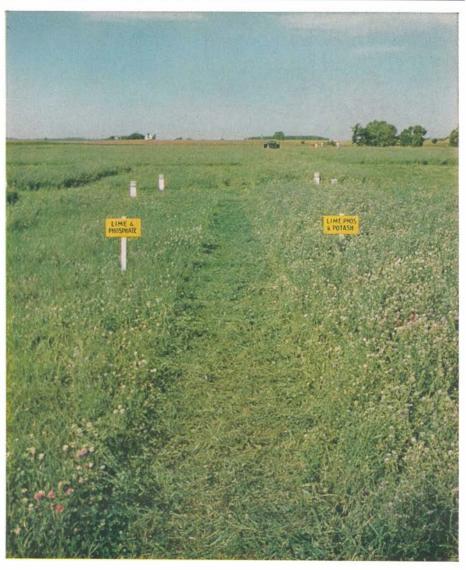
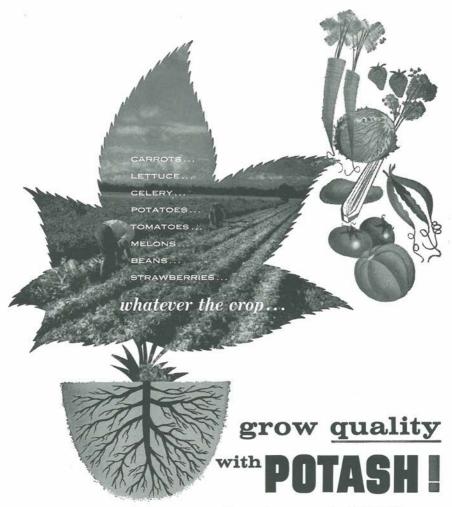
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ON THE COVER . . .

... We see a striking answer to a basic question many farmers ask: "What is the

life expectancy of alfalfa?"

For 9 or more years, alfalfa has been grown continuously on experimental fields in northwestern Wisconsin on land once thought to be entirely unsuited for this crop.

The Wisconsin stands, still healthy and vigorous after years of growth, were established by making needed applications of limestone, phosphate, and potash ac-

cording to soil tests.

The successful crops were topdressed with high potash fertilizer each year in order to maintain good stands and high

yields.

The area shown on the cover is one phase of those experiments—featuring the old but true story of LP vs. LPK in alfalfa management. The left plot received only lime and phosphate. The right plot received lime, phosphate, and potassium.

Look at the picture again—at the density of growth, at the height of the LP plot and then the LPK plot—and

draw your own conclusions.

For details of the Wisconsin experiments, read the Attoe-Peterson story

starting on page 8.

For lasting stands, they recommend adequate liming and fertilization, adapted varieties (winter hardy and wilt resistant), proper drainage, and good management practices.

"In many areas," they point out, "farmers normally expect alfalfa stands to thin out within two or three years and be replaced by timothy, bromegrass, or quack-

grass

"Because of low yields or because the farmer wishes to maintain a relatively high proportion of cultivated crops in the rotation, alfalfa is often plowed under following the second or third year of hay.

"Severe winter weather, disease, wet soil, poor seed, improper management, or competition from grasses can cause loss of alfalfa stands—but frequently the main reason is starvation for lime, phosphate, or potash."

Better Crops wiPLANT FOOD

The Whole Truth Not Selected Truth

SANTFORD MARTIN, Editor

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

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Schoolmates



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WASHINGTON, D. C., JANUARY 1958

No. 1

In the Century Ahead . . .

PRODUCER'S PROGRESS

Jeff M'Dermid

(ELWOOD R. McIntyre)

WHENCE will come our Agricultural Amos? We stand in need of an agricultural prophet of discernment, sagacity, and imagination. Such a one emerging bravely from today's wilderness of frustration and slough of despond would probably do us some good—especially our attitude toward the farming future.

Such an inspired person might well be the author of a new Producer's Progress—"from the times that are to those which are likely to come, delivered in the similitude of a dream." Respected for his known ability, he would arise undismayed and be forthright, telling us the farm dilemma would get worse before it got better. Yet he might well establish within us a new faith in the happy solutions of many vexing things that have assailed country life.

Two obstacles would be among the first to be resolved—the food surplus bogey and the exodus from the land. Instead of cringing and fretting over the surplus, we would reaffirm the honest doctrine that it is better to have too much than not enough sustenance, so we might share it with the hungry millions who represent the biggest drawback to peace.

We would affirm it is unfair and unwise to penalize a declining farm force because it has adopted scientific, labor-saving methods through constructive research. By making the surplus useful, as it is intended

to be, we would find it easier to maintain the fertility of the soil and

the integrity of the farm plant.

Next would come positive action for a farm business big enough to keep the labor force fully employed and able to buy and use equipment geared to modern progress. We would prove that small units have small output and not much chance for margins above costs in a commercial way. Such low capacity farms would become a social rather than a farm problem as the years went by. There would be a voluntary shift of many such farmers to other occupations, while their land became absorbed by larger, well-managed family farms.

Trustworthy thinkers claim that by the year 2000 A.D., only about two million large commercial family farms will grow enough balanced food for 300 million U. S. consumers—and still, have some for reserves. This number would be about 40 percent of the farms that we counted in 1955. But, you see, by that time—42 years hence—we will have a new, safe, scientific, generally accepted policy toward agriculture. This assumes that world tensions are eased and peace assured. It would not be brought about by political pressures, but by the sheer weight of national urgency.

Thus our prophet might explain that the lack of enough farm voting power to achieve this rural renaissance would not be much of a factor. Gradually, he would say, the situation grew intolerable in the early

1970's, with the rising urban population.

"THE SUBSTANCE OF THINGS HOPED FOR . . .

It was induced by the lack of good land and sound farm management, accumulated over years of false proposals, general pull-hauling, urban indifference, and soil deterioration.

It might also be shown that a miserable period ensued wherein experiment stations were shorn of funds and equipment as well as trained staffs, leaving even the best farm operators naked to swarms of locusts, hosts of virulent plant and animal diseases, weeds, soil erosion, and poultry pests. Consumers, too, would share in this distress.

But, you see, this went on before the renaissance. What may be hoped for in this newly dedicated farm policy for the distant year 2000?

Here each and every capable agency now closely linked with farming (including "agribusiness") would have its own ideas of what's ahead in 40 years. Only man's brains, courage, and faith are limits to what we could do for human welfare through a better, safeguarded agriculture. Ergo, "the substance of things hoped for and the evidence of things not seen."

This possible renaissance for farm life will foster and grant incentives for the best-trained, licensed farm managers. They will be organized and educated to protect our crops and soils, conserve fertility and raise the best types of market livestock, produce protective fluid milk, and

superior poultry products.

They will have the finest, fastest, most labor-saving automatic and

January 1958 5

atomic powered crop-making machinery. Scores of trained repair men and adjusters will work in each, major farm township, keeping the equipment and services humming for land owners, cooperatives, and food stores.

Great rich pools of credit on favorable terms by private, cooperative, and government agencies will tide these farmers through critical expense periods, in the interest of public welfare. Huge emporiums catering to all the farm and home needs will arise in the open country. This entire realignment of the farm and its creative capacities will take care of thousands of older persons and youthful workers—the ones who could not meet the stiff competition with their low acreage, small capital, inferior kinds of equipment and livestock.

Meanwhile, more need than ever will arise for highly trained teachers of vocational agriculture. The courses will be broadened to include subjects in the whole realm of countryside economy, with the modernized family farm as the hub of a network of interlocking food produc-

ing spokes.

County extension folks and all the specialists in the wake of the rural renaissance will achieve more and contribute more as they pass on the wider streams of newer know-how from huge, well-staffed research centers—some of them attending to the affairs of counties, others to the affairs of states, others to the problems of the nation.

. . . THE EVIDENCE OF THINGS NOT SEEN"

A major utilization research program will be in the picture. It will be one solution for greater output of certain convertible crops. It will spring from the noteworthy chemurgic theory of the 1940's. New outlets, wider markets, even brand new varieties for special purposes

will be supplied by chemists and plant breeders.

Incentives will be given for scientists to explore mysterious locked-up principles of nature which might in due time become the sources of practical, applied research. The out-moded idea that every move of public scientists must be in tune with immediate application, or else—this will give way to skillful teams devoting full time to fundamental discoveries hitherto unknown. They will prove that not all the marvels challenging man are found in the orbit of the celestial bodies. They will show that man may find his most precious goals in the overlooked things around him.

Forty years hence research will shorten the distance between the farm and the city table. It will evaluate the economics of alternative land use. It will investigate new uses for all types of farm products. It will continue effective protection of crops and livestock from ravages of pests. It will study soil and water relationships more fully. It will find better ways to permit use of our lands without physical and chemical damage and loss.

The preamble to the code of principles that will direct our farm

stability in the century ahead might read like this, plus anything else you care to add:

"American agriculture is dynamic, not static. Because of change and threat, research on most farm problems will never be ended. The perfect spray for apples or potatoes will never be found, nor the final formula be advanced for the perfect dairy or poultry ration. As each new advance is made, the need will come for such things as:

"More efficient management, still better varieties of crops, higher producing cows and hens, more effective ways to control insects and diseases, improved processing and marketing of more nutritious foods and their preparation, betterment of rural living, more opportunity for youth.

"A complete, coordinated, well-financed research program and its educational counterpart on a stable basis to solve fundamental and applied problems is the only safe course through which agriculture and the consuming public can best be served."

TO FIGHT EROSION

Grass waterways, an important soil conservation measure, are needed on most farms to carry off surface water without erosion damage to fields, reports C. C. McKee, Purdue University extension soil conservationist.

The waterways can be prepared with equipment on the farm. They should be shaped by plowing in the gullies, and the seedbed prepared with a disk.

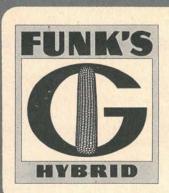
According to the specialist, any grass with a fibrous root system is good for waterways with the fescues, timothy and red top among the best. Rye grass or other small grain will provide a quick temporary cover.

A mixture of grasses—such as 12-15 pounds of Kentucky or Alta fescue, two pounds of red top or timothy, and five pounds of rye grass—can be used.

A rather new grass, Reed's canary, can be used on wet ground where other grasses may not grow.

Seed should be drilled in with commercial fertilizer. In the absence of a soil test, McKee suggests that lime and 400 pounds of 10-10-10 fertilizer be applied. Strawy manure can be disked in.

A straw mulch should be applied after seeding and runoff diverted by plowing a furrow on the upper end and down both sides of the waterway. The furrows should be worked in after the waterway is well established.



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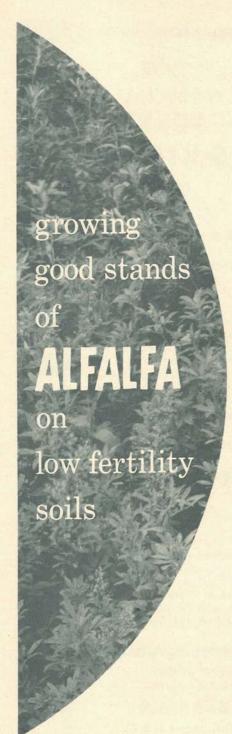
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With . . .

Adequate liming and fertilization.

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Proper drainage and good management practices.

. . . alfalfa stands can often be made productive for 9 or more years, extensive Wisconsin field trials have shown.

HOW long productive alfalfa stands will last is very important to many farmers in the northern half of the United States—especially to those living in areas where good yields of corn are not very certain due to early fall frosts of cool weather during the growing season.

In many areas, farmers normally expect alfalfa stands to thin out within two or three years and be replaced by timothy, bromegrass, or quackgrass.

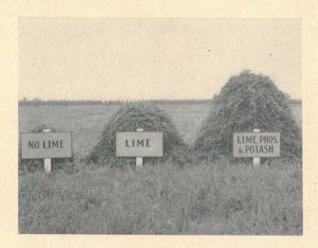
Because of low yields or because the farmer wishes to maintain a relatively high proportion of cultivated crops in the rotation, alfalfa is often plowed under following the second or third year of hay.

Severe winter weather, disease, wet soil, poor seed, improper management, or competition from grasses cause loss



Dr. O. J. Attoe, Chairman of the University of Wisconsin. Soils Department, is a native of Wisconsin. Former high school teacher, principal, and superintendent of schools, he earned his B.A. in Chemistry from the University of lowa, his Ph.D. in soils from the University of Wisconsin.

Here we see the influence of different fertilization on the yield from a second cutting of second year alfalfa hay. Alfalfa with no lime produced .07 ton; with 5 tons per acre of lime, .39 ton of hay; with 5 tons per acre of lime and 500 lbs. per acre of 0-13-30, 1.12 tons of hay.



of alfalfa stands, but frequently the main reason is starvation for lime,

phosphate, or potash.

Alfalfa often survives unfavorable conditions and remains productive for a surprising number of years when provided with a favorable soil reaction and with adequate amounts of phosphorus and potassium in available form. Alfalfa may even become more productive with age.

The problem of growing good alfalfa crops is very important on the Spencer silt loams and similar soils of the northern half of Wisconsin.

These soils—about three million acres of them—were developed on granitic glacial till overlain by several inches of loess. They are naturally very acid, low in available phosphorus and potassium, and usually have poor

internal drainage. Unless properly limed and fertilized, they are unsuited for growing alfalfa. In some cases, it may be necessary to smooth the land and install terraces to provide satisfactory removal of surface water.

Experiments Started in 1942

Experiments were started on Spencer silt loam in 1942 to determine the levels of lime and available phosphorus and potassium for the most satisfactory

crop yields.

The rotation used was corn, oats, and two years of alfalfa-timothy hay. The hay was cut twice each year. On going into corn, all plots received manure in proportion to their crop yields—one ton applied for each ton of dry matter harvested. In 1947, plans were modified in the case of the lime levels experiment and in 1948 in

By
O. J. Attoe and A. E. Peterson

Soils Department University of Wisconsin Dr. A. E. Peterson, born and raised on a Wisconsin farm, earned his B.S., M.S., and Ph.D. degrees from his home state University and in 1950 joined its Soils Department as an Extension Soils Specialist. Since 1955, he has served in research and teaching, specializing in soil fertility and soil tillage practices.





This stand of alfalfa is a striking example of the Wisconsin field trials. This alfalfa field has produced over 3½ tons of hay per acre annually for the past 9 years. Initial soil treatment included 5 tons of lime and 500 lbs. of 0-20-20 per acre, with 200 lbs. of 0-0-60 annually.

the case of the fertility levels experiment to allow the alfalfa to grow as long as the stands remained productive. So far, one block of plots in the lime levels experiment has remained in alfalfa for *nine years* of hay and one in the fertility levels experiment for eight years.

The plots which received adequate amounts of lime and high potash fertilizer have produced abundant yields of alfalfa during these periods, and apparently will continue to do so for several more years.

Highly Profitable Use

Yields for nine successive years of hay in the lime levels experiment are given in Table I. Note that total acre yields of hay for the nine years ranged from about 13 tons (mostly timothy and quackgrass) for the unlimed and unfertilized plot to about 35 tons of alfalfa for the plot receiving 10 tons of lime plus fertilizer. The average acre increase for this period due to liming alone was about 15 tons.

Profit on the lime and fertilizer investment may be calculated by contrasting the cost of the lime and fertilizer and the value of increased yield it produced. Using current prices, the acre costs for the lime and fertilizer applied on treatment 4 are as follows:

5 tons ground limestone spread at \$4 per ton \$20.00 1000 lbs. 0-20-20 (500 lbs. in

Table 1.	Yields of nine successive crops of alfalfa in the lime levels experiment on
	Spencer silt loam in Barron County, 1948-1956, inclusive.

				Lbs./A muritate	Tons per acre hay*			
Treat- ment num- ber Tons/A lime- stone	Approx. pH of soil (1953)	Lbs./A 0-20-20 in 1947	of potash (60%) topdressed each fall	Total	Annual	Increase over check		
				starting in 1950		average	Total	Annual
1	0	5.2	0	0	12.72	1.41		
2 3	0	5.2	500	200	19.14	2.23	6.42	0.82
3	3 5	6.0	500	200	30.28	3.36	17.56	1.95
4		6.5	500	200	30.88	3.43	18.16	2.02
5	7	6.8	500	200	32.25	3.58	19.53	2.17
6	10	7.1	500	200	34.62	3.85	21.90	2.44

^{*} No lime treatments mostly timothy and quackgrass, other treatments mostly alfalfa.

1947 and 500 lbs. charged against original application in 1942) at \$65 per ton ... 32.50-1200 lbs. muriate of potash $(60\% \text{ K}_2\text{O})$ at \$60 per ton ... 36.00 70TAL ... \$88.50

The value of the increase in yield for this treatment may be calculated as follows:

31 tons of alfalfa hay at \$20
per ton \$620.00
Less 13 tons of mostly timothy
and quackgrass at \$12
per ton \$156.00

 per ton
 156.00

 DIFFERENCE
 (OR PROFIT)

 \$464.00

Divide the increased yield value (\$464) by the lime and fertilizer cost (\$88.50) and you get a \$5.00 return on each dollar invested in lime and fertilizer. This figure is probably conservative since manure would normally be topdressed on alfalfa, reducing topdressing fertilizer cost about 50%.

Also other benefits, such as an increase in the organic matter content of the soil and improved soil structure, were not taken into account.

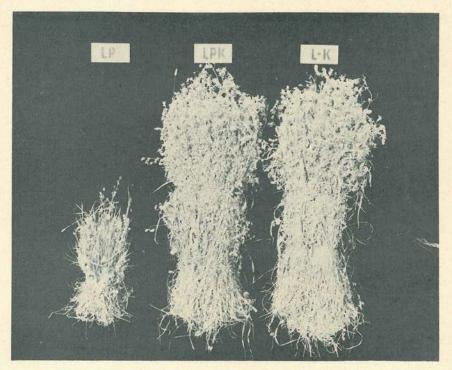
We now know that, due to increased availability of soil phosphorus from applications of limestone to these soils, more phosphate fertilizer was applied in the beginning (1942) than was actually needed. Many excellent stands of alfalfa have been established on these soils with an average acre application of about 5 tons of ground limestone and 500 to 1000 pounds of 0-10-30 fertilizer.

Alfalfa Needs High Potash Fertilizer

Yields for the eight successive years of hay in the fertility levels experiment are given in Table II. Note that total acre yields ranged from about 15 tons of mostly timothy and quackgrass in treatment 1 for lime only to nearly 31 tons of alfalfa in treatment 8 for phosphate and potash in addition to lime.

It is very important to note that potash application with lime in treatments 2 to 4 inclusive yielded about 24 to 27 tons per acre, or nearly as high as treatments with phosphate in addition to potash and lime.

But chemical analyses revealed that the phosphorus content of the alfalfa on the no-phosphate plots averaged



Benefits from adequate lime (L), phosphate (P), and potash (K) applications are shown by these year square samples from the second cutting of 6-year-old alfalfa. LP yielded .20 ton; LPK, 1.37 tons; and LK, 1.47 tons.

about 0.15% which, according to some livestock researchers, is too low for proper animal nutrition. It would therefore seem wise to fertilize with a high potash fertilizer containing some phosphate, such as 0-10-30 or supplement the livestock ration with phosphorus.

Lime and Potash Help Prevent Winterkilling

The great importance of lime and potash in reducing winterkilling of alfalfa is shown on page 15. The content of water soluble protein in the alfalfa crowns appears to be closely related to its resistance toward winterkilling.

Liming to pH 6.5 (5 tons lime) or higher and fertilizing to levels of 200 or more pounds per acre of exchangeable potassium seem to favor both the protein content and resistance qualities.

To maintain alfalfa stands over a period of years, it is usually necessary to topdress each year with 150 to 200 pounds per acre of muriate of potash or its equivalent in mixed fertilizer. Where these conditions were met (as in the lime levels experiment), good stands and good yields were maintained for the nine years the plots were in alfalfa. Also, the prospects are that the alfalfa on these plots will continue to withstand severe winter conditions and remain productive for several years.

Lime Increases Availability of Soil Phosphorus

In the beginning (1942) of these experiments, corn, oats, and alfalfa responded about as much to phosphate

Table II. Yields of eight successive crops of alfalfa hay in the fertility levels experiment on Spencer silt loam in Barron County, 1949–1956, inclusive. All plots limed to pH 6.5.

	Approx. lbs. per acre available after initial		Lbs. per acre 0-0-60 top- dressed on alfalfa each fall	Tons alfalfa hay per acre**			
Treat- ment num- ber	fertilization (1943)*			Total (1949-	· Annual	Increase over check	
	Phosphorus	Potassium	beginning in 1950	56)	average	Total	Annual
1		[100 (check)	0	15.03	1.88		
2 3	15 to 25	150	100	26.14	3.27	11.11	1.39
	(check)	200	200	24.01	3.00	8.98	1.20
4		300	300	27.71	3.46	12.68	1.58
5 6 7		(100 (check)	0	16.68	2.09	1.65	0.21
6	30 to 40	150	100	25.22	3.15	10.19	1.27
		200	200	24.85	3.11	9.82	1.23
8		300	300	30.52	3.82	15.49	1.94
9		(100 (check)	0	16.35	2.04	1.32	0.16
10	45 to 55	150	100	26.38	3.30	11.35	1,42
11	43 10 33	200	200	26.69	3.34	11.66	1.46
12		300	300	26.99	3.37	11.96	1.49
13	AND SELECTION S	100 (check)	0	17.40	2.18	2.37	0.30
14	95 to 105	150	100	23.35	2.92	8.32	1.04
15	,0.0100	200	200	23.90	3.49	12.87	1.61
16		300	300	30.28	3.79	15.25	1.91
17	The state of the s	10–20 on oats ertilizer drill.	0	19.58	2.45	4.55	0.57

* To establish the levels of P in treatments 5 to 8, 9 to 12, and 13 to 16, inclusive, 350, 700, and 1630 lbs., respectively of 43% superphosphate were applied; the 150, 200, and 300 lb. levels of K took 300, 600, and 1200 lbs., respectively, of 50% muriate of potash.

** Mostly timothy and quackgrass where no potash was applied and about 40 to 50% alfalfa on plots topdressed with 100 lbs. per acre of muriate of potash; other plots usually 60 to 80% alfalfa.

as potash. But when lime became more thoroughly worked into the land over a period of time, the crops, especially alfalfa, responded less and less to phosphate fertilizers.

Abundant evidence now indicates this was due largely to an increase in the availability of the phosphorus naturally present in the soil, especially that in the forms of organic matter and hydrated iron and aluminum phosphates.

Lime on acid soils increases the availability of the soil phosphorus, data in Table II shows. Some increase in acid soluble phosphorus occurred in treatments 5 and 6 but none in treat-

ment 4. Any increase in the amount of acid soluble phosphorus due to the lime applied in this latter treatment was probably more than offset by the amounts of phosphorus removed by the larger yields which it produced.

Furthermore, during the 11-year period, liming caused a release of 26 to 68 pounds per acre of inorganic phosphorus (largely in all probability, from hydrated iron and aluminum phosphates) and 42 to 64 pounds per acre from the organic form. Thus, the total amount of phosphorus released from these two forms is about 100 pounds per acre, or about 9 pounds per acre per year for the 11-year period the

Table III. Influence of applications of limestone to Spencer silt loam in 1942 on th forms and amounts of soil phosphorus found after 11 years. All plots received 40 lbs. per acre P_2O_5 as $0-20-20$.	
	THE SE

Treatment number	pH of soil	Per cent organic matter	Pounds per acre phosphorus			
			Soluble in 0.002 N H ₂ SO ₄	Alkali soluble		
				Inorganic	Organic	
2	5.1	2.3	56	180	325	
4	6.5	2.3	54	112	263	
5	6.9	2.3	71	146	261	
6	7.1	2.7	70	154	283	

plots had been in operation at the time of sampling. This is equivalent to about 100 pounds per acre annually of 0-20-0 valued at about \$2.00.

Similar data were obtained for a number of other acid soils. Except for the higher percentage of organic matter found in treatment 6, liming appeared not to affect appreciably the content of this soil constituent.

Boron Starvation Cuts Alfalfa Yields and Quality

Boron starvation in alfalfa—sometimes called "yellow top"—frequently occurs on sandy soils and on many other soils during drouth. Most of the available boron in soils comes from the breakdown of soil organic matter. When the soil is low in this constituent or when the plow layer dries out so the supply of available boron is greatly reduced, starvation symptoms often appear, with yield and quality being lowered.

Such symptoms did appear from time to time in the experiments just discussed, but they soon disappeared when about 30 pounds of borax were applied per acre. Such borax applications were made three times in 13 years of operating the plots.

In practice, it is usually more convenient to topdress the borax or fertilizer borate already mixed with the regular fertilizer. Frequently this mixture is 0-10-30B, the letter B indicating that borax has been added.

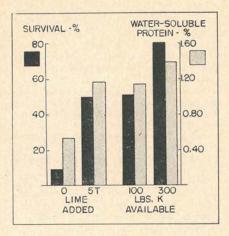
Summary

The Spencer silt loams are similar to many other acid, low fertility soils throughout the northern United States.

The results of the field trials reported here are convincing evidence that with (1) adequate liming and fertilization, (2) use of adapted varieties (winter hardy and wilt resistant), (3) proper drainage and good management, alfalfa stands may often be made productive for a period of 9 or more years.

The essential steps used in establishing and maintaining the alfalfa in the Surefire Program in Wisconsin are given as follows:

- 1. Select fields with good surface drainage or provide such drainage by suitable terracing, ditching, or land forming.
- 2. Take soil samples to determine the needs for lime and phosphate and potash fertilizers.
- 3. Apply the needed lime and fertilizer. If four or more tons of lime are needed, it is usually preferable to split



Here is shown the effect of lime and potassium on survival and content of water-soluble protein in alfalfa crowns sampled in November. (In lime comparison, the soil contained 10 lbs/A available P and 100 lbs/A available K. In the potassium comparison, the soil received 5 tons lime per acre and contained 10 lbs/AP.

the application and apply half before plowing and half after, with thorough working in each case. Favorable results usually result by applying 200 to 300 pounds per acre of fertilizer with the grain nurse crop and the balance broadcast and disced in before seeding.

- 4. Harvest the crop at the proper time. Usually each cutting should be taken soon after the first flowers appear. Several inches of growth should be left in the fall to hold the snow for winter cover.
- 5. Topdress with high potash fertilizer as needed, usually 200 to 400 pounds per acre 0-10-30 or 0-10-30B where boron starvation is indicated to maintain stands for several years.
- 6. Retest the soil about every four years or each rotation to determine needs for lime and fertilizer.

"Surefire Program"

Getting farmers in northern Wisconsin to grow alfalfa was largely a financial problem—overcome by the teamwork between local bankers, official agricultural advisors, and progressive farmers.

This teamwork became known as the Surefire Alfalfa Program.

On the average, the initial application needed was 5 tons of lime and 1,000 pounds of 0-10-30 fertilizer—costing about \$45,00 per acre. About \$500 was needed to buy the lime, fertilizer, and seed necessary for establishing a 10-acre stand of good alfalfausually alfalfa-brome mixture.

Area meetings were set up to interest local bankers in arranging loans for the initial treatment. And when they saw the yields of alfalfa resulting from proper lime and fertilizer treatment, seven banks arranged for loans in 1950 to finance the program.

The banks asked the farmer to have his farm examined, the soil tested for its lime and fertilizer needs, and a 10-acre field with proper surface drainage selected for the alfalfa. The farmers agreed to treat the soil and put in the seedings as their official agricultural workers directed.

Following their county agents and University of Wisconsin Soils Department advisors, most of the farmers entering the program are now getting 3 and 4 tons of high quality alfalfa-hay per acre from land once unproductive.

Today, bankers throughout the area make two-to-three-year loans for lime and fertilizer purchases used on basic soil improvement.

One leading banker of the program, Mr. John Stauber of the Citizens National Bank at Marshfield, expressed the bankers' sentiments this way:

"A farmer doesn't have to go out and buy his livestock feed. He raises it himself and becomes more self-sufficient. Our bank is interested in financing his ability because we feel-it makes a better farmer, a better citizen, and finally a better customer for our bank."

REVIEWS

January, 1958

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directly to the original source.

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MAKE AGRONOMY

For you, agronomy can be a fascinating and rewarding profession. If you are now or ever have been at all interested in working with crops and soils, you should consider a career as an agronomist.

What is agronomy? By definition it is the science and practice of soil management and crop production.

There are a great many varieties of agronomists within the two main divisions of soils and crops. Some use their agronomic training in agricultural businesses and industries, in agricultural research, teaching, or extension, or in soil conservation and other types of government work. Others may be farmers that use the soil and plant sciences to produce field crops or to

manage grasslands.

Increased needs of a rapidly growing population in the face of declining production of some lands and few new acres that can be farmed, emphasize the important role that agronomy must play in the years ahead.

It has been widely predicted that requirements for agricultural products

By R. E. Wagner

Department of Agronomy
University of Maryland

in 1975 will be about one-third higher than current levels of production. These requirements must be met by increased production per acre rather than by bringing new land under cultivation.

Relatively small acreages not now being farmed can be drained or otherwise improved and brought into production. But it is expected that such acreages will be largely offset by increased land requirements for cities, highways, industry sites and other nonagricultural uses.

This presents a real challenge to agronomists of the future. New crop and soil practices will need to be developed to meet this demand for more food from the same number of acres.

There is good reason to believe that these needs of the foreseeable future can be met, particularly if past experience can serve as any kind of guide.

Many examples could be cited to illustrate progress of the past:

The development of hybrid corn, new varieties of small grains, soybeans, cotton, sugar beets, forages, and other crops; the introduction of a sizeable array of effective weed killers; the development of improved fertilization and soil management practices.

These are but a few examples of the agricultural progress that has made our standards what they are today.

But to get this job done, we need the right kind and amount of manpower and brainpower. This is the main concern. The fact that numbers of students graduating in agriculture

YOUR CAREER

have been decreasing in recent years is common knowledge.

For example, one survey shows that the number of students receiving the B.S. degree in agriculture was 8624 in 1951 compared to 5890 in 1955, a

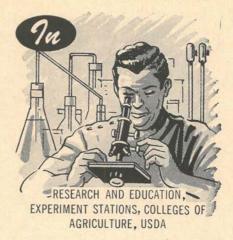
decrease of 30 per cent.

However, it is gratifying that there has been an increase in numbers pursuing graduate study. In 1951, 1145 students received the M.S. degree, and for 1955 this number increased by 40 per cent to 1593. An even greater increase occurred in the Ph.D. category. In 1951, 249 Ph.D. degrees were awarded to students of agriculture, compared to 792 in 1955, an impressive increase of 220 per cent.

Although these figures tell the story for agriculture as a whole, it is much the same for the field of agronomy—except for one important difference. Of the total number of students receiving the B.S. degree in agriculture, about 10 per cent are trained in agronomy. On the other hand, about 13 per cent of those receiving the M.S. degree are agronomists and 15 per cent of agricultural students receiving the Ph.D. degree are agronomists.

These significant figures indicate that agronomy is an attractive field for advanced work.

The trend toward higher salaries for agronomists in recent years, or even in recent months in some cases, has been a real boost to the profession. Indications are this trend will continue—as it should, in order to keep pace with other businesses.







Starting salaries for those holding a B.S. degree on the average range from \$3500 to \$4500 annually; for the M.S. degree, \$4500 to \$5500; and for those with Ph.D. degrees, \$5500 to \$7000.

Starting salaries are one thing, and how far one can advance in his chosen profession is another. A most encouraging and stimulating development in the agronomic profession is that opportunities for advancement today are almost unlimited for those who are well trained and have proved their productiveness over a period of years.

Job opportunities for which agronomy graduates are particularly suited are of a wide variety and interesting in nature. Research, teaching, extension, or agricultural industry are available to them. With soils training, one may become a soil surveyor, soil chemist, a soil microbiologist, a conservationist, or a fertility specialist.

A crops man may concern himself primarily with the introduction, selection and breeding of crops, the control of weeds, insects and diseases of crops, or with various aspects of culture, production and management of crops for greater efficiency of production. A turf specialist is a possibility. For those interested in crops or soils, but also with a flare for animals, a career in forage crops or grasslands has special appeal.

It is obvious that there are opportunities in a great variety of fields for those trained in soil and crop science. Where are these openings for agronomists?

Each state has at least one agricultural college and experiment station which employs agronomists. Jobs are available in the Soil Conservation Service or the Agricultural Research Service of the United States Department of Agriculture, either in Washington, D. C., or in the several different states.

Commercial companies interested in production and sale of seed, fertilizers, lime, fungicides, insecticides, herbicides, and similar agricultural products, employ agronomists.

They are also hired by banks, dairy companies, feed manufacturers, public utilities, and makers of equipment and machinery. By no means to be forgotten is that agronomy provides good training for anyone interested in farming, either for himself or as a manager for someone else. These, together with many others, are opportunities that lie ahead for graduates in agronomy.

What about the amount of training needed in this field? The extent of training, of course, depends upon one's interests and ultimate objective. For many purposes, a four-year college course will suffice. However, research in soils or crops or university teaching or the more specialized phases of industry related to agriculture require graduate training, preferably at the Ph.D. level.

This calls for an additional three or four years of study and research during which an individual is thoroughly schooled in supporting biological and physical sciences.

A man with this training, coupled with an ability to produce, will find rich reward both financially and, above all else, in the opportunity to contribute to the welfare of mankind.

Good jobs are available for those with agronomic training. If you are interested in preparing yourself for one of these, simply drop a card or letter to the Director of Instruction or to the Department of Agronomy, College of Agriculture, at your state university. They will be glad to provide you with any information you request.



By Bernice DeShong

Stillwater, Oklahoma

BERMUDAGRASS, once considered a pest of the farm lands, was employed by Harry Stiers of Indianola, Oklahoma, to convert his cropland—unprofitable for cultivation in the early '40's—to land that now produces 50 bushels of corn per acre (shown above).

Fifteen years ago, Stiers was attempting to maintain the fertility of his soil by planting alternate rows of corn and cowpeas. But the land was so severely eroded that he gave up the idea of trying to crop it.

In the spring of 1942 Stiers, long a cooperator with the Gaines Creek Soil Conservation District, decided to sprig his badly-eroded, unproductive acres to Bermudagrass and overseed it with Korean lespedeza for pasture. Later he added Hop clover and some other legumes. For 12 years, he grazed his ever-increasing herd of shorthorn cattle on the thriving pasture.

In the spring of 1955, he plowed up the pasture and planted the field to maize. He was pleased with the yield of grain, and the Bermuda made good growth after the maize matured. This furnished an abundance of pasture.

The excellent cover protected the land, and soil and water losses from the field were negligible.

In 1956, he prepared an excellent seedbed and planted the field to corn (shown above), applying 200 pounds of 10-20-10 per acre at seeding time. Although the rains failed to come, the corn grew luxuriantly, and when the corn was harvested in September, the once unprofitable field had yielded 50 bushels per acre.

Stiers is convinced that Bermudagrass is an excellent crop to use in the conservation crop rotation with corn, vetch, and small grain. The abundance of Bermuda cover and roots improves the soil structure and adds organic matter that keeps the soil "alive." It enables the soil to soak up water and hold it until the plants need it.

Vetch and other legumes, together with the judicious use of balanced fertilizers, give added insurance for profitable yields.

FERTILEGRAMS

Well-fertilized pastures will furnish better grazing for a longer time than those which have not received enough plant food.

John F. Shoulders, associate agronomist at VPI, says pastures which are well-fertilized will furnish grazing two weeks later in the fall, and will be ready to graze two weeks earlier in the spring.

They also have greater ability to re-

cover after a drouth.

These facts add up to some timely advice from Shoulders—topdress your pastures this winter.

Use the upper limits of the following recommendations if your soil is low in fertility. If you have already fertilized liberally and your soil is very fertile, the lower limit may be enough.

For ladino clover-tall grass mixtures (about half and half), topdress with 400 to 800 pounds per acre of 0-14-14 or 2-12-12.

Use 5-10-10 on pastures that are closely grazed in summer and fall and when early grazing is desired.

If soil tests show your soil is low in potash, use 0-10-20 instead.

For good blue grass-white clover pastures, topdress with 900 to 1,200 pounds per acre of 0-16-8 or 0-14-14 every three or four years as a maintenance application.

If you are in doubt about the pH of your soil, have it tested. Apply the lime needed to bring the pH up to 6.0 or 6.5. Soil tests also will show if the soil needs phosphate and potash.

ing a simple electrical device tested recently by the U. S. Department of Agriculture.

their crops need irrigating by us-

The device measures moisture stress—an indicator of the plant's moisture needs.

For a rapid reading of a plant's water requirements, two small prongs of the device are stuck into the stem of the plant. The prongs are two stainless steel electrodes connected to an ohmmeter. The ohmmeter measures the electrical resistance in the plant.

In tests with cotton plants, researchers found that electrical resistance went down as moisture went up. Within four hours after irrigation, a sharp drop in resistance was observed on the ohmmeter.

USDA scientists report research on the device will be continued. They believe that it holds promise as a simple tool to help the average farmer determine when to irrigate.

Why sulfate of potash in tobacco fertilizers?

This question is raised so often by farmers and fertilizer people that George Corder, of the University of Kentucky Agronomy Department, feels "some explanation is desirable." And it is this:

Muriate of potash is made up of potassium chloride (KCl) whereas sulfate of potash is made up of potassium sulfate (K₂SO₄). When muriate

Farmers may someday tell when

from Across the Land

FOR BETTER SOILS . FOR BETTER CROPS

of potash is applied to tobacco land, the chlorine is taken up by the tobacco; and when present in the soil in a large amount, results in "white stem" or "wet tobacco." If the crop gets excess chlorine, the tobacco stays in "high case" or in a "wet condition." This lowers the quality, saleability, and usability.

Part of the potash in barnyard manure is in the muriate form. Many farmers are running into difficulty with chlorine by using excessive amounts of manure on tobacco even though they use only sulfate of potash in their fertilizers. This is especially true on continuous tobacco land. Therefore, farmers should limit the manure to about ten tons annually on their tobacco land.

Potash in commercial fertilizer to be applied to tobacco land should be from sulfate.

Dairy cows produced 2,333 more pounds of milk per acre on fertilized grass pastures than on untreated fields on Minnesota farms, according to Midwest agronomists.

Milk yields in the test totaled 4,333 pounds per acre on the fertilized pasture, compared to only 2,000 pounds on the unfertilized pasture.

The fertilized pastures yielded 233 "cow days per acre" compared to only 101 days on the untreated fields.

The increased milk output on the fertilized pastures returned a net of \$66 per acre after deducting the cost of the plant food. The cows received no other feed other than pasture.

This pasture improvement program not only produced more forage, but more feed value as well.

The protein content of the fertilized pasture averaged 21.1 per cent, compared to 14.3 per cent on the untreated area.

Most scientists who work with crops are interested in building up the soil, but here's one who does his best to destroy it.

Robert E. Danielson, assistant agronomist at Colorado Agricultural Experiment Station, has purposely subjected soil to a terrific beating with trucks, cement rollers and other heavy equipment.

He wants to find out the effect of soil compaction on crop production.

Danielson started his experiments in the spring of 1956. After compacting the soil as much as possible, he worked it up and planted pinto beans. On other plots the soil was untreated.

Ordinarily compaction would be expected to affect plant emergence, but a light rain which fell soon after planting provided ideal conditions for germination.

As a result, a near-perfect stand of beans was obtained on both the compacted and normal plots. The yield of cleaned beans averaged 37.01 bushels per acre on the normal plots and 33.73 bushels on the compacted plots.



The Ratliffs have done it again. This time it was Lindon Ratliff and Dolly who have been in on the act since the beginning. They harvested the highest corn yield in the United States for 1957—on an acre of land once considered right poor.

When a 14-year-old boy harvests nearly 5 wagon loads of corn from one acre of land that once yielded less than one wagon load, he *must* be following sound farming practices

When he grows the highest corn yield on a measured acre in the United States for 1957 — 250.85 bushels — he is following sound farming practices.

Lindon Ratliff, brother of Lamar who topped the U. S. four times in 5 years, is eager to share his know-how with anyone interested in greater yields on fewer acres, according to Taylor Smith, County Agricultural Agent of Prentiss County, Mississippi.

And he is just as eager to top his brother's 304 bushel record of 1955, highest yield of corn ever grown on one acre.

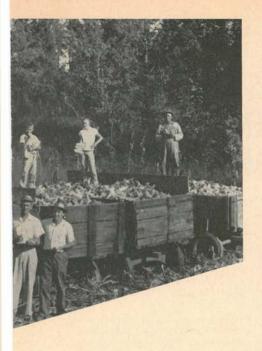


Here Lindon, and some of the folks who helped him grow the nation's champion corn crop, look over the five wagons of top quality corn he grew down in Prentiss County, Mississippi. Among the major hands in Lindon's success were County Agricultural Agent Taylor Smith and his assistant, Jim Archer.

But, right now, the question is: How did the Baldwin, Mississippi, 4-H youth grow the champion corn yield of 1957—what practices did he follow?

1—He grew his corn on the same measured acre that produced the famous 304 bushel yield in 1955. The Ratliffs own less than 15 acres of crop land. They have concentrated on this small piece of bottom land for almost 10 years until it is one of the most fertile in the world. Neighbors now call it "God's Little Acre."

2—He used over a ton and one-half of commercial fertilizer, and applied 70 loads of manure. This included 700 pounds of 15-15-15 in the subsoil, then 300 pounds of 15-15-15 at the side of the plants. He also used 700 pounds of ammonium nitrate (33-0-0) and 300 pounds of ammonium



Another CHAMP



To get corn like this, Lindon used over a ton and one-half of commercial fer-filizer, applied 70 loads of manure, plowed the ground 9 times, used 30-inch spacings between the rows, and planted a whole bushel of seed on the acre.

nitrate sidedressed.

3—He plowed the ground nine times and used 30-inch spacings between the rows rather than the 40 inches common to the Corn Belt.

4—He planted a whole bushel of seed on the acre—or 6 to 7 times more seed than the average farm uses per acre—the same Funk's G-711 variety the Ratliffs have used for all their records.

5—He then thinned his plants with a hoe to get a perfect stand.

6—He got his power from Dolly, a 20year-old mule who has supplied the "horsepower" for all the Ratliff records. In fact, when they made their first state yield back in 1950, Dolly supplied one of her shoes for the Ratliff trophy case. Since then, the trophies and shoes have really swelled.

7—County Agent Smith and his assistant, Jim Archer, measured off the acre and marked it. Then Lindon and his folks husked the ears which were weighed to compute the yield. Moisture samples were sent to Mississippi State College where final calculations were made.

Harvesting the farm plot has become almost a national event. And what happens to all that fine corn? Lindon feeds it to his 4-H poultry project—and also to the Ratliff's dairy cows and, of course, all the bushels Dolly can eat.

As we reported in the outset, Lindon plans to shoot at his brother's seemingly invulnerable 304 bushel mark next year—and the year after that, if necessary.

POTASH DEFICIENCY AND CARBOHYDRATE METABOLISM

Scientists conclude . . .

- Tests for accumulated sugars in plants can be related to visual symptoms of potash deficiency if comparisons are made between deficient and normal plants.
- Accumulation of sugars over extended periods together with necrosis of plant tissues resulting from potash starvation probably enable leaf disease organisms to invade and develop rapidly in deficient corn plants.
- More research in the future will be directed toward interrelationships between mineral nutrition, organic synthesis, and disease incidence of crops.

THE importance of potassium in crop production can be emphasized in many ways.

For instance, by examining the weak stalks, diseased roots, and poorly filled ears of potassium-deficient corn plants, attention is focused on the basic requirement of potassium in plant nutrition. Poorly developed roots and tubers, frenching of tobacco leaves, cotton rust, reduced citrus size, and marginal scorch on leafy vegetables are all symptoms which may be attributed to a need for additional potassium.

Some Functions of Potassium

The functions of potassium within the plant are many. Indeed, the external effects of an acute shortage may be evident in several parts of a plant—leaf, stalk or petiole, root, or fruit—at the same time. Sometimes symptoms appear one after another. The disturbance of one or more

vital processes logically results in varied visual symptoms of disorder. Unfortunately, it is difficult to assign definite roles within closely related physiological processes.

To emphasize the fact that not a great deal is known about the specific functions of potassium as a mobile constituent in plant tissue, one may ask a number of questions.

For example, why is marginal yellowing or bronzing of the leaf structure so characteristic of potassium-starved crops? About the only lead has come from studies by Steinberg, who found frenching of tobacco plants seemed related to abnormal protein metabolism and an excessive accumulation of free amino acids.

Is potassium essential for photosynthesis? A number of physiologists have suggested that potassium deficiency results in reduced rates of carbon dioxide assimilation. However, this point is difficult to prove since fertilization with potash increases the leaf surface areas of many plants on potash-deficient soils.

What is the role of potassium in enzyme systems? This is an interesting question, but we are still groping for the answer. Schweigart has shown potassium is essential for a number of enzyme systems. It can be regarded as an integrating part of several enzyme systems, as well as an integrating or faculative activator in other enzyme systems, with functions not yet known. At least one worker has assumed that absence of the potassium ion may activate such enzymes as amylase, sacchrase, and B-glucosidase, which catalyze the transformation of carbohydrates. In this case, the glucosestarch ratio would rise as the supply of available potassium decreased.

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Decreased Carbohydrate Accumulation

How does potassium affect the synthesis of simple sugars and starch in plants? Ample evidence shows the potassium level has a marked influence on carbohydrate accumulation. Just why this element is essential for this activity in living cells is not clearly understood.

Generally speaking, a decrease in carbohydrates has been associated with severe potassium deficiency, although a few workers have reported initial accumulation in the early stages of starvation. Reduced Photosynthetic activity or green leaf surface may be partly responsible, but in addition several workers have also pointed out that respiration in plants is highly accelerated by potassium deficiency. This condition would tend to lower the overall level of carbohydrates.

Susceptible to Disease

Anyone who has seen the shriveled, immature seed of small grains of corn or the small, nubby tubers of potato plants starving for potassium, can realize its importance in starch accumulation. An inadequate supply may also be responsible for the susceptibility of root tissues to certain types of disease organisms.

As early as 1930 Hoffer found a lack of available soil potassium resulted in accumulation of iron compounds in the nodal tissue of corn plants, disrupting translocation from leaves to roots. As food supply was reduced, root tissues were weakened and became more susceptible to fungal attack.

Certain Sugars May Accumulate

We might then ask ourselves-are po-

tassium deficient plants lower in sugars than normal plants?

This query can be answered in several ways:

(1) The total production of sugars is undoubtedly lower in plants where po-

tassium stress is apparent.
(2) The level of sugars, especially reducing sugars, may at times be higher in potassium deficient tissues. Evidence for the latter statement comes from investigators who found a higher proportion of reducing sugars to total carbohydrates in plants inadequately supplied with potach

This point regarding accumulation of sugars in potassium deficient plants was brought to our attention in the late summer of 1955 by Mr. Herb Garrard, field agronomist for the American Potash Institute. He believed that plant sap from the stalks of some potash-starved corn plants tasted sweeter than that of nearby healthy plants.

At his suggestion some preliminary tests for sugars were made from stalks collected in early September. Using the α-naphthol reagent (Molisch test), tissue extracts of non-deficient plants seemed to contain as much or more sugar than ones showing marked need for potassuim. However, it was believed that the sampling date was too late since ear formation was essentially complete. At this stage sugars would tend to accumulate in all plants. Plans were made to continue the study at an earlier period the next year.

About the third week in August, 1956, corn stalk samples, 3 to 6 inches above the corn ear, and sugar beet petioles were collected at mid-day from plots receiving 1000 pounds per acre of 5-20-0 and

5-10-40 fertilizer at the Michigan State

Experimental Muck Farm.

Again the Molisch test indicated no difference—abundant sugars being present in plants from both high and low potash treatments. Considering that, perhaps, the early morning would be a better time for sampling, it was found by the same test that potassium deficient plants were distinctly higher in sugars. Apparently during the night a large proportion of sugars in normal plants had been translocated out of the stalks of petioles to storage organs.

This was not the case for the potashstarved crops. In the following table are listed the yield and leaf potassium content of corn and sugar beets from plots with and without potash. Relative values are also given for the α -naphthol

sugar test.

Table 1.—Yield, potassium content, and sugar test of normal and potash deficient corn and sugar beet plants.

	5-20-0 5-10-40	Sugar beets 5-20-0 5-10-40
	(bushels)	(tons)
Yield	27.2 86.8	2.2 12.2
Leaf K	0.19% 2.37%	0.67% 5.01%
Sugar test*	High Low	High Low

^{*}Sampled August 27, 1956 at 7 A. M.

Testing for Sugar

In testing for sugars, the following procedure was used:

- (1) Ten grams of freshly chopped tissue was processed with 200 milliliters of distilled water in a Waring Blendor for one minute.
- (2) The extract was then filtered and 50 milliliters of the filtrate diluted with water.
- (3) Then 5 milliliters of diluted extract were placed in a test tube and after adding 5 drops of a 10% α -naphthol solution (made up in 95% ethyl alcohol), the tube was thoroughly shaken.
- (4) Five milliliters of concentrated sulfuric acid were then slowly added down the side of the tube to form two layers.

A violet ring formed at the junction of the layers when sugars were present. Upon shaking the tube the entire contents turned a blue-violet.

Standards can be made with sucrose solution and the reagent is sensitive to as little as 0.001% sucrose. In the course of this study it was found that faint colors tend to fade. In addition, some tissue extracts contain considerable pigments and probably certain polysaccharides which are decomposed by sulfuric acid and give off-shade colors. However, this problem extract. Usually, dilutions in the range of 10 to 50 times are sufficient to distinguish differences between deficient and non-deficient plants.

Summary

The authors feel that tests for accumulated sugars in plants can be related to visual symptoms of potash deficiency provided comparisons are made between deficient and normal plants. More information is needed on different crops and environmental conditions at the time plant samples are collected.

Accumulation of sugars over extended periods together with necrosis of plant tissues as a result of potash starvation probably enable leaf disease organisms to invade and develop rapidly in deficient

corn plants.

Undoubtedly more research in the future will be directed toward interrelationships between mineral nutrition, organic synthesis, and disease incidence of crops.

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¹ Contribution from the Department of Soil Science, Michigan Agricultural Experiment Station, East Lansing, Mich. Authorized for publication by the Director as Journal Article No. 2043 of the Michigan Agr. Exp. Station.

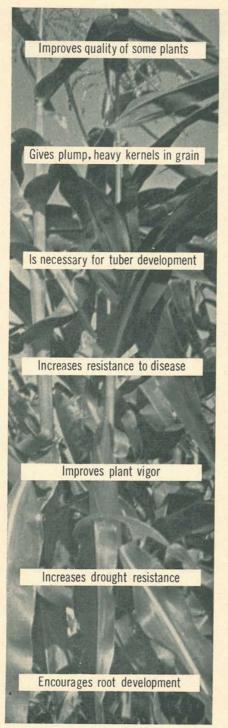
SOIL AND PLANT ANALYSIS



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POTASSIUM

And Availability As A Major Plant Food

Without food there would be no life. This applies to plants and animals, as well as to man. For plants to grow and produce normally, they must be well fed.

Potassium is one of the major plantfood elements, used in large quantities by most plants. Though a few soils are well supplied with available potassium, most soils have little or only a limited amount. Consequently, the functions and use of potash in plant growth are important to the fertilization of crops.

In its effects on plant growth, potassium tends to check, balance, support, and supplement the other essential plant-food elements. This relationship is very important in fertilizer practice since it influences the results that may be attained by applying fertilizers, influencing the economy and effectiveness of their utilization.

The potash added supplements the soil nutrients to make available to the plant the correct proportion of potassium to go along with nitrogen, phosphorus, and other plant-food elements. Whenever one of the plant elements is lacking, the effectiveness of the others is seriously handicapped.

Dr. W. J. Peevy, head of Soil Testing Laboratory for the Louisiana Agricultural Experiment Station, gave an excellent example of this improper balance of plant food. Working very closely with a large dairy farmer near Hammond, he and the farmer used about 250 pounds nitrogen (equivalent to 750 pounds ammonium nitrate), from 80 to 120 pounds P₂O₅ (equivalent to 400 to 600 pounds superphosphate), and until the fall of 1954 120 pounds K₂O (equivalent to 200 pounds muriate of potash).

For an oat crop, the potash application was reduced to 60 pounds K2O per acre. The oats came up, turned reddish in color, and made practically no growth. Peevy suggested that additional nitrogen be tried in strips across the field; that additional phosphorus be tried similarly, and also potash. No noticeable results were obtained from the extra application of either nitrogen or phosphorus. But when extra potash was added, the oats immediately began very rapid growth and lost the reddish color. The remainder of the oats were then topdressed with potash, giving excellent results, according to Dr. Peevy.

He now recommends to this dairy farmer from 126 to 168 pounds K₂O annually, depending on the crops being grown. He says this amount of potash was necessary to give the proper balance with the large amount of nitrogen and phosphorus being used. And if this extra quantity of potash was not used, the yield would be reduced accordingly.

In other words, plants can only grow and develop to the point at which some element becomes a limiting factor. In this case, it was potash—a common occurrence on many of our soils.

Turning under large quantities of legumes may disturb the potassiumnitrogen relationship, causing decreased yields. This effect has been observed rather widely throughout the Corn Belt where sweet clover has been used as a cover crop. A typical example occurred in Missouri. In a twoyear rotation of corn, wheat (sweet clover), the sweet clover plot yielded 23.5 bushels more corn per acre than the check plot the first year of the experiment. This differential decreased to 14.8 bushels for the second corn crop. After the third crop of sweet clover had been turned under, the yields were 21 bushels less than those on the check plot. The plots showed signs of potash deficiencies with excessive lodging.

Most mineral soils, except those of a sandy nature, are high in total potassium. Yet, the potash held in an easily exchangeable condition at the mineral interfaces is *usually small*. Thus, higher plants must depend, in part at

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least, on the ordinary processes of solution or effect on availability by direct contact with the undecomposed soil minerals and the colloidal complex.

Drainage water from mineral soils will usually have large amounts of potash, at least enough annually to satisfy the needs of higher plants. Yet, they may be suffering a potash deficiency. They apparently must be in contact with a comparatively concentrated solution in order to obtain a satisfactory amount of this element, especially if other cations are relatively high in the soil solution.

Some of the very fertile Red River soils in Louisiana give good responses to the application of potash even though the soils are high in potash. No doubt there are many other such cases.

Not only is potash essential for increasing yields, but it also plays an important role in determining crop quality. Experiments with cotton have shown that potassium increases the strength of the fiber and produces a higher percentage of lint per seed. Research has also shown it increases the protein content of the seed.

In the field of horticultural crops, nearly everyone knows the desired shape of good grades of sweet potatoes is obtained only in the presence of ad-

equate potassium.

If water and a comparatively low percentage of ash are excepted, proteins, carbohydrates, and their derivatives make up the bulk of a plant. Potassium which is necessary for carbohydrate formation, plays an important role in regulating the nitrate reserves in many plants by accelerating the absorption of anions, such as nitrates.

Considerable evidence indicates that directly or indirectly potassium is essential for reducing nitrate and perhaps for later stages of protein synthesis. As new proteins are synthesized from nitrate, carbohydrates are utilized in the process and more potassium is needed for the synthesis of more carbohydrates. This being the case, potassium is very important to cell wall formation and stiffness of stems.

Structural elements of lignin or cellulose, which represent carbohydrates in the most condensed form, cannot become highly developed when there is a carbohydrate deficiency. If nitrate reserves are high in relation to carbohydrates, and if carbohydrates are not replenished through photosynthesis faster than they are used in respiration and protein manufacture, cell walls become thin and stems structurally weak.

Some Texas Agricultural Experiment Station research shows that lodging is very bad with corn plants where there is a potash deficiency. When potash is added, the lodging is reduced to a minimum.

Many rice farmers report that the extra ease of harvesting rice with adequate potash more than pays for the potash. Some of the rice millers are asking for rice that has been fertilized with potash because of the improved milling qualities.

Except for simple salts, it is not known whether potassium enters into any organic combination in the plant. It is freely translocated from mature to meristematic tissues when there is

a deficiency of it.

Further, when developing fruits are present, potassium is often in large part transferred to them, with subsequent death of vegetative growing point. These facts have been brought out by many workers, who have consistently emphasized the importance of potassium in the cambium and in other actively growing tissues. Therefore, the lack of potassium may drastically modify plant form.

Potassium encourages root development in plants. As an example, corn plants well supplied with potash are very hard to pull up and if they are pulled up, a large clump of roots will be pulled from the ground. Corn plants with deficient potash are usually easily pulled up and only a small clump of roots is pulled from the

ground.

The root system of the corn plant is very important in supplying moisture and nutrients to the plant. Therefore, the extent of the root system will greatly influence the growth and productivity of the plant. Drought resistance is increased.

In a Louisiana corn fertility experiment where soil moisture was depleted to a low level, only the plants on plots which had high potash were not wilted at the time of the observation. With continued drought, the plants on these plots would have eventually wilted.

The presence of adequate available

potash in the soil has much to do with the general tone and vigor of the plant. It increases resistance to disease. One of the common potash-deficiency diseases is *rust in cotton*.

With a soil low in potash, the margins of corn leaves, small grains, and grasses become scorched or brownish in color and finally die. In corn, the vascular system becomes disrupted, limiting the free movement of plant nutrients and moisture.

Potash-deficiency symptoms show up in practically all crops where the deficiency is severe. A person should never wait to use these deficiency symptoms as a guide in crop fertilization because they only occur when the lack of potash is very severe. Increased yields from the application of potash will occur long before deficiency symptoms show up.

Potassium tends to eliminate prematurity. It is important to the grain formation of cereals, giving plump, heavy kernels. It also seems especially valuable to all leguminous crops. It is absolutely necessary for root and tuber development, being very important in the growth of potatoes. In fact, all root crops respond to liberal applications of potash.

There is another feature of fertilization that is usually overlooked. Too little is known about it. Commercial fertilizers, when added to a soil, influence the micro-organisms just as profoundly as they do higher plants. In fact, the fertilization of the soil flora is an essential feature of successful soil management. Since the bacteria, fungi, and actinomyces are more successful than are higher plants in

their competition for nutrients, their needs are satisfied first. Thus an amount of fertilizer fully adequate for crop needs may fail to give the desired results when added to a soil because of chemical and biochemical fixation.

The supply of potash for crop fertilization will be adequate for several generations. Potash is being mined in the United States in the Permian Basin near Carlsbad, New Mexico, and extracted from the brines of Searles Lake, California, and the salt flats of Utah. There are seven major producers in this country. Additional production is being considered.

In conclusion, the functions of potassium are as follows: It . . .

- 1. Is a major plant-food nutrient.
- 2. Is necessary for production of carbohydrates.
- Plays an essential role in the absorption of anions, such as nitrates.
- 4. Is essential for reduction of nitrates.
- 5. Favors protein manufacture.
- Has a balancing effect on excessive amounts of nitrogen and phosphorus.
- 7. Gives plump, heavy kernels in grain.
- 8. Encourages root development.
- Is necessary for tuber development.
- 10. Increases resistance to disease.
- 11. Improves plant vigor.
- 12. Is necessary for the development of chlorophyll.
- 13. Tends to prevent pre-maturity.
- 14. Increases drought resistance.
- 15. Improves quality of some plants.

POTASH PAYS

When nitrogen and phosphate levels are kept high the acre value of burley tobacco can be increased, even though yields are only slightly affected. For instance, on a soil well supplied with nitrogen and phosphate, but low in potash, an application of 150 pounds of potash increased the income \$283 per acre even though the yield was increased only about 100 pounds. This was an increase in crop value of \$23,58 for each dollar spent on potash.

Kentucky Bankers Association

Why We Use FERTILIZER

By James Burns

Winner: 1957 Fertilizer Essay Contest California Fertilizer Association

AS American farmers and others connected with farming, let us stop and think why we are using more fertilizers in this day and age. Hundreds of years ago when our forefathers came to this country, they did not use fertilizers. They farmed their land until the crops they grew were no longer up to par. When this condition developed, they would sell their land and move on, rather than attempt to solve their problems.

After they sold their farms, they moved westward and found new land which they destroyed as they had the last. This went on year after year. Now we cannot move, but we can build up the land we now farm through

fertilization and soil conservation.

We started out with approximately nine inches of top soil and we have depleted it to six inches and even less in some areas. What will fertilization do for your farm or ranch? One of the most important things that it will do is to build up and conserve your land. The American farmer can make more money through fertilization. For example, if he is growing a vegetable crop, his product is consumed by the housewife and her family. When the housewife buys her vegetables, she looks for large, lush, well-developed vegetables. If these vegetables have been properly fertilized, they will appeal to her eye. The result will be more money in the farmer's pocket through the use of fertilizer.

The use of commercial fertilizers on a farm should blend in with crop rotation, green manures and stock yard manures. These things, properly applied, will build up the land and preserve it for the years to come.

George Washington was an early user of fertilizers in his experiments in the field of agriculture, but it was not widely used until many years later.

In this report I will relate to you information concerning fertilizers applied to the following crops: rice, potatoes, cotton, sugar beets and lettuce. These

are some of California's leading crops.

In California, fertilization of rice crops is a common practice, except on quite fertile farms and new lands, which is a small proportion of California's land. Nitrogen fertility results when rice follows a legume, such as burr or ladino clover. Nitrogen is the key plant food for rice and gives favorable response. It is said that phosphorus may be needed on red soils along the eastern edge of the Sacramento Valley.

Our chief rice-producing areas in California are the Sacramento and San Joaquin Valleys. These soils are mostly heavy and only nitrogen is used here for profitable response. No farmer should spend money for something that

will not bring him profitable returns.

Submerged rice fields take in nitrogen from the soil in the form of ammonia, so it should be applied in the form of sulphate of ammonia, urea, or cyanamid. Rice does not respond well to nitrate fertilizers when grown under continuous submergence. The rate of fertilizers applied varies with the fertility of the soil. We must take into consideration that no two soils are the same and, therefore, the methods of application must differ.

An average acre that is producing 35 sacks of rice per year without fertilization could be made to produce more with the application of 150 pounds of sulphate of ammonia. On land of lower fertility, and which produces about 20 sacks of rice without fertilization, 250 pounds of sulphate of ammonia should be applied. If production is 45 sacks or more per acre, fertilization is not necessary that year, for fertilizing rich land may delay

maturity and increase sterility.

The time to apply fertilizer is from the time of seeding up to 65 days thereafter for good results. Fertilizing after seeding is done by airplane. Fertilizing at the time of seeding increases the rate of growth and the vigor of the young seedling. It is unnecessary to lower the water when applying fertilizer. Apparently there is no loss from the field through water drainage.

A farmer can produce eight tons more rice by applying sulphate of ammonia to average land. Fertilizing through irrigation water is not being practiced because of uneven distribution of nitrogen. The use of cyanamid should be made only on dry soils before seeding so that the period of toxic effect will be over before the seed germinates.

The examples I have given on the fertilization of rice are both inexpensive

and profitable.

Potato farming is growing rapidly in California. We look to high yields per acre and in order to accomplish this we need high soil fertility. Experiments have been made in Kern County which show that an average crop of potatoes removes 125 pounds to 200 pounds of nitrogen, about 60 pounds of phosphoric acid and 300 pounds of potash per acre.

Our soil in California cannot meet these requirements of nutrients so we must fertilize. Manures and cover crops can be used to build up soil, but potatoes are largely dependent on inorganic nutrients or commercial fertilizers. Tests have been made in other counties, but what is effective in one area will

not always be profitable in another.

For example, Kern County uses 100 pounds or more of nitrogen per acre. (500 pounds of ammonium sulfate contains about 100 pounds of nitrogen.) In a lighter soil, such as that around Fresno, up to 140 pounds of straight nitrogen are used on the spring crops, and half of this amount for the fall crop. In all areas, fertilizer with some phosphorus should be applied.

On the peat lands, 500 to 1,000 pounds of 10-10-10 should be applied on the older fields. On newer peat lands, you can use 0-10-10. Always remember that no two fields are the same. Ammonium sulphate, here again, is the best form of nitrogen, but could be used with blood-meal, half and half. Cyanamid has proved toxic, as little as 60 pounds of nitrogen per acre from this material showing toxicity throughout the entire growing season.

Applying fertilizer to potatoes should be done at time of planting seed pieces. Methods of application may vary somewhat, but an attachment to the planter works about the best. The fertilizer should be applied one inch below and two inches to the side of the seed.

Lettuce is one of California's large and profitable crops. The farmer strives for firm solid heads of lettuce, for that is what the consumer wishes to buy. To do this the crop needs proper irrigation and cultivation. But without fertilization, here again, he will not reach his goal. Soil fertility must be maintained.

The largest lettuce areas in California are Imperial Valley and the Central Coast areas. Our lettuce areas are limited, so we must keep them productive. In maintaining soil fertility, crop rotation is a good idea. Farmers use no one set system of crop rotation, but crops that can be used are alfalfa, cantaloupe and flax. Alfalfa, which is a legume, is a nitrogen builder. If followed by a shallow-rooted crop, this makes a good crop rotation.

Barnyard manures are good on poorer land. Ten tons to the acre will increase yields up to 54 per cent and lettuce will mature two to four weeks earlier. Green manures are valuable in lettuce production, and increase soil fertility. However, green manures, barnyard manures, organic matter and crop rotation are not enough. There is yet a need for commercial fertilizers.

On lettuce, the three main plant foods are needed—nitrogen, phosphorus and potassium. Nitrogen can be applied in the inorganic form from sodium nitrate, ammonium sulphate, ammonium nitrate or calcium nitrate. Organic forms are urea, tankage, fish meal, cottonseed meal and dried blood. Phosphorus and potassium will not move much in California soils, therefore they should be applied deep in the bed where the soil will maintain moisture, so the roots can develop in the region of the fertilizer. There is no one type of fertilizer that can be used on this crop, for all soils are different.

When planting lettuce, fertilizer should be applied one to two inches below the seed and two to three inches beside the seed row. This can be achieved by the seeder. Just remember that with proper fertilization you can obtain

the type of crop you are after.

Sugar Beets are another of California's important crops. If a farmer intends to get large yields, he must apply fertilizers. For example, applying 240 pounds of nitrogen, he can get a net gain of \$250 per acre. But nitrogen is not the only key plant food for sugar beets. A complete plant food such as 8-10-12 is desirable for many of our soils. The selection of the proper kind of fertilizer is of great importance.

With any crop, the efficiency of the fertilizer you use depends on the kind of material, time of application, placement of material with respect to the plant

roots, and the rate of application.

Sugar beets are relatively a deep-rooted crop. Tests have proved that the application of fertilizer five or six inches deep at the time of thinning is quite profitable.

Besides the plant foods listed, others that are needed are calcium, magnesium and sulphur in substantial amounts. Others that are used in smaller amounts are boron, zinc, iron, and copper.

Cotton was the leading crop of the south, but with improper use of the soil, the land was soon depleted, and the crops yielded less and less. Now, through proper fertilization, California has become a leading state in the production of cotton.

Does your cotton need fertilizing? The answer is yes! Nitrogen, phosphorus and potash is needed along with micro-elements such as copper, magnesium and zinc. Although there is generally an adequate natural supply of micro-elements in our soils, in some cases they are still needed. The amount of fertilizer you need is based on original soil fertility, cropping and soil fertiliza-

tion history, soil management and seasonal conditions.

In general, there is usually enough potash in the soil for cotton. An average amount of fertilizer, depending on what type of soil you have, can be supplied by any number of commercial materials. The distribution can be in bands and sidedressings or broadcasting. Broadcasting is done on the soil surface and through diffusion moves into the soil. If using it in bands, it should be done at the time of planting, three inches to the side of the seed and two inches deep. If the plants are already established, place it to the side of the roots so there is no danger of injury from burning. If broadcasting is used after the time of planting a good deal of water is used to get to the root area. Through the proper type of fertilization, your cotton crop will be increased by many bales.

In this report I have brought out certain conditions and have given examples. No two soils are the same, and there can be plant foods in the soil that are not available to the plant, so we must fertilize. Taking these facts into consideration, the proper use of fertilizer will bring the California farmer more dollars per acre.

K₂O Hunger In California

Soils in many areas of California are becoming deficient in their native supply of potash, California farmers were recently informed by the California Fertilizer Association.

This development is being caused primarily by consistently heavy-cropping. Another factor, showing up with increasing frequence in specific crops, is the difference in plant food appetite of the various crops.

To show the difference in vegetable crop uptake of plant food elements, the Association pointed out that Irish potatoes (tubers) must take up from each acre of soil 108 pounds of nitrogen, 42 pounds of phosphoric acid (P₂O₅), and 192 pounds of potash (K₂O), to produce 500 bushels.

Lima beans require 95 pounds of nitrogen, 24 pounds of phosphoric acid, and 113 pounds of potash for a production of one ton.

To produce 350 crates of celery, the soil must have these supplies of plant food elements in a form available for the plants to take them up: 80 pounds nitrogen, 65 pounds phosphoric acid and 235 pounds of potash.

In Madera County, California, application of potash to Ripperdan soil has increased the yield of potatoes by about 66-100 pound sacks per acre. These experiments, under the direction of County Farm Advisor Clarence Johnson, have included rates of potash applied ranging from 150 to 400 pounds actual K₂O per acre. They indicate that the soils which test lowest in available potash will generally increase crop yields when an adequate supply of potash is applied.

The Association recommends the local fertilizer supplier as a reliable source of information concerning soil fertility and plant nutritional problems in the area which he serves.



FROM...

Cotton built this plantation home in the Southern Piedmont.

But the declining production of eroded fields could not maintain it.

SCS Photo.

Three Periods Of Southern AGRICULTURE

- Exploration
- Exploitation
- Permanency

THREE words describe quite well the three periods through which Southern Agriculture has passed since the first European settlements were made on the western shores of the Atlantic Ocean.

Exploration! Exploitation! Permanency!

The hardy pioneers came mostly

from the British Isles, with a few from France, Germany, Spain, and other continental countries. But all brought with them knowledge and traditions of a husbandry better suited to a colder climate than what they found in their new homes.

Theirs was an era of exploration. Not only was it necessary for the first ...10



Strip cropping, contour cultivation, terraces, protected water ways and proper use of every acre of land are pointing the way to a permanent agriculture throughout the Old Cotton Belt of the South.

settlers to explore the tidal streams that flowed lazily through dense forests of pine and hardwood—they had to find the best uses to which the land might be put and discover the crops best suited to their conditions and potential markets.

Natural Resources Abundant

Our forefathers were surrounded by such a wealth of natural resources that it seemed logical for them to rely upon the products of the forest rather than to plant seed and spend months cultivating and harvesting crops.

The Honorable Harry Hammond writing in the South Carolina Board of Agriculture Handbook for 1883, described the activities of the early Carolina settlers as follows:

"They soon found it would be more profitable to employ themselves in collecting and exporting the products of the great forests that surrounded them. In return for the necessities of life, they exported to the Mother Country and her colonies, oranges, tar, turpentine, rosin, masts, potashes,

By T. S. Buie

Columbia
South Carolina

Dr. T. S. Buie, S. C. native, is State Conservationist there. He earned his B. S. at Clemson, M.S. and Ph.D. at Iowa, studied at England's Rothamsted Experiment Station. After serving as Georgia agronomist, Clemson division head, Superphosphate Institute field agronomist, he joined the Soil Conservation Service in 1932. Was Conservation Society president in 1948.





A common rotation cycle in the Southland during the Exploitative Period was cotton, gullies, broom straw and pines—similar to this hillside. SCS Photo.



The finger-sized corn stalks sparsely distributed over this eroded Piedmont hillside were caused by continued over-cropping without proper fertilization and attention to soil-improving crops.

SCS Photo.



Such scenes were common during the exploitative period of Southern agriculture now fast disappearing, replaced by pastures, ponds, and pines. SCS Photo.

cedar, cypress and pine lumber, walnut timber, staves, shingles, canes, deer and beaver skins, etc."

In time, the situation changed—as they began producing annual crops instead of depending entirely on the forests and streams for both their sustenance and income.

Indigo and Rice Plantations

The efforts of these early pioneers to introduce suitable crops and develop an established plant husbandry led to indigo and rice plantations in the coastal area.

In the tide-water section of South Carolina and Georgia, the social culture and living level was probably higher during the late colonial period than that of any other strictly agricultural community in the history of the world. But even during these years, most of the people relied on a system of subsistence agriculture. Of necessity, they had to be content with what they had at hand in the way of food and raiment. They did not have the means to acquire extensive land holdings, nor to own the number of slaves necessary to tend the crops on large plantations.

Although small cotton acreages were grown during this period, the laborious process of separating the lint from the seed limited the amount produced for market. Not until Whitney's cotton gin was developed in the 1790's did cotton become an important factor in Southern agriculture. Then the period of exploration, with its limited land use, came to an end.

Period of Exploitation

Now the means for producing a crop in seemingly unlimited quantity for market were at hand. And, about this time, the expanded industrial activities in England and on the Continent created a demand for much more cotton.

Also, steam was being successfully applied to the transportation of goods by both rail and water. This made it

possible to move countless bales of cotton from the interior of the country to the coast and on across the ocean at small cost.

Thus, a period of exploitation of the land began early in the 19th century. For 100 years and more, Southern farmers were to clear the slopes farther and farther up the hillsides to expand their cotton acreage.

What did it matter if in only a few years the topsoil should be lost through erosion? The land would be paid for long before then, and there were always more acres waiting to be cleared, burned, and plowed. And for the more adventurous youth, the wideopen spaces of Alabama, Mississippi, Tennessee, Louisiana, and Texas beckoned.

The reign of cotton as king in Southern Agriculture began shortly after 1800 and continued for more than a century. During this period, numerous incidents influenced agriculture. The most far-reaching in its effect was The War Between the States and the resultant freeing of the slaves.

But the effect of the War was largely economic and cultural. It did not markedly affect the system of agriculture. Slave labor or free, panic or prosperity, cotton remained supreme.

Under conditions faced by the 19th Century farmer in the Southeast, he did what was best for him and that which offered him the most stability. It would be grossly unfair to criticize the farmers of this period for damaging their land by continuous cotton planting. It was the one crop admirably suited to their economic and climatic conditions. Cotton was demanded by the world markets. Southern farmers could produce it, and they did just that.

End of Exploitation Period

This period of land exploitation, characterized by overemphasis on cotton, began to end shortly after the close of World War I.



Countless former cotton fields are now planted to Coastal Bermudagrass. Fertilized heavily, this new grass provides excellent summer grazing and a surplus of hay for winter feeding as well. SCS Photo.



Today's Southern farmers are vitally interested in learning new methods. Here, South Carolinians study the planting of soy beans in grain stubble without prior land preparation. SCS Photo.



Traveling the highways of the South, through fields formerly planted to cotton, you now see more and more dairy and beef cattle grazing well growing pastures.

SCS Photo.



Who would have thought Southern farmers would plant corn and Bermudagrass in the same row? Yet, this South Carolina Soil Conservation District Cooperator did it, gathering 65 bushels of corn per acre from a field with an excellent stand of Coastal Bermuda to boot.

SCS Photo.

The reasons this period came to an end at this time were varied—ranging from changes in women's styles to the increasing efforts of many other countries throughout the world to become independent of the American cotton monopoly.

Also causing the end of this period were:

(1) The shift of cotton from the old Cotton Belt of the Southeast and Middle South to the drier lands of the West, (2) the advent of the boll weevil, (3) the development of competing synthetic fibers, and (4) the long-deferred realization by many farmers that much of their land could not go on producing cotton year after year without dire consequences.

Let us look at the condition of the land at the time this period of exploitative agriculture came to a close. There was little reason for the first settlers along the coast to give attention to erosion. The land which they cleared for their limited use was flat and the fields small. But their grandsons and great-grandsons moved inland and, along with other settlers of a later day, found a country of hills and valleys. The soil was productive, however, and well suited to the everexpanding cotton acreage. Countless hillsides, some of which were very steep, were cleared of their protective cover of trees and put to the plow.

Thus, as the Cotton Empire of the South grew, erosion became a menace. Nature took her toll. Throughout the Piedmont and other rolling sections of the Old Cotton Belt there are many evidences, even yet, of land misuse during this second or exploitative period.



The highly competitive nature of present-day farming makes it necessary to use the best methods of crop production. And this includes the application of supplemental water to high value crops such as bright-leaf tobacco in South Carolina.

Two Important Developments

Two significant developments in this period were to have a marked influence and lasting effect on Southern agriculture:

(1) The application of scientific knowledge to the solution of the farmers' problems, (2) the development of the fertilizer industry as one phase applying scientific knowledge to agriculture.

Until the Land Grant Colleges and associated experiment stations were established about three quarters of a century ago, farming was largely an art with little science.

The early technical workers gave attention to problems of production: activities such as (1) the development of prolific varieties of field crops and fitting them into practical rotations: (2) control of destructive diseases and

insects; and (3) the determination of what kind and amount of fertilizer to use for each crop on each kind of soil.

The fertilizer industry, even in these formative years, was quick to utilize the scientific knowledge available.

Phosphates from the South Carolina coastal deposits, potash from the mines of Europe, and nitrogen from the nitrate beds of Chile and in the form of various manufacturing by-products were compounded to provide products which greatly increased crop yields.

Cotton planters soon recognized the advantages of applying commercial fertilizer to their fields. While the fertilizer was of low grade in terms of plant food and the rate of application correspondingly low, the effect on the cotton crop was marked.

Fertilizer compensated in part for

the wasteful practices of land misuse and mismanagement. Only because it was available and used was much of the land kept in profitable production during the latter decades of the ex-

ploitation period.

The percentage of plant food contained in the fertilizer and the rate of application steadily increased. Toward the end of this period, nearly one half of all the fertilizer manufactured in the United States was used by the farmers of the Carolinas and Georgia. And most of it was applied to cotton—the universal "cash crop," at that time.

Beginning of Permanent Period

As stated previously, the exploitative period began to give way to the Period of Permanent Agriculture shortly after the close of the First World War. By the middle of the 1930's, the Period of Permanency was in full swing. Certain factors, to which reference already has been made, contributed to the end of the exploitative period.

These and others were responsible for the development of the next, or permanent, period. Among the others which may well be mentioned were:

(1) The increasing store of scientific knowledge developed as a result of agricultural research activities; (2) the dissemination of this knowledge to the rank and file of the farm population; (3) the initiation of a national soil and water conservation program; (4) changing economic and social conditions, and (5) the belated realization on the part of farmers generally that the soil is not indestructible—that it will not continue to produce crops year after year without proper care.

Thus, after almost 300 years of exploratory and exploitative agriculture, our Southeast farmers are now entering a period of permanency insofar as land use is concerned.

They are now practicing a system of agriculture based on the capabilities of

the land itself and what it requires to produce indefinitely — without damage or hazard to the future.

It is, indeed, fortunate that this changed attitude regarding the proper use of land has occurred. Fortunate not only from the standpoint of the farmers who own and till the land, but fortunate also from the standpoint of those of us who do not live on the land but from the land.

Changes in Land Use

This modern concept of proper land use, plus current economic developments, have caused a marked change in the way land is used in the South, as well as in other parts of the country.

For instance, we now produce a number of grazing and hay crops unknown to this section just a few years ago. These crops have helped our farmers shift from cotton and other row crops to a better balanced system of agriculture—one in which livestock is finding its proper place.

And one of the most important facts this new type of agriculture has taught us is that the grazing quantity obtained from a pasture is in almost direct proportion to the amount of

fertilizer applied.

It is not uncommon to hear a farmer say: "That depends upon how much feed I will need," as he replies to the question: "How much fertilizer do you apply to your pasture?"

The Future?

What of the future? Cotton will continue to be grown in the Old Cotton Belt, even as we develop further the period of permanent agriculture. This period is just now getting well under way, but already we can recognize some of its characteristics. One of these is continued cotton production on land well suited to that crop.

There are, of course, difficult times ahead for the Southern Farmer. There will doubtless be years—possibly decades—when the Dixie farmer will find it difficult to make ends meet. The

shift to larger farm units and the movement of people from the land to new industries will undoubtedly continue. And the acreage devoted to cotton will, no doubt, be reduced substantially below what it now is.

But our landowners of the Southeast are now moving forward on a stable base, one which will insure permanency to their occupation and their

use of the land.

No longer does the spectre of ero-

sion and abandoned fields stare them in the face.

No longer do they need to fear what their sons will do with the worn-out farms they inherit.

The present-day conservation type of farming will insure a degree of permanence our Southern agriculture has not known since it began almost three centuries ago with the displacement of the Indians along the South Atlantic Coast by the first European settlers.

CORN LODGING

IF YOU HAVE IT, HERE ARE SOME REASONS

Corn lodging and stalk breakage can't be pinned down to any single cause.

It can result from one or a combination of several things, according to Charles Simkins, extension soils specialist, and Herbert Johnson, extension plant pathologist at the University of Minne-

Some of the causes include:

- 1. Root and stalk rot. Fungus organisms called Giberella and Diplodia are the most important causes of root and stalk rot.
- 2. Insect damage. Corn borers, corn root worms, wireworms and other insects may weaken stalks, causing them to finally break and drop the ear. Also, the entrance made by an insect in plant tissue allows an easy pathway for root and stalk rotting organisms.
- 3. Nutrient balance. When the fertility level of soil is out of balance-especially when potash level is low-stalk rot may develop faster and cause more lodged plants. Also, research and observation indicates that applying nitrogen alone favors stalk rot.
- 4. Plant populations. Stalk breakage and lodging increases when there are more than 18-20,000 plants per acre. Stalks are smaller, generally taller and more susceptible to breaking at high populations.
- 5. Corn variety. Different varieties vary in their standing ability, an important factor in lodging. Some plants apparently contain soluble substances which slow growth of some stalk rotting fungi.
- 6. Treatment with 2, 4-D. This herbicide sometimes causes brittleness when sprayed on corn for a period of about 10 days following treatment.

Johnson and Simkins add that soil and weather also affect corn lodging. They say the greatest hope for a solution is in using resistant hybrids, insect control, proper fertilizing, using correct plant populations, and good crop management.

Abstracts

FROM THE
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Through its library, the American Potash Institute summarizes the important findings on the role of potash in good soil management and balanced soil fertility. This program abstracts the important potash information from each article that is summarized. These abstracts are available on request to professional agricultural workers of the United States and Canada. Each issue Better Crops features a small portion of the abstracts available in current issues. If you are interested in receiving this summary service regularly in complete issues, please write the above address.

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Various NPK Levels Affect Potash Yields and Starch

Black, W. N. and Cairns, R. R.

The effect of varying levels of nitrogen, phosphorus and potassium and manure on the yield and starch content of potatoes. Agrl. Inst. Review 12(3):42. May-June 1957. (Abs. of paper presented at 1957 Ann. Mtg. Agrl. Inst. of Canada).

Fusarium Wilt Reduced by Potash Rishbeth, J.

Fusarium wilt of bananas in Jamaica. II. Some aspects of host-parasite relationship. Annals of Botany N. S. 21(82):215-245. April 1957.

Wilt is usually worse where K was low. Apparently heavy K applications, above those directly increasing yield, are necessary to increase the resistance of bananas to disease. Nitrogen alone increased disease. Phosphorus was also helpful in control.

Effects of Potash Forms

Dushechkin, A. I. and Lempitskaya, V. K. The effect of various forms of potash fertilizers on yields and quality of potatoes. Nauch Trudy Inst. Fiziol. Rast Agrokhim. Akad. Nauk urkan. SSR No. 10, 87-98. R. Zh. (Biol.) 1956 (104076). 1956. Abs. Soils & Ferts. 20(3):1119 June 1957.

In pot experiments with potatoes grown in light sandy clayey soil supplied with NP, application of 0.15 g K₂O per 1 kg soil in the form of (a) KCl, (b) K₂SO₄ and (c) 50% KCl + 50% K₂SO₄ increased the plant weight after 25 days from 272 g (control) to 413 in (a) 528 in (b) and 554 g in (c). The yield of tubers was also higher in (b) than in (a). The form of K did not significantly affect the starch content of the tubers.

Effect of Phosphorus and Potassium on Chlorophyll Content

Dorokhov, L. M.

The effect of phosphorus and potassium on the concentration and total content of chlorophyll in leaves. Trudy kishinev. s.-kh. Inst. 6, 141-150. R. Zh. (Biol.) 1956 (99211). 1956. Abs. Soils & Ferts. 20(3):973. June 1957.

In pot and field trials with cereals and legumes supplied with varying K and P levels, K deficiency resulted in the destruction of chlorophyll and dying-out of the leaves. With N_2K_2 the chlorophyll content in the leaves of barley increased with growth. With N_4K_4 the pigment content decreased with barley. A simultaneous increase in N, P, and K levels increased the chlorophyll content in barley leaves particularly during shooting and earformation; the total chlorophyll content of the plant was also increased.

Possible Role of K in Combatting Vascular Wilt Disease

Prendergast, A. G.

Observations on the epidemiology of Vascular Wilt disease of the oil palm (Elaeis guineensis, Jacq.). Jour. W. African Inst. Oil Palm Res. 2(6):148-175. April 1957.

Symptoms of Vascular Wilt of oil palm have been more fully described than previously. Evidence has been presented of the way in which the disease spreads in a plantation and the succession that may be expected when a diseased area is replanted. Facts relating to effects of fertilizers, variety of palm, age, and some environmental conditions on the incidence of disease have been given and discussed. There is significantly less disease on areas which receive adequate amounts of K fertilizers. The possible role of K and some environmental conditions on disease incidence have been discussed.

Release of Potash by Soils of Different Great Soil Groups Garman, W. L.

Potassium release characteristics of several soils from Ohio and New York. Soil Sci. Soc. Amer. Proc. 21(1):52-59. Jan.-Feb. 1957.

Seventeen Ohio surface soils, 25 New York surface soils, and 21 New York subsoils were investigated. Potassium release characteris-tics were determined by continuous cropping and by 4 different chemical methods. A continuous leaching method employing the use of 0.01 N HCl gave the highest correlations with continuous cropping. Cumulative amounts of K removed by this leaching technique were plotted to produce a family of curves with specific characteristics for each great soil group. A measure of the rate of release of K from structural positions is indicated by the slope of the line drawn between the points plotted from 5 to 10 liters of leachate. Potassium release from both surface and subsoils followed the order of Brown Forest more than Gray-Brown Podzolic more than Brown Podzolic more than Podzol. The average K concentration in the last 5 liters (10 liters total) of leaching solution from surface soils was as follows: Brown Forest 0.31 ppm., Gray-Brown Podzolic 0.12 ppm., Brown Podzolie 0.05 ppm., and Podzol 0.04 pp.m

Potash Fixation and Release—Methods of Measurement

Grissinger, E. and Jeffries, C. D.

Influence of continuous cropping on the fixation and release of potassium in three Pennsylvania soils. Soil Sci. Soc. Amer. Proc. 21(4):409-412. July-Aug. 1957.

Fixation and release of K by 3 Pennsylvania soils was studied under greenhouse conditions using ryegrass as the indicator crops. Soils studied were representative of the two types of clay mineral distributions determined by a previous mineralogical survey of the soils of Pennsylvania. The K fixed by the soil during the greenhouse experiment was measured two ways: the fixation of exchangeable K as non-K as acid insoluble. The amounts of K as non-exchangeable and as acid insoluble K were approximately the same. The K fixed under moist greenhouse conditions was less than that fixed by repeated wetting and drying the soils at 75°C. The difference in the K fixation capacities of the soils was related to the physical characteristics of the vermiculite contained in the respective soils. The release of K by the soils during the greenhouse experiment was again measured two ways: the release of acid insoluble K as acid soluble, and the release of acid soluble K as exchangeable. The best indicator of the rate of release of K was the acid soluble K. different rates of release of K by the soils were related to the hydrous mica content and were responsible for the significant differences in the ryegrass yield of the three soils.

Effect of Soil Conditions on Root and Leaf Diseases in Coconut Palm

Sankarasubramoney, H., Pandalai, K. M., and Menon, K. P. V.

Studies on soil conditions in relation to the "root" and "leaf" diseases of the coconut palm in Travancore-Cochin. Part III. Total available and exchangeable potassium contents of coconut soils. Indian Coconut J. 9, 90-100. 1956. Abs. Soils & Ferts. 20(3):1160 June 1957.

While the total K-content of sandy, alluvial and red loams and lateritic soil was higher in healthy areas than in those where coconut palms showed symptoms of "root" disease (deterioration of the root system and flaccidity of leaves), their contents of available and exchangeable K were lower. Leaf concentrations of N, P, and Mg were higher, and those of K and Ca were unchanged, in affected plants. Deficiency of K may possibly be the direct cause of the disease or may indirectly affect susceptibility (sic) to parasitic fungi.

Mineral Nutrition Affects Tobacco Diseases Klein, E. K.

The effect of mineral nutrition on the leaf content of free amino acids and monosaccharides and the effect of this on the susceptibility of the plant to fungal parasitism. Bayer. landw. Jb. 33, 347-367. 1956. Abs. Soils & Ferts. 20(1):303. Feb. 1957.

Increased application of NHs fertilizers in nutrient solution caused large increases in the glutamin and glutamic-acid contents of tobacco leaves, explaining in part the high susceptibility to Alternaria, Cercospora and Sclerotinia of plants receiving NHs. High K decreased the monosaccharide and free aminoacid contents and susceptibility.

Effects of Potash Deficiency Tserling, V. V.

Diagnosis of potassium requirement by plants. Pochvovedenie No. 6, 59-71. 1956. Abs. Soils & Ferts. 20(1):231. Feb. 1957.

In a sand-culture experiment with white mustard (Sinapis alba L.) the effect of K deficiency on the morphological changes in plants was investigated, using the microchemical method. Potash deficiency in the nutrient solution induces K deficiency in the apical meristem and results in the cessation of flower-bud formation at an early stage; pollen production does not take place, due to cessation of nuclear division. The development of small embryonic buds ceases, they turn brown and abort. For the diagnosis of K deficiency by chemical analysis of plants it is better to use the lower leaves; the analysis of higher leaves gives better results in the determination of the degree of increased K supply.



A scandalmonger is one who puts who and who together and gets whew!

The car was crowded and the conductor was irritable.

"Where is the fare for the boy?" he snapped as the father handed him one fare.

"The boy is only three years old."
"Three years! Why, look at him.
He's seven if he's a day."

The father leaned over and gazed earnestly at the boy's face. Then he turned to the conductor.

"Can I help it if he worries?" he asked.

Father to small son: "Never mind how I first met your mother—just don't go around whistling!"

"Sir, do you have an opening in this office for a smart young man like me?" asked the job applicant.

asked the job applicant.

"Yes, we do," said the office manager, "and please don't slam it on your way out."

"I wouldn't worry too much if your son makes mud pies," said the psychiatrist, "nor even if he tries to eat them. That's quite normal."

"Well, I don't think it is," replied the mother, "and neither does his wife." The man watched his bride remove her false teeth, false hair and complicated make up. "I'm so tired," she sighed, "I've not been able to get off my feet all day."

"Say!" he cried. "Do you mean they come off, too?"

A mother was telling her 4-year-old son Charles a story about a little boy who had had some exciting adventures. When the story was finished, Charles asked, "But where was the boy's mother?" "The story didn't mention his mother,' she said, "so perhaps he didn't have one. Maybe she was dead." Charles commented dramatically, "I'll bet she was killed in a nervous wreck."

Some men work hard and save their money so their sons won't have the problems that made men of their fathers.

Two small boys were trying to awaken their dad. They got no response to their questions. Finally one of the boys lifted an eyelid, peered at it and said: "I don't know why he doesn't answer. He's in there."

The Mrs: What's the idea of all the crowd at church?

The Mr.: There's a traveling salesman down there confessing his sins.







Alfalfa yellows and rosetting

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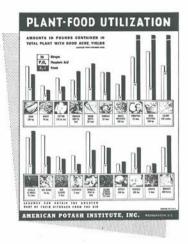
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