. L. Bentz, Jr., and C. P. Ellington.

"Planning for Full Season Pasture," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 107, June 1955, A. M. Decker, Jr. and A. O. Kuhn.

"Growing Better Maryland Tobacco," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 108, May 1955, O. E. Street and J. H. Hoyert.

"Zoysia as a Turf Grass," Agr. Ext. Serv., Univ. of Md., College Park, Md., Ft. Sh. 112, June 1955, A. O. Kuhn.

"Seedling Year Management of Medium Red Clover, Trifolium Pratense L.," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. 453, Feb. 1955, R. J. Allen, Jr. and A. O. Kuhn.

"Pastures for Beef Cattle," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. 455, June 1955, T. S. Ronningen, A. M. Decker, Jr., R. L. Jones, and J. E. Foster.

"Annual Report, 1953-1954," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. 482, Sept. 1954.

"Mesabi and Wanda, New Chrysanthemums," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 26, Jan. 1956, R. A. Phillips and R. E. Widmer.

"Sixty-Eighth Annual Report of the Director of the Mississippi Agricultural Experiment Station for the Fiscal Year Ending June 30, 1955," Agr. Exp. Sta., Miss. State College, State College, Miss.

"Birdsfoot Trefoil," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 779, June 1955, G. H. Ahlgren, R. A. Briggs, M. A. Sprague, and R. C. Wakefield.

"The Adams Walnut," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Cir. of Inf. 550, Aug. 1955, Q. Zielinski and H. Hartman.

"Sixty-Seventh Annual Report, 1954, of the Tennessee Agricultural Experiment Station," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn.

"Blue Panicgrass," Agr. Ext. Serv., Tex. A. & M. College, College Station, Tex., B-245, Aug. 1954, E. M. Trew.

"Red Clover Variety Tests in East and Central Texas," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1827, Nov. 1955, E. C. Bashaw, J. R. Wood, M. E. Riewe, E. D. Cook, and O. E. Smith.

"Summary of the 1955 Texas Corn Performance Tests," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1829, Dec. 1955, A. J. Bockholt, J. S. Rogers, and J. W. Collier.

"Carrizo Springs Cotton Variety Test, 1955," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1830, Dec. 1955, R. A. Schwartzbeck and J. A. Tynan.

"Winter Garden Cotton Variety Test, 1953-55," Agr. Exp. Sta., Tex. A. & M. College, College Station, Tex., Prog. Rpt. 1831, Dec. 5, 1955, R. A. Schwartzbeck and J. A. Tynan.

"The Foreign Tobacco Market and You,"

Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 662, July 1955, G. R. Matthews.

Economics

"Type-of-Farming Areas in Arkansas," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 555, June 1955, V. B. Fielder.

"Movement of Citrus Trees from Florida Nurseries, July 1, 1928 to June 30, 1955," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Ag. Ec. Mimo. Rpt. 56-4, Dec. 1955, Z. Savage.

"How Farm People Accept New Ideas," Agr. Ext. Serv., Iowa State College, Ames, Iowa, Sp. Rpt. 15, Nov. 1955.

"Cost of Producing Apples and Pears in the Hood River Valley, Oregon, Progress Report VII," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Cir. of Inf. 548, Sept. 1955, D. C. Mumford and A. E. Irish.

"Some Economic Aspects of Forage Integration on Irrigated Farms," Agr. Exp. Sta., Univ. of Wyoming, Laramie, Wyoming, Bul. 334, May 1955, J. A. Hopkins.

"Marketing Costs for Food," U.S.D.A., Agr. Mktg. Serv., Wash., D. C., Misc. Pub. 708, Dec. 1955.

"Productivity of Resources Used on Commercial Farms," U.S.D.A., Wash., D. C., Tech. Bul. 1128, Nov. 1955, E. G. Strand, E. O. Heady, and J. A. Seagraves.

"Vegetables—Fresh Market, 1955 Annual Summary, Acreage, Production and Value of Principal Crops by Seasonal Groups and States with Comparisons," U.S.D.A., Agr. Mktg. Serv., Wash., D. C., TC-55:1203, Dec. 19, 1955.

"Crop Production, 1955 Annual Summary, Acreage, Yield, and Production of Principal Crops by States with Comparisons," U.S.D.A., Agr. Mktg. Serv., Wash., D. C., Dec. 19, 1955.

"Marketing Efficiency in a Changing Economy," U.S.D.A., Agr. Mktg. Serv., Wash., D. C., AMS-60.

"Apples, Production by Varieties, 1955, with Comparisons," U.S.D.A., Agr. Mktg. Serv., Wash., D. C., Dec. 1955.

"Commodity Credit Corporation Charts, Providing A Graphic Summary of Operations 1933—June 30, 1955," U.S.D.A., Wash., D. C., Nov. 1955.

"The World Agricultural Situation, 1956," U.S.D.A., Foreign Agr. Serv., Wash., D. C., Jan. 1956.

Fertility—Lime Status of Mississippi Soils . . .

(*From page* 20)

The tests for potassium showed 51% of the samples low, 39% medium, and 10% high. Exchangeable potassium levels for five soil areas of Mississippi are given in Figure 4.

Data for the two-year period 1953-54 during which time 54,000 samples were tested indicate, according to data in Table III, that the residual levels of both phosphorus and potash in cotton soils were slightly higher than in corn soils. This was considered to be a reflection of past fertilization history.

TABLE III.—PERCENTAGE OF SOIL SAMPLES ACCORDING TO INDICATED CROPS OCCURRING IN VARIOUS PHOSPHORUS AND POTASH RESPONSE RANGES.

Crop	Phosphorus			Potassium		
	L	M	H	L	M	H
Cotton......	64%	19%	17%	59%	28%	13%
Corn........	60%	17%	14%	67%	20%	13%

TABLE IV.—THE RELATIONSHIP OF SOIL PHOSPHORUS TO POTASH IN MISSISSIPPI SOILS AS INDICATED BY 54,000 SOIL TESTS MADE DURING TWO-YEAR PERIOD 1953-54.

Fiscal year	Percentage of soil samples requiring P_2O_5:K_2O ratio indicated		
	2:1	*1:1*	*1:2*
1953–54.......	31%	53%	17%
1954–55.......	17%	67%	15%
Mean.........	24%	60%	16%

The summarization of data for this same period as given in Table IV indicates that a mixed fertilizer of 1:1 ratio of P_2O_5 to K_2O was needed on 60% of the soils, one of 2:1 on 24%, and one of 1:2 on 16%. According to these data, it would appear that only three basic P_2O_5:K_2O ratios are needed in mixed fertilizers to provide appropriate rates of these plant nutrients for crops.

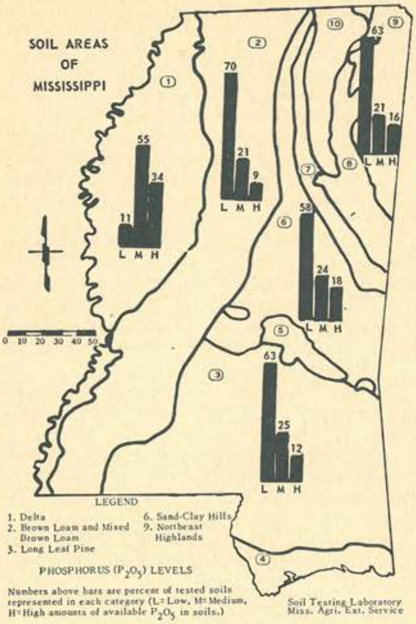


Fig. 3.

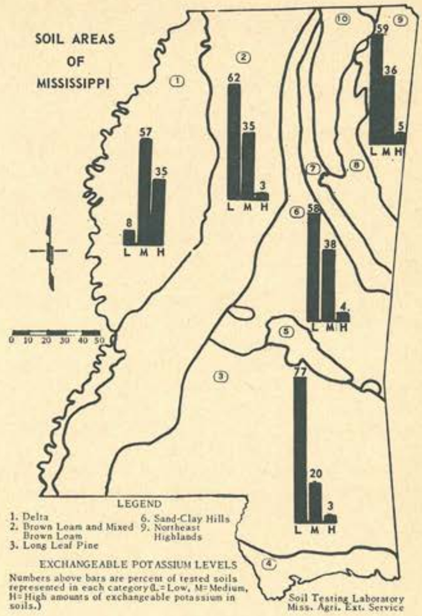


Fig. 4.

Taking Soil Samples

Data presented in Table V show that farmers, on the average, are sampling larger areas less intensively than recommended. Most states recommend that a farm be divided into approximately five-acre fields, according to kind of land and crops to be grown, for the purpose of collecting soil samples. Then, about 20 small samples of surface soil are collected from each five acres and composited to make the topsoil sample. Four samples of subsoil should be collected from the same area and composited to provide a subsoil sample. On the average, the farmers composited only 14 small samples of surface soil and less than two subsoil samples from each field in collecting both top and subsoil samples. These samples were collected and composited from nine-acre fields. This practice by

TABLE V.—HOW GOOD ARE SAMPLES SENT TO THE SOIL TESTING LABORATORY FOR ANALYSIS?

Surface soil*				Subsoil			
Av. No. sub-samples per sample		Av. No. stops per surface acre		Av. No. sub-samples per sample		Av. No. stops per surface acre	
Taken by farmer	Re-com'd	Taken by farmer	Re-com'd	Taken by farmer	Re-com'd	Taken by farmer	Re-com'd
14	20	1.55	4	1.11	4	0.3	0.8

* Average size of fields sampled: *9 acres.*

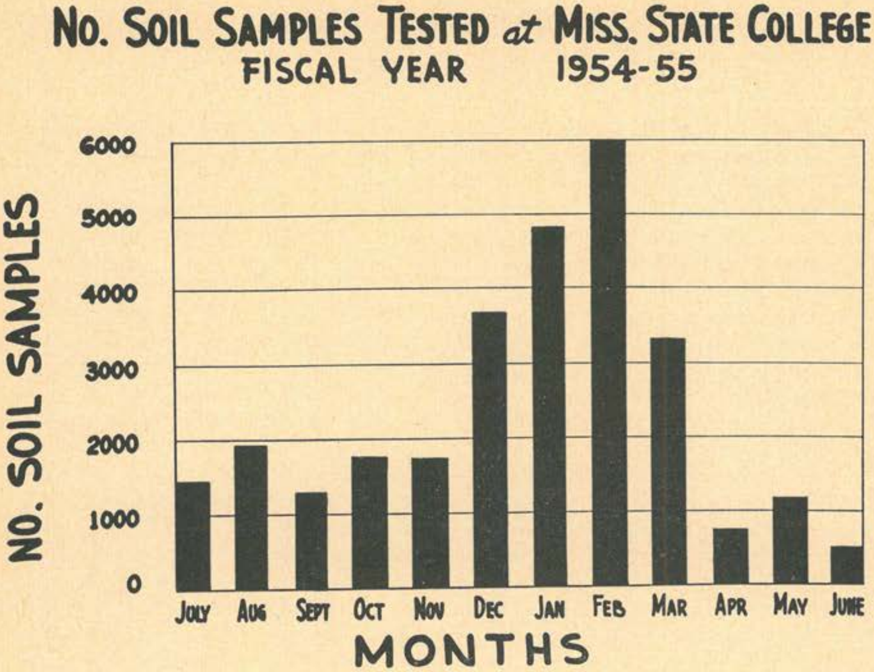


Fig. 5.

farmers is an indication of need for more emphasis on proper soil-sampling technique in the educational program.

As related in Figure 5, to receive the most efficient service from a soil-testing program, farmers should avoid, if possible, collecting and sending samples for analysis during the peak of the testing season which occurs in January, February, and March of each year. It would be desirable to collect samples for spring-planted crops throughout October, November, and early December. For fall-seeded crops the samples should be taken during late spring, summer, and early fall. Such practice will provide farmers with faster service from the laboratory and permit use of soil-testing data and fertilizer recommendations to serve as a guide for buying as well as applying fertilizer to the soil.

Summary

During the period 1950-54 the Soil Testing Laboratory analyzed 97,586 samples representing 573,309 acres of cropland for 15,175 Mississippi farmers. The soil test summary indicates that more than 50% of the soils tested were low in phosphorus, potash, and lime. Residual levels of phosphorus and potash in cotton soils were slightly higher than in corn soils. There is a wide difference in fertility status of soil areas within the State, particularly when the Delta area is contrasted with soil areas in the Hill section. The majority of the soils in the Delta area require only nitrogen. The summary shows, also, that only three basic ratios of P_2O_5 to K_2O in mixed fertilizers are necessary to provide appropriate ratios of these plant nutrients for crops.

Further, the summary shows that farmers are not sampling as intensively as they should to insure representative samples on the average. For spring-planted crops soil samples should be collected throughout October, November, and December and for fall-seeded crops they should be taken during late spring, summer, and early fall to insure faster and more efficient service.

Give Fertilizers a Chance

(*From page* 10)

sods depends upon the dispersion rate of the aggregates. The inherent stability of the aggregates differs with various soils. It is another one of the natural characteristics of the soil and probably stems from the type of parent material from which the soil is formed. The type of aggregate formed in the soil, that is, crumbly, blocky, and platy, is a natural trait governed by the parent material. The consistent use of cover crops will, of course, lengthen the interval between sods.

The use of sods in an otherwise intensive farming program is quite a management factor for the operator. He will not be satisfied just to be told that he should use sods. Efforts should be made to show him why and how he can determine when they should be used.

Keep the Topsoil in Place

"A method of plowing our hillsides horizontally, introduced into this most hilly part of our country by Col. T. M. Randolph, my son-in-law, may be worth mentioning to you. He has practiced it a dozen or 15 years and its advantages were so immediately observed that it has become very general, and has entirely changed and renovated the face of our country." Quoted from a letter by Thomas Jefferson to Tristram Dalton, May 2, 1817.

The topsoil has certain specific functions which it alone can perform. It is the stabilized portion of the soil—the part that can take the beating of cultivation, tillage, traffic, and weather. When the topsoil is stripped off, the exposed subsoil's aggregates disperse rapidly. The same effect is produced but is less noticeable when only part of the topsoil is removed and the remaining part is diluted with subsoil plowed up from below.

The topsoil, because of its organic matter content, contains the greatest cation exchange capacity of the soil. It is where the plant does most of its feeding. Because of the organic matter coating on the aggregates, the topsoil wets easier and permits the better infiltration of water. The topsoil being generally of lighter texture than the subsoil has a greater number of noncapillary pore spaces to permit the more rapid escape of by-product gases.

All of these things, and probably more, cause the topsoil to be a very important part of a soil and for these reasons it must be kept in place. How it is held in place is beside the point but it should remain where it is formed. Conservation and erosion-control practices have sales resistance to a farmer; then why antagonize him? Explain to him what soil really is and how it behaves. Put him on a genuine speaking acquaintance with soil and then let him devise his own methods. So far the only known way to keep topsoil in place is to reduce the runoff by absorbing more water into the soil and handle the excess by farming on the level. If he can think of some other method—more power to him.

Lime

Lime should be considered as an adjustment valve on the soil. When the pH is too low, the acid condition favors an excess of iron, aluminum, and manganese with a corresponding lack of nitrogen, phosphorus, calcium, and magnesium. When the pH is too high, iron, manganese, and potash may become limiting. A soil with a pH adjusted to between 6.0 and 6.5 has an adequate amount of all elements provided they are originally in the soil. The improper use of lime can practically nullify all the effects of an applied fertilizer. The frequency of application and the amount of lime to use should be governed by a soil test. The pH of a soil is another natural equilibrium, and since any changes produced will be of a temporary nature, constant checking must be carried out to produce the desired effects. It is difficult for a farmer to understand why pH behaves as it does. Fundamental and basic information presented in an understanding way is the only manner by which this can be explained.

Fertilizers

The most popular, convenient, and lowest cost management practice employed on soils is the application of fertilizers. It is popular because it has been discussed and talked about more than any other farm practice. It is convenient because equipment has been designed to handle it effectively and its use does not entail changes in farming plans or operational procedures. It is low cost because the fertilizer industry has devised manufacturing methods which permit its delivery to the farm at unbelievably modest prices per pound of nutrient. In the present era of very high yields, nutrients must be added to the soil to satisfy the requirements of the crop.

Although fertilizer is delivered to the farm at incredibly low cost, it is still a major factor in the cost of production and every effort should be made to obtain the greatest return per dollar invested. Fertilizer can only show its brightest colors when aeration, water supply, and soil reaction are such as not to hamper its effectiveness. Fertilizer is not a catholicon. Positive steps should be taken through teaching and education to show farmers why this is true. It is time to give fertilizers a chance to show what they can do.

Soils do not wear out, die, or just pass away. When managed properly, they improve with age. Our objective should be to produce top economic yields this year and in so doing improve the soil so that next year top yields can again be produced with less problems than last. The six basic principles of soil management make this a reality. Those principles are: (1) Matching the crop and the soil; (2) an annual increment of organic matter; (3) rotation containing a sod crop; (4) keeping the topsoil in place; (5) proper adjustment of soil reaction with lime; and (6) additions of adequate amounts of properly combined fertilizers.

George Washington in a letter to Arthur Young, December 4, 1788, has arranged perfectly the words for the conclusion of this article. He said, "The more I am acquainted with agricultural affairs, the better I am pleased with them; insomuch, that I can nowhere find so great satisfaction as in those innocent and useful pursuits. In indulging these feelings, I am led to reflect how much more delightful to an undebauched mind is the task of making improvements on the earth, than all the vain glory which can be acquired from ravaging it, by the most uninterrupted career of conquests."

Supplemental Irrigation in South Carolina

(*From page* 18)

115 bushels for the non-irrigated.

Pimento peppers irrigated three times produced 12,195 pounds per acre. Of this amount 10,676 pounds were marketable as compared to 7,074 pounds produced and 4,252 pounds marketable for the non-irrigated peppers.

History and Growth of Irrigation

Irrigation in South Carolina dates back to the time when the early settlers first flooded the rice fields. The area along the coast in the vicinity of Charleston, Beaufort, and Georgetown is also one of the oldest vegetable-growing areas in the United States, and early truckers in this area tried out every conceivable idea in order to water these crops during dry weather. This area experienced the complete evolution of irrigation from the surface method through overhead systems of portable steel tubing. Prominent in the history of irrigation of truck crops are such pioneers as the Paul Sanders family of Ritter, the Geratys of Meggetts and the more recent irrigators including the Stevens, McLeods, and others who began in the early thirties. It was not until the late thirties that irrigation spread to other crops such as sweet potatoes and tobacco. Ralph Bell of Lee County was a pioneer in this field, also Dave White of McBee, who was active in promoting irrigation in the early forties and was one of the earliest peach irrigators.

The introduction of light-weight, portable aluminum irrigation tubing and quick couplers, during the war and immediately afterwards, put sprinkler irrigation on a more practical basis.

According to County Agent reports in South Carolina, the number of sprinkler irrigation systems have increased from 34 in 1947 to 542 in 1953. The total number of acres irrigated increased from 2,371 to 16,029 (exclusive of rice irrigation). The fastest growth took place between 1950 and 1953, an increase of 412 systems and 11,571 acres under irrigation during this period.

Summary

Some costly mistakes in planning for irrigation can be avoided by following some simple suggestions:

1. Be sure of an adequate water supply to irrigate acreages planned.
2. Plan to plant the crop to be irrigated on the most productive land nearest the water source. Pumping water long distances costs money.
3. Plan the system to fit your farm. A package-deal system seldom works satisfactorily. Have a thorough study of your problem and help from Extension Service, Soil Conservation, other agricultural agencies and private consultants in planning your system. Many mistakes may be avoided.
4. Apply sufficient water as often as necessary for good crop growth. Many farmers do not use their irrigation systems enough. It takes a little more time and effort than originally thought. Sometimes farmers are inclined to wait, thinking it is going to rain. Apply water before the crop begins to suffer.
5. Use enough fertilizer and seed to get maximum efficiency from water applied. To produce larger yields per acre with irrigation requires closer spacing of plants and more fertilizer.
6. Use water on high value crops first—tobacco, peaches, vegetables, and dairy pasture. Other crops may be irrigated profitably when systems are purchased for the above crops if ample labor and water are available.

Although farmers have been irrigating in South Carolina for many years, we by no means have all the answers. Irrigation is no substitute for good farm practices.

Plant-food Content of Crops . . .

(*From page* 23)

fertilizer costs of this program can be justified. At the current prices the total cost of fertilizer for the rotation will be less than $75.00. One hundred bushels of corn at $1.50 per bushel, 40 bushels of barley at $1.00 per bushel, 1.25 tons of straw at $16 per ton, and 10.5 tons of alfalfa hay at $50.00 per ton would have a total value for the rotation of $735.00. It would seem therefore, that a fertilizer expense of approximately 10 per cent of the total crop value could well be justified.

I would again like to point out that

TABLE IV.—FERTILIZATION OF A CORN, BARLEY, THREE YEARS ALFALFA ROTATION

Source of plant food	Pounds per acre applied		
	N	P_2O_5	K_2O
For Corn			
Alfalfa-grass sod turned under	75	?*	?*
400 lbs./A 0–10–20 turned under with sod or broadcast after plowing	0	40	80
400 lbs./A 5–10–15 planter application	20	40	60
For Barley			
400 lbs./A 5–10–15 drilled	20	40	60
For Fall Seeding of Alfalfa			
450 lbs./A 0–10–20 plowed under or broadcast after plowing	0	45	90
250 lbs./A 4-12-12 drilled with seed	10	30	30
For Topdressing Alfalfa			
400 lbs./A 0–10–20	0	40	80
400 lbs./A 0–10–20	0	40	80
400 lbs./A 0–10–20	0	40	80
Totals	125	315	560

* Since good estimates of the amounts of P_2O_5 and K_2O furnished by alfalfa sods are not available, no values have been assigned for these plant foods.

this approach to the problem of determining rotation fertilization has several faults. It does not take into account the amount of plant food furnished by the soil. With experience on a particular farm, the farmer may well be able to increase or decrease fertilizer use to suit his own soil conditions.

Another fault with the discussion is that nitrogen and potash applied in fertilizers are assumed to be 100 per cent effective. Of course this is not true, but when we consider that additional nitrogen is supplied by soil organic matter and that potash may be supplied by soil minerals, perhaps this assumption will not lead to great errors in planning a fertilizer program.

In spite of these faults, a consideration of the amount of plant food removed by crops in a rotation can serve as a guide to fertilizer needs.

Fertilizer Statistics . . .

(*From page* 14)

ries, non-bearing fruit trees and vines, or other crops which are either fertilized lightly or not at all. For example, 70% and 13% of the acreage of this combination category in Maine and New Hampshire, respectively, consists of potatoes alone, and 20% and 63% of fruit. Both States have substantial acreages of wild blueberries that are regularly harvested and about one fourth of the fruit-tree acreage is of non-bearing age. The average rates of application on fruits, vegetables, and potatoes, when used in Maine and New Hampshire, are 1,889 and 1,096 pounds per acre, respectively. Eighty-three per cent of the total acreage of these crops in Maine and 53% in New Hampshire were fertilized. Only relatively small parts of the total acreages of hay and pasture in most States are fertilized, but when they are, the rates of application are about as

TABLE II.—ESTIMATED FERTILIZER CONSUMPTION, AVERAGE APPLICATION RATE WHEN USED, AND PORTION OF THE CROP FERTILIZED BY CROPS AND REGIONS, 1954.[1]

Region	Hay and cropland pasture			Improved pasture			Corn			Wheat			Tobacco [4]		
	Fertilizer	Rate when used	Portion fertilized [2]	Fertilizer	Rate when used	Portion fertilized [3]	Fertilizer	Rate when used	Portion fertilized	Fertilizer	Rate when used	Portion fertilized	Fertilizer	Rate when used	Portion fertilized
	Tons	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*
New England	84,899	433	14.4	9,130	426	43.9	30,553	532	79.2	....	....	......	34,540	3,448	97.0
Middle Atlantic	198,667	369	10.4	52,719	368	34.2	498,341	376	87.4	200,128	346	88.4	35,606	915	98.2
South Atlantic	465,650	393	30.0	306,752	353	56.0	1,338,605	389	94.8	[5] 143,000	403	87.7	669,074	1,299	99.0
East North Central	302,580	318	8.2	54,597	295	43.0	2,032,661	244	76.1	631,849	267	84.7	16,792	1,004	86.3
West North Central	213,740	216	6.5	40,436	213	21.6	1,014,682	163	36.8	302,087	135	18.2	1,906	984	90.0
East South Central	362,155	329	14.4	139,537	318	43.0	925,038	288	82.8	33,369	294	56.6	251,359	1,366	98.4
West South Central	172,936	216	8.6	61,591	199	11.8	158,177	222	41.6	[5] 55,000	121	12.2	....	....	......
Mountain	70,059	198	5.7	4,966	167	2.7	[5] 12,000	188	16.9	45,052	103	11.4	....	....	......
Pacific	102,166	249	10.8	22,591	254	14.8	[5] 9,000	225	38.5	74,086	96	44.5	....	....	......
United States	1,972,852	302	10.1	692,319	304	26.2	6,019,057	258	59.8	1,484,571	203	28.5	1,009,277	1,316	98.5

[1] 1954 Census of Agriculture, except as indicated in other footnotes.

[2] In computing this percentage the fertilized acreage was multiplied by 100 and the product was divided by the total hay and pasture acreage. Hay acreage is taken to be the sum of those reported for soybeans and cowpeas grown for hay, alfalfa hay, clover and timothy hay, lespedeza hay, small grain hay, vetch and pea hay, other tame hay and grass grown for silage.

[3] The census category under fertilizer usage is "other pasture," but the census definitions put all pasture to which any lime or fertilizer is applied in the category "improved pasture." Therefore the acreage under "improved pasture" was used in computing these percentages.

[4] The census does not give the tonnage of fertilizers applied to tobacco in Pennsylvania, Maryland, West Virginia, South Carolina, Georgia, Florida or Wisconsin. Estimates were therefore based on data in the files of the Crop Reporting Board for these States. This involved 22% of the total used on tobacco.

[5] Partly estimated by the author. The census gives fertilizer usage on corn for only Colorado and New Mexico among the Mountain and Pacific States. Estimates for the other Western States were based on data in U.S.D.A. Handbook 68. They total 12,500 tons of fertilizer. The wheat estimates similarly made for a few States involved 13% of the total for wheat. In the case of cotton estimates for Virginia, North Carolina, Kentucky, Tennessee, and Missouri were based on data in the August 1954 number of "Cotton Production." These estimates represent 13% of the total.

Table II. Continued:

ESTIMATED FERTILIZER CONSUMPTION, AVERAGE APPLICATION RATE WHEN USED, AND PORTION OF THE CROP FERTILIZED BY CROPS AND REGIONS, 1954.[1]

Region	Cotton [5]			Fruits, vegetables and potatoes [6]			Other crops [7]			All crops		
	Ferti-lizer	Rate when used	Por-tion ferti-lized [2]	Ferti-lizer	Rate when used	Por-tion ferti-lized [3]	Ferti-lizer	Rate when used	Por-tion ferti-lized	Ferti-lizer	Rate when used	Por-tion ferti-lized
	Tons	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*	*Tons*	*lbs./acre*	*Per cent*
New England	....	....	......	187,507	1,632	76.7	18,087	534	73.4	364,716	847	25.6
Middle Atlantic	....	....	......	462,609	1,043	76.1	325,002	359	79.8	1,773,072	445	41.7
South Atlantic	682,941	576	99.6	1,056,737	1,308	84.5	492,086	466	95.9	5,154,845	537	68.6
East North Central	....	....	......	185,004	529	62.8	853,988	265	29.9	4,077,471	262	43.8
West North Central	40,851	220	75.9	32,129	257	50.0	498,360	150	12.4	2,144,191	162	17.8
East South Central	721,409	404	95.4	107,810	699	69.0	234,436	333	52.7	2,775,113	363	46.4
West South Central	407,149	239	31.6	95,782	365	57.7	304,579	163	26.2	1,255,214	210	19.0
Mountain	76,115	312	77.3	56,891	439	54.3	109,053	257	46.2	374,136	223	10.5
Pacific	142,048	381	84.8	482,719	642	59.7	289,949	266	40.3	1,122,559	322	32.3
United States	2,070,513	379	57.9	2,667,188	849	68.1	3,125,540	253	23.0	19,041,317	309	29.4

[6] The total acreage was taken to be the sum of those for Irish potatoes, sweet potatoes, vegetables harvested for sale, berries and other small fruits harvested for sale, and tree fruits, nuts, and grapes.

[7] These data are based on differences between the census totals and the sum of the other data in this table and will therefore not check the census data for "Other crops." The census gives data for usage of fertilizers on oats in Michigan, Wisconsin, Minnesota, Washington, and Oregon. It also shows 49,139 tons of fertilizer used on sugar beets in the Mountain States and 39,901 tons used on rice in California. The rates when used were 335 and 212 pounds per acre of sugar beets and rice, respectively. Seventy-two per cent of the sugar beet and 79% of the rice acreages were fertilized in the Western Regions.

TABLE III.—ESTIMATED USAGE OF FERTILIZERS BY CROPS IN SPECIFIED CALENDAR YEARS[1]

Crops	1927		1938		1946		1954	
	Ferti-lizer	Por-tion of total	Ferti-lizer	Por-tion of total	Ferti-lizer	Por-tion of total	Ferti-lizer	Por-tion of total
	1,000 tons	*Per cent*	*1,000 tons*	*Per cent*	*1,000 tons*	*Per cent*	*1,000 tons*	*Per cent*
Corn	1,509	22.0	1,633	21.8	3,275	20.6	6,019	28.7
Cotton	1,693	24.7	1,462	19.5	1,484	9.3	2,071	9.9
Pasture	20	.3	161	2.2	986	6.2	1,754	8.4
Wheat	682	9.9	739	9.9	1,114	6.9	1,485	7.1
Commercial vegetables	297	4.4	425	5.7	1,559	9.8	1,347	6.3
Oats	326	4.8	347	4.6	883	5.6	1,150	5.5
Tobacco	472	6.9	505	6.8	973	6.2	1,009	4.8
Hay	164	2.4	239	3.2	892	5.6	911	4.4
Potatoes[2]	692	10.1	689	9.3	1,158	7.3	700	3.3
Fruits	249	3.6	313	4.2	895	5.7	620	3.0
All other farm	560	8.3	708	9.5	2,110	13.3	1,975	9.4
Non-farm[3]	180	2.6	250	3.3	550	3.5	1,900	9.1
Total	6,884	100.0	7,471	100.0	15,879	100.0	20,941	100.0

[1] Continental U. S. Includes phosphate rock, but not basic slag, gypsum, or sulfur. Government distributed fertilizers are also included. The usage on cotton is based on data published in the August numbers of "Cotton Production" of the respective years, except 1954. The tobacco data, except for 1954, are from Agron. J. 41, 240-246 (1949). Other 1927, 1938, and 1946 figures are based on data published by the National Fertilizer Association as the First, Second, and Third Fertilizer Practices Surveys. The 1954 estimates are based largely on the preliminary reports of the 1954 Census of Agriculture. See also Table II.

[2] Both Irish and sweet potatoes.

[3] Estimated as the difference between the total consumption and the sum of the other items. Farm-consumed vegetables are included with "all other farm crops." "Non-farm" consists of gardens in cities and towns, road sides, parks, airports, etc.

heavy as on grain crops in the same region.

Estimates are given in Table III of the quantities of fertilizer used on different crops in 1954 as compared with 1927, 1938, and 1946. Quantities used on corn, cotton, wheat, oats, pasture, and for non-farm purposes have all greatly increased since 1946, whereas those for commercial vegetables, fruits, potatoes, and all other crops have decreased, even though total consumption of fertilizers increased 36% from 1946 to 1954. Usage on corn, cotton, pasture, and wheat and for non-farm purposes increased as percentages of the total consumption. Fifty-four per cent of all fertilizer used in 1954 was applied to only four crops, although 59 crops are important enough so that regular statistics concerning them are published by the Crop Reporting Board. The same four crops used 43% of the total in 1946.

The estimate for non-farm use of fertilizer may be in error as much as 10%. Wherever possible tonnages of gypsum, basic slag, and sulfur were subtracted from State figures published by control authorities, State colleges, or other sources so that the totals would be as nearly as possible on the same basis as those in the census of agriculture.

Although people eat more fruits and vegetables proportionately than in the past and the population has increased, the total acreage of 29 vegetables grown commercially—not including Irish or sweet potatoes—decreased from 4,277,000 acres in 1946 to 3,902,000 acres in 1954. The potato acreage decreased in the same period from 3,163,600 to 1,-751,600 acres. This decrease in vegetable acreage is due to many factors, important ones being the use of more efficient fertilizers and pesticides.

Rural and suburban non-farmers are growing flowers, fruits, and vegetables on an unprecedented scale. It seems likely that over a million tons of fertilizer were used on home lawns and in non-farm gardens in 1954.

Prior to 1939 the amount of fertilizer used in road building was negligible. Now specifications of the U. S. Bureau of Roads and nearly all State highway departments require the use of liberal applications of fertilizer in the building and maintenance of highways. It has also become standard practice to use fertilizer on airports, cemeteries, parks, military parade grounds, golf courses, and similar turf or landscaped areas.

Use Enough Fertilizer

IT pays to add enough fertilizer for high crop yields whether farm prices go up or down, according to Frank Miller, University of Missouri Agricultural Economist. Miller came to this conclusion after summarizing a number of farm tests involving fertilizer use.

High, medium, and low rates of fertilization were used in the tests. In times when corn, wheat, soybeans, and hay prices are high, net returns per acre from these crops can average as much as $126 when large amounts of fertilizer are used according to soil tests.

But, when only small amounts of fertilizer are used, net returns may average only $26 an acre.

When prices of these four major crops are near the long-time average, fertilization according to soil tests can bring a net of $54 per acre. This compares with a loss of $8.20 from the low rate of fertilization, Miller's figures show.

In periods when prices were below the expected long-time average, the high rate of fertilization returned a net gain of $2.65 an acre. Although this figure is low, it still is very favorable when compared to a $33 loss an acre when fertilizer use was reduced.

Continuous Meadow

EARL Jones, Ohio State University Extension Agronomist, says that Howard Call, Summit County Dairyman, has a continuous meadow on a part of his farm with sloping land. He uses it for hay, silage, and pasture and reseeds without having a corn crop on the land.

These areas are pastured close in the fall, plowed during the fall or winter, and seeded with oats the next spring. The land is limed; 500 pounds of fertilizer are applied on oats when seeding; and the established stands of alfalfa-bromegrass are treated yearly with manure and 0-20-20 to supply 60 to 80 pounds of potash per acre per year and maintain the phosphorus content of the soil.

Jones says there are rotation fields on many farms where such practice might be followed. Some of these fields are some distance from the barn; some have no water available; and on some farms it is not desirable to drive the herd across a heavily traveled road.

The Low-potash Soils in Adirondack Forests

(*From page* 26)

to have much effect on the supply of potash in ionic form. Hence, most of the element in available form is held on the organic colloids. So in light soils, organic matter is the "frugal custodian" of the potash supply.

Practical Use

One will no doubt wonder what earthly value such barren lands can be. Fertilization for cultivated crops continues to be economically prohibitive, and cattle will starve if dependent upon grass and herbs growing in the sand plains.

How about tree crops? Spruces and some pines—white and red—as noted earlier, won't grow well, but Scotch pine will. Scotch pine is quite in demand for Christmas trees in the New York area.

But even the spruce and potash-demanding pines will make nice Christmas trees if fertilized. Commercial muriate of potash (60%) is recommended. This granular material is easily broadcast in plantations less than 10 feet tall. About 200 pounds per acre should be sufficient.

Newly planted evergreens—and even those 3 feet high—may suffer from "burning" if chemical fertilizers contact roots. Care should be taken not to exceed a half handful of potash per tree and to spread it in a band no closer than 6 inches from the base.

Some landowners of planted pines and spruces probably have hopes of someday reaping a pulpwood, or even a sawlog, harvest. This is not improbable. But repeat fertilizer applications may be necessary.

With this in mind foresters, in cooperation with the American Potash Institute, have already begun spreading chemicals from the air. That, incidentally, is the first aerial fertilization of forest stands on record; and both the forest and fertilizer industries will be watching for a report of its feasibility.

Bibliography

Heiberg, S. O., and White, D. P.
1951. Potassium deficiency of reforested pine and spruce stands in northern New York. Proc. Soil Sci. Soc. Amer. 15: 369-376 and Better Crops with Plant Food Magazine, Dec., 1952.

Heiberg, S. O., Stone, E. L., and White, D. P.
No date. Potash and magnesium fertilization of young pine and spruce trees. College of Forestry, Syracuse, leaflet.

Stone, Earl L., Jr.
1953. Magnesium deficiency of some northeastern pines. Proc. Soil Sci. Soc. Amer. 17: 297-300.

Walker, L. C.
1955. Foliar analysis as a method of indicating potassium-deficient soils for reforestation. Proc. Soil Sci. Soc. Amer. 19: 233-236.

Walker, L. C.
1953. White birch helps restore potash-deficient forest soils. Better Crops with Plant Food Magazine, December.

Heyday in Hops

(*From page* 5)

half of them by hand anyway, and then running them through a hand screen, was greater than would have been required for a good hand picker. The Watertown machine had spiked rolls for picking and a cylinder screen for the separating. Holly dubbed this one a fizzle too. He said it took as long to strip a vine of its burs as it would for a person doing it by hand. The editor believed that the best machine exhibited at the trials was one built and patented by Augustus Briggs of Buffalo in Sauk county. Few of these machines were ever adopted because they came into perfection too late to fit into the crest of the hop fever.

A fellow named Emmet Wells concocted a weekly hop letter after the fashion of some of our contemporary columnists. Writing in July he said: "Low and medium grades of hops are a drug on the market. Lager brewers cannot use them, while ale and porter brewers are mostlv holding back to get the late crops. Growers must be prepared for the inevitable crash which will follow if the Wisconsin crop reaches 60,000 to 70,000 bales in 1868." Wells claimed that the total United States consumption of hops would be less than 100,000 bales per year.

Expansion in the Midwest in 1868 may have been prompted by a huge hop failure from lice attacks which ruined the hopes for hops in most of New York state the season before—1867. Instead of a predicted 70,000 bales for New York growers, the heat and the lice caused it to hit a new low of less than 10,000 bales. They also had some trouble with honey-dew on the vines.

Severe drought checked the 1868 crop in most of the Midwest centers. It bid fair to be much lower under the protracted drought than market scouts had been yelping about. However, even then Wisconsin and Michigan growers had their hands full at harvest time.

HOPS mature in late summer or early fall. They must be picked at the right time. Many of the early-day growers felt obliged to harvest hops extra early to avoid the chance of a labor shortage later on. Rust often hastened the harvest. But the quality of hops picked too green is not uniformly good. This is because the hops are lighter and therefore "weaker" in action than those that get well ripened.

Midwest growers were told that the lupuline or "powder" of hops is largely formed after the crop starts to ripen up. This lupuline factor in hops at their maturity was deemed essential by brewers. Some damage was done to the vine roots also when the harvest was too early. Little damage came to well-ripened hops when they stood untouched up to the time of first frosts.

Not all of the growers in the sixties owned their own drying facilities, and in such cases they depended on neighbors who had them. Most of the curing houses had floor screens. The picked hops were dumped on the floor screens and stirred around, being sure to stir the heap clear to the bottom. Shovel stirring was common. Wood fires were the source of heat. The curing sheds had top ventilators and cold air feeders at the bottom.

Pickers for Midwest growers used cotton-gathering bags which usually held two standard boxes of hop cones. The Eastern growers mostly used one bag to one box and claimed it made for easier handling. In 1867 the Kilbourn-Sauk county area required 15,000 hop pickers. Of these, fully 10,000 came into the region from elsewhere in the State. That fall about 600 girls arrived at the Kilbourn depot in one train, mostly from towns along the railroad eastward toward Milwaukee. Two leading growers and capable contractors went out weeks ahead of harvest time to secure girls to harvest the coming crop. They visited Madison, Milwaukee, and cities up the Fox river valley.

PICKERS were paid an average of 50 cents per boxful of hops and were able as a rule to pick four or five boxes daily. In addition the contractors promised the girls good board and room. The argument was that hop picking was a healthful, outdoor job. Editor Holly again commented on the situation by saying:

"The sight of all these girls arriving in our midst will be worth going to see. But excuse us from either commanding or trying to resist such an army as that. But inasmuch as only 500 or so will arrive here at one time, Kilbourn should be able to withstand the siege."

On the eve of the incoming horde of grace and beauty, another thought struck the sagacious editor, which he decided should be imparted to his readers at once.

"Besides the healthful work involved, there is the social enjoyment which may be pleasant and profitable, if the company being kept is intelligent and pure. If the company kept by the girls is corrupt it will prove to be of a ruinous character. You employers of these innocent girls have great responsibilities. There will be for the next several weeks between 20,000 and 30,000 young girls picking hops, coming from this region and outside of it. The latter will be beyond the reach of the influence of parents or guardians.

"The girls will be divided into groups of from 20 to 100 each, and you employers are under a moral obligation which you cannot avoid, to stand in the place of parents and guardians and look to the welfare of these young visitors."

THE flood of arrivals reached its crest early in September 1868. Right after that momentous day that made history in Kilbourn City, Mr. Holly averred that "never in all the days of yeast and lager-making has there been anything to compare with the scenes that have been going on in this region for the past week."

Hop growers were teeming through the streets of all the big "hop towns" gathering up their needful supplies for harvest time. Merchants were on the jump waiting on them, and some of their clerks were giving them trouble because of better earnings offered by the hop-picking schedule.

Already 30,000 pickers were at work in the whole area. More than 10,000 of these came through Kilbourn City en route to the vineyards. Fully 8,000 of them arrived by trains and the rest bounced into town in wagon loads of a dozen or so apiece. The girls wore rough work gowns and sunbonnets. They lugged baskets and parcels.

On one occasion about 2,000 girls poured out of 26 railway passenger cars. They were met at the depot by growers whose wagons and light buggies had been parked in waiting lines covering several acres of vacant land adjacent to the depot.

Such cheering, laughing, shrieking, and clucking! Soon the newcomers were lined up in some sort of military formation, probably by some veterans lately back from the Civil War. Each squad had its appointed female sergeant. It was admirable confusion without rank disorder. The girls marched to the wagons awaiting them, loaded down with umbrellas, satchels, handboxes, bags, bundles—and a few babies!

On the next day a second train brought in 2,500 more pickers. About two hours before the whistle tooted, 250 wagons were counted in the waiting lines, some of them being four-horse outfits. The conductor of this last picker train wiped his brow and said that the seats were all filled half way from Milwaukee and hundreds had to wait over for the next day's express.

BUT such scenes were never equalled after the year of 1868. Hop-growing rapidly declined. A few experienced and well-equipped growers held on for two or three seasons more, but the rank and file of ardent devotees lost their shirts and were counted out.

In my own lifetime I knew many fine women who told with glee the incidents and amusements connected with the gala harvest of the brewers' vine. One of my uncles went broke in the shambles of the low-price seasons, but happily for him, it was a sideline to his regular vocation as a grist miller.

So despite the rivers of beer which originate in my bailiwick, the culture of hops is not one of the pastimes of our capable farmers. They have not mourned its passage westward and they cater instead to the beverage that old and young may enjoy regardless of ordinance or personal restraint—pure, sweet milk from contented cows.

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THE AMERICAN POTASH INSTITUTE

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Uncle Ezra was making his first visit to the West Coast. His relatives, eager to impress him with the wonders of their adopted home, drove here and there, pointing out places of interest. "There," they assured him, "is a wonderful view of the mountains, but the fog hides 'em today. And from right here, you get a wonderful view of the bay—on clear days."

After a couple of hours, Uncle Ezra remarked dryly, "Mebbe we ain't got so much scenery back in the Corn Belt but, by golly, you can see it."

* * *

She—"If wishes came true, what would you wish for?"

He—"Gosh, I'm afraid to tell you."

She—"Go ahead, you fool, what do you think I brought up this wishing business for."

* * *

"And in conclusion, my dear students, I shall give you a demonstration of the evils of the Demon, Rum. I have here two glasses, one filled with water, the other with whiskey. I will now place a worm in each glass. Notice how the worm in the water squirms and vibrates with the very spark of life, while the worm in the whiskey writhes in agony, curls up and dies. Now, young man, what is the moral of this story?"

Young man: "If you don't want worms, drink whiskey."

Mother: "How did you like the wedding we went to yesterday?"

Sonny: "Gee, it sure was nice, but what did the man mean when he said, "love honor and O'boy!"

* * *

Customer: "Let me have some winter underwear."

Clerk: "How long do you want it?"

Customer: "I want to buy it."

* * *

A contestant appearing on a television show was asked: "Are you in New York on your honeymoon?"

"No, sir," the contestant replied. "This is merely a pleasure trip."

* * *

Asked what he'd learned at Sunday School, the ten-year-old began, "Well, our teacher told us about when God sent Moses behind the enemy lines to rescue the Israelites from the Egyptians. When they came to the Red Sea, Moses called for the engineers to build a pontoon bridge. After they had all crossed, they looked back and saw the Egyptian tanks coming. Quick as a flash, Moses radioed headquarters on his walkie-talkie to send bombers to blow up the bridge and saved the Israelites."

"Bobby," exclaimed his startled mother, "is that really the way your teacher told that story?"

"Well not, exactly. But if I told it her way, you'd never believe it!"

Better Crops with PLANT FOOD

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