BETTER CROPS W

The Pocket Boo

TABLE OF CONTENTS

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of Agriculture

April-May 1935 to October 1936

MARCH 1936

APRIL 1936

MAY 1936

JUNE-JULY 1936

AUGUST-SEPTEMBER 1936

OCTOBER 1936

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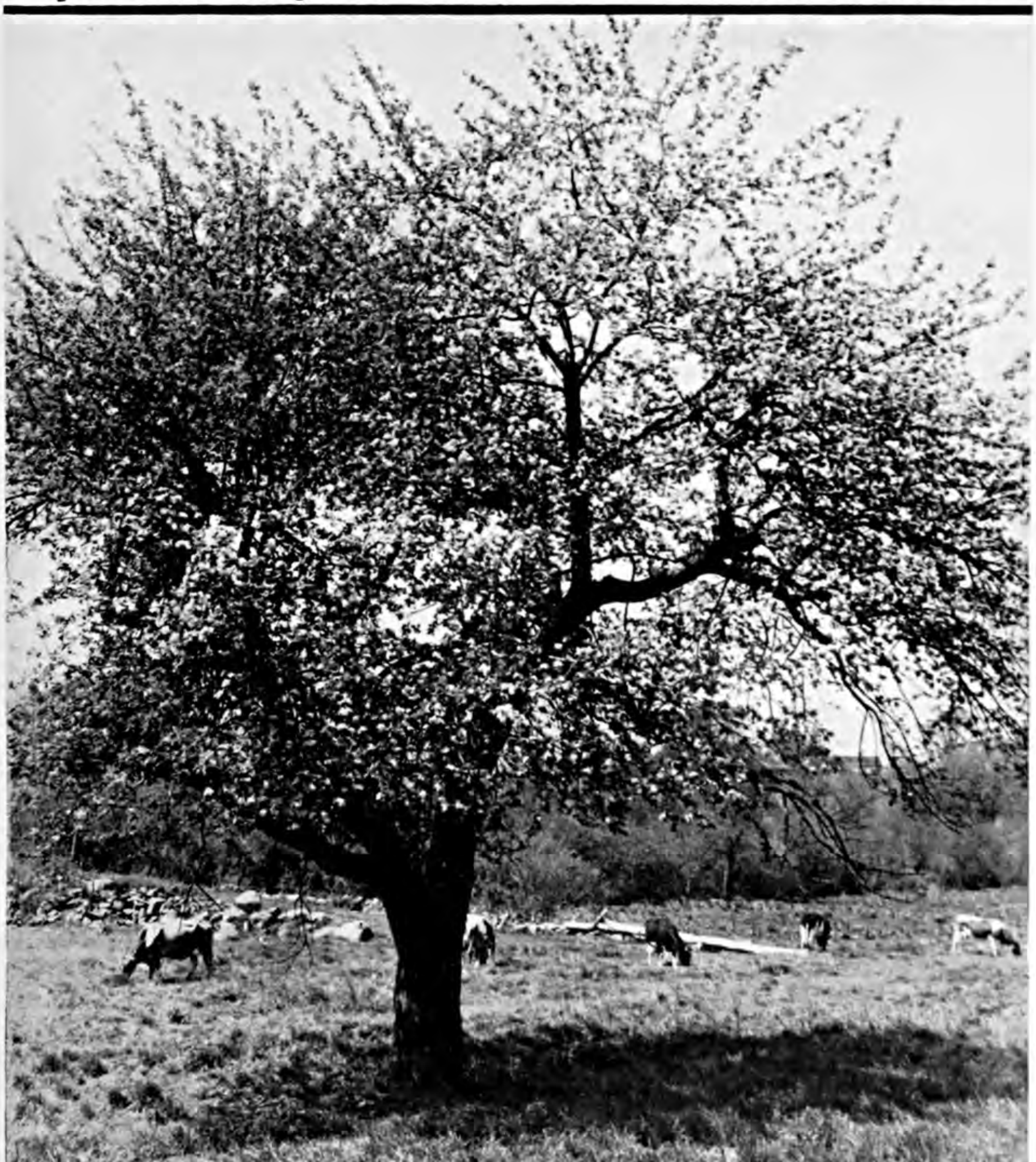

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth — Not Selected Truth

R. H. STINCHFIELD, *Managing Editor* SID NOBLE, *Editor*

Editorial Offices: 19 West 44th Street, New York

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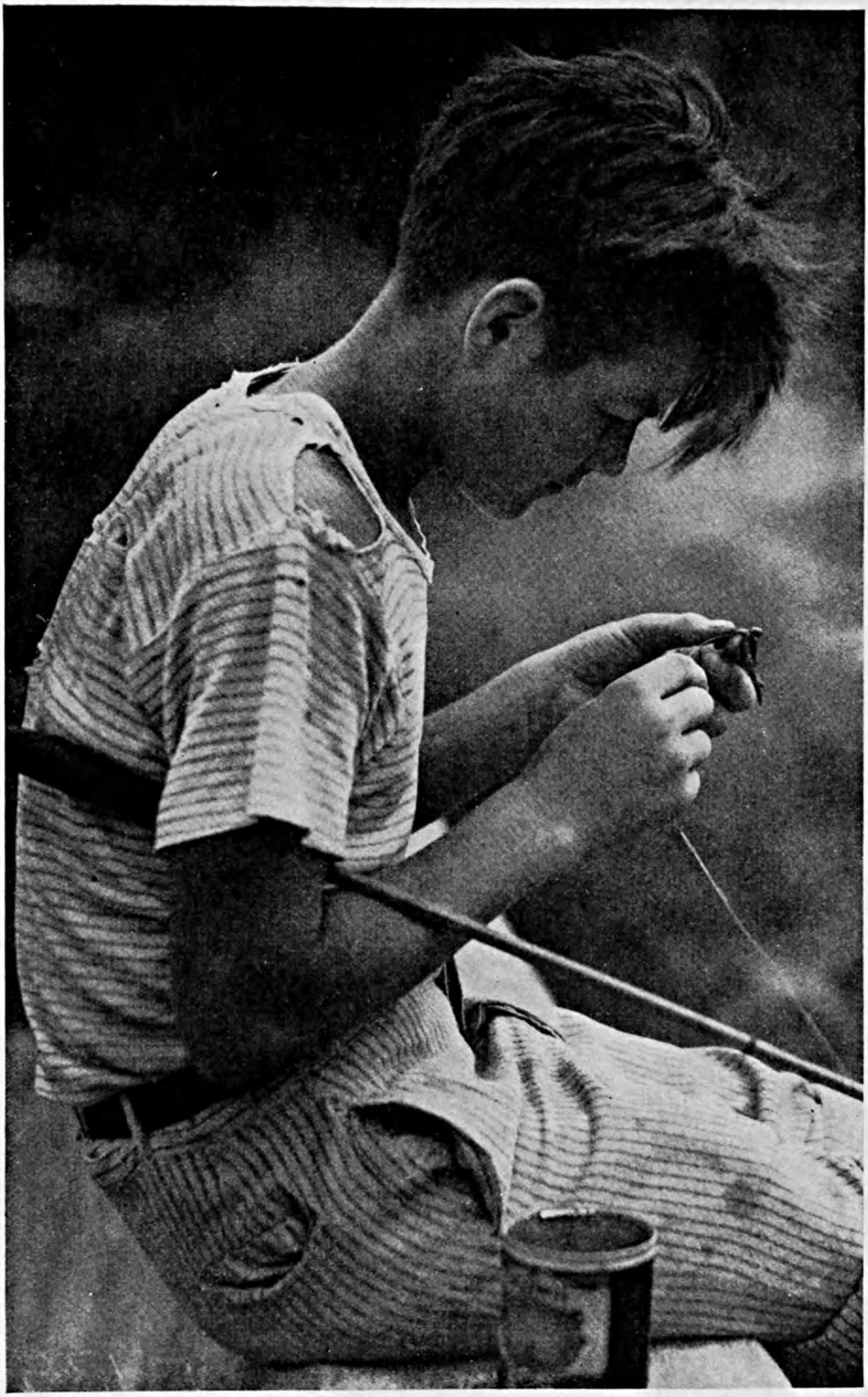

IF NOT A SPORT OF KINGS,—*THE* SPORT OF BOYS

Better Crops with PLANT FOOD

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VOL. XX NEW YORK, APRIL-MAY, 1935 NO. 1

Fellowship *in the* Furrow

By Jeff McDermid

ALONG toward corn planting time we who devoted the best young years of our lives to farm journalism sort of hanker to pile into the old bus and get right out again among the hills. You see, what was once simply a case of answering the call of the loam and the sunshine for a numberless crew of writing enthusiasts has dwindled down to an almost perfunctory pursuit vouchsafed only to a minor contingent of those gallant devotees and interpreters of rural life who still find the means through this vocation to buy their gas and groceries.

It seems rather ironical that the readers out on the farms who so enjoyed "fat books" during the boom-acre days when our weeklies were in the ascendency should be caught in the maelstrom of drought, debts, and dust storms without the friendly pages of their favorite trade journals, which were wont to come along regularly with each phase of the moon. Naturally, it is tough on a lot of us, who filled those columns with advice, warning, and discriminating praise for both individualistic and cooperative agriculture, to be denied the open road, the loaded kodak, and the hearty hand clasp of earth's closest partners.

I suppose that most of us scribes were none too discerning and none too courageous even when we sensed occasional signals of economic storms, and that even if we had published our periodicals every day, the lot of the average reader would be little the better for it—at least *financially*. I am aware that a few of us sometimes deserved to have a mastiff escort us to the exit because of the precious time we took on some man's busy estate trying to reveal to his competitors how to produce just as thick sweet cream or as flourishing alfalfa, or in delving into the trade secrets of some shrewd marketing association which wanted to keep a few jumps ahead of the others.

YET there still remains a kindred bond which seldom completely severs, linking the interests of the erstwhile farm writers of the old school to the traditions and the fortunes of the furrow. No doubt, as I have intimated, many of our subscribers whom we visited like itinerant circuit-riders regarded us as professional writers, aloof from the sphere of farm experience, and they often classed us with the vendors of wonderberries, patent nostrums, and wire stretchers. I am convinced, despite the stupendous chicken dinners we have consumed in many a family circle, that they often felt a bit easier when we had departed, and that some who met us for the first time lost some of their former devotion to and confidence in the infallibility of the staid bucolic publication which their folks had taken as regularly as the almanac since the Civil War.

In justice to a majority of farm editors, however, it must be said that had there been no greater reward or more satisfying compensation than the stipend found in the pay envelopes, their ranks would have thinned out long before the advertising famine. Taking the country over, it is not likely you could have found a harder working outfit of word wrestlers and fact finders doing their steady grind for so small a recompense—in *cash*.

There were several men of this "ship's company" fit to be admirals on any journalistic or literary gunboat now sailing on the bounding waves of public favor and battering the target of opinion with reverberating center-shots. There were masters of prose who wrote brilliantly of pork and pumpkins; wizards of diction who lavished it on pasture grass and bullocks; and many an epic poet who found content in waging relentlessly against the rising tide of petty graft, poor schools, and miserable tenancy. Perchance a scrap-book here and there in some farm-house treasury supports my contention in this regard. If not, come with me on some leisure day to the libraries where dusty files repose and we will let the sunlight set forth the sparkles of forgotten journalistic gems.

BEAR in mind meanwhile that the people who read those yellowed leaves a quarter of a century ago were unpossessed of radio or daily news dispatches, yet those columns reflect their own and their leaders' opinions, which stand today like a prophetic vision of the higher aspirations and the finer principles toward which agriculture has bent its energies for the welfare of the country. Maybe the lack of so much distracting information shaped their courses more directly, and imparted to the farm journals of that day a mellow blend of craftsmanship, citizenship, and culture peculiar to none of the technical press in other major industries of America.

No doubt some of us writers fostered class consciousness and encouraged provincialism and sectionalism along some particular lines, and we may have overplayed pure sentiment as compensation for the injustice and the relatively meager returns which our patrons received from the soil. Granting that this is true, it is not my place to assume a caddish note of apology in this respect—and none is required.

At every call to arms, at every cry for relief of the hungry and the naked, and on every occasion when group sacrifice has glorified the humdrum existence of everyday life, you must admit that no class has responded with more unselfish devotion and disinterested sincerity than the subscribers to American farm journals.

The right and the duty to get cursing-mad one minute and then be caught dashing a tear from the rough cheek in the next is the reflection of that inherent spirit governing those who live much out-of-doors and close to plants and animals. "Tongues in trees, books in the running brooks, sermons in stones, and good in every thing—" the lashing of the summer storm ends in the peaceful twilight and the germinating freshness of rain-washed earth.

Neither am I content to gloss over so-called radicalism or class fealty among the farm leaders who have borne the brunt of the struggle. Many of them have started papers of their own, too, and snitched a little lineage on us older fellows, claiming that we had abandoned the cause or followed the easy path. In some cases they were right. In nearly all cases they were rugged. Only when they fell into the snares of political intrigue may it be said that their work was wasted. Many of these men at least had the vision of a vital brand of journalism and public service, which some of us tied to commercial hitching posts were impatient to emulate. They kept the fires hot under our boilers, even if the steam "blew" sometimes.

And after all, to be class conscious is not the cardinal sin of sins. To be conscious of the destiny of a race, or a mass of toilers within a race, and to train it properly to encourage self-reliant progress may work out well for all others who earn their bread in humble ways. The best way to kill a nation at the roots is to let its farmers become virtual peasants, too weary to be aroused, too unconscious to be militant, too indifferent to demand facts. If the American farm publishers have done no more than nurse the combined sense and sentiment of rural readers, their small salaries have been among our best national endowments.

When, as a tyro, this writer had the privilege of joining the ranks of professional farm journalism, enriched by the kindly but vigorous tutelage of a man now listed among the leading experiment station editors of America, the inspiration and tradition of the craft was at high tide. To an awe-struck, farm-minded lad, "informally" trained but reinforced by several generations of farm folks, the opportunity of enlisting in the profession as an earnest amateur seemed the height of a glorified ambition.

Consequently, I attended occasional meetings of the clan at Internationals and State fairs, or sat well forward among the winter-bound toilers at some college short course, to hear such exponents of culture in agriculture as Joseph E. Wing, Herbert Collingwood, Uncle Henry Wallace, and Alvin H. Sanders. Again, when time afforded, I exchanged greetings by letter or submitted articles to DeWitt C. Wing, Dan Wallace of Minnesota, J. Clyde Marquis of Pennsylvania, and the late James M. Pierce of Iowa, all of whom left some helpful suggestion or generous word of encouragement.

One of the happy moments I remember was on the steps of the white building on Grand Avenue in Des Moines one spring evening when James M. Pierce clasped my hand in parting to remark: "Every young man with the proper spirit to work and to learn what farm folks need to know for their own and their country's welfare will succeed in a career of agricultural writing—even though his education may lack some of the accepted things."

AS the months passed any youngster engaged in this work discovered that many of the technical precepts of newspapering could be used effectively for the improvement of these weekly country-bound journals. The elements of news sense, brevity, and accuracy of course applied to rural journalism just as they did to the daily press, and the call for more frequent photographic and line-drawn illustrations helped to illuminate pages somewhat sloughed in the mire of conservative custom. Yet from this point the paths and goals of these two classes of journalism separated.

It was clearly apparent that the daily press cared chiefly for the snap-dash of the momentary and fleeting impressions of the calendar's events, and seldom dug meatily into the substance of the forces which caused farmers to react as they often did on public occasions that merited reportorial treatment. It was their sole apparent function to tell the world about some row or scandal disrupting a funny farmers' meeting, or in shrewd estimates of the *political* significance of new rural marketing movements.

The desk editors and reporters making up the city editions were city-minded; the papers were dressed and tuned to urban approval. The power of sympathy which leads to understanding and finally to *translation* of rural ideals on a broad civic pattern—these were for the most part utterly ignored. Farmers were "queer dodos" in queerer duds—so why give space to them at the cost of a society page or a frenzied nonpareil stock market dope sheet. Their interest was in running blatant chatter written by some night-hawk of the bright-light zone, instead of finding out some of the equally human and far more constructive wayside stories close at hand.

To them, all was volume, regardless of the vacuum within that volume. Like many of their advertising clients, the daily press of that day wanted nothing but production plus from the farmers, so that the turnover would be rapid and the commissions very plentiful. Their idea of rural mathematical perfection was for the farmer to stick to his red-schoolhouse "rule of three"—one for the producer and two for the fellows who handed it to consumers. Some of them are not yet over the nightmare which the use of calculus and the slide rule has brought to the agricultural sense, or the adoption of the test-tube and the microscope in the solution of farm problems.

WITHIN later days there has been a change, partly due to the rural delivery of daily mail—a service which the farm papers themselves supplied unaided through years of publicity and "lobbying." Somewhat slow to grasp its significance, the daily press has only recently emerged with any vital service of remote value to farmers, and even that often "eats at the second table" when space is scarce.

On the other hand, the agricultural journals were often slow to recognize that the farmer was a citizen and a shareholder in state and national responsibility. Here they made an error as grievous as their cousins of the city room committed, for the interrelation of the class workers to their country

(*Turn to page* 31)

Saleable Sweets

By George R. Cobb

Salisbury, Maryland

"POTASH gives the potato more weight and starch and causes it to fill out and make a perfect crop." Serving at the time as agricultural agent in Maryland in one of the most prominent sweet potato producing counties in the United States, I naturally was vitally interested. It was in 1919 and I was attending a Farmers' Institute in an adjoining county and listening to talks given by successful sweet potato growers on the many cultural points to be observed in producing a large yield and high quality.

The speaker was E. E. Nock, one of the oldest and most successful growers, and he said that while he had been growing sweets for 33 years and still felt that he knew very little about them, one thing he had discovered and that was that "Potash gives the potato more weight and starch and causes it to fill out and make a perfect crop."

Clays Need Potash

Results of experiments conducted by the Alabama Experiment Station and by the Georgia Experiment Station were the next reports I noticed, also back in 1919 I believe. The experiments in Georgia were conducted on a clay loam and I was very much surprised that potash showed a definite increase on this type of soil as I had been taught that clay soils contained plenty of potash. Later on I learned that clay soils contained plenty of potash but that the potash was locked up and was not available to the plants

A readily marketable size.

or, as I heard Dr. Firman Bear say in a talk, "It has been raining on this good old earth of ours for thousands of years, and if a soil still shows plenty of potash, it would seem apparent that this potash is not soluble and thus not available to the plants."

Referring to the experiments at Alabama and Georgia, I found that the authors had this to say, "The significant point to notice in this experiment is the great reduction in yield when potash is omitted." In the Georgia experiment the plot where potash was applied produced per acre about 2,000 pounds more sweet potatoes than did the check. This plot exceeded in yield all other plots with the exception of the plots receiving 1,800 pounds of a complete fertilizer and the one getting 24 tons of manure.

Local growers of sweet potatoes on the Shore were in many cases applying

10 tons of manure plus from 1,000 to 2,000 pounds of kainit per acre and producing fine yields. The war came on, and potash became so scarce and expensive that growers were forced to omit that ingredient from their fertilizer mixtures. The result can be expressed in the words of H. O. Hall, one of the most extensive and successful sweet potato growers on the Eastern Shore of Virginia: "For the first and even the second year we got along all right, but each following year our yields and quality dropped until we could hardly grow a crop at all."

Potash Makes Chunks

I had the pleasure of discussing the New Jersey experiments with the investigators who discovered and proved that plenty of potash made a chunky potato, the kind that the markets demand. The ideal sweet potato, I learned, was from 4½ to 5 inches long and 2½ inches through its thickest part. These same investigators found that a chunky tuber has a large active cambium and this large cambium is directly associated with a high percentage of protein. As the lack of potash decreased the formation of protein and thus directly influenced the size of the cambium, the reason for potash producing chunky potatoes became apparent.

While attending one of the annual meetings of the Peninsula Horticultural Society being held at Camden, Delaware, I heard Dr. H. H. Zimmerley, now Director of the Virginia Truck Experiment Station, report on fertilizer tests on sweet potatoes. These tests or experiments, from 1920-1928 are fully reported and discussed in Bul. 66 of the Virginia Truck Experiment Station. I was more than surprised to hear Dr. Zimmerley tell that a 3-3-15 mixture had given the best results, as 10 per cent potash was about as high as growers and fertilizer manufacturers discussed. The recommendation was for 1,000 pounds of a 3-3-15 mixture or 750 pounds of a 4-4-20 analysis or in other words, "A fertilizer mixture which will furnish 30 pounds of ammonia, 30 pounds of phosphorus, and 150 pounds of potash per acre is recommended for the Jersey type of sweet potato on soils of moderate fertility."

Returning home from that meeting, I immediately arranged with some of our local growers to run a test the coming year comparing the 4-4-20 with the popular 2-8-10 mixture used by many of the farmers. The growers applied 1,000 pounds of the 4-4-20 mixture to one acre and 2,000 pounds of a 2-8-10 to another acre with the following results—the cost of fertilizer was $13.50 less for the 4-4-20 and the yield was exactly 42 bushels more per acre with the 4-4-20.

Experimental work conducted by Dr. F. W. Geise, of the Maryland Experiment Station, here on the Shore enabled me to participate directly in an official test. The results are stated as follows: "Potash gave the greatest increase, nitrogen second, and phosphoric acid seems to be of least importance as indicated by the small increase in yield;" and "Plots treated with muriate of potash alone or in combination with N or NP yielded considerably more marketable potatoes than any other plots included in the test."

Potash Makes Sales

One of the most important facts brought out in the above quotations is that potash produced the most "marketable" potatoes. In other words potash develops primes or number ones to a greater extent than any other element, thus securing for the grower the greatest profit or return per acre.

Another line of experimental work with sweet potatoes that was of great interest to growers on the Shore was the tests on keeping qualities. Thousands of bushels of sweet potatoes are stored each year, and any treatment that will reduce the shrinkage from rots and natural causes is of interest. In reference to potash or other fertilizing elements injuring the keeping quality, Dr. Zimmerley states that there is no relation between the fertilizer used and storage rots and shrinkage. Dr. R. A. Jehle, of the Maryland Station, inspected potatoes from plots that were fertilized with 18 per cent potash and others from plots with much lower potash fertilizer and he found that the higher potash did not affect the keeping qualities adversely but that there was more variation between potatoes in the same row than there was in the different rows that were treated with different analyses.

The most recent tests that have come under my observation were conducted in Wicomico county this year on the farms of W. J. Hotton and J. Galen Adkins, both outstanding farmers. The layout of the plots was the same in each case, but the tests were on widely separated farms and under different farm management conditions. The comparison was as follows: Plot (1) a 3-8-10 analysis, which is very popular on the Shore for sweet potatoes; plot (2) a 3-8-10 analysis plus 200 pounds of muriate and/or sulphate of potash; plot (3) a 3-3-15, which is the official Virginia recommendation; and (4) the 3-3-15 plus 200 pounds of muriate and/or sulphate of potash per acre. The commercial mixtures were applied at the rate of 1,000 pounds per acre about two weeks after planting. The extra potash was applied about one month before planting.

As it is the custom on Del-Mar-Va Peninsula to harvest at least part of the crop early for direct shipment to market, and as an increasing number of farmers are growing their crops to full maturity and storing, those in charge of the tests decided to make two harvests, one in early September and a final harvest about the middle of October. Although the yields, as is to be expected, were smaller in the early harvests, the same persistent increase in yield developed as the potash was increased. The results of both the early and late harvests for the two tests in question are presented in the following table.

Analyzing the results of these two tests, one notices first that the 3-8-10 analysis on both farms and at both the early and late harvest dates gave the smallest yield. Where this analysis was supplemented by 200 lbs. of

(*Turn to page* 30)

Fertilized with 3-8-10.

Fertilized with 3-3-15.

The Inquiring Mind *and the* Seeing Eye

By Dr. A. S. Alexander

University of Wisconsin

TRADITION has it that the grandparents of Dr. Curtis Fletcher Marbut, Scientist in Charge of the Soils Survey, U. S. Department of Agriculture, migrated from the mountains of Tennessee to the Ozarks of Missouri on a mule.

That story, however, is incorrect, for at the time of their journey of several hundred miles, in 1841, they had at least six children who could not well be piled onto the hybrid's back, nor could they safely cling to its tail like the pups of an opossum as "On mules we find two feet behind, and two we find before; we stand behind before we find what the two behind be for."

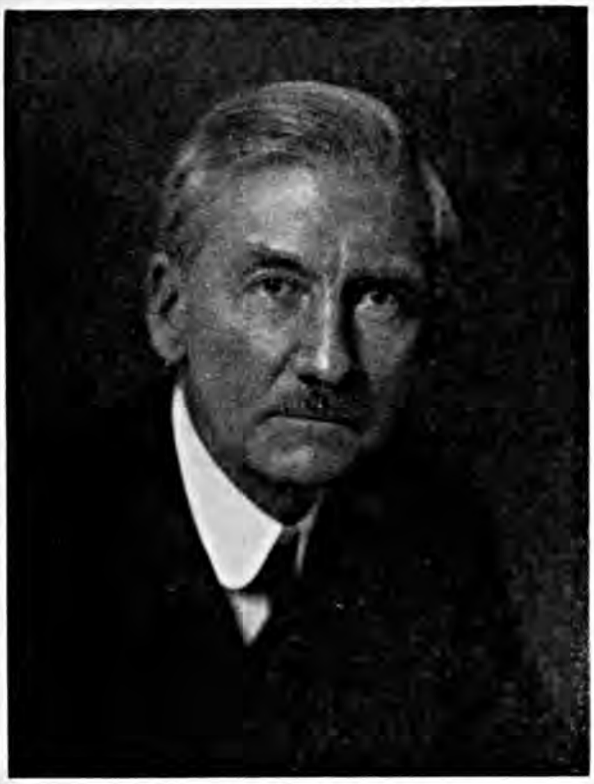
The fact is that the family made the long trip in a sturdy wagon, every part of which was made by grandfather Marbut. He was an accomplished mechanic of the old school, who despised wagons from the factories, accounting them cheap and flimsy. Later, however, those factory-made vehicles put him out of business and forced him to take up farming, a vocation for which he had no special liking or talent.

His first attempt at farming was made on the barren clay ridges of Giles county in middle Tennessee and proved a starvation experience; therefore, he and his family followed two of his sisters a year later to what is now Barry county, Missouri. Crossing the Mississippi at the Iron Banks, they wallowed their way through Nigger Wool Swamp in the southeastern Missouri lowlands, a feat of which he was intensely proud; then they turned northward to the Ozark Uplands and Iron Mountain, westward through Salem in Dent county, southwest to Hartville in Wright county, and finally west by way of Springfield. It is evident that his unfortunate experience on the sterile clay lands of Tennessee had not taught him the importance of choosing fertile land for his farming operations, for he squatted at first on a barren post-oak flat where the soil was miserably poor. A year later he had recognized his mistake, and he moved to the alluvial lands occurring in half-mile wide strips along Flat Creek.

Of Pioneer Stock

Grandfather Philip Marbut was born in 1797, probably in Newberry, South Carolina. His wife was a Thomas. They had, in time, a family of twelve sons and daughters. The pioneer lady died in 1858; and one of the married sons took over the farm. Then came the Civil War and the old man did not regain his independence and sense of leadership when the country settled down to work after that devastating struggle. He died in 1889 at the age of 92 years. Dr. Marbut remembers well his grandfather's wagon shop, his dry kilns, and store of seasoned materials.

Dr. Marbut was born in Lawrence county, Missouri, July 19, 1863. His father's name was Nathaniel Thomas Marbut, born in Tennessee in 1837, and he was 6 years old when the family trekked to Missouri. His mother was a Hudson. Nathaniel's father trained him to do the blacksmithing work of wagon making; but on his



DR. CURTIS F. MARBUT

marriage in 1859 he settled on a tract of valley land near the old wagon maker's farm and after the war, in which he served the Union Army, remained a farmer.

Dr. Marbut is of Scottish and English blood on his mother's side of the family. They were descendants of Englishmen and Scots who "couldn't be cavaliers and wouldn't be flunkies." The family came west from the southern Appalachians. Grandfather Browning was a typical pioneer of the Daniel Boone type—a hunter who could not stand civilization. The farming necessary for the subsistence of the family was done mainly by other members of the family.

Dr. Marbut's mother spent her childhood days doing the drudgery work that usually falls to the lot of the oldest child of a pioneer family; but it developed in her a fine spirit of fortitude and efficiency. Despite the fact that few opportunities for education were offered in their isolated district, she became an ardent reader and so enriched her penetrating mind. Her son says of her: "In the welter of political conditions preceding the Civil War and in the period of intense religious emotion that swept backwoods communities in those trying times, she never lost her head. I owe more to her steady guidance in times of hesitation and doubt than to any other single influence." She died in 1892, in her early fifties, and her husband passed away in 1909 in his 73rd year.

A Rugged Childhood

It was in this primitive environment that Dr. Marbut grew up, knowing nothing of the luxuries of life, but benefited by the example of rugged, honest people who inculcated in him sterling attributes of manhood and citizenship. He worked at farm chores as soon as he could help the older folks, and learned how to "plow and sow, to reap and to mow, and to be a farmer's boy." Climbing about in the Ozark hills, working in the forest, and hunting and fishing when leisure allowed, he developed robust health and hardiness in the open air and sunshine which, throughout life, have stood him in good stead and enabled him to undertake and endure herculean tasks.

At the early age of five years he began to acquire a rudimentary education. His earliest instructor was an itinerant teacher who wandered into the neighborhood and got a few children together for "book larnin'." His parents insisted that he should not miss a single day, now that the opportunity presented, and until he was 17 years old he attended the little school through each short annual term of about four months without a break. During that time he had become a voracious reader. His grandfather's small collection of books was to him a gold mine of entrancing treasures. There was no definite direction in his reading; but his mind was insatiable and he studied and absorbed all sorts of information which gradually stimulated him to seek a higher education.

In 1881, when 17 years old, he was granted his first certificate to teach in the district schools, largely through the liberality of the county school commissioner. This work occupied much of his time for a few years, but he also managed to attend the local school. While teaching, he boarded at home. His entire salary for teaching a whole winter term was $150.

"A Place in the Sun"

He had intended to go to Drury, a small college at Springfield, Missouri, near his home; but happening to obtain a catalogue of Missouri University, he became interested in the courses offered, and after accumulating some money by teaching and from the sale of some cattle he had bought and fed, entered the university. There he was an earnest student, but lack of funds prevented continuous attendance. He persevered, however, and was a proud lad when, in 1889, he had earned the Bachelor's degree. That honor did not, however, signify that he had attained a high plane of culture. "I was," he tells us, "still a raw, uncouth country boy;" but we feel sure that despite that modest estimate, he had acquired real ability and a keen desire to attain a "place in the sun."

His qualifications must, indeed, have attracted favorable attention, for after teaching in the village high school for eight months following his graduation he was, in 1890, made a member of the State Geological Survey. In 1893 he entered Harvard University, received his master's degree in 1894, and remained another year to complete the residence requirements for a Doctorate. During that time he wrote a thesis which later was published as one of the reports of the Missouri Geological Survey; but he was unable to return to Harvard for the final examination, and so did not receive the Ph.D. degree. That is an honor Harvard owes him, in our opinion, and which we hope will be conferred in recognition of the eminent scientific services he has rendered the Government and his fellow citizens.

From 1895 to 1897 he was instructor in Geology in the University of Missouri, assistant professor 1897-1899, and professor 1899-1910. He was director of the soil survey of Missouri, 1905-1910, special agent of the U. S. Bureau of Soils 1909-1910, and has been Chief of the Division of Soils Survey ever since the latter date. In 1899-1900 he traveled in Europe, and in 1919 in Central America. He married Florence L. Martin on December 17, 1891, and they have a family of three sons and two daughters.

He is a member of the Geological Society of America, American Society of Agronomy, Association of American Geographers, American Soil Survey Association, and of the fraternities Phi Beta Kappa, Sigma Xi, and Sigma Alpha Epsilon. In 1916 the University of Missouri honored him with the LL. D. degree. In politics he is a Democrat and in religion a Unitarian.

Awarded Cullum Medal

In June 1934 Dr. Marbut was appointed Honorary Professor of Soils in the University of Missouri where, upon retiring, he may devote a part of his time to soil research.

Dr. Marbut, the self-made lad from the Ozarks, gradually but surely has worked himself to the "top of the tree" and earned and received the esteem and approbation of all who have been interested in and benefited

(*Turn to page* 23)

Typical hay scene where soybeans are popular.

The Soybean Is Here to Stay

By Dr. W. L. Burlison and A. L. Lang

Agronomists, Illinois College of Agriculture

DURING the last 15 years soybeans have attained a significant place in the agriculture of many sections of the United States, particularly in the corn belt. The total production for the United States in 1934 was approximately 17,800,000 bushels according to G. C. Edler, Bureau of Agricultural Economics, or about half again as much as 1933. Illinois accounted for half this figure, while Indiana and Iowa together contributed one-fourth of the total. *This is a remarkable record.*

With hundreds of farmers trying soybeans for the first time, with the increased interest in the crop resulting from continued economic difficulties, and with small grain surpluses and continued invasion by the chinch bug and possibly the corn borer, it is no wonder that there is unusual interest of a very vigorous type in the soybean. Soybeans have many valuable characteristics which have influenced farmers to become more and more interested in them.

Space does not permit a discussion of these characteristics, but actual experience on the farm has demonstrated their high value.

Soybeans are well adapted to widely varying soil conditions. Hay and seed yields, however, are strikingly influenced by natural productive levels as well as by productive levels that have resulted as cumulative effects of systems of soil management. Those systems of soil management which are effective over a period of years on the rotation as a whole are generally effective on the hay and seed production of this legume. Usually soybeans are more responsive to systems of soil treatment as a hay crop than they are as a seed crop. More than 150 crops from 23 soil experiment fields averaged by soil groups according to their natural productive levels furnish data for conclusions regarding the performance of this crop.

An abundance of well-filled pods is desirable in the soybean plant.

Dark-colored soils are relatively high yielding in both hay and seed. Light-colored soils are relatively low yielding. Sandy soils are intermediate with a hay yield equal to 61 per cent and a seed yield equal to 45 per cent of the most productive soil types.

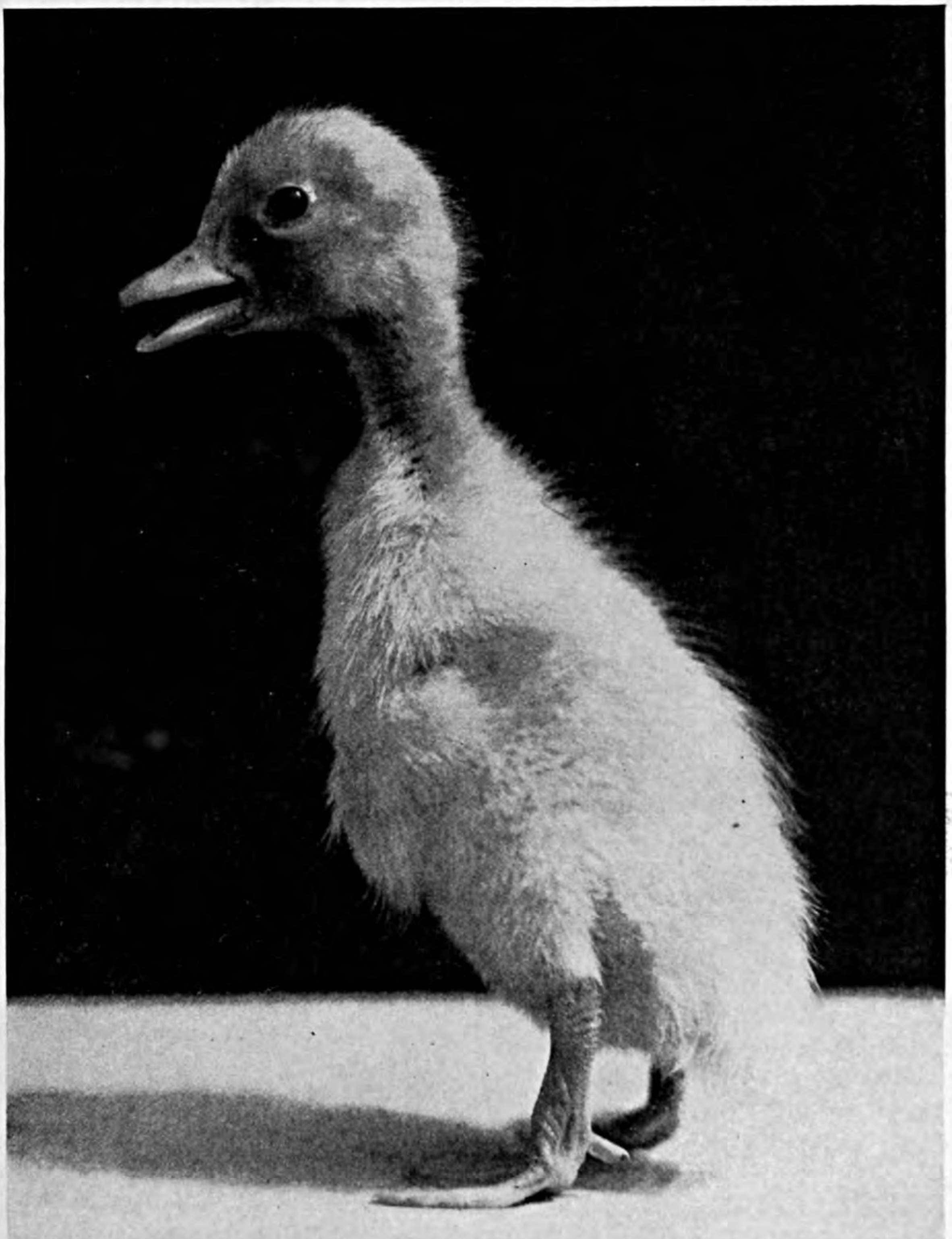
Hay production on two groups of light-colored soils has been more than doubled with the use of manure and limestone, while on a third group it has been trebled with manure, limestone, and phosphate. Sandy soils also have given good response to manure and limestone. These treatments make the hay yields on the less productive soils almost as good as those on the untreated land of the better soil types. On dark-colored soils manure, limestone, and phosphate have materially increased hay yields on two of five groups. Manure and limestone without the phosphate have had similar effects on three other groups.

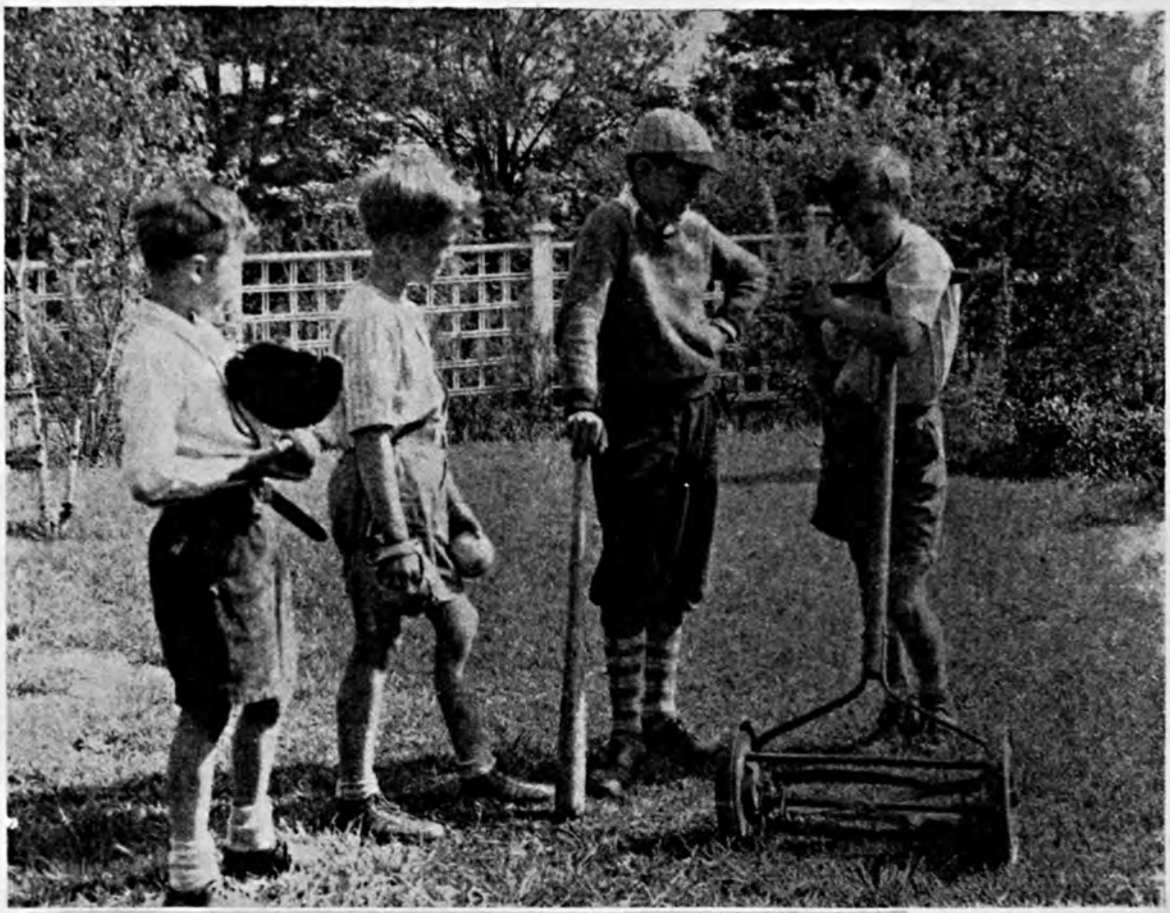
Yields of seed have been practically doubled on the less productive light-colored soils with a complete system of soil treatment, including limestone, phosphate, and potassium in addition to the regular residue treatment. Although increases are not large, treatment on soils of intermediate productivity has proved profitable, while on the highly productive soil types profits from treatment become practically negligible. That seed production has not been enhanced so successfully by soil-treatment practices as have hay yields is in line with response of certain other crops on which those factors that are effective in heavy foliage production are not always so conducive to good seed production. These responses varying from the simple to the complex systems illustrate the fact that no one practice can be expected to be the most profitable one for all existing conditions.

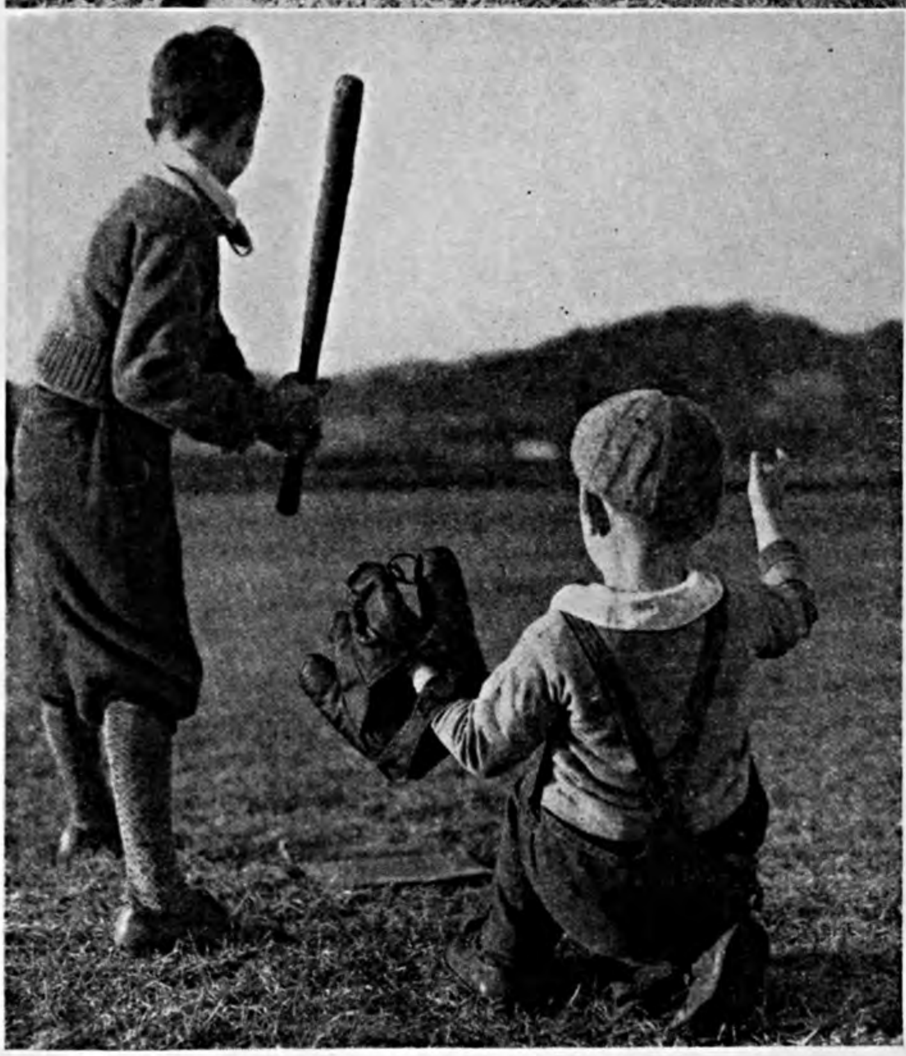
Since they are more acid tolerant than most of the widely grown legumes, it is not surprising that the above condition exists and much less surprising that soybeans show even less response to direct fertilization. As a legume it furnishes, when properly inoculated, its own nitrogen, a material usually deficient in acid soils; but if not inoculated, the soybean must depend upon the soil for its nitrogen, as it does for it mineral requirements. The plant needs little limestone on soils otherwise productive, because like many other acid-tolerant plants, it is a strong forager

(*Turn to page 26*)

Pictorial





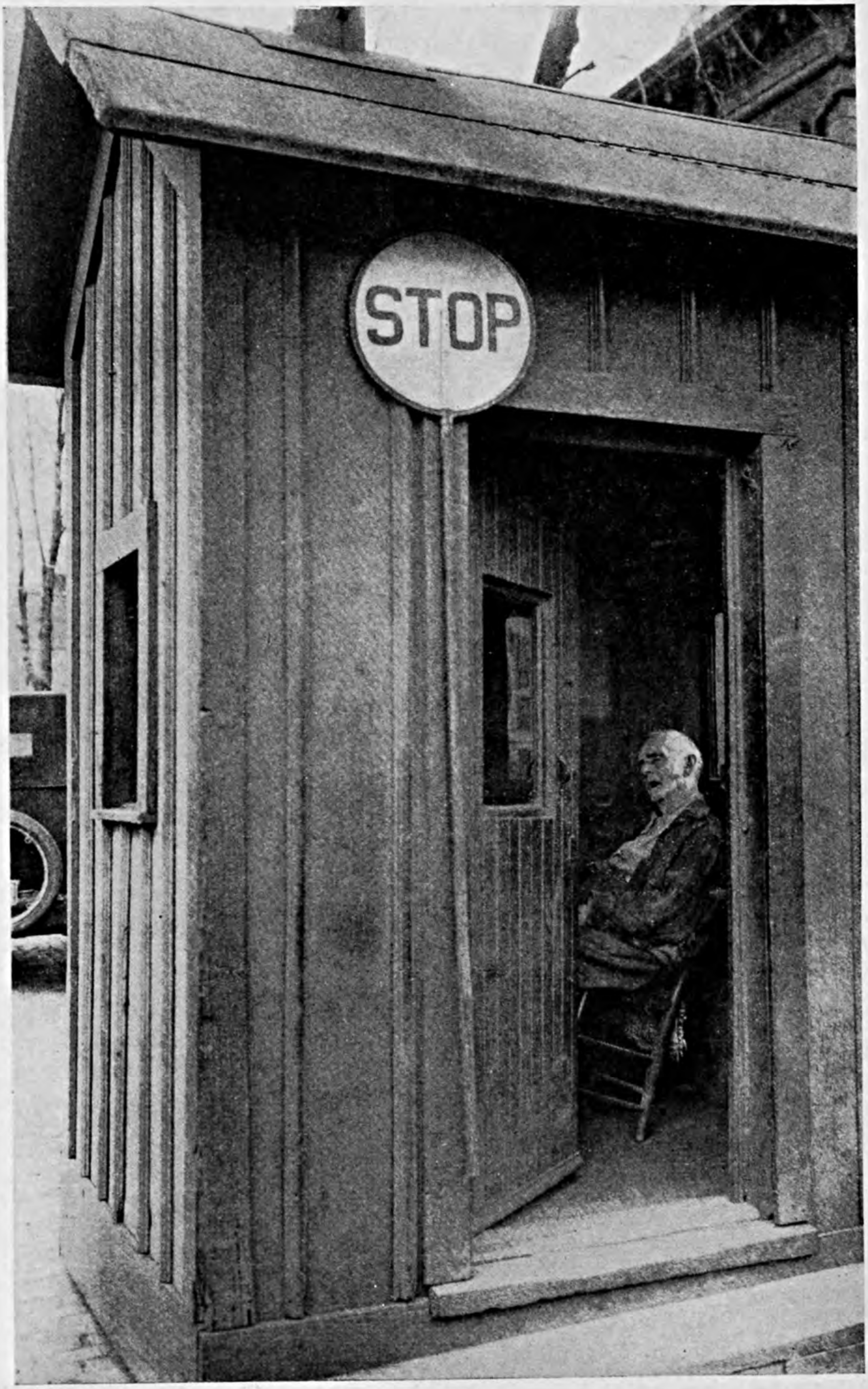


Above: And nothing can be done about it.

Left: Batter up—all set for a fast one.

Right: The early promise of good apples.

Below: Tung oil trees in bloom in Florida.



SPRING FEVER

The Editors Talk

The Status of Agronomic Research

In the maelstrom of our agricultural problems, one cannot help but wonder about the status of agronomic research. With its former goal of producing two blades of grass where one grew before apparently having resulted in the growing of three, where is agronomic research to turn to further its invaluable service to our national well-being?

Research in crop production is temporarily overshadowed by the difficult problems of crop prices, production control, markets and marketing, rehabilitation, and other social and economic problems. One does not have to go back far to find the steep downward trend in prices farmers received for their crops which finally reached devastating and bankruptcy levels. As income dropped each year, the condition of the farm income became more and more important. Administrative circles spent more and more time in devising methods of raising farm prices and income.

This great emphasis on prices, crop restriction, marketing, rehabilitation, etc. had two effects on research: (1) Inevitably a program of such huge dimensions, new in many of its aspects, demanded the time of administrative circles and of most of the agricultural workers in actual contact with agriculture; and (2) The old function of research being to produce two blades of grass where one grew before was questioned.

Trends and Outlook

However, the importance of agronomic research is as great as ever. And to the analyst there are apparent at least four definite trends, the importance of which will be clearly evident when the picture of all that is now taking place has been clearly etched for future generations.

The *first* of these trends is that, in contrast to the concept of inert material, the present emphasis is on the concept that soils and plants are living bodies subject to constant change. The causes, conditions, and results of these changes and the identity of substances involved are the basis of much current research work. The *second* trend is establishing a much closer and more intimate relationship between plants and soils. The *third* is a trend toward a greater inclusiveness. Research is widening its bounds, not only to include a greater emphasis on the relationship of plants to soils, but to include problems of land utilization, soil erosion, and other subjects dealing with arable acreage from the national viewpoint. These three major trends are generating a *fourth*, a trend towards a greater efficiency in methods of research and in the economy of crop production.

In spite of reduction in the volume of research and possible temporary confusion in the goal, the outlook for research in agronomy is very encouraging. It is an essential and necessary work. Whatever the marketable volume of our crops or the methods of distribution and marketing, the production of crops of the best market grade at the lowest cost of production will be with us for generations to come. A sure foundation of efficient, low cost production is essential for a successful agriculture, and the problem of efficient production is increasing rather than diminishing.

Let research keep a sound heart growing out of a fidelity to fundamental work in the changes taking place in research and let its work, whatever its inception, be pointed straight to an ultimate relationship to the broader problems of crop production and distribution.

Science and the Depression

"It is interesting and somewhat disheartening to note that our country, with all its boasted progressiveness, has paid less official attention to science as a means of combating our present difficulties than any of the other great powers." So says Dr. Karl T. Compton, President of the Massachusetts Institute of Technology, in an article titled, "The Government's Responsibilities in Science," appearing in the April 12 issue of *Science.*

Admitting that the range of opportunity in science in this country is so great and the extent to which the government should undertake responsibility in this field involves such complex considerations that it is perhaps rash to undertake a discussion of the problem, Dr. Compton attempts to sketch briefly the problem of the government's present responsibilities in science and gives some suggestions as to ways in which these responsibilities may profitably be extended.

"The truth is," he says, "that we have been fortunate enough to have great natural resources, which we have exploited riotously; we have had a pioneering spirit which has bred some great inventors; this same pioneering spirit has developed some industrial giants who have plunged into big things and have brought 'quantity production' into operation; we have been blessed with a few great philanthropists whose altruistic vision has led them generously to support scientific work and other activities for human welfare in universities and other private institutions. But, as a people and therefore as reflected in our national policies, we have been more lucky than intelligent. Now that we are no longer able to thrive on the unrestricted exploitation of the gifts of nature, it is imperative that we take steps to utilize our resources more intelligently and effectively, and this means scientific research on an increasing scale.

What Is Needed?

Dr. Compton concludes that what this country needs is a bilateral program for putting science to work for the national welfare. There is needed on the one side the cooperation of the scientists of the country generally, to assist the government in putting the work of its scientific bureaus on a scale of maximum efficiency and value. There is needed on the other hand a new type of government leadership whereby the scientific men of the country may be brought together to make an intelligent and coordinated attack on the great problems which are facing the country at those points at which science may offer hope of alleviation or solution.

REVIEWS

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

Fertilizers

The extent and diversity of the work carried on by the Bureau of Chemistry and Soils of the U. S. Department of Agriculture are shown in the Annual Report of Dr. Henry G. Knight, Chief of the Bureau. Investigations are conducted on many practical problems of immediate interest to the farmer and other groups. The report contains too many items to be considered here, but its perusal will reveal much interesting and valuable information.

"Grades of Fertilizers for Corn and Cotton," Agr. Exp. Sta., Auburn, Ala., Cir. 70, Feb. 1935.

"Fertilizer and Fertilizer Material," Dept. of Agr., Montgomery, Ala., Dept. Bul. 24, Fiscal Year 1933-34, Seth P. Storrs.

"Quarterly Bulletin," State Board of Agr., Dover, Del., Vol. 24, No. 4, Fertilizer-Seed Report, July-December 1934, Miscellaneous, January-December 1934, for Quarter Ending Dec. 31, 1934, H. H. Hanson.

"Studies on Firmness and Keeping Quality of Certain Fruits," Agr. Exp. Sta., College Park, Md., Bul. 366, July 1934, E. S. Degman and J. H. Weinberger.

"Fertilizer Recommendations," Ext. Serv., Univ. of Del., Newark, Del., Informa. Card No. 22, Jan. 1935.

"Maryland Fertilizer Facts for 1934," Agr. Exp. Sta., College Park, Md.

"Report on Phosphate Investigations During 1934—Part I. Tests with Legumes and Grains; Part II. Tests with Potatoes," Agr. Exp. Sta., Bozeman, Mont., Bul. 296, Jan. 1935, Jesse Green.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 74, Nov. 1934, H. D. Haskins.

"Inspection of Agricultural Lime Products," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 76, Dec. 1934, H. D. Haskins.

"Fifth Annual Fertilizer Report," Feed Fert. Control Office, State College, N. M., Mar. 15, 1935, F. E. Oakes.

"Report of Analyses of Commercial Fertilizers Sold in New York State—July 1, 1933 to June 30, 1934," Dept. of Agr. and Markets, Albany, N. Y., Bul. 290, Sep. 1934, Charles H. Baldwin.

"Commercial Fertilizers in 1933-34," Agr. Exp. Sta., College Station, Tex., Bul. 498, Nov. 1934, G. S. Fraps and S. E. Asbury.

"Fertilizer Studies with Sugar Beets in the Arkansas Valley Area, Colo., 1921-28," U. S. D. A., Washington, D. C., Cir. 319, Aug. 1934, L. A. Hurst and A. W. Skuderna.

Soils

"The Physical and Chemical Characteristics of the Soils from the Erosion Experiment Stations—Second Report," U. S. D. A., Washington, D. C., Tech. Bul. 430, Aug. 1934, H. E. Middleton, C. S. Slater, and H. G. Byers.

"Studies on the Irrigation of Pear Orchards on Heavy Soil Near Medford, Oreg.," U. S. D. A., Washington, D. C., Tech. Bul. 432, Aug. 1934, M. R. Lewis, R. A. Work, and W. W. Aldrich.

Crops

Eighteen Annual Reports are among the publications listed below. There is no better time than early spring for these summaries to come into circulation. At this season farmers with renewed hope are making their plans, and much guidance can be obtained from these reports on the past year's work of their experiment stations. In addition, many States issue outlook reports, some of which will be found listed under "Economics."

"Forty-fourth Annual Report—Fiscal Year Ending June 30, 1933," Agr. Exp. Sta., Auburn, Ala.

"New Facts for California Farmers," (Biennial Report 1933-1934—June 30), Univ. of Calif., Berkeley, Calif., C. B. Hutchinson.

"Proceedings Sixty-seventh Convention of California Fruit Growers and Farmers, Riverside, California, December 18, 19, and 20, 1934," Mo. Bul., Dept. of Agr., Sacramento, Calif., Vol. XXIV, No. 1, Jan. 1935.

"What Research Has Done for Subtropical Agriculture," Univ. of Calif., Berkeley, Calif., Nov. 1934, Herbert J. Webber.

"The Suwannee Cowpea," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 472, Feb. 1935, Geo. E. Ritchey.

"Annual Report for the Fiscal Year Ending June 30, 1934," Agr. Exp. Sta. Gainesville, Fla., Wilmon Newell.

"Winter Legume Cover Crops for the Coastal Plain of Georgia," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 23, Mar. 1934, J. L. Stephens.

"Muscadine Grapes," Ga. Exp. Sta., Experiment, Ga., Bul. 185, Nov. 1934, W. D. Armstrong, T. A. Pickett, and M. M. Murphy, Jr.

"Irish Potatoes at Georgia Mountain Experiment Station," Ga. Exp. Sta., Experiment, Ga., Cir. 103, Dec. 1934, J. E. Bailey.

"Apples for North Georgia," Ga. Exp. Sta., Experiment, Ga., Cir. 104, Jan. 1935, J. E. Bailey.

"Report on Agricultural Research for the Year Ending June 30, 1934," Agr. Exp. Sta., Ames, Iowa, R. E. Buchanan.

"Preliminary Studies of the Length and Uniformity of Staple of Louisiana Cotton Varieties," Agr. Exp. Sta., Baton Rouge, La., La. Bul. 259, Nov. 1934, H. B. Brown.

"A Study of the Physical and Chemical Properties of Red Clover Roots in the Cold-Hardened and Unhardened Condition," Agr. Exp. Sta., College Park, Md., Bul 370, Nov. 1934, Glenn A. Greathouse and Neil W. Stuart.

"Blueberry Culture in Massachusetts," Agr. Exp. Sta., Amherst, Mass., Bul 317, Feb. 1935, John S. Bailey and Henry J. Franklin.

"Comparative Values of Farm Crops Grown at the Central and Branch Stations in Yield Trials," Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Bul. 312, Dec. 1934, H. K. Hayes and Carl Borgeson.

"Starting the Orchard," Agr. Exp. Sta., Columbia, Mo., Cir. 181, Dec. 1934, T. J. Talbert.

"A Forward Look—The Fortieth Annual Report July 1, 1932 to June 30, 1933," Agr. Exp. Sta., Bozeman, Mont., F. B. Linfield.

"Forty-seventh Annual Report," Agr. Exp. Sta., Lincoln, Neb., Feb. 1, 1934, W. W. Burr.

"Quality of Cotton Produced in New Mexico, 1928-1932," Agr. Exp. Sta., State College, N. M., Bul. 225, July 1934, James R. Kennedy and John C. Overpeck.

"Fifty-third Annual Report for the Fiscal Year Ended June 30, 1934," Agr. Exp. Sta., Geneva, N. Y., U. P. Hedrick.

"Winter Injury to Fruit and Nut Varieties in New York State," Agr. Exp. Sta., Geneva, N. Y., Cir. 156, Jan. 1935.

"The Herb Garden," Agr. Exp. Sta., Geneva, N. Y., Cir. 157, Feb. 1935, G. P. Van Eseltine.

"Irish Potato Manual for 4-H Club Members," Agr. Exp. Sta., State College Station, Raleigh, N. C., Ext. Cir. 204, Dec. 1934, H. R. Niswonger.

"Pruning the Apple Tree," Agr. Exp. Sta., State College Station, Raleigh, N. C., Ext. Cir. 205, Feb. 1935, H. R. Niswonger.

"The Total Calcium, Phosphorus, and Nitrogen Content of Native and Cultivated Plants in the High Plains of Oklahoma and a Study of the Mineral Deficiencies That May Develop in Livestock When Emergency Feeds Are Fed," Panhandle Agr. Exp. Sta., Goodwell, Okla., Bul. 56, Mar. 1935, Harley A. Daniel.

"Applied Research Contributions to Oregon's Agricultural Income—A Biennial Report of Activities and Accomplishments 1932-34," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 334, Dec. 1934, Wm. A. Schoenfeld and Ralph S. Besse.

"Forty-Seventh Annual Report for the Year Ended June 30, 1934," Agr. Exp. Sta., Clemson College, S. C., Dec. 1934, H. W. Barre.

"Forty-Sixth Annual Report 1933," Agr. Exp. Sta., Knoxville, Tenn., James D. Hoskins.

"Lespedeza Sericea," Agr. Exp. Sta., Knoxville, Tenn., Bul. 154, Feb. 1935, C. A. Mooers and H. P. Ogden.

"The Japanese Persimmon in Tennessee," Agr. Exp. Sta., Knoxville, Tenn., Cir. 51, Dec. 1934, Brooks D. Drain.

"Rye for Pasture and Seed in Tennessee," Agr. Exp. Sta., Knoxville, Tenn., Cir. 52, Jan. 1935, L. R. Neel.

"The Production of Winter Vegetables in the Lower Rio Grande Valley," Agr. Exp. Sta., College Sta., Tex., Cir. 73, Dec. 1934, W. H. Friend.

"Peanut Growing in the Gulf Coast Prairie of Texas," Agr. Exp. Sta., College Sta., Tex. Bul. 503, Jan. 1935, R. H. Stansel.

"Forty-Fourth Annual Report for the Fiscal Year Ended June 30, 1934," Agr. Exp. Sta., Pullman, Wash., Bul. 305, Dec. 1934, Edw. C. Johnson.

"Aiding West Virginia Agriculture Through Research—Report of the West Virginia Agricultural Experiment Station for the Biennium Ending June 30, 1934," Agr. Exp. Sta., Morgantown, W. Va., Bul. 263, Dec. 1934.

"Forty-Fourth Annual Report 1933-1934," Agr. Exp. Sta., Laramie, Wyo., J. A. Hill.

"Report of the Chief of the Office of Experiment Stations, 1934," U. S. D. A., Washington, D. C., J. T. Jardine.

"Methods of Reestablishing Buffalo Grass on Cultivated Land in the Great Plains," U. S. D. A., Washington, D. C., Cir. 328, Aug. 1934, D. A. Savage.

"Bur-Clover Cultivation and Utilization," U. S. D. A., Washington, D. C., Farmers' Bul. 1741, Dec. 1934, Roland McKee.

Economics

"Types of Farming in Idaho—Part II—The Type of Farming Areas," Agr. Exp. Sta., Moscow, Idaho, Bul. 208, June 1934, Neil W. Johnson and Harold A. Vogel.

"Agricultural Outlook for Illinois 1935," Agr. Exp. Sta., Urbana, Ill., Cir. 426, Dec. 31, 1934, H. W. Mumford.

"Effects of Inflation and deflation upon Nebraska Agriculture, 1914 to 1932," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 71, June 1934, H. Clyde Filley.

"Rural Homes for Non-Agricultural Workers—A Survey of Their Agricultural Activities," Agr. Exp. Sta., Wooster, Ohio, Bul. 547, Feb. 1935, F. L. Morison and J. H. Sitterley.

"Cooperative Vegetable Marketing Associations of the Lower Rio Grande Valley," Agr. Exp. Sta., College Sta., Tex., Cir. 74, Jan. 1935, W. E. Paulson.

"The Agricultural Outlook for 1935," U. S. D. A., Washington, D. C., Misc. Pub. 215, Nov. 1934.

"Alfalfa Hay an Economical Feed for Dairy Cows," Agr. Exp. Sta., Pullman, Wash., Ext. Cir. 23, Feb. 1935, J. C. Knott and C. C. Hampson.

"Consumer Preferences for Potatoes," Agr. Exp. Sta., Madison, Wis., Res. Bul. 124, Nov. 1934, Henry H. Bakken.

The Inquiring Mind

(*From page* 12)

by his splendid achievements in soil survey work. He must have felt well repaid for his efforts when, on February 25, 1930, he was awarded the Cullum Medal of The American Geographical Society at a banquet held in New York City. The medal bears the inscription *For his Geographical work on the soil, "the foothold of all things."* It is the medal which, in years past, has been awarded to the most famous geographers of the world, including Peary, Nansen, Scott, Murray, and Shackleton.

The honor was richly deserved in consideration of Dr. Marbut's many years of direct supervision of the soil survey work of the U. S. Department of Agriculture. Up to the time of the presentation, more than 880,000,000 acres, approximately half of the agricultural land of the United States, had been examined, mapped, and described as to soil character, quality, and adaptability for agricultural purposes. The total has far exceeded that figure today.

"Probably no man living," says Dr. A. F. Woods, director of the scientific work of the Department of Agriculture, "has a wider or more intimate scientific knowledge of soils of the world." In 1899, Dr. Marbut spent a year in examining and classifying the soils of every country in western Europe except Spain. In 1918 he directed the work of classifying the soils of Africa. His report of this study, "Vegetation and Soils of Africa," written in collaboration with Dr. H. F. Shantz, was published by the American Geographical Society in 1923.

The Official Record of the U. S. Department of Agriculture for February 27, 1930, stated that Dr. Marbut was, at that time, chairman of the International Commission on Genesis, Classification, Morphology, and Mapping of Soils. He presided over the sessions of that commission held in May 1929 in the Free City of Danzig. As chairman of the subcommission on mapping the soils of the Americas, he has made a study of the soils of South America, in addition to his lifelong study of the United States, upon which he was to report at the triennial meeting of the International Soil Congress held in Leningrad July 1930.

The soil study and survey work (pedology) in which Dr. Marbut has so long been engaged is regarded by Dr. Woods as the most important of all the work that is going forward, because the agricultural problem today can be solved only by getting facts and applying them to the present situation. It lies at the foundation of our whole program of agriculture. In addition to the great economic benefits to be gained from the use of the soil survey as a guide to the selection of soils and the adaptation of the proper land to the right crop, the soil surveyors say that this work has revealed erosion as the greatest menace to the fertility of the American soil and has pointed to the means of solution by establishing the characteristics and location of those soils peculiarly liable to loss from rainwash and gullying. Hugh H. Bennett, specialist in erosion and field inspector of the U. S. Bureau of Chemistry and Soils, once stated that there is 21 times more annual loss of plant food from rainwash than from cropping. The character of the soil is also the most important factor determining the appraisal of rural lands for taxation assessment and determining land values. The appraisers of the Federal Land Bank have made the utmost use of all available soil maps in carrying out the program of the Farm Credit Administration.

Difference in View

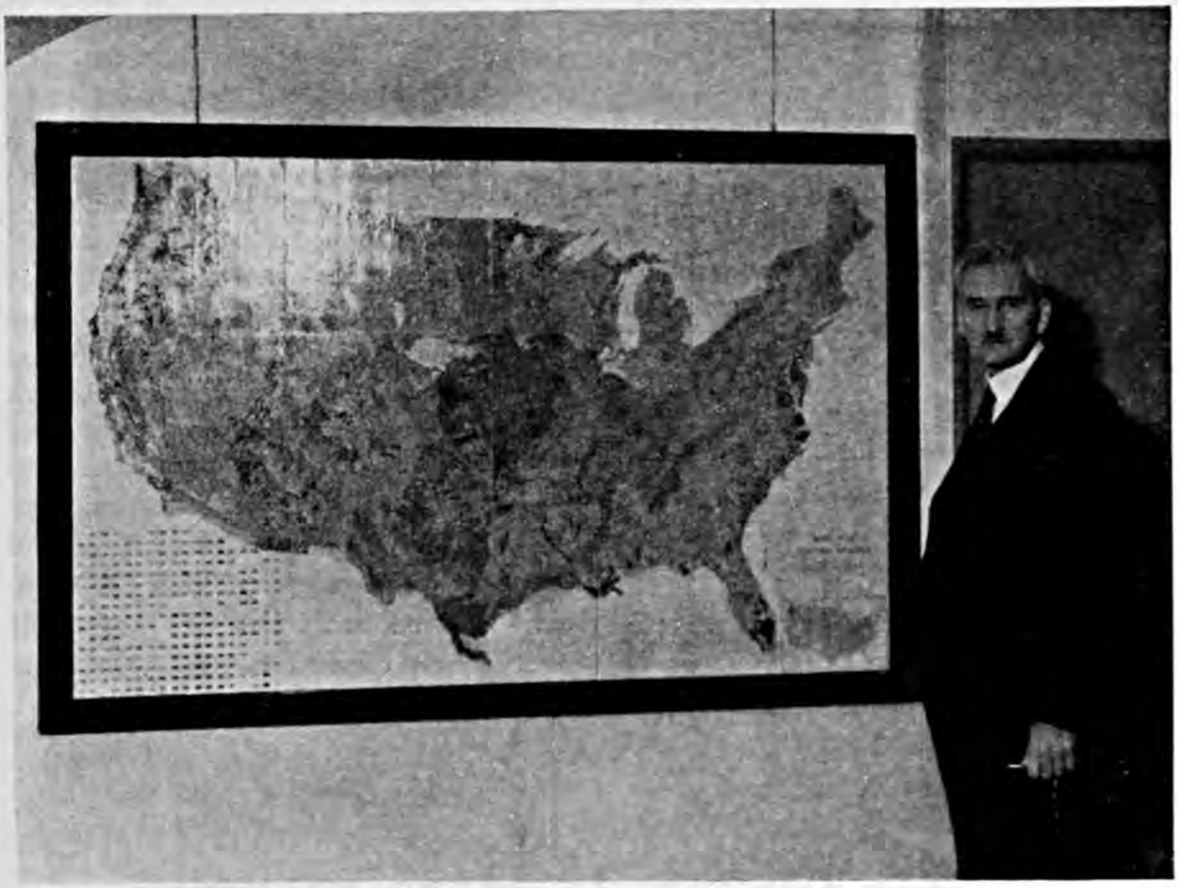
Dr. Marbut explains that the point of view maintained by the pedologist is different from that of the geologist. The latter studies his geologic section from the point of view of the physical processes by which the materials were accumulated and the historical succession of the several layers of successively overlying beds. The pedologist studies his soil section or "soil profile," as he calls it, from the point of view of processes by which the successively overlying layers of material that he finds were developed in place after the geological processes of accumulation had finished their work. He studies these processes as the product of environmental forces acting on the spot, through a period of time.

Since the soil as such differs from the layer of unconsolidated geological material of which it is geologically a part, in such a way as to show that the changes wrought in the original material to produce the soil acted from above downward, he soon realizes that his soil is the product of the environmental forces working on the earth's surface of which he learns, by broad geographic correlation studies, that climate and natural vegetation are the two principal ones. He finds it necessary, therefore, to look upon the soil as the result of an evolutionary rather than a mere physical development. In that sense therefore, the soil becomes, not an organism or even organic, but a body related more closely in its fundamental nature and its processes of development to an organic body than to a physical body.

Map of U. S. Soils

The soil characteristics are an expression of the soil's capacities. The agriculture must therefore reflect those characteristics. The soil units shown on a soil survey map have been determined on the basis of these same characteristics and on no other basis. It is inevitable, therefore, that a close relationship exists between the soil map and the type of agriculture on the same area. "It is the only line of research," says Dr. Marbut, "in which the soil is studied in relation to the plant cover, and in which a correlation is made between the characteristics and successful growth of given plants and the characteristics of a given soil."

Soil scientists of the Department of Agriculture have recently prepared a large map with many colors showing the facts made available by the soil



Dr. Marbut explaining the soil map of the United States in 250 color patterns.

survey. It is on a scale of 1 inch to 40 miles. Although necessarily very general, it gives the location of groups of similar soils shown in detail on the county soil maps published on the much larger scale of one inch to the mile. While this large map of the country does not furnish the detailed data necessary in comparing one farm with another, it does allow important regional comparisons. It furnishes the best summary of the soil resources in this or any other country.

Professor A. R. Whitson, Chief of the Soils Department of the University of Wisconsin, regards the late Dr. E. W. Hilgard (1833-1916) as the great American pioneer in the development of the science of Pedology. During the very earliest periods of the development of that science in Europe, he was actively engaged in the study of the influence of climate and vegetation on soils. Other American soil scientists who were engaged in the wide-spread study of the soils of the country, in connection with the soil survey being made by the Federal government, scarcely appreciated Dr. Hilgard's point of view; but when Dr. Marbut took charge of the survey in 1910 he also recognized that the correlation of the soils with the rock material from which they were derived does not furnish an adequate basis for their classification.

According to Prof. Whitson, Dr. Marbut then began his major life work, which has been the fundamental study of the principles of pedology and their application to the interpretation of the origin and physical and chemical character of the soils of the United States, and of several other regions he has investigated. Almost alone he has, by indefatigable labor in the field, laboratory, and library, brought the science of pedology in this country to a more perfect state of development than has been reached even in the European home of that science. His work in the Amazon Basin and in the interpretation of all available literature on the climate, vegetation, and soils of Africa also has given rise to suggestions regarding the interpretation of the soils of those regions which will undoubtedly be of great assistance in their further study. Professor Whitson believes that Dr. Marbut will unquestionably be recognized in the future as "one of the greater leaders of this generation in the development of agricultural science."

At the annual dinner of the American Soil Survey in honor of Dr. Marbut in Washington, D. C., on November 20, 1934, Dr. Henry G. Knight, Chief of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture, said, "One of the finest things about Dr. Marbut is his personality. Through it he has profoundly influenced not only the soil survey in America but soil science throughout the world." Dr. J. G. Lipman, Director of the New Jersey Experiment Station, added, "When you think of Dr. Marbut, give him credit as a pioneer in an international organization that can deal more effectively with the problems of land, and remember that he has contributed something that has increased the good will of nations."

Now that he has returned to his "old stamping ground" in the land of the Missouri mule, we hope Dr. Marbut will still be able to roam over those beloved Ozark hills as he did when young, and spend his declining days blessed with the satisfaction of work well done and of approbation richly earned and cheerfully rendered.

The Soybean Is Here to Stay

(*From page* 14)

for soil minerals such as calcium, phosphorus, and potassium.

The soybean is a better crop to precede corn than a non-legume crop such as timothy, but it is not as good as the more deep-rooting legumes such as red clover or alfalfa. This is illustrated in the following data from the experiment field at Mt. Morris.

Three-Year Average Yield of Corn

After timothy was removed for hay	45 bu. an acre
After soybeans were removed for hay	51 bu. an acre
After red clover was removed for hay	61 bu. an acre
After alfalfa was removed for hay	64 bu. an acre

There are literally hundreds of varieties of soybeans, but the choice for a given locality should be made with care. Plant breeders are doing a good job of creating new types of soybeans. Illinois has produced the Illini soybean; Indiana the Dunfield; and so on through the list of soybean states, each with its favorite kind. To mention the best variety for each state and each purpose would take more space than is here available.

For the successful production of soybeans a good seed bed is a first requisite. The seed bed must be firm with loose soil to cover the seed well and sufficient moisture to start germination promptly. The ideal seed bed is prepared either by fall or early spring plowing. Harrowing or light discing at frequent intervals during April and May is desirable in order to kill as many weeds as possible before seeding.

Thorough inoculation of the soybean is essential. The value of inoculation is not limited to its influence upon subsequent crop yields. Immediate benefit is obtained in the form of increased yields of beans. Furthermore the bean crop itself contains a higher percentage of protein when inoculated than when uninoculated.

Under conditions which prevail generally in the corn belt, the proper date to seed soybeans is about the time corn is planted. With most varieties late planting should be avoided, especially if the crop is to be grown for seed, since practically all common varieties require the entire season to mature. Early planting will usually be accompanied by somewhat earlier ripening, although the difference in time of maturity will not be so great as the difference in time of planting. The chief reason for not seeding soybeans as early as corn-planting time is to enable the grower to kill "another crop of weeds."

There are two common methods of seeding soybeans, one is in rows to permit cultivation and another where the grain drill is used, which enables the farmer to seed the beans solid in the same manner as wheat or oats.

Whether the crop is to be grown for hay or for seed will influence somewhat the method of seeding. Soybeans can be grown satisfactorily when seeded solid with the grain drill if the land has been carefully prepared and if there is no objection to the presence of some weed grasses in the crop at harvest time. If the grower expects to keep out weeds or if he desires to use a minimum amount of seed, he should plant in rows 18 to 32 inches apart depending upon the machinery available.

Proper cultivation of the soybeans cannot be overemphasized. Most effective cultivation will usually be done "before the beans are planted," that is, killing the weeds by cultivating the land before the planting is done. It is frequently advisable and sometimes necessary to cultivate beans once before they come through the ground. In soils that tend to crust badly, it is desirable to break up the hard surface two or three days before the beans are ready to come through. The plants are easily broken off just as they are coming up and frequently, unless given assistance, will "break their necks." The rotary hoe is excellent for breaking the crust, and the spike-toothed harrow is also satisfactory. Beans seeded in rows are commonly cultivated with corn machinery. Cultivation should be frequent enough to keep down the weeds at least until the beans are tall enough to shade the ground. Two or three cultivations after the beans are well up will be found sufficient.

There is a growing interest in soybeans for hay. Up to 1934 about 56 per cent of the bean crop grown in this country was used for hay. With the drought and the shortage of forage last year, soybean hay saved the

Field of Illini soybeans in 24-inch rows.

situation on thousands of farms. Early cut hay is probably richer in protein but hay cut after the seeds are well formed and before the leaves fall gives the greatest total yield. Discolored soybean hay may not be quite so nutritious as that made without exposure to rain, but it nevertheless is of good feeding value.

An average yield of medium-maturing soybeans on fertile soils may range from 2 to 3 tons of hay per acre. On the less fertile soils beans of the hay type such as the Virginia and Wilson should yield from about 1¾ to 2½ tons. The mower is the implement commonly used for cutting the hay crop. The binder, favored by some growers, has disadvantages. When cut with a mower, soybeans are usually allowed to remain in the swath for a day or so for wilting, after which they are raked into windrows where they may be allowed to complete curing or, as is sometimes done after a day in the windrow, they may be piled into cocks or bunches to complete the curing. Under favorable conditions a good quality of hay can be made directly from the windrows.

Harvesting the Seed

The soybean seed crop should be cut when the pods are fully matured, the seed in the hard-dough stage, and, with most varieties, when the leaves are practically all off. There is no time, however, when soybeans can be cut and produce a crop of good hay and at the same time make a high quality seed crop. The hay will usually be cut three weeks or a month before the seed crop is ready for harvest. The grain binder is generally used for harvesting the seed crop, but some varieties, especially on poor soils, grow so short that it is necessary to use the mower. When cut with a binder, soybeans are handled practically the same as any other grain. Bundles should be comparatively small and not bound too tightly. They should be set up in small shocks and allowed to cure.

Some growers, after producing a good crop of soybeans and harvesting them efficiently, have had difficulty in getting the crop threshed. The ordinary grain separator will thresh soybeans satisfactorily after a few adjustments. The speed of the cylinder must be reduced to practically one-half the normal threshing rate. Even though the small grain separator is very effective, the combine is coming rapidly into use in the central corn-belt states and is used as much for beans as for wheat.

The fact that this legume proved to be a valuable high-protein roughage led farmers to consider the soybean as a companion crop to be planted with corn to serve as fall pasture, especially for hogs. Thousands of acres are now used to advantage in this manner. Where this mixed planting is practiced, the yield of corn is likely to be somewhat reduced. There is an indication that when the two are grown together the soybeans protect the corn from chinch bugs.

The method of handling soybean seed immediately after threshing is important. Beans which test more than 12 per cent moisture at threshing time should be examined frequently when stored in large lots. If the moisture content exceeds 15 per cent, the beans either should be spread out to permit frequent stirring or put in bags. Where only small lots are handled, the threshed beans are sometimes put in loosely woven burlap sacks.

Uses Rapidly Increasing

The industrial utilization of the soybean has developed very rapidly, especially during the last five to ten years. Utilization of soybean oil is attracting thoughtful attention. There is a demand for soybean oil in edible products, paints, varnishes, linoleum, soaps, and for a variety of other miscellaneous purposes. Although soybean oil has a wide range of usefulness, certain desirable outlets have

COMMODITIES IN WHICH SOYBEANS OR SOYBEAN PRODUCTS ARE USED

(A partial list)

Food Products

Soybean flour	Vegetable shortening	Lektizoy
Soybean meal flour	Infant foods	Zoy Soup
Refined edible soybean oil	Diabetic foods	Zoybeans (cooked beans)
Soybean salad oil	Oleomargarine	Bacon and Zoy Beans
Chocolate bars (30% soybean flour)	Lard substitutes	Zoy Bouillon
Cocoa (up to 60% soybean flour)	Filled sweets	Soy Bean Biscuit
Sausages (up to 50% soybean flour)	Soybean sprouts	Casein Gluten Flour
Bread (7½% soybean flour)	Soybean cheese	No-fat Mayonnaise
Rolls (10% soybean flour)	Soybean milk	Fatless Spread
Macaroni (20% soybean flour)	Soybean buns	Fluffo
Soybean muffins	Soybean ice cream	Canadian Products
Soybean cookies	Soya Cream Biscuits	Milqo (soy milk)
Soybean doughnuts	La Choy—Soy Sauce	Vi-tone (chocolate)
	Soyolk (flour)	Soya Flour
	Soy Biscuits	Soyex-Malt-Cocoa Drink
	Soy Flour	Soyex
	Vi-Zoy	Macaroni

Feed Products

Cake or meal	Dog chow	34% protein chow chow
Commercial feed	Chicken chowder	24% protein chow chow
Dairy feed	Steer fatena	Chick startena
Dairy chow	Claf chow	Chicken fatena
How chow	Lay chow	Olelene
Poultry chow	Rabbit chow	Grainola

Industrial Products

Paint	Printer's ink	Lauxein emulsifier
Varnish	Glycerine	Soap
Enamels	Celluloid	Core binders
Oilcloth	Lauxtex plastic wall coat	Rubber substitutes
Linoleum	Lauxeine waterproof soybean glue	

been somewhat restricted. The quality of soybean oil has varied widely in the past, but this is being rapidly overcome, and the oil now coming on the market is a much finer product than formerly. Indeed developments in processing and refining have been so improved in recent years that today's product is more uniform in quality and altogether superior to imported oil.

About 6,000,000 pounds of soybean oil, or one-sixth of the oil from the 1930 domestic crop, were used in edible products. Hydrogenated soybean oil is being used successfully in salad oils and as lard substitutes. Soybean oil has been given a good deal of publicity for paint and varnish purposes. There are a number of paint concerns now placing soybean oil paint on the market. When it is realized that we import more flax seed than we grow, it is only just that we find a substitute for this import product. The farmer has a growing conviction that, "If we buy your paint, you buy our oils." There is a rather definite demand on the part of the farmer now to have a paint with a larger amount of soybean oil.

Products derived from the soybeans grown in this country are many. The foregoing is a partial list of such products actually being placed on the market in the United States and Canada. This list is rapidly growing and is not intended to be complete. It gives, however, some idea of what the future holds for the soybean.

Strawberries Thrive Best in Neutral Soil

Strawberries grow better in North Carolina if the grower is careful not to let the soil become too acid, fertilizer tests revealed. The best fertilizer mixture for the rather sandy strawberry soils of the Carolina coastal plain, according to R. A. Lineberry of the United States Department of Agriculture, proved to be a mixture containing 5 percent nitrogen, 8 percent phosphoric acid, and 6 percent potash. Increasing or decreasing the proportion of either the nitrogen or the potash made the mixture less desirable. In the tests the fertilizer was applied semi-annually, 750 pounds to the acre in August and the same amount in November. Liming the soil until it was almost neutral in reaction favored vigorous growth in the plants.

Saleable Sweets

(From page 9)

extra potash (either muriate or sulphate) there was a decided increase in yield on both farms.

Comparing the 3-8-10 with the 3-3-15 analysis on both farms and for both early and late harvests, the 3-3-15 in each instance gave significantly larger yields. It will be observed also that in every case the 3-3-15 analysis plus 200 lbs. (muriate or sulphate) produced decidedly larger yields than the 3-3-15 alone.

Viewing the results broadly and as an eye-witness to the several harvests, the only conclusion possible is that under the conditions of these tests the 3-3-15 analysis greatly outyielded the 3-8-10, and that neither of these analyses alone gave as large a yield as when supplemented by 200 lbs. of extra muriate or sulphate of potash. The soils on both of these farms would be classed as of moderate fertility at least and were fairly well supplied with organic matter. Soil tests showed the soils of both farms to have a pH of 6.0, both medium in phosphorus and both well below medium in reserve potash.

In addition to the facts discussed relative to these demonstrations, I want to quote from those who had supervision of the work: "The real significance of the higher potash analysis or ordinary analysis plus extra potash broadcast is that it gives a higher percentage of primes as well as larger yields in the early season harvest, which if prices are fair, may mean vastly larger profits." "Of sig-

SUMMARY OF FERTILIZER TESTS

on farms of J. Galen Adkins, Salisbury, Md., and W. J. Hotton, Mt. Hermon, Md.

Name, Address, and Soil Type	Fertilizer Analysis	Amount per Acre Lbs.	Yield Primes Bus. Per A. Sept. 10th	Increase Primes Due to Potash	Yield Primes Bus. Per A. Oct. 15th	Increase Primes Due to Potash
J. Galen Adkins Salisbury, Md.	3-8-10	1000	200		250	
Norfolk sandy loam	3-8-10 & Muriate	1000 200	337	137	375	125
(1934)	3-3-15	1000	275		370	
	3-3-15 & Muriate	1000 200	400	125	520	150
W. J. Hotton Mt. Hermon, Md.	3-8-10	1000	170		433	
Norfolk sandy loam	3-8-10 & Sulphate	1000 200	208	38	600	167
(1934)	3-3-15	1000	243		466	
	3-3-15 & Sulphate	1000 200	380	137	533	67

nificance in the late harvest is the fact that there was a very small percentage that might be classed as 'Jumbos'. And, too, total yields of primes about doubled."

It doubtless would be of interest to discuss the rotations followed on these farms, methods of setting plants, number of times cultivated, chemical soil tests, etc., but space will not permit. The yields, however, will show the experienced grower that the cultural practices must have been nearly ideal and that soil conditions and weather conditions were favorable.

Testimonials from growers are very easy to obtain and as a result are not often believed, but in talks with both of these growers and other growers who either saw or knew of the results with the extra potash, these statements were heard: "I wouldn't have believed it possible, and I am surely going to use extra potash next year."

Fellowship in the Furrow

(*From page 6*)

and to each other gradually became the issue of the age.

"Spot news" of a broad state and national or international nature cannot well be recounted freshly as of yore in the less frequent appearing technical farm press. As means of spreading spot news increased, the frequency and the size of many farm journals have decreased.

Yet it would seem that the mere first telling of news and the first startling disclosure of an event affecting agriculture or its related industries by no means ends it. Such events only fire a spark in a string of tinder. The size of the bonfire or its final effect on the lives and fortunes of the farmers depends largely on the consideration given to that eventful spark and the mental reactions ensuing long after the spot news has been forgotten.

Where else but in the thoughtful columns of comment, discussion, and aftermath reporting open still to worthwhile, alert farm journals, may the rural citizen truly weigh and gauge the forces developing in the wake of changing news events? More reader comment, more contact with farmers instead of less—these are essential to the destiny of modern agricultural papers. Hasty acceptance of some news statements would indeed mark the close of calm reflection so common to farming, and it is the field of the farm press to mirror that mass opinion and to set it right when it feeds on untruth.

IT would seem, therefore, that while the force and following of the usual metropolitan daily editorial writer and his intimacy with his readers has become far less effective, the reverse may be true of the better directors of rural periodicals.

Providing that a farm editor does not have a bias toward simon-pure partisanship or a deaf ear to progress and new economic needs, the response he may get from his better posted patrons will be gratifying indeed. There is little room, of course, for the decadent theorist or the stand-pat scriviner, because so many of his pet platforms are dead issues and the planks are too weak to "stand-pat" upon anyhow. Maybe this is bad medicine for men too old to "reform," and maybe it means younger men at the helm of farm papers. But personally I do not think so, because the last ten years have taught many an old dog new tricks he never thought he could master. Not the age of the scribe, but his personal alertness and vigor, his awareness of mind, and his willingness to move forward—these make up the present qualifications for the rural quill. And above all else, tolerance and patience when things in the news are not quite clear, and again, intolerance and a good display of force when bad news gets worse against the safety of agriculture.

HERE I have come almost to the end of my rope for this issue without working in examples of some of the farm characters whose association in the past decade have recompensed me manifoldly for the financial wealth which I failed to garner en route. I may yet have such a chance, if the public and the publisher permit.

Just the other day a man passed away whose life was spent in allegiance to powerful interests opposed to agricultural welfare. He occupied a handsome suite in the same office building where my simple loft was cornered. Not being a Pharisee, it is not my part to conjecture on his modicum of reward hereafter. All I know about it is that I was welcome in places of abode amid green fields where he was not highly regarded. Not caring further to compare either brains or wealth with him, probably to my confusion, I am willing to look back and be quite content with my own experiences and friendships—truly and simply of the earth earthly.

And not being so old or so wise or so rich in such friends as I hope to become, I look ahead to more fellowship in the furrow.

EXPERIENCE

"Were you scared on your wedding day?"

"Yes, but I've learned since that I was not nearly so much as I should have been."

Teacher—"Robert, what do they raise in Ireland?"

Robert—"I know, but I don't want to say it. Mother tells me I mustn't talk tough."

The sleight-of-hand performance was not going very well.

"Can any lady or gentleman lend me an egg?" asked the conjurer, coming down to the footlights.

"If we 'ad one," shouted a man in the audience, "you'd 'av got it long before this." *London Opinion.*

Visitor (to little girl): "And was your grandpa covered with insurance when he died?"

Little Girl: "No'm; just a nightshirt."

Before marriage she says: "When do we eat?"

After marriage, he says it.

"So the doctor's trial marriage has been found out?"

"Yes, and he's been arrested!"

"What's the charge?"

"Practicing without a license."

SATISFIED

Proud Father: "What shall we call it?"

Fond Mother: "Let's call it Quits."

A beauty expert informs us that a mud bath makes the skin soft, smooth, and silky. We must go down to the zoo again and have another good look at the hippopotami.

A football player in a small college was extraordinarily dumb, but to the surprise of everyone, he passed all of his work, including a special examination in chemistry. The chemistry professor was asked about it, and he said, "I decided I would let him pass if he answered 50 per cent of the questions correctly.

"I asked him two questions—one he answered wrong—one right. Therefore I let him pass. The first was 'What color is blue vitriol?' He answered, 'Pink.' That time he was wrong. The other was 'How do you make sulphuric acid?' He answered that he didn't know. That time he was right."

FATHER SAID NO MORE

Jimmy, I wish you'd learn better table manners; you're a regular little pig at the table."

Deep silence on Jimmy's part. So father, in order to impress him more, added, "I say, Jimmy, do you know what a pig is?"

"Yes, sir," replied Jimmy meekly. "It's a hog's little boy."

Better Crops WITH PLANT FOOD

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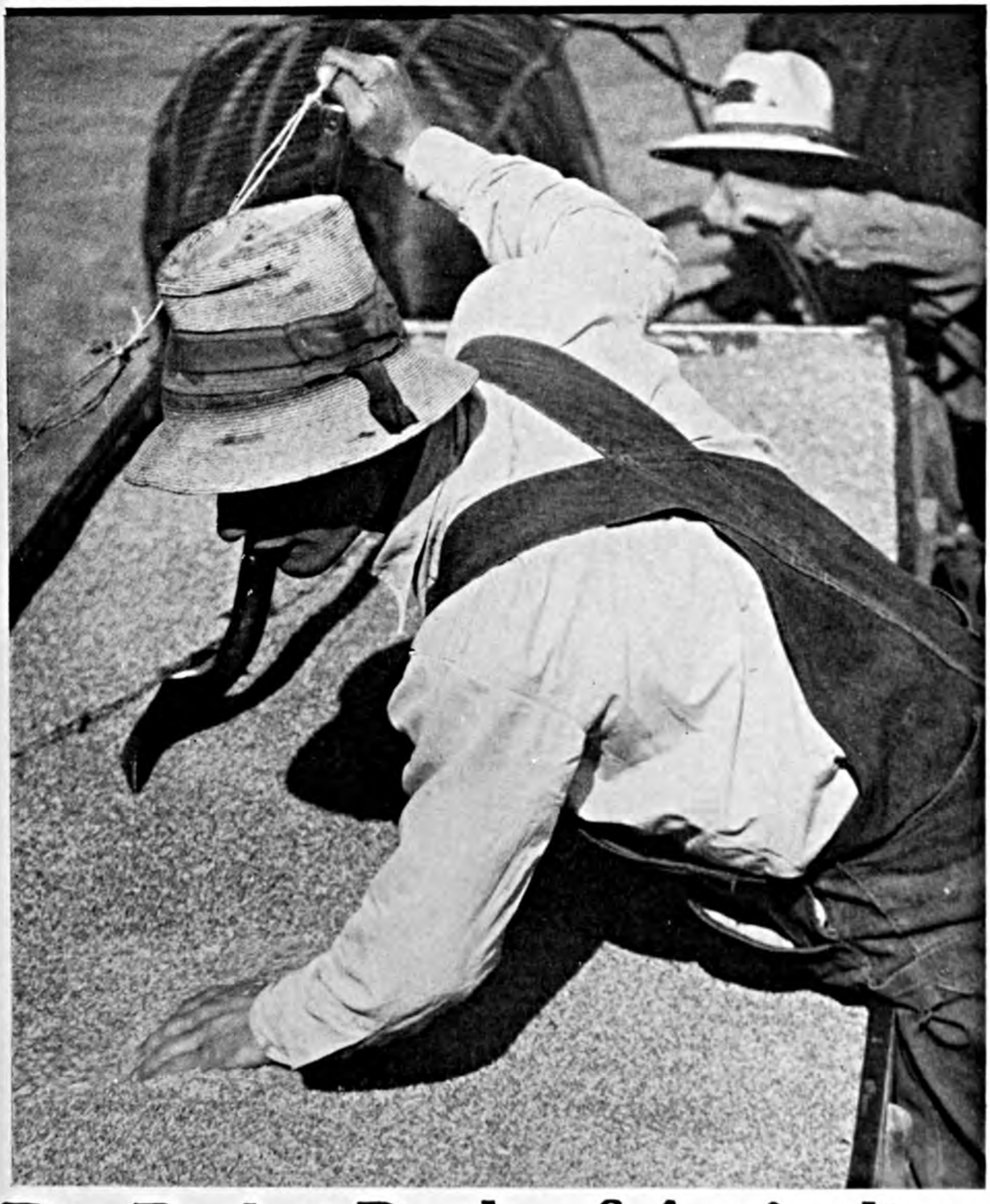

The Pocket Book of Agriculture

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The Whole Truth — Not Selected Truth

R. H. Stinchfield, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER TWO

Table of Contents, July-Aug. 1935

American Potash Institute, Inc.

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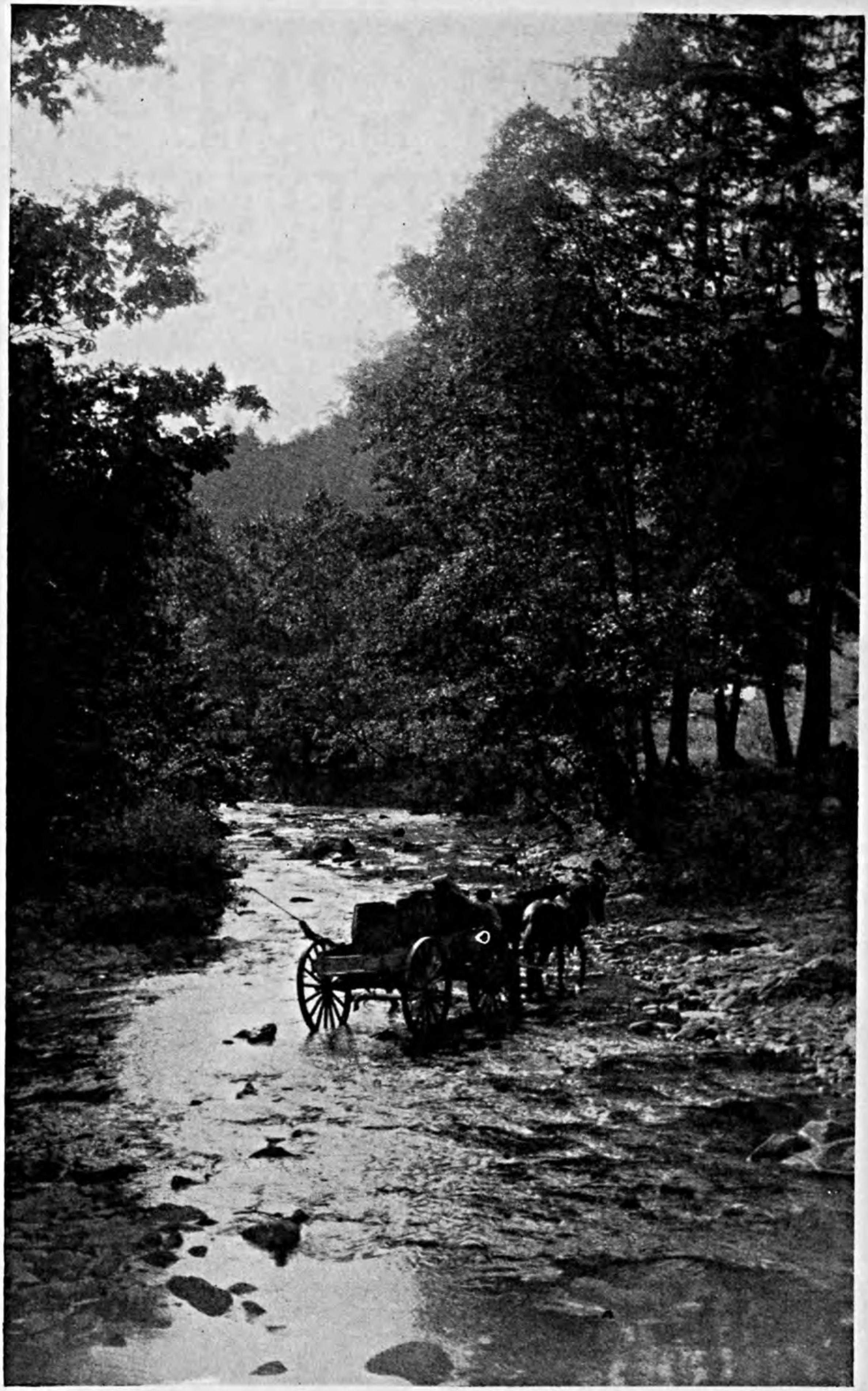

REMINISCENT OF THE OLD THRESHING OUTFITS

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Jeff says, "It's in the cards, no matter who deals them."

Science Plus

By Jeff McDermid

ORIGINALLY devised to utilize laboratory science in the conquest of the boll-weevil and the poll-evil, the farm extension service has of late helped to establish a rural economic democracy fitted for an emergency, out of the charts, curves, and indices of economic science, reinforced by processing taxes and benefit payments. Thus emerged the era of the test tube plus the slide rule plus organized and "subsidized" determination.

Let's start with Genesis and drift along toward the apocalypse. One best gets a glimpse of the future by scanning the past. County agents and extension specialists, as I first knew them nearly a score of years ago, were field educators. At first their movements were regarded with skepticism or tolerance, or even bitterness, surrounded as they were by men of the old practical school who had little fondness for or dependence upon books or pencils in farming.

Gradually as the more scholarly sons took charge of the farms and communities, the lot of the county agents assumed a brighter hue, while some distinct gains were made in the application of science to farm and livestock problems, over the plaintive wails of the stand-patters.

The gang at the court-house used to snicker when the county agent came in loaded down with soil samples, bunches of weeds to identify, and other stray mementoes of his rattling peregrinations.

THE pompous county clerk and the dry little county treasurer would proceed to the sheriff's dingy sanctum and exchange bits of jealous comment on this interloper who "rode around on county gas at more than twice our wages." Or they would go down to the drug store and swap stabs at the county agent with the tight-lipped old apothecary, mixer of questionable livestock dips and dopes, who railed savagely because the newcomer had been telling the farmers to substitute good feeding, testing, and sanitation in place of sure-fire cure-alls. If they still had a grudge unsatisfied, these moochers would spend the evening with the dour, old, cross-grained and entirely rugged and ruthless stock-buyer, in his shack near the chutes at the depot. That worthy would show them his books to prove how damaging to local trade and private profits were the pools and pro rata sheets of the cooperative livestock sales unit, which this new scapegoat from the university had introduced to the countryside.

Then, one by one, these foeman of the extension man and stoppers of education would inveigle the unwary and whisper advice to them to disband the farm bureau or elect good old-time pioneers to the county board once more.

IT wasn't usually the "big selfish corporations" who tried to undermine the local business of awakening the farmer and helping him to act as an intelligent unit in a well-informed group. On the contrary, some real aid came to hard-pressed county agents and farm leaders from the broader-gauged companies allied with agricultural commerce.

It is significant to recall that it was the rural-minded folks of Dixie who began the first county agent work in 1904 and 1906, when Evans, Procter, and Bill Stallings went into Texas to carry on the initial itinerant teaching by demonstration. Not until 1910, when Pennsylvania and Ohio inaugurated the first northern county agent work did it expand to the region which has since become its chief field of effort.

"Personal contact" was the motivating theory of the famous Smith-Lever Act of 1914, ushering in the \$1,200 salary, the horse and buggy, and the weekly circuit-riding of those 928 county agents who used their homes for offices, wrote their reports on Sundays in longhand, and paid their own expenses. Some of them returned home at the week-end with all the plunder of an impecunious Methodist minister or a country editor, provided by the generosity of their remote constituents.

THEY were told by the preamble of their charter to "aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics and to encourage the application of the same." No mention yet of any economic emergency or restoration of agricultural purchasing power. State contributory financial aid was the keynote of its provisions, and hence it became one of those early misnomers, "legislative bribery," over which the critics and cautious Charlies spent so much useless blather. Some of the skin-penny boys had it all figured out to a nickel an acre as to the terrible burden which such new-fangled notions posited on the patient public.

After a decade of this side-road evangelism with many backsliders, an accidental outgrowth of extension work proved its salvation at a time when things were becoming pretty stale. Somebody discovered that farm kids would not hanker for city excitement if their leaders made farm life a pleasure and a challenge and farm work a brisk and thrilling game of wits and alertness. It was a darn sight nicer to herd with a bunch of awkward young lads and rosy-cheeked damsels than to be an adult reformer.

National development of the youth movement started in earnest with the eighty per cent salary provision of the

Capper-Ketcham Act of 1928, devoting that portion solely to captains of junior bush-leaguers in the work which put zest into the extension field and revitalized many discouraged rural communities. Yet tougher times were coming and men of steel resolve were needed to withstand their rigors and rise above their defeats.

It is a godsend that the 4-H movement got its roots established before the heavy clouds of the post-war period blotted out the sun of agriculture. Had it not been for the enlistment and training received by many present-day farmers in the 4-H army, no effective alignment for the years of 1932 to 1935 would have been possible. And even beyond, in the trying and critical times through which agriculture must pass before its legal status to self-determination and broad national planning is fixed, we shall truly find that the seeds of the "head, heart and hands," pledged to carry on, will bear enormous yields.

Turning next to the Farm Board period of dilemma and vain voluntary appeals for crop adjustment that ensued after Government stabilization alone had failed, we see the extension folks doing their best to follow the flag. While Professor Spillman and others were conjuring up a way out through the domestic allotment plan, the cow-testers and soil-mappers kept plugging along on the individualistic path because no other large movement with sufficient national force and recognition had been hatched.

Of course there were a crop of strikes and plenty of moratoriums to choose from, but somehow these lacked common sense and seemed like going after wolves with air-guns. Few of the county agents got much "het up" over the noise-makers of the lunatic-fringe rebellion. Like wise soldiers they kept their strength in reserve and their automatics well oiled for big game. Just one thing may be said for the rabble rousers, which is that in a way they helped to shift the scenery around and get the stage all set for the grand entrance of the coup d'e tat. Otherwise, without the blue blazes and the red fire, the famous young AAA would have died aborning in Congress and become a snoring "ZZZ."

FEW folks know it, but along in the primitive days of the much-berated and much-blessed agency referred to there was a slight hitch about using the county agent system for the prime mover of the business. Some doubters feared it would interfere with the scientific side of their work and still others raised the old bogey of prejudice.

But the machine was all there, fairly well geared up, and it would have been time-wasting and expensive to attempt an entirely new organization afield. Many of the boys were part-time Federal agents anyhow, so in the end the resistance broke down and the extension system assumed its proper function in a way it had long sought to do.

Much of an illuminating nature could be fixed up in readable form concerning the job the boys had coaching some of their State leaders so as to shove the Generals ahead in double formation in periods when snipers began taking pot-shots at the new "farm trust." I reckon they often had more fuss and bother with their own majordomos than they had with the pigless sows, the sowless pigs, and the cornless quarter sections. This, however, is only an incident in the tale of an epoch, so let's forget it.

THOUGHTFUL surveys of the extension service in these recent years of farm credit and crop adjustment, drought hazards, and super-organization in a crisis, convince anyone that the machine ran smoothly. In a few days more than 70,000 production-control committeemen were hitched into the harness and ready to drive ahead in the greatest single piece of social engineering that American farming has witnessed. County agents did it.

There were enough delay, legal fog, and contrary orders to put the average untrained fellow into the filbert class in short order; but somehow, trained as they were in patience and endurance, the majority of the agents hung on like grim death and saw it through. They had to. Unless they carried on, the whole caboodle of contracts would have gone amiss, the radical rooters would have taken the reservation, and the extension system itself might have vanished.

There were probably few of those five million contracts which some of the boys did not have a hand in signing. Similarly and simultaneously, while the adjustment furore was on full tilt, the mortgage amortizing business, starvation livestock, live-at-home-if-you-can, and bitter dust storms contributed to keep the county agent from ennui. Give all the credit you wish to Washington, D. C., but save a shred or two for the home brigade. And when, in the aftermath, any cussing is in order, the boys can take it, too, and send a little of it back if necessary.

And don't forget the duties they had to foster on the side, just as usual, for the folks who signed no contracts and couldn't be hired to do it by anybody on earth. *They* demanded help to produce more instead of less, and I suspect we owe some of our ever-normal granary to the back-action along that line by the county agents serving the die-hards. And again, there was the problem of replacement crops, soil-salvage, legumes, erosion, better pastures, dairymen versus the rest of the universe, and the enraged tax-paying consumer who thought it a sin for embattled ruralites to cut the crop even by fifteen per cent. I am convinced that hair dye and wigs will be in demand among the county agents this year or else we will have plenty of gray locks and shiny pates among them.

YET my thesis is that the whole business, despite the grief and gunplay, has been a good boost for the system. The service depended primarily on the welfare of agriculture and it could not last through a few more years of poverty and dismay. The team-work between county agents and specialists and the farmers developed in these later seasons ought to command mutual respect in most cases. Yes, and even some of the disgruntled small-town tradesmen have turned around and thanked the extension workers for saving their bacon for them, which is the capsheaf of reward. Here for once it was proven that a mighty strong army

(*Turn to page 45*)

Alsike Clover, 1933, Livingston Farm

LNPK
Av. yield 3415 lbs.

LP
Av. yield 1715 lbs.

Conn. Valley Soils Need Potash

By Ford S. Prince

Agronomist, New Hampshire Agricultural Experiment Station

NO other farming region in New England is better known than the Connecticut Valley. Forming the boundary between New Hampshire and Vermont, this river, flanked as it is by flood lands and broad smooth terraces, flows on to the sea forming the very agricultural heart of Massachusetts and Connecticut. Huge crops of onions, wrapper tobacco leaf grown in shade and in the open, vegetables, dairy products and forage crops, these and many others are grown on this comparatively narrow strip of land which is justly famous.

During past ages the waters of this river have been developing the different terrace levels which now form the farming lands of its beautiful valley. Sand, silt, and other soil components have been brought from the hills of these states through the tributaries of the river at flood tide to be deposited into new soil when the flood waters have receded. This material has come from limestone valleys in Vermont, and from the glacial deposits of New Hampshire and the other states. That the river has not yet finished its work was amply demonstrated in November 1927, when deposits of sand and silt were laid down in many places to a maximum depth of two and three feet.

With such a variety of parent materials to draw upon, it is little wonder that the soils in this great melting pot present certain variations from other lands in the states bordering the river. Flood deposits investigated in New Hampshire after the 1927 flood revealed the fact that these newly laid soils were the only ones in the whole state that carried sufficient lime and other alkaline materials to raise the test up to or above the neutral point, and that instead of ruined land, these new deposits were, in many respects, actually more fertile than the underlying soils which they had so deeply covered.

Show Need for Potash

Such is a brief resumé of the history of Connecticut Valley soils. Chemical studies which have been made on the soils of one of the terraces of the valley show that the need for lime is less and the need for potash greater than on other soils of the rest of New Hampshire. It is quite probable that this will hold true of the whole valley in comparison with the other land in the bordering states, if an exception is made of the limestone valley soils wherever they occur.

That these soils respond to potash more than certain other lands in New Hampshire is illustrated by certain comparative data with sweet clover. Of the legumes, sweet clover appears to be better able to rustle its potash from the unavailable supplies in the soil than most other crops.

In an experiment covering yields of two crops of sweet clover at Greenland, N. H., the addition of potash to a manure, lime, and phosphorus treatment gave no increase in yield. On the Connecticut Valley terrace where data have been taken on yields of this same crop for two different years, all the treatments with potash scored tremendous increases, the stimulation from 150 pounds of muriate of potash being greater than that from 10 tons of manure.

The case for phosphorus is exactly reversed. Slight increases in the yield of sweet clover in the Connecticut Valley were not significant, while good stimulation was produced in sweet clover at Greenland from generous applications of superphosphate.

With sweet clover behaving so differently on the two soils, and indicating as it does a vital need for potash, it is not surprising to find that other crops give a tremendous response to potash in the valley of the Connecticut.

In the same field where sweet clover was grown, a mixture of alfalfa and timothy was seeded in 1929. Data covering five cuttings in three years are now available. The first year the crop was harvested, the stand was largely alfalfa. The second season's crop was about half alfalfa and half timothy, while the third year's stand was almost wholly timothy.

It was no surprise when alfalfa responded to potash, but when the increases were well maintained on the timothy crop after the alfalfa had largely killed out, it was rather astonishing, yet this is just what happened.

A summary of the results with this mixed hay combination is well illustrated by the table which follows, where the average response for all the different possible combinations is given for each substance used as a fertilizer.

Material Used	Increase, Lbs. Hay per Acre
100 lbs. Muriate of Potash	1200 lbs. Hay
100 lbs. Nitrate of Soda	750 " "
100 lbs. Superphosphate	185 " "
1 T. Ground Limestone	2600 " "
1 T. Manure	225 " "

These figures represent the response for five cuttings and include the harvests when alfalfa made up most of the stand as well as those when timothy was more abundant. While all of the materials mentioned were used at a profit, potash gave the greatest return on the money invested. At a valuation of $15 per ton for the hay, a fair average during the period studied, and using the mean cost of the materials applied, one dollar invested in potash returned $3 in hay, while one dollar invested in nitrogen and phosphoric acid returned $2.25 and $1.39 respectively. Lime brought in $2.80 for each dollar spent, and manure paid back $1.69 for each ton used. At present costs, the money return for potash and nitrogen would be considerably higher on account of reduced costs for these materials.

After plowing the land where the alfalfa-timothy plots had been in the summer of 1932, an August seeding of red clover was made. The plots which, during the same years had produced sweet clover, were seeded to alsike clover at the same time. No additional lime or manure was used, but the plots were top-dressed the following spring with the fertilizer variations as in previous years.

On the plots that had received no potash, both alsike and red clover made a very unsatisfactory growth. Taking the yields from the red clover plots as an example, the average growth produced by four treatments without potash was 1026 pounds of cured hay, while six treatments with potash responded with 3394 pounds of hay, more than three times as much.

It would, of course, be unfair to say that all of this wide difference in yield is due to the potash used. In fact, there is much evidence in the data to prove that available phosphoric acid is of great importance as well. The entire mass of data is too long to be submitted in a brief summary of these tests, but the following table will serve to show what happens when these two elements are hitched up.

Treatment	Red Clover Hay
Average yield 12 checks....	668 lbs.
500 pounds Superphosphate.	1276 "
150 pounds Muriate of Potash	2177 "
500 Superphosphate + 150 Muriate of Potash...	4005 "

(*Turn to page* 38)

Check
Av. yield 965 lbs.

Alsike Clover, 1933, Livingston Farm

LNPK
Av. yield 3415 lbs.

The Inquiring Mind *and the* Seeing Eye

By Dr. A. S. Alexander

University of Wisconsin

THE source, composition, character, and qualities of the soil have intrigued Andrew Robeson Whitson ever since the days of his childhood on his father's 600-acre farm in southeastern Minnesota. His inherent bent in that direction, enhanced and cultivated by practice and education, led inevitably to the adoption of soil science or pedology as his specialty and brought him, in time, the position of Professor of Soils in the University of Wisconsin, which he has filled with credit since 1901.

His intimate acquaintance with "Mother Earth" began at an unusally early age of his life, for when he had just turned seven years of age, he might have been seen proudly driving three sturdy work horses hitched to one of the first Bradley steel riding plows used in Minnesota, and turning over a 16-inch furrow of rich, black prairie soil. His father had marked off an 80-acre "land" with rounded corners for his initial efforts, and "round and round" it went the team and embryo soil scientist until the wheat stubble was covered and a fine seed bed provided for the succeeding crop. Nothing could stay or stop that red-headed boy, whom the folks and neighbors nicknamed "Gritty." He accomplished the task set him with the indomitable persistence he had inherited from his Scottish ancestors, and the ability for persistence and plodding that has characterized him from that day to this.

All farm boys in those pioneer days on the prairies of the northwest early learned how to work willingly and well. They began with the lighter chores of the farm, soon learned to milk, and then to work horses in the field. This labor, while sometimes irksome no doubt, developed fine traits of independence, efficiency, and resourcefulness in farm boys like "Gritty" Whitson. It is not surprising, therefore, that perched high on the spring seat of a Studebaker wagon, when but 10 years old, he drove one of the teams hauling wheat from the home farm near Stanton, Goodhue county, to the Red Wing elevator 28 miles away on the Mississippi.

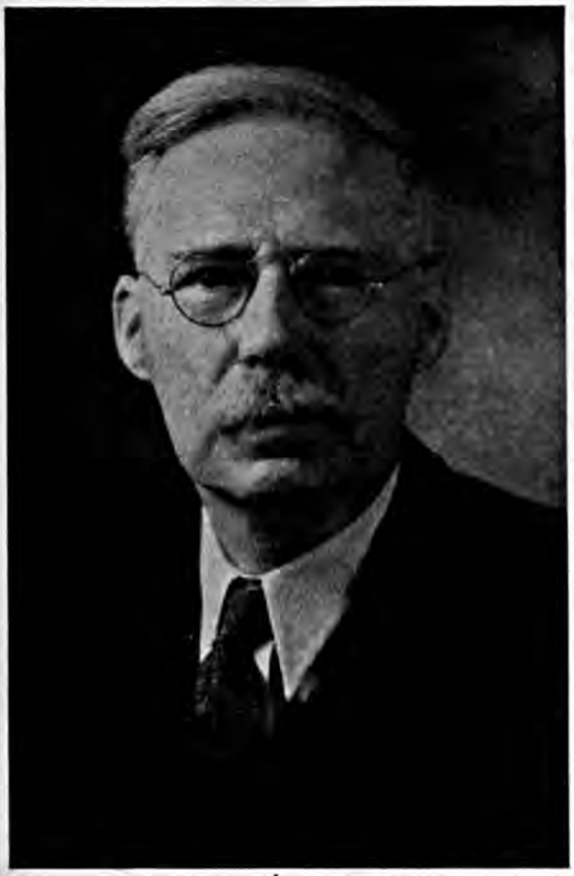
Inherited Will to Do

In those early days, from the sixties to the eighties, spring wheat reigned supreme as the pay crop in southern Minnesota and the Red River Valley. It was largely of the red Fife variety and produced 40 bushels or more per acre at first, and even 30 to 35 bushels an acre at the time of "Gritty's" hauling; but then, alas, the devastating chinch bugs descended, ruined the wheat crops, and drove the grain growers into the dairy business.

Those, too, were the days when

flocks of wild passenger pigeons sometimes shrouded the sun as they flew over the Whitson farm, but man murdered them and the white pine forests of the north and now they are no more.

It should not be understood, however, that Andrew Whitson's father, also called Andrew, was a hard task-



PROFESSOR A. R. WHITSON

master. On the contrary, he insisted that the boy should faithfully attend the country school, and do his chore work early and late enough to permit of that. The old man had worked strenuously to acquire his great farm since coming to Minnesota in 1863 with his wife, Abigail Dack Whitson, from the famous Glengarry Country in Canada where they were born. Young Andrew's ancestors were Scots. In 1907 he succeeded in finding the home his grandfather, a Master Mason, had built in Edinburgh, Scotland, of which city, a few years ago, a Whitson was Lord Provost. His grandmother was Ann Alexander, whose father was an instrument and clock maker of Hull, England. One of the most prized treasures in Professor Whitson's home today is the fine grandfather clock, with its mellow-toned silver bell, which Grandfather Alexander made and presented to his daughter on the occasion of her marriage. Another antique of particular interest is the Whitson family Bible which is some 300 years old.

Andrew Robeson Whitson was born on the farm near Stanton, Minnesota, October 9, 1870. On the home farm young Andrew did the practical work we have mentioned, and his rudimentary education was acquired at the nearby country school. When he was 11 years old the family moved to Northfield, the seat of St. Olaf and Carlton colleges, so that the children might have better educational advantages. There he finished the work of the public school and had three years of preparatory work in Carlton College.

Early Interest in Geology

On the home farm he had made a collection of rocks and plants, and having become interested in geology and botany, he naturally made these studies his specialty at Carlton, in preference to the Greek and Latin to which, at first, the college professors directed his attention. Gradually he became so interested in the study of rocks that he decided to further his knowledge of geology in the University of Wisconsin. In that institution he took the first two years of the course in General Science and especially the courses in mineralogy and geology under Professors Hobb, Salisbury, and Chamberlain.

When the University of Chicago was opened, in the autumn of 1892, and attracted President Chamberlain and Professor Salisbury to its faculty, young Whitson went with them and continued his studies in geology and other sciences. For two summers he was engaged in the work of the U. S. Geological Survey in Pennsylvania and

New Jersey under their direction. In 1894, he received the Bachelor of Science degree from the University of Chicago. His first year of graduate work was largely devoted to Geology and Chemistry; then, in 1895, he became Principal of the High School of Beloit College, Wisconsin, and instructor in science there.

In 1897, he married Miss Louise Josephine Fitch. They have three children.

After serving in Beloit College for four years he was appointed Assistant Professor of Soil Science in the College of Agriculture of the University of Wisconsin, and was advanced to a full professorship in 1901. He had worked with Professor F. H. King of the University of Wisconsin during two summers while connected with Beloit College, doing chiefly research with that eminent scientist on the flow of water through sand and the soil.

Pursued Graduate Study

It was that experience which led to his invitation to join the faculty of the Wisconsin College of Agriculture in 1899, and he was also given the opportunity for an additional year of graduate study in the University of Chicago. When Professor King was attracted to the U. S. Department of Agriculture at Washington in 1901, Professor Whitson was appointed his successor in the Wisconsin College of Agriculture, and there he is serving today in an unassuming, but purposeful and highly successful way.

His first sabbatical leave of absence, granted in 1907, was used for further graduate study in Berlin and a study of soil management during the following summer in Germany, Austria, Italy, Holland, and England. During that year he was appointed by Secretary of Agriculture James Wilson, U. S. Delegate to the International Congress of Agriculture in Vienna.

Professor Whitson is a charter member of both the American Society of Agronomy and the American Association of Soil Survey Workers. In 1933 he was elected a member of the American Geological Society of New York, and a fellow of the American Society of Agronomy. He is also a member of Sigma Xi and Alpha Zeta.

When Professor Whitson began work in agricultural physics at the Wisconsin Agricultural Experiment Station in April, 1900, methods of rapidly determining nitrates in field soils were perfected and determinations made, throughout the growing seasons of 1900 and 1901, on the soil under all major Wisconsin crops. These were, we believe, the first systematic determinations of nitrate development and use by crops under field conditions. In 1902 and 1903, further studies showed that plants growing on soil having a high content of nitrates or available nitrogen produced crops with a higher protein content than those growing on soil poorly supplied with available nitrogen.

From 1900 on, Professor Whitson also studied the fertilizer requirements of marsh soils in various parts of Wisconsin. He found that while potash was the element chiefly lacking in the peat soils of the limestone region, those of the central and northern districts, which are acid, also lacked phosphorus and lime. Studies of the methods of applying fertilizers were undertaken in 1902.

Found Many Soil Problems

Difficulties in cranberry growing next attracted Professor Whitson's attention, and in 1903 work in cooperation with the Department of Horticulture was begun. The work showed that frost on peat land was chiefly due to its poor conductivity rather than to air drainage, which meteorologists had assumed to be the cause on low ground. A light layer of sand was found to reduce and in many instances entirely prevent injuries by frost. The differences in temperature in the zone of the cranberry vines on sanded and unsanded land often was

(*Turn to page* 40)

Micro-chemical Methods As *an* Aid *in* Studying Soil Fertility Problems

By Jackson B. Hester

Soil Technologist, Virginia Truck Experiment Station

AGRICULTURE at the present time is engaged in a most difficult struggle. What has happened to this industry during the past few years, together with the situation which confronts it at present, compel the most enthusiastic grower to pause and consider some of the problems involved in the economic production of a crop. If he is to emerge successfully, the most intensive farming methods must be used.

During the past the element of crop failure through neglect has been all too great, and methods to control and correct these conditions must be followed. It has been admitted that many lands not suitable for crop production, due to depleted nutrient content, poor physical condition, and improper fertilization, have reduced the operators to poverty. In order to bring agriculture out of the mire, these things must be corrected. It is believed that the short-chemical methods now being developed, in the hands of the properly trained man, can most definitely help to do this.

The crop-producing power of a soil must be considered to be a combination of many factors. For convenience they may be evaluated by stating that productivity depends upon such factors as (1) weather, (2) plant disease, (3) cultural methods, (4) soil reaction, (5) organic matter, (6) available nutrients, (7) texture and structure of the soil. The first factor, although a most potent one, is beyond our control. The second one can be minimized by crop rotation, seed treatment, etc. For the remaining, more or less definite aid can be given. The interdependence of soil reaction, organic matter, available nutrients, and texture as an aid to studying soil fertility problems will be considered as developed by the quick chemical tests.

Soil Solution and Extracting Reagent

Soil chemistry has advanced a long way since chemical methods were first used in its study. Indeed, much water has passed under the bridge since Milton Whitney (1892) put forth the view that plants obtained their nutrients from the ions present in the soil solution. Around this idea he built an elaborate theory of soil fertility, much of which has proven unacceptable. Still, the hypothesis that the soil solution is the culture solution of the plant is now accepted. The quality of the soil solution is greatly affected when the soil is limed or soil amendments are applied, etc.

The method that one employs in studying soil fertility should be governed by the cropping systems and soils concerned. At least some idea as to what soil constituents are being affected by the extracting reagent must be at hand. This can only be learned through established methods of research embodying plant growth as well as chemical studies. Once this has been established for a given set of soils within a particular locality, the method becomes quite valuable. The soil solution contains the whole of the nitrate readily available to the plant, some of the calcium, magnesium, and potassium, but only a fraction of the phosphate.

No definite proportion can be set to include all soils, but broadly 40 to 250 parts per million of nitrate, 10 to 40 of potassium, and from 1 to 2 parts of phosphate are found in the soil solution. While the most fertile soils generally analyze the highest in these ions, the renewing power of the soil is exceedingly important and dependent upon the composition of the soil and the activity of the soil microorganisms. So, at the best, an extracting reagent can only approximate these conditions. From a knowledge of the renewing power of the soils involved and the nutrients present, one can predict what is to happen for a short time at least. From this standpoint the use of a dilute extracting reagent seems well founded. Whichever method is employed, a dilute acid salt solution or a more acid mixture, it becomes more valuable to one as he gains information of the soil condition, soil constituents affected, and cultural practices of a given community. The weak points of the methods are also learned and likewise their application becomes more valuable.

In studying the soil fertility problems at the Truck Station, we have employed a comparatively dilute solution of sodium acetate buffered to pH 4.8 to 5.0. It is prepared by dissolving 10 grams of sodium hydroxide in water and adding 20 milliliters of acetic acid, giving a final volume of two liters. Ten grams of soil are extracted with 25 milliliters of this solution and from the extract phosphorus, potash, magnesium, ammonia, nitrate, etc. can be detected. The reason for employing a comparatively dilute solution is that vegetable crops make a very rapid growth in a very short time. Thus, abundant plant nutrients must be present in a readily available state if the plant is to get sufficient for rapid growth.

Phosphate Availability

The Norfolk trucking area has been farmed since 1700 and trucked since 1844. Large quantities of fertilizer have been applied to the soils, affecting them in many ways. For example a large phosphorus reserve has been built up in the soil. This is readily understood when it is realized that from 100 to 160 pounds of phosphoric acid are generally applied in the growing of a crop of Irish potatoes, whereas only 12 to 15 pounds are actually utilized and less than this amount actually removed from the

Table 1

THE INFLUENCE OF SOIL ACIDITY UPON THE AVAILABILITY OF PHOSPHORUS

Norfolk Sandy Loam

	p.p.m. of P_2O_5 in soil*						
Water Soluble	0.8	1.4	1.9	2.0	2.0	1.9	1.8
Sodium Acetate Soluble	2.0	3.5	5.5	8.0	9.0	9.0	9.0
Soil pH	4.4	5.0	5.5	5.9	6.2	6.4	7.0

* *Soil analyzed* 0.15 *per cent* P_2O_5—*not fertilized within one year of tests.*

Growth of beans in phosphorus test—shown in Table 2.

soil. Very little is leached from the soil, so from year to year this has accumulated. Many factors influence the availability of phosphorus, notably the soil reaction and organic matter content.

The effect of soil reaction is brought out most strikingly in Table 1. Here also is shown the relation of water-soluble to sodium-acetate-soluble phosphorus. Phosphate fixation is very great on the acid soils. Indeed, the yield curves on these plats closely follow the available phosphate curve. This clearly shows that a knowledge of the fixing power of a soil for phosphorus is very important.

The fixing power of a Norfolk fine sand is possibly best shown in Table 2. This experiment was run to study the phosphate-fixing power of the local soils. The pots received the initial application of phosphoric acid from superphosphate as shown in the table. Each pot received an abundance of potash and nitrogen with the variable supply of phosphorus. The beets did not show such a great difference in yield to the high applications of phosphorus as did the beans. This was due to the fact that the beets were planted immediately after the application of phosphorus and the soil had not had a chance to fix the phosphorus.

Table 2

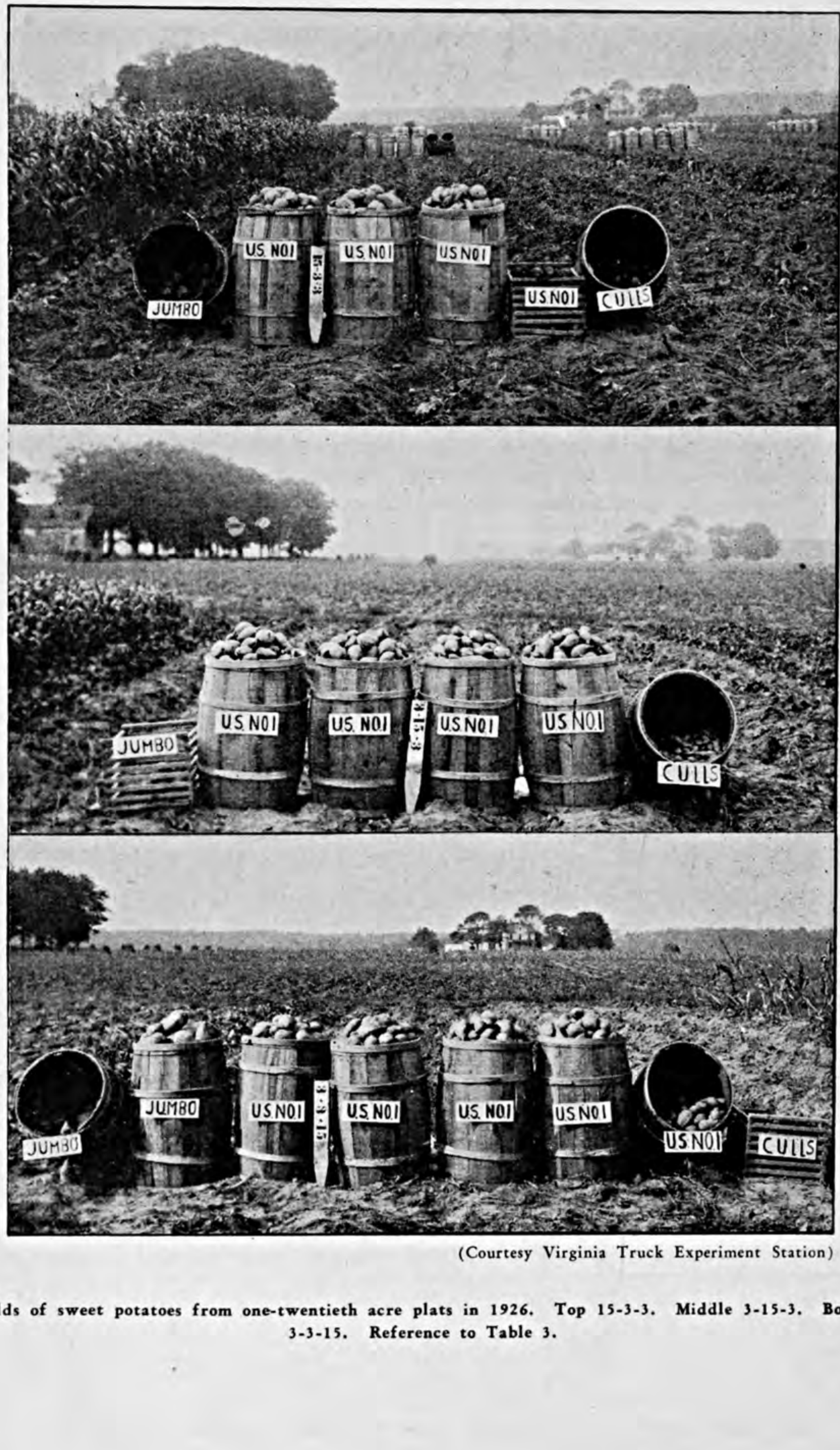
PHOSPHORUS TEST IN GREENHOUSE

(Norfolk fine sand)

Yield in Grams Increase Over Check and P_2O_5 in Milligrams Per Pot

P_2O_5 Added 2/5/34	Yield of Beets 4/10/34	* P_2O_5 Absorbed by Beets	P_2O_5 Leached 4/9/34	P_2O_5 in Sodium Acetate Extract	Yield of Beans 6/11/34	P_2O_5 Absorbed by Beans
500	11.8	97	0.5	46	3.4	13
1000	14.4	158	1.4	182	8.9	42
2000	12.6	162	1.6	306	13.3	81
4000	19.7	339	11.0	452	20.2	180

Study run at pH 6.2. * *Minus that absorbed from the natural soil.*



(Courtesy Virginia Truck Experiment Station)

Yields of sweet potatoes from one-twentieth acre plats in 1926. Top 15-3-3. Middle 3-15-3. Bottom 3-3-15. Reference to Table 3.

Eleven weeks elapsed between the time of planting the beets and the bean crop. One day before the harvest of the beet crop, soil samples were taken for analysis and then the soil in the pots was leached with about the equivalent of two inches of rain water. The sodium-acetate-soluble phosphorus was obtained from the soil samples and the drainage water also was analyzed.

Quite a close correlation was noted between the phosphorus shown by the sodium-acetate extraction and that absorbed by the crops. From this it is believed that an extracting reagent that most closely correlates with that absorbed by the plant is more valuable than one that shows more nearly what has been added. It has been our experience with some of the more acid extracting reagents, found to work in some parts of the country, that a high test for phosphorus is found in most of our soils. This, I believe, is explained by the nature of the compounds in the soil affected by the extracting reagent. It is not practical to use water extracts of the soil because of the time-consuming element.

Potash Availability

While some soils show a comparatively high power for fixing potash in a difficultly available form it is far less than the fixing power of some soils for phosphorus. Likewise, crop utilization is much higher. A crop of potatoes, while it utilizes only from 12 to 15 pounds of phosphoric acid to the acre, will utilize from 50 to 75 pounds of potash. In this connection, the data in Table 3 are interesting. These data were taken from the long-time fertility plats located at Onley, Virginia. The yield data are given to explain the test for available potash.

The wide ratios used in this work serve to provide significant differences in soil treatment against which to compare micro-chemical methods of testing soils. The yields also show the importance of properly balancing the fertilizer according to the crop needs as well as soil deficiencies.

Even though considerable potash from the high-potash plats had been removed by large crops of sweet potatoes, the test for available potash gave some correlation with the amount applied and also some correlation with the total replaceable potash found in the soil. The results indicate that even though large amounts of potash have been applied in the second treatment over a period of years, there is not enough left in an available state, as shown by chemical tests, to grow a good crop of potatoes without the usual fertilization.

The soil tests have been very valuable in this section in locating fields that are likely to show magnesium deficiency in potatoes. Almost without exception soils that have shown magnesium-deficiency symptoms in the field have given a poor test for magnesium in the laboratory. The aluminum test has likewise aided in

(*Turn to page* 42)

Table 3
POTASH TESTS ON FERTILIZER PLATS
Sassafras Sandy Loam

Fertilizer used 12 Years	K_2O p.p.m. of Soil: Total Applied	Replaceable in Soil	Sodium Acetate	Bushels per Acre: 10 Yr. Av. Irish Potatoes	9 Yr. Av. Sweet Potatoes	5 Yr. Av. Corn
15-3-3	186	71	10	158	206	45
6-9-6	558	78	20	172	241	43
3-3-15	930	190	140	92	289	31

Muck-grown Potatoes Can Top the Market

By E. B. Tussing

Extension Horticulturist, Ohio State University

THE prejudice against "muck" potatoes is no longer justified. It still exists on many markets; but if the potatoes are properly grown and cleaned, they often will bring a premium in these same markets because their identity as muck-grown is lost. I have seen them bring a 10 per cent premium in our Ohio markets.

For years the buying public has discriminated against muck-grown potatoes, which have had a displeasing appearance caused by the adherence of the soil and which have tended to be soggy when cooked. In many instances the growers did a haphazard job. The potato crop was secondary and was planted only after the wind had destroyed the onion crop and it was too late to reseed. This method of growing did not add to the quality. Low quality is generally associated with poorly drained muck and the insufficient use of potash fertilizer.

Cleaning Stimulates Buying

Interest in potato growing on the muck is being revived since the introduction of cleaning machinery and the better quality to be gained through proper drainage and fertilization. This is particularly true in New York, Ohio, and Indiana. No doubt some of this interest is due to the low prices that other muck crops have been bringing on the market, and some to the stimulated buying of cleaned muck potatoes. Labor problems may have an influence on the shift because less labor is needed to grow a good crop of potatoes than is required in producing many of the other muck crops, especially those that have to be hand weeded.

The growing of potatoes on muck involves a number of problems but probably the most serious are drainage, proper fertilization, frost damage, scab and Rhizoctonia, digging injury, and the cleaning of the tubers. It is essential to good quality to have the muck well-drained. Frost damage is a serious problem and about the only control that can be practiced is an adjustment of planting dates. It is essential that potatoes be planted as early as possible and still avoid serious frost damage.

Early Planting

Three years of work at the Muck Experiment Farm at McGuffey, Ohio, show that early May plantings have been yielding better than the later ones, if they escape June frosts. Cobblers planted in 1934 on May 4 yielded 433 bushels while those planted on May 22 yielded 322. White Rurals planted May 4 yielded 470 bushels as compared to 371 for the May 22 planting. There was but slight difference in the yield of White Rurals planted May 22 and those planted June 7. Those planted June 20 yielded 190 bushels and were immature when killed by frost on September 28. The years of 1932 and 1933 were seasons with severe June frosts, hence the early May plantings did not appreciably out-yield the later plantings.

The amount of damage will depend to a large extent upon the number of rotten seed pieces. If cut potatoes are used and the seed piece fails to heal properly, recovery of the plants cannot be expected. It is essential when planting early on muck that the seed pieces be intact after the plant has been frosted. To be sure of this, it is advisable to use small whole certified seed or to heal the cut seed.

There is nothing definite to offer in the way of controlling scab on muck except to recommend the use of an acid fertilizer instead of one that leaves an alkaline residue. Of course, many mucks are sour and some of them to such a degree that it is necessary to add lime to grow a profitable potato crop. Growers having a sour soil are fortunate. No inexpensive method for reducing the pH of muck soils has been developed.

Rhizoctonia on muck is oftentimes serious. Shallow planting will help control Rhizoctonia but shallow-planted potatoes on muck will be badly sunburned. Plots in Ohio showed that deep-planted seed on muck is subject to considerable Rhizoctonia injury and that there is no advantage in planting more than four inches deep. To plant deep and still get shallow covering, the discs are removed from the planter, the seed put down to the required depth, and only an inch to one and one-half inches of muck pulled over the seed. After the sprouts come through, the trench is filled by running the weeder over the ground. This will help control the Rhizoctonia from girdling the plants, but it does not prevent the tubers from being spotted.

A 100-acre field of potatoes growing on muck in Hardin county, Ohio.

Rhizoctonia on the tubers shows very plainly when the potatoes have been brushed. I know of no successful method to prevent this trouble. One of our large growers on the muck this year used the hot formaldehyde treatment on his seed. He seemed to think that it helped some. At the Experiment Farm, an attempt has been made to secure seed quite free from Rhizoctonia and this has been planted without being treated. I think the control has been as good as with treated seed.

Because of the short growing season on the mucks, potato varieties used should be those that have a short growing season. The white-skinned potatoes, while more susceptible to scab, are more attractive than the thicker skinned russets.

The Irish Cobbler is the best early variety we have found and is to be highly recommended for muck. For the intermediate crop, two varieties can be recommended—the late Cobbler which is similar in all respects to the Irish Cobbler except that it matures two weeks later, and the Katahdin, a new variety introduced by the United States Department of Agriculture. The Katahdin matures about the same time as the late Cobbler but has a distinct advantage of being a smooth, round, white tuber which cleans readily. It has yielded well and is recommended for trial. It should be spaced in planting to avoid large tubers as the large tubers tend to have a very deep bud end. Seed is available in small quantities. The new Chippewa, also introduced by the United States Department of Agriculture, was tried this year and gave promise of being a good variety for muck. The tubers are similar to the Katahdin but are somewhat earlier. Seed of this variety is not available in quantities as yet.

Certain strains of white or smooth rurals can be recommended for the late crop. At least three strains that yield as well as russet strains have been found among those tested in Ohio. Rurals are more resistant than Cobblers to injury from leaf hopper and flea beetle; therefore, do not require as thorough spraying. Rurals mature so late that they are usually green when hit by frost. Another weakness is a tendency to large growth cracks in favorable seasons.

Potash in Large Quantities

Three years' fertilizer results are now available at our muck farm. The muck there is 30 to 36 inches deep and has a soil reaction of pH 5.7. Severe frost injury in 1933 in the fertilizer plots materially reduced the yields. The three years' results show that the omission of either nitrogen or superphosphate has resulted in a small reduction in yield just sufficient to indicate that these elements are required in small amounts. Potash in large quantities is required for high yields.

1934 *Potash Results*

Fertilizer *	Yield per Acre
3-9-0	165 Bus.
3-9-9	344 "
3-9-18	416 "
3-9-27	487 "
3-9-36	509 "

* *Application—750 Lbs. per Acre.*

The fertilizer practices used on new and old muck would naturally be different. Seldom does new muck need any commercial nitrogen, but it is usually deficient in potash and phosphoric acid; while old muck will need a small amount of nitrogen and if heavily fertilized, may have a carry-over of potash and phosphoric acid.

Spraying, Irrigation, Etc.

Potatoes on muck should be spaced so as to prevent oversized tubers. Spacing of 32 to 11 inches have proved satisfactory. Since plantings are usually made later on the muck than on the upland, seed pieces develop more sprouts. This results in a heavier set; and closer spacing than 11 inches is not necessary to keep down the size of the tubers.

While no spraying demonstrations have been conducted, observations show that more adequate spraying is required on the muck than is required on upland. The tops grow so fast that 10 days to 2 weeks spraying fail to cover some of the leaves.

Inadequate spraying was particularly noticeable when June frosts killed part of the foliage. When part of the tops are killed, the insects concentrate on the uninjured leaves, some of which are not covered with spray. In 1933, after a frost these lower leaves were so heavily infested and the injury so great the plants failed to recover normally and the yield was greatly reduced. Weekly spraying this year gave excellent control.

Both overhead and sub-irrigation

(*Turn to page* 46)

The Humus Front

By Dr. R. E. Stephenson

Oregon State Agricultural College

AMONG the various fronts upon which Civilization is fighting is the "New Humus Front." Reduced crop yields, in spite of a greater use of commercial fertilizer, are due to an increasing lack of humus in long-farmed soils. With the loss of humus the "old force" is gone out of the soil.

In this country we are yet farming comparatively new land. Yields on the average have not fallen. In fact a slight increase, due to many causes such as better methods, more and better fertilization, better seed, etc., is probable. But we are concerned about the humus economy of our soils. Those soils in which the humus has become depleted are not as productive as in their virgin state. Dry years are increasingly disastrous because of lack of humus. We have some worn-out soils. The humus is gone or going rapidly in too many soils.

Market gardeners find it increasingly difficult to secure stable manure. The family horse of the city is no more, and manure from the city is scarce and high priced. The stockyards and feed lots supply an inadequate amount. What is the solution of manure shortage?

Part of the solution to date has been the increased use of commercial fertilizer. Not four or five hundred pounds but four or five tons per acre are sometimes used in the attempt to boost yields and produce quality crops. With irrigation, which supplies the moisture, the possibilities of fertilization are illimitable, but soil fertility can never be maintained without due consideration of humus renewal. Drouth years are doubly destructive as the humus vanishes, and many seasons have drouth periods when lack of humus adds to the handicap of lack of water.

Green manuring is an effective means of humus renewal, and orchardists are making increasing use of green manure crops for supplying humus. The liberal use of commercial fertilizers to grow an abundance of humus is a sound practice. Orchards and even individual trees produce and are profitable somewhat in proportion as humus is renewed.

Truck farmers are using green manures, but not as whole-heartedly as

(*Turn to page* 44)

In Aroostook county, Maine, great crops of clover are plowed under to furnish humus for maintaining potato yields. This close-up shows the soil scraped away and the decaying mass of clover.

Black Locusts Will Anchor Sand

By A. F. Gustafson

Professor of Soil Technology, New York State College of Agriculture

ABOUT 25 years ago the late Frank Markert planted black locust sprouts on some dune sand on his farm which is located near Bath, Mason county, in Central Illinois. This county alone has 75,000 acres of more or less shifting dune sand, and this acreage constitutes 21 per cent of the area of Mason county. It was while a field party under his direction was making the soil map of this county that the writer became interested in the possibilities of growing the black locust on this immense area of dune sand.

Easily Established

While planting locust seedlings and pine on some additional acreage of this dune sand, the writer's attention was attracted to the mat of organic matter under a thick stand of the trees growing from the original planting of black locust sprouts made a quarter of a century earlier. The reason the sprouts had not attained saw-log size during this period is that fires have gone through the plantation many times, averaging once in three or four years. The last fire occurred in 1931, three years previous to the time of this observation. The heat from these fires is so intense as to kill nearly all of the locust growth above ground, particularly the smaller sprouts.

Samples of the organic material collected in such a manner as to represent a given area were taken to Ithaca, New York, for examination. Dry matter, loss on ignition, and percentage of nitrogen were determined. The loss on ignition indicated more than 1.1 tons of organic matter on the water-free basis or more than 1¼ tons of air-dry organic matter. This material which had accumulated during the three years since the last fire, including some sand, weighed 8,695 pounds and contained 1.2 per cent or 101 pounds of nitrogen over an acre. Surely it is a crime to permit the destruction of so much organic matter and nitrogen and the killing of the above-ground locust growth as well.

It was notable that under these locust trees absolutely no movement of sand occurred owing to the surface covering of leaves. A similar situation, no doubt, obtains under ordinary forest trees. The difference lies in that the locust, owing to the fact that it is a legume, can be established readily on dune sand which is almost free of nitrogen.

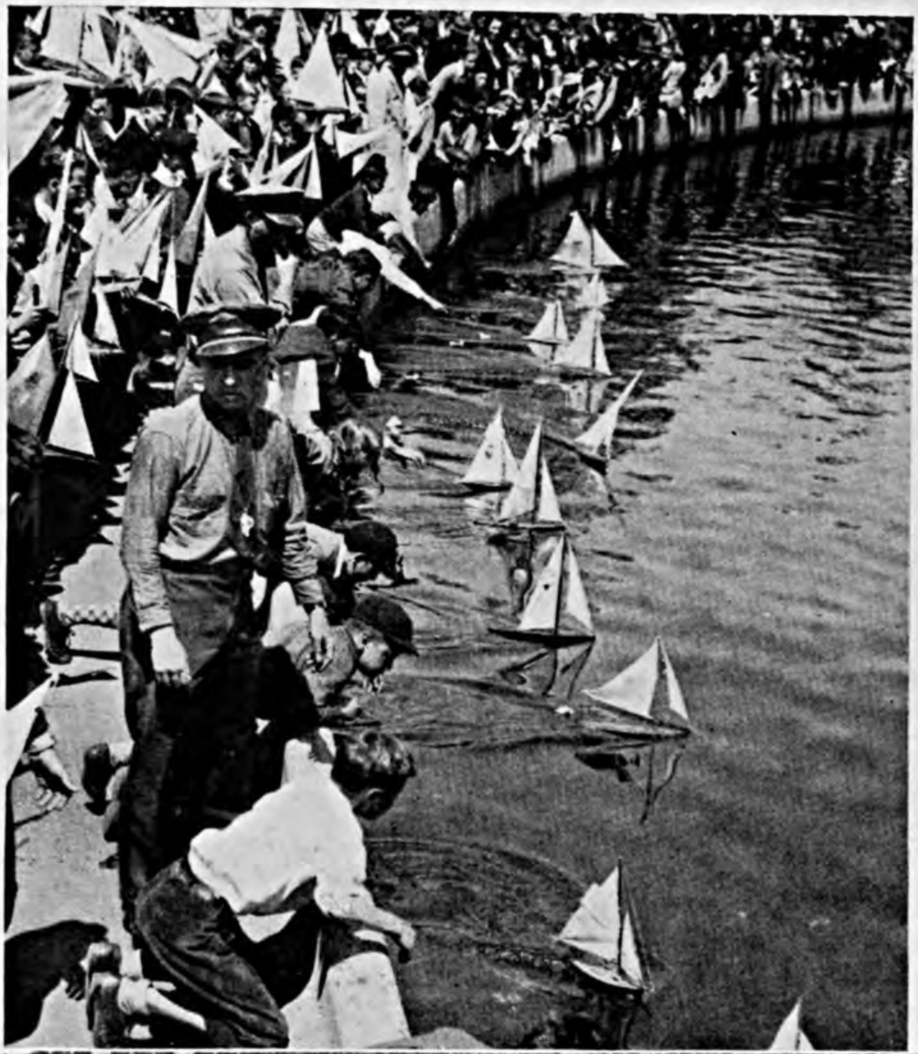
Conserve Adjacent Soils

During this period in April, 1934, the writer observed the effects of three days and nights of continuous strong wind. Much of this dune area supported what would be regarded as a fairly good cover of tall bunchy grass. A continuous grass cover would, of course, hold sand movement to a minimum, or, in fact, practically prevent any movement, whatever. During this strong-wind period, how-

(*Turn to page* 38)

Pictorial

"I WISH I COULD HITCH A HORSE TO THIS GOL-DARNED THING"



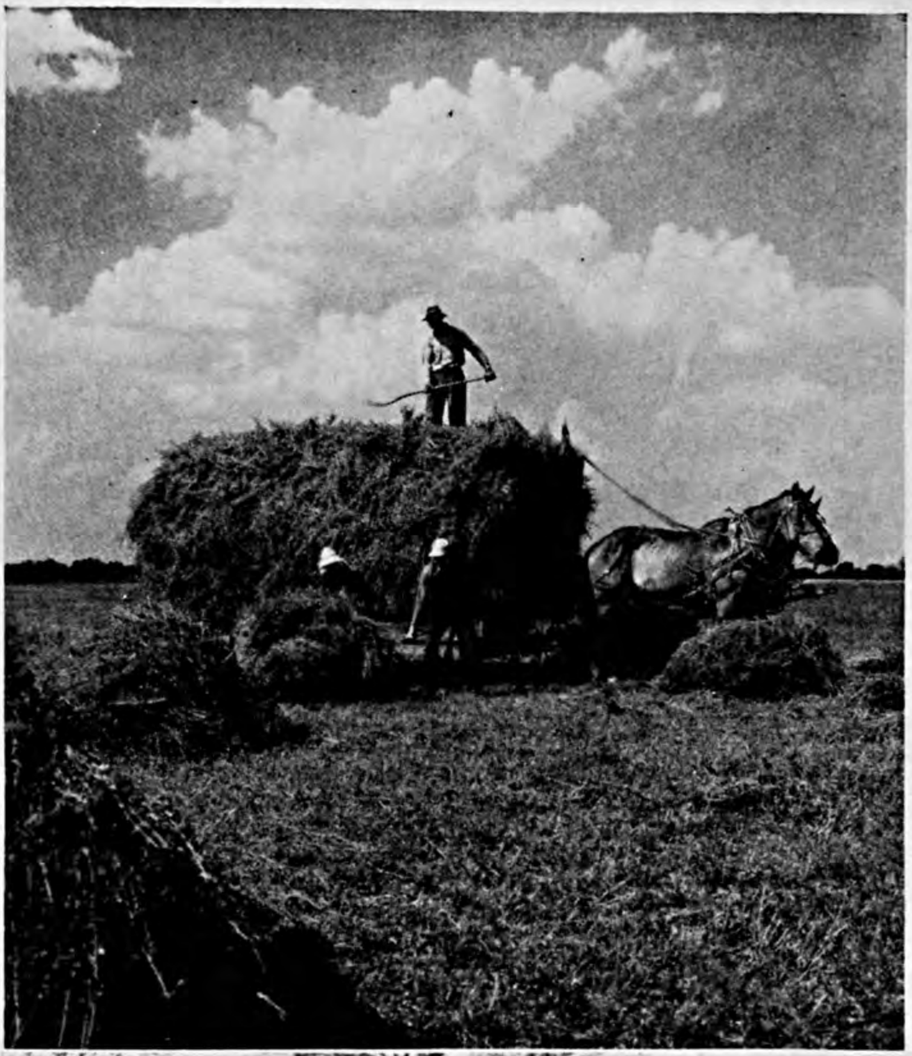
Left: Competition is the basis of many of the summer pastimes of city children. This sailboat regatta is being held in Central Park, New York.

Ewing Galloway, N.Y.

Below: Cooperation to meet competition is also taught young muscle builders in the crowded city playgrounds.

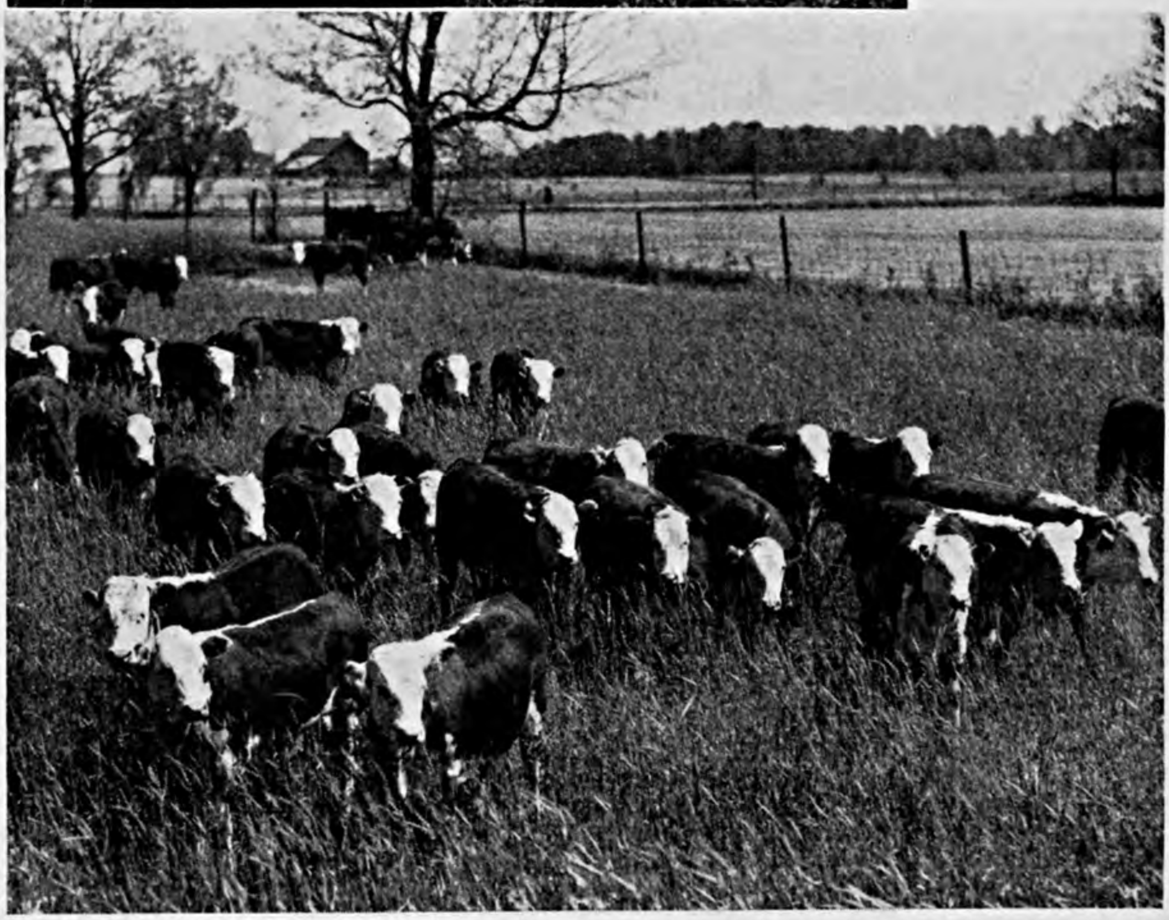
Above: Farm children often lack playmates, but self-reliance at an early age finds many opportunities for development.

Right: Responsibility, frequently thrust upon farm youths of tender years, is tempered by wholesome and interesting surroundings.



It's hard work, but "hustle" at certain times to insure good quality hay means—

profit in animals like these when they are ready to be finished for the market.



The Editors Talk

American Potash Institute, Incorporated

On May 28, 1935, the American producers and importers of potash salts announced the organization of the American Potash Institute, Incorporated, to be established in Washington, D. C. "In view of the growing importance of potash in the agriculture of North America and in order to lend assistance in this nation's fertilizer research program," the organizers said, "the Institute has been organized to carry on scientific and agricultural investigations to promote the efficient and profitable use of potash in crop production. It is recognized that an increasing and effective use of fertilizers, including potash, can only be based on facts resulting from scientific work.

"It will be the policy of the Institute to cooperate, as opportunity affords, with State and Federal institutions in carrying on research and experimental work in the United States, Canada and Cuba, and with the agricultural work sponsored by the National Fertilizer Association and other scientific and trade organizations."

Dr. J. W. Turrentine, for years past in charge of Potash Researches of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has been appointed President and Treasurer. G. J. Callister, for 24 years connected with the educational work of the potash industry, is Vice-President and Secretary.

Better Crops With Plant Food

Beginning with this issue, BETTER CROPS WITH PLANT FOOD is to be published in the interest of the policies of the Institute. Our editorial offices will be in the Investment Building, Washington, D. C. Sid Noble, who has been associated with BETTER CROPS WITH PLANT FOOD, is remaining with one of the potash producing companies and will no longer be connected with the magazine. Upon severing his services, Better Crops Publishing Corporation wishes to express to him its appreciation and its good wishes for his future.

The policy of the magazine will remain unchanged. More than ten years ago in several issues we emphasized our aims and purposes. It may be well to quote from one of these statements:

"In developing a more efficient agriculture, you believe—as we do—that one of the most important factors is sound research and experimental work. It is our policy, therefore, to actively support all groups and agencies doing such work, especially the State Agricultural Experiment Stations and Colleges, and the United States Department of Agriculture.

"We believe that such research work is of the greatest value when translated into more efficient production and better living on the farm. Agriculture should be put on a business basis. The farmer is entitled to a larger share of the consumer's dollar. Living and working conditions on the farm should be improved. Consequently we are glad to heartily support the work of the agricultural extension forces and the county agricultural agents.

"Especially do you want all the facts, not selected facts. It is therefore a very vital part of our policy to publish all the facts. You want these facts presented by authorities in an easy-to-read and attractive form. To combine a soundness of purpose with brightness of treatment is one of our chief aims."

That this policy has borne fruit, we believe, is evidenced in the many friends which we have made and our steadily increasing number of readers. We appreciate hearing from our readers and to have you make us a forum for exchange of ideas, opinions, and experiences. In return we pledge that we will constantly strive to make BETTER CROPS WITH PLANT FOOD intertesting, attractive, and at all times thoroughly dependable.

International Cooperation

One of the most striking examples of international cooperation is being called to public attention in the Third International Congress of Soil Science to be held in Oxford, England, from July 30 to August 7, 1935, under the Presidency of Sir John Russell, Director of the Rothamsted Experiment Station, England. Following the initial Congress held in Washington in 1927 and the second held in Leningrad and Moscow in 1930, this third gathering of soil scientists from all countries of the world demonstrates a full realization of the value of effort in common for the betterment of mankind.

Arduous research into the complexities of the soil is recorded in various scientific journals for the benefit of all workers. However there is a distinct value and inspiration, a cementing of common aims and purposes, to be gained in personal contacts, which never can be gained from the printed page. It would be hard to measure the benefit to civilization of these congresses of men who are devoting their lives to a better understanding of the soil, the basis of all life and prosperity.

Without doubt this year's meeting will, if possible, be characterized by even more open minds and spirit of friendliness on the part of the delegates from the different nations, for if the world depression has taught anything, it is interdependence. National welfares are interlocked and national viewpoints have given way to world outlooks. Likewise, more than the agricultural industry is vitally interested in the important problems which will be discussed by these learned men. As science unlocks the doors, cooperation airs the rooms to greater enlightenment and well-being.

Approximately thirty-five prominent American soil scientists, representing the United States Department of Agriculture and fourteen States, make up the delegation which sails from New York on July 20. Included among the States to be represented are New Jersey, Ohio, New York, South Carolina, Connecticut, Illinois, Delaware, California, Massachusetts, North Carolina, Florida, West Virginia, Colorado, and Wisconsin.

To these men, we wish BON VOYAGE. And we want to thank them for all they will give and receive toward the high ideal of advancement for all.

REVIEWS

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

Fertilizers

"Annual Report, State Board of Agriculture 1933-1934," State Board of Agr., Dover, Del., Quar. Bul. Vol. 24, No. 3, Sep. 30, 1934.

"Commercial Fertilizers, Commercial Feeds and Agricultural Liming Materials," Univ. of Md., College Park, Md., Control Series, Bul. 152, Aug. 1934.

"Relation of Light, Potassium, and Calcium Deficiencies to Photosynthesis, Protein Synthesis, and Translocation," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 141, Dec. 1934, R. P. Hibbard and B. H. Grigsby.

"Registration, Labeling, and Inspection of Commercial Fertilizers; 1934," Agr. Exp. Sta., Columbia, Mo., Bul. 348, Apr. 1935, F. B. Mumford, L. D. Haigh, and E. W. Cowan.

"The Effect of a Controlled Nitrogen Supply with Different Temperatures and Photoperiods upon the Development of the Potato Plant," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 75, Sep. 1934, H. O. Werner.

"The Value of Gypsum as a Supplement to a Concentrated Fertilizer," Agr. Exp. Sta., State College Sta., Raleigh, N. C., Bul. 290, June 1934, L. G. Willis.

"Tobacco Fertilizer Recommendations for 1935," Agr. Exp. Sta., State College Sta., Raleigh, N. C., Agron. Informa. Cir. 87, Sep. 1934.

"Commercial Fertilizers—1935," Dept. of Agr. and Mkts., Madison, Wis., Bul. 162, Mar. 1934, W. G. Griem.

Soils

"Orchard Soil Management," State Fruit Exp. Sta., Mountain Grove, Mo., Bul. 28, June 1934, F. W. Faurot.

"Methods for Determining the Hydrogen-Ion Concentration of Soils," U. S. D. A., Washington, D. C., Cir. 56 (Rev.) Jan. 1935, E. F. Snyder.

"Base Exchange and Related Properties of the Colloids of Soils from the Erosion Experiment Stations," U. S. D. A., Washington, D. C., Tech. Bul. 461, Oct. 1934, C. S. Slater and H. G. Byers.

"Soil Survey of Bay County, Michigan," U. S. D. A., Washington, D. C., Series 1931, No. 6, C. H. Wonser, J. O. Veatch, L. R. Jones, and L. R. Schoenmann.

"Soil Survey of Washtenaw County, Michigan," U. S. D. A., Washington, D. C., Series 1930, No. 21, J. O. Veatch, L. C. Wheeting, and Arnold Bauer.

"Soil Survey of Alger County, Michigan," U. S. D. A., Washington, D. C., Series 1929, No. 32, J. O. Veatch, L. R. Schoenmann, F. R. Lesh, and Z. C. Foster.

"Soil Survey of Houston County, Minnesota," U. S. D. A., Washington, D. C., Series 1929, No. 31, A. L. Gray, W. J. Moran, A. H. Hasty, Sam Hill, C. H. Mattson, H. C. Newman, and H. T. Petraborg.

"Soil Survey of Sherman County, Nebraska," U. S. D. A., Washington, D. C., Series 1931, No. 5, L. A. Brown, R. L. Gemmell, and F. A. Hayes.

"Soil Survey of Columbia County, Oregon," U. S. D. A., Washington, D. C., Series 1929, No. 35, W. G. Harper and E. F. Torgerson.

"Soil Survey of Wyoming County, Pennsylvania," U. S. D. A., Washington, D. C., Series 1929, No. 34, B. H. Hendrickson, R. T. Avon Burke, K. V. Goodman, and R. L. Smith.

"Soil Survey of Potter County, Texas," U. S. D. A., Washington, D. C., Series 1929, No. 33, E. H. Templin and A. E. Shearin.

"Soil Survey of Rockbridge County, Virginia," U. S. D. A., Washington, D. C., Series 1931, No. 4, R. C. Jurney, R. E. Devereux, and Edward Shulkcum.

Crops

The outstanding publication in this section which has come into circulation since our last issue is Miscellaneous Publication No. 200 of the U. S. Department of Agriculture, "Manual of the Grasses of the United States," by A. S. Hitchcock, Principal Botanist, Division of Plant Exploration and Introduction, Bureau of Plant Industry. This is a good-sized volume of 1040 pages, bound in buckram, and priced at $1.75. To say the least, it is a veritable encyclopedia of the grasses to be found in this country. Its importance can be gauged by the introductory paragraph: "Of all the plants of the earth the grasses are of the greatest use to the human race. To the grasses belong the cereals, sugarcane, sorghum, and the bamboos; and, since they furnish the bulk of the forage for domestic animals, the grasses are also the basis of animal industry."

"The Black Locust in Alabama," Agr. Exp. Sta., Auburn, Ala., Cir. 73, Mar. 1935, L. M. Ware.

"Agricultural Research in Arizona—Forty-fifth Annual Report for the Year Ended June 30, 1934," Agr. Exp. Sta., Tucson, Ariz., P. S. Burgess.

"Vetches and Related Crops for Forage," Agr. Exp. Sta., Berkeley, Calif., Cir. 336, Nov. 1934, L. Gordon Goar.

"Report of the Director for the Year Ending October 31, 1934," Agr. Exp. Sta., New Haven, Conn., Bul. 336, Jan. 1935, William L. Slate.

"Report of the Director for the Year Ending June 30, 1934," Conn. State College, Storrs, Conn., Bul. 199, Sep. 1934, William L. Slate.

"Twenty-third Biennial Report of the Department of Agriculture From July 1, 1932, to June 30, 1934," Dept. of Agr. Tallahassee, Fla., Nathan Mayo.

"Bramble Fruits—Raspberries, Blackberries, Dewberries—How to Grow in Illinois," Agr. Exp. Sta., Urbana, Ill. Cir. 427, Jan. 1935, A. S. Colby, H. W. Anderson, and W. P. Flint.

"Report of the Director for the Year Ending June 30, 1934," Agr. Exp. Sta., Lafayette, Ind., J. H. Skinner and H. J. Reed.

"Agricultural Extension Work in Indiana, July 1, 1933, to June 30, 1934—Report of the Director," Agr. Exp. Sta., Lafayette, Ind., J. H. Skinner and T. A. Coleman.

"Louisiana Copenhagen Cabbage—Methods of Breeding and Description," Agr. Exp. Sta., Baton Rouge, La., Bul. 260, Nov. 1934, Julian C. Miller.

"Summary Report of Progress, 1934," Agr. Exp. Sta., Orono, Me., Bul. 377, Dec. 1934.

"Annual Report of Maine Extension Service Year Ending June 30, 1934," Agr. Exp. Sta., Orono, Me., Bul. 213, Dec. 1934.

"Seed Inspection," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 77, Feb. 1935, F. A. McLaughlin.

"Killing Weeds with Chemicals," Mass. State College, Amherst, Mass., Ext. Leaf. 78 (Rev.), Jan. 1934, Orton L. Clark.

"Agricultural Experiment Station Report—Two Years Ended June 30, 1934," Mich. State College, East Lansing, Mich., V. R. Gardner.

"Report of the Proceedings of the Seventeenth Annual Convention of the Michigan Muck Farmers Ass'n.," Mich. State College, East Lansing, Mich., Paul M. Harmer, Sec'y-Treas.

"Crop Mixture Trials in Michigan," Agr. Exp. Sta., East Lansing, Mich., Spec. Bul. 256, Dec. 1934, R. H. Morrish.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 17, No. 3, Feb. 1935.

"Forty-eighth Annual Report of the Agricultural Experiment Station of Nebraska," Agr. Exp. Sta., Lincoln, Neb., Feb. 1, 1935, W. W. Burr.

"Annual Fodder and Silage Crops for Nebraska," Agr. Exp. Sta., Lincoln, Neb., Cir. 52, Mar. 1935, W. E. Lyness and T. A. Kiesselbach.

"Cultural Practices in Corn Production," Agr. Exp. Sta., Lincoln, Neb., Bul. 293, Jan. 1935, T. A. Kiesselbach, Arthur Anderson, and W. E. Lyness.

"Wilt and Cold Resistance of Self-Fertilized Lines of Alfalfa," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 76, Sep. 1934, George L. Peltier and H. M. Tysdal.

"Annual Report of the Board of Control for the Fiscal Year Ending June 30, 1934," Agr. Exp. Sta. Reno, Nev.

"Forty-seventh Annual Report, 1934," New York State College of Agriculture and Cornell University Agricultural Experiment Station, Ithaca, N. Y.

"Report of the North Carolina Department of Agriculture, from July 1, 1932, to June 30, 1934," Dept. of Agr. Raleigh, N. C., Wm. A. Graham.

"The Culture and Handling of the Blakemore Strawberry," Dept. of Agr., Raleigh, N. C., The Bulletin, Nov. 1934, G. M. Darrow and Charles Dearing.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. 20, No. 173, March-April 1935.

"Applying Science to Agriculture—Report of Oklahoma A. & M. College Agricultural Experiment Station July 1 1932, to June 30, 1934," Agr. Exp. Sta., Stillwater, Okla., C. P. Blackwell.

"Studies with Alfalfa Hay for Milk Production," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 328, June 1934, I. R. Jones, P. M. Brandt, and J. R. Haag.

"The Tung Oil Tree in Texas," Agr. Exp. Sta., College Sta., Tex., Cir. 75, Mar. 1935, P. R. Johnson and S. H. Yarnell.

"Good Gardening in Vermont," Agr. Exp. Sta., Burlington, Vt., Ext. Cir. 82, Apr. 1935, Mrs. C. P. Brooks, P. R. Miller, and M. B. Cummings.

"Department of Agriculture—Immigration of Virginia," Richmond, Va., Bul. 326, May 1935.

"Home Gardens," Agr. Exp. Sta., Pullman, Wash., Ext. Bul. 202, Mar. 1935, J. C. Snyder.

"Potato Growing in Wisconsin," Agr. Exp. Sta., Madison, Wis., Ext. Cir. 273, Jan. 1935, J. G. Milward and J. W. Brann.

"Pea Diseases and Their Control," U. S. D. A., Washington, D. C. Farmers' Bul. 1735, Nov. 1934, L. L. Harter, W. J. Zaumeyer, and B. L. Wade.

"Why Red Clover Fails," U. S. D. A., Washington, D. C., Leaf. No. 110, Nov. 1934, E. A. Hollowell.

"Influence of Spacing and Time of Planting on the Yield and Size of the Porto Rico Sweetpotato," U. S. D. A., Washington, D. C., Cir. 327, Nov. 1934, J. H. Beattie, Victor R. Boswell, and E. E. Hall.

"Agricultural Investigations at the Belle Fourche (S. Dak.) Field Station, 1926-32," U. S. D. A., Washington, D. C., Tech. Bul. 454, Oct. 1934, Beyer Aune, L. A. Hurst, and Albert Osenbrug.

"Seasonal Variations in Carrying Capacity of Pastures for Dairy Cows in Milk," U. S. D. A., Washington, D. C., Tech. Bul. 465, Dec. 1934, T. E. Woodward and R. R. Graves.

"Cotton and Cottonseed," U. S. D. A. Washington, D. C., Misc. Pub. 203, Nov. 1934, Rachel P. Lane and Emily L. Day.

Economics

While primarily based on income from a dairy herd, Wisconsin College of Agriculture's Bulletin 429, "Managing the Farm for Better Income," contains practical discussions for farmers in other sections of the country. The authors, P. E. McCall and I. F. Hall, have divided their discussion of the findings from research into six general headings:

1. 60 to 80 acres may be enough,
2. Diversification adds income,
3. High production per cow needed,
4. Efficient feeding necessary,
5. Good crop yields important,
6. More land in alfalfa pays.

The presentation is concise, practical, and interesting.

"Economic Changes in Montana's Wheat Area," Agr. Exp. Sta., Bozeman, Mont., Bul. 295, Jan. 1935, E. A. Starch.

"Price Movements and Pennsylvania Agriculture," Agr. Exp. Sta., State College, Pa., Bul. 309, Oct. 1934, F. P. Weaver and D. H. Walter.

"A Study of the Costs and Returns from Grading Vegetables," Agr. Exp. Sta., Kingston, R. I., Bul. 249, Jan. 1935, R. B. Corbett.

"Price-Quality Relationships in Farmers' Cotton Markets of Texas," Agr. Exp. Sta., College Sta., Tex., Bul. 501, Dec. 1934, W. E. Paulson and Joel F. Hembree.

"Relative Importance of Intangible Property in Texas," Agr. Exp. Sta., College Sta., Tex., Bul. 505, Feb. 1935, L. P. Gabbard.

"Grade, Staple Length, and Tenderability of Cotton in the United States 1928-29 to 1932-33," U. S. D. A., Washington, D. C., Sta. Bul. 47, Jan. 1935.

Erosion on Small Slopes

Because their cultivated lands are fairly level, many farmers think they are not losing fertile topsoil by sheet erosion during heavy rains and do not need to protect them by terraces or other methods. But much of the land is losing soil. Measurements by engineers of the United States Department of Agriculture at a soil-erosion experiment station near Ardmore, Okla., where land is fairly level, show considerable losses on unterraced and otherwise unprotected areas.

A rain in 1932 at Ardmore of 6.1 inches caused a loss of approximately 11 tons of soil an acre from an unterraced land slope of 1.9 per cent. Comparison of this loss with that of 14.5 tons an acre caused by a 3-inch rain on a slope of 5.1 per cent at the Guthrie, Okla., farm illustrates the seriousness of erosion on land slopes as small as 2 per cent.

U. S. D. A. Clip Sheet

Michigan Grows Good Potatoes

By J. J. Bird

Field Representative, Michigan Crop Improvement Association

FIFTY-NINE 300 Bushel Club members averaging 379 bushels of potatoes per acre can't be wrong. What potato grower is not interested in the methods used to produce 519 bushels per acre in Michigan in 1934? For that matter what grower is not interested in the production methods followed by the 40 or 50 growers producing 300 or more bushels per acre on five or more acres each year? Obtaining this information constitutes the chief reason for the existence of the Michigan 300 Bushel Potato Club, organized in 1922.

The First Two

Alphonse Verschure of Manistique heads the list of 59 members for 1934 with his high yield of 519 bushels of Russet Rurals per acre on 10 acres. These Rurals graded 95 per cent U. S. No. 1 and were of excellent type. Facts of this nature are important since they emphasize the important connection between high yields and high quality, and there is no overproduction of high quality produce. Such yields are not matters of chance since Mr. Verschure has been a consistent producer of 300 bushels or more per acre for many years.

Weather conditions must be favorable for good yields but methods are more important. This is borne out by the fact that the average 1934 yield for Schoolcraft County, where this grower lives was 84 bushels per acre. Something would be wrong if Mr. Verschure failed to get a high yield of excellent potatoes when he fall plowed a clover sod, dragged and disked it 12 times, row-cultivated only twice, applied 2,000 pounds of commercial fertilizer per acre, planted 30 bushels of certified seed per acre, and sprayed with Bordeaux mixture six times. This schedule of production may appear extreme to many growers, but with the exception of the amount of commercial fertilizer used, it will not appear extreme when compared with the methods followed by the average 300 Bushel Club member.

Roy Eagle of Sault Ste. Marie took second honors with his yield of 502 bushels of Green Mountains per acre. He fall plowed a mixed hay sod, dragged and disked 12 times, row-cultivated twice, applied 400 pounds of a 4-16-16 commercial fertilizer besides seven loads of manure per acre, planted 20 bushels of seed per acre, and sprayed seven times.

Comparison

The recent interest in Green Mountain growing in Marquette, Baraga, and Houghton counties has greatly increased the number of yields over 300 bushels per acre in the Upper Peninsula during the last five years. Thirty-six members of the present Club live in the Upper Peninsula representing 12 counties and had an average production of 388 bushels per acre. The 23 members in the Lower

Peninsula representing nine counties averaged 365 bushels per acre. The Club average yield of 379 bushels per acre was 240 bushels above the average yield of the 21 counties represented by the 1934 Club members.

Varieties

The varieties represented include the Russet Rural, White Rural, Green Mountains, and Katahdin. In the Upper Peninsula 23 members grew Green Mountains, 11 grew Russet Rurals, and two grew White Rurals. Russet Rurals predominated in the Lower Peninsula, 22 growing this variety, one growing the White Rural, one Early Minnesota, one Katahdin, and three a combination of Russet Rural and Katahdin. The new variety Katahdin, recently released to Michigan growers through the Michigan State College, produced yields equal to the Rurals, but in most cases the acreage was below the five-acre requirement for the Club. Yields of 450 and 465 bushels per acre were reported by two Club members in the Lower Peninsula.

The effectiveness of certified seed production practices was emphasized by the fact that 57 of the 59 members were growers of certified seed potatoes. The Upper Peninsula group was the most consistent in the use of commercial fertilizer, in reducing the number of row-cultivations, and in the number of sprays applied. The following data on production methods practiced by the 59 Club members of 1934 are significant:

Tillage

Probably the widest departure from the methods used by the average Michigan potato grower is found in the tillage operations. The potato plant produces a large number of roots near the surface of the soil which may be easily injured by the ordinary row-cultivation. Being a plant of large leaf area it consequently suffers seriously from root pruning. It is evident that the leading potato growers as represented by the 300 Bushel Club members try to do most of the cultivation before the plants are six inches high rather than after.

Since the organization of the Club in 1922 the number of soil-fitting and weed-control operations with the drag and disk has been gradually increasing and the number of row-cultivations decreasing until at present the drag or disk is used on an average 7.3 times and the row-cultivator is used twice, the latter being the lowest average number of row cultivations recorded for the Club to date. This, compared with the average grower's figure of five times for the row-cultivator, is worth considering. One grower in the Upper Peninsula did not row-cultivate at all and 12 row-cultivated only once. Since practically all of the Club members each year are certified potato growers, it goes without further mention that the fields represented were practically free from grass and weeds as required for certification. Weed control was effected by the use of the drag two or three times after planting and followed by the weeder once a week where possible until the plants were over half grown. Club members are rapidly coming to make more use of the weeder.

Quack Grass

Alfalfa sod was plowed for potatoes by 70 per cent of the Lower Peninsula members. In the Upper Peninsula alfalfa is becoming established in the potato rotation. Quite a bit of new land is still being broken up for potatoes in that region.

Quack grass has apparently ceased to be a menace. In fact it would appear to be a fairly good green manure crop for potatoes since eight of the 36 members in the Upper Peninsula plowed a quack sod in the fall or summer of 1933 for their 1934 crop. The fourth highest yield was produced on a quack grass sod dragged 22 times and required only three row cultivations. An average of 8.4 draggings and 2.3 row-cultivations were given the quack grass fields.

Fall plowing was favored by 75 per cent of the members. Only four spring plowed in the Upper Peninsula where the season is shorter than farther south. Those not fall plowing made a practice of early spring plowing about May 1. Sixteen plowed twice.

Planting

With the exception of two, all growers qualifying for Club membership planted certified seed. In the matter of amount of seed planted per acre there is a wide departure from the State average of approximately 11 bushels to the present Club average of 22 bushels per acre. One member planted 35 bushels and said that it was his best investment. Five planted 30 or more bushels per acre, following their regular practice.

The leading growers plant early enough to mature the variety they grow. In the Upper Peninsula 60 per cent planted before May 30 and in the Lower Peninsula 50 per cent planted before June 15. All seed was planted the day it was cut.

Fertilizer

Drought seasons do not discourage the 300 Bushel Club members from using commercial fertilizer. Besides an average application of 8.7 loads of manure per acre, an average of 456 pounds of high analysis commercial fertilizer was applied, 4-16-8, 3-12-12, 2-12-6, and 2-16-8 being the most popular analyses. In practically all cases commercial fertilizer was applied in the row at planting time.

Spacing

Close spacing of plants in the row has come to be a standard practice with the 300 Bushel Club members. Spacing as close as 9 to 12 inches in the row is common. Eighty per cent spaced plants 15 inches or closer in the row, with row spacing varying from 28 to 36 inches. Club members have found that close spacing of plants under good cultural conditions not only increases yield but reduces hollow heart, usually a serious defect in Russet Rurals in seasons of late rainfall. The twice normal rainfall in September of 1934 resulted in 30 per cent hollow heart in many check rained fields. The 300 Bushel Club members had less than five per cent hollow heart in their potatoes.

Spraying

Less than 10 per cent of Michigan potato growers do a good job of spraying. All growers in the 1934 Club used high-pressure sprayers and made on an average 5.1 spray applications of Bordeaux mixture. Nine sprayed seven or more times. All spray machines used were equipped with three nozzles per row and developed approximately 200 pounds pressure. In all cases Bordeaux mixture was home-mixed, and the standard formula of eight pounds of copper sulphate and twelve pounds of chemical hydrated lime was used. Calcium arsenate for chewing insects such as the common potato bug was rarely used over twice. Nineteen growers controlled the potato bug with one application of calcium arsenate. Beginning the spraying schedule early when the plants were from four to six inches high was the secret of bug control with these growers.

Awards

Each grower qualifying for membership in the Michigan 300 Bushel Potato Club is presented with a medal in the form of a miniature approved type Rural potato in gold, silver, or bronze. Those producing 400 or more bushels per acre receive the gold medal; those producing 350 to 400 bushels receive the silver medal; and those producing from 300 to 350 bushels receive the bronze medal. These awards are made at the time of the Crop Improvement Association Banquet during Farmers' Week.

Disease Resistant Varieties of Crops

By Dr. E. N. Bressman

Oregon Agricultural College

THERE is striking evidence that varieties of certain plants are able to withstand attacks of diseases like smut, rust, mildew, and wilts of various sorts, while other varieties are readily susceptible. The reason why certain varieties are resistant and others susceptible affords an extremely complicated study but progress, in finding out just what disease resistance is, has been made in several places.

Resistance may be due to several things. It may be due to the structure of the plant, both internal and external structure. It may be due to a heritable factor. Ordinarily this factor may be transferred and the plant breeder bases much of his work on the ability to transfer disease resistance from one variety to another. A third explanation of resistance is based on the physiological action within a plant. This may be due to the development of the tannin content of a plant, its acidity, its osmotic pressure and similar factors.

Time of Planting

Other escapes may be due to the fact that the plant is so early that it is harvested before the disease develops. Later varieties may be readily attacked. Many commercially important varieties have this factor of either earliness or lateness which help them to resist disease.

There are many peculiar external types of growth about plants which help them to fight off disease. For example, we have some varieties which have extremely hairy leaves; others have waxy leaves; others have thick leaves; etc. One of the most recent contributions to the resistance of wheat varieties to rust attributes this faculty to the small stomata in certain varieties. These small breathing pores in some cases keep out spores of fungi or disease which must enter through them. In other cases, the time of stomata opening appears to be of importance, according to recent work. This type of resistance is not only important from the plant-disease standpoint, but also from the standpoint of insect damage. Hairiness of the leaves may stop aphids. Various colors of leaves and parts of the plant also may have an effect upon their attraction or repelling action on various parasites.

Internal Structure

In some cases plants resist disease by means of some internal structure. The disease enters the plant but there appears to be an antagonism set up and the plant overcomes the disease organism. This may be due to the release of acids or poisonous substances through the action of enzymes. Recent work in Canada has shown that this may be an important factor in warding off black stem rust of wheat. With stinking smut or bunt, which has done so much damage to our wheat crop, it is thought by some workers that the organism enters all varieties and is overcome by some internal condition in those that are resistant.

The environment appears to have a great effect upon a plant's ability to remain healthy. Under some conditions of temperature and moisture the plant is very susceptible while under other conditions it is resistant.

Fertilizers Important

Fertilizers appear to play an important role. Potash has long been credited with building up a resistance to disease in plants, and there are many examples where this important element not only affects yields but reduces disease. Under some conditions plants develop considerable crude fiber and this stops some organisms from tearing down the plants. In many cases seedlings are susceptible to disease while the mature plants are resistant.

In the development of disease-resistant varieties, perhaps as much work has been done with black stem rust of wheat as with any other single organism and plant. Many outstanding varieties have been developed, but the situation is somewhat complicated by forms of the disease which differ in their ability to attack varieties. In other words, varieties are resistant to some forms of the disease and not to others. Inasmuch as there are about 100 known forms, one can readily see that the problem is no easy one. It is fortunate, however, that certain varieties are resistant to large groups of these forms, and so the possibilities of combining resistance to all forms in one variety is still great. Varieties of various crops to resistant leaf rust, crown rust, and many of the other types of rusts, including rust on ornamentals such as snapdragons, have been found.

It is very difficult to name high yielding varieties of a crop which are entirely resistant to all forms of any one disease and under all environmental conditions. There are many so-called resistant varieties, however, which are superior to most other varieties of the same crop. Several of these are mentioned below. They are not only of value to the grower but also to the breeder who is interested in further development of disease-resistant varieties.

Kanred is a winter wheat resistant to many forms of leaf rust. Hope, Ceres, and Marquillo are spring wheats resistant to many forms of black stem rust. Tenmarq wheat is resistant to Hessian fly and leaf rust. Missouri winter wheat No. W 529 and Trumbull from Ohio are resistant to loose smut.

A large number of bunt-resistant varieties of wheat have been developed. Practically all of them are resistant to only some of the forms of this disease. These new varieties include Ridit, Albit, Oro, Ashkof, Minard, Nabob, and Berkeley Rock.

Iogold is a stem-rust resistant oat variety. Victoria and Anthony are resistant to many forms of crown rust of oats.

Markton is a pure line selection of oats developed at the Moro, Oregon, Experiment Station. It is very resistant to covered smut of oats. Ohio No. 201 is resistant to loose smut.

Several new disease-resistant flax varieties have been developed. Buda is resistant to flax wilt and Bison to both rust and wilt.

Other Varieties

Hardistan alfalfa is resistant to alfalfa wilt. Tennessee Anthracnose-resistant Red Clover, as its name implies, is resistant to a dreaded disease. Hungarian vetch is resistant to aphis attack.

Alcross and Horol, two varieties of canning peas developed in Wisconsin, are claimed to be strongly resistant to wilt.

There are even some potato varieties immune to some of the baffling virus diseases. Both the Irish Cobbler and the new Katahdin are resistant to mild mosaic.

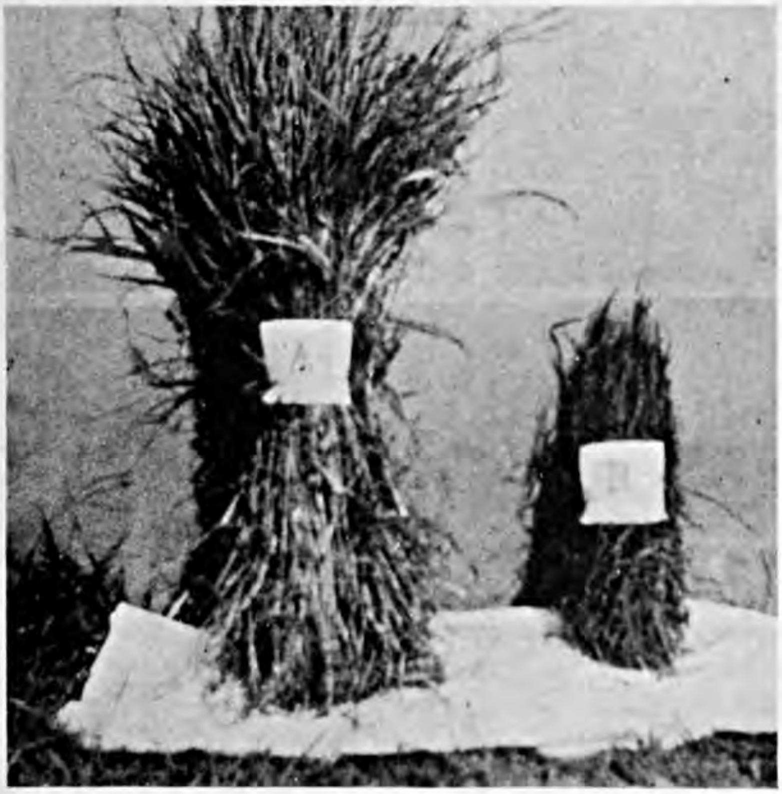
The total list of such varieties resistant to various diseases runs into hundreds of names. In addition to the above examples, one can find the Iron variety of cowpeas, resistant to both wilt and root knot; Columbia, Marvel, and Norton tomatoes, resistant to wilt; Iocope cabbage to yellows; Estella, Orel, and Kiefer pears to fire-blight; Robust beans resistant to anthracnose, and numerous others.

Reed Canary Grass Demands Plant Food

by H. L. Harris

Publicity Specialist, Minnesota Agricultural Experiment Station

REED Canary grass, limelighted into popularity during the last few years by the Minnesota Agricultural Experiment Station, is proving a valuable crop for peat bogs and other low-lying areas too wet for other hay or grain crops. Like any other plant, however, Reed Canary grass demands plant food, a fact repeatedly stressed by the Universitv soils specialists and the county agents who have played a big part in introducing this crop to farmers.



Reed Canary grass yields on a high-lime peat.

Left Yield from 300 lbs. per acre of 0-9-27 fertilizer.

Right Yield from similar plot with no fertilizer.

In 1934, Agent A. R. Rollin of Aitkin County and George H. Nesom, University soils specialist, conducted a demonstration on the farm of Fred Mackaman of Aitkin to show the result of applying phosphate and potash to a high-lime peat bog. On a part of this bog, 300 pounds per acre of 0-9-27 fertilizer was applied. The remainder of the bog received no fertilizer. The fertilized bog produced 2.12 tons of Reed Canary grass hay per acre; the unfertilized part only six-tenths of a ton, showing very conclusively that adding phosphate and potash fertilizer to high-lime peat bogs is very necessary and worth while.

Conn. Valley Soils Need Potash

(*From page 9*)

Comparing the treatments, we find that when used alone, superphosphate and potash give a total increase of 2117 pounds of hay, but when used conjointly the resulting increase was 3337 pounds. All differences are, of course, figured from the check plot yields.

The response for alsike clover is even more striking, total increases for the two elements being 694 pounds while their conjoint use totaled 2922 pounds.

It appears that superphosphate gave a slightly better account of itself upon red and alsike clover than it had on the preceding crops on these plots. It may be recalled that all the chemicals were applied by top-dressing, annually. As superphosphate is largely fixed in the surface layers and hence does not reach to any extent the feeding area of hay roots, it seems that plowing and working the soil immediately preceding the red and alsike clover crops served to mix these previous applications of superphosphate deeper into the soil, and that natural agencies rendered them more available to the clovers that were grown than they had been to the crops for which they were applied.

On these two pure stands of clover, nitrogen actually appeared to depress the yield, even where used with phosphoric acid and potash; the effect of manure applied four years earlier had almost entirely disappeared, and lime gave a very disappointing account of itself. These results only serve to emphasize the importance of potash on these Connecticut Valley soils, and superphosphate, too, where it can be made to penetrate the area of the feeding roots.

The results for the clovers on this terrace were very disappointing, in our opinion, in view of the sweet clover and alfalfa sods that had been utilized, except where phosphorus and potash had been applied. The land therefore was plowed following the first harvest of the clovers and given a uniform application of 10 tons of manure per acre, to more closely approximate farm practice, and seeded to winter wheat in the autumn of 1933. The wheat was used as a nurse crop for red and alsike clover broadcast in March 1934, these crops being switched in their former locations in the field. The plots were again top-dressed according to schedule.

The winter of 1933-34 was very severe in New Hampshire, and some winter-killing was noted on the wheat.

Black Locusts Will Anchor Sand

(*From page 22*)

ever, even coarse sand particles were moved long distances by saltation or a sort of jumping movement. Thus were the horse tracks of a road filled level full during these days. And in this very manner has the wind covered several acres of highly productive brown loam and sandy loam with coarse sand. Once covered with from 10 to 20 inches of such coarse material, good productive soils are forever lost from ordinary cultivation.

Obviously the economical procedure is to plant black locusts on blowing sands and thus anchor it now. Doing so will conserve for future use productive soils situated adjacent to dune sands.

The crop was harvested, however, and weighed as hay.

The average response for the various substances used on the wheat plots for both areas combined, expressed as increases in hay per acre, is here summarized.

Lime	— 240	pounds
Nitrogen	— 197	"
Phosphorus	—1565	"
Potash	—1686	"

Here again it must be remembered that there must have been much residual effect from the superphosphate and potash applied during previous years, but the data appear to be conclusive that potash is most essential even where manure has been applied, and that superphosphate stimulates yields particularly if it can be so applied as to come into contact with the feeding roots.

This summarizes in a brief manner the results of five years' work with fertilizers and lime on hay crops on one of the terraces of the Connecticut River near Claremont, New Hampshire. We feel that the need for frequent plowing so as to introduce fresh quantities of superphosphate into the soil is emphasized. Lime for alfalfa and sweet clover is indicated but is not yet so necessary for crops having a lower lime requirement. Nitrogen is important where grass alone is considered. But none of these substances can do their best without fresh increments of available potash, which, on this particular soil, appears to be the element most likely to limit the growth of the forage crops with which we have been working. We have not tried tests on all the crops in the category of Connecticut Valley farmers, but we begin to have strong suspicions as to what the results might be if we did.

Crop of Timothy Seed Seems Certain Profit

A farmer in writing to the United States Department of Agriculture asked for an opinion as to whether his profits will be greater from a crop of timothy hay or a crop of timothy seed.

Dr. Adrian J. Pieters, of the Forage Crops Division says that while no one can see into the future, timothy seed is almost certain to have a sure, high cash value. This spring there was an estimated shortage of about 33,000,000 pounds. Supplies of neither timothy hay nor timothy seed are equal to the demand.

Other hays, especially annual plants such as Sudan grass and soybeans, may appear in quantities this year if conditions are favorable, and can substitute for timothy. But there is no way to make up the shortage of timothy seed, except with timothy seed—grown in this country. Imported seed is not so well adapted to conditions here as that grown in this country. Most of it comes from the northern European countries where the days are longer and the nights shorter than in most of the timothy States.

The farmer who decides to harvest his timothy as seed still has a lot of valuable feed left in the timothy straw remaining. That is another reason why Dr. Pieters favors harvesting a crop of timothy seed this year, rather than as hay, other conditions being equal.

The Inquiring Mind *and the* Seeing Eye

(*From page* 12)

found to be as much as 6° or 8° and occasionally as high as 12° at the time of minimum temperature in the early morning. This study was continued later by the U. S. Weather Bureau and Professor Whitson's conclusions were corroborated.

Confirmed Exhaustion Theory

Studies in 1905 and 1906 disclosed that nearly one-third of the nitrogen and organic matter and more than one-third of the phosphorus originally present in the virgin soils of Wisconsin, that to date had been cropped for about 50 years, had been exhausted. This supported Dean W. A. Henry's contention that a change to livestock production and especially dairying, would be of the utmost importance to Wisconsin agriculture. From 1906 on, Professor Whitson studied the conditions affecting the availability of phosphorus to growing crops. He found that acidity of the soil greatly reduced the availability of phosphates, by forming iron phosphates which are much less available than those of calcium. This work was continued with Professor Stoddard, and the results were published in Wisconsin Research Bulletin No. 2 in 1909. It has been followed up by Professor Truog during the past 16-18 years.

In 1903, Dean Henry asked Professor Whitson to make a study of conditions in the northern part of the state. This study was made and led to the establishment of experimental fields at Superior, Iron River, and Ashland, which later resulted in the establishment of the sub-stations at Ashland, Spooner, Marshfield, and Sturgeon Bay.

The study of land drainage conditions and their influence on productivity begun in 1904, with the assistance later of Professor E. R. Jones, proved that it was practicable to under-drain the heavy red clays of the Lake Superior region. During this period field studies on the improvement of marsh, sandy, and heavy clay soils were undertaken at Mather, Sparta, Marinette, and other points in Wisconsin. The work at Sparta led to the establishment of a sub-station at Hancock. A comprehensive study of soil acidity and liming was undertaken about 1911 with the assistance of W. W. Weir.

State Soils Laboratory

In 1913, an annual appropriation of $5,000 was provided by the Legislature partially to defray the expenses of field examinations of farms and laboratory analyses of soils, under the direction of Professor Whitson. This work led to the establishment of the State Soils Laboratory and the extension work in soils now being conducted by the Agricultural Department, which work had been developed on a high standard by Professor C. J. Chapman.

The field work drew Professor Whitson's attention to the necessity of controlling losses of soil erosion and at that time, about 20 years ago, recommendations he suggested were strip farming, increased grass and hay crops on steep lands, and the putting in of dams for filling gullies as means of combating the trouble.

As an outcome of these studies the Director of the Geological and Natural History Survey, which had already made a very general map of the soils of a portion of north-central Wisconsin from data collected in connection with the geological survey, asked Professor Whitson to take charge of a new soil survey division. Largely through the interest of the late ex-Governor W. D. Hoard, the Legislature of 1909 made an appropriation for this undertaking and a detailed survey of the soils of the state was begun in cooperation with the Federal Bureau of Soils. This work has continued and has resulted in the publication of soil maps and reports on nearly all the counties of the southern half of Wisconsin, and of general or reconnaissance maps of the northern half.

Trainer of Experts

In 1926, a comprehensive report on the soils of the state was written by Professor Whitson and published as Bulletin No. 68 of the Geological and Natural History Survey. A most important result of this soil survey work has been the development and training of young men as experts in that line of service. Among these may be mentioned Jos. A. Chucka, Guy M. Conrey, T. J. Dunnewald, Oscar Magistad, A. H. Meyer, W. H. Pierre, Geo. D. Scarseth, L. R. Schoenmann, H. L. Walster, and W. W. Weir.

The study of the soil, through survey work, later drew the attention of Professor Whitson to its connection with the development of forestry. While forest growth is dependent on the soils in a complex way, it became apparent that the relation of forest growth to soils must be approached from an angle quite different than that of the relation of agricultural crops to soils. As the outcome of this matter Dr. S. A. Wilde, who recently came to this country after several years study of forest soil work in Central Europe, is now undertaking a comprehensive study of the forest soils of the northern half of Wisconsin.

The soil maps and reports prepared by Professor Whitson and his associates have been extensively used by people interested in many lines, including actual farmers, teachers of agriculture, tax and highway commissioners, loaning agencies, and especially by experts engaged in the recent appraisal work of the Federal Loan Bank, and in connection with erosion control and forest and land zoning.

In this useful way, throughout the long years of his service, Professor Whitson has kept himself interested, busy, and useful, and has also found time for much instructional teaching which he began as assistant to Professor King. His early work with the Short Course in land drainage, gasoline and steam engine operation, use of small feed grinders, and various other subjects led eventually to the establishment of the present Department of Agricultural Engineering. He also taught Long Course students, saw the class in soils grow to over 140 members and gradually exceed that number, and had the satisfaction of knowing that work in that course developed a number of outstanding men in the instructional work in Soils, including Dr. H. L. Walster, now Dean of the North Dakota College of Agriculture, Dr. Guy Conrey of the Ohio State University, and Professors E. J. Graul and Emil Truog of the Wisconsin College of Agriculture.

An Able Writer

Professor Whitson's writings on his specialties have been voluminous and of great practical value. They include his notable treatise on the "Soils of Wisconsin" published in 1926; "Notes on Soils" in 1910; and in 1912 "Soils and Soil Fertility" (with Dr. H. L. Walster). In his publications he tells us that it is the object of the soils survey to make an inventory of the soils of the state and to be a practical help to farmers in locating and describing the different soils, by determining their physical character and chemical compositions, and by offering suggestions for their management. In this useful work chemical analyses of the soils are also made to determine the amounts of various essential plant-food elements which are present. Such analyses show whether the soils contain a large store of plant food or only a small quantity, and indicate which kinds of plant food will probably be needed first. The amounts of organic matter in the soils are determined, and tests are made to show conditions relative to soil acidity.

One of these analyses showed that sediment washed from a side hill contained nearly three times as large a percentage of nitrogen and more than twice as much phosphorus as did the soil from which it had been removed. The erosion work now being done by Professors Whitson, E. R. Jones, and other assistants and engineers in Wisconsin is being undertaken to stop such losses, save many farms from utter ruin, and turn science to the practical aid of the farmer.

That, always, has been the chief object of Professor Whitson's life work and we wish him many more years of useful service, extend him the thanks of those he has benefited by his labors, and trust he will be blessed with good health and happiness in the remaining years of his life.

Micro-chemical Methods

(*From page* 17)

lime recommendations for crops that require an acid soil. For example, aluminum solubility is associated with the soil reaction and organic matter content of the soil. If a soil gives a test for aluminum in the soil extract, the soil should be limed or the organic matter content increased, or planted to a crop more tolerant to soluble aluminum. The above examples serve to show some of the instances in which the soil tests have aided in soil fertility problems. These no doubt will be extended when more information and better methods have been developed. The short chemical methods have possibly their greatest application in diagnosing the failure of some soils to grow crops. For example, one often sees spots in fields or parts of a field that fail to produce. A comparison of the analyses of the soil from both the productive and unproductive areas often reveals the source of the trouble. After the trouble has been corrected, the crops grow equally as well on all parts of the field.

The grower has long looked to the chemist for help in solving some of his problems. He has felt that there must be some way that his soil and crop needs could be diagnosed without actual experience in the field, which is both time-consuming and expensive. While too much must not be expected from a soil diagnosis, some insight to the soil fertility can be gained. The grower's response to this type of service is tremendous. In general, he is likely to be so well pleased with the results that a test of every field is wanted before the crop is planted and often several times after the crop has been planted for additional fertilization.

It is believed that the available methods are best used by one versed in chemistry and quite familiar with soils and the special requirements of the different types of plants. This person should, by all means, be familiar with the individual or the community fertility problems. As the occasion and demand arise, these experienced and technically trained persons, who understand the scientific principles underlying the common field procedures and who also are in touch with the problems of the farmers, may train and send out men to perform this service.

Sod Dams Save Soil

By A. A. Jeffrey

Editor, Missouri College of Agriculture, Columbia, Missouri

BLUEGRASS sod, cut into six-inch squares and placed in old fertilizer bags, has proved the cheapest and most effective material for building small barriers to check incipient gullies in the wheat fields and meadows of J. O. Erhart in Cole county, Missouri. In seven years of continuous use this method has given such good results that it is spreading among Mr. Erhart's neighbors and is now recommended by his State College of Agriculture throughout the State.

The work can be done at any time in the year when the beginnings of gullies make their appearance, as well as at wheat seeding time, when barriers are placed in the natural draws and depressions that invite erosion of the newly worked soil. Bluegrass sod from fence-rows adjacent to the field is spaded up in pieces about the width of the spade and half as thick. These are tumbled loosely into empty fertilizer sacks—or other burlap bags—and each sack, when one-third to one-half filled, is securely tied at the top.

These sacks of bluegrass sods are then carried to the draws or gullies and flattened out to form small barriers or dams. In many places one sack will do the trick, in others two or three are used, each being tramped down snugly to fit the contour of the ground. The coarse burlap holds the sod in place but does not prevent the bluegrass from growing through the upper sides or from sending its roots down through the lower.

Mr. Erhart, the originator of this method, points out that there is always enough fertilizer adhering to the sacks to give the bluegrass a good vigorous push and that this same remnant of fertilizer would soon rot the sacks and make it useless if saved for other pur-

J. O. Erhart and his son with the type of sod barrier used on their Missouri farm.

folks, to have them appreciate that state lines are purely geographic and legal, but never economic lines of demarcation. Countymen are groping for ways to substitute international viewpoints for nationalistic narrowness in this "diminishing" world. There are voices trying to make it clearer to cotton planters or dairymen, or any other class of tillers, that they cannot prosper through being insulated from the common hazards of all.

Our mistake of the past was to uphold agriculture in fine speeches and then break up into clans and small pressure groups in behalf of regions or commodities. The new plan aims to make land operation and rural life the real bond of national union regardless of the crop we raise or the state in which we pay taxes. So far, with a few exceptions, this plan has worked amazingly. It has shattered the old wheeze of scoffers: "farmers are always kicking but never sticking."

If county agents are able to ward off the cankering effects of too much partisan politics in connection with the present economic voting and vowing by an aroused countryside, and if the food consumers' pay envelopes meanwhile begin to fatten a trifle, I am not so much concerned over the future of farming and extension work. With those hurdles safely passed, nothing is going to stop us from eventual victory over ourselves and our basic weakness.

For there is no technicality known which outweighs the prime necessity of mankind; the belly is the boss, and a farm-made national policy for agriculture is right there in the cards, no matter who deals them.

Muck-grown Potatoes

(*From page* 20)

have been tried at the muck experiment farm. The greatest benefit has been from the overhead irrigation. Sub-irrigation was designed to maintain a uniform water table, but leakage into an adjacent drainage ditch spoiled the results to some extent. This year on the plot where a 20-inch water table was maintained, the sub-irrigation equaled the results obtained from overhead.

More care must be exercised in digging potatoes on muck than on upland soils. If at all possible, potatoes should be dug mature. A continuous web on the diggers should be used to prevent the potatoes from being dropped on the shaker. If the elliptical agitators are replaced with rollers, this will prevent shaking and if the speed of the elevator apron is slowed down, the muck will not fall through the chain so readily. The shaker attachment can be covered with rubber hose and the sides with canvas. The ends of the rods or hooks on the elevator chain can be covered with a light steel plate or old rubber tubing bolted through the frame above the apron. Picking baskets should be lined and care should be exercised in handling the freshly dug potatoes. They should not be thrown, dropped, or walked upon.

If immature potatoes are run through a brusher, they will skin and feather badly. If the potato vines are frosted, about two weeks will be required for the skins to set so they will not be badly damaged when run through the brusher.

Potatoes of high quality can be produced on a well-drained muck if a fertilizer high in potash is used. The crop can be made profitable by using short season varieties which are carefully handled and cleaned.

"ATICS"

The dusky highwayman stepped out in front of the elderly colored brother.

"Tho up you han's, boy," he ordered.

"Ah cain't; Ah gots rhumatics," replied the other.

"You kin—Ah gots automatics."

"You win, Mistah, you win," he said as his hands went up, "looks lak you' 'atics' is de stronges'."

"What shall I do?" wailed the sweet young thing. "I'm engaged to a man who just cannot bear children."

"Well," remarked the kindly old lady, "you mustn't expect too much of a husband!"

Intoxicated Passenger: "Let me off at the next stop, conductor. I thought this was a lunch wagon."

PRECOCIOUS

During dinner one day a father spoke to his son: "Sonny," he said, "I want to talk to you after dinner. I want to discuss with you the facts of life." So after dinner the son quietly closed the door and said, "Well, Dad, what is it you would like to know?"

When a married man wants sympathy he never goes to a bachelor for it.

An old-timer is one who can remember when about all the abbreviations he had to know were BVD and RFD.

MAYBE!

Mother: "You acted wrongly in disobeying me. I am punishing you to impress it on your mind."

Sonny: "Aren't you proceeding under a slight misapprehension as to the location of the mind."

"Do I really need brushing off?" asked the passenger in the Pullman.

"Does you!" exclaimed the porter with great emphasis, "Boss, I'se broke."

Lawyer: "You want to divorce this woman? Can you name any correspondent?"

King Solomon: "Not offhand, of course, but I strongly suspect the 97th Regiment of the Royal Light Infantry."

AS GOOD AS ANY

Billy's mother looked at him accusingly.

"What have you done with all your money, son?" she asked. "Your little bank is empty."

"Well, mother," answered the boy, "yesterday was a rainy day, so I spent it."

"Whenever I look at that girl I think of a hymn."

"Which one?"

"How Firm a Foundation."

Country Bridegroom (on being asked, "Wilt thou have this woman . . . . ?"): "Why, o' course! I come a-purpose!"

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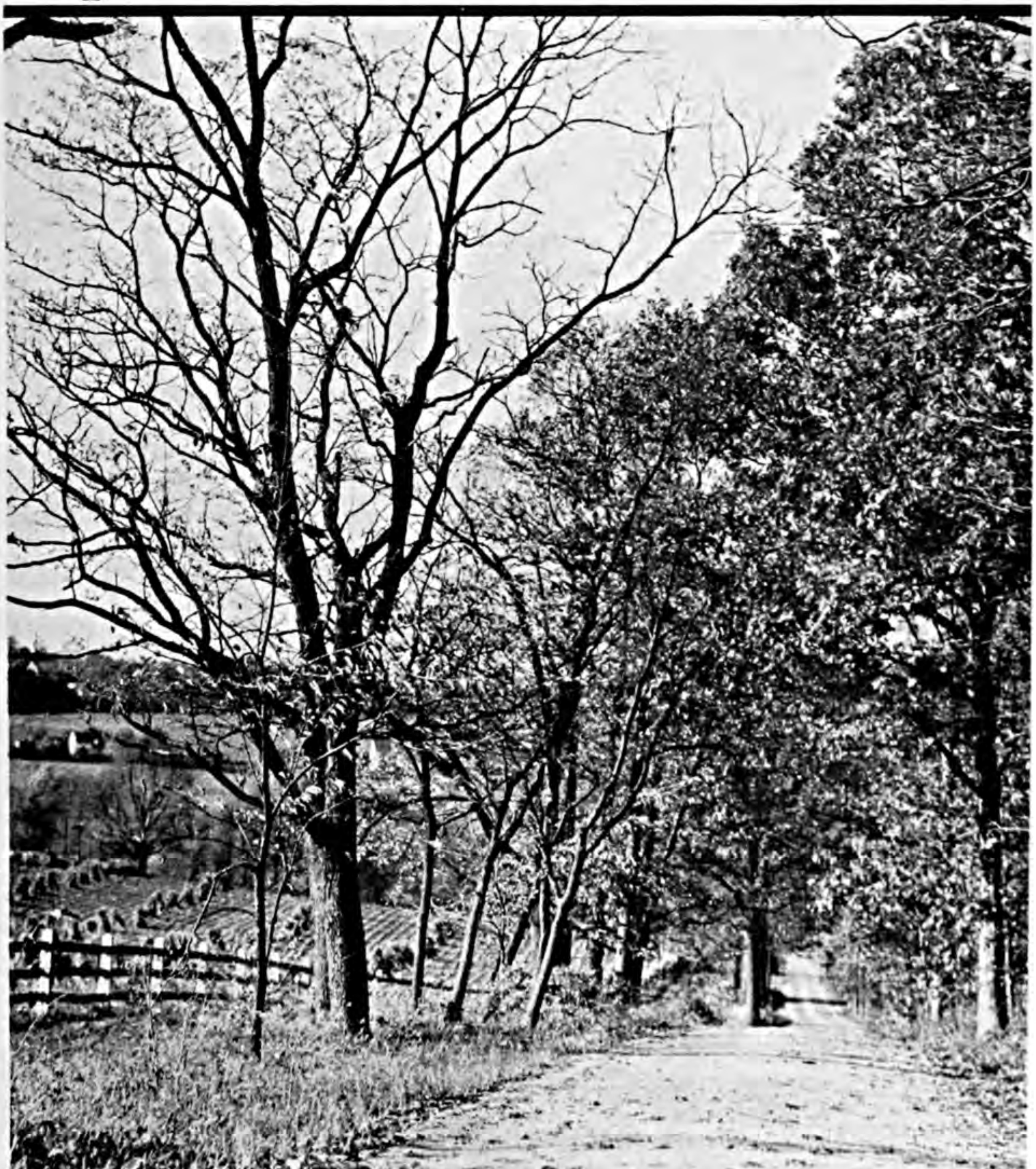
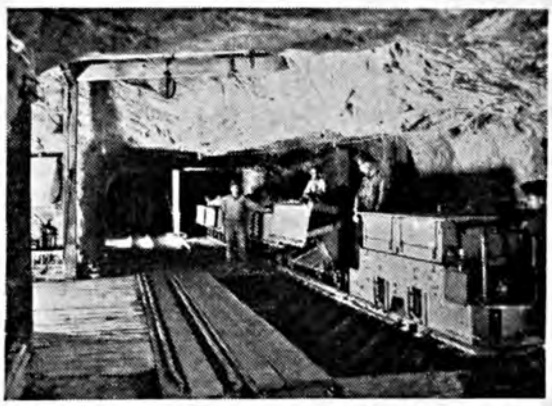


The Pocket Book of Agriculture

The refinery and warehouse of UNITED STATES POTASH COMPANY *near Carlsbad, New Mexico.*

Refinery of U. S. POTASH CO. *near Carlsbad, N. M., with tramroad leading to mine.*



Underground vein showing electric locomotive hauling ore to hoist.

Better Crops with PLANT FOOD

The Whole Truth — Not Selected Truth

R. H. STINCHFIELD, *Editor*
Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER THREE

TABLE OF CONTENTS, SEPT.-OCT., 1935

American Potash Institute, Inc.
Investment Building, Washington, D. C.
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A GOOD HARVEST INCLUDES PROVISION FOR NEXT YEAR.

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VOL. XX WASHINGTON, D. C., SEPT.-OCT., 1935 No. 3

Want a book about fairs?
Jeff says he'll write it.

All's Fair

By Jeff McDermid

BARNUM and his long train of cheerful successors in carnivals and fairs have perhaps not done as much for agriculture as Burbank or Babcock, but good old P. T. and the other purveyors of honest fun and clever sports are not without due honor in the annals of well-balanced agriculture. Hearty and wholesome relaxation has been characteristic of rural community life. This has ever been so, back in the old mother countries as well as in the pioneer and development stages of American farming.

The fine native ability of farm folks to take economic punishment at times and still bob up serenely at fall festivals, harvest homes, husking bees, and fairs has been one of the chief sources of their wonderful strength and staying power. This recurring spirit of zestful fun is an antidote against taking life too seriously. It forgets dry digits and indices and banishes curves of production, price, and income for more vibrant, amusing, and courage-building human experiences.

So the fairs of the autumn season open their gates, and we are again among the ones found gaping at the same old mildewed stunts and the same gay deceivers that intrigued us as of yore in the times of freckles, short pants, and small change. And why not? The shut-in season is ahead of us, and there's plenty of time left to study and plan beside our winter fires. But for the present fleeting moment, let's relax along the raucous midway. What could be "fairer"?

PERHAPS I will be regarded as prejudiced, having known sundry fairs in various places from the standpoint of patron, exhibitor, judge, and reporter. Just why I remain favorably prejudiced may seem a mystery. But having survived Swedish waffles at Saint Paul, much brau foam at Milwaukee, baked beans at Springfield, Mass., and escaped hot-dog barkers everywhere on the tan-back circuit, I come through with more tolerance and original zest for fairs than might be expected from such a hardened veteran.

Anticipation, they say, is more than half the fun. As a youngster I recall how long it took to arrive at the county fair—both on the calendar itself and when the real morning dawned. How we watched the promising melons and groomed the shoats and bullocks is in itself a summer's epic or a rural elegy. Then came the moment of departure in the dewy hours, after a night of loading and preparation.

We lived twenty miles from the county-seat, and this meant starting at five o'clock to be at the fair before ten. The old dog followed us to the gate and shared with the fence-row squirrels and robins our commiseration for not being privileged like us to go forth into the wide world for a day of joy.

Frequent cardboard signs on gnarly oaks and elms or painted on lichen-covered boulders along the mellow way to town kept beckoning us onward to this paradise of pleasure. An occasional driver of a spirited team would pass us in a blot of dust, calling forth estimates of ours on how much this rural dandy might have to spend for entertainment of the lass beside him. But Father would say "easy come, easy go" and remind us that we carted precious cargo of premium-earning capacity, worth far more in the end than a day of riotous rollicking.

By degrees and with some discomfort, soon discounted, our family caravan joined others and came down the main street, like an hegira of old, to the music of Luder's silver cornet band tooting on the steps of the court house prior to the general exodus of the excited villagers to the outlying arena. If the tune, most likely, was "Hot Time in the Old Town Tonight," our Father's wit would jerk to the surface with the remark that it was ninety in the shade already and he wasn't tempted to stay until evening. But as we passed the elevated dance pavilion, decorated with straggly evergreen boughs, it made some of us chaps in the upper teens feel daring enough to bust all official regulations and be a night-hawk until half-past nine—or even worse!

WHICH reminds me that one time it was the privilege of Brother and myself to be "lent" by our Mother to serve as night watchmen extraordinary at a food and lemonade stand set up during the fair to catch the nickels of the members, and otherwise, belonging to a church aid society. We did not get to any shin-dig in town, but we found out a lot about the wild man of Borneo and the bearded lady during their leisure hours. I also recall that the mosquitoes refreshed themselves at our caravansary more liberally and economically than the customers did by day.

Resuming our eager drive to the park, it seemed that the last height in the zenith of anticipation was reached when we got to the wooden arch gate and had to remain in line while Jeb Harris and his assistants checked over the season tickets we held and O. K.'d our final entrance into that haven of delight, whose varied sounds came over the planks in a crescendo of magnificent promise. From then on the day was yours, and the delights thereof are now a memory.

Judging at fairs is either an act of heroism, an evidence of super-discernment or an emergency bluff. My

service as a judge puts me in the last-named class because there were no others present at the time willing to stick out their necks. I had always yearned to wear an official badge and be escorted around in conspicuous places, but I did not get the judicial job for which I imagined I was most qualified, cake-eating culinary referee.

They pressed me into service, of all places, at my own home fair as arbiter between wrought-up local cattle exhibitors. As if the task wasn't tough enough already, they assigned me to pick, a la catalog, the grand champion bull of all breeds! To an outsider it would have been a real heroic position to assume, but you can't get old neighbors to put you in any other role than clumsy dummox under such circumstances. And to make it still more tragic, my outbound train was late!

However, as armor, I had acquired all the stage business of livestock judges whom I had followed through manure piles all over the circuit. Standing off and squinting, smoothing backs and flanks, hesitating and returning to verify, scratching the head, folding arms and frowning, shifting leaders, reshifting tail-enders, "giving the gate," and the final arm-swinging flourish of decision—I had them all mastered. Without this keen observation of the ways of the top-notchers from college departments, I would have carried away two black eyes instead of one.

Evidences of extreme deliberation and complexity in awarding is a compliment to the owners. A man who picks his winners too prosaically and swiftly is depriving the fans of half their entry fees. Like the midway itself, the judging ring must have its tinge of ballyhooly or it descends to a mere dull educational lesson; and that comes "free" with your taxes!

Much as art, science, and mechanics have moved ahead to provide the modern fair its present galaxy of rural power and might, we know that amusements have changed but little in the glorious interim. Save for an occasional midget golf course on the grounds, the blessed mountebanks and charming charlatans, with their accompaniment of whirligigs and hurdy-gurdies, hootchy-koochies and fairies-in-the-well, cane stands, corn games, and swatting racks, still pitch their restless tents as always on the fields of rural glee.

AS LONG as they keep sober and genial, or do not pick pockets by stealth when they can do so openly and at your pleasure, these kindred care-banishing souls may have the run of any cow pasture in my bailiwick for all of me.

I know they are for the most part gypsy-like and sordid, unwashed and alien to agriculture, call farmers "hay snatchers" and care only enough about processing taxes to be conveniently near when they are distributed. Yet try to keep a fair minus the mountebanks profitable in a corn-belt county!

High and mighty resolves to reduce agricultural fairs strictly to vivid and varied crop demonstrations, skull-blasting panoramas of erudition, and unbiased offerings of unvarnished truth have been made by better managers than we. Yet no heavy meal is complete without dessert; and nearly every farm table, as you recall, serves both pie and cake and maybe some sauce besides, to give you pleasure with your protein.

I FIRMLY believe that we get over larger and more potent doses of "do-something" because we have sense enough to let the customers relax on the midway and take time out from imbibing our laboratory lessons and our pageants of progress stuff. It sort of salts down the silage and gives the tired minds a recess.

What if young Zeke Smithers does spend a nickel to show his best girl how stout he is with a mallet? He'll keep the other ninety-five cents toward a down-payment on the mortgage, be sure of that. And maybe if he didn't demonstrate his prowess she would marry some guy from town and upset another ideal farm romance, with all the commercial losses in its train. Maybe after young Billy Jones sees the two-headed calf he won't be so much abused when Dad sends him to teach the latest arrival how to drink milk from a pail.

Broadly speaking, there are two general classes of farm fairs. In the first and major group are the pumpkin shows of the tall-grass regions, the central meeting place of the rural trading territory, the simon-pure survival of the original European kind. The second group may be summed up in the phrase, "a contact with agriculture is necessary to the commercial success of a metropolis." Here we have a few of the state fairs and most, if not quite all, of the national livestock classics. Both have their own respective values and disadvantages, depending on the purpose of fairs as you see them.

Having been raised in the atmosphere of the squash circuit, I lean a little toward these annual events myself. I find advantage in a cheaper gate and more old friends to meet back there behind the horse barns, where the combines and fertilizer distributors are flashing their brilliant sheen of new steel and flare of paint to a sympathetic audience of discriminating users.

It's a great old spot to dream in a gossipy way about changes in the countryside, the incompetency of sheriffs, the tendency of taxes to go up or down but never to disappear; and also the prevalence of quack grass, blind staggers, patent medicine salesmen, and bad side-roads. And then, of course, you often get quite a lot of value out of the exhibits—if you finally get around to see them.

On the contrary, at the metropolitan farm fairs one takes his gossip by the cigar counter when somebody is shaking dice with a dizzy blonde, or else in a noisy cafe. This is too distracting for the deliberate and mellow tone suited to the proper discussion of livestock goals and values.

HOWEVER, I honestly believe that as a result of fairs held in cities many very ignorant people have really discovered agriculture — although perhaps too late. If this is so, then these transplanted fairs have rendered their part in the civilization of America.

After all, it's "the little snips," as one croaker called the 4-H youngsters, who have anchored our rural fairs to the future. I guess they *are*

(*Turn to page* 45)

Apple Trees Need A Balanced Diet

By Dr. Fred W. HofMann

Agricultural Experiment Station, Blacksburg, Virginia

SEVERAL years ago it was pointed out by the writer that apple trees in general in Virginia will at least ultimately be benefited by applications of nitrogen, phosphorus, and potash in complete fertilization. In their younger history and up to the time the roots of the apple trees become crowded, the more pronounced growth and yield responses show up as a result of nitrating. As crowding progresses, direct responses in apple trees as a result of phosphorus and, still later of potash applications added to those of nitrogen, show up to the extent that such applications may give profitable returns.

In some soils of Virginia, profitable growing of apples may be carried on for 20 to 25 years or even for the entire commercial life of the orchard without the need of applying any fertilizers other than those carrying nitrogen. In most soils of Virginia, however, as apple trees increase in size, the need for phosphatic and potassic applications increases.

Experimental Data

Many questions come up in the mind of the apple grower in regard to the more profitable way of fertilizing the orchard soil. It is the purpose of this article to show several experimental results with different fertilizer applications. It is hoped that these results will provide a definite answer to various questions that may come up.

Observations were continued on the experimental orchards of the Virginia Agricultural Experiment Station planted out in the spring of 1911. These are described in bulletin 269 and other reports appearing in the proceedings of the American Society for Horticultural Science.

In the fall of 1930 and the spring of 1931 another series of experiments were set up in a near-by orchard also set out in the spring of 1911 and known as the Price orchard. At the time the fertilizer experiments were begun, these trees were about 20 years of age. The soil in this orchard is classified as a Clarksville silt loam. It is very cherty, shows a pH reading of about 6, and except for spots is of average fertility. The subsoil, composed mostly of a tight stiff clay, is seldom penetrated by the tree roots to much over a depth of two feet.

The trees, composed of York, Stayman, and Grimes Golden successively, were planted 25 feet apart with the intention of making removal as more room was needed. In their earlier years the trees made good growth, but by the time they reached 15 years of age very little growth was made because of the close planting. This slowing up of growth and general stunting of the apple trees, particularly because of close planting and root competition, provided excellent material to show what fertilization will do to stunted trees in contrast to those on the station grounds which, because of wider planting distances, were in a better state of growth.

Rate of Growth

In some cases covering 21 years, the treatments receiving nitrogen alone show growth gains over those receiving complete fertilizers. In these cases the plots receiving nitrogen alone were very definitely favored in regard to position, and had at the beginning a soil of better fertility than the plots that were treated with complete fertilizers. In spite of the handicaps, higher rates of gain were made by the complete-fertilizer treatments. Over the entire 21 years, Stayman trees treated with nitrogen alone showed a total gain of 3.08 inches circumference increase, 62 per cent of which was made in the first 11 years but only 38 per cent in the last 10 years. Another set of Staymans showed a total gain of 6.55 inches with 75.6 per cent of the gain in the first 11 years and only 24.4 per cent in the last 16 years. With a similar comparison for a case in York trees there was a total gain of 4.03 inches of circumference increase for those receiving nitrogen alone, with 61.3 per cent of the gain shown up the first 11 years and only 38 per cent the last 10 years.

A higher rate of increase of the handicapped complete-fertilizer plots to the level of the favored plots receiving nitrogen alone was also observed with terminal growth measurements. Stayman with a total gain of 9.5 inches terminal growth over a period of 21 years for nitrogen alone showed 53.7 per cent of the gain taking place the first 11 years and only 46.3 per cent the last 10 years. Another case in Stayman showed over the same period a gain of 8.4 inches terminal growth for nitrogen alone, with 76.2 per cent of the gain taking place for the first 11 years and only 23.8 per cent the last.

In one case with Yorks the handicapped complete-fertilizer plot caught up with the level of the favored nitrogen-alone plots. The total terminal growth gain in favor of the nitrogen-alone plot for the 21 years recorded was 19.8 inches. This entire gain occurred in the first 11 years, after which the trees in the complete-fertilizer plots caught up with the much more favored plots receiving nitrogen alone.

The significant observation in the cases mentioned is that in the 17th and 18th years the trees treated with complete fertilizers, in spite of their handicaps, made better rates of growth than those receiving nitrogen alone. According to this rate the prospects are that they may show even better growth responses later. The most interesting observation is that the gains of the favored nitrogen-alone plots began to recede at just about the same time that the complete-fertilizer plots started to outyield the other treatment.

Root Crowding

Certain aspects of yield responses are brought out in Table I. In this table, beside the actual yields, sliding averages over a 5-year basis were computed to smooth out the yield distribution over the 17 years of records. These sliding averages overcome the abruptness in yields that occur from year to year, thus making it more possible for a smoother comparison between the two different distributions arrayed against one another.

It will be noticed that the Stayman apple trees in one series commence to show yield gains after the 14th year, in another after the 16th, and in York series after the 17th. This corresponds as a general trend with the growth responses.

TABLE I—Actual and Sliding Average Apple Yields in Pounds of Fruit per Tree

Series I—Stayman

Year	N* Actual Yield	N* Computed Sliding Average	Check* Actual Yield	Check* Computed Sliding Average	NPK* Actual Yield	NPK* Computed Sliding Average
1918	8	2	6	1	5	19
1919	0	33	0	17	0	41
1920	0	118	0	50	0	147
1921	0	179	0	79	0	184
1922	2	264	0	154	92	250
1923	155	266	82	154	111	232
1924	433	385	168	175	533	344
1925	307	391	135	198	183	388
1926	423	508	305	286	333	551
1927	10	481	0	256	0	578
1928	750	709	186	370	673	830
1929	467	573	283	343	750	710
1930	890	643	575	419	1000	763
1931	290	581	237	380	467	704
1932	1150	678	571	427	1258	783
1933	67	441	48	356	75	546
1934	817	817	663	663	1017	1017

Series II—Stayman

Year	N* Actual Yield	N* Computed Sliding Average	Check* Actual Yield	Check* Computed Sliding Average	NPK* Actual Yield	NPK* Computed Sliding Average
1918	3	2	0	1	1	15
1919	0	13	0	3	0	18
1920	0	60	0	5	0	101
1921	0	103	0	52	0	158
1922	7	241	3	86	75	249
1923	57	239	13	115	15	254
1924	238	301	10	122	417	331
1925	213	364	233	134	283	338
1926	688	476	170	117	453	466
1927	0	509	150	158	103	561
1928	368	669	48	179	400	789
1929	550	605	67	195	450	724
1930	775	675	150	318	923	907
1931	850	650	375	360	930	904
1932	800	583	258	355	1242	895
1933	50	475	125	404	75	721
1934	900	900	683	683	1367	1367

Series III—York Imperial

Year	N* Actual Yield	N* Computed Sliding Average	Check* Actual Yield	Check* Computed Sliding Average	NPK* Actual Yield	NPK* Computed Sliding Average
1918	2	2	3	25	12	91
1919	0	21	0	46	0	95
1920	0	152	0	178	0	201
1921	0	152	0	178	0	201
1922	7	220	123	286	443	285
1923	99	219	106	262	31	203
1924	656	296	660	290	530	309
1925	0	400	0	333	0	374
1926	338	489	540	362	423	479
1927	5	629	4	404	29	481
1928	483	666	248	433	563	704
1929	1175	727	875	489	856	642
1930	448	511	141	350	525	651
1931	1038	527	753	400	430	682
1932	188	356	150	286	1144	767
1923	788	441	550	354	266	578
1934	94	94	158	158	900	900

* N = Nitrogen; P = Phosphorus; K = Potash; Check = Unfertilized.

Much quicker responses in both growth and yields occurred in the Price orchard. (See tables II, III, and IV.) These results are interesting in showing how quickly some apple trees may respond directly to complete fertilizers. Where it has taken about the 15th year for apple trees in the experimental orchard to begin to show responses to complete fertilization, marked response occurred in the apple trees in the Price orchard within three years.

The results of the experiments at the Station orchard and the Price orchard show clearly and definitely that under certain conditions apple trees are not entirely different from other plants in responding to complete-fertilizer applications. Direct effects in heavier and larger fruit buds were observed the late fall of 1931 following the spring application of that year.

It would appear that most of our Virginia orchard soils contain phosphatic and potassic material in adequate amounts to take care of apple trees through their entire commercial life. In some instances this is the case, but the point that may be overlooked is that in most Virginia apple orchards these materials become increasingly inaccessible as the root systems of the apple trees develop and displace soil in a limited space. Such trees become something like "pot-bound" plants with the root systems confined to a restricted area. (See plate I.) Apple trees reaching a physiological limit may draw upon their reserves to such a degree that they are liable to become susceptible to various stages of decline. This pulling away of the plant's stored reserves may continue some time without any discernible symptoms. However, there may be present the danger of hastening definite symptoms of nutrient deficiency. Such symptoms as die-back, greater susceptibility to wood rots, and leaf scorch have been observed to develop under such conditions. It is of particular interest to review here the statements of Hoagland and Chandler in the following quotation: *

*Some effects of deficiencies of phosphate and potassium on the growth and composition of fruit trees, under controlled conditions. Proc. Am. Soc. Hort. Sci. Hoagland, D.R. and Chandler, W.H.

Plate I—Where formerly there was soil, there is now a mass of crowded roots. Most of the apple trees in Virginia over 15 years of age are root-crowded. Root-crowding of these apple trees not only presents a problem of depleted nutrients in the soil that is left for root foraging, but also a problem of soil displacement. As this root-crowding increases with the age of the trees, further development is checked unless the necessary nutrients such as nitrogen, phosphoric acid, and potash are adequately replenished.

TABLE II—Average Annual Yield Picked Fruit 1932-1933-1934

Dean Price Orchard

Row	Bushels per tree: Grimes	York	Stayman	All Varieties	Treatment
1	1.23	1.07	1.65	1.32	Calcium Cyanamide 5 lbs. Fall
2	2.43	1.39	1.27	1.65	Calcium Cyanamide 10 lbs. Fall (none applied 1934)
3	1.74	.89	1.14	1.25	Check*
4	2.79	1.74	2.28	2.27	Sulphate of Ammonia 5 lbs. Fall
5	1.91	1.32	1.25	1.49	Nitrate of Soda 6.5 lbs. Fall
6	1.36	1.19	1.38	1.31	Calcium Cyanamide 5 lbs. Spring
7	.89	1.18	.33	.80	Check
8	1.45	1.35	1.55	1.45	Calcium Cyanamide 10 lbs. Spring (none applied 1934)
9	1.80	1.23	.62	1.22	Calcium Cyanamide 15 lbs. Spring (none applied 1933–34)
10	.70	1.19	.30	.73	Check
11	1.09	1.59	1.41	1.37	Sulphate of Ammonia 5 lbs. Spring
12	1.19	.44	.39	.67	Check
13	5.31	2.91	1.75	3.32	Ammo-Phos.13 lbs.Spring (none applied 1934)
14	3.66	3.07	2.71	3.15	Ammo-Phos. Pot. 17½ lbs. Spring (none 1934)
15	1.19	1.39	.62	1.07	Check
					Average Annual Yield 1933–34
Fall Application:					
16	3.75	2.75	4.00	3.50	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs., Sulphate of Potash 4.2 lbs.
17	4.13	2.07	2.69	2.96	Calcium Cyanamide 10 lbs. Sul. Potash 4.2 lbs.
18	4.44	2.63	2.44	3.17	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs.
19	1.82	.38	.57	.92	Calcium Cyanamide 10 lbs.
Spring Application:					
16	5.50	2.25	4.00	3.54	Same as 16 above
17	4.00	1.07	2.44	2.50	Same as 17 above
18	4.22	2.38	2.44	3.02	Same as 18 above
19	1.88	.38	.57	.94	Same as 19 above

*Check = Unfertilized.

"Among the soils from die-back areas, one produced marked stunting of growth as well as leaf scorch, the first year the trees were planted. In another soil, no certain injury appeared until the fourth year, but from the fourth to the sixth year trees *have been increasingly affected,* showing definite leaf scorch as early as June .... The heavy applications of potassium salts (in such a manner as to influence the whole mass) at the time of planting the trees completely prevented the appearance of leaf-scorch symptoms."

In orchards with lighter textured subsoils such as occur in the mountain coves and with the wider planting distances, there is more room for root development and consequent foraging for nutrient material. In such conditions apple trees are able to grow to relatively greater ages without showing any certain symptoms of definite nutrient deficiencies. Many of these trees planted in more favorable conditions of fertility and space may be exploited profitably for the greater part of their commercial life without the addition of any fertilizers whatever. In Virginia in general such exploitation will not be altogether profitable. Most Virginia apple orchards at some time of their commercial life will need all three of the essential elements, namely, nitrogen, phosphorus, and potassium. This is clearly indicated in the results of the 24-year old station orchard at Blacksburg and those of the Price orchard in the near vicinity and of the same age. Both orchards are typical in most essentials of those found in Virginia. The results secured furnish a basis for scientific and practical information, not only for most orchards in Virginia but for those apple-growing sections adjoining.

Since the more outstanding responses that generally come from nitrogenous applications have not been so generally observed in apple orchards from potash applications, their full ultimate value may be overlooked. It would be well to be aware of certain symptoms caused by potash deficiencies and be prepared to make applications to prevent certain

TABLE III—AVERAGE ANNUAL CIRCUMFERENCE INCREASE
1931-1932-1933-1934

Dean Price Orchard

Row	Inches per tree: Grimes	York	Stayman	All Varieties	Treatment
1	.82	.95	.85	.87	Calcium Cyanamide 5 lbs. Fall
2	.82	.91	.82	.85	Calcium Cyanamide 10 lbs. Fall (none applied 1934)
3	.72	.65	.65	.67	Check*
4	.96	1.06	1.01	1.01	Sulphate of Ammonia 5 lbs. Fall
5	.99	.97	.96	.97	Nitrate of Soda 6.5 lbs. Fall
6	.94	.96	.93	.94	Calcium Cyanamide 5 lbs. Spring
7	.61	.67	.66	.65	Check
8	.93	.93	.63	.83	Calcium Cyanamide 10 lbs. Spring (none applied 1934)
9	1.05	.94	.84	.94	Calcium Cyanamide 15 lbs. Spring (none applied 1933–34)
10	.73	.76	.54	.68	Check
11	.90	.99	.88	.92	Sulphate of Ammonia 5 lbs. Spring
12	.73	.74	.65	.71	Check
13	1.17	1.27	1.30	1.25	Ammo-Phos. 13 lbs. Spring (none applied 1934)
14	1.12	1.13	1.02	1.09	Ammo-Phos. Pot. 17½ lbs. Spring (none 1934)
15	.71	.69	.65	.68	Check
					AVERAGE ANNUAL CIRCUMFERENCE INCREASE 1932–1933–1934
FALL APPLICATION:					
16	1.17	1.17	1.13	1.16	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs. and Sulphate of Potash 4.2 lbs.
17	1.33	1.17	1.13	1.21	Calcium Cyanamide 10 lbs. Sul. Potash 4.2 lbs.
18	1.09	.88	.92	.96	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs.
19	1.00	.59	.75	.78	Calcium Cyanamide 10 lbs.
SPRING APPLICATION:					
16	1.17	1.00	1.00	1.06	Same as 16 above
17	.96	1.00	.92	.96	Same as 17 above
18	.83	.67	.50	.67	Same as 18 above
19	.75	.83	.84	.81	Same as 19 above

*Check = Unfertilized

mal-effects that will eventually occur in the absence of sufficient quantities of this element.

Symptoms of potash deficiencies have been reported from various sources. A brief review of several reports will indicate how serious such deficiencies may be.

According to Davis and Hill of the Canada Department of Agriculture, those series lacking potash exhibited foliage of a good dark-green color until well into the fruiting season, but the plants were not as large nor as vigorous as the full nutrient solution plants. "The foliage gradually became dull, losing its lustre and by the end of the fruiting season the leaves began to curl considerably and exhibited a bronzing with considerable purple on the under side of the leaf. This color, by late summer of the first fruiting, had spread to the upper surface and occupied the entire margin of most leaves, with only the center showing green."

Garber of England shows, "In recent years the balance of the fertilizer

TABLE IV—Average Annual Terminal Growth—1931-1932-1933-1934

Dean Price Orchard

Row	Inches per tree: Grimes	York	Stayman	All Varieties	Treatment
1	2.8	2.1	3.7	2.9	Calcium Cyanamide 5 lbs. Fall
2	2.3	2.0	3.2	2.5	Calcium Cyanamide 10 lbs. Fall (none applied 1934)
3	2.0	1.5	2.5	2.0	Check*
4	2.8	2.0	3.3	2.7	Sulphate of Ammonia 5 lbs. Fall
5	2.6	1.8	2.9	2.4	Nitrate of Soda 6.5 lbs. Fall
6	2.7	2.0	3.2	2.6	Calcium Cyanamide 5 lbs. Spring
7	1.7	1.5	1.9	1.7	Check
8	2.6	2.0	2.4	2.3	Calcium Cyanamide 10 lbs. Spring (none applied 1934)
9	2.9	1.7	2.4	2.3	Calcium Cyanamide 15 lbs. Spring (none applied 1933–34)
10	1.8	1.4	1.8	1.7	Check
11	2.1	1.4	2.6	2.0	Sulphate of Ammonia 5 lbs. Spring
12	1.5	1.1	1.8	1.5	Check
13	4.3	3.2	4.8	4.1	Ammo-Phos. 13 lbs. Spring (none applied 1934) (only half of trees fertilized 1933)
14	3.9	3.2	6.8	4.6	Ammo-Phos. Pot. 17¾ lbs. Spring (none 1934)
15	1.3	1.3	1.7	1.4	Check
					Average Annual Terminal Growth 1932–1933–1934
Fall Application:					
16	3.5	2.1	3.5	3.0	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs., Sulphate of Potash 4.2 lbs.
17	4.2	2.6	5.0	3.9	Calcium Cyanamide 10 lbs. Sul. Pot. 4.2 lbs.
18	3.6	2.0	6.1	3.9	Calcium Cyanamide 10 lbs. Acid Phos. (20%) 13 lbs.
19	2.9	.9	1.5	1.8	Calcium Cyanamide 10 lbs.
Spring Application:					
16	2.6	1.3	2.4	2.1	Same as 16 above
17	1.6	1.0	1.6	1.4	Same as 17 above
18	1.6	.7	1.1	1.1	Same as 18 above
19	1.3	.7	1.2	1.1	Same as 19 above

*Check = Unfertilized.

treatment usually given to fruit trees has been called into question in connection with a trouble known as 'leaf scorch.' This consists of a browning of the edges of the leaves, and is associated with general unthriftiness and lack of vigor in the trees. *These symptoms have been shown to be related to deficiency of potash and excess of nitrogen* . . . the foliage of plots receiving very heavy nitrogenous dressings shows in the absence of potash a dying off of the margins of leaves very similar in general habit to the leaf scorch of fruit trees. . . . Where liberal use is made of nitrogenous fertilizers, the need for potash is therefore increased."

Gildehaus points out in the Botanical Gazette that it is well known that leaf scorch is a symptom of potash starvation, and this is verified in recent experiments. "The addition of a greater amount of potassium . . . greatly reduced the amount of affected foliage. The addition of an excess of potassium eliminated all scorching tendencies. Trees which were supplied with an excess of nitrogen were also found to develop a severe case of leaf scorch. When this amount of nitrogen was reduced to one-third, practically no scorch was developed. The results of these foliage observations seem to indicate that development of leaf scorch on apple trees is favored by a wide N/K ratio in the nutrient media. . . . In support of the absence of an adequate supply of potassium, the trees were unable to support the area of the foliage produced. This suggestion is supported by the fact that when production of large leaves is stimulated by the addition of nitrogen, leaf scorch which reduces the area of living foliage becomes more pronounced. Conversely, by reducing the nitrogen supply and consequently rendering the plant less vigorous vegetatively, the potassium supply appears to be adequate for the smaller leaves produced and leaf scorch does not appear."

Janssen and Bartholomew in the Journal American Society of Agronomy say they find there is an inverse relationship between the potassium and nitrogen content of the plant where there is insufficient potassium for normal growth.

Wallace of England mentions that it has been shown that potash deficiency in fruit trees is an extremely serious problem in the important fruit areas of this country. "As a result of such deficiency, fruit plants such as the apple, gooseberry, black currant and red currant exhibit the condition known as leaf scorch. . . . Trees on the nitrate of soda plots

Grimes apple tree—No fertilizer.

have been shown to be suffering from potash deficiency by treating a portion of the plot with sulphate of potash, the potash treatment having produced a marked growth response and resulted in the elimination of leaf scorch in three seasons. . . . A very large number of cases have been investigated and, in every one, it has been found that the healthy trees were high-potassium trees and the scorched trees of low-potassium content, thus showing the patchy nature of potassium deficiency in the field."

Hoblyn, another English investigator, explains that the most important manurial information which has been obtained from his experiments with very different varieties is the necessity of having in soils a proper balance between nitrogen and potash. For yield, nitrogen alone has been not only ineffective but inadvisable except in the presence of potash.

Experiments by the two Missouri investigators, Murneek and Gildehaus, show interesting results with groups of semi-dwarf apple trees which have been planted in quartz sand and loess soil in tubs. "These trees have been fertilized with in-

Above: Grimes apple tree—Nitrogen only.

Below: Grimes apple tree—Complete Fertilizer.

creasing and decreasing amounts of nitrogen and potassium while the phosphorus content of the fertilizer has been kept constant. When the nitrogen was increased without a corresponding increase in potassium supply, marginal scorching of leaves was induced. Increasing its potassium content obviated this harmful effect of the fertilizer."

According to the more recent report of Shaw, of the Massachusetts Agricultural Experiment Station, nitrogenous applications to apple trees that were not doing so well seemed to injure rather than improve the condition of the trees. The observations suggested to this investigator that the leaf burn and general poor condition of the trees in this orchard may be due to lack of potash in the soil.

The effects of potash deficiencies upon apple trees are touched upon by Munson of the Maine Agricultural Experiment Station as early as 1908. He reports as follows:

"In August, when about the size of walnuts, the fruits (apples) began to crack and drop. Marked indentations, somewhat similar to those made by curculio, were abundant. No evidence of insect work could be discovered, however. When the fruit was opened, the tissue under the indented parts was found to be dry and brown. Most of the fruit ceased to grow, and by the first of September the larger part of it was on the ground; though early in the season all the trees were well loaded. . . . Though a small portion of the fruit was on the trees at harvest time, it dropped so easily that no attempt was made to save it for packing. The slightest jarring of the limbs caused it to fall. . . . It was then observed that the condition existed only on certain trees included in a fertilizer experiment in which an excess of available nitrogen is applied every year. The first tree noticed was in the plot which received nitrate of soda and acid phosphate, and later it was found that every tree on the plot, as also on the adjoining plot which received nitrate only, was affected as described. In one or two instances check trees which adjoined the nitrate plot, and received no direct application of fertilizer, showed a tendency in this direction. A fertilizer plot on which were muriate of potash and acid phosphate, and another on which was muriate only, separated from the first by only a single row of trees, were entirely free from this disease. . . .

The supposition was, therefore, made that the trouble was physiological and due to the excessive amount of available nitrogen and the lack of potash."

Several very striking observations suggesting potassic deficiency were found in the Price orchard, especially in the row of trees receiving heavy applications of ammoniated phosphorus. Some most interesting cases of cross-feeding into the next row treated with complete fertilizer only 25 feet away were found. On the side next to the unfertilized row, several marked symptoms were found in the ammoniated-phosphorus row the second season after the fertilizer applications were made. The symptoms showed up to a much less extent on the side of the row next to the one which received a complete-fertilizer application. Likewise these symptoms showed up also but somewhat less in that side of the check row next to the one that received only ammoniated phosphorus. The most outstanding symptom on those portions of the check trees cross-feeding into the ammoniated-phosphorus row next to the complete-fertilizer row was the earlier dropping of fruit. There was also a high prevalence of cork spotting and later of Sporotrichum malorum spots. (See plate II.) The variation of these symptoms in the ammoniated-phosphorus row on the side next to the completely fertilized rows was likely due to a certain degree of cross-feeding of some of the roots of the trees in the ammoniated-phosphorus row into the completely fertilized row. This seems a very logical conclusion because the row treated with complete fertilizer was almost free of these symptoms.

Plate II—Typical cork and Sporotrichum malorum spotting found on Grimes Golden apple trees not receiving potash applications. These two types of spotting were prevalent to the greater degree in plats fertilized with nitrogen and phosphorus without potash and noticeably less where potash was added or where there was evidence of cross-feeding into the potash plats.

There is a very interesting connection between certain tissue malformation resulting in corked tissue and the absence of sufficient amounts of potash. This type of disorder is most frequently an aftermath of earlier dry, hot summer spells particularly in orchards underlain with rock or heavy impenetrable subsoils and in certain irrigated districts when a sufficient amount of water is not applied. This is also present during dry, hot seasons in root-crowded and heavy sod orchards.

Evidences of this histological disorder, though in a general way somewhat similar, may become localized and thus are often referred to by such various names as "drought spot," "cork spot," and "York spot." In these cases the corking penetrates the flesh of the apple in varying degrees. The term "crinkle" is also used with apples in which the tissues are more or less "marbled" with corky cells causing a crinkled appearance on the apple.

During the dry spells mentioned, the potash intake is very likely slowed up to such a degree that even if it were present in sufficient abundance in the soil, it could not be taken up in adequate amounts. In seasons of abundant early summer rainfall, there is very little of this spotting, particularly in orchards that have been given potash manuring. This was brought out in the past season of 1934 for Virginia which was outstanding for a moist summer and for fruit of high finish and texture. Even in soils that have not been so liberally manured with potash salts, with an abundance of moisture there is some chance for a better distribution of the potassic material that may be reached. With adequate moisture facilitating a greater solution of the various salts, even in crowded orchards there is some chance of potassic materials coming in from unexploited areas to within the root-occupied soil areas. All this helps to contribute towards a better nutrient balance and, as consequence, a fruit of better finish and quality.

Keeping Quality

During 1933 and 1934 fruit was selected from apple trees treated with different fertilizer combinations. The selections were made from the following plots: 1-nitrogen only; 2-phosphorus and nitrogen; 3-nitrogen and potash; 4-nitrogen, phosphorus, and potash; and 5-check (no fertilizers). Ten lots were selected for each one of these treatments to be tested for pressure at 10 different periods from November to April. Each lot was so selected that each one had the same number of apples of the same size and the same degree of color and so that the comparison was on the same level except for the fertilizer treatment. In every case significantly higher pressure tests were found in those treatments which included potash over those in which this manurial salt was absent. The lowest percentage of breakdown occurred in the lots having the higher pressure tests and those coming from the plots which included potash as a fertilizer.

More Evidence

Recent results reported by Davis, of Canada, indicate the important bearing on the value of balanced fertilizers as an aid to better keeping quality of fruit. According to this worker it has been the general experience in his section that high nitrogen feeding and possibly high nitrogen and phosphorus feeding are the two greatest factors in destroying the keeping quality of apples. It has been found that the ill effects of high nitrogen can be overcome by the addition of potassium in so far as vegetation is concerned. The author makes special emphasis on impressing the fruit grower that a highly vegetative apple tree, making excellent growth and possessing good-looking foliage, is not necessarily capable of producing good-keeping fruit. Davis also presents some tabular evidence to show the value of nitrogen, phosphorus and potash balance. The per cent of spoilage from internal browning that he reports is as follows: 9 nitrate only—32 per cent; 9 nitrate and 6 slag—12 per cent; 3 nitrate and 6 slag—100 per cent; and 9 nitrate, 6 slag, and 3 potash—none. It is pointed out that where nitrogen has been fed alone, the spoilage due to core flush has been considerable, viz., 32 per cent; but that where nitrogen has been fed in conjunction with a reasonable amount of slag, this has been reduced to 12 per cent; where an excess of slag over nitrogen has been used, it has jumped to 100 per cent; and that where potash has been added there is a drop in percentage from the 12 per cent to no spoilage.

(*Turn to page* 40)

Ladino pastures in the Oakdale, California, district carry 20 sheep per acre for 60-90 days twice during the season.

Ladino Clover *to the* Rescue

By M. E. McCollam

San Jose, California

MANY a heroic role has been played on the farming stage by clover. Throughout the world it has continually been making crop rotations more effective by improving soils and furnishing better forage.

California, at first thought, would seem an unlikely place to once more cast clover as a hero. Alfalfa has been the exclusively favored forage in this State for a long time. Clover seemed to be able to perform its wonders only in the more humid northern regions. The improbable has happened, however, and nowhere has there been a more sensational and thoroughly satisfactory clover performance given than in the community of Oakdale, California. In this particular case, the hero is one of the younger members of the clover family, economically speaking. Its first name is Ladino.

Ladino clover came to the United States from Italy years ago. It appears to be white clover's big brother, having the same creeping habit and the same white blossoms, but a much larger and more luxuriant growth. Ladino seed was distributed for trial all over the country, and it is still being tried each year in many different localities. In the West, Ladino found favor in the Twin Falls section of Idaho, and in some sections of Washington and Oregon. Finally, it is now well established in California and has given tremendous impetus to our interest in irrigated pastures.

At Oakdale, California, the Ladino

development is making progress that in telling sounds fantastic. This locality is the center of a large stock-raising industry and an irrigation district comprising 75,000 acres. Not very many years ago the community was in bad financial condition which was fast becoming worse. Alfalfa would not grow; grain crops were not particularly good; and feed became such an expensive item to produce that a steadily growing number of farmers faced failure. The dark future faced by the farmers was, of course, shared by the merchants and the bank.

Fortunately for the community the president of the First National Bank of Oakdale, Mr. W. Rodden, had enough practical farming experience to know what was wrong and enough vision to see that a high-quality, high-producing forage crop would change the whole picture. Ladino clover first came to Mr. Rodden's attention in 1928. He was quick to recognize the possibility of irrigated Ladino pastures in his district, and after the first trials, he knew that here was the plant that could rebuild his community. It takes plenty of effort and enthusiasm to establish a new crop and a new system of farming. Mr. Rodden set about his task, did the work well, and the crop "took hold." Ladino has now reached the stage where it is spreading out of its own momentum, and one sees many fields from 200 to 1,000 acres being prepared for seeding.

In preparing land for Ladino, no attempt is made to level the rolling land, because of the shallow nature of the soil. In such locations the land is smoothed over and contour checks constructed for irrigation. It is amazing to see some farms that are quite rolling, but where every square foot can be irrigated by means of ingenious ditching and contour checking. On fairly level land careful leveling is done, and narrow border irrigation checks constructed.

Ladino takes its water frequently in small doses. The total requirement of irrigation water, however, is no more, and probably less, than for

(*Turn to page* 37)

Ladino clover—Unfertilized.

Ladino clover—Fertilized.

The Inquiring Mind *and the* Seeing Eye

By Dr. A. S. Alexander

University of Wisconsin

GERMANY has been the birthplace of many a man who, on coming to America, has more than "made his mark," especially in the field of chemistry and chemical research. Of these, it is our privilege this month to introduce to the readers of *Better Crops* Dr. Oswald Schreiner, who has earned an enviable reputation as Chief of the Division of Soil Fertility Investigations in the Bureau of Chemistry and Soils of the United States Department of Agriculture.

His parents brought him to Baltimore, Maryland, when he was but eight years old and at once gave him the benefit of a liberal education which in time developed in him to the highest degree those attributes of application, thoroughness, industry, and exactitude which have characterized so many scientists of his race, and enabled them to accomplish wonders in their chosen vocations.

Pleasure in Work

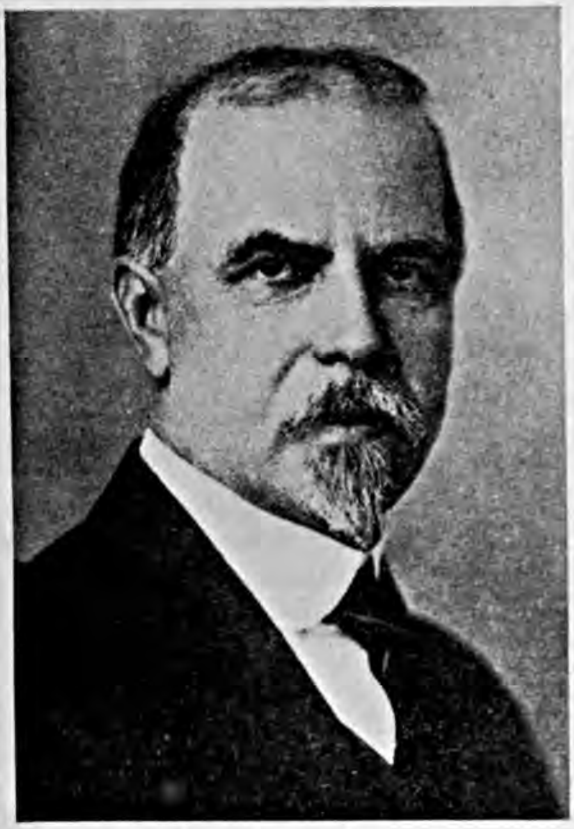
Work for the young immigrant proved a pleasure from the first, and being carried on in a congenial environment and encouraged by the kindly interest of all who recognized the inherent ability of the boy, he progressed apace and soon attracted attention. Destined to succeed and given facilities and efficient training in the land of his adoption, nothing could deter his progress, and when manhood's days were attained he had forged to the top and been given an opportunity usefully to exercise his genius for field and laboratory work in his chosen subject.

The amount and variety of work Dr. Schreiner has accomplished is stupendous and yet, today, he is not satisfied to rest from his labors but goes on, undaunted, tackling new projects and problems and as keenly as ever seeking their solution.

Achievements Are Many

A detailed category of his achievements would require much more space than is at our disposal, but a few of them may be recorded here. One of the notable ones has been the origination and introduction, with the aid of J. J. Skinner, of the "Triangle" or fertilizer ratio system to cope with soil fertility and fertilizer problems. This method has, for many years, been used in the Government soil fertility greenhouses and laboratories to study the effect of organic compounds isolated from soils and found either beneficial or toxic. Later, the Triangle method was made applicable to field work for determining the fertilizer requirements of prominent soil types over wide areas of the United States, including such crops as cotton, potatoes, sugar beets, sugar cane, and the citrus fruits, etc.

Details of the method were explained and illustrated in a paper on the subject presented by Dr. Schreiner at the Tenth Annual Meeting of the American Society of Agronomy, Washington, D. C., November 13, 1917, and printed in volume 10 of the Journal of that Society for September 1918. The presentation attracted great attention, and the system it described was regarded as a sufficiently comprehensive basis, with proper and careful attention to soil differences as far as they can be mapped in advance or in the course of the experiments, for the proper interpretation and easy presentation and handling of the results.



DR. OSWALD SCHREINER

Dr. Schreiner's development of methods for determining water-soluble plant-food constituents also has been an outstanding feature of his scientific career and he has, further, made important studies, with his able assistants, covering the physiological relation of the so-called rarer elements to the health of plants and the human race. While modern research has been largely devoted to the study and application of nitrogen, phosphorus, and potash, it has been Dr. Schreiner's belief and contention that deficiencies of the rarer elements in soils and plants also can exist, so that there is good reason for the study of their role in plant and animal physiology, which is occupying the attention of many research men at the present time. Of these elements Dr. Schreiner mentions manganese, copper, boron, iodine, zinc, arsenic, barium, strontium, calcium, chromium, vanadium, aluminum, and silicon.

Dr. Schreiner is likewise noted as the inventor of the Schreiner colorimeter which, on account of its great applicability to various lines of research, is widely used in chemical laboratories in this country and abroad. His laboratory researches upon the fundamental principles of soil fertility, especially that relating to the chemistry and biochemistry of soil organic matter or humus, and its function in promoting or hindering plant developments, have won for him and his associates a leadership among soil scientists at home and abroad. To the Government laboratory, under his direction, belongs credit for the chemical discovery, physical separation, and plant physiological study of more than 50 new soil compounds, which have materially altered the fundamental conception of scientists regarding soil humus and its functions in crop production.

Winner of Prizes

The Ebert prize was awarded Dr. Schreiner in 1900 for chemical investigations on sesquiterpene hydrocarbons and derivatives, and also the prize of the American Pharmaceutical Association for chemical investigations on sesquiterpenes. In 1912 he received the Longstreet medal of merit for "important researches in agricultural chemistry" from the Franklin Institute. He is the author of many scientific papers on the chief subjects he has studied and has been an attractive and instructive lecturer at agricultural colleges, clubs, and scientific societies and before Farmers' Institutes.

Among the many recent "jobs" undertaken by him is that delegated to him by Secretary of Agriculture Wallace at the request of the National Recovery Administration to represent the U. S. Department of Agriculture in all fertility grade reduction work, thereby providing for Federal cooperation with State Agricultural Authorities and the fertilizer industry at all hearings on this important matter.

War Service

Dr. Schreiner and his laboratory assistants also rendered eminent service to the government as chemists during the World War. This service consisted of organic chemical research and the preparation of some 20 rather unusual chemicals for the use of the gas warfare investigations, in cooperation with the American University Experiment Station; the preparation of several hundred pounds of organic chemical mannite necessary in the medical work of the army, in cooperation with the medical supply depot of the United States Army; the investigation of methods for the manufacture of metol, needed in the photographic work of the war, that led to the devising of the method for the preparation of this German chemical, which was registered as a public service patent.

He also worked on fertilizer matters connected with the utilization of by-products and excess products of the Ammonium Nitrate plant at Perryville, Md., in cooperation with the ordnance division of the army; investigations and reports on war fertilizers for sugar cane culture, especially as to the replacement of ammonium sulphate with sodium nitrate, in cooperation with the food administration and war trade board; cooperation with the national research council and the ordnance division of the army on various chemical matters; and utilization of excess war materials for fertilizers, in cooperation with the ordnance division of the army and the national research council.

He is the author of "The Sesquiterpenes" (1904); "Colorimetric, Turbidity and Titration Methods Used in Soil Investigations" (1906); "The Chemistry of Soil Organic Matter" (1910); "Lawn Soils" (1911); "Nitrogenous Soil Constituents" (1913); as well as numerous contributions to scientific journals.

On September 1, 1934, his division was transferred to the Bureau of Plant Industry.

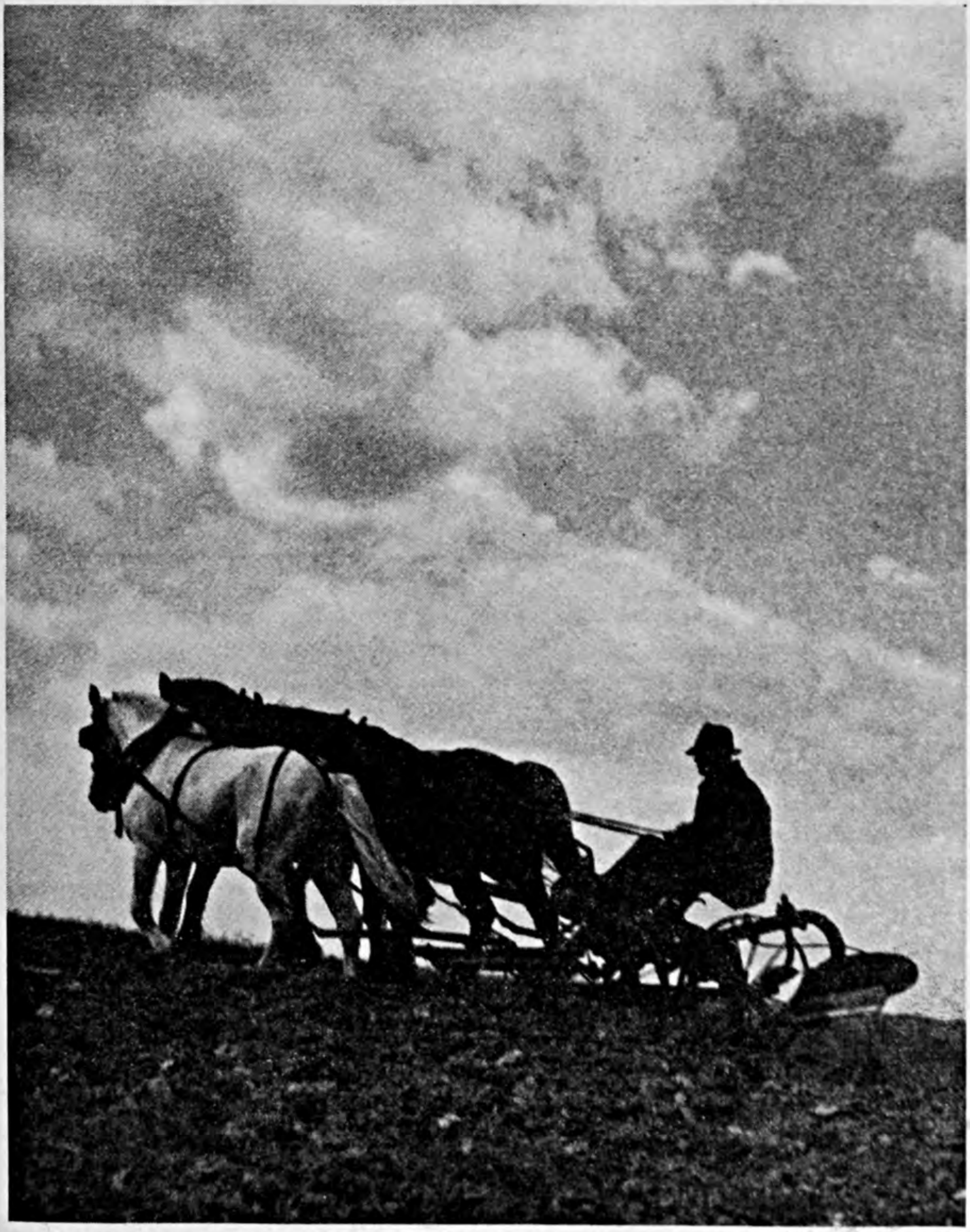
Oswald Schreiner was born in Nassau, Germany, May 29, 1875, the son of Louis and Susanne (Volkert) Schreiner, who came to Baltimore, Maryland, in 1883. After preliminary studies in the local schools, he entered Baltimore Polytechnic Institute. He graduated from that school in 1892, and from the Maryland College of Pharmacy in 1894, with the degree of Ph.G. He was an honor student, having been awarded three gold medals for proficiency in chemistry. Thereafter he continued his studies in the graduate class of 1894-95 at Johns Hopkins University, and then at the University of Wisconsin.

Degrees at Wisconsin

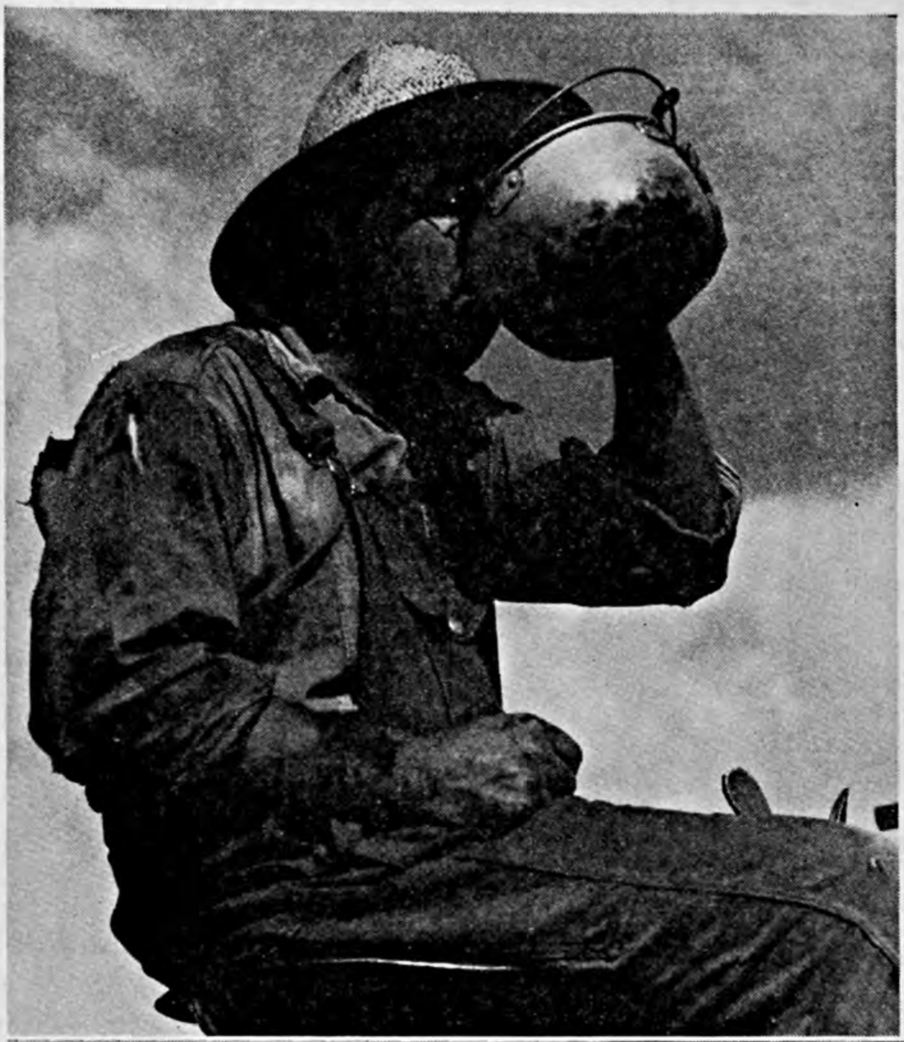
In the latter institution he was a Research Fellow, 1895-96; Assistant in Pharmaceutical Technique, 1896; Instructor in that subject, 1897-1902, and Instructor in Physical Chemistry 1902-03. From the University of Wisconsin he received the degree of B.S. in 1897; M.S. in 1899; and Ph.D. in 1902. In 1902 he was married to Frances, daughter of Ralph McDougall Rector of Delavan, Wisconsin. They have two children,

(*Turn to page* 41)

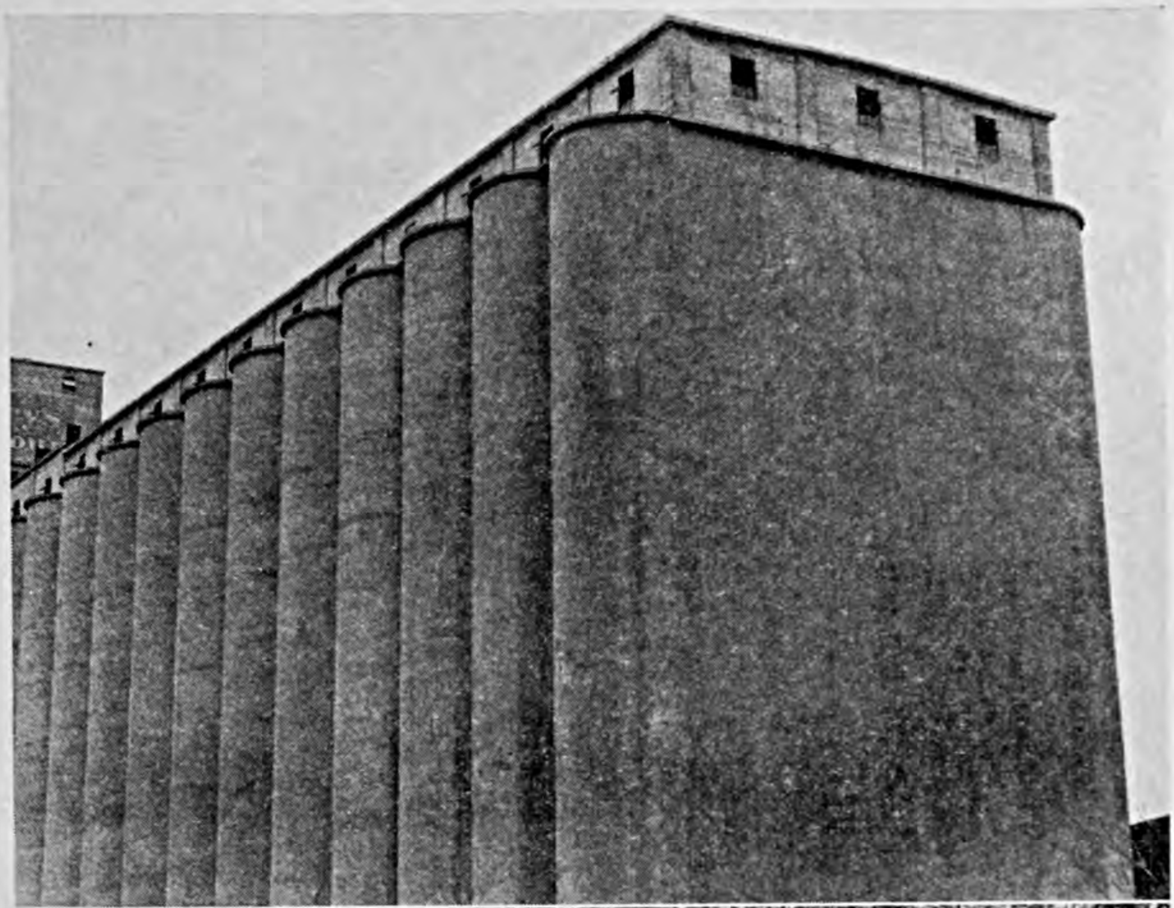
Pictorial



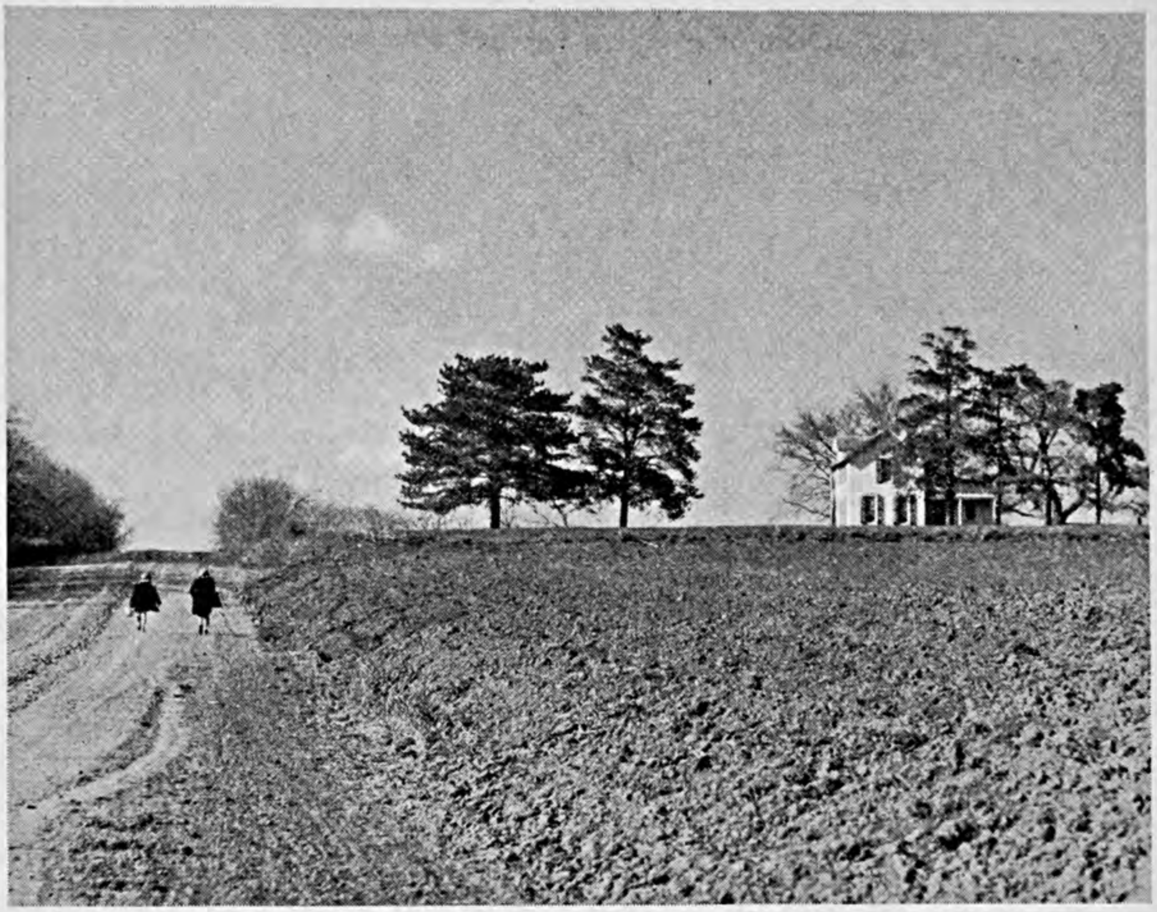
A PROGRESSIVE FARMER TURNS ARTIST'S MODEL.



Respite from Harvest Toils.



Symbols of the Ever-normal Granary.



Town and Country—School Days

The Editors Talk

We Shall Miss Them

Since our last issue, the life's work of three prominent men, well-known to our readers, has been completed. Well-earned were the fine tributes which have been paid them in the press and to them we can only add an expression of our own deep sense of loss—a loss occasioned not only by the passing of three notable and outstanding personalities, but by the cessation of three great sources of authoritative information and counsel based on long and fruitful years of experience and productive work.

Dr. Curtis F. Marbut, for many years Principal Soil Scientist and Chief of the Soil Survey Division of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, died on August 25 in the English hospital at Harbin, Manchuria. In spite of frail health and protests of friends, Dr. Marbut, after attending the Third International Congress of Soil Science at Oxford, England, at the request of the Chinese Government was en route to that country to make a study of the soils of China.

For 25 years Dr. Marbut had had supervision of the soil survey work of the U. S. Department of Agriculture, which has mapped approximately a billion acres of land, or about half the agricultural area of the United States. As a guide to farm practice, this inventory of soil resources is one of the most important parts in the scientific foundation of this country's program for agriculture. In addition, Dr. Marbut had examined and classified the soils in every country of western Europe, had directed the classification of the soils of Africa, and had made a study of the soils of South America.

In our April-May 1935 number, we were very pleased to present to our readers Dr. Alexander's tribute to the life work of Dr. Marbut. A strange coincident of fate willed that soon after sending us his article on Dr. Marbut, he too was called away.

Dr. A. S. Alexander died at his home in Madison, Wisconsin, on July 12. A nationally-known veterinary scientist, this beloved character was also a poet, an artist in water colors and oils, a scholar of original Greek and Latin, and a writer, whose writings over a period of 40 years in agricultural papers throughout the United States as well as for Scotch and English publications had won for him a large following.

For three years prior to 1890, Dr. Alexander was editor of the Farmer's Review, Chicago. With others he founded the Chicago Veterinary College where he served as professor of veterinary science and livestock breeding and feeding until 1907. He then went to the University of Wisconsin to fill the newly created chair of Veterinary Science, which he held until his retirement in 1930.

Dr. Alexander, already well-known to a great many of our readers, became a regular contributor to Better Crops With Plant Food in May 1930 when he started his series of articles, "The Inquiring Mind and the

Seeing Eye." These resumés of the life work and contributions to agriculture of outstanding scientists appealed so greatly to our readers that each subsequent issue of the magazine has contained one of Dr. Alexander's tributes. At the time of his death he was working on some in advance, and these we hope to have completed and published.

Quite as well-known in another field and particularly in the South was John S. Carroll, who passed away September 15 at his home in Jackson, Mississippi. For more than 30 years, Mr. Carroll had been associated with the potash interests in agricultural and scientific work. To think of potash in the South was to think of John Carroll with his gracious personality and sincere imparting of authoritative information on the practical use of this plant-food element.

Mr. Carroll's early training included the teaching of chemistry in the Mississippi Agricultural College and service as assistant State Chemist with work in connection with the Inspection and Analysis of Fertilizers. At the time of his death, he was manager of the Southwest Territory for the American Potash Institute.

And so we can but add our word to those of the countless others who will miss these men. They will not be forgotten. Work well-done, service for the betterment of humanity, memories of kindly personalities live long, and appreciation of their qualities grows with the years.

The Farmer's Partner

It has been said that the man who makes a partner of his soil, who strives to understand its mysteries and its peculiarities, is much more likely to be a successful producer of profitable crops than is the farmer who considers the soil but mere dirt, a slave to be driven without mercy.

Harvests are in. Yields are computed. The late fall days ahead provide an excellent time for the farmer to check up on his partner, the soil, and see if it produced in line with his expectations at the beginning of the growing season. Partners in their capabilities vary. Soils differ greatly in their characteristics. Yet a good manager knows his partner and his resources. A good farmer should make just as much of a study of his soil's productiveness.

Disappointments in harvest, within a farmer's means of control, should not be allowed to repeat. Expenditures for good seed, careful cultivation, sprays, etc., are expenses which the soil will waste if it does not naturally contain or is not provided with the plant food necessary to feed a quality crop. While the soil is now recognized as a living, vital, changing thing, it cannot fulfill orders unless it is equipped to do so. No more than a factory can produce beyond its capacity, can a soil grow crops for which it does not have the necessary plant foods.

The general recommendations of agronomists and soilsmen for the fertilizing of any particular crop or type of soil usually bring profitable returns. However, no two farms have soils which are entirely similar. Far more satisfactory results accrue when such recommendations are followed with a check-up of harvests against expectations. This is the time to do it.

REVIEWS

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

Fertilizers

An interesting series of experiments with different types and combinations of fertilizers when used in a rotation is summarized in Pennsylvania Agricultural Experiment Station Bulletin 315, "Field Experiments with Phosphates," by C. F. Noll, C. J. Irvin, and F. D. Gardner. As the title implies, the main object of the work was a comparison of different amounts and carriers of phosphates. However, the treatments were such that the effects of varying amounts of potash, the value of manure and nitrogen, and the influence of sulphur could be determined. Superphosphate and large applications of rock phosphate gave high net returns under the conditions of these experiments. Increasing the muriate of potash applications from 50 to 100 and 150 pounds per acre increased the yields in each case. The authors state: "It would seem that even a larger amount than 150 pounds per acre could be used profitably." As used in this work, nitrogen was not profitable. Manure, supplemented with phosphates gave good increases in yield, but when compared with commercial fertilizer, it was found to have a value of only $1.24 a ton in crop-producing ability. Gypsum and sulphur, added to rock phosphate, both increased yields over rock phosphate alone.

A handy and practical chart of fertilizer recommendations for Ohio has been prepared by R. M. Salter and E. Jones in Ohio University Agricultural College Extension Service Bulletin 136 entitled "Fertilizing Field Crops In Ohio." The amounts and analyses of fertilizers recommended for the most important crops of the state when grown on various soils in different types of management are tabulated. Other information and suggestions on the use of fertilizer are included in this handy publication.

Changes in the average fertilizer analyses used by farmers and in the average price per pound of plant nutrients in commercial fertilizer are shown by C. S. Cathcart in New Jersey Agricultural Experiment Station Bulletin 582, "Analyses of Commercial Fertilizer and Ground Bone; Analyses of Agricultural Lime, 1934." For example, the average nitrogen content of New Jersey mixed fertilizer increased from 2.94% in 1925 to 4.19% in 1934; available phosphoric acid increased from 8.41% to 9.25%; while potash increased from 5.77% to 6.88%. These figures show that farmers are using more concentrated fertilizers with relatively more nitrogen and potash than ten years ago. Fertilizers have become much cheaper during this period, as the average retail cost of one pound of plant nutrient was 11.0c in 1925, while it was only 7.2c in 1934. Other tables on tonnages and analyses of fertilizer and liming materials are included in the bulletin.

"Commercial Fertilizers, Agricultural Minerals," State Dept. of Agr., Sacramento, Calif., Sp. Pub. 132, 1934, Dr. Alvin J. Cox.

"Annual Report, State Chemist of Florida, 1934," Dept. of Agr., Tallahassee, Fla., 1934, Vol. 44, No. 1, J. J. Taylor.

"Commercial Fertilizers for Potatoes in the Kansas River Valley," Agr. Exp. Sta., Manhattan, Kan., Cir. 174, Feb. 1935, A. L. Clapp, H. E. Myers, and F. L. Timmons.

"Fertilizers for Vegetable Crops," Agr. Exp. Sta., Columbia, Mo., Cir. 185, Mar. 1935, R. A. Schroeder and H. G. Swartwout.

"Availability of the Phosphoric Acid of Finely-Divided Rock Phosphate," Agr. Exp. Sta., College Station, Tex., Bul. 509, June 1935, G. S. Fraps.

Soils

Using the Neubauer seedling method, a mass of instructive data has been collected by S. F. Thornton and reported in Purdue University Agricultural Experiment Station Bulletin 399 entitled, "Soil and Fertilizer Studies by Means of The Neubauer Method." Details of carrying on soil investigations by means of the Neubauer method are given and precautions to be observed in using it and interpreting the results are included. The available phosphoric acid and potash in the surface soils of the variously treated plots of a number of experimental fields in Indiana are correlated with the treatments given, the acidity of the soil, and the crop yields produced. The amount of fertilizer added was so small that, in most cases, it had little effect on the available phosphoric acid and potash in the soil. Nearly every fertility plot in the state, regardless of the treatment, studied by the author contained insufficient phosphoric acid and potash for most field crops, judging by the standards he used. The crop yields on the plots in most cases reflect the low fertility levels of the soils. Results from an experimental field in Virginia on which heavier fertilizer applications were made showed that the available phosphoric acid and potash in the soil and corn yields were correlated with fertilizer treatment.

A large number of soils were grouped according to their range in acidity, to determine whether this had an influence on available nutrients in the soils. The data indicated that the more acid soils tended to have less available phosphoric acid and potash on the average. "However," the author states, "soils in any reaction range may be either very deficient in or abundantly supplied with either of these nutrients. With the method used no evidence is found that soil reaction may be used as an indication of fertilizer needs."

The proportion of added phosphoric acid and potash recovered by the rye seedlings was determined on a number of soil types from several states and Cuba. The results show that the amount of the added fertilizer recovered by the crop varied greatly with the different soils. Data are not complete enough to allow any classification of soils on the basis of the results obtained.

Liming an acid soil increased the proportion of added monocalcium phosphate (comparable to superphosphate) recovered by the seedlings. The recovery of phosphorus from tricalcium phosphate (rock phosphate) or potash from muriate of potash was not influenced by liming, on the soil used. Fineness of grinding rock phosphate did not appear appreciably to influence its availability.

It was found that muriate of potash increased the amount of phosphorus plants could obtain from each of the 22 different phosphorus carriers studied. The potash fertilizer also made more available the phosphorus in the 21 soils investigated. This was true for both the phosphorus already present in the soil and for that added as fertilizer.

The amount of available phosphorus and potassium in a large number of soils from several states was determined. The available phosphorus usually was somewhat lower in the subsoil than in the surface soil. The same was true to some extent also for available potassium, but there were many exceptions with this nutrient. Consideration of the proportion of the soils deficient in these nutrients shows that, of the surface soils, 68% are deficient in phosphate and 49% deficient in potash, while 83% of the subsoils are deficient in phosphate and 51% deficient in potash, on the basis of Dr. Thornton's standards.

"Fit the fertilizer to the crop and soil as you would shoes to the feet" is a statement made by the Ohio Agricultural Experiment Station. Further confirmation of this quotation is made by J. B. Hester and F. A. Shelton in a report of an investigation of the fertility characteristics of three soils on the Coastal Plain of Virginia. The lime and fertilizer requirements of these soils differ widely owing to their differences in properties such as fixing power, organic matter contents, relative proportions of acids and bases present, etc. The data also show that the crop growth on the soils is strongly influenced by the degree to which the lime and fertilizer treatments conform to the peculiarities of the soils and make the necessary corrections. The work, published as Virginia Truck Experiment Station Bulletin 84, "Comparative Data for Three Coastal Plain Soils for Soil Characteristics and Plant Growth," is rather technical in nature but has an important practical application to soil management.

The instructive bulletin on the influence of various liming materials on the leaching of lime, magnesium, potash, nitrates, and sulphates from two soils in Tennessee and Virginia by W. H. MacIntire, W. B. Ellet, W. M. Shaw, and H. H. Hill, previously published as Bulletin 152 of the Tennessee Agricultural Experiment Station, has now been put out by the Virginia Agricultural Experiment Station as Technical Bulletin 54, entitled "The Conservation of Burnt Lime, Limestone, Dolomite and Calcium Silicate in Soil as Influenced by Methods of Incorporation." The work was carried on as a cooperative project by the two stations and the results are now available to the farmers of both states. Readers are referred to page 22 of the October-November 1934 issue of Better Crops With Plant Food for a review of this interesting bulletin.

The literature on rapid methods of testing soils has been enriched by Dr. M. F. Morgan's Bulletin 372, of the Connecticut Agricultural Experiment Station, "The Universal Soil Testing System." Three features of this bulletin are the large number of chemical constituents of the soil for which tests have been devised, a single extracting agent for removing all these constituents from the soils at one operation, and a closer correlation of the test results with the actual fertilizer and lime requirements of the crop and soil. The author gives detailed instructions for taking soil samples, preparing the various chemical reagents, and conducting the tests. Noteworthy are the suggestions relative to interpreting the tests. The crop to be grown, the kind of soil, and other pertinent factors are given consideration. The grouping of crops with respect to their lime, nitrogen, phosphoric acid, and potash requirements is interesting, and a helpful guide in itself in making fertilizer recommendations.

"The Use of Electrodialysis for Estimating Phosphate Availability in Calcareous Soils," Colo., Exp. Sta., Fort Collins, Colo., Tech. Bul. 12, Feb. 1935, James B. Goodwin.

"The Influence of Lime upon Soil Reaction and the Yield of Irish Potatoes," Reprint from "Transactions of Peninsula Horticultural Society," St. Bd. of Agr., Camden, Del., Vol. 24, No. 5, 1934, Jackson B. Hester.

"The Effects of Lime on the Hydrogen-Ion Concentration and Base Exchange Complex of Grundy Silt Loam," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 178, Jan. 1935, R. H. Walker and P. E. Brown.

"Utilization of Land Types for Fruit

Production, Berrien County, Michigan," *Agr. Exp. Sta., East Lansing, Mich., Sp. Bul.* 257, *Dec.* 1934, *J. O. Veatch and N. L. Partridge.*

"Studies of Nitrogen Fixation in Some Michigan Soils," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 143, *Feb.* 1935, *L. M. Turk.*

"The Influence of Soil Reaction (pH) on the Yield and Feeding Value of Hay," Agr. Exp. Sta., New Brunswick, N. J., Bul. 586, *May,* 1935, *A. W. Blair, A. L. Prince, and S. H. Winterberg.*

"Lime—For Soil Improvement," Agr. Exp. Sta., New Brunswick, N. J., Ext. Bul. 146, *Nov.* 1934, *H. R. Cox.*

"Classification and Agricultural Value of New York Soils," Agr. Exp. Sta., Ithaca, N. Y., Bul. 619, *Jan.* 1935, *Frank B. Howe.*

"Ecological Problems of the Humus Layer in the Forest," Agr. Exp. Sta., Ithaca, N. Y., Memoir 170, *Feb.* 1935, *L. C. Romell.*

"Ionic Exchange of Peat Soils," Agr. Exp. Sta., Ithaca, N. Y., Memoir 172, *Feb.* 1935, *B. D. Wilson and E. V. Staker.*

"Certain Rarer Elements in Soils and Fertilizers, and Their Role in Plant Growth," Agr. Exp. Sta., Ithaca, N. Y., Memoir 174, *Apr.* 1935, *R. S. Young.*

"North Carolina Soils Evaluated for Crop Growth," Agr. Exp. Sta., State College Station, Raleigh, N. C., Agronomy Infor. Cir. 94, *June* 1935, *C. B. Williams and J. F. Lutz.*

"The Soil Testing Service," Agr. Ext. Serv., Columbus, Ohio, Cir., Aug. 1934, *F. J. Salter.*

"Drainage and Irrigation, Soil, Economic, and Social Conditions, Delta Area, Utah" Agr. Exp. Sta., Logan, Utah, Bul. 255, *Apr.* 1935, *O. W. Israelsen.*

"Drainage and Irrigation, Soil, Economic, and Social Conditions, Delta Area, Utah," Agr. Exp. Sta., Logan, Utah, Bul. 256, *May* 1935, *D. S. Jennings and J. Darrel Peterson.*

"Seepage of Groundwater and Its Relation to Alkali Accumulation," Agr. Exp. Sta., Logan, Utah, Cir. 106, *July* 1934, *D. S. Jennings, Willard Gardner, and C. W. Israelsen.*

"The Rational Use of Lime in Potato Production in Eastern Virginia," Va. Truck Exp. Sta., Norfolk, Va., Bul. 83, *Apr.* 1934, *Jackson B. Hester.*

"Soil Survey of Jefferson County, Georgia," U. S. D. A., Washington, D. C., Series 1930, *No.* 26, *R. T. Avon Burke, S. W. Phillips, J. W. Moon, R. Wildermuth, and A. L. Gray.*

"Soil Survey of The Dixon Area, California," U. S. D. A., Washington, D. C., Series 1931, *No.* 7, *Stanley W. Cosby and E. J. Carpenter.*

"Soil Survey of Iowa, Crawford County," Agr. Exp. Sta., Ames, Iowa, Soil Survey Report No. 73, *Mar.* 1935, *P. E. Brown, T. H. Benton, and H. R. Meldrum.*

"Soil Survey of Mercer County, Kentucky," U. S. D. A., Washington, D. C., Se ies 1930, *No.* 23, *H. W. Higbee, Yandal Wrather, and W. C. Boatright.*

"Soil Survey of Knox County, Nebraska," U. S. D. A., Washington, D. C., Series 1930, *No.* 25, *F. A. Hayes, E. A. Nieschmidt, L. A. Brown, B. J. Abashkin, R. L. Gemmell, R. H. Lovald, and H. Otte.*

"Soil Survey of Tioga County, Pennsylvania," U. S. D. A., Washington, D. C., Series 1929, *No.* 30, *B. H. Hendrickson, R. T. Avon Burke, K. V. Goodman, and R. L. Smith.*

"Soil Survey of Collin County, Texas," U. S. D. A., Washington, D. C., Series 1930, *No.* 32, *M. W. Beck, E. G. Fitzpatrick, and L. G. Ragsdale.*

Crops

Of greatest interest among the publications which we classify under this heading is the new "Yearbook of Agriculture, 1935," which is the Secretary of Agriculture's report to the President. Articles of practically all phases of technical and economical research done in the U. S. Department of Agriculture appear in the volume. These articles are non-technical and cover a great variety of subjects. Topics receiving special attention include soil erosion, the eradication and control of insect pests, forest conservation, animal husbandry, and chemical investigations. Secretary Wallace, in his foreword, emphasizes the importance of organizing scientific research without destroying the spirit of free inquiry. The book may be obtained through Senators and Congressmen or from the Superintendent of Documents, Washington, D. C., at $1 a copy.

A new publication important to the sweet potato grower is Indiana's Extension Bulletin No. 204, "Sweet Potato Production." W. H. Ward, the author, discusses market preferences, suitable soils, fertilization, cultivation, and marketing, illustrating important considerations with splendid photographs. Growers of this popular tuber will benefit by adding this publication to their reference files.

"Forty-Fifth Annual Report for Fiscal Year Ending June 30, 1934," *Agr. Exp. Sta., Auburn, Ala., M. T. Funchess.*

"Lima Beans," Agr. Exp. Sta., Auburn, Ala., Leaf. 14, *Apr.* 1935.

"Date Growing in Arizona," Agr. Exp. Sta., Tucson, Ariz., Bul. 149, *May* 1935, *D. W. Albert and R. H. Hilgeman.*

"Crested Wheat Grass for Dryland Pastures," Colo Exp. Sta., Fort Collins, Colo., Press Bul. 84. *Feb.* 1935, *M. S. Morris.*

"Strawberry Growing in Colorado," Colo. Exp. Sta., Fort Collins, Colo., Press Bul. 86, *Apr.* 1935, *George Beach.*

"Field Peas in Colorado," Colo. Exp. Sta., Fort Collins, Colo., Bul. 416, *Apr.* 1935, *Dwight Koonce.*

"Rate of Planting Corn under Irrigated Conditions," Colo. Exp. Sta., Fort Collins, Colo., Bul. 417, *Apr.* 1935, *Warren H. Leonard and D. W. Robertson.*

"Studies on the Critical Period for Applying Irrigation Water to Wheat," Colo. Exp. Sta., Fort Collins, Colo., Tech. Bul. 11, *Nov.* 1934, *D. W. Robertson, Alvin Kezer, John Sjogren, and Dwight Koonce.*

"Tobacco Substation at Windsor, Report for 1934," *Agr. Exp. Sta., New Haven, Conn. Bul.* 367, *Feb.* 1935, *P. J. Anderson, T. R. Swanback, and O. E. Street.*

"1934 *Report, Cooperative Extension Work in Agriculture and Home Economics," Agr. Ext. Serv., Univ. of Fla., Tallahassee, Fla., June* 30, 1934, *Wilmon Newell.*

"Rose Growing in Florida," Agr. Ext. Serv., Gainesville, Fla., Bul. 78, *Oct.* 1934, *W. L. Floyd and John V. Watkins.*

"The Home Garden," Agr. Ext. Serv., Gainesville, Fla., Bul. 80, *June* 1935, *F. S. Jamison.*

"Blackberries and Dewberries," Agr. Exp. Sta., Univ. of Fla., Tallahassee, Fla., Press Bul. 474, *Mar.* 1935, *Harold Mowry.*

"Peach Culture in Georgia," Agr. Ext. Serv., Athens, Ga., Vol. 22, *Cir.* 253, *July* 1934, *T. H. McHatton.*

"Sweet Potato Culture," Agr. Ext. Serv., Athens, Ga., Vol. 22, *Cir.* 254, *June* 1934, *R. L. Keener.*

"Illinois Corn Performance Tests, Results for 1934," *Agr. Exp. Sta., Urbana, Ill., Bul.* 411, *Feb.* 1935, *G. H. Dungan, J. R. Holbert, W. J. Mumm, J. H. Bigger, and A. L. Lang.*

"Plant Forcing with Electric Light," Agr. Exp. Sta., Lafayette, Ind., Cir. 206, *Oct.* 1934, *Robert B. Withrow.*

"Seventh Biennial Report of the Director," Agr. Exp. Sta., Manahattan, Kan., Dec. 1935, *W. E. Grimes, Acting Director.*

"Annual Report for the Fiscal Year Ending November 30, 1934," *Agr. Exp. Sta., Amherst, Mass., Bul.* 315, *Mar.* 1935, *F. J. Sievers.*

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 17, *No.* 4, *May* 1935.

"Sudan Grass," Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Cir. 45, *May* 1934, *A. C. Arny.*

"The Relationship Between Certain Morphological Characters and Lodging in Corn," Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Tech. Bul. 103, *Aug.* 1934, *D. M. Hall.*

"The Home Vegetable Garden," Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Bul. 315, *Jan.* 1935, *A. E. Hutchins.*

"Seed Potato Production in Central Nebraska," Agr. Exp. Sta., Lincoln, Neb., Bul. 294, *Apr.* 1935, *H. O. Werner and L. L. Zook.*

"The Greenhouse Culture of Carnations in Sand," Agr. Exp. Sta., New Brunswick, N.J. Bul. 588, *June* 1935, *H. M. Biekart and C. H. Connors.*

"Pasture Management for High Quality Feed at Low Cost," Agr. Exp. Sta., New Brunswick, N. J., Cir. 351, *May* 1935, *Howard B. Sprague.*

"Pumpkins and Squash," Agr. Exp. Sta., New Brunswick, N. J., Ext. Bul. 139, *Aug.* 1934, *C. H. Nissley.*

"Carrots," Agr. Exp. Sta., New Brunswick, N. J., Ext. Bul. 140, *Sept.* 1934, *C. H. Nissley.*

"Turnips and Rutabagas," Agr. Exp. Sta., New Brunswick, N. J., Sept. 1934, *Ext. Bul.* 141, *C. H. Nissley.*

"For y-Fifth Annual Report," Agr. Exp. Sta., State College, N. M., 1933–1934, *Fabian Garcia.*

"Apple Growing in New York," Agr. Exp. Sta., Geneva, N. Y., Cir. 158, *Mar.* 1935, *G. H. Howe.*

"Fifty-Third Annual Report," Agr. Exp. Sta., Wooster, Ohio, Bul. 548, *Apr.* 1935, *C. G. Williams.*

"Sugar Acidity, and Juice Color Determinations in Grapes," Agr. Exp. Sta., Wooster, Ohio, Bul. 550, *July* 1935, *J. S. Shoemaker.*

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. 20, *No.* 174, *May-June* 1935.

"Annual Report for the Fiscal Year Ending June 30, 1934," *Agr. Exp. Sta., Brookings, S. D., James W. Wilson.*

"Summary Report of Progress, July 1, 1932 *to June* 30, 1934," *Agr. Exp. Sta., Logan, Utah, Bul.* 250, *Sept.* 1934, *P. V. Cardon.*

"Cherries of Utah," Agr. Exp. Sta., Logan, Utah, Bul. 253, *Feb.* 1935, *Francis M. Coe.*

"Herbs—Their Culture and Use," Agr. Ext. Serv., Burlington, Vt., Cir. 83, *May* 1935, *Charlotte P. Brooks and Abbie Graham.*

"Emergency Hay, Green Feed, and Pasture Crops," Agr. Ext. Serv., Burlington, Vt., Brief. 411, *May* 1935, *P. R. Miller.*

"Department of Agriculture—Immigration of Virginia," Richmond, Va., Bul. 327, *June* 1935, *and Bul.* 328, *July* 1935.

"Progress in Research at Reymann Memorial Farms," Agr. Exp. Sta., Morgantown, W. Va., Cir. 68, *Jan.* 1935, *G. A. Bowling.*

"Growing Grapes in West Virginia," Agr. Exp. Sta., Morgantown, W. Va., Cir. 69, *Mar.* 1935, *H. E. Knowlton and W. H. Childs.*

"Strengthening the Farmer's Position," Agr. Ext. Serv., Madison, Wis., Cir. 274, *Apr.* 1935.

"*Fig Growing in the South Atlantic and Gulf States*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1031, *Rev. Apr.* 1935, *H. P. Gould.*

"*The Production of Cucumbers in Greenhouses*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1320, *Rev. Mar.* 1935, *James H. Beattie.*

"*Vegetable Seeds for the Home and Market Garden*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1390, *Rev. July* 1927, *W. W. Tracy, Sr.*

"*Pear Growing in the Pacific Coast States*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1739, *Jan.* 1935, *C. F. Kinman and J. R. Magness.*

"*Vetch Culture and Uses*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1740, *Dec.* 1934, *Roland McKee and H. A. Schoth.*

"*Cotton Diseases and Methods of Control*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1745, *May* 1935, *David C. Neal and W. W. Gilbert.*

"*Subsistence Farm Gardens*," *U. S. D. A., Washington, D. C., Farmers' Bul.* 1746, *Feb.* 1935, *W. R. Beattie, J. W. Roberts, L. L. Harter, W. H. White, and D. L. Van Dine.*

"*Workers in Subjects Pertaining to Agriculture in State Agricultural Colleges and Experiment Stations*, 1934–35," *U. S. D. A., Washington, D. C., Misc. Pub.* 214, *Apr.* 1935, *Mary A. Agnew.*

Economics

Apple growers, widely distributed over the United States as home orchardists and concentrated in some sections as commercial growers, undoubtedly will be much interested in a new bulletin by the U. S. Department of Agriculture entitled, "Marketing Apples." Although this is listed as technical bulletin No. 474, there is much in the contents to interest the small grower. The development of the apple industry in the United States, producing regions, varieties, utilization of the crop, storage, and prices are some of the subjects treated in discussion and data by J. W. Park and R. R. Pailthorp, the authors, which will win for this publication a wide distribution.

"*Part-Time Farming in Connecticut*," *Conn. State Col., Storrs, Conn., Bul.* 201, *Mar.* 1935, *I. G. Davis and L. A. Salter, Jr.*

"*Farmers' Cooperative Association in Florida*," *Agr. Exp. Sta., Gainesville, Fla., Bul.* 276, *Mar.* 1935, *H. G. Hamilton and Marvin A. Brooker.*

"*Cost of Production and Price*," *Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Sp. Bul.* 166, *Aug.* 1934, *George A. Pond.*

"*Factors Affecting Strawberry Prices*," *Agr. Exp. Sta., Columbia, Mo., Bul.* 347, *Feb.* 1935, *F. L. Thomsen.*

"*Missouri Farm Prices for 25 Years*," *Agr. Exp. Sta., Columbia, Mo., Ref. Bul.* 221, *Mar.* 1935, *D. R. Cowan and F. L. Thomsen.*

"*Montana County Organization, Services, and Costs*," *Agr. Exp. Sta., Bozeman, Mont., Bul.* 298, *Apr.* 1935, *Roland R. Renne.*

"*Farm Economics*," *N. Y. State Col. of Agr., Ithaca, N. Y., No.* 90, *June* 1935.

"*Costs and Returns and Factors for Success on Truck Farms on the New Truck Area of South Carolina*," *Agr. Exp. Sta., Clemson, S. C., Bul.* 301, *June* 1935, *B. A. Russell and J. L. Fulmer.*

"*Tax Delinquency on Farm Real Estate in Texas*," *Agr. Exp. Sta., College Station, Tex., Bul.* 507, *Apr.* 1935, *L. P. Gabbard.*

"*Cost of Producing Pears in Washington*," *Agr. Exp. Sta., Pullman, Wash., Bul.* 307, *Apr.* 1935, *Chester C. Hampson and E. F. Landerholm.*

A "Punkin!"

A politician, addressing a group of farmers, wished to impress them with the fact that he was a farmer once himself.

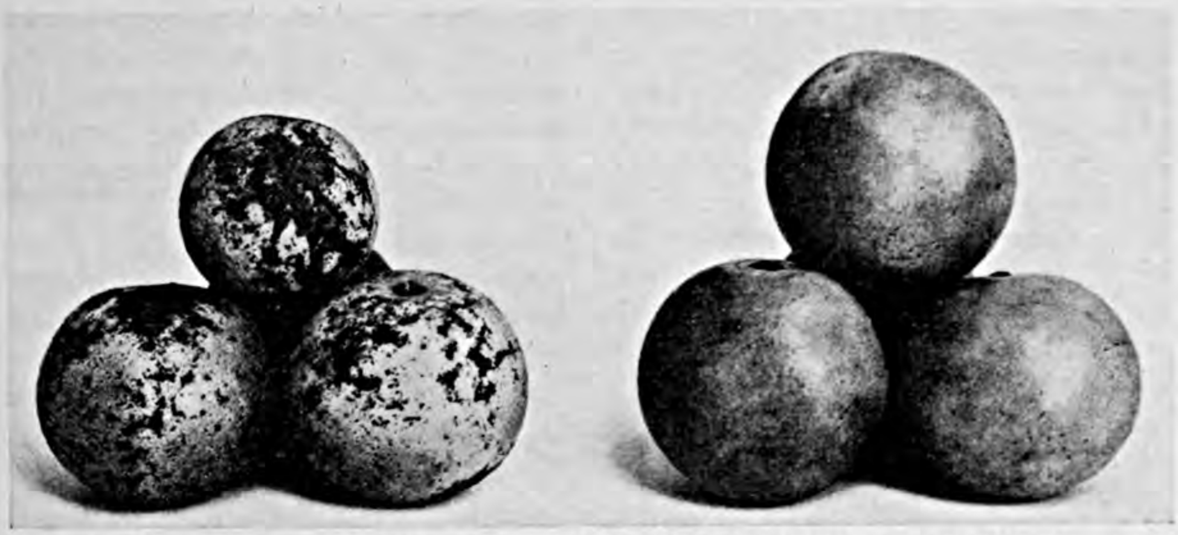
"Yes, sir," he said bombastically, "I was raised right between the corn rows as it were, and—"

"A punkin, by gum," an old farmer back in the crowd broke in.

Silence!

"But, my dear," bleated the poor little henpecked husband, "you've been talking for half an hour and I haven't said a word."

"No," snapped the wife, "you haven't said anything, but you've been listening in a most aggravating manner, and I'm not going to stand for it."



Note the difference in quality—Left: Grown with an unbalanced fertilizer; and, Right: Grown with properly balanced plant food.

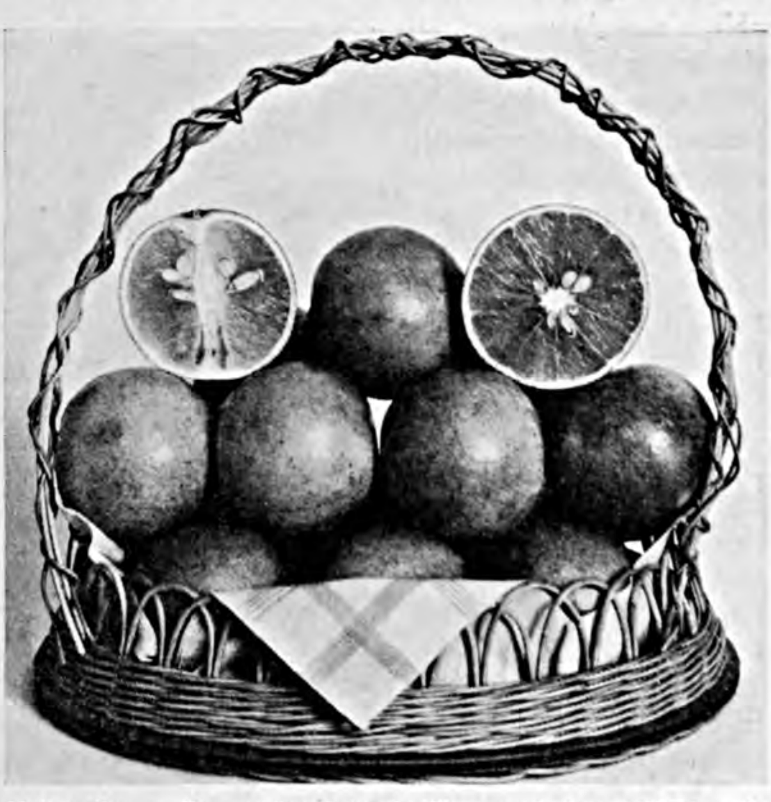
Quality Citrus

By C. W. Lyons

Tampa, Florida

THE question of fertilization of citrus trees in the production of good quality fruit has caused much comment and discussion, particularly when the grower felt the stress of economy on account of poor prices for his fruit. Up until five years ago practically all the fruit produced in Florida was grown from standard mixtures put out by various fertilizer companies. Later on through the same stress of economy, many growers found it necessary to reduce the application, and in fact some resorted to the use of straight materials in order to get along some way, feeling that they were doing the best that they could under the circumstances.

Doing the best that you can under circumstances, of course, is all that



Notice the quality produced by fertilizer analyzing 4-10-11 and 3-10-13 (NPK).

can be done. What really should be done in the make-up of fertilizer for the production of quality fruit is one thing and, of course, the financial condition of the grower is another.

During these last few years we have found out very definitely that citrus fruit requires adequate fertilization. Successive cropping of soils originally low in plant nutrients have depleted Florida soils of plant foods necessary for the growing of quality fruit. These nutrients can best be replaced by commercial fertilizer.

Beginning with nitrogen, great care must be exercised in the use of nitrogen or ammonia in the production of citrus fruit. Both trees and fruit develop very rapidly, and for this reason nitrogen, chemical and organic, should be on a balanced basis.

Phosphoric acid, procured from Florida phosphate rock treated with sulphuric acid and producing a 16 to 18 per cent available phosphoric acid, is a factor in the production of the seed and the rag of oranges and has some influence on early maturity under favorable weather conditions.

Potash as the sulphate is recommended as a general application for the production of citrus, this material playing a very important part in the texture of the fruit, its sweetness, and above all its carrying quality. In respect to the carrying quality, I find by tracing back the origin of the grove where the fruit is produced that where the fruit has decayed to a greater extent, there has been a lack of potash.

The successful citrus grower here works on the theory, which I agree with in practice, that there should be a sufficient supply of potash in the soil for the tree to feed on. Being a grower myself, we advocate a minimum of 8 per cent potash and preferably 10 per cent in the fertilizer.

In summing up the general quality of citrus fruit produced in Florida, in my opinion we have no choice in the matter as to what we should do in the production of quality fruit. By quality I mean the eating quality—the flavor that these materials tend to produce in fruit. It might surprise the average consumer to know that there is a wide variance in many instances as to the flavor of citrus fruit produced in Florida. We are constantly, through research and experiment, trying to develop a uniform flavor, and it is the consensus of opinion that this only can be accomplished by a uniform fertilization program embodying all the elements

A well-balanced tree as a result of well-balanced fertilizer has excellent fruit distribution.

that have been found necessary in the production of quality fruit.

Many programs through the application of economy have proven to be very expensive in the final analysis. In our own particular business it has been our recommendation to the grower at all times to use less fertilizer if it is necessary, but stick to the mixtures that would produce the quality. As many manufacturing concerns consistently advertise, there is no substitute for quality, and certainly this applies to the production of our citrus fruit if we want to maintain our markets.

Ladino Clover

(*From page* 19)

alfalfa. The soil structure of the soils around Oakdale is admirably adapted to the irrigation requirements of the clover. A rather heavy clay and a hardpan underlie the sandy loam soil at a depth of from 12 to 30 inches. This prevents excessive deep percolation and holds the light irrigations up in the surface soil in contact with the shallow-rooted Ladino.

Oakdale farmers were quick to accept the approved methods of intensive pasturing. Animals are rotated from one pasture field to another. Fields therefore are heavily stocked for short periods. This means efficient grazing.

The use of mineral fertilizers is accepted as a necessary procedure, because it is realized that such intensive pasturing draws heavily on the soil. At the present time superphosphate is the most extensively used fertilizer. This material has caused remarkable increases in the yield of clover. Superphosphate has been applied quite generally during the fall after the clover has become dormant, but there is some feeling that spring application when growth is starting would be better. The fall application seems to stimulate weed growth while the clover is dormant, causing the clover to be quite foul during the first spring grazing periods.

While no actual figures on yield of Ladino clover in terms of tons per acre are available, the yield of the fertilized stands must be tremendous. That fertilizer treatment pays a big profit is admitted by all, and it is generally said that after the second year of pasturing the use of fertilizer is absolutely necessary in order to maintain the clover's productiveness. A shallow soil, in which the plant is doing its feeding mostly in the surface foot, and the desirability of maintaining a highly productive pasture combine to make the use of fertilizer a subject of prime importance.

The growing of Ladino is so recent a development that little can be said as to length of life of the clover pastures. There are some fertilized pastures that are now six years old. Perhaps with good management and regular use of fertilizer, the pastures will last for many years. Under favorable conditions, in other localities, white clover has maintained itself in pastures for 30 years.

If you start to ask questions of Oakdale Ladino growers regarding the carrying capacity of the pastures, be prepared for statements which savor of "Paul Bunyan" yarns. While talking with Mr. Rodden in the bank, the writer popped the question on carrying capacity. The reply was 20 head of sheep per acre for 60 to 90 days, twice during the season. In other words this is 40 head per acre. What would a stockman, who usually figures number of acres per head instead of number of head per acre, say to this? The writer did a little checking up with other growers and the story was the same. One stockman pastured 12,000 sheep on 300 acres during the season. Simple arithmetic brings us right back to our first authority. It looks like Oakdale has struck "green gold"!

Shade Trees Require Proper Fertilization

SHADE trees require food the same as shrubs, evergreens, flowers, or garden crops. They will develop properly if given a supply of food material and any additional care relative to thinning or pruning which may be necessary.

Shade trees will exhaust the food supply in the ground over a period of time. Root systems very often come very close to the surface of the soil in search of food, aeration, and water. Conditions detrimental to the growth of trees are threefold: famine, starvation, and suffocation.

Make Needs Known

Trees indicate their need for food when the following symptoms are shown: (a) leaves either brown, yellowish, or undersized; (b) thin foliage; (c) dead branches or tips of branches dying back; (d) short annual twig growth and undersized buds.

It must be remembered that a shade tree is an investment. It acts as protection and provides relief from the excessive sunlight. Insects and diseases often work havoc with trees. A thrifty growing tree can best fight its enemies inasmuch as its resistance will be high.

In planning for the fertilization of shade trees one must assume that the soil needs all of the elements necessary for plant growth. A fertilizer should be applied to the feeding roots of the tree which will be found beneath the drip of the branch spread. There is a perfect balance ordinarily between the branch system of the tree above ground and the root system below ground.

Trees may be fertilized at any time of the year provided only slow-acting organic materials are used. When chemical fertilizers are used they should be applied from March 1 to August 1. The seasonal growth of the tree is completed about the first of August.

Watering is just as important as feeding trees. The food must be in solution before a tree can make use of the fertilizer. It has been estimated that a tree with a spread of 50 feet will throw off through transpiration 30 barrels of water a day. In watering a tree the soils beneath the spread of the tree should be perforated and soaked to a depth of 30 inches. The water should be permitted to run for several hours at least once every two weeks.

When fertilizer is applied at the time the buds begin to swell, any good complete commercial fertilizer, 4-8-4, 4-12-4, or 5-10-5, can be applied at the rate of one-fourth to one-half pound to each one inch diameter of the tree. This fertilizer can be applied broadcast if the tree stands in bare soil and watered into the ground. If the tree stands in the lawn, holes 15 inches to 18 inches in depth should be punched to the outermost spread of the branches on an angle toward the roots. The fertilizer should be placed in each hole in proportion and water permitted to run slowly in the hole until the hole is filled; then the water should be permitted to run for a period of a couple of hours as mentioned above. The holes which are used around the roots of the trees should be spaced about 30 inches apart. Shade trees given the proper attention will produce luxuriant growth.

In experiments conducted at Cornell University it was found that a 10-20-10 fertilizer could be recommended at the rate of one-half pound per inch in trunk diameter. Since there are many types of fertilizer on the market for shade trees, the general rate of application may vary. Shade trees may be fertilized either in the fall or in the spring, however, preference is given to spring fertilization. In fall fertilization, applications should be made not earlier than September 1.

Canada's Prairie Provinces

GREAT progress in agricultural development has been witnessed in the Prairie Provinces of Canada during the last 35 years. During the years 1901 to 1931 the area of occupied farm land in the prairie region increased from 15 million acres to 110 million acres, or more than sevenfold. In 1901 the Prairie Provinces contained 24·3 per cent of the total occupied farm acreage in the Dominion and by 1931 this acreage had increased to 67·3 per cent of the total. In the same period the improved farm acreage increased from 18·5 per cent to 69·8 per cent and the field crop acreage from 18·2 per cent to 69·1 per cent. The decade 1901 to 1911 witnessed the greatest expansion, due to the rush of homesteaders into Saskatchewan and Alberta. Occupied farm land increased from 15 million acres to over 57 million acres. Of the improved land in the Prairie Provinces in 1931, 67 per cent was in field crops.

Farming in the Prairie Provinces comprises four more-or-less distinct types—wheat growing, mixed farming, dairying (usually associated with mixed farming), and ranching. Wheat growing predominates in southwestern and central Alberta, throughout the whole of Saskatchewan except the northern and eastern fringe and the dry belt, and in southern Manitoba, although in the latter area, the proportion of other cereals and forage crops is growing rapidly. Mixed farming is found in northern and western Alberta and in the northern and eastern parts of both Saskatchewan and Manitoba — in other words over practically the whole of the park belt. Mixed farming is also the dominant type in the irrigated districts. The greatest development in dairying has occurred in eastern Manitoba, northeastern Saskatchewan and northwestern Alberta. Ranching is practically confined to the dry area in southwestern Saskatchewan and southeastern Alberta and to a strip of land extending from the international boundary northward along the foothills to beyond Calgary.

Apple Trees Need Balanced Diet

(*From page* 17)

The results of the experiments from Virginia, together with those from Canada and Africa, point to the value of potash for better keeping qualities in apples.

On the whole more stress is generally laid upon the value of either phosphorus or potash to the cover crops particularly for the purpose of producing as heavy a growth as possible to be worked into the orchard soil as organic matter. Not so much thought is given to what direct benefits the apple tree itself might derive from such fertilizers.

Generally the cover crop response is the first to be observed as benefits from complete fertilizer application. With older and root-crowded trees, growth and yield responses have been found in the trees that are directly attributable to phosphatic and potassic applications. Excellent examples of such responses are indicated in the results secured in the Price orchard. (See tables I, II, and III.) In every instance where either or both phosphorus and potash were added to a nitrogenous carrier, very pronounced gains in growth and yields were obtained. The buds of the trees receiving a complete-fertilizer combination were almost four times heavier than those receiving only a nitrogenous application. These responses developed in the first season of application, thus showing how quickly apple trees may respond to a complete fertilizer.

Apple trees are more likely to show more direct and marked growth and yield responses to complete fertilizers as they become older and root-crowded. Responses have been observed with apple trees as early as their 17th year in the more favorable situations, as was brought out in the results presented earlier in this report. Outstanding results were shown in the Price orchard with trees at a more advanced stage of root crowding as soon as one season after application. Although responses were not observable until sometime after the 15th year in the more favored trees in the Station orchard, they nevertheless became manifest and showed with significance from then on.

In general, apple orchards of Virginia and in many sections adjoining are fairly well represented in most of their ultimate nutrient needs by the results secured either from the Station or the Price orchard. Even though a wide chemical variation exists, there are two physical factors that put most of the apple orchards on very much the same level. With the exception of some mountain cove orchards and perhaps some with deeper and lighter textured soils for root descent, the average orchards of Virginia have only between 2 to 3 feet of soil that can be penetrated by the roots of the apple trees. Coupled with this are the prevailing planting distances of the apple trees which over the State are of negligible variation. Thus on the whole, everything else being equal, the same varieties of apple trees over the State will all decrease in their rate of growth and yield when their root systems fill up their allotted soil areas to the degree of root crowding. From then on all of them will be on very much the same level. In 25 to 35-foot planting distances, all trees of the same variety after they are 20 to 25 years of age will come to much the same level of growth and yield rate decrease in such soils. The larger number of our Virginia orchards are just about at this stage at present. Most of them are now at a root-crowded stage.

Everything else being equal, all trees confined to a same space and degree of root crowding will respond to about the same degree to applications of nutrient salts in such depleted soils. In this way most of the apple trees in Virginia and its adjacent section can be fertilized on very much the same basis.

The value of potash in so far as improving the keeping properties of the fruit also should be considered. Apple trees fertilized properly with the three elements nitrogen, phosphorus and potash should in the end give the more profitable returns.

The Inquiring mind

(*From page* 22)

Louis Rector Schreiner and Oswald Schreiner, Jr.

In 1902 he became a naturalized citizen, and was appointed expert in physical chemistry investigations in the Bureau of Soils, U. S. Department of Agriculture, and became Chemist in 1903; Soil Scientist in 1904; and Chief of the Division of Soil Fertility Investigations in 1906. He continued in charge until 1915, when he was transferred to the Bureau of Plant Industry as Biochemist in Charge. On July 1, 1927, his division was transferred to the Bureau of Chemistry and Soils and in July 1928, Dr. Schreiner was appointed Principal Biochemist in Charge of Soil Fertility Investigations.

During this period he also found time to deliver many instructive addresses before Farmers' Institutes and Farmers' Clubs, as well as before Scientific Societies. He was lecturer in the Graduate Summer School in Agriculture, Ithaca, N. Y., in 1908, and at Lansing, Michigan, 1912, and rendered similar services at Columbia University, Cornell University, Michigan Agricultural College, Missouri University, Pennsylvania State College, Ohio University, Virginia Agricultural College, and the University of West Virginia.

Dr. Schreiner was Chairman of the American Organizing Committee of the First International Soil Science Congress, held in the United States in 1927; President of the Association of Official Agricultural Chemists in 1928; United States Delegate to the Fourth Pacific Congress and to the Third International Congress of Sugar Cane Technologists, both held in Java in 1921; Chairman of the Soils Committee for the Fourth International Sugar Cane Congress held in Puerto Rico in 1932; and he was elected Honorary Fellow in the American Society of Agronomy in 1929, in recognition of his scientific contributions to plant and soil chemistry. He is also a member of the American Association of Biological Chemistry; American Chemical Society; Washington Academy of Science; a Fellow of the American Association for the Advancement of Science; a member of the Botanical Society of America; and a member of Phi Beta Kappa and Phi Delta Chi. In 1930 he was elected a member of Sigma Xi by the Wisconsin Chapter. He visited the principal European research laboratories and experiment stations in 1899 and 1908, and has traveled in China, Cuba, East Indies, Japan, Malay, and the Philippines.

The field work of the division under Dr. Schreiner's charge has increased enormously since 1913. At that time it was practically confined to a single cooperative station at State College, Pa., in grass studies. Since then more than 20 field stations have been established, where soil fertility studies and fertilizer tests are carried out with potatoes, cotton, celery, lettuce, sorghums, corn, clover, pecans, citrus fruits, etc. This work is being conducted cooperatively with one or more of the offices of the Bureau of Plant Industry, agricultural experiment stations, or other state institutions, county organizations, and farmers. The inauguration of this work has involved much organizing ability, leadership, and cooperative spirit on the part of Dr. Schreiner and his co-workers, and the results of the experimental work are everywhere appreciated because of the direct practical application to local problems as well as the scientific value to the study of soils, fertilizers, and plant nutrition.

Authentic Library

Studies of the so-called "potash hunger" and related malnutrition disease and of the injuries done by borax in fertilizers have been successfully carried out, among other subjects, with results of direct value to farmers and fertilizer men. A system of experimentation with fertilizer salts has been devised, and new lines of leadership in investigation are being established. The publications of the Office of Soil Fertility form an authentic library of great scope and practical and scientific value.

Cooperative soil fertility and fertilizer field work also has been done at Presque Isle, Maine; Riverhead, Long Island, N. Y.; State College, Pa.; at Holmdel and New Brunswick, N. J.; Arlington Farm and Norfolk, Va.; New Bern, N. C.; Florence, Darlington and Pee Dee, S. C.; at Americus, Athens, Pecan City, Putney, Cairo and Dewitt, Ga.; Scottsburg, Ind.; Ashland, Wis.; Sheridan, Wyo.; Alma, Ark.; and at Monticello and Sanford, Fla.

Our readers will be interested to know that in a paper presented at the Second National Fertilizer Conference, held in West Baden, Ind., September 5 and 6, 1928, Dr. Schreiner suggested, first, a national unification and coordination of soil fertility and fertilizer experiments by the State Experiment Stations and the U. S. Department of Agriculture along regional lines, based on soil, climate, and crop characteristics; second, the establishment of one or more super-stations with exceptional facilities for the scientific study of fundamental factors connected with soil fertility or fertilizer investigations; and, third, the founding of an Institute of Fertilizer Research for solving the industrial problems directly connected with the manufacture of fertilizers.

Nine Regions

For the purposes of a national program of fertilizer investigations, he proposed to divide the United States into nine regions, viz., 1—The New England States (Maine, N. H., Vt., Mass., R. I.; and Conn.); 2—The Middle Atlantic States (N. Y., Pa., N. J., Del., Md., Va., W. Va.); 3—The Southeastern States (N. C., S. C., Ga., Fla.). He then grouped other states as follows: 4—(Wis., Mich., Ill., Ind., Ohio, and Ky.); 5—(La., Miss., Ala., Tenn.); 6—(N. D., S. D., Minn., Neb., Ia., Kan., Mo.); 7—(Okla., Ark., Tex.); 8—(Idaho, Mont., Utah, Wyo., Col., N. Mex., Ariz.); 9—(Ore., Wash., Nev., Cal.).

Relative to the action of fertilizers on soils, which is a much disputed question, Dr. Schreiner holds that the weight of evidence is against the assumption that their effect is due altogether to the increase of plant food as such. If so simple an explanation were the true one, nearly a century of investigation of this problem by scientists of all civilized nations would surely have produced greater unanimity of opinion than now exists in regard to fertilizer practice.

Thoughtful investigators everywhere are finding that fertilizer salts are influencing many factors which contribute toward plant production besides the direct nutriment factor for the plant. It is this additional influence of fertilizers, according to Dr. Schreiner, which makes them doubly effective when rightly used and inefficient when improperly used. To this influence of fertilizers on soil, and biological conditions, is due their capriciousness when applied on the theory of lacking plant food, and any study which throws further light upon the mooted question will be a direct help toward reaching that view of soil fertility and soil fertilization which will eventually result in a more definite, more rational, and more remunerative fertilizer practice than in the past, and thus bring about the more extensive use of fertilizers in agriculture.

Toxic Secretions

Experiments by Dr Schreiner and his assistants have shown, we note, that healthy growing plants excrete from their roots substances which have a deleterious effect upon the growth of the root and that are especially toxic to plants of their own species. They conclude that: "The production of toxic secretions by the roots of the higher plants appears to afford an explanation of some of the important phenomena connected with association, invasion, and succession of plants. It is no less important as an explanation of certain underlying principles in agriculture, chief among which are those of crop rotation and productivity of the soil." An experiment made by him in 1907 also showed that while plants alone and fertilizer substances alone were able to accomplish a partial destruction of the toxic substances in soil, the combined action of plants and substances, ordinarily employed in fertilizers, caused a much greater destruction of toxic material and consequently an improvement in plant growth.

Dr. Schreiner and Dr. J. J. Skinner in 1910 proved that an organic soil constituent, dihydrostearic acid, hinders the growth of wheat plants when it is present in solution in pure distilled water, and also in the presence of nutrient or fertilizer salts in all ratios of fertilizer elements.

Minor Elements

Experiments on a highly calcareous soil in Florida demonstrated beyond all doubt that, whatever the fundamental function of manganese may be, the element is indispensable to the normal growth of tomato plants under conditions prevailing in that soil. It was found, too, that heavy applications of organic fertilizer could not meet the deficiency of manganese in the soil. However, farmyard manure apparently carried sufficient manganese to supply the demands of the plants.

Dr. Schreiner has deemed iodine of some importance, seeing that it occurs in some of the salt deposits used as fertilizers, notably so in sodium nitrate; but whether this iodine in a fertilizer is of economic importance is a debatable question upon which more evidence is needed. According to Von Wrangell, the iodine does not increase the yield of plants sufficiently to warrant its addition to fertilizers in goiter-affected regions, and it was thought best to rely upon the selection of suitable food-stuffs to supply the necessary iodine for body use.

As to the employment of nitrogen in farming operations, Dr. Schreiner stated in 1911 that the chief aim has been to convert it into nitrates, an operation which is far from simple, especially by distinctly chemical processes. His researches at that time were very suggestive of the fact that for agricultural purposes it may not be necessary to convert all nitrogen into nitrates, but that nitrogen of waste nitrogenous material in the industries can be converted into certain compounds, and so make available to agriculture much nitrogen now lost because of the difficulty in converting it into nitrates. His Bulletin No. 83 demonstrated that a nitrogenous constituent, creatine, which exists in soils, manures, and in many plants and seeds, and had been previously recognized only in connection with products of animal origin, is also beneficial to crops and that it seems able to replace nitrogen in aiding plant growth.

Oxidation in Soil

In Dr. Schriener's Bulletin No. 56 of 1909, the farmer is informed that the progress of oxidation by roots is largely, if not entirely, due to the activity of peroxidase produced by the roots. This oxidizing enzyme is most active in neutral or slightly alkaline solutions. The activity of the enzyme may be inhibited by the presence of acid and also by the conditions in solutions where putrification processes occur. This oxidization by roots has considerable agricultural interest, since processes promoting oxidation play a large part in the best methods of soil cultivation by tillage. This oxidation, in the soil, as shown by Dr. Schreiner in his bulletin No. 73 of 1910, is parallel to oxidation in plants and animals, and all the various kinds of oxidation going on in these undoubtedly can be duplicated by a detailed study of oxidation in soils. Whatever decreases the oxidation in soils tends also to bring about the conditions which decrease growth, and the factors which favor oxidation are the factors which favor soil productivity.

In Bulletin No. 53 of 1909, by Dr. Schreiner, the work reported also furnished a simple, tangible proof of the presence of injurious organic compounds in soils. In it he described four organic compounds he had isolated, all of which were well-defined crystalline bodies. One of them was pronounced quite injurious, one slightly harmful but not related to much more harmful compounds, and two were not harmful, so far as wheat seedlings used in the tests were concerned. In addition to these there had been isolated a number of other well-defined crystalline bodies.

Helpful Counsellor

The results and scope of the investigations of Dr. Schreiner's office are large and varied. His total number of contributions to science are upward of 90 articles, papers, and bulletins; and the total number of original contributions resulting from the scientific research work of the Office of Soil Fertility Investigations has been exceptionally large, indicating industry, ability, efficient organization and cooperation among its personnel. Credit for the work is shared with Dr. Schreiner by Dr. E. C. Shorey, Dr. J. J. Skinner, Bailey E. Brown, and Lewis A. Hurst.

Dr. Schreiner, we are informed by Mr. Brown, has been a helpful counsellor to many soil scientists who have gone out to make a mark in the scientific or commercial world. Of these may be mentioned Dr. H. S. Reed of the Citrus Experiment Station, Riverside, Calif.; Dr. M. X. Sullivan, Director of Chemo-Medical Institute, Washington, D. C.; Dr. E. C. Lathrop, Technical Director of the Crown Willamette Paper Co., Camas, Wash.; Dr. Rolla M. Harger, Professor of Biochemistry, Indiana University School of Medicine; and Dr. L. E. Wise, Professor of Forest Chemistry, University of

Syracuse, New York. In his capacity as Counseling Professor of Chemistry in the American University, he also has been a help and inspiration to many students aspiring to advanced degrees. They are unanimously appreciative of his assistance and frequently consult him about their problems.

Withal, he willingly takes his coat off and goes to work, whether on committees or in the field, even to the digging of potatoes in a North Carolina experimental plot on an exceedingly hot day. In his younger days he played tennis to keep him trim, and of late he has taken great interest and found real enjoyment in the growing of fine delphiniums. Another hobby has been the collecting of alchemical symbols.

Dr. Schreiner's life work has been monumental and his achievements praiseworthy in his line of effort. He still is active and as busy as ever, has attained a commanding position in his profession, and so is well worthy of applause and esteem. Palmam qui meruit ferat. (*Let him who has won it bear the palm.*)

All's Fair

(*From page* 6)

"little snips,"—the way they can take old flour sacks, a few yards of cheap calico, and other odds and ends and snip them with capable scissors into the nicest garments, with the neatest French (and other linguistic) seams you ever saw on a Paris gown. The lads of my time stood wistfully on the outskirts at fairs and seldom got into real training or met each other in anything but wrestling or pie-eating contests.

So gradually, by standing around, they sort of got the same perspective on farms and farming that the side-show people had acquired. It seemed to one who merely watched it, to be a futile fumble, a weary old repetition of moss-grown stunts with the weather-man, the middle-man, and the mortgage-man as chief directors. When things got thicker around home, they envied these wandering minstrels and fair fakirs; and finally came the exodus.

But today you can check over the premium files of your county or district fairs a few years back and behold, the 4-H exhibitors and winners of those yesterdays are the ones who are now pressing electric buttons on the farms instead of punching time-clocks in some far-off hive of urban industry.

Yet even before the 4-H clubs came to save our generation from ennui and gloom, the far-sighted agricultural colleges and crop-improvement associations joined hands to conjure up dynamic, dramatic, and purposeful prods to a slothful agriculture through modern expo experiences. To be sure, their first poor charts and "befores and afters" smacked of Doctor Munyon's Peaceful Panacea, but exhibit technique soon profited by its early errors, and, led by the ingenious corps of craftsmen at the Federal Department of Agriculture, these fair features grew to a leading informational force. They *had* to improve or else retire completely from the lot and let the clowns and cheap jacks grab the show. Just as the wisest churches installed something modern and lively to hold the crowds, so have the educational forces of fairdom been obliged to unbend in dignity a trifle and release some human feelings.

Thumb through the catalog of a modern fair and see what a crossroads it has become. Every social, athletic, fraternal, and political interest has seized upon these hours of rural recess to pin their respective banners to the boards. Poor old baseball has been out-maneuvered by kitten ball, log-rolling, horseshoe-pitching, diaper-pinning, checker tourneys, bridge feuds, hobby contests, husband-hooting, hog-calling and dog-racing, not to omit auto-wrecking and air-stunting. Up, down, and sideways goes the weary head of the perspiring patron, trying to get his money's worth.

Probably it is more fatiguing to attend the modern exposition than it used to be when the bass drum and the homesick calf were the chief noise-makers on the grounds. But Americans are a hardy race, and being radio-toughened, they can stand any audible combination with the "greatest of ease." When you are thoroughly frazzled out it's a sign you have had a real nice day of it. Furthermore, you will remember the fair man's bumper corn formula by the size of the bunions you acquired.

Critics explain in my state that we have too many fairs, all duplicating each other and taking money away from folks who should use it for fuel and taxes. They would cut down our number of fairs from eighty-odd harvest shows to one in each "relief district" or rural resettlement zone," or something equally hypothetical. Too much gadding about is bad for tempers and tires, they say, and it costs too much in "bribes" to judges. Why not all go to the state fair or else wait for the coming Post-New-Deal world's exposition?

Like the arguments about the constitution, they say our weedy old fair parks belong to the horse-and-buggy days and so deserve to be regulated into behavior or relegated into oblivion. They argue that the unpaid premiums and the interest on the dilapidated buildings would build a new insane asylum or something.

No doubt these efficiency experts are right, but the state aid going to all these fairs is distributed by keen local politicians, and nobody ever puts the "previous question" after they debate it, so it never gets to a vote. After all, efficiency and a good time seldom move in the same orbit, so we still have our numerous fairs on our hands. The best way to glean the value of all fairs is to picture our country without any.

After the last mow is filled and the final autumn furrow is turned, we are faced with a period of pause before the ice king's coming, in which to check up on each other and the state of agriculture in general. In the absence of any fairs we should be obliged to do a lot of telephone rubbering, bulletin reading, and newspaper and magazine culling to get any tangible line on things which deeply concern us. Of course, there might be one grand radio fair at Rockefeller Center where you would be taken around under able guidance to see the wonders that have been, that are, and that may be.

BUT I am sure no such artificial substitute for a jovial, comfortable, sweaty old time on the midway and in the hall of horticulture would be acceptable to us chaps from the silo sections. We want our fairs served up in the genuine way, and we think we could get along without almost anything else but.

In fact, I am so "sot" on the subject of fairs that when I get too old and grizzly to continue as an office ornament, it will be my ambition to write a tremendously thick book called the History and Mystery of Fairs in America. If you care to subscribe in advance so that I may warn my publishers, just leave your names at the box-office.

NO FOOLING

If a fellow tries to kiss a woman and gets away with it, he's a man; if he tries and doesn't get away with it, he's a brute; if he doesn't try but would get away with it if he tried, he's a coward; but if he doesn't try and wouldn't have gotten away with it if he tried, he's wise.

Man (to small son of one of his workmen who has met with an accident): "When will your dad be fit for work again?"

Boy: "Can't say for certain, but it will be a long time."

Man: "What makes you think that?"

Boy: "'Cause compensation's set in."

FREE WHEELING

An old Indian came to town one day, and for the first time he saw a man riding a bicycle.

"Huh!" he exclaimed, "White man heap lazy. Sits down to walk."

City Girl: "And I suppose at dusk, when the sun is stealing over the Rockies in purple splendor, you cowboys are huddled around the campfire broiling venison and listening to the weird, eerie, unnatural howlings of the coyotes."

Rattlesnake Gus: "Well, ma'am, not ezzackly. Usually we go inside and listen to Amos and Andy."

CONFESSION

One of Levinski's customers was notorious for his slowness in meeting liabilities. In desperation Levinski sent the following letter:

"Sir: Who bought a lot of goods from me and did not pay? You. Who promised to pay in sixty days? You. Who didn't pay in six months? You. Who is a thief, liar, and scoundrel?

"Yours truly,
"Al Levinski."

Little Rosalie, a first-grader, walking with her mother, spoke to a small boy. "His name is Jimmy and he is in my grade," she explained.

"What is the little boy's last name?" her mother asked.

"His whole name," said Rosalie, "is Jimmy Sitdown—that's what the teacher calls him."

Jackson: "I noticed you got up and gave that lady your seat in the tram the other day."

Hackson: "Since childhood I have respected a woman with a strap in her hand."

ONLY FOOLING

Rastus and Miranda were strolling through the cemetery, when Miranda called to Rastus, "Oh Lordy! come here see what that says! 'Not dead, but sleeping.'"

Rastus: "Sleep on, big boy, you ain't fooling nobody but yourself."

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TABLE OF CONTENTS, NOV.-DEC., 1935

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Looking Backward

By Jeff McDermid

WHILE we wait for the agricultural policy of 1935 to jell in the national mold, it might be somewhat reassuring to ponder at the year's end on the rural problems, projects, and opinions which were current in this country a century ago.

With the aid of a dust mop and a considerate librarian, we find ourselves peering at the yellow pages of the middle 1830's, which by a coincidence of political history, puts us in the midst of a robust era of Jacksonian Democracy, with polished classical phrases dripping from the quill pens of plain farmers, for the eternal glory of agriculture and the rights of the common man.

Although the Ohio valley and some of the Midwest territories were slowly taking on hints of their agricultural destiny, the center of population, farm ownership, and large estates was in the South. The first railroad to carry passengers had just been started between Charleston and Hamburg, South Carolina, in 1830, with another later line to the Savannah river on which the first U. S. mails were carried behind a steam locomotive. Therefore, though we now seek in the Mississippi valley for our representative farm thought, in 1835 it was found below the fortieth parallel and east of the ninetieth meridian.

The chief economic difference between their era and ours is that Americans could then go West when weary and distraught and start new commonwealths, and the rest of the world hadn't plastered us with their I. O. U's. Otherwise, barring the effects of a few thousand subsequent useful inventions, the human parallel is strangely familiar to ours.

WITH natural pride of craft, I point out that the chief sources of information about these rural trends of 1835 were obtainable in the limited technical farm periodicals of the times. In this country a century ago there were, quoting one of them: "No less than seven journals, all strongly striving to perfect that best of all arts, the culture of the earth, and to place it on a sure and solid foundation by scientific investigation."

By the testimony of the editors, there were circulating at the time the following general farm papers: "The New England Farmer," Boston; "The New York Farmer," New York City; "The Genesee Farmer," Rochester, New York; "The American Farmer," Baltimore; "The Western Tiller," Cincinnati; "The Western Plough Boy," Edwardsville, Illinois; and "The Southern Agriculturist and Rural Review," Charleston, South Carolina.

In the files I find them rejoicing that the prejudice against book-farming is rapidly fading and that "the rising generation are not willing to follow the beaten track of their fathers without finding whether they be right or not, although ready to give them all the due weight antiquity deserves." Of the seven standard farm journals circulated in 1835 perhaps the ones with heaviest frontier liabilities were the ones at Cincinnati and Edwardsville. Both were located at growing livestock markets, the one at the booming Ohio Porkopolis, and the other near the early beef-packing center of Alton in Madison county, Illinois. A few other papers and magazines claimed rural attention, but they do not reflect the keen personal comment of squires and planters found in the original papers penned by soft candlelight for these century-old rustic reviews.

To get a good preface to the thought animating the best rustic leaders of the middle 1830's, one cannot do better than to glean a choice portion of the remarks of one Francis Quash, principal speaker before the South Carolina State Agricultural Society. He indulged in all the rhetoric and Latiny allusions common to public addresses and manuscripts in that era, and he probably spent more time at the job of preparation than some of us hasty hustlers do today when called upon for like services. Leading off with reference to the Roman necessity for provisions in her warlike enterprises, he mentions the part played by the celebrated Georgic poems in arousing men to become "enamoured with rural life"—*"At prius ignotum ferro quam scindimus aequor,"* und so viter.

THEN he says that the most valuable feature of Roman farming was the uniform effort not only to perpetuate the fertility of the soil, but to improve it. "They had recourse to the expedient of resting lands," Quash said, "and returning the growth to the soil as well as their imperfect implements of husbandry would permit. They also relieved their lands by changing the grain. They ridiculed the idea of the land ever wearing out." And then he lifts a quote from some old senator: "It is neither just nor true to think that the nature of the ground, which the Creator of the Universe endowed with perpetual fecundity, is affected with barrenness, nor does it become a wise man to believe that the earth, with a divine and everlasting youth bestowed upon it and called the common parent of all things, should grow old like a woman."

Indulging in more soil fertility reminders, the speaker admonished his audience in Charleston on that long-gone day to take heed "that the system of nature practiced in the forest must be applied by art to the fields under cultivation." By this, he said,

was meant that there must be a constant replenishment of vegetable substance, to enable the soil to endure the stimulating qualities of most artificial manures. (From all that the records show, the only artificial manures then in ordinary use were land plaster, ashes, and some saltpeter and lime, with stable manure, kitchen waste, and leaves.)

But still more pertinent for us to ponder were his remarks about "the many existing causes which retard the advancement of agriculture." Proceeding like a modern brain-truster but with far more flourish and fancy language, Quash listed the farm ills of 1835 as follows: 1—Lack of wide information and interchange of farm ideas and experiments; 2—The "embarrassed fortunes of its followers": 3—Compulsory absence from plantations to escape the "fever'n ague," or in other words, unsanitary conditions; 4—The "unwise interference of government and the unjust operation of laws"; 5—Specifically, the burdensome tariff of "abomnations" imposed about 1830 and modified by Henry Clay a few years later.

Very significant, and somewhat like our recent national experience, is the direct quotation with which we dismiss Mr. Quash and turn to others writing on kindred themes. Touching upon the debt and low finances of the planters, he said: "The prosperity which beamed on our country just after the Revolutionary War, and at a subsequent period, when the nations of the world paid us well for furnishing them with the means of destroying the resources of each other, the cheapness of credit and land enabled our predecessors to accumulate fortunes—and rocked in the cradle of wealth, habits of luxury and extravagance soon matured, casting their dark shades on the hopes and happiness of the rising generation. But the poor can never be reformers, and men of education and wealth accustomed to refinement will not, though the grim visage of bankruptcy scowls upon them."

Writing from Columbia, on the apathy which pervaded the South, another correspondent remarks: "Some who consider themselves the better class of society appear to act as though the tilling of the soil was an abject and merely mechanical calling, only allowed to exist by sufferance. Ninety-nine hundredths of the laws passed are for the benefit of the 'cits' and poor agriculture is left to shift for itself and never receives the protecting and encouraging help of government, so as to enable it to meet other professions on equal footing."

HE THEN takes up the cudgel for rural education, saying: "Are there not extensive and richly endowed institutions, with well paid professors for the promotion of useful knowledge in divinity, law, commerce and medicine? We have some few agricultural societies in the land, but without the fostering hand of power, and without funds, what can they do? Notwithstanding all these unanswerable proofs of the worthlessness of agriculture, my habitual and rustic obstinacy will not yield, and continues refractory to the superior sense and polished reasoning of the followers of the more favored professions."

THIS writer in a caustic vein goes on to show that the city folks are indebted to farmers for everything that renders civilized man superior to the savage. He snaps out with: "The great city of Charleston itself might perceive, to its astonishment, that without the country folk back of it, it would only be a miserable village of fishermen, and as it is, its almost sole dependence for support and protection under any circumstance is to agriculture." He accuses the Charleston big-wigs of turning away European farm immigrants, allowing them to go North instead of coming to "our almost deserted middle country."

He also flings away at the consuls and diplomatic corps abroad who he claimed send all choice seeds and cuttings of tropical plants to perish in Northern hot-houses, when they might be tried with success in outdoor cultivation in the South. He is jealous of Northern achievement, concluding: "It is strange that with inferior soils and climates, our Northern neighbors are far exceeding us in the cultivation of those things for which we are so eminently situated. They are entering largely on the cultivation of the vine and the silkworm, they have large flocks of sheep, they raise a superabundance of bread, meat, horses and mules. The time is past when we in the South should be satisfied with two or three staple objects of export. We are now too passive, and calamities await us if we neglect any longer to rise up and be doing."

Although cotton had replaced indigo as a main crop, we find reference to the situation on sugar-cane plantations a century ago. In a letter to the Secretary of the Treasury, the Louisiana planters officially told about their vast enterprise and its management. There were then five kinds of cane in their fields, Creole cane, Bourbon cane from Otaheite, two varieties of riband cane, and the violet cane from Brazil. They described the five sugar kettles mounted on the furnaces, known as the great, the clean, the flambeau, the syrup, and the battery kettles. Taking a typical cane farm of 700 acres, 500 would be in the main crop and the rest in corn and beans. It required a force of 150 slaves for labor in raising the cane and making the syrup. The yield averaged 400,000 pounds of sugar, which at 5½ cents per pound yielded $22,000. This and the molasses at 18 cents per gallon made a gross estimated revenue of $25,600.

OVERSEERS' wages, and those of the engineer and sugar-maker, plus corn, feed, provisions, medicine, clothing, 15 horses, several teams of oxen, depreciation on implements, and the cost of lime, oakum, planks, and nails, totaled $10,000. The gross profit was on the supposition that the planter paid no freight, made all his own fences, his levee, casks and hogsheads, and iron work. Such a plantation located between latitude 29 and 30 was valued with improvements at $240,000. "At present cane prices, such an estate would not yield over seven per cent of its value, while the conventional interest of this state is ten per cent," the report concluded.

(*Turn to page* 44)

Tomatoes Make Known Their Diet Needs

By M. B. Davis and H. Hill

Central Experimental Farm, Ottawa, Canada

IN a broad sense general fertilizer recommendations for various crop plants have proven of considerable value, although variations in soils and climate have at times rendered them unsatisfactory. In order to enable us to modify general treatment according to plant response influenced by soil and climate, it has been found necessary to possess a working knowledge of the interrelationship of the different elements in relation to plant response, as well as symptomatic knowledge of plants when suffering from deficiencies or excesses of specific elements.

Considerable work in nutritional studies with the tomato plant has been undertaken at the Horticultural Division, Central Experimental Farm, Ottawa, during the past six years to obtain information regarding the response to excess and deficient feeding of the various essential

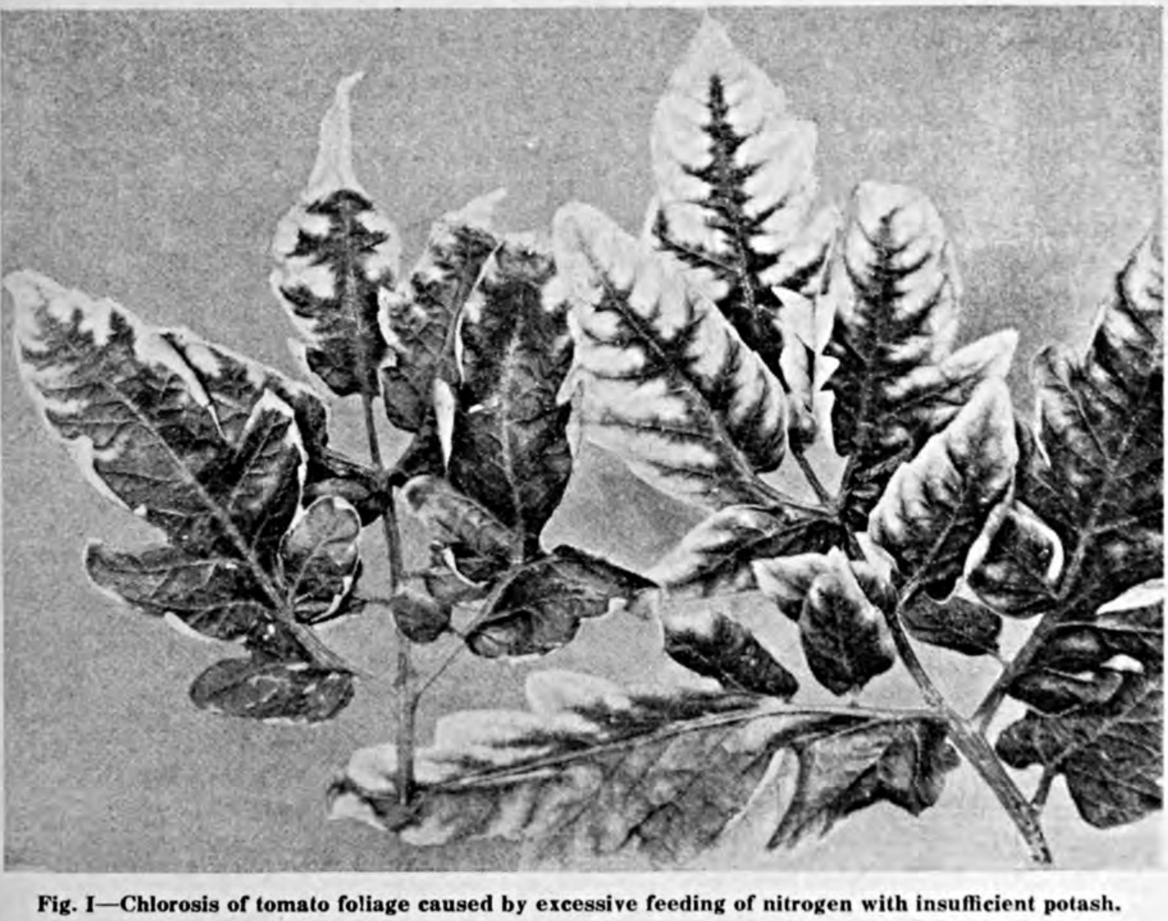


Fig. I—Chlorosis of tomato foliage caused by excessive feeding of nitrogen with insufficient potash.

elements. The studies have been conducted in pure sand cultures in pots and in beds, and as a result a considerable accumulation of interesting data has been secured, much of which is corroborative of the work of other investigators.

From these data there emerge certain plant symptoms or expressions which may be employed as a partial aid in judging the food requirements of tomato plants during growth. Some of these symptoms have been common knowledge to practical growers for years, while others have been observed from time to time but not so correctly diagnosed.

Insufficient Nitrogen

The symptoms of deficient nitrogen for instance are well known. Such plants possess a stunted appearance, slender main stems and petioles, thin leaves of a pale green or yellowish colour. These plants will quickly respond to applications of nitrogen particularly if the soil in which they are growing has an ample supply of the mineral elements.

Frequently one encounters a situation where the plant is somewhat stunted or dwarfed but the stems and petioles are reasonably stout and the foliage a medium green colour without any other signs of debility; in other words, healthy but lacking in general vigor. Such plants indicate a moderately well-balanced food supply, available, however, in too limited amount. The kind of food available is satisfactory but the quantity is insufficient. In such cases, an increase of all the major elements would be in order.

In the Ottawa experiments one of the most easily diagnosed set of symptoms has been that due to the feeding of excess nitrogen. Excess nitrogen symptoms, as will be developed later, are similar to those of deficient potassium in the early stages. There appears to exist a very close relationship between the feeding of nitrogen and the element potassium. The latter appears to act as the counterpart of nitrogen; where nitrogen promotes soft, sappy growth, potassium on the contrary hardens growth. While the symptoms of excess nitrogen do to a marked extent resemble those of deficient potassium, there is a suitable difference to be noted.

There is considerable evidence to show that luxury consumption of a nutritional element may take place, that is, the plants may absorb nitrogen in approximately the same proportion as it is available in the nutrient medium even though it is present in excess of the amount required for physiological balance. Instances of potassium deficiency are often associated with a fairly high potash level masked as it were by an excessively high nitrogen level.

Insufficient Potash

When a luxury absorption of nitrogen takes place in the presence of an otherwise ample potassium supply, the first response of the plant is that of excessive vegetative vigor, indicated by stout stems and large leaves of an abnormally dark green to bluish green colour. This is soon followed by a stage when the basal leaves are affected with a marginal chlorosis, later spreading between the veins and finally causing a burning or browning of the leaves, curling, and ultimate death. Probably by the time the lower leaves have reached the advanced chlorotic condition exhibited in Figure 1, the main stems of the plant will be exhibiting dark brown lesion-like patches which later turn black, resembling to some extent the disease known as stripe. These brown lesions or burnt patches are illustrated in Figure 2 and are particularly valuable as indicators of an excess nitrogen condition.

When such a condition exists it may be corrected by the increased

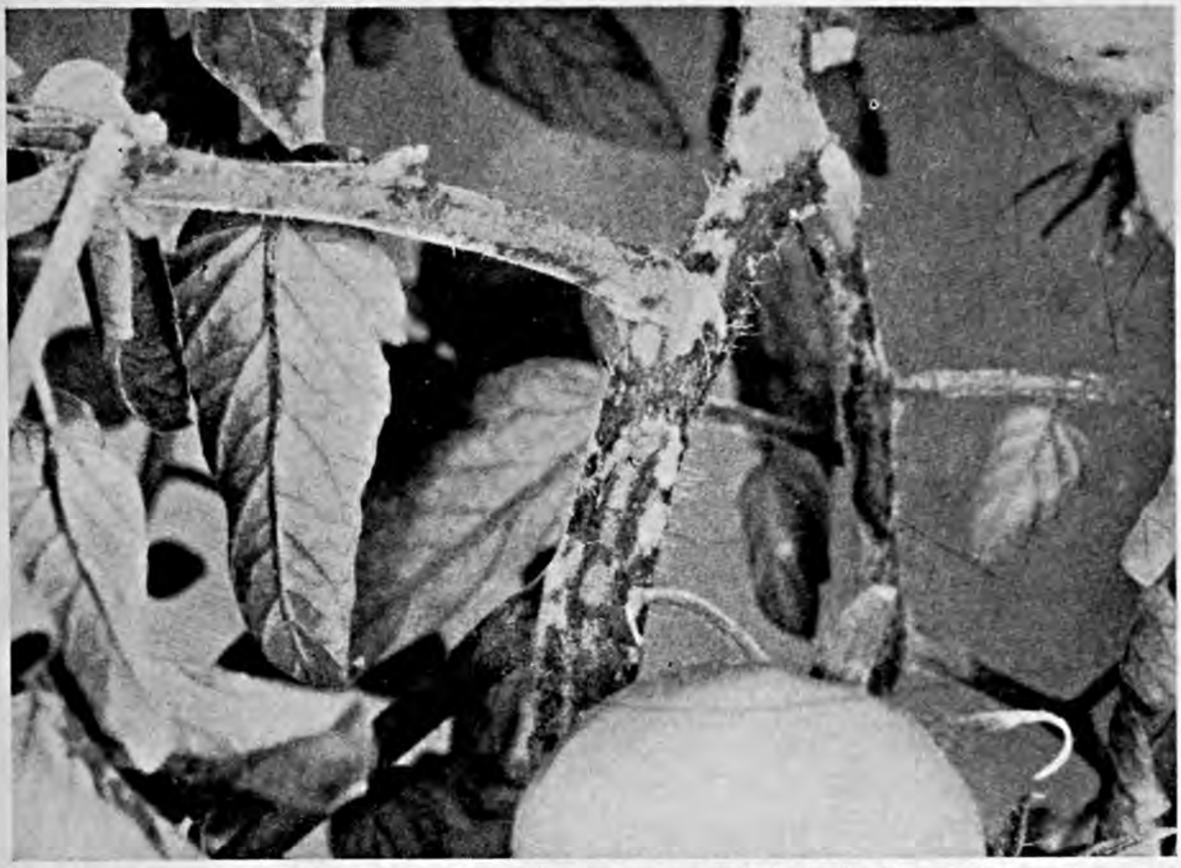


Fig 2.—A luxury feeding of nitrogen with insufficient potash will bring lesion-like patches on the stems.

feeding of potassium, that is, by the correction of the N/K ratio. The increased feeding of potassium will enable the plant to function normally insofar as vegetative production is concerned; but it has been our observation that when the level of nitrogen is such as to induce such symptoms as described above, increasing the amount of potassium, while preventing injury to the foliage and stems, results in extensive vigor and the occurrence of a large amount of blossom-end rot, which point will be developed later.

When a *real* deficiency of potassium occurs in the presence of a moderate nitrogen supply, the plants do not possess the initial high vigor produced by luxury feeding of nitrogen. In fact, growth is poor, the plants somewhat stunted, the foliage dark green but individual leaves not large. Later the margins of the lower leaves become chlorotic similar to excess nitrogen symptoms but the stem lesions do not occur. The chlorosis of the leaves progresses inwards between the veins, ultimately resulting in severe scorching or browning and the death of the leaf. As the plant progresses, injury spreads upwards until in severe cases only the new foliage is free of trouble. In extreme cases of potassium deficiency the yellowing of the leaf margins may be followed by a purpling of the under side and a curling downward toward the stem.

A somewhat similar condition to the above may be brought about by the excess feeding of phosphorus, for an excess supply of this element may actually bring about a potassium-deficient condition in the plant. The earlier symptoms of excess phosphorus feeding are a general yellowing of the leaf (see Figure 3), followed by the appearance of white speckles or large necrotic areas similar to potassium-deficient symptoms reported by Janssen & Bartholomew but never obtained by us except in the presence of excess phosphorus. Upon the death of the affected leaf

(*Turn to page* 39)

The Inquiring Mind *and the* Seeing Eye

By Alister B. Alexander

Madison, Wisconsin

"SO FAR as I know, I have never heard an individual say an unkind thing about him, nor he an unkind thing of another individual. At the same time, he does not hesitate to present his own ideas and to battle for them in a fair and considerate manner."

This is the word picture of the character of Professor D. R. Hoagland of the University of California, painted by his friend and associate, Dr. A. R. Davis, Professor of Plant Physiology at the same institution.

Early Education

Dennis Robert Hoagland, Chairman of the Division of Plant Nutrition at the College of Agriculture, Berkeley, California, was born at Golden, Colorado, on April 2, 1884, the son of Charles B. and Lillian Burch Hoagland. His father, born in Kentucky of Dutch ancestry, and his mother, a native of Colorado but of English ancestry, passed on to him a sturdy foundation for the character that invoked the tribute quoted above.

Dennis Hoagland received his early education in the grammar and high schools of Denver, and then entered Stanford University, where he majored in Chemistry and graduated with the A.B. degree in 1907. While an undergraduate his marks entitled him to entry into Phi Beta Kappa, and gave an indication at that time of the brilliant mind that was later to be so helpful to his native state, and to the other states in which he has worked and experimented.

After his graduation he spent one semester in graduate work at Stanford as an assistant in chemistry; then came an appointment as an instructor and laboratory assistant in the laboratory of animal nutrition, under the late Professor Jaffa, in 1908. Following this training period, he became an analyst, then an expert chemist and Consulting Scientific Expert for the Referee Board of the United States Department of Agriculture, during the period from 1910 to 1912. During this time he was associated with Dr. Alonzo Taylor in his work on the toxicity of aluminum, copper, and sulphur compounds. These compounds were being employed at that time in fruit processing and as preservatives, and, under the influence of Dr. Wiley, the Referee Board was set up to determine whether such compounds had any deleterious effect on human metabolism.

In order to adequately test the toxicity of these compounds, a so-called "poison squad" was formed, composed of volunteer pre-medical students at the University of California. The work was carried on there in 1910, and in 1911-1912 at the

University of Pennsylvania, with Professor Hoagland acting as expert chemist in connection with the experiments. After the completion of the work of the Referee Board, Professor Hoagland went to the University of Wisconsin, where he received his master's degree in 1913, with his thesis on "The Influence of Sodium Benzoate on the Synthesis of Urea." The same year he was appointed Assistant Professor at the University of California, in the newly organized Division of Agricultural Chemistry, under Professor John S. Burd.

PROFESSOR D. R. HOAGLAND

During the war period he particularly concerned himself with the problem of potassium storage in sea weed, the extraction of which added considerably to the nation's potash supply. In 1922, the Divisions of Agricultural Chemistry and Soil Chemistry and Bacteriology were combined into the Division of Plant Nutrition, with Professor Hoagland as head.

At about this time he set out to study the problem of absorption of ions by plants, a field in which he since has become the leader. In this work, he adopted the broad viewpoint embodied in a concept of plant-soil interrelations. He was interested in soil as supplying minerals to the soil solution, and he was interested in the plant as absorbing from that soil solution. He early discovered that if important progress were to be made, more quantitative methods of study were imperative. He therefore set out to control the experimental conditions so that the results of his studies might more accurately be interpreted.

Professor Hoagland has contributed many papers to this field of study, and these contributions have been made use of both by plant and animal workers over the entire world. During this period of great activity in research, he still found time to guide the work of many graduate students, some of the most outstanding younger men in America having come under his influence.

Exceptional Executive

Professor Hoagland has an exceptional ability in organization of research programs and in the analysis of data resulting from research work. He also has the ability to summarize decisively the outstanding points in the research work of others. This is especially shown by him in many of his summary articles, and in his position as Associate Editor of the Annual Review of Biochemistry.

His achievements have been recognized by his selection as the guiding officer of many different national organizations, such as the Western Society of Soil Science (1924); Pacific Division, American Botanical society (1929); Western Society of Naturalists (1931); American Society of Plant Physiologists (1932); and others, culminating in his recent selection as Vice-President of the Section of Plant Physiology at the Sixth International Botanical Congress at Amsterdam in 1935. He also was awarded the Stephen Hales Award for distinguished contributions to plant physiology, presented by the American Society of Plant Physiologists in 1930, and has recently been selected for membership in the National Academy of Sciences.

Practical in Research

Professor Hoagland combines a knowledge of the theoretical with an appreciation of the practical to a degree unusual in the research worker. His understanding of the practical problems of plant nutrition which confront the agriculturist in California, combined with his sound theoretical knowledge, has gone far toward a solution of many perplexing problems. This is illustrated by his recent work on the relation of zinc to the little-leaf of peach and the mottle-leaf of citrus. In collaboration with Professor W. H. Chandler he has worked out practical methods for the solution of this fascinating problem.

Another problem combining theoretical with practical knowledge was in connection with "tip-burn" of the prune. This baffling trouble, in certain localities in California, was found to be associated with potassium deficiency in the soil, and not with an organism, as had long been supposed. Many other so-called "deficiency" diseases have been and are being studied by Professor Hoagland.

Published writings of Professor Hoagland have been varied and of great value to the agricultural interests of the nation. In 1915 he wrote several articles concerning the organic constituents of Pacific coast kelps, and the complex carbohydrates and forms of sulphur found in marine algae. In the following years he issued "Acidity and Absorption in Soils as Measured by the Hydrogen Electrode," and an important article on "The Effect of Hydrogen and Hydroxyl-ion Concentration on the Growth of Barley Seedlings."

His later writings have covered "The Freezing Point as an Indication of Variations in the Soil Solution Due to Season and Crop Growth;" "The Relation of Plants to the Reaction of the Nutrient Solution;" "The Effect of Certain Aluminum Compounds on the Metabolism of Man;" "Effect of Season and Crop Growth on the Physical State of the Soil;" "The Soil Solution in Relation to the Plant."

Others include "The Feeding Power of Plants;" "A Comparison of Sand and Solution Cultures with Soils as Media for Plant Growth;" "Minimum Potassium Level Required by Tomato Plants Grown in Water Cultures;" "Little-leaf or Rosette in Fruit Trees;" "Nutrition of Strawberry Plant under Controlled Conditions;" and several important contributions concerning the absorption of ions, in which field, as previously stated, he is a leader.

A Man of Promise

Although his achievements seem ample, Professor Hoagland is still a comparatively young man, and will undoubtedly add a great deal more to the agricultural and soil knowledge of California and of the United States. He was married in 1920 to Jessie Smiley, whose sudden death from pneumonia in 1933 saddened her family and her wide circle of friends. Fortunately, she left three fine boys to be companions to their father, and to grow to respect his knowledge and character, of which Dean C. B. Hutchinson says, "I have long admired his unusual ability to analyze intricate and difficult problems and then direct toward their solution the modes of attack and techniques of the physical and botanical sciences. In all of my educational and research experience, I have never known a man who could do this better than he. For this reason I regard Dennis Hoagland as one of the most outstanding men in agricultural science today."

New Laws, New Ideas New Enterprises

By G. Chalmers McDermid

Charleston, South Carolina

SOME years ago, when the United States Department of Agriculture placed an embargo on the importation of certain flower bulbs from Holland, J. M. Harrison, vegetable grower of Charleston, S. C., conceived the idea that bulbs would be a paying venture on his farm. Accordingly, he contacted bulb importers and Department of Agriculture officials and started his crop, in a small way, off in one corner of his farm. From this beginning of a few acres in 1922, he has gradually increased his plantings to 40 acres last season, and it is this figure that he intends holding as his limit.

Mr. Harrison has left the bulb growing entirely to his brother-in-law, James W. Geraty, who besides growing from 100 to 150 acres of potatoes, spinach, squash, cabbage, and beans, still has time to talk about his bulbs. "If I have a hobby," says Mr. Geraty, "that hobby is bulbs, not only because they make such a beautiful showing during the growing season, but because they answer so readily to any treatment I give them."

The prevalent soil type on the Harrison farm is Norfolk sandy

Fields of narcissi like this lend a reason for the name of the farm—"Harrison's Pleasure Grove Farm."

loam, in which the bulbs seem to make their best growth. While Mr. Geraty has used both the heavier and the lighter soil types for bulbs in years gone by, experience has shown him that the loamy type gives him best results. This soil is well-drained and warms up rapidly during the winter months, and so he has relegated the other fields to the growing of truck crops.

Increased Potash Application

Planting usually begins in October. "Earlier planting," says Mr. Geraty, "gives us as good a stand, but we find that the longer the bulbs are in the ground, the more chance there is of a certain kind of second growth which causes them to split into smaller sizes, and this cuts down the number of marketable bulbs. I lay off my fields in 2½ foot rows, apply from 1,000 to 1,500 pounds of 4-8-8 (NPK) fertilizer in the rows, and stir well with my cultivators. After a few days in the soil, preferably after a light shower, I freshen the ground again with a light plow and plant."

When questioned as to why he had settled on his fertilizer analysis and rate of application, Mr. Geraty stated that he had started out in an experimental way, with applications of from 1,500 to 3,000 pounds of 8-7-5 fertilizer, thinking that nitrogen was the big element needed. Finding that these amounts of nitrogen were too much, he cut the applications down to 1,500 pounds of 5-7-5. Later, through much correspondence with the Department of Agriculture and others, he still further cut the nitrogen to 4 per cent and increased his potash to 8 per cent. Since that time he has been well satisfied with results, although he still feels that he could cut his nitrogen down another per cent and "get away with it."

Sometimes he follows potatoes or cabbage with his bulbs. Then he is able to cut the nitrogen down to 2 per cent, feeling sure that the amount of this plant food left over in the soil is sufficient to give his plants enough to carry them through. He has grown bulbs for as many as five years in succession in the same fields and says that they are managing to hold their own. He feels that this is a bad practice, however, because they will eventually exhaust certain essential plant foods and hurt the land.

"Phosphorus and potash seem to be the limiting factors for bulbs on my soil," says Mr. Geraty, "because I can't get satisfactory crops without them, especially the potash. I find that I can get away without nitrogen at all or just a little of it for a season or two, but a complete fertilizer running 3-8-8 or 4-8-8 is the best. When I have this analysis mixed, I insist that all nitrogen come from organic sources, such as cottonseed meal, fish meal, or blood, and the potash from manure salts or muriate of potash."

Insects do not bother this planting, and each year the State Crop Pest Commission gives it a clean bill of health. Thus is done away with the necessity of either treating the bulbs at planting time or fumigating the marketable bulbs at selling time.

Quality Brings Good Prices

Digging season comes in June, the tops beginning to die down in May. "Tater" digging also comes in late May and June, and Mr. Geraty is sometimes in a quandary as to which he shall dig first. "Taters will rot," says he, "if you leave them too long, and nature put a coat on narcissus bulbs which keeps them safe, so I always get the spuds first."

Prices received have been satisfactory, according to Mr. Geraty, except for the last year or so. He has been shipping his bulbs into most of the important Eastern and Midwestern cities, and his customers nearly al-

(*Turn to page* 44)

John Jackson and Son, Colebrook, N. H., have twice won cups with yields like these.

Learning *from* Club Yields

By Ford S. Prince

Agronomist, New Hampshire College of Agriculture

WE HAD a selfish motive in promoting New Hampshire's 300-bushel potato club. To the growers it may have appeared that the object of this effort was to reward them with suitable insignia when they produced the desired yield. But our real reason was to inquire into the methods they used to produce large yields of potatoes, for we have always believed that, within certain limits, big yields and low costs go hand in hand. This certainly means more profit on the potatoes that are grown.

Most of these men, who have succeeded in making the grade, by virtue of growing more than 300 bushels of potatoes per acre on a three-acre tract, are not average farmers. They are, in the main, much better than that. They are a keen, wide-awake group; men who drive, some of them, 100 miles or more to attend a meeting if they believe that there they will get an idea that will help them improve their methods. This they have done, as evidenced by the fact that the state record has crept steadily from slightly less than 400 to 532 bushels per acre, and with a significant increase in the average yield of the growers as a whole.

An explanation of how these growers produce high yields, the methods they employ, and how they have changed their fertilizer practices, seed usage, rotation methods, and spray programs to keep in the forefront in the potato game is the object of this article.

The rotation system followed on most farms has been the greatest weakness of these potato growers. They are used to long rotations, with the land down many years in hay, and it was not easy to shorten the cropping practice, until the wireworm menace came into the foreground. These insects infest old sod lands and cause damage to the potato stand as well as to the quality of the potatoes produced. Except by shortening the rotation, it is practically impossible to control these pests. That the growers are attempting to avoid wireworm dangers is borne out by the fact that in 1934 only 25 per cent of them used old sod land for spuds. In 1932, 40 per cent planted their crops on old sod land, and in the earlier years of the club, the percentage planted on old sods was even higher.

Another method of avoiding wireworms is to use the land for potatoes two or more years. In 1932 one out of twelve growers followed this method; in 1934 one in five planted potatoes on land that had been in potatoes the year before. While this does not necessarily shorten the rotation, it does avoid wireworm injury, as the damage the second year is always less than it was the first, even where the land is infested, due to the fact that many of the wireworms have emerged as click beetles. As the adults lay their eggs only in sod land, no new infestation occurs in land that is not down in hay.

Aside from quality due to the presence or absence of wireworms, the rotation followed has had an effect on yield wherever a clover sod is utilized for the potato crop. On farms where a short rotation has been practiced by members of this club and where a clover sod has been utilized, the average yield has been 427 bushels per acre, while the average yield on all the other farms has been but 376 bushels.

Yields in our New Hampshire club have not run as high as in many other states. In our club, a member must have at least three acres in order to enter, and yields are checked on this three-acre tract. This means in almost every case that the contest area is not loaded but is representative of the methods used on all the growers' acreages. Although a farmer has a right to select the three acres where the yield is to be checked, it is the exception rather than the rule to have him choose the area for taking records. We believe this keeps the club within the realm of practicability and the methods followed by the members applicable on many of our farms.

Mr. Jackson gives much attention to quality as well as yields.

One very definite result that has been obtained amongst the men who have entered the club is securing a better stand of potatoes. Due to the yield aim, the average width of row be hungry during the season. Although the amounts applied have varied slightly, depending largely on the price received for the preceding crop, there has been a tendency to

Potato growers "turn out" at the field meetings held during the growing season.

has been narrowed from 36 to about 34 inches, and the potatoes now are spaced closer in the row. The net result is the use of more seed potatoes per acre, and this is one of the trends that has become evident. In the early years 15 bushels of seed were the rule. The amount used has increased each year, until in 1934 the average was 19.4 bushels per acre. What the final outcome in this respect will be, we do not know. It is quite apparent that the maximum has not yet been reached, and early reports from the 1935 crop indicate that the average may run well over 20 bushels of seed per acre this year. It now has been firmly established that good yields are possible only with good stands and that labor, fertilizer, and spray material are wasted on a poor stand of potatoes.

These potato growers are not stingy with fertilizer. They believe thoroughly in applying abundant plant food so that the crop will never increase the plant food. The amount jumped from 1,960 pounds in 1929 to an average of 2,280 pounds in 1934, when the fertilizers used were all reduced to a 20-unit basis. Better soils, rotations, and methods permit of the use of more fertilizer with profit. Although certain experimental work that we have done in New Hampshire, work which these growers are keenly following, does not indicate abundant profits in applying more than one ton of 20-unit plant food or its equivalent, it is quite apparent that these men are not allowing their crops to suffer for want of something to eat.

The formula of the fertilizer that is used is receiving more and more attention from the potato growers. With experimental work as a background, they have learned that certain soils require more phosphoric acid than is found in the ordinary formula. Old sod lands where plant-

(*Turn to page* 41)

Discing down bur clover preparatory to bedding the land for planting cotton.

Winter Covers *for the* South

By E. B. Ferris

Extension Agronomist, Mississippi State College

THE older parts of the cotton belt boast of mild winter temperatures and a high annual rainfall. Properly taken advantage of, these factors might have proven blessings; but under the prevailing system of growing clean-cultured crops, like corn and cotton, they have, in fact, contributed largely to a rapid wearing out of the soils as a result of heavy winter rains falling on bare fields. In the more northern latitudes of the United States such rapid loss of plant food has not taken place even under a like system of clean-cultured crops because the lands freeze in winter and much of the precipitation comes as snow rather than rain.

It is estimated that several times as much plant food has been lost to the South from erosion and leaching as has ever been removed in crops. One has only to observe the millions of acres of gullied and abandoned fields in our section to be convinced that this estimate is not an exaggeration. Not only have the gullied hillsides themselves been destroyed, but inert subsoil material from them has covered even larger areas of once fertile bottom lands, filling up drainage ditches and obstructing the flow of natural creeks, and even rivers.

Of course, the mechanical protection of these hillsides with proper terraces is of first importance, but alone will never entirely correct the trouble because sheet erosion, while not so evident to the eye as actual gullying, is still as potent a factor in removing plant food. It may be said here that the South as a whole was never more erosion-conscious than now, following the intense campaign that has been going on recently in Soil Erosion stations and our many CCC Camps. Therefore, the time seems ripe to stress other factors that must be considered if our southern fields are again to be brought back to their once productive state when they rivaled any part of the civilized world in the crops produced.

The factors that have contributed most to a rapid wearing-out of these soils, namely, open winters and heavy rainfalls, might be made assets in growing more winter cover crops. These crops will prevent erosion and leaching and at the same time furnish winter grazing for livestock, and when turned under in the spring will add much humus to the soil, as well as nitrogen, if they are legumes. That our people are not all unaware of this fact is proven by the record in many of these states. As an illustration, the state of Alabama has a record of having planted only 50,000 pounds of winter legumes in 1918 and having increased this amount to some 6,500,000 pounds in 1934. To this time vetch and winter peas have been used more largely than any other kinds and their use is being greatly increased, not alone by intensive campaigns put on by the Experiment Station and Extension forces, but as well by the general knowledge among farmers, after seeing the results of their neighbors, that the growing of such crops pays wonderfully well.

While the vetches and winter peas will likely continue to be the most popular of these winter legumes, some wonderful results have been had in certain parts of the cotton belt from the use of bur clover as a cover crop following cotton or corn. Bur clover has long been used in the South as an early pasture plant and has one decided advantage over vetch and winter peas in its ability to produce abundantly seed which may be saved at small cost by the farmer. Too, when once well seeded, the seed ger-

An excellent crop of vetch is one of the most popular of the winter legumes.

minate slowly and enough seed will remain ungerminated in the soil to continue to give stands over a period of four or five years. Thus, in the Mississippi Delta certain planters have found that by letting a single heavy crop of this clover go to seed, they may continue to get stands for five successive winters even where these stands are plowed under in the spring before being given time to make seed. Such fields are watched, and where the stands begin to get poor, the crop is allowed to reseed, thus growing another abundant supply. These fields are then planted to late corn rather than cotton and are continued in the clover over an indefinite period.

A committee of planters studying a good growth of bur clover being used as a winter cover crop.

One of the greatest deterrents to the more general use of these winter legumes is the cost of annual seeding, which cost mounts to several dollars per acre for seed and inoculation alone, besides the expense of actual planting. If it proves practical to substitute over a wide area bur clover for vetch or winter peas, it will prove a great boon to the farmer. However, the cost of starting the planting of bur clover is much higher than with vetch or peas, because 8 to 10 bushels of seed in bur are required to plant an acre and they do not germinate so well nor as quickly as do the more commonly grown winter legumes. But the seed in the burs carry their own inoculation and while they sell for approximately $1.00 per bushel on the markets, they can be saved at home by the simple process of sweeping them up in the spring at the low cost of two to three cents per bushel for actual labor. A single acre well developed will furnish enough seed for planting 10 or more acres.

In Mississippi, numbers of farmers are planting small lots of this bur clover with the expectation of allowing it to seed and from this small start gradually increase their plantings as seed are available and the general knowledge of the crop is increased. In other parts of the state, crimson clover is being used to a limited extent for winter cover and has given fine results, but it, like vetch and winter peas, requires annual seeding and usually out-of-pocket money for purchasing seed and inoculating material. While vetch reseeds itself fairly well and has been known to perpetuate itself in a field

(*Turn to page* 43)

"Man Cannot Live By Bread Alone"

By C. J. Chapman

Soils Department, University of Wisconsin

I AM going to relate a soil fertility story that illustrates well the quotation from the Bible which I have used as title to this article.

I have in mind right now a large farm, some 1,200 acres, located at Oconomowoc, Wisconsin. This farm is owned by Fred Pabst of Blue Ribbon fame—fame gained both through his blue ribbon Holsteins and Blue Ribbon Beer. Some five years ago Mr. Pabst, through his manager F. J. Southcott, appealed to the Soils Department for help. Something was wrong with the soils on this farm. Crop yields had been slipping for several years.

It was in the fall of 1929 that I first visited this farm. I made a complete soil survey, taking samples of soil from the various fields on the farm. We tested these soils in our laboratories for acidity, available phosphorus, and available potash. We also ran greenhouse pot tests on representative samples from two of the fields on the farm where we planned to conduct field trials the year following. Our chemical tests and greenhouse results clearly indicated an unbalanced state of fertility.

I checked up on the previous history of this farm and found that practically every acre of tillable land had been limed. I found further that several carloads of rock and superphosphate had been used, and literally trainloads of feed concentrates had been purchased and fed to the large herd of dairy cattle on the farm.

Our laboratory tests on soil samples, our greenhouse pot tests, and the history of the fertilization, all pointed toward a potash problem. Of course, the lime-phosphate program

Potash paid on barley on the Fred Pabst farm, Oconomowoc, Wis. An 0-20-10 fertilizer increased the yield 5.6 bushels per acre in one of the driest seasons in history. Net profit from the treatment was $2.70 per acre. Superphosphate alone increased the yield 2.5 bushels per acre with a net profit of $.05.

had temporarily stimulated crop production, but all the time the reserves of potash were being lowered. The feeding of so much grain and other feed concentrates had tended still further to accentuate this potash shortage.

Mr. Pabst is one of the early graduates of the Short Course in Agriculture of the University of Wisconsin, and at the time he was a student our program for lime, phosphates, and legumes seemed to be fundamentally sound. Most of the soils of the state by chemical analyses showed tremendous reserves of total potassium, and we had little thought that potash would ever become a limiting element.

Crop Showed Potash Hunger

The soil on the farm has been mapped largely as Waukesha silt to fine sandy loam. For the most part it is a level terrace, underlain at a depth of two feet or more with a gravelly, silty clay, and on some portions with a sandy subsoil. This type of soil, even under average farming practice, has shown response to potash fertilizers in recent years.

In the spring of 1930, we laid out some large 3-acre plots on an 80-acre field of barley. We used straight superphosphate and compared this treatment with mixtures, with nitrogen and potash in varying proportions. The results of this first year's field trial and of subsequent tests have verified my suspicions that the lack of potash was largely responsible for the lowered productiveness of this land.

I recall vividly that first spring in 1930 an 80-acre field of alfalfa which showed in a most striking way the characteristic symptoms of potash hunger. The crop was stunted in growth. The leaves showed white flecks in their margins and the lower leaves were yellow and dried up prematurely, both symptoms indicating potash starvation.

We tried an experiment on this field. After the first crop of alfalfa was harvested, we made two rounds with a broadcast fertilizer sower across the entire length of the field, using on one strip pure 50 per cent muriate of potash and on the other strip an 0-20-20 mixture.

Very little benefit could be seen on the second crop that year, but the following spring those two strips in this field stood out head and shoulder above the rest of the field. Not only was there a marked difference in the growth of the alfalfa on these two strips, but we found that there had been less winter-killing where the potash fertilizer had been used.

In 1931 Mr. Pabst purchased a carload of superphosphate and potash fertilizer (10 tons each of 45 per cent superphosphate and muriate of potash.) In fact, he has been buying phosphate-potash fertilizers every year since, and it would do your heart good to see the alfalfa on this farm at the present time. No longer is there any evidence of potash starvation on fields which have been fertilized, but rather big, rank, dark green, thrifty, beautiful stretches of this great hay crop.

Varied Amounts of Potash

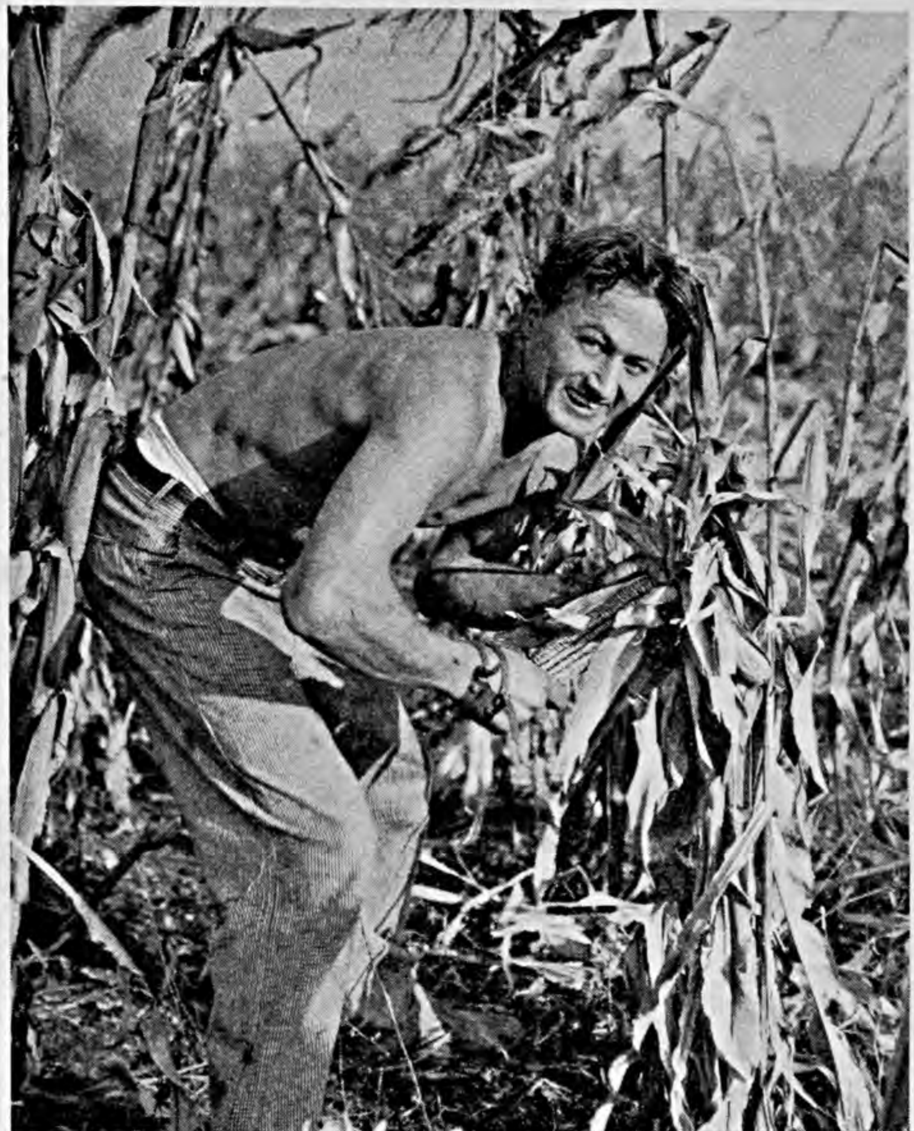
Last year Mr. Pabst became very much interested in the use of fertilizers on malting barley. He purchased a large 16-disc combination fertilizer drill, and on our recommendation purchased enough potash-phosphate fertilizer to cover 105 acres. We conducted some experiments on one field of barley to check the influence of varying amounts of potash in mixtures with phosphate on the malting quality of barley.

It is well known that the season 1934 was the driest in history in Wisconsin. Yields were cut short by reason of a lack of moisture and intense heat. In spite of the unfavorable season, however, there was a

(*Turn to page* 37)

Pictorial

NOT A CREATURE WAS STIRRING.

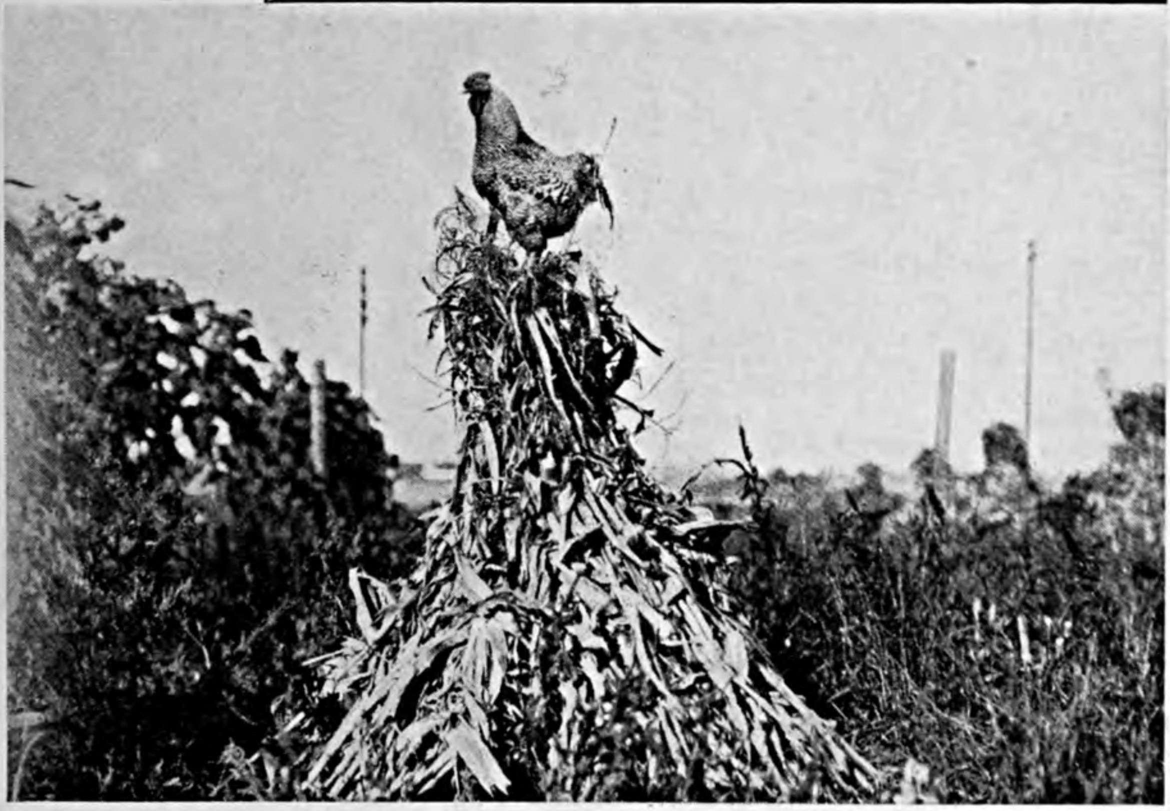


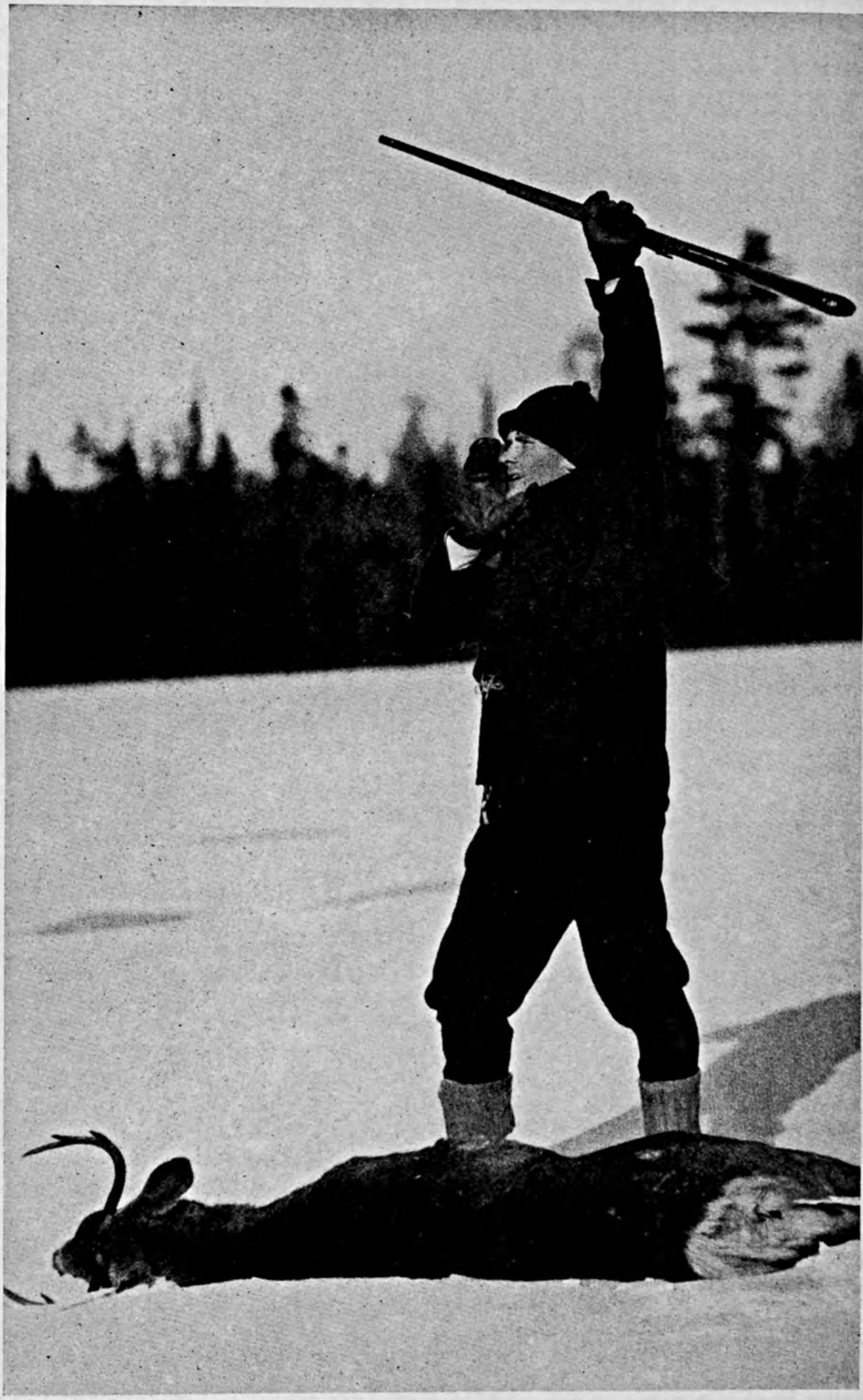
King of the Cornhuskers – Elmer G. Carlson, 26-year-old farmer from Audubon, Iowa, won this year's National Corn-husking Contest, recently held at Newton, Indiana. He set a new world's record by husking 41.5 bushels in the allotted 80 minutes.

Below: Interested Spectators.

Queen of the Muck Crops Show – Miss Evelyn Edwards was crowned "Queen" at the Northern Indiana Muck Crops Show held this fall at North Judson, Indiana. She competed with 20 other girls from surrounding communities to win this honor.

Below: Royalty, Self-crowned.





WHEN HUNTERS BREAK SILENCE

The Editors Talk

Christmas Spirit

Again we are at the end of another year. Mental and actual inventories of accomplishments of the aims and purposes with which we set forth on our living of 1935 flood upon us. To some there will come a degree of satisfaction; to others disappointment. Both will merge into a joyous Christmas Spirit if we will but open our hearts to it.

What is the source of the Christmas inspiration? What makes a sane and blase world prepare for the "holly day" in the same excited and happy way year after year? What makes an essentially and materially-minded people forget self in a furtherance of "Good Will Toward Men?"

It is, of course, the Christian significance. And yet, isn't there also evident the very human need of a means of clarifying our lives and putting ourselves in tune with a brotherhood out of which progress only can come?

We need a time to pause and check up. We need a time to forget our worries and cares. We need a time to fully appreciate our human relationships. We need the humbleness of the Christmas spirit. Let us imbide to the fullest extent possible.

Right Application Means More Profit

Several million tons of commercial fertilizer are applied to our farm lands every year. There is a right and a wrong way of applying this fertilizer to the land. The best methods of application mean larger yields and cheaper costs of production. Careful experimental work has shown that potatoes yield 20 to 25 more bushels per acre, corn 5 to 10 bushels, cotton 100 to 200 pounds more seed cotton per acre, and some other crops in proportion, if proper methods of application are used. Hence experimental work in this field is of much practical importance.

Investigations were started by the formation of a committee in the fall of 1925. During 1926-27-28 a number of cooperative experiments were conducted. A more comprehensive program, involving the use of machines in contrast to the old method of application by hand, was started in the spring of 1929 in South Carolina. During 1929 and 1930 the fertilizer and farm equipment industries contributed a substantial sum to cover expenses incidental to getting the program started.

Since 1931 the Bureau of Agricultural Engineering has expended in its cooperative work with the committee and with State Experiment Stations somewhat more than $100,000. During that time a number of experimental machines have been developed and a laboratory building was erected at Arlington Farm. The Bureau of Plant Industry and the Bureau of Chemistry and Soils and many State Agricultural Experimental Stations have contributed much to this cooperative program. The fertilizer industry is represented on the Joint Committee on Fertilizer Application. R. H. Smalley of the National Fertilizer Association is General Secretary.

The experiments in fertilizer application so far have been made on cotton, corn, tobacco, potatoes, cabbage, peas, tomatoes, snap beans, canning corn, lima beans, kale, spinach, sugar beets, and white beans. Experimental work to date has shown that the method of applying fertilizer to potatoes, for instance, in the bottom of the row mixed well with the soil, does not on the average produce the best yields. For practically all crops that have been under investigation, the work has given conclusive proof of the value of applying fertilizer in bands at the sides of the hill or row.

In addition to the work on methods, the farm-equipment industry has made distinct progress in developing new machines and attachments for old machines in order that fertilizer may be applied in accordance with the recommendations of the committee.

The results already obtained are of great value in the more efficient use of fertilizers. Further work should be heartily supported by everyone interested, to the end that where better practices are demonstrated, they may be put into general use for the betterment of all concerned.

Conserve the Soil

"Conservation of Our Natural Resources" is a term known to almost everyone. However, to most "Our Natural Resources" mean minerals, oil, gas, forests, and water power. Too few include what is now being emphasized as our most *important* natural resource—the soil.

"As a nation we have been blind to the need for conservation of our soil. Apparently we have felt that like Tennyson's brook which runs forever, the soil is imperishable and will continue to support plant growth," says Dr. J. S. Buie, formerly Chief Agronomist, Clemson College, S. C., and now a Regional Director of the Soil Conservation Service. He points out the danger in such an attitude by declaring that whether one does or does not own land, he is concerned in maintaining the productiveness of the soil. Every man, woman, and child in the United States is affected either directly or indirectly by the problem of soil conservation. It is not just an agricultural problem, but one of far-reaching economic and social significance, for it is impossible to substitute any other medium for soil in the culture of plants, without which human and animal life could not long continue.

It is gratifying to have Dr. Buie also say that the growing interest in the problem by the general public and the active participation in control measures by diversified groups are most encouraging.

REVIEWS

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

Fertilizers

A very interesting discussion of the geology of the soils in the state of Massachusetts as related to reserves of soil potash and the economical use of potash salts in crop fertilization is to be found in the new Agricultural Experiment Station Bulletin, No. 324, "Potash in Massachusetts Soils—Its Availability for Crops." Chemical analyses of soil samples from the 10 major soil series reveal quite a wide variation in total potash, higher percentages frequently being associated with higher content of silt-clay particles. On the average the percentage of potash in the silt-clay particles is only slightly higher than in the sand particles. Since the soils average about 75 per cent sand, much of the soil potash is contained in these sand particles. Probably the potash in this large percentage of sand is not as available as that contained in the smaller silt-clay percentage. In the opinion of the author, efficient use of fertilizer potash on these soils requires careful consideration of the soil texture and water supply. An abundance of water will enable a crop to make use of more of the soil potash, while with a scanty water supply, there is need for liberal use of easily dissolved potash fertilizers. Soil research workers and agronomists working with soils of a glacial origin should find this bulletin most helpful.

Bulletin No. 322, Massachusetts Experiment Station, "The Effect of Fertilizers on the Longevity of Mowings," is a report of experiments with varying amounts of N, P, & K on Merrimac fine sandy loam. In this work nitrogen was the most effective nutrient in producing differences in yield, with potash a close second. Increments of phosphoric acid were of no value in increasing yield. The results show a superior type of vegetation, particularly with respect to clover, on the plots which received high potash, while on the high-nitrogen plots there was a slightly higher percentage of the better grasses. High-nitrogen, high-potash fertilizers in a 3-1-2 ratio, in the opinion of the authors, should produce the best yield and quality of hay. They specifically point out that fertilization alone does not insure permanency of mowing, but rather does it prolong the period of profitable production. This bulletin is a most valuable contribution to our knowledge of hay-land management and fertilization.

"Effects of Certain Soil Types, Seasonal Conditions, and Fertilizer Treatments on Length and Strength of Cotton Fiber," Agr. Exp. Sta., Fayetteville, Ark., Bul. 319, *June* 1935, *O. A. Pope.*

"Fertilizers for Potatoes," (Second Report) Agr. Exp. Sta., Storrs, Conn., Bul. 203, *May* 1935, *B. A. Brown.*

"Vegetable Fertilizers with Special Emphasis on Home Mixing," St. Col. Ext. Serv., Storrs, Conn., Bul. 215, *Feb.* 1935, *Albert E. Wilkinson.*

"Borax as a Fertilizer for Celery," Agr. Exp. Sta., Gainesville, Fla., Pr. Bul. 478, *Aug.* 1935, *E. R. Purvis and R. W. Ruprecht.*

"Commercial Fertilizers," Agr. Exp. Sta., Lafayette, Ind., Cir. 212, Apr. 1935, H. R. Kraybill, O. W. Ford, O. S. Roberts, L. E. Horat, M. H. Thornton, C. M. Cohee, and J. W. Jackman.

"Soil Management and Fertilizers for Indiana Fruit Crops," Purdue Univ., Lafayette, Ind., Leaf. 185, Rev. Apr. 1935, Monroe McCown.

"Report of the Fruit and Truck Experiment Station, Hammond, La.," Agr. Exp. Sta., Hammond, La., Issued 1935, B. Szymoniak.

"Inspection of Commercial Fertilizers for 1934," Agr. Exp. Sta., Durham, N. H., Bul. 283, Dec. 1934, T. O. Smith and H. A. Davis.

"Fertilizer Experiments with Sweet Clover," Agr. Exp. Sta., Durham, N. H., Sta. Cir. 47, May 1935, F. S. Prince, P. T. Blood, T. G. Phillips, and G. P. Percival.

"Top-Dressing Pasture Lands with Fertilizer," Agr. Exp. Sta., Durham, N. H., Sta. Cir. 48, Apr. 1935, F. S. Prince, P. T. Blood, T. G. Phillips, and G. P. Percival.

"Fertilizer Report, 1934," Pa. Dept. of Agr., Harrisburg, Pa., Vol. 18, No. 4, Gen. Bul. 530, June 1, 1935.

"Recommendations with Reference to the Fertilization of Flue-Cured, Sun-Cured and Shipping Tobacco Grown on Average Soils in Va., N. C., S. C., and Ga. for the Year 1936," Sept. 1, 1935.

"Analyses of Commercial Fertilizers," Agr. Exp. Sta., Clemson, S. C., Bul. 304, Aug. 1935.

"The Fate of Added Barium Silicofluoride and Its Effect upon Sulfates and Other Soil Components, as Influenced by Limestone and by Dolomite," Agr. Exp. Sta., Knoxville, Tenn., Bul. 155, June 1935, W. H. MacIntire, W. M. Shaw, and Brooks Robinson.

"Commercial Fertilizers," Agr. Exp. Sta., Burlington, Vt., Bul. 397, Aug. 1935, L. S. Walker and E. F. Boyce.

"Boron in Soils and Irrigation Waters and Its Effect on Plants, with Particular Reference to the San Joaquin Valley of California," U. S. D. A., Washington, D. C., Tech. Bul. 448, Feb. 1935, Frank M. Eaton.

Soils

An ingenious chart showing the influence of soil reaction on the availability of mineral nutrients and other elements of importance in plant nutrition has been devised by N. A. Pettinger. This chart is incorporated in a bulletin describing in non-technical language the meaning, significance, and system of expressing soil reaction. The importance of soil reaction on the availability of a number of beneficial and non-beneficial elements in the soil is briefly discussed, and the suitable soil reactions for a number of field and garden crops are given. A very helpful table, which tells how much lime to apply to change the reaction (pH) of the soil a desired range, is included.

The author has wisely drawn attention to the limitations of benefits that may be expected from bringing the reaction of the soil to the proper range. Liming is not a cure-all for the non-productivity of soils. Proper fertilization, drainage, organic matter, and other factors also are important in producing good yields, and it is only by giving proper attention to all these factors that best yields of high-quality crops are obtained. However, soil acidity is a very important factor in the humid sections and best returns from fertilizers will not be obtained if the soil reaction is not favorable.

Farmers and those advising them will find this practical bulletin very useful. It is published by the Virginia Agricultural Experiment Station as Extension Bulletin 136, entitled "A Useful Chart for Teaching the Relation of Soil Reaction to the Availability of Plant Nutrients to Crops."

"The Measurement and Significance of Hydroxyl-ion Concentration in Alkaline-Calcareous Soils," Col. of Agr., Tucson, Ariz., Tech. Bul. 57, June 1935, W. T. McGeorge.

"The Use of Sugar Beet Petioles as Indicators of Soil Fertility Needs," Colo. Exp. Sta., Fort Collins, Colo., Tech. Bul. 14, July 1935, Robert Gardner and D. W. Robertson.

"Soil Erosion in Missouri," Col. of Agr., Columbia, Mo., Bul. 349, Apr. 1935, L. D. Baver.

"Soils in Relation to Fruit Growing in New York, Part VI. Tree Behavior on Important Soil Profiles in the Williamson-Marion Area, Wayne County," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 626, Apr. 1935, Joseph Oskamp.

"Soils in Relation to Fruit Growing in New York, Part VII. Tree Behavior on Important Soil Profiles in the Kinderhook, Germantown, and Red Hook Areas in Columbia and Dutchess Counties," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 627, Apr. 1935, L. P. Batjer and Joseph Oskamp.

"Field Crops on Berks Shale Soil Respond to Lime and Fertilizers," Va. Agr. Exp. Sta., Blacksburg, Va., Bul. 292, *Nov.* 1933, *P. T. Gish and T. B. Hutcheson.*

"Pasture Irrigation," Agr. Exp. Sta., Pullman, Wash., Bul. 313, *May* 1935, *L. J. Smith, Maynard S. Grunder, and Harry L. Garver.*

"Selenium and Other Toxic Minerals in Soils and Vegetation," Agr. Exp. Sta., Laramie, Wyo., Bul. 206, *June* 1935, *O. A. Beath, H. F. Eppson, and C. S. Gilbert.*

"Soil Blowing and Dust Storms," U.S.D.A., Washington, D. C., Misc. Pub. 221, *Mar.* 1935, *Charles E. Kellogg.*

"Chemical Studies of Infertile Soils Derived from Rocks High in Magnesium and Generally High in Chromium and Nickel," U.S.D.A., Washington, D. C., Tech. Bul. 471, *Apr.* 1935, *W. O. Robinson, Glen Edgington, and H. G. Byers.*

"Soil Survey of Perry County, Alabama," U.S.D.A., Washington, D. C., Series 1930, *No.* 30, *J. F. Stroud, M. E. Stephens, M. E. Swann, G. A. Swenson, W. E. Tharp, and B. H. Williams.*

"Soil Survey of the Brighton Area, Colorado," U.S.D.A., Washington, D. C., Series 1932, *No.* 1, *W. G. Harper, Lloyd Acott, and Elmer Frahm.*

"Soil Survey of Benewah County, Idaho," U.S.D.A., Washington, D. C., Series 1930, *No.* 22, *E. N. Poulson and K. B. Platt.*

"Soil Survey of Monroe County, Iowa," U.S.D.A., Washington, D. C., Series 1931, *No.* 9, *C. L. Orrben and W. E. Tharp.*

"Soil Survey of Iowa, Poweshiek County," Agr. Exp. Sta., Ames, Iowa, Soil Sur. Rep. 74, *Mar.* 1935, *P. E. Brown, T. H. Benton, H. R. Meldrum, and A. J. Englehorn.*

"Soil Survey of Iowa, Guthrie County," Agr. Exp. Sta., Ames, Iowa, Soil Sur. Rep. 75, *Mar.* 1935, *P. E. Brown, C. L. Orrben, H. R. Meldrum, and A. M. O'Neal.*

"Soil Survey of Iowa, Hancock County," Agr. Exp. Sta., Ames, Iowa, Soil Sur. Rep. 76, *Mar.* 1935, *P. E. Brown, H. R. Meldrum, T. H. Benton, and G. B. Killinger.*

"Soil Survey of Iowa, Washington County," Agr. Exp. Sta., Ames, Iowa, Soil Sur. Rep. 77, *Mar.* 1935, *P. E. Brown, C. L. Orrben, H. R. Meldrum, and A. J. Englehorn.*

"Soil Survey of Woodson County, Kansas," U. S. D. A., Washington, D. C., Series 1931, *No.* 8, *M. H. Layton and C. E. Dornberger.*

"Soil Survey of Neosho County, Kansas," U. S. D. A., Washington, D. C., Series 1930, *No.* 33, *M. H. Layton, R. W. O'Hara, and C. E. Dornberger.*

"Soil Survey of Tillman County, Oklahoma," U. S. D. A., Washington, D. C., Series 1930, *No.* 24, *A. W. Goke, E. G. Fitzpatrick, and W. C. Boatright.*

"Soil Survey of Randall County, Texas," U. S. D. A., Washington, D. C., Series 1930, *No.* 27, *E. H. Templin and T. C. Reitch.*

"Soil Survey of Galveston County, Texas," U. S. D. A., Washington, D. C., Series 1930, *No.* 31, *Z. C. Foster and W. J. Moran.*

Crops

The Agricultural Extension Service of Ohio State University has recently revised and brought up to date several of its best publications. Among those in the listings below are such subjects as "Growing Vegetable Plants," "Tomatoes for Canning," "Home Gardening," "Lawns," and "Better Pastures for Ohio Livestock." These publications make available for handy reference in one volume basic information with which many readers are familiar and all new data on the subjects involved.

An important winter crop is house plants. While usually of greatest interest to women, this crop occasions many inquiries to agricultural extension workers with reference to satisfactory cultural practices. A new bulletin, No. 206, "House Plants," by E. R. Honeywell, Department of Horticulture, Purdue University Agricultural Experiment Station, is detailed in its information on essentials of plant growth, plant containers, insects and allied pests, selection of house plants, care of greenhouse-grown plants, and other related subjects. Not only agricultural extension workers but every housewife who is interested in brightening up her windows will find this publication full of practical advice.

"The Quality of Arizona Cotton," Agr. Exp. Sta., Tucson, Ariz., Bul. 150, *June* 1, 1935, *R. L. Matlock and J. R. Kennedy.*

"Annual Report of the Director for Fiscal Year Ending June 30, 1934," *Agr. Exp. Sta., Newark, Del., Bul.* 192, *May* 1935, *C. A. McCue.*

"Growing and Handling Sweet Potatoes in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 55, *Rev. May* 1935, *D. R. Porter.*

"The Farm That Became a College," Univ. of Calif., Berkeley, Calif., Third Series, Vol. XXVIII, No. 16, *May* 15, 1935.

"Effects of Certain Environmental Factors on Germination of Florida Cigar-Wrapper Tobacco Seeds," Agr. Exp. Sta., Gainesville, Fla., Tech. Bul. 277, *May* 1935, *Randall R. Kincaid.*

"*Effects of Freezing Temperatures on Sugarcane in the Florida Everglades*," *Agr. Exp. Sta., Gainesville, Fla., Tech. Bul.* 278, *May* 1935, *B. A. Bourne.*

"*The Digestible Nutrient Content of Napier Grass Silage, Crotalaria Intermedia Silage and Natal Grass Hay*," *Agr. Exp. Sta., Gainesville, Fla., Tech. Bul.* 279, *May* 1935, *W. M. Neal, R. B. Becker, and P. T. Dix Arnold.*

"*The Tung-Oil Tree*," *Agr. Exp. Sta., Gainesville, Fla., Bul.* 280, (*Revision of Bul.* 221) *June* 1935, *Wilmon Newell, Harold Mowry, R. M. Barnette, Rev. by A. F. Camp and R. D. Dickey.*

"*Composition of Miscellaneous Tropical and Sub-Tropical Florida Fruits*," *Agr. Exp. Sta., Gainesville, Fla., Bul.* 283, *July* 1935, *A. L. Stahl.*

"*Cotton Varieties for Florida*," *Agr. Exp. Sta., Gainesville, Fla., Bul.* 285, *Sept.* 1935, *W. A. Carver.*

"*The Iodine Content of Some Georgia Vegetables and Water as a Factor in Its Variation*," *Ga. Exp. Sta., Experiment, Ga., Bul.* 190, *May* 1935, *K. T. Holley, T. A. Pickett, and W. L. Brown.*

"*Science Aids Idaho Farmers*," *Annual Report, Agr. Exp. Sta., Moscow, Idaho, Bul.* 217, *June* 1935.

"*Lespedeza in Illinois*," *Agr. Exp. Sta., Urbana, Ill., Bul.* 416, *July* 1935, *J. J. Pieper, O. H. Sears, and F. C. Bauer.*

"*More and Better Potatoes*," *Purdue Univ., Lafayette, Ind., Ext. Bul.* 89, *May* 1935, *W. B. Ward, C. T. Gregory, and C. E. Gould.*

"*4-H Corn Club Manual*," *Purdue Univ., Lafayette, Ind., Ext. Bul.* 157, *Mar.* 1935, *A. T. Wiancko and W. R. Amick.*

"*Peach Pointers*," *Purdue Univ., Lafayette, Ind., Ext. Bul.* 171, *Mar.* 1935, *Monroe McCown.*

"*Indiana Baltimore Tomato—Its History and Development*," *Agr. Exp. Sta., Lafayette, Ind., Cir.* 207, *Dec.* 1934, *Edw. C. Stair.*

"*Helps for the Home Garden*," *Purdue Univ., Lafayette, Ind., Rev. Ed., May* 1935.

"*Korean and Other Lespedezas*," *Purdue Univ., Lafayette, Ind., Leaf.* 175, *Apr.* 1935, *K. E. Beeson.*

"*Growing Tomatoes for the Early Market*," *Purdue Univ., Lafayette, Ind., Leaf.* 182, *Apr.* 1935, *W. B. Ward.*

"*Currents and Gooseberries*," *Purdue Univ., Lafayette, Ind., Leaf.* 193, *Apr.* 1935, *Clarence E. Baker.*

"*Extension Progress*," *St. Col. Ext. Serv., Manhattan, Kan., Ext. Bul.* 75, *Dec.* 1934, *H. J. C. Umberger.*

"*Forty-Seventh Annual Report of the Director for the Year* 1934," *Agr. Exp. Sta., Lexington, Ky., Jan.* 1, 1935, *Thomas P. Cooper.*

"*Biennial Report of the Rice Experiment Station, Crowley, Louisiana,* 1933–1934," *Agr. Exp. Sta., Baton Rouge, La., J. Mitchell Jenkins.*

"*A General Summary of Experiments with Sugarcane*," *Agr. Exp. Sta., Baton Rouge, La., Bul.* 267, *Aug.* 1935, *W. G. Taggart, C. B. Gouaux, E. C. Simon, C. W. Edgerton, E. C. Tims, P. J. Mills, W. E. Hinds, and B. A. Osterberger.*

"*Nitrogenous Metabolism in Irish Potatoes during Storage*," *Agr. Exp. Sta., College Park, Md., Bul.* 372, *Jan.* 1935, *Neil W. Stuart and C. O. Appleman.*

"*Permanent Pastures in Maryland*," *Agr. Exp. Sta., College Park, Md., Bul.* 373, *Feb.* 1935, *Fred V. Grau.*

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Economics

Potato growers interested in factors affecting farm income will find Bulletin 378 of the Maine Agricultural Experiment Station, entitled "A Study of the Organization and Management of Potato Farms in Aroostook County, Maine," full of valuable information. It is pointed out by the author, William E. Schrumpf, that the factors influencing most the labor income are size of business, yield rate of potatoes, and man-labor efficiency. As the number of acres, yield rate, and number of acres per man increased, there was a significant increase in labor income per farm. The author also emphasizes the fact that there has been a decided trend toward the use of higher analysis fertilizer. For example, the long popular 5-8-7 analysis, which in 1928 represented 60.3 per cent of the total tonnage on the 165 farms surveyed, had decreased by 1930 to 32.4 per cent. During the same period the 6-9.5-8.5, 5-7-10, and 10-16-14 analyses showed an increase of around 100 per cent in tonnage used.

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U. S. Farm Map Changed

CHANGES in the agricultural map of the United States, especially in the last half century, are easily evident. But the part that improved machinery has had in these changes is not so well known, says S. H. McCrory, Chief of the Bureau of Agricultural Engineering of the United States Department of Agriculture.

Wheat lands considered as unprofitable 30 years ago have become profitable through low cost production—largely because of the development of tractors and combines. Since 1915 there has been a general decline in wheat acreage east of the Mississippi, but the acreage has increased in Texas, Oklahoma, Kansas, Colorado, North Dakota, and Montana.

The Central Great Plains is more completely suited to extensive livestock farming because development of the combine led to the breeding of a dwarf grain sorghum—a low-cost grain when harvested with a combine. A man with a team will harvest not more than 2 acres a day of grain sorghums. But a 15-foot combine with 2 men will harvest and thresh 20 to 25 acres a day.

Combines also are making large acreages of soybeans especially profitable in the Corn Belt. Development of silage machinery makes it possible to turn the coarse, low-cost, low-producing forage crops of the Great Plains into palatable winter feeds. With modern hay machinery the Mississippi Valley farmer has increased his hay acreage.

While cotton acreage in South Carolina, Georgia, and Alabama was shrinking, it was expanding on less productive lands in Texas and Oklahoma, where yields are comparatively low but net profits are high because of low cost production with machinery.

The first result of improved agricultural machinery was larger farms and large machinery. But now the trend is towards adapting mechanical equipment to the small farm. The one-plow tractor and the small combine harvester are examples.

"New machines and improvement of present day machinery," says Mr. McCrory, "probably will continue to make changes in locations where crops can be most profitably grown and even in the kind of crops produced."

Silt Fills Man-Made Lakes

CITY people as well as farmers lose from soil erosion. Uncontrolled water not only removes tons of valuable topsoil from farms each year but it puts this soil into lakes and reservoirs used for water and power supplies. Many such reservoirs, built usually at high cost, in a few years will be filled with silt, rather than water, according to studies by the Soil Conservation Service of the United States Department of Agriculture.

This washing of topsoil usually is due to bad grazing, farming, and forestry practices in the watershed contributing to the reservoir—practices which have removed a vegetative cover and induced gullying and sheet erosion.

The Soil Conservation Survey gives these examples of man-made lakes which are rapidly filling: The Rogers Reservoir at Rogers, Tex., in 12 years has lost nearly one-fourth its storage capacity because of silting. Lake Waco, at Waco, Tex., in 5 years has lost more than 12 percent of its capacity. The reservoir at Spartansburg, S. C., in 8 years has lost more than 17 percent of its capacity. The efficiency of the Great Morgan Falls Reservoir near Atlanta "has been practically ruined due to the collection of silt and clay above the dam. Only the stream channel is open." The huge San Carlos Reservoir on the Gila River in Arizona in a little more than 6 years has lost nearly 3 per cent capacity.

Terracing, contour farming, strip cropping, gully control, more grass crops, and the planting of oversteep lands to permanent grass or tree crops retard erosion and will retain most of the silt now filling reservoirs, say soil conservation workers.

Fertilizer Makes Legumes Better Nitrogen Factories

LEGUMES are natural nitrogen factories—but their production may be increased with the use of phosphorus and potash.

Many farmers grow legumes as green manure crops because they collect nitrogen from the air and put it into the soil. Applications of phosphorus and potash to legumes stimulate their growth enabling them to produce more nitrogen than if they did not receive these fertilizer materials. These are not wasted as they are available for the next crop as corn or cotton when the legumes are plowed under and decay.

By this method the farmer gains the use of three fertilizer materials although he applied only two.

Phosphorus and potash applied to legumes when grown as a green manure crop help to produce heavier yields of corn and other crops than if the same fertilizer is applied directly to the crops, tests of the United States Department of Agriculture show. In the South, fertilizer mixtures of 0-10-4 and 0-8-4 applied at the rate of 400 pounds an acre are generally satisfactory for increasing the growth of the Austrian winter pea and other legumes grown as a green manure crop preceding corn and cotton.

Indian Summer Results From Whims of Weather

"INDIAN summer," according to the United States Weather Bureau, is one of those picturesque traditions, no one knows just how or when. Meteorologists have never really defined the term, but they consider it to have more foundation in fact than such purely fanciful weather ideas as the one about the groundhog.

The ideal Indian summer, the official weathermen say, is a tranquil period—with little or no wind, with much hazy sunshine, and with temperatures well above normal, though not as high as in the real summer. It sometimes follows cold, stormy, somewhat unseasonable weather the latter part of September, in October, or even in November. Some autumns—about one-fourth of them—have no very definite Indian summer; others have two or three periods that might qualify as such.

The so-called "Indian summer" is the result of a strong, persistent high atmospheric pressure along the Gulf and South Atlantic coasts and out over adjacent waters. This high pressure forces cyclonic, or widespread storms to take a more northerly course than usual, and their centers to pass along the northern boundary of the United States. Thus an almost continuous flow of warm southern air is drawn into northern territory. The haziness in Indian summer air is due to soil dust, smoke, and particles of dead leaves that rise readily with occasional gusts of wind, and remain long suspended because there is no rain to wash them out.

Fruit Growing in Canada

FRUIT growing is an important branch of Canadian agriculture, embracing a wide range of fruits from hardy northern berries to peaches and grapes. Many kinds of fruit are successfully grown in many sections of the Dominion, but fruit growing as a commercial industry is limited to rather well-defined districts, these being principally the Annapolis Valley in Nova Scotia, the southern half of Ontario, and the valleys of British Columbia. The valley of the Saint John river in New Brunswick produces apples on a commercial scale, and there are parts of Quebec where apple growing is successfully practiced on a commercial scale.

In Nova Scotia, the apple-growing industry has assumed great importance, the bulk of the crop being annually exported to Great Britain. The first experimental commercial shipments of apples to England from the Annapolis Valley were made in 1861. Up to 1890 production of apples in Nova Scotia rarely exceeded 100,000 barrels, but after that date there was a pronounced increase in acreage and production, and in 1909 the production reached a million barrels. A record crop of about 1,900,000 barrels was produced in 1911, and further records were made in 1919 when the gross crop exceeded 2,000,000 barrels.

Apple growing in Quebec dates back to 1663, and it is in this province that the celebrated Fameuse apple is thought to have originated. The capabilities of Quebec for the production of apples of the finest appearance and of the best quality are very great, but at present there are not sufficient apples grown for the local demand.

In Ontario, where the commercial production of all kinds of fruit that can be successfully cultivated in Canada has reached its highest development, apples have been grown from the middle of the eighteenth century. Commercial orcharding has developed only within the past fifty or sixty years and was only made possible when the building of railways permitted trees and fruits to be transported rapidly. In addition to apples, peaches, pears, plums and cherries, small fruits and grapes are produced upon a large scale in the Niagara fruit-growing district.

In British Columbia commercial fruit growing is of comparatively recent origin, but the development of commercial orcharding has been very rapid, especially during the last ten years. The most noted fruit district is that of the Okanogan Valley. Pears, plums, peaches, apricots, cherries and small fruits are also grown on a large scale.

Good Tobacco Crops

ONTARIO'S 1935 flue tobacco crop will go on record as one of the brightest colored, as well as one of the largest tobacco crops, ever produced in the province. From the standpoint of quality the crop is the best since 1932, and there have been few tobacco crops produced in Ontario that would equal it as a whole.

The estimated total acreage of flue tobacco in Ontario is 31,000 acres as compared with 24,000 acres in 1934. The average yield is placed at 925 pounds per acre, producing a total crop of 28,675,000 pounds; in 1934 the production was 21,860,000 pounds. The acreage of burley, which declined between 1931 and 1934, was expanded greatly this year and is placed at slightly above 9,000 acres, compared with some 6,800 acres in 1934. The average yield of burley is estimated between 1,200 and 1,300 pounds per acre, resulting in an output of approximately 11,250,000 pounds compared with 7,950,000 pounds last season. It is an excellent crop and is curing up well. The 2,000 acres of dark tobacco also show good yield and quality.

Man Cannot Live by Bread Alone

(*From page* 22)

marked response to the fertilizer treatment. On our plots we used straight 20 per cent superphosphate, an 0-20-10, 0-20-20, and straight potash (20 per cent Kainit). All fertilizers were applied at rates of about 250 lbs. per acre with a combination fertilizer drill. The fertilizer was drilled in direct contact with the seed. Acre plots were used, running the entire length of the field. These plots were separated by blank strips 18 inches wide, to facilitate accurate harvesting.

The plots were harvested and threshed separately. Weights were taken of the grain as it came from the fields before threshing, and records kept both of weight of straw and weight of grain.

The 0-20-10 plot gave the largest net returns ($2.70 per acre). We observed, however, that in the case of the 0-20-20 there was some firing or burning, probably due to the extreme dry, hot weather. I am still of the opinion that had the season been normal, the 0-20-20 plot would have shown the largest yield.

Malting tests were made on barley from the various plots, but by reason of the dry season very little difference in quality could be determined.

Still Investigating

On the basis of our tests in 1934, Mr. Pabst used this year the 0-20-10 mixture on 275 acres of barley, applying at rates of from 140 to 150 pounds per acre with combination fertilizer drills. Tests are being repeated on one of the fields to check once more the influence of varying amounts of potash, not only on yields but on the malting quality of the barley. Moisture conditions have been favorable so far, and at this writing, June 17, the 0-20-20 plot is showing up best.

You may ask, why not use some nitrogen in the mixture? Frankly, I'm afraid to recommend nitrogen on this farm. Mr. Pabst can grow plenty of straw in a normal year, and the addition of nitrogen may result in decreased yields if weather conditions are unfavorable at the finish. In fact, we have tried nitrogen in our mixtures in previous years, and this year we have a 4-20-10 plot in comparison with the 0-20-10. It may prove profitable, but with a high level of nitrogen on this farm, we believe that year in and year out it is safest to omit the nitrogen.

It is my belief that in normal years a 1:1 ratio of phosphoric acid to potash will prove most profitable, both from the standpoint of yields and malting quality, and also influence on legume seedings.

It is a surprising and interesting thing to note that even though the level of phosphorus on the soils of this farm is high, the barley crop seems to respond to and requires phosphorus as well as potash for maximum results. Where alfalfa is being seeded, with barley as a nurse crop, we are recommending somewhat higher ratios of potash to phosphoric acid.

What we have learned of the need for potash on the Pabst Farm is true of thousands of other farms in Wisconsin and other states. The liming of our soils and the continued use of phosphates are bound to accentuate the need for potash. There is no one program of soil fertility that is going to work under all conditions. A fact today may be a fallacy tomorrow. We have no sooner patched up one weak link in the chain than another one develops. But it's true that we must maintain a balanced state of fertility in our soils if we would harvest maximum yields.

New Opportunities

"Man cannot live by bread alone," nor can plants live by lime or phosphorus alone. Many of the soils that we thought were sufficiently well supplied with potash to last for hundreds of years to come are now responding profitably to potash fertilization. Our knowledge of the plant-food requirements of crops and of the plant-food limitations of our soil is still meager, but we are learning more every year. Larger numbers of carefully conducted demonstrations and field trials over a period of years will result in new and startling discoveries. And it looks now as though we are going to have to start all over again in many of our experimental plots, and include mixtures carrying some of these so-called rare elements, particularly magnesium, copper, manganese, and even iron and boron.

I am satisfied that in Wisconsin there is still an almost untouched field of educational work to be done in getting our farmers to use potash where potash is needed; phosphates where phosphates are needed; nitrogen where nitrogen is needed; and combinations of these fertilizing elements where combinations are needed. There are thousands of acres of land in this and other states where crops growing on them are hungry and crying for plant food. There are thousands of farmers who in their smug complacency are content to follow along with the same old system, completely asleep and unaware of their opportunity. It is a challenge to the extension workers in crops and soils to arouse our farmers to their opportunities—an unending task and unlimited field of endeavor.

Tomatoes Make Known Their Diet Needs

(*From page* 9)

areas instead of turning dark brown as in the case of excess nitrogen or deficient potassium, they turn a whitish yellow colour.

Phosphorus deficiency is indicated by a stunting of the growth and small-sized leaves dull green or greenish brown in colour which later turns to a purple or bluish purple.

Plants receiving excess or luxury potassium feeding tend to be slender in growth, leaves are spaced farther apart, and the foliage is somewhat lighter green than exhibited by balanced feeding. In extreme cases there is a mosaic-like mottling of the lower leaves sometimes accompanied by dull purple spotting or patches.

In extreme cases excess calcium causes a marked curling of the leaves which are harsh and brittle in texture; necrotic spots appear on the lower leaves, whitish yellow in colour and characterized by concentric water-marked circles. These areas are similar to those produced by a deficiency of magnesium.

The symptoms detailed above do not include all deficiencies and excesses studied

Fig. 3—An excessive or luxury feeding of phosphorus brings white, necrotic spotting on the leaves.

but those most likely to be encountered in tomato growing. Among those described probably excess calcium is the least likely to be of trouble with the tomato plant. Excess nitrogen is probably the most frequently encountered and one of the causes of severe losses in tomatoes due to physiological disorders of the fruit. In greenhouses lack of balance between nitrogen and potassium is a common trouble producing considerable plant debility, easily corrected by increasing the potassium applications.

Peculiarly enough we have obtained death of the plant from luxury feeding of phosphorus more easily than from the excess feeding of any other element.

In sand cultures we found that a ratio of 1.5 of P_2O_5 to 1 of K_2O in the nutrient solution to be satisfactory. Increasing this ratio to 3 of P_2O_5 to 1 of K_2O gave a definite depression in yield and vigor, while a ratio of 4.5 to 1 produced definite foliage injuries as described. A ratio of 7.5 of P_2O_5 to 1 of K_2O brought about the death of the plants.

Balanced Ratios

In the case of excess feeding of nitrogen, foliage injury in the form of chlorosis and burning of the lower leaves was produced with a N/K_2O ratio of 4.5 to 1. Widening this ratio to 9 to 1 caused the injury to be much more severe, with lesion-like patches on the stems and petioles but without causing the death of the plant.

Whilst it is not recommended to feed excess nitrogen at any time, it should be pointed out that there is a definite danger in supplying excessive quantities of phosphorus especially when the potassium is not at a high level. In sand cultures, it would appear that the N/K_2O and the P/K_2O ratios should not exceed 1.5 to 1. In sand cultures even lowering the P_2O_5 content considerably did not produce any signs of phosphorus deficiency.

In other words, on a sterile soil, the above ratios have been found approximately correct. On regularly cultivated areas, the factors which would necessitate a change in this ratio would be the availability of the plant foods in the soil, but with a soil well supplied with available phosphorus it would appear undesirable to increase the phosphorus content of a fertilizer much beyond that of the potassium.

Nitrogen-Potash Ratio

To produce an extremely vigorous tomato plant free of foliage disorders is a comparatively simple matter. The minimum amount of all elements plus a large amount of nitrogen with a corresponding amount of potassium will accomplish this. In other words, the maintenance of the correct ratio between potassium and nitrogen is the important factor. Such plants will also produce a large crop of fruit but probably severely affected with blossom-end rot. The following table sets this forth more fully:

	Yield in oz. per plant	*% blossom-end rot*
Normal Solution...	57.0	1.6
Normal Solution + 2 × (nitrogen + potassium)......	83.1	26.9
Normal Solution + 3 × (nitrogen + potassium)......	87.2	47.5
Normal Solution + 4 × (nitrogen + potassium)......	90.8	59.3

In other words there is a definite positive correlation between susceptibility to blossom-end rot and extreme vigor of the plant. Since this vigor is dependent upon a high supply of nitrogen, it is considered that heavy applications of a nitrogenous fertilizer at any one time are contributory to this trouble. It would probably be advisable to commence with a soil which is not extremely rich in nitrogen but well supplied with minerals, and supply light dressings of nitrogen as the growth of the plants indicates the necessity.

The source of nitrogen also has an effect upon the susceptibility of plants to this trouble. It would appear that quickly available sources of nitrogen are more dangerous than more slowly available forms. Results from the Experimental Farm at Sidney, B. C., show that the former produced three times the amount of blossom-end rot as produced by the latter supplying an equal amount of nitrogen.

Susceptibility to blossom-end rot is also influenced by season or length of day. Plants handled in an identical manner and fed the same nutrients have significantly different percentages of infection when grown during different seasons of the year. Thus a nutritional treatment, which produced 57 per cent infection with plants grown from February to May, produced only 17 per cent infection with plants grown from July to September. The following table further emphasizes this point.

Date of Fruiting	*% Blossom-End Rot*
April 16	100
25	83.7
30	47.0
May 4	32.9
9	21.2
14	22.5
19	22.2
26	14.3

Susceptibility to this trouble is markedly increased during a short day period and especial care should be taken to avoid undue forcing of growth by the excessive use of nitrogenous fertilizers. During dull weather tomato plants require a good deal of potash and little nitrogen and may employ much nitrogen with somewhat less potash in fine, sunny weather.

Learning from Club Yields

(*From page* 17)

food availability is low and highly acid soils which carry an abundance of phosphorus-fixing elements such as iron and aluminum need a high-phosphorus formula. John Jackson & Son of Colebrook, New Hampshire, recognize this need and have twice won the state cup for producing the highest yield. In 1931 they broadcast a half ton of superphosphate in addition to their regular fertilizer and secured a yield of 506 bushels per acre. In 1934 they applied a half ton of basic slag with a resulting yield of 532 bushels, which is the club record to date.

Potash, as well as phosphorus, comes in for its inning. On the river valley soils and on soils that do not exhibit extremely acid conditions, this element is used perhaps more abundantly than phosphorus, in analyses like the 4-6-10 or 8-12-20. Where the soil needs are not definitely known, it appears wise for a grower to keep the phosphoric acid and potash on the same level in amounts ranging from two to three times that of the nitrogen content of the fertilizer.

About half of the growers have used double or multiple-strength fertilizers, such as an 8-16-14 or 8-16-16, while the others have applied materials approximating 20 units of plant food. Yields for the two groups are not vastly different, with double-strength users slightly in the lead so far. There may be cases where low-analysis goods are preferable, such as very light soils demanding much organic material. But with a substantial price differential, the high-powered goods have a strong appeal, especially in the face of low potato prices.

The one question, aside from fertilizer, that has been most largely discussed in 300-bushel club circles is whether it is better to spray or dust. Advocates of dusting shout loudly and proclaim their method is best, while spraying devotees adhere just as strongly to applying their vine protection wet.

A study of the records does not reveal much advantage in yield for either method. From the data available we gather that 115 men have sprayed, with an average yield of 388 bushels per acre; while 62 that have dusted have grown 381 bushels per acre. Certainly neither group has much advantage. The men who sprayed have had to go over their fields slightly oftener than those who dusted.

Less Labor in Dusting

From the viewpoint of practicability, spraying gives a grower cheaper material cost, while dusting necessitates considerably less labor. When other farm work presses, dusting can be done in early morning or in the evening when the dew is on the vines or just before it condenses. Spraying on the other hand, necessitates an abundant water supply, and while most growers concede that spraying is preferable in combating early blight, the lack of water often forces a farmer to dust when otherwise he might prefer to spray. The use of home-made dust mixers or inexpensive purchased outfits enables dust users to cut their material costs about 40 per cent, and most of the men who prefer or have been forced to use dust mix their own materials. These have proved very satisfactory.

There is a growing tendency to use more lime in dusts and sprays in order to get a better shading of the potato leaves. Tip-burn, hopper-burn, the effects of flea beetles, and early blight can be partially controlled if a shading of the leaves is effected. A coating of lime on the leaves is the method of producing there a partial shade.

There is no debate about whether to apply materials to control insects and disease. All over New Hampshire this practice is universal. Growers are tending to start somewhat earlier and to get on more applications of spray or dust than formerly were made. Leaf-hopper and flea-beetle ravages of late years have made the growers more conscious of this necessity.

The use of certified seed is one practice that is well-nigh universal. Even in the northern part of the state where the climate is almost ideal for the potato crop, the custom is to get at least enough good seed each year to produce the potatoes for the following year's crop. In southern New Hampshire where the climate is not so ideal and where insects that spread virus diseases are more abundant, new seed is bought practically every year. In fact, about 40 per cent of the entire potato acreage of the state is annually planted to certified seed and about 90 per cent of the acreage is planted to potatoes that are not more than one year from certification.

Competition Holds Interest

Most of the larger potato growers of the state are or have been at one time enrolled in the 300-bushel club of New Hampshire. Many have entered and failed the first time, but came back to win the coveted honor, after their mistakes were pointed out.

A few growers have entered year after year and enjoy enviable records in the club history. H. E. Webster of Franklin has been in the club seven times and has an average yield of

423 bushels per acre. Burton A. Corbett and John Jackson and Son of Colebrook have been in the club six years and have an average yield of 446 and 445 bushels, respectively. R. W. Dunbar of Warren has a six-year record of 385 bushels. W. G. White and M. R. Young of North Haverhill have five-year averages of 408 and 411 bushels, respectively. H. G. Burns and Son of Milford, New Hampshire, have succeeded in growing 439 bushels over a four-year period.

The responsiveness of these growers to new and better methods is one of the outstanding features of the 300-bushel club. They form today the backbone of potato improvement work in New Hampshire and have been in the forefront in the marketing organizations that have been perfected to dispose of the certified seed and table stock crops.

Winter Cover Crops for the South

(*From page* 20)

for an indefinite time if annually allowed to mature, winter peas usually are destroyed by insects in late spring and may not be depended upon to reseed at all. In common practice the seed for both vetch and peas are usually purchased and sown each fall, almost solely for their soil-enriching properties.

While these common winter legumes have the ability to get their nitrogen from the air, they have no such power to obtain the mineral plant foods and it is quite essential to success that these minerals be supplied. Numerous tests over Mississippi by the Soils Department of the Experiment Station, as well as by similar work fostered by the Tennessee Valley Authority, have shown that the growth of these winter legumes has been materially increased by the use of the mineral plant foods where they are deficient in the soil for the regular summer crops. Also it has been shown that the inoculation of the seed before planting is even more essential, bur clover being the exception because it carries its own inoculation when raked from the soil and saved in the bur, as is the customary practice.

The successful growing of winter cover crops is no longer an experiment and no one doubts the advisability of the practice, but many handicaps stand in the way of its extension to the South as a whole. One of the greatest of these handicaps is the fact that so many of our fields remain unfenced, and, even where stock laws prevail, animals roam at large over the fields during the winter. Another deterrent is the rather heavy cost of annual seeding and the difficulty in dry falls of getting the seed to germinate early enough to become well rooted before the occasional winter freezes. At best the education of the farmers to the point of getting winter cover crops started has been slow, but the increase, in 18 years, from 50,000 pounds to 6,500,000 pounds of seed planted in a single season, the record of one state, is certainly proof of the fact that the work is progressing and merits the consideration of the farmers as a whole. Certainly no such numbers of them ever could have been induced to this practice if the earlier trials had not proven profitable.

Based on the sound experience of thousands of farmers who have tried it, the growing of winter legumes seems one sure way of building and maintaining soil fertility in the South. We have not been able, and can never expect, to maintain soil fertility under a system of clean-cultured crops like cotton so long as the bare soils are left in winter to the mercy of our heavy rainfalls, unprotected and without the roots of plants to hold the soil particles intact as well as to take up and store the plant foods that become available.

Any winter cover will do this much and will to this extent prove valuable. However, when at the same time it will store the equivalent in nitrogen of hundreds of pounds of our common nitrogen carriers, we can scarcely afford to substitute the non-legumes for the legumes, or to plant oats, rye, or wheat rather than vetch, winter peas, or several of the clovers.

New Laws, Ideas, Enterprises

(*From page* 14)

ways send "repeat" orders. He sells in four grades, the 12, 13, 14, and 15 centimeter sizes, and does not bother to pick out the extremely large 16 and 17 centimeter bulbs because the extra money he would get for them does not pay for the time and trouble it takes to get them out. Small bulbs and the splits and slabs, he uses for seed and finds them very satisfactory. Some growers tell him that he should get 200,000 bulbs from an acre, but he is satisfied to get from 115,000 to 120,000. His yields may be smaller than those of other growers, but Mr. Geraty believes that they use a closer spacing than he does, and he is satisfied with a two for one increase.

Now comes the most "ticklish" part of the whole bulb proposition, that of curing them. Mr. Geraty places his bulbs in regular field boxes in the field. They are hauled to the curing shed. This building is wide open on all sides, with a wooden floor four feet from the ground, and the roof is very low hanging at the eaves. For the first two weeks, the bulbs are turned over and over, every second day, to prevent their molding or nesting and to keep the natural heat, which always is present in a newly dug root crop, from injuring them. During the next three weeks, they are turned at least twice a week, and after that once a week or ten days until they are sold. No artificial heat is used in the curing process, climatic conditions being such that air drying does the work very well.

Florists and householders of Charleston frequently drive to the Harrison farm to purchase flowers, but no systematic effort has ever been made to sell them. Mr. Harrison and Mr. Geraty are in the bulb business for bulbs, and it's your garden and my garden that benefit from these carefully grown products of a relatively new Southern enterprise.

Looking Backward

(*From page* 6)

"If cotton comes down to six cents, our case will be deplorable, but what can be substituted in its room?" inquires a worthy squire from the Middle Country. He notes that the ancestors of the planters during the revolution were more prosperous, and he asks if the present population had inherited their economy as they had the land. "Ask any old revolutionary inhabitant how many coaches, with their retinues, were driven to the town; and if stick-a-back chairs, with servants in attendance, were then the common mode; or if there were any Balston spas, Saratoga springs, or tours to Canada by way of Niagara Falls, to drain the planters of their cash?"

Checking off the possible substitutes, this sage observes that the country was not suited to grain and that its overproduction in any event would mean a low price and a greater evil than six-cent cotton. "Grapes have not succeeded for want of proper treatment or the right kind." Silk he dismisses as equally futile. "If we resume growing indigo or tobacco, the amount of the first would supply the whole world without taking account of that grown elsewhere, while our lands are too much exhausted to attempt tobacco. To be sure we might again consider cane, as molasses, syrup and rum may be made from it," the old scribe continues, "but in the former we shall be rivalled by the West Indies; and the whiskey taste and temperance societies will destroy any expectation we may have from rum." (Sort of betwixt the upper and nether millstones.) Hark now to his final blast: "The only recourse that presents itself is a *general retrenchment*—this, hard as it may appear, is the only relief to which we can resort." (Did this philosopher vision the era of 1935?)

IN THEIR extremity, the planters discussed freely on public occasion such topics as whether more livestock would be an advantage along with cotton and corn, and argued the merit of introducing the plow to the lowlands where sea-island cotton was listed by slaves with hoes.

"Where cotton is the principal crop, the raising of any kind of stock is impracticable as a matter of profit," writes another truculent planter. "With little cessation from labor in preparation of cotton and corn, how then is the force employed to find time for stock? Where are the shelters to protect them from inclemency or the forage to sustain them? Look at the skeleton appearance of the cattle in March, hardly tempting enough for the turkey-buzzard as he soars by in search of prey." Taking opposite view, a few others cannily point out that much manure for land improvement and much provisions would be returned by live stock; but as a rule their opinion was in the sad minority.

ONE of the rare articles revealing the social customs of the time came from the quill of W. W. Hazzard of Georgia. It discussed the paternal management system of plantations. One bit from this morsel is enlightening in these days of so much solicitude for the unemployed, the infirm, and the aged. He relates that it was his daily custom to take counsel with the Negroes concerning their relations with himself. "I assure them," he writes, "the laws of the land have secured to them rights which the master dare not violate without risk of incurring heavy penalty or imprisonment in the penitentiary; and that it is the duty of the courts on receiving information on oath of any infirm slave being in suffering situation from neglect, to make inquiry and render such relief as they in their discretion may deem proper." Then he winds up with the climax: "This protection which our laws have provided for them in their old age and infirmity, Europe and the Northern states have never extended to the poor old white man!"

Much as the high duties on imported manufactured articles imposed by the tariff blistered the minds of the agricultural South, eventually leading to the famous Nullification Act, one finds less impatient discussion of that hated measure in the farm press than of the more fundamental topic—land deterioration.

Some contributors of original papers saw clearly that some day the opportunity to abandon worn-out plantations and move farther West into the fertile reaches of Arkansas, Missouri, Texas, and Tennessee would be ended; and they besought the people to remain in the old colonies and improve their heritage by scientific farming. As we scan the pages of those budding times in the light of our modern knowledge of soil conservation and chemical restoratives, we admit that it would have required heaps of courage to stay in Georgia and the Carolinas, depending on the meager and conflicting experiments with limited fertilizing materials, when vast empires awaited the settler's plow and hoe within the borders of our domain.

YET there is pitiful logic and hopeless common sense found in vain pleas of the elders to keep their sons and daughters content in the land of their birth. They acknowledged that the "fatal impediment" to successful farming was indifference and aversion to technical reading, and the absence of schools and experiment stations.

One who takes the pen-name of Highlander undertakes to strike at this obstruction, and he writes: "Our farms are going rapidly into hopeless sterility and if cotton should double in present value, the prospect before us would be scarcely less gloomy." Then he clinches it by adding: "The planter whose worn-out fields produce nothing for sale can have but little choice between high and low prices. Within the range of my acquaintance there are planters who, by means of fresh soil, great industry, rigid economy, and a convenient market, realize an annual income of eight, ten or even twelve per cent on the capital employed; others hardly one per cent, and some tending to pauperism."

In a final gesture of resignation, Highlander writes: "There is scarcely anywhere in the United States a more robust, active and laborious yeomanry than is found in the upper country of the Carolinas and Georgia. Give them good soil and stimulating prices and no people can out-crop them. But they are for the most part as unused, and as disinclined to give attention to manuring as their predecessors, the Catawbas, Creeks and Cherokees." Then he closes with eloquent phrases: "Perhaps some one more sagacious or resolute than the rest may already have made a lucky experiment demonstrating the feasibility of retrieving an exhausted cotton field, or preserving its pristine fertility. If so, in the name of patriotism let him speak, let him give us the ways and means in detail, so that we may bring up our paternal estates to a condition of profitable use; or on that dire alternative, an inglorious flight to the woods, wilds, and durances of the Southern and Western frontier."

NOWADAYS we have no foreboding about losing our offspring to the call of the virgin acres. There are no more rainbows in the Western sky for youth to reach for in search of the golden harvest. Just as the story in the Bluebird tells us, we may quit seeking far and long for the horn of plenty locked in the bosom of earth. Our happiness lies in our own convenient meadow, ready to spring forth under the wand of science and practice. The hoar frost and the dew point the way afield to our own "acres of diamonds," the domestic wealth and content which those sages of a century ago dreamed of, but never realized.

I wonder if, in 2035, the delver in the dust of ancient times of our own day will regard *us* as constructive planners, purposeful writers, discerning philosophers? Modesty and lack of space forbid me to answer.

COMPENSATION?

A Negro preacher was talking to his congregation about salvation. Finally his sermon was finished, and then he said, "Now, Brother Smith, will you take up the collection?"

At this point an elderly man got up and started for the door, saying, "Parson, Ah thought you said salvation was free—free as the water we drink."

"Well, brother," replied the preacher, "salvation is free and water is free, but when we pipes it to you, you has to pay fo' de pipin'."

Mother—"Now, do you know where bad little girls go to?"

Molly—"Oh, yes—they go almost everywhere."

SURPRISE

He was at the fountain-pen counter making a purchase. "You see," he said, "I'm buying this for my wife."

"A surprise, eh?"

"I'll say so. She's expecting a Packard."

A man was fumbling at his keyhole in the small hours of the morning. A policeman saw his difficulty and came to the rescue.

"Can I help you to find the keyhole, sir?" he asked.

"Thash ald right, old man," said the other cheerily, "you just hold the house still and I can manage."

LOYAL ROOTER

Mother: "Now say your prayer, sonny, and go to sleep."

Little Dicky (a football enthusiast): "God bless Ma, God bless Pa, God bless me—rah! rah! rah!"

Lifeguard (with girl in arms): "Sir, I have just resuscitated your daughter."

Father: "Then, by Gad, you'll marry her!"

"Love makes the world go round."

"So does a good swallow of tobacco juice."

Drunk (bumping into lamp post): "Excuse me, sir." (Bumping into fire hydrant): "Excuse me little boy." (Bumping into second lamp post and sitting down): "Well I'll just sit here until the crowd passes."

DIPLOMACY

A colored country preacher, who was strong on visiting the female members of his flock, was traveling along the road to the home of one of his congregation when he met the small son of the lady member.

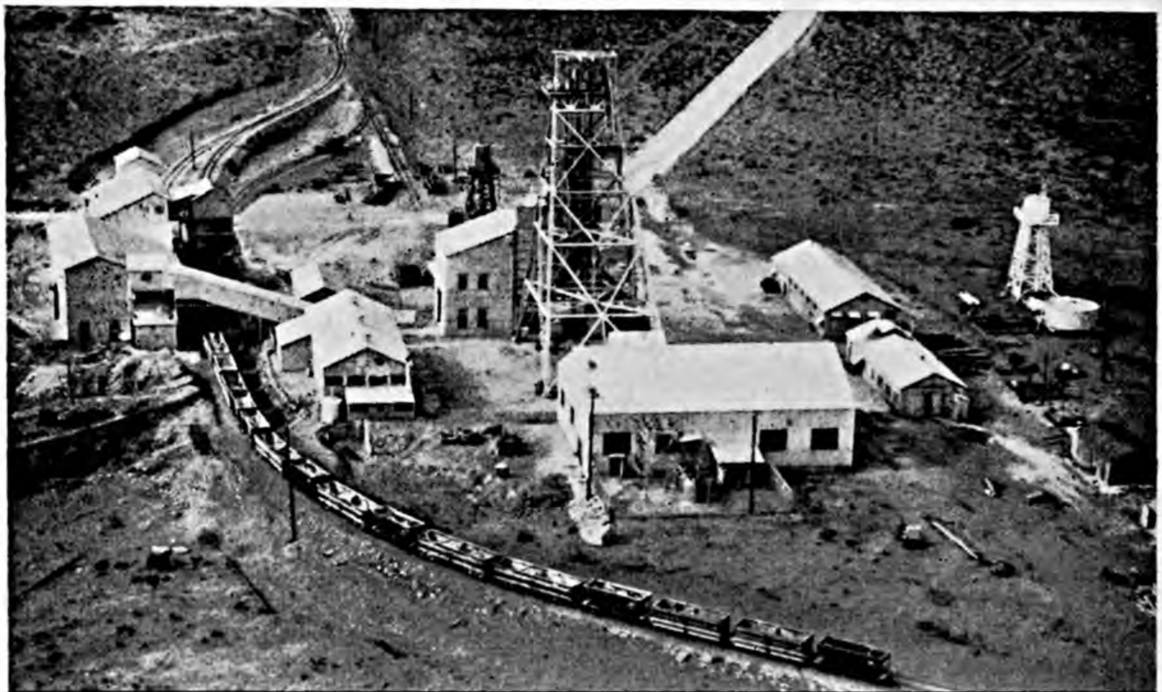
Parson: "Where's your mother?"

Small Negro: "She's home."

Parson: "Where's your paw?"

Small Negro: "He's home."

Parson: "Tell 'em howdy fuh me."



Aerial view of hoist and grinding plant at the U. S. Potash Company's mine near Carlsbad, N. M.

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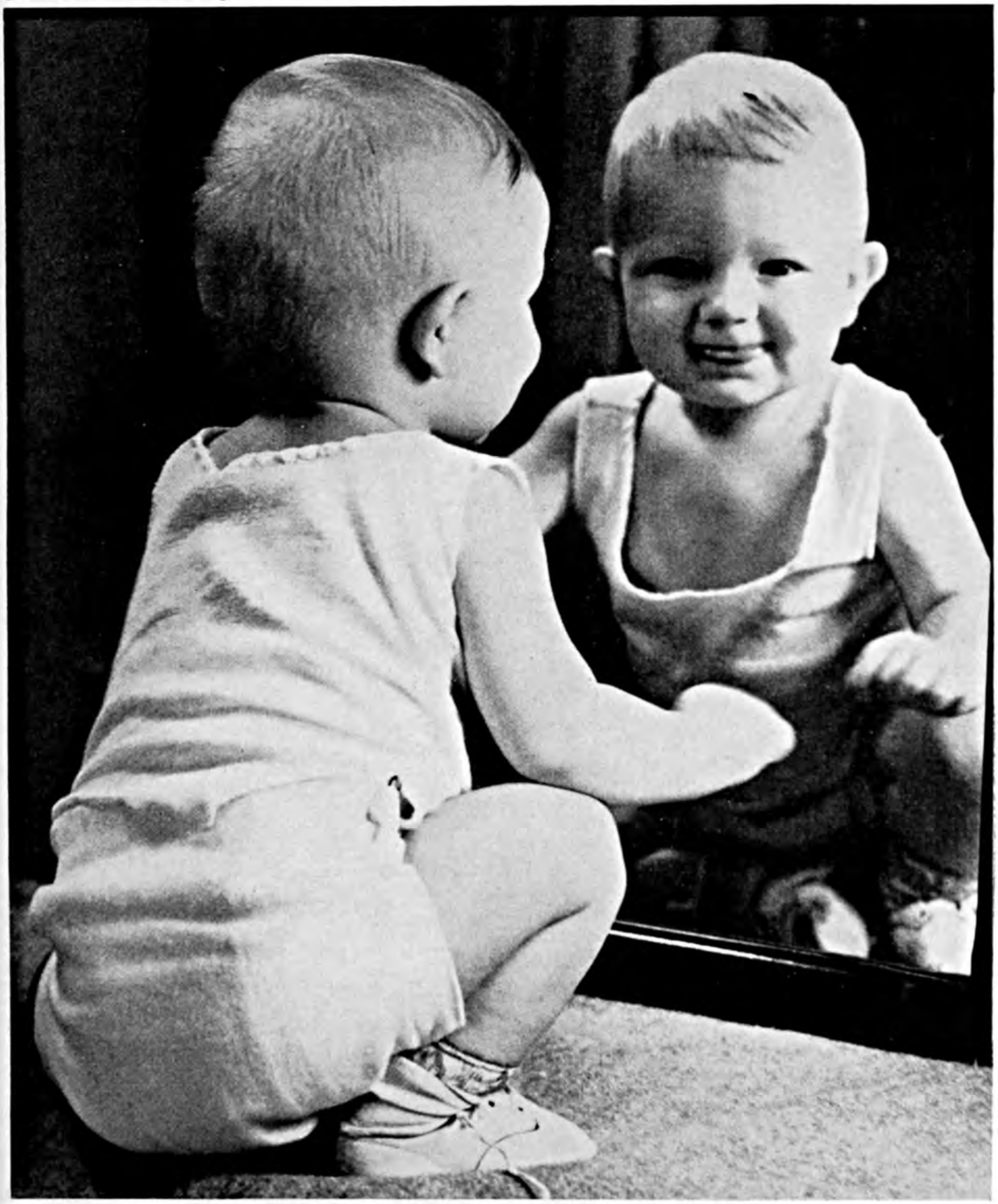

The Pocket Book of Agriculture

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The Whole Truth — Not Selected Truth

R. H. STINCHFIELD, *Editor*
Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER FIVE

TABLE OF CONTENTS, JANUARY, 1936

American Potash Institute, Inc.
Investment Building, Washington, D. C.

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Welcome Welfare

By Jeff McDermid

"WELFARE" is going to be a mighty big and imposing word in 1936. You need only scan the newspapers today to see how potent that old noun is bound to become before we meet on this page in another twelvemonth. Pick up some of those greetings you got by the basketful this New Year's Day, and somewhere will appear a reference to your welfare and perhaps that of your mother-in-law—unlikely as it may seem for these things to happen simultaneously.

Read the grand summary of the fiscal year issued by the banking fraternity and see if you can find the hidden word "welfare" in the puzzle of digits and hints of inflation. Never mind if it isn't staring at you; it's hovering around just the same. Bankers do not mention it so loud in election years. It's for quiet use in annual statements to stockholders.

It also bobs up at Washington, Distracted Center, where legal ponderosity and obscurity are now engaged in a tremendous threshing-bee. There nine judges are hunting in the chaff thrown over them for a few grains of truth anent the mossy old "welfare clause" in the Constitution, to determine whether Congress may use it any more except for campaign purposes.

Welfare in a country seems to me like health in the body. The more you talk about the symptoms of disease, and the way a case of colic, pyorrhoea, floating kidney, or jimjanders begins, the more "sartin" you are that you have contracted it incurably.

OF course, the analogy has already run its first course here, and when the farmers took sick we all began to run temperatures. Let's not be too historically clinical, however, but face in the convalescent direction, grasping a cane and a bottle of physic.

If we are a bunch of weepy-eyed and pale-jowled survivors of a few major financial operations, the cheerful New Year's conversation need not be marred by a lot of tripe about the stitches, the anesthetic, and the gas pains. We ought not to "fash ourselves," like old Scotch shepherds around a rickety lamb, about the chances we face of being afflicted anew or being run over by a new model without insurance. Upon our release from the ward we may not be quite lively enough yet to crack our heels together and whoopee, but we should resolutely face our undertakings without ghoulish mention of the undertaker.

Parenthetically, this doesn't prevent us from packing along a little caution. If we start being bumptious and greedy again, we are apt to get fatty heart or something; and when the fat is badly distributed, the body suffers—just like the country's welfare when unjust or unwise accumulations occur at given points, and anemia and emaciation develop elsewhere.

Now at first thought we would think it easy to discuss such a gladsome topic, and such a desirable objective, as our welfare. Yet before we proceed very far, the simple words of the old saw come to jar our prospects of indulgence. You all recall it, "What is one man's meat is another man's poison." That's why we don't all order oysters, lobster, or Welsh rabbit, despite the fact they are writ mighty large on the welfare signs of Broadway. If welfare were a spot on the map, all the guide-books would disagree as to the shortest and the best way to get there, and there would be plenty of people ready to drain your gas tank or puncture your tires, so they might get there before all the turkey was gone and all the soft beds taken for the night.

Why in the world such a worthwhile thing as welfare is set up as an idol with one hand and then shoved in the ash-can with the other, is more than my feeble philosophy can penetrate.

The trinity of welfare, split up for vivisection, consists of health, comfort, and prosperity. The first branch, that of good health, is relatively definite. Yet in our American scene an unhealthy or harrowed mind hurts a strong body oftener than it used to here and more than it does in the peasant realms of Europe.

ON the contrary, health is also something you can't force a guy to hang onto if he wants to overstock himself with comfort and prosperity. I know several chaps who started out with unspotted livers and strong gizzards. Today they have calcimined their tissues with so much vat virus and kettle grease that their general welfare is considerably hamstrung. They not only looked on the wine when it was red, but they demanded the whole fluid rainbow, regardless of its distilled origin. "To be merry," quaffed they, "one should guzzle and gobble."

They figured that Diamond Jim Brady, Nebuchadnezzar, and the international grand champion barrow thrived in history by keeping near the nick-nacks. "And as for the Constitution," said they, "it's a tough old bird and we can always amend it."

Curious how blamed involved this becomes! I know still other old-timers who violated every rule of the Y. M. C. A. cafeteria and have teeth and bones as sound as ivory, despite a ton of tobacco, five hogsheads of intestinal varnish, and countless toxic menus. They claim to have enjoyed themselves, and maybe that's welfare.

But remember, we don't legislate and educate for the exceptional ones. That's left to the do-nothings who

believe in the survival of the fittest. It isn't safe to plot any health-welfare index curves on those old buzzards. Proceed with the case.

Next consideration is given to health exploited and prostituted by commercialism and armed conquest. Everything from the Hull House to Hopkins and Tugwell is allied in Red Cross work, patching up the former; and the League of Nations and the Sanctions are "pouring oil" on the troubled waters of the latter. Yet American efforts to maintain world peace are hampered by our efforts to save the pieces at home.

COMMERCIAL greed is not as rampant an enemy of health welfare as it was in the fifteenth century, but that's about the best we can say for it. We might notice here that the American motor speed mania killed more people in 1935 than all the slums and starvation combined. It seems that health welfare is not secured by resolutions and regulations quite as effectively and thoroughly as we might desire. It has, however, increased the average life expectancy nearly a decade in thirty years. Yet some claim that life expectancy is the only expectancy that has been bettered, but maybe they are misanthropes.

COMFORT is another stumbling block on our avenue of logic. To some extent it lends itself to regulation and to enforced standards, but there are exceptions.

I have known tree-sitters, human projectiles, devotees of broadside tattooing, marathon dancers, and obliging bridge-game volunteers. Regardless of long hours of personal torture and muscular discomfort, they have sacrificed their welfare to no indispensable cause. We get half our comfortable thrill entertainment out of somebody's silly discomfort, because we pay them for being uncomfortable. Thus we put a premium on being out of repose and in awkward and trying positions.

I have not looked in the debates on the Constitution to see if Alexander Hamilton or John Randolph had any opinions on our rights and duties to interfere in such cases of palpable infringement of personal welfare. If I find same, I will file a brief before election.

Comfort is also too variable a factor to be roped off and legislated around with must-do's and do-not's. Climate affects it, and we have a blamed lot of climate to consider. Personal whims alter it. It isn't measured in a standardized way for all. Save for broad limits of physical endurance one way or 'tother, comfort is too vague for me to recommend to my ambitious political friends as a field for their talents. The tariff and oleomargarine afford them far better targets.

If you think that "comfort" makes good legislative material, page the janitors, the landlords, the hotel-keepers, and the train and bus operators—yes, and maybe a brace of colored porters for extra testimony, in case the white man's word is insufficient.

ASK them among other useful and trivial questions, what are the proper lengths of bed-sheets, the right temperature for bathroom or parlor, the best kind of soap for the lavatory, and how much ventilation and humidity are required to keep everybody happy. Ask them how hot shaving water must be and how cold is a good drink. Find out, while you are still sane, how much coal is needed to heat a boarding-house for two old maids, four stevedores, and a guy with the rheumatism. Also be sure to ask them when to turn on the electric fan.

I'm trying to show that welfare is a kind of will-o-the-wisp. We all chase it. Some of us see it double, and others see it in many distant spots at once. How may we all catch up with it? Up to this point I hope my case is as clearly muddled as the Hoosac Mills argument or the N. R. A. sick chicken docket—to say nothing of what is ahead of us in the Guffey coal case, the T. V. A., and the nominating conventions. If I omit a few "and-ors" please be lenient with a layman.

Health, comfort, and prosperity,—and the greatest of these is prosperity! Which merely brings back anew that darned old, disagreeable question as to whether we know when we are well off! Those who do are always possessed of welfare, even enough of it to last six weeks after Christmas without looking for more.

It is disturbing to have the road to our mutual welfare turned into a race-course. It is on the path of money prosperity that most of the havoc occurs. Here possibly some adjustment of brakes and gears and plenty of traffic cops with shootin' irons are necessary day and night. No doubt if we had more of these preventives, there would be less need for the arnica, bandages, and restoratives used by poor-relief agencies.

The egg who would advance a plea of self-determination and the rugged right to drive as he pleases on the busy but overcrowded boulevard of business is going to get more than a ticket hereafter. They may even take some of his oil and gas to fill the tanks of a few sober and decent flivver drivers and then put a damper on his accelerator.

Yet it's queer how most folks not in the studious, academic, and cloistered group are bent on getting sudden financial prosperity, and how much time they spend in vexing their souls over those "32 millionaires" and the other dinosaurs in the upper quartile of fortune.

THUS envious, they fall prey to all manner of sham and chicanery, from counting dots, doing upside-down puzzles, and answering radio gags, to going in for old-age benefit bonanzas, bonus marches, and share-what's-left parades.

After all now, answer me this: what difference in covetousness is there between one of these and the limousine lizards, whose fabulous but uneasy incomes only make them restless and grasping? Just as we have said that "the boy is the father of the man," we may exclaim that the rich man is sired by his own original poverty.

I stand for reasonable curbs on commercial selfishness, but I am also in favor of a halter on pressure groups who help themselves to gravy by keeping foolish folks in a stew. These lobby artists really do not want a state of satisfaction to prevail or a

(*Turn to page* 45)

A liberal application of wood ashes on the above area changed the vegetation from moss and fern to a thick mat of wild white clover. (No seed or other treatment given except close grazing.)

Potash *and* Clover *for* Better Pastures

By Dr. A. R. Midgley

Research Agronomist, Vermont Agricultural Experiment Station

THE chief function of potash in pasture fertilization is to increase and maintain white clover. Legumes require much more potash than grasses, and while the soil may have a sufficient amount available for the latter, yet legumes, especially pasture clover, may readily respond to additional amounts.

While grasses usually respond immediately to added nitrogen, and the user can see results from his efforts the same season it is applied, response from minerals, such as phosphate and potash, is much slower. Maximum results are often delayed for a year or more after application. This is mainly because fertilizers are usually applied as top-dressings to established pastures, and these minerals move downward very slowly into the feeding root areas. On run-down pastures, where very little clover is present, maximum results cannot be obtained until the clover is established.

Fertilizer response greatly depends on the plant used, and for this reason it is difficult to say from chemical soil tests that there are, or are not, sufficient plant nutrients available. At the Vermont Agricultural Experiment Station, in both field and greenhouse studies, certain soil types responded remarkably well to added potash when clover was the predominating plant, but when it was nil and grasses predominated, much less plant response was obtained. This is clearly shown in the table of experimental data obtained on Ray Tillotson's farm at Middlesex, Vermont.

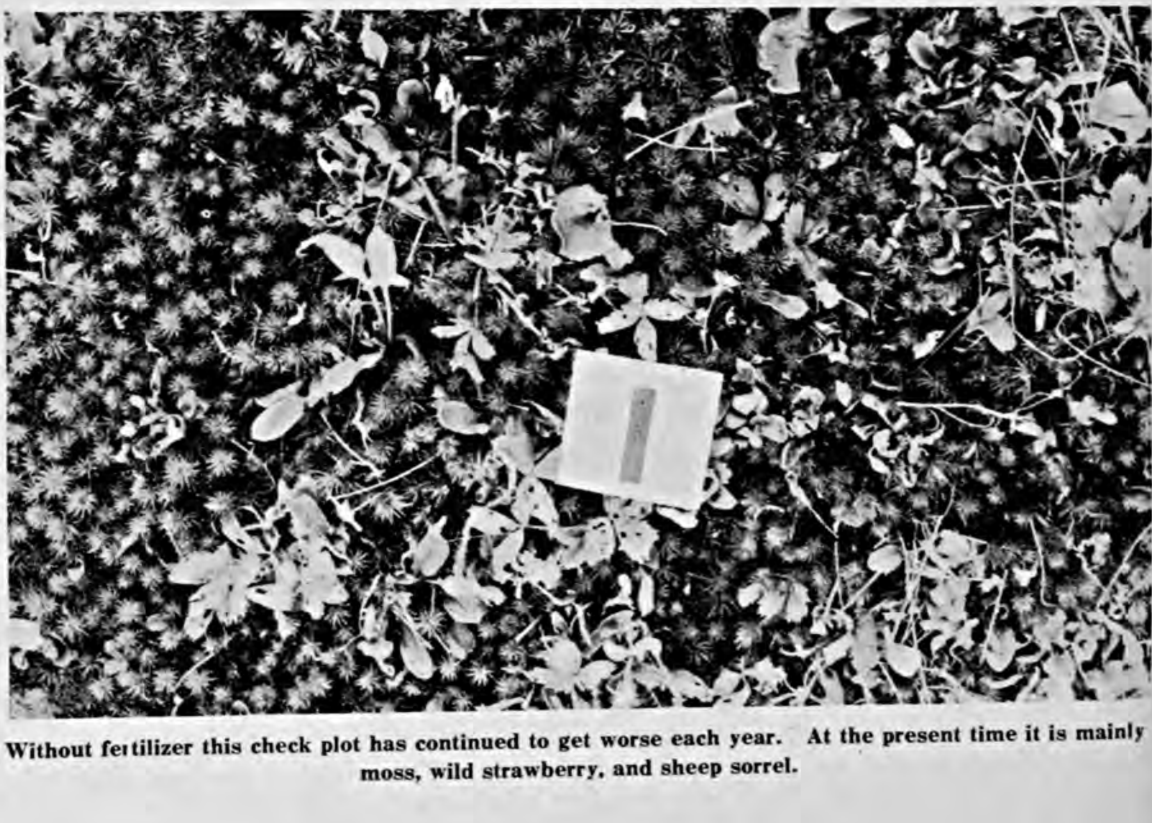
These fertilizer test plots were started in the fall of 1931, and careful records were obtained during the past four years. Limestone was applied to all limed plots at a rate equivalent to one ton per acre. The rates of other materials used on certain designated plots were 300 lbs. muriate of potash, 800 lbs. 16 per cent superphosphate, and 250 lbs. sodium nitrate per acre. The nitrogen was applied early each spring, and all plots were cut rather frequently and managed in such a way as to promote the growth of existing wild white clover.

Many interesting data have been obtained from this experiment, and it is clearly evident from the table that nitrogen gave tremendous increases compared with the other treatments during the first year. This was mainly because grass was the predominating plant, but after two years, clover became the predominating plant on all plots where potash was used, especially in combination with phosphate.

YEARLY PERCENTAGE INCREASES IN YIELDS FROM USE OF VARIOUS FERTILIZERS OVER NO-LIME CHECK PLOTS

Plot No.	*Soil Treatment*	*Year* 1932 %	1933 %	1934 %	1935 %
1	Limestone Only	10	6	50	68
2	Lime and Potash	50	55	80	172
3	Lime and Phosphate	25	11	45	70
4	Lime, Potash and Phosphate	85	175	185	400
5	Lime, Potash, Phosphate and Nitrogen	387	190	343	450

At the beginning of the experiment nitrogen with minerals and lime gave nearly 400 per cent more herbage than the check plot without any treatment, while potash and phosphate only gave an increase of 85 per cent. After four years, however, minerals and lime without nitrogen gave practically as much total material as the same treatment with nitrogen. Phos-



Without fertilizer this check plot has continued to get worse each year. At the present time it is mainly moss, wild strawberry, and sheep sorrel.

phorus alone, or in combination with lime, has given very little response on this soil. In fact, during the past four years, the turf on these plots, as well as on the check plots, has continued to get worse, and it is now rather mossy with considerable wild strawberry present.

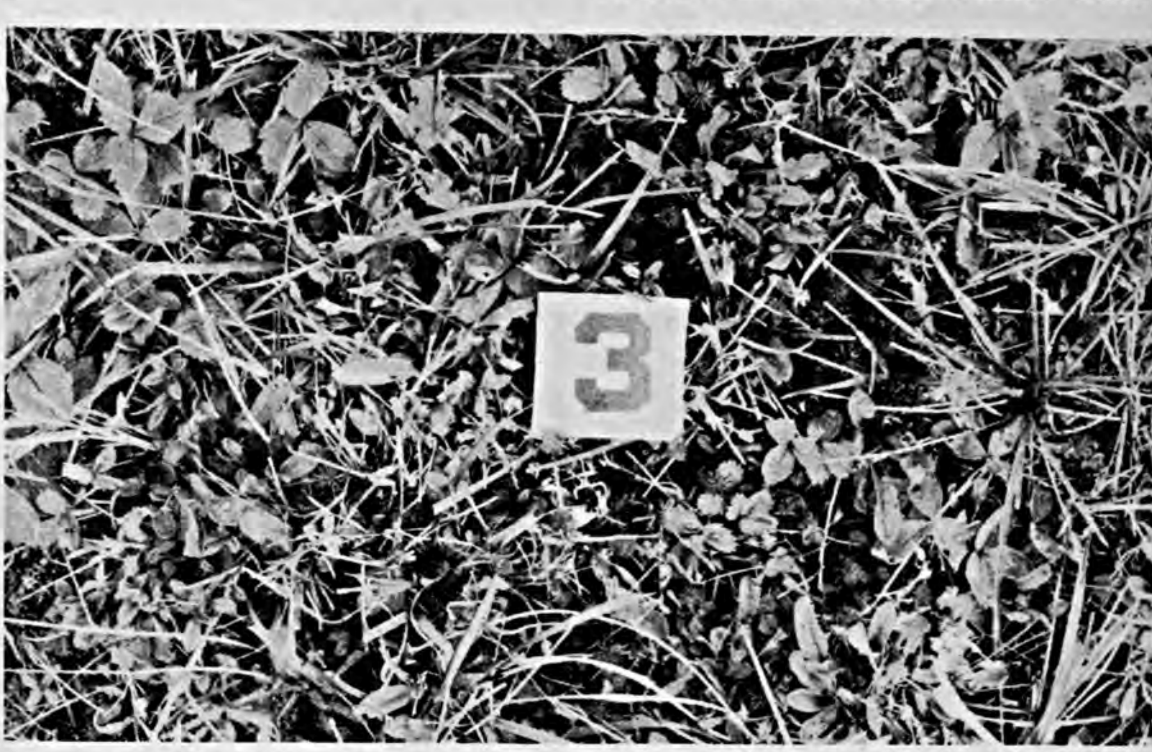
This is strikingly different from plots where potash is used alone, or in combination with phosphate, since these plots have a very good clover turf, as readily can be seen in the illustrations. Just why phosphate with lime has not been more beneficial on this soil, which is so low in this mineral, is difficult to understand, because most pasture soils respond readily to added phosphate. While it is true that potash gives greater response than phosphate on this soil, neither one alone can be recommended because of its apparent relationship to the other. In fact there is some evidence that potash helps to maintain phosphate in an available condition on this soil.

In most pasture programs nitrogen has been given a prominent place, but recently clover instead of nitrogen has been receiving considerable attention for permanent pastures. The main reason why pasture clover has not been more satisfactory is that we have not realized that the fundamentals necessary for maintaining it are very different from those for maintaining grasses. For example, pasture clover requires high mineral fertilization with close grazing, while grasses require high nitrogen fertilization without close grazing.

Poor methods of seeding and handling pastures are another reason why it is difficult to obtain a good clover turf. The common practice on the better pasture fields is to plow the land, put it in a rotation, and ultimately turn the meadow into a pasture. Good pasture mixtures are seldom seeded in the rotation, and even the clover that would naturally come in, together with the low-growing bottom grasses, is shaded out by the hay crop, or by the so-called "nurse crop."

It seems as though it will be a long time before the farmer becomes educated enough to realize that the "nurse crop" really nurses very little except his pocketbook; that is, he hopes to get a crop while the small

Potash and lime have greatly increased the amount of clover and grass and reduced the moss and wild strawberry. (Compare with check plot.)



Phosphate and lime without potash have not greatly increased the clover on this field.

grasses and clovers are being established. This works fairly well for some of the tall-growing grasses and clovers in hay mixtures, but it usually does severe damage to the establishment of low, prostrate pasture plants. A nurse crop, such as oats, barley, etc., should in many cases be considered a "controllable weed" because it competes with the other plants for light, moisture, and plant nutrients, and therefore helps to keep real weeds in check. But when cut or pastured off, a nurse crop does not readily come back to compete again as other weeds might do, and in this respect it is a controllable weed.

There is some virtue in a nurse crop which is sometimes overlooked, and that is its ability to produce a temporary turf and keep the surface soils somewhat more moist for the young seedlings to become established. However, it is very desirable to remove the nurse crop long before severe competition results and prostrate plants become erect.

Perhaps the most important fundamental necessary to produce a good clover turf is a liberal supply of minerals, together with proper management such as close grazing and the prevention of shading by grasses. Close grazing, however, should not be confused with over-grazing, because all green plants get their energy from the sun and most of their raw food from air and water. Therefore it is necessary that they are not overgrazed and grubbed so closely that very little green material remains above the ground.

Wild white clover is remarkable in its ability to withstand continued close grazing, and many results show that the herbage should not get more than four or five inches high if the clover is to successfully compete with the grasses. When nitrogen is used, even greater precautions are necessary, because white clover is a sun-loving plant and intolerable to shade. Since it is prostrate and not erect, it cannot stand competition with erect, growing grasses.

In addition to close grazing, a liberal supply of minerals is also very essential for clover maintenance; and since most pasture soils are low in these materials, they must be supplied in the fertilizer. It is very doubtful if pasture fertilizer recommendations

Potash, phosphate, and lime produced a good clover-grass turf which continued to get better.

have been adequate, in respect to these minerals, for proper clover maintenance. It should be remembered that the requirements of the soil and its existing organisms must first be supplied before the pasture plants can obtain their needs.

It seems highly desirable, therefore, to maintain a fairly high level of these minerals in pastures, as leaching losses are usually very small, and there is a rapid turnover from pasturage to manure which may quickly return to the soil and be used again. This is especially true in regard to potash because pasture plants require and contain large quantities, while grazing animals require very little potash as such either for bone, milk, or flesh, and thus they return most of it to the pasture in their manure. Since less potash is removed and sold off the farm in dairying than in any other type of farming, it should be comparatively easy to maintain a high level of potash once a good pasture is established and a sufficient amount of potash has been applied.

Practically all Vermont pasture soils are very low in available phosphate; therefore, it is more or less universally recommended. On the heavy clay soils in the Champlain valley, where available potash is quite high, outstanding results have been obtained from liberal addition of superphosphate alone, but even here some added potash can well be used to promote and maintain wild white clover. Some of the lighter soil types in the state have responded to potash more than they have to phosphate. This is especially true on the Berkshire soil type, as discussed in the table at the beginning of this article. On this same farm Mr. Tillotson has been able to maintain a good stand of wild white pasture clover with manure alone, which of course is rather high in potash.

Further evidence concerning the value of potash on this field is shown in an illustration where he applied wood-ashes which he produced while making maple syrup. The vegetation here changed from fern and moss to a very compact clover turf as shown in a close-up picture on the wood-ash treated area. Part of this benefit can be attributed to lime, because practically all clovers are lime-loving plants; but this wild white clover has adapted itself to a rather acid soil, and it thrives quite well even on soils that are somewhat too acid for red clover.

Practical Varieties

Since there are several kinds of clover seed available for pasture purposes, it might be well to discuss some of their virtues and limitations. At present there are four more or less distinct white clovers which may be used for pasture purposes:

1. Ladino (mammoth or giant),
2. Commercial White Dutch,
3. English Wild White (Kent, etc.),
4. Native Wild White (more or less indigenous to this country).

These particular clovers are being grown in several parts of Vermont in an attempt to determine their yield and longevity with different fertilizer levels and closeness of grazing. Results are available for only two years, but they show some interesting facts.

Ladino clover cannot stand real close grazing as well as the others, because it is much more erect, with long stems and large leaves. Under rotational grazing, where the vegetation is allowed to get up six inches or more before being grazed, it has maintained itself quite well and has produced more pasturage than the other clovers. On the plots that are being closely grazed, the yields are low and it is rapidly being killed; but in all cases it has a remarkable recovery or come-back after being cut or grazed.

The ordinary commercial white Dutch clover, with growth habits between that of Ladino and wild white, is able to withstand somewhat closer grazing, but like Ladino, it is not as perennial as it should be for a good pasture clover, and some experiments where these clovers have been under observation for a longer time show that they often kill out after two or three years. The clover that remains after that time is often seed from some of the mother plants, or else the wild white clover which naturally comes in with proper management.

The two wild clovers referred to offer the greatest possibilities for permanent pasture where it is not desirable to put the field into crop rotation. The English wild clover is the cornerstone of the famous pastures in England which are very seldom, if ever, plowed. This English wild clover has been tried in this country with more or less success, but before it can be highly recommended, additional experimental data are necessary. The plant has remarkable pasture qualities in that it forms a very compact turf and withstands very close continuous grazing; in fact, close grazing is very essential for its maintenance. It is very prostrate, with short stems and small leaves—even the seed is somewhat smaller than the ordinary white Dutch clover.

Native Strain Best

The native wild white clover, or that which naturally comes in well-managed pastures, is very similar in growth habits to that sold as English white clover. Since the former has been grown in this country for a long time, it has no doubt become better adapted to our soils and climatic conditions than any other strain of clover. The main difficulty encountered, however, is that this seed can not be purchased, because we have in the past failed to realize that the wild white clover is different from the ordinary white Dutch, obtainable on the open markets, and have not attempted to produce locally grown seed. The main source of white Dutch clover seed is from foreign countries such as Italy, or southern states such as Louisiana; hence there is little wonder that it is not better adapted to the northern part of New England.

(*Turn to page* 42)

Florida Grows Celery *for the* Nation

By J. L. Baskin

Orlando, Florida

FLORIDA produces more than one-third of the nation's celery, and when one realizes that our population of 125 million people consumes celery by the trainload, this is no small order. Celery is harvested from December through May, thus furnishing the national table for six months of the year.

Seminole county, located along the Saint Johns River, produces three-fourths of Florida's crop. Commercial celery growing in this area dates back about 25 years, and the area is still expanding. Considerable expansion is taking place in the lower end of the county where deep muck, hammock land is being brought under cultivation.

Sanford, the heart of the older district, is located on a low, level plain of Norfolk sand, gradually tapering off to Norfolk fine sand, Portsmouth, and into hammocks, swamps, and lakes. Flowing wells and underground tile furnish perhaps the best controlled irrigation and drainage found in the United States. The splendid physical condition of these soils and their comparatively level surface make them ideal for control purposes, thereby permitting intensive cultivation. In their native state, these soils were not considered especially fertile or productive.

The process of clearing, leveling, and tiling these lands requires a very

(*Turn to page* 39)

Laying out new areas in a muck hammock for the planting of celery.

The Inquiring Mind *and the* Seeing Eye

By Alister B. Alexander

Madison, Wisconsin

THIS month we are taking you on a trip to North Carolina, to visit a man who has made an enviable record in agriculture. He gave to North Carolina the soybean, that has since become a major crop over the entire nation, opening up practically limitless possibilities as a feeding element and as a base for many commercial products. The man upon whom we are calling is Charles Burgess Williams, Head of the Department of Agronomy at the North Carolina College of Agriculture and Engineering at Raleigh.

Professor Williams was born at Shiloh, Camden County, North Carolina on December 23, 1871, the son of Robert J. Williams and Susan Burgess Williams. The latter is still living at Elizabeth City with her only daughter. He grew up on a general farm and attended the rural schools of the district, at times walking six miles daily to and from classes. He later attended the Shiloh High School during the period from 1885 to 1888 and went to the Military High School at Littleton during the following year. On October 3, 1889, he entered the first class at the new North Carolina A. and M. College and graduated with highest honors, having specialized in agriculture and chemistry.

While a youngster Professor Williams worked on his father's farms during vacations, and in the evenings and mornings while attending school. The summer following his junior year in college was spent in Central New York on the farm of his professor of agriculture. His father and grandfather were fairly large landowners of some of the best farm lands in Camden and Currituck Counties, North Carolina. Demsey Burgess, an ancestor, was a member of the Provisional Congress at Hillsborough, N. C., in 1775, and at Halifax in 1776, at which time the Constitution of the State of North Carolina was drafted and adopted. The same Demsey Burgess was a Lieutenant Colonel in the Continental Army, and a Member of Congress for two terms while George Washington was President, so that he left as an inheritance not only land, but a rich background of the history of our country.

Religious Influence

As a boy Charles Williams joined the Shiloh Baptist Church, which is the oldest church in North Carolina, having been organized in 1727 at the home of William Burgess, another ancestor. The religious training received there remains as an important part of the character of Mr. Williams, as he is very faithful in his attendance at the First Baptist Church in Raleigh where he is a deacon, and where his counsel and uprightness are leaned upon by the members of the congregation.

F. H. Jeter, editor for the North Carolina College, says, "In my opinion, Professor Williams is the outstanding authority in the South on soils and fertilizers. He was one of the first to recognize the value of a soil survey, supplying fundamental information necessary to a full knowl-

PROFESSOR C. B. WILLIAMS

edge of the fertilizer requirements of the various crops. He has consistently worked toward the end that every foot of land in North Carolina shall be surveyed before the job is completed, and it is largely due to his interest that such a large part of the State survey has been completed."

After his graduation from college in 1893, Charles Williams was appointed Assistant Chemist of the North Carolina Agricultural Experiment Station and the Experiment Station of the Department of Agriculture. He served in this capacity from 1893 to 1896, when he left to attend Johns Hopkins University for a year on a state fellowship in chemistry. He returned to his old position in 1897 and served in it until 1906. In 1906 he became head of the Department of Agronomy; in 1907, Director of the North Carolina Experiment Station; and in 1917 was made Dean of Agriculture, serving in that capacity until 1924. During this period he was also in charge of the State Soil Survey in 1915, and Chairman of the Tobacco Research Committee in 1920.

Professor Williams also attended the National Graduate Summer School of Agriculture at Ohio State University. He is a member of Phi Kappa Phi and the Pine Burr Society, both honor groups; the American Society of Agronomy; National Grange; and is a Fellow of the American Association for the Advancement of Science.

Systematic Worker

Professor Williams' work has been marked by a methodical regularity. He has been one of the most faithful members of the North Carolina staff, going to his office day after day and year after year with very little time lost. A noticeable feature of his service to his state is that he has never allowed any information to go out under his name until it is based on the average results of many years of experimental data, and until he himself is convinced that it is right.

When he became interested in the soybean, many years before the plant had been propagated by the United States Department of Agriculture, he first secured every bit of information that he could gather and then published circulars and bulletins dealing with the subject, in order to acquaint North Carolina farmers with its possibilities. When the bean was first planted on a very small acreage in the eastern part of the state, Professor Williams immediately recognized its worth and began a campaign to make it popular, a campaign that his associates say was so spectacular and interesting that it became known all over the United States.

Developed Library

Professor Williams, in line with his methodical ways, has always been careful to save and have bound all of the printed publications from the various experiment stations of the country, and for years the only agricultural library to be found at State College was that made up of the files in his office. Even now those who despair of finding certain agricultural information elsewhere instinctively turn to his office as a last resort, and usually get the information they desire.

Mr. Jeter says, "I have never, in our twenty years' association, called upon Professor Williams for an article dealing with any of the crops of North Carolina, any of the fertilizer problems of North Carolina, or any of the soil problems of North Carolina that he did not respond immediately with a clear-cut and readable story dealing with the question involved." That being the case, the State of North Carolina certainly has been enriched in its soil and fertilizer knowledge by Professor Williams, for we find listed during the period from 1896 to date some 230 articles, bulletins, and books of which he has been the author, either alone or with his associates. It hardly seems possible even for one so methodical to find time to turn out this mammoth amount of material, in addition to his class work, soil survey work, and other activities.

The articles referred to cover every imaginable subject in soil and fertilizer research. Among the most interesting published writings of Professor Williams and his associates is the report of the trip made by a party of twenty-two Southern agricultural leaders in the summer of 1928, of which party Mr. Williams acted as chairman. The study covered the soil-building and fertilizer practices of France, Switzerland, Germany, Holland, and Belgium. So that the greatest possible benefit might be derived from the findings of the party, a report was published upon their return, and it is interesting to note in this report the great difference between our methods and those of foreign farmers.

The party found that the European countries, densely settled and intensively farmed, require maximum returns from the soil in order to produce ample crops. Steep hillsides and the banks of streams produce vegetables and fruits for food. Even the wayside land along railroads is utilized. In some cases pear, apple, or peach trees are planted close beside, and trained to grow flat against, stone houses or stone walls to conserve space. In many of the districts visited they found the farmers living in small villages, going out each day to work their farms, which often consisted of only three acres. Most of the work is done by hand, and every attempt is made to prepare the land, cultivate the crop, and harvest it in such a way as to gain the maximum return. The handicap to economic production has been overcome, however, to a large extent, by large acre yields made possible by keeping the lands well fertilized, perfectly cultivated, and always busy producing crops.

Fertilizer Practices

Fertilizers are more extensively used, and one of the cardinal principles of fertilizer application in Europe is that the potash and phosphate should be applied to the field some time before the crop is planted. This method permits the material to become thoroughly incorporated in the soil before the seed is sown. Crop rotation is practiced with religious

(*Turn to page* 44)


A well-kept lawn completes the beautiful setting for this farm home.

A Good Lawn *is* Its Own Reward

By T. D. Gray

Extension Landscape Architect, West Virginia College of Agriculture

WHO has not seen a beautiful, green sward and wondered what magic the owner or his gardener used in developing and maintaining such a lawn? Probably very little had been done that any home-owner could not do if a good lawn is desired. Careful grading, drainage, good soil, sowing of proper grasses, proper fertilizing, mowing, pest and weed control, all contribute their part to the lawn.

A prominent landscape architect recently stated that proper grading, drainage, and soil preparation were the foundations of all landscape work. This is particularly true of lawn-making.

Proper grading is very important to give an interesting effect. In general, the area around the house should be level to give a restful feeling. Farther away the lawn may break more sharply; however, terraces should be avoided wherever possible. Few if any of our grasses will withstand the harsh, arid conditions on a terrace. All top-soil should be saved by removing the upper four to six inches of the area which is to be graded. The soil should be piled and replaced after the sub-grading is completed.

Soils differ very materially in their drainage requirements, sandy soils requiring the least drainage and clay soils the most. Where drainage is necessary, three-inch agricultural tile should be laid in trenches 20 to 30 feet apart and from 2 to $2\frac{1}{2}$ feet deep. A slope or fall of nine inches to one foot for each 100 feet of tile should be maintained. The main lateral can be drained into a ravine or sewer. Drainage not only removes surplus water, it permits air to readily enter the soil, which is necessary for best growth of the grasses.

Some home-owners are blessed with fertile soil while others are handicapped by a lack of it. The latter must or should improve the soil before sowing. If humus is lacking, well-rotted manure at the rate of 500 to 1,000 pounds per 1,000 square feet should be added. Fresh manures are apt to be polluted with weed seeds; however, they may be treated to kill the weed seeds. The manure should be incorporated into the upper six to eight inches of soil.

Heavy clay soils can be improved by adding course sand or ashes to a fifth or more of the volume of the upper eight to ten inches of soil. The reverse is true of extremely sandy soils. The surface may be pulverized thoroughly by raking and re-raking with a garden rake. All stones, sticks, and anything which may make the lawn bumpy should be removed at this time.

Top-soil should be piled before the grading is started.

The ground will be quite loose when first prepared and should be compacted by thorough rolling or by waiting for a soaking rain. The latter gives best results when following the rain, the lawn can be raked lightly and prepared for sowing. An application of complete fertilizer should be applied before the last cultivation, and worked into the upper four to six inches. Twenty-five to thirty pounds of a 10-8-6 fertilizer per 1,000 square feet of lawn may be used. It is particularly important, the experiment stations tell us, to get the phosphorus down around the grass roots. If the phosphoric acid is applied later on the surface, the soil acids fix it and it does not reach the roots and become available for considerable time.

The selection of a seed mixture will depend largely upon location. For most of West Virginia, Kentucky bluegrass makes the most successful lawn. In sections where they are native, such as Massachusetts and Rhode Island, bent grasses prove most satisfactory for lawn purposes. Kentucky bluegrass does not make a lawn quickly and red top should be mixed with the bluegrass before sowing. Four parts of Kentucky bluegrass and one part of red top have given good results throughout West Virginia. A small portion of perennial rye grass or White Dutch clover may be added as a nurse crop. Some object to White Dutch clover due to its coarse foliage.

Success on acid soils has been obtained with a mixture of four parts Rhode Island bent and one part red top. The principal objection to the bent grasses is the extra work required to keep them in condition. This is particularly true of creeping bent, which requires frequent rolling and cutting.

Chewing's fescue or rough-stalked meadow grass (*Poa trivialis*) should be added for the shady locations. For dry, shady locations Chewing's fescue does well, and where the soil is moist, rough-stalked meadow grass gives better results. Where shade is intense, such as that under Norway and sugar maples, no grasses may succeed. Here Japanese spurge (*Pachysandra terminalis*) or myrtle (*Vinca minor*) may be used. Both are broad-leaved evergreens; however, they will not withstand hard usage. Thinning-out the trees by removing many of the branches throughout, and particularly the low branches to let in the light, will often result in success with grass.

Most success is had when the lawn is sowed in late August or early September. Grasses stool better in the fall and avoid the hot summer and weed competition which follows after spring sowing. By the succeeding summer the lawn is well established and better able to withstand the heat and weeds.

The standard Kentucky bluegrass mixture should be sown at the rate of three to four pounds per 1,000 square feet. Users should not skimp in the quantity of seed if a thick even turf is wanted. The best time for sowing is when the air is quiet, which is most often during the early morning hours. Sowings may be broadcast by hand or by a mechanical seeder. If sown by hand, the seed is divided into four equal parts and one part is sown by crossing the yard east and west. Another portion

(*Turn to page* 37)

This yard after grading has dry stone walls to maintain grade differences.

"As a Man Soweth So Shall He Reap"

By C. J. Chapman

Soils Department, University of Wisconsin

"TRAIN a boy in the way he should go, and when he grows up he will not depart from it." These may not be the exact words of the author, but they convey the meaning.

The early environment and training of a child, in other words the kind of soil in which he grows, determines to a large degree the kind of a man he is going to be. Fortunate is that boy or girl who has had the right kind of soil in which to grow. Early environment and early influences are of great importance. If we would harvest good fruit, we must plant good seed in well-fertilized and fitted soil, and then nurse the crop along in its early struggles with weeds and other adversities. And if we would succeed with alfalfa, there are certain definite requirements and conditions which must be met. Too many farmers have just sown the seed and then let nature take its course. The result of such careless planting is expressed in the early death of the little alfalfa seedlings, or at best a ragged, spotted, and uneven stand.

Largest Acreage in History

The largest acreage of alfalfa in history was seeded last year on Wisconsin farms. A million tons of lime were made available to Wisconsin farmers at reduced costs this past year, enough to cover an additional 300,000 acres of land. A work employment project sponsored by the College of Agriculture and prosecuted through the facilities of the Wisconsin Emergency Relief Administration, and the Works Progress Administration, state-federal agencies, made this possible. We estimate that an additional 300,000 acres of alfalfa have been seeded on Wisconsin farms this past year, which together with our 798,000 acres of old alfalfa puts Wisconsin well over the million-acre mark in total acres.

Insure Successful Stand

But what about the success of this 300,000 acres of new alfalfa? Has it made a successful stand? My answer is "Yes, on about 75 per cent of the land there is good catch, but yields in 1936 and in subsequent years will be low unless these fields were well fertilized." A good catch, or even a good stand, doesn't always mean good yields. Lime will go a long way toward the successful establishment of alfalfa on acid soils, but there are going to be failures. At least 25 per cent of the alfalfa seeded this past spring will fail, largely because farmers took a chance and sowed their good seed on fields that were in a low state of fertility or poorly fitted.

I believe that the successful establishment of alfalfa is almost 100 per cent certain if the land is properly fitted, limed, and fertilized. I am not going to say that it will come through this winter 100 per cent. However, it is true that a strong growth of alfalfa the first year has a better chance of wintering than poor, weak, thin stands.

But I would rather see a farmer cut down his acreage and succeed, than to attempt too large an acreage and fail on part of it. It is true that lime is the foundation stone on which a soil-building program must be built, yet many soils need more than lime in order to successfully establish alfalfa and produce abundant crops. The lack of phosphate or phosphate and potash on many of our soils will prevent the alfalfa seedlings from making a good strong start in the early part of the season. The lack of fertility may result in complete failure to establish alfalfa.

You have all seen spots in a field where the alfalfa was rank and the stand perfect. You know that these spots were the result either of concentrations of plant food from manure piles or they may have been spots where brush piles were burned. You may have seen spots in fields where, years ago, straw stacks were burned. You know that the alfalfa, and even clover, here will frequently blossom out in the fall of the first year. Tests on soil samples from these areas invariably show a high phosphorus, potash, and lime content as compared with the rest of the field.

Test Soils First

There is no question but that our soils are less productive than they were in the early days. The leaf mold and organic matter of the virgin soil has long since been used up. We have pulled down the reserves of phosphorus and potash in our soils, and we know that the lighter sandy soils need potash even more than they need phosphorus. Some of our silt and clay loams which are a long distance from buildings, where little or no manure has been applied, are in an impoverished state of fertility.

And so we have been urging farmers who plan to seed alfalfa to have their soils tested first in order to check up on the fertility and determine what elements may be lacking. Our motto is: "Don't waste good alfalfa seed on land that is acid and in a low state of fertility. On the other hand, don't waste good lime or fertilizer on soils that do not need it."

During the past 12 months we tested over 15,000 samples of soil in our laboratories. We have found that about 75 per cent of these soils were low either in phosphorus or potash or both. Fully 80 per cent of all the soils we have tested in our (*Turn to p.* 41)

In one of Wisconsin's best farming areas, barley as a nurse crop responded to fertilizer: no treatment = 25.7 bus.; 0-20-0 = 40.5 bus.; 0-20-10 = 50.4 bus. A striking difference in the growth of the alfalfa last fall promised added profits from the fertilizer in increased yields of hay in 1936 and subsequent years.

Science *and the* New Agriculture

By Morris Halperin

THERE is so much heard, said, and read nowadays regarding science and the new social and economic sciences that it would be enlightening to arrive at a clear conception of just what science is. If we do that, we will be in an intelligent position to test any new agricultural or general proposition carefully to find out whether it is in line with true progress.

A knowledge of what science is should be particularly timely, in view of the fact that, on the one hand, scientists are commencing to be greatly interested in presenting the facts and importance of their science to laymen, and on the other hand, laymen are now manifesting a true interest in science and in scientific information.

Science Means Knowledge

To begin with, our word science is derived from the Latin word which simply means knowledge, not necessarily University knowledge, nor technical knowledge, nor experimental knowledge, but any kind of knowledge. Indeed, when the word science was first inaugurated, there were no universities, no technical information of any kind, and no experimentation either. In those days science meant anything and everything which was known, believed, assumed, or even imagined. Indeed, the famous scientists, such as Archimedes and Leonardo da Vinci, of ancient and medieval times, literally knew everything from stars to bugs. The word science has gradually grown until now it properly denotes knowledge or information concerning anything, including the plowing of a field, the raising of a hog, the baking of a cake, or anything else which has ever been done by God or man. Thus it can be seen that the term science may be applied, without apology, to any form of knowledge.

Knowledge is Observation

Every existing science or knowledge has been born and raised by observation or experimentation, and usually by a combination of both. For instance, the farmers in ancient times observed that accidentally manured spots in the field produced taller pasture and heavier grain than the surrounding soil. They also observed that the grain crop following clover or alfalfa was bigger than the crop which repeated itself. These observations led to deliberate experimentation, in which manure and other fertilizers were added to a grain field and a deliberate system of crop rotation was followed. The expected increase was noted, usually, but not always. Why not always? Because there was no check treatment to show what the result would have been without the addition of fertilizer or without the inclusion of a legume.

In modern fertilizer experimentation there is an extensive plot-technique in which a check plot or treat-

(*Turn to page* 35)

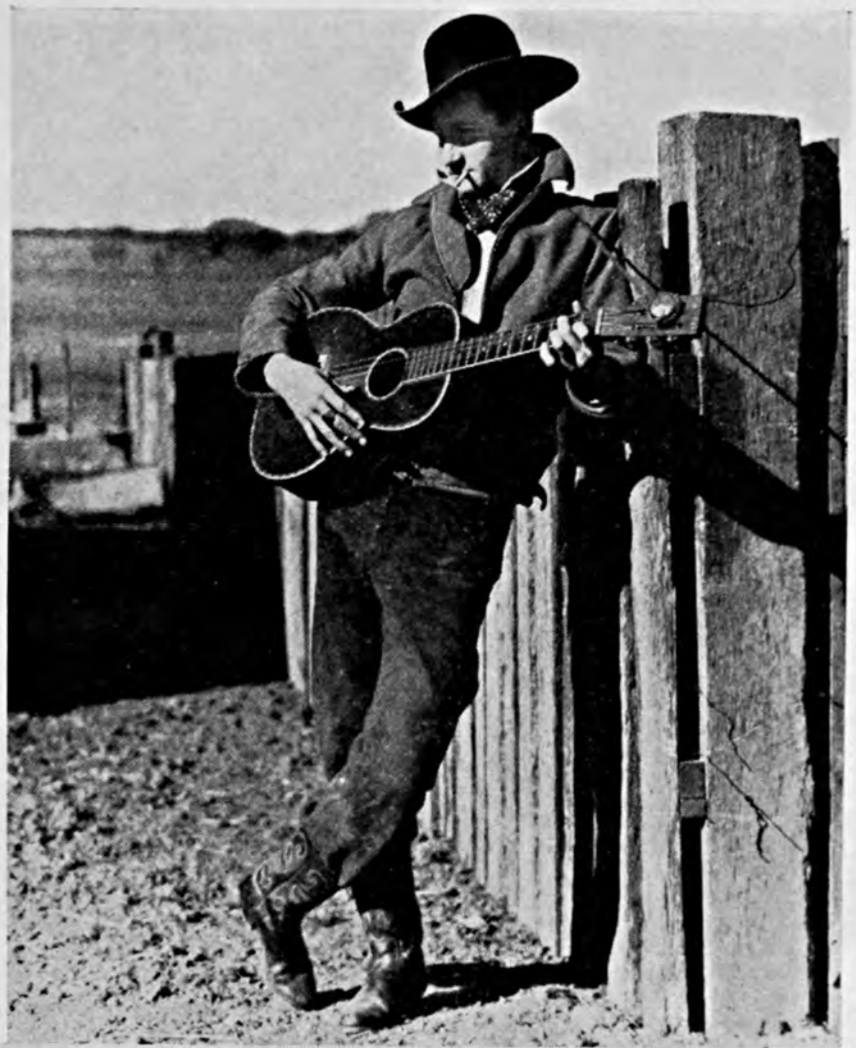
Pictorial

EVEN PLAY HAS ITS UPS AND DOWNS.

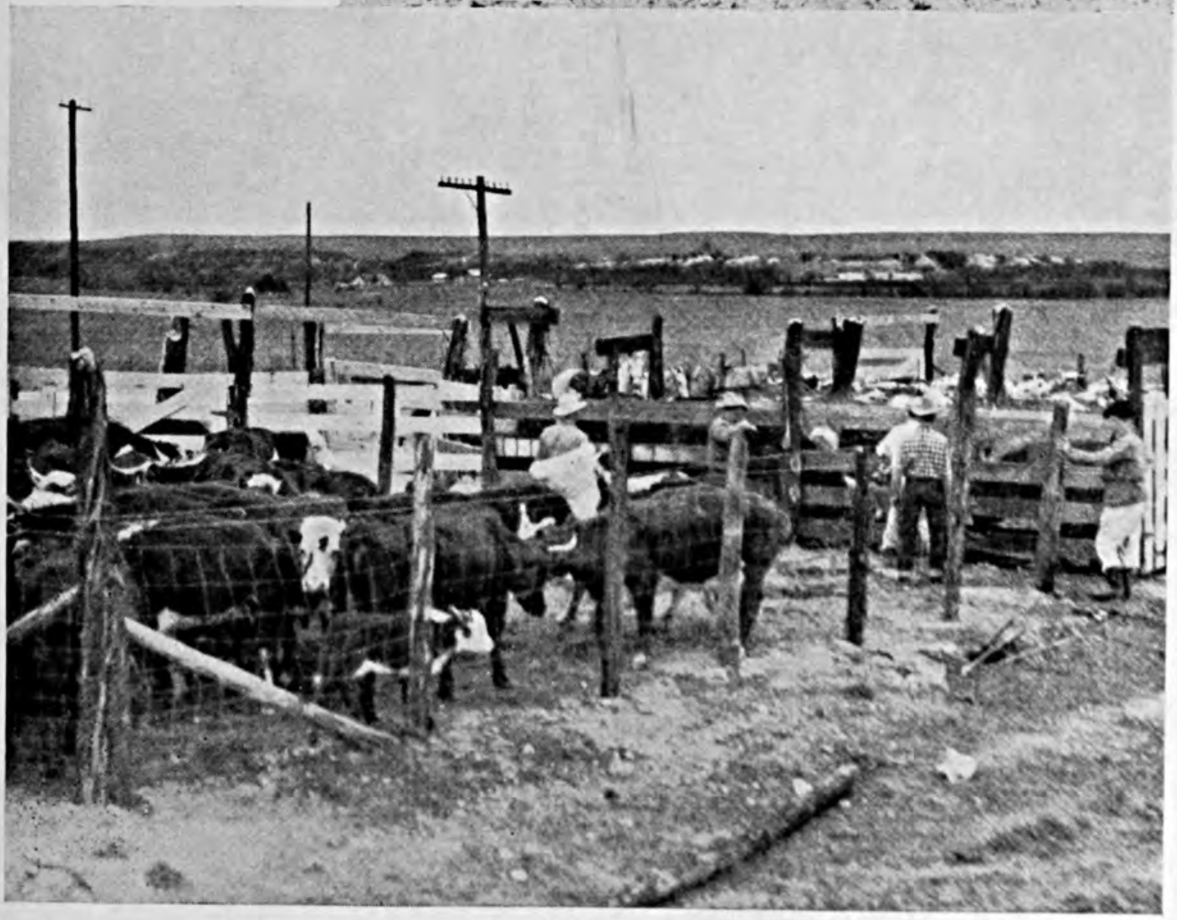
Many National and World problems are "settled" in scenes like the above.

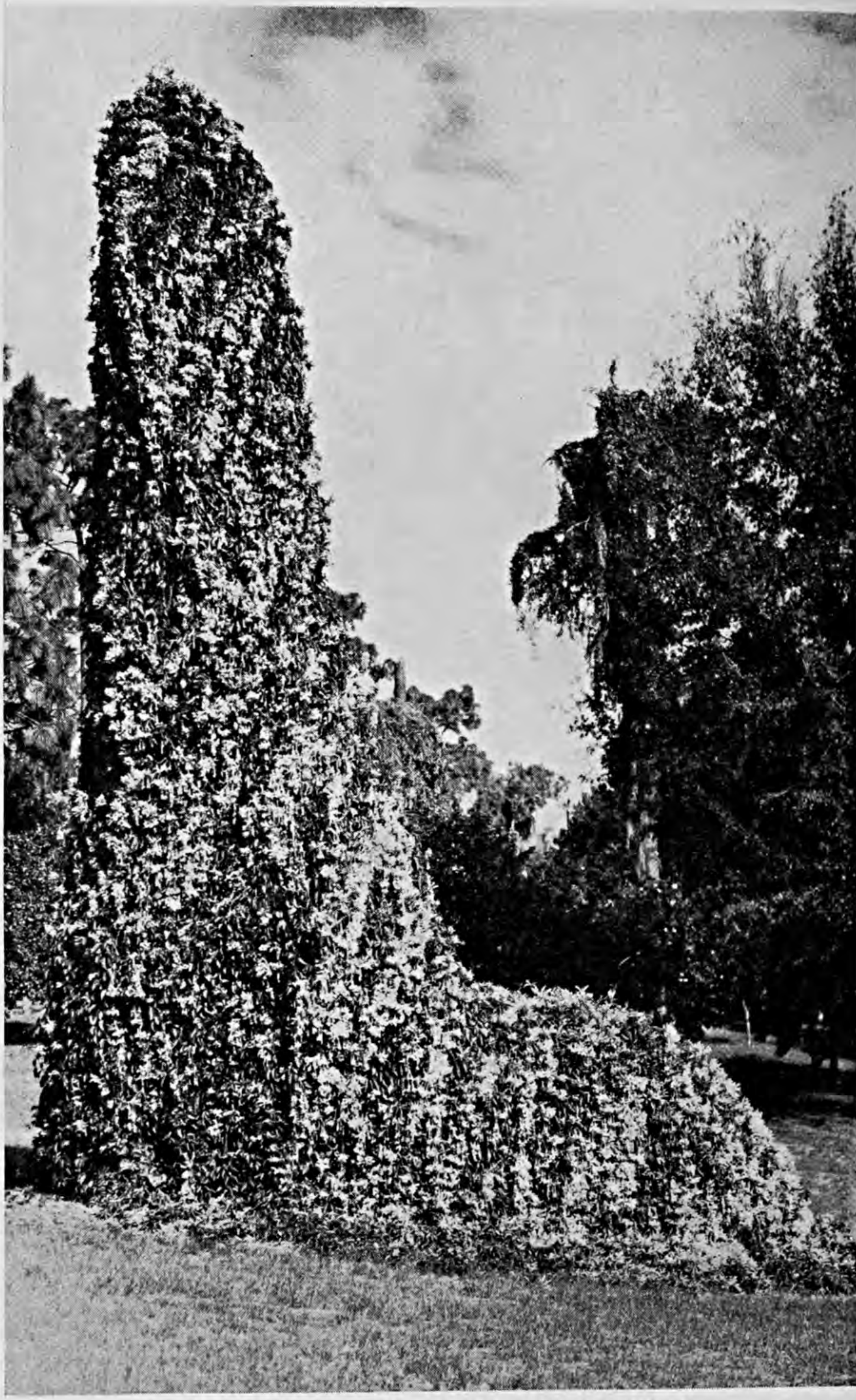
Left: Typical of the "old-fashioned" chores on January days.

Right: "Oh, give me a home where the buffalo roam!"



Rope and cow pony are absent in modern branding and horn-clipping.





NATURE BUILDS HER OWN SKYSCRAPERS IN FLORIDA.

The Editors Talk

Protect the Cost

Among the many enterprises afoot for the establishment of agriculture on a permanent basis of enduring prosperity, none fires the imagination or arouses the enthusiasm as does soil conservation as now being promoted by the Soil Conservation Service.

A truth too obvious to warrant mention in time may be forgotten. In dealing with the complexities of agriculture, those of us whose lives are dedicated to agricultural betterment have too frequently permitted ourselves to become absorbed in the solution of the particular problem assigned us and latterly to become distracted by the more acute economic problems of agriculture, with the result that we have been prone to forget the ultimate truth that after all the basis of all agriculture is the soil, and the fundamental problem transcending all others is its maintenance in place and the perpetuation of its fertility. Meanwhile, the soil to which every problem is related has been depleted in plant food, in many instances to the point where even the cover crop, normally provided by nature, has been unable to persist, leaving the soil unprotected against the ravages of rain and wind and the soil itself to be carried away from beneath our unheeding feet. The insignificant quantities of plant food supplied from artificial sources have fallen far short of the requirement of the crops being grown, inevitably resulting in a depletion which all too frequently has passed beyond the point where even the hardiest of native growth can perpetuate itself.

The importance of soil conservation is beyond controversy, beyond the realm of political or other expediency, and is so secure from contravention that it is one idea on which all who have the slightest concern for the common or even the selfish welfare beyond the current moment, may unite.

Now Recognized as National Problem

For years there has been a "voice crying in the wilderness." For years that intellectual and physical stalwart, H. H. Bennett, witnessing the ravages of erosion from one end of his native land to the other, has plead with his official superiors all the way up to congressional committees and over their heads, so to speak, with the American people themselves, in many effective published articles, that something be done to stop it. Economy regimes for years blocked all but trifling pittances of appropriations. The budget had to be balanced.

But at last an end has come to timid temporizing. Soil erosion has now been recognized as something to be dealt with, and the nation has undertaken the job—aggressively, as a nation-wide problem, with a total of 141 demonstrational and conservational projects already established. "The effective practices employed in the demonstration areas are beginning to trickle across the project boundaries," in the words of Mr. Bennett, a trickle which we predict will grow into a flood. The state experiment stations are lending their valiant assistance, and into the Service are being attracted many of the outstanding among the younger agriculturists, in their new work reflecting the enthusiasm of their chief.

The soil fertility problem here dealt with is in a sense unique in that, while fertilizers are generally applied to soils that are regarded as capable of producing a crop, here barren soils—subsoils exposed by erosion or by terracing—are required to yield a cover crop to hold them in place, the essence of the problem being to arrest erosion until a cover crop of sufficient density has been established. How is a cover crop to be grown to prevent erosion on a soil which by definition is being eroded because it is too infertile to grow a cover crop? The engineer designs and places his dams, slopes, and terraces in terms of expenditures—the major job, possibly to be done all over again if before the advent of the winter rains a cover crop be not established to hold the soil in place. Here obviously the agronomist's skill, acquired through long experience with complete fertilizers in growing two blades of grass where only one grew before, is as important as that of the engineer's. The agronomist places the capstone in the arch and by a trifling expenditure for plant food safeguards the benefits of the larger expenditures for engineering work. Already we find the beneficial results of fertilizer application being measured in terms of radically reduced erosion, developing the fact hitherto disregarded that there is a direct relationship between fertilizer use and erosion control.

Heretofore the benefits of fertilizer use have been measured in terms of the increased cash value of the crop produced. Here is a new measure—the value of the engineering work which the cover crop, efficiently fertilized, is enabled to protect from destruction.

Happy New Year!

Beginning with this issue, Better Crops With Plant Food will be restored to a monthly basis of publication. Since October 1931 we have been reaching our readers only once every two months. On the basis of the continued interest and support which you have given us during that time, we believe you will welcome again receiving the magazine every month. At this end, we are happy to be able to present with greater frequency the excellent articles which some of the outstanding agricultural scientists have planned for our pages.

Our circulation is national and international in its scope. With this in mind and with a full knowledge that the agricultural extension workers and research men are keen in their interest of what goes on beyond their own "line fences," we hope in each issue to vary the subjects to cover as many regions as possible. We shall want to hear from you. The magazine was designed and is edited for your interest. If you have no use for it, please tell us so in order that we may be spared the expense of sending it to you. If, on the other hand, you are particularly interested and we can cooperate by giving you more information along any certain lines, write us.

And so with the idea of entering into your new year, at least with as much interest and helpful information on problems of profitable soil and crop management as we can give, we wish you all a HAPPY AND PROSPEROUS 1936.

REVIEWS

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

Fertilizers

In their resume and timely discussions of experimental results, A. L. Mehring, L. M. White, W. H. Ross, and J. E. Adams have released interesting data in U. S. D. A. Technical Bulletin No. 485, "Effects of Particle Size on the Properties and Efficiency of Fertilizers." The preparation of commercial fertilizers composed from particles of a homogeneous size is important to prevent segregation, the authors conclude. Fertilizers prepared from particles of different sizes tend to disassociate from each other under conditions such as pouring, settling, and vibration. A commercial fertilizer, although thoroughly mixed, may become rearranged when jarred or shaken, unless the particles are of similar size. Regrinding a segregating mixed fertilizer a little finer was found to reduce this fault considerably. The most efficient particle size was 80 to 150 mesh under the average circumstances determined from this study with grained fertilizers.

Of particular interest to commercial growers of sweet corn is a summary of extensive investigations to determine the most effective fertilizer combination for this crop as reported in University of Illinois Agricultural Experiment Station Bulletin 417, "Fertilizer Requirements of Sweet Corn," by W. A. Huelsen and M. C. Gillis. These authors have also issued a circular, No. 439, "Fertilizer Treatments for Sweet Corn," based on this work. A four-year rotation of wheat or oats, red clover, and two crops of sweet corn was employed in the experiments. Among several recommended fertilizer combinations of the 63 treatments under trial for five years, optimum results were secured with an application of 400 pounds of 0-16-12 per acre supplemented by 50 pounds of sodium nitrate as a side-dressing. "From the standpoint of maturity," the authors state, "commercial fertilizers are used for two purposes—to increase the total yield and to advance maturity." When the proper ratio of the fertilizer ingredients is used, each constituent serves a definite purpose. Nitrogen affects the vegetative growth; phosphorus promotes growth of the roots during the early life of the plant and later hastens the ripening process; and potash exerts an influence on the vigor and general health of the plant. The authors state: "Potassium-starved plants are not only stunted in the same way that plants are that lack nitrogen and phosphorus, but they may even fail to reach maturity." In all instances these studies demonstrated that maturity was hastened from three to five days with the proper application of commercial fertilizers.

"Some Responses of Yellow Transparent Apple Trees in Delaware to Various Nitrogen Treatments." Agr. Exp. Sta., Newark, Del., Bul. 195, *June* 1935, *F. S. Lagasse.*

"The Role of Zinc Sulfate in Peach Sprays," Agr. Exp. Sta., Urbana, Ill., Bul. 414, *Apr.* 1935, *K. J. Kadow and H. W. Anderson.*

"The Efficiency of Soil and Fertilizer Phosphorus as Affected by Soil Reaction," Agr. Exp. Sta., Wooster, Ohio, Bul. 553, Sept. 1935, Robt. M. Salter and E. E. Barnes.

"Progress Report of Fertilizer Studies with Jonathan Apples Upon Ephrata Fine Sandy Loam," Agr. Exp. Sta., Pullman, Wash., Bul. 319, July 1935, F. L. Overley and E. L. Overholser.

"Effect of Alfalfa and Farm Manure on Yields of Irrigated Crops in the Great Plains," U. S. D. A., Washington, D. C., Tech. Bul. 483, Sept. 1935, Stephen H. Hastings.

Soils

An instructive publication dealing with investigations of orchard-soil relationships, namely, "Soils in Relation to Fruit Growing in New York, Part VIII," is available in Cornell University Agricultural Experiment Station Bulletin 633, by Joseph Oskamp.

As a result of studies conducted in 66 Baldwin and Greening apple orchard units in Orleans county, the author arrives at several noteworthy conclusions which should prove valuable information to orchardists in other areas. It is disclosed in this discussion that soils uniformly sandy in texture and of a uniform brown color in the first two feet are better drained and support productive orchards. On the other hand, a soil of the same texture but having a gray layer with a gray and mottled subsoil is poorly drained, producing relatively low yields in orchards growing on a soil of this nature.

It was found that productive orchards would likely develop on soils where silt and clay are contained in the profile that shows considerable grayness in the upper subsoil and mottling in the lower subsoil if they have moderately rapid surface drainage or internal drainage so that the free carbonates will leach out of the surface three feet. However, profiles of the same general description but with a more highly developed gray layer, slow surface drainage, and calcium carbonate within three feet of the surface, will support orchards of relatively low production.

"Disinfesting Soils by Electrical Pasteurization," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 636, July 1935, A. G. Newhall and M. W. Nixon.

"Selenium Occurrence in Certain Soils in the United States with a Discussion of Related Topics," U. S. D. A., Washington, D. C., Tech. Bul. 482, Aug. 1935, Horace G. Byers.

"Soil Survey of Luce County, Michigan," U. S. D. A., Washington, D. C., Series 1929, No. 36, J. O. Veatch, L. R. Schoenmann, C. E. Miller, and A. E. Shearin.

"Soil Survey of Grant County, Oklahoma," U. S. D. A., Washington, D. C., Series 1931, No. 10, A. W. Goke, C. A. Hollopeter, and M. E. Carr.

"Soil Survey of Texas County, Oklahoma," U. S. D. A., Washington, D. C., Series 1930, No. 28, E. G. Fitzpatrick and W. C. Boatright.

Crops

Vegetable growers in the Southwest may be guided materially by a splendid reference manual, "Vegetable Varieties for the Winter Garden Region of Texas," Bulletin 508 of the Texas Agricultural Experiment Station, by Leslie R. Hawthorn. Included in this bulletin is a report on 590 varietal names representing 49 kinds of vegetables. The adaptability of varieties and the manner in which each is identified, diseases and insects to which the vegetable is most commonly subject, and general recommendations regarding the importance of varieties and the variations in stocks are given.

An effective method to curb the noxious crab grass and similar summer weeds in established lawns is prescribed in New Jersey Agricultural Experiment Station Circular 354, entitled "Crab Grass Control on Lawns," by Howard B. Sprague. The treatment recommended greatly improves the vigor of desirable turf grasses in the lawn. Since the permanent grasses continue healthy, steady growth for several months in the fall after the crab grass ceases active growth, and also make at least two months' growth in the spring before seeds of crab grass and other undesirable weeds germinate, corrective measures outlined by the author are given during this period to restore density and vigor that will allow neither space nor light for crab grass seedlings to develop. The importance of raking the lawn late in the summer before mowing to lift prostrate stems of the weed and facilitate their removal is stressed. Subsequent operations include the application of either hydrated lime or finely ground limestone to correct soil acidity. It is also stated that an application of 15 to 25 pounds of a complete fertilizer analyzing about 5 per cent nitrogen, 10 per cent phosphoric acid, and 5 per cent potash per 1,000 square feet would stimulate turf growth when crab grass is dormant. The bare spots about the lawn should be reseeded with a suitable mixture of adapted grasses. To induce further growth of the turf grasses an additional application of commercial fertilizer early in the spring is recommended. The author advises less frequent watering in the warm months in order to prevent the stimulation of the crab grass seedlings. Instead, periodic deep watering is greatly preferred to frequent shallow sprinklings.

Growers of tomatoes for home and commercial utilization will receive much benefit from the revised edition of "Tomatoes for Canning and Manufacturing," issued in Farmers Bulletin No. 1233 by the U. S. Department of Agriculture. A thorough discussion of the important considerations in tomato growing is given by the author, James H. Beattie. The distribution of the tomato-canning industry, soils adapted and their preparation, selection of the varieties least susceptible to diseases, commercial fertilizers, and cultivation are among the subjects treated in this publication.

"Winter Barley, A New Factor in Missouri Agriculture," Agr. Exp. Sta., Columbia, Mo., Bul. 353, *Aug.* 1935, *W. C. Etheridge, C. A. Helm, and E. Marion Brown.*

"Twenty-five Years of Research," Agr. Exp. Sta., Durham, N. H., Bul. 287, *Aug.* 1935, *F. C. Kendall, Director.*

"Abstracts of Bulletins 489-502, *Circulars* 69-72, *and Other Publications During* 1934," *College Station, Texas, Cir.* 76, *Dec.* 1934, *A. D. Jackson.*

"Department of Agriculture—Immigration of Virginia," Richmond, Va., Bul. 332, *Nov.* 1935.

"Markton and Other Varieties of Oats," Agr. Exp. Sta., Pullman, Wash., Bul. 314, *Aug.* 1935, *O. E. Barbee.*

"Yields of Barley in the United States and Canada, 1927-31," *U. S. D. A., Washington, D. C., Tech. Bul.* 446, *Mar.* 1935, *H. V. Harlan, P. Russell Cowan, and Lucille Reinbach.*

"Classification of Wheat Varieties Grown in the United States," U. S. D. A., Washington, D. C., Tech. Bul. 459, *Apr.* 1935, *J. Allen Clark and B. B. Bayles.*

"Investigations on Runner and Fruit Production of Everbearing Strawberries," U. S. D. A., Washington, D. C., Tech. Bul. 470, *Apr.* 1935, *George F. Waldo.*

"The Native Persimmon," U. S. D. A., Washington, D. C., Farmers' Bul. 685, *Rev. Aug.* 1935, *W. F. Fletcher.*

"Flaxseed Production in the North Central States," U. S. D. A., Washington, D. C., Farmers' Bul. 1747, *Sept.* 1935, *A. C. Dillman and T. E. Stoa.*

"Variety Tests of Sugarcanes in Louisiana During the Crop Year 1932-33," *U. S. D. A., Washington, D. C., Cir.* 343, *Mar.* 1935, *George Arceneaux, I. E. Stokes, and C. C. Krumbhaar.*

"A Device for Separating Different Lengths of Fibers from Seed Cotton," U. S. D. A., Washington, D. C., Cir. 360, *Aug.* 1935, *Homer C. McNamara and Robert T. Stutts.*

"Safflower, A Possible New Oil-seed Crop for the Northern Great Plains and the Far Western States," U. S. D. A., Washington, D. C., Cir. 366, *Aug.* 1935, *Frank Rabak.*

Economics

Many interesting facts are portrayed in Washington Agricultural Experiment Station Bulletin 316, entitled "Part-Time Farming in Washington," by Ben H. Pubols. The study was inaugurated to depict the organization of part-time farms and obtain data concerning type of farm, source and amount of income, occupation of operator, and other phases of part-time farming. The information should help those persons planning this mode of living. Using the author's own words in the introduction: "The objective sought by such small farm operators ordinarily is to decrease the cost of living by lowering house rent and by raising various food products for home use while working at some occupation not connected with the farm. The degree of success which may be achieved by this method of operation, more commonly called part-time farming, is dependent to a large extent on adequate knowledge concerning essential requirements." The author states that part-time farms are located mainly within or adjacent to urban and industrial centers. One of the chief findings as reported from this work is that nearly all part-time farms had a vegetable garden and a cow or poultry. The average gross value of farm products was $294 per farm.

"Economic Digest for Connecticut Agriculture," Conn. State College, Storrs, Conn., No. 63, *Sept.* 1935.

"Illinois Farm Economics," Agr. Ext. Serv., Urbana, Ill., No. 5, *Oct.* 1935, *and No.* 6, *Nov.* 1935.

"Ohio Agricultural Statistics, 1934," *Agr. Exp. Sta., Wooster, Ohio, Bul.* 554, *Sept.* 1935, *G. S. Ray, L. H. Wiland, and P. P. Wallrabenstein.*

"Trend of Taxes on Farm and Ranch Real Estate in Texas," Agr. Exp. Sta., College Station, Texas, Bul. 512, *Aug.* 1935, *L. P. Gabbard.*

"Migration of Farm Population and Flow of Farm Wealth," Agr. Exp. Sta., Pullman, Wash., Bul. 315, *Sept.* 1935, *Fred R. Yoder and A. A. Smick.*

"The Farm Real Estate Situation, 1933-34," *U. S. D. A., Washington, D. C., Cir.* 354, *Apr.* 1935, *B. R. Stauber and M. M. Regan.*

Arbeiten Ueber Kaliduengung
Potash Research

The above are the German and English titles of a new book * by Prof. Dr. Dr. h. c. O. Eckstein which has just been published as Vol. II to follow a book on the work of the agricultural experiment station in the Lichterfelde section of Berlin established by the German Potash Syndicate in 1929. The first book appeared in 1931 and was reviewed in the April-May 1932 issue of Better Crops With Plant Food.

The new volume, which will serve a wider group of readers because of its summary of each chapter printed in English, carries on with the important work done at the experiment station since the publication of the first book. It offers to research workers in definite form the Lichterfelde method of soil analysis, which is based upon the investigations of thousands of soil analyses from all over the world.

With particular reference to the United States, it is noted that there has been special interest in comparing conditions in the United States with those in Germany. "The function of the German farmer is to secure as large yields as possible, consistent with suitable quality, and especially maximum yields of crops rich in protein, fat and fibres, respectively. In the United States of America, however, where agricultural over-produc-

* "Arbeiten Ueber Kaliduengung"—"Potash Research" Vol. II by Prof. Dr. Dr. h. c. O. Eckstein, Landwirtschaftliche Versuchsstation, Berlin-Lichterfelde, 480 pages, 66 illustrations, price 6.75 Reichs Marks, Verlagsgesellschaft fuer Ackerbau m. b. H., Berlin SW 11.

tion during recent years has been an economic calamity, the problem is quite a different one. In most oversea countries the problem is to raise the quality of the crops, so far as quality influences the capacity of the market to absorb them, to as high a degree as possible and to promote the culture only on the most suitable soils and by the best possible crop treatment. In consequence of such agricultural conditions, our station has decided to tackle problems such as the investigation of the relationship between potash manuring and the length and strength of the cotton fibre and of the sisal hemp and how taste and keeping qualities of fruits and vegetables are influenced by the use of different potash fertilizers."

The contents of the book are divided into four main headings: I—Soil Research; II—Physiological Investigations; III—Investigations on the Influence of Commercial Fertilizers on the Chemical Composition and Nutritional Value of Food and Feeding Stuffs; and IV—List of Papers Published by the Experiment Station, Berlin-Lichterfelde.

Because, in the words of the author "In nearly every country today there is a general opinion that agriculture can only be made to pay by the intensive use of all auxiliary methods which science can place at the disposal of the practical farmer," this book should prove of great interest and value to many agricultural research and scientific workers.

Fertilizer in the Rotation

The value of good rotations has been known for a long time, but the practice has not been adopted in farming to the extent that it should be. In those sections where the same crop is grown on the land year after year, the soil soon becomes notoriously poor and unproductive. When a crop like tobacco or cotton is grown year after year on the same land, the soil organic matter becomes depleted, diseases increase, and the available plant foods become so low that profitable yields are no longer possible. Though only a small number of farmers grow the same crop continuously, there are far too many who follow a poor rotation or do not rotate crops frequently enough. Rotations which do not contain legumes do not, as a rule, give nearly so profitable returns as those which contain them. Frequently land is in one crop for several years then in another for several years, and so on for several cycles. This type of rotation, although better than growing one crop continuously, is very inefficient.

The primary object of a crop rotation is to build and maintain soil productivity. It should be a means of cutting down the amount of commercial fertilizer needed to produce profitable crop yields, but should never be considered as a substitute for needed fertilizer ingredients.

In view of the experiments which have repeatedly shown that fertilizer used on rotated lands is more efficient and profitable than fertilizer used on continuously cropped land, the rotation should be considered as a necessary farm operation and one that will give maximum returns on money invested in fertilizers.

There are a number of systems of fertilization based upon different principles. A few of these will be mentioned.

1—A system based upon the influence of a single element. This system assumes that so far as fertilizing is concerned crops may be divided into three groups: (1) plants especially benefited by nitrogen, (2) plants especially benefited by phosphorus, (3) club plants especially benefited by potassium. In this system it is asserted that nitrogen is the dominant ingredient for wheat, rye, barley, grass, and oats; phosphorus for turnips, corn, and sorghum; and potassium for peas, beans, clover, and potatoes. This does not mean that one should fertilize with a single element, but that the element especially required by the particular crop be dominant in the fertilizer used. Thus specific fertilization is arranged for various rotations, each crop receiving that which is most useful.

2—A system based on the necessity of an abundant supply of minerals. This system requires that phosphorus and potassium be maintained in available form in amounts greater than required to meet the immediate needs of plants, nitrogen to be applied in available form when needed and in such quantities as will insure maximum yields. This system is useful in building up unproductive soils quickly.

3—A system based on the chemical analysis of plants. This system is based on the theory that the different plants should be provided with nitrogen, phosphorus, and potassium in the proportions in which they are found in the plants. This system may be applied to green-house crops and market garden crops, but usually is not economical or practical in field crop production.

4—A system in which fertilizer is applied only to the money crop in the rotation. In this system the crop in the rotation which gives the largest money returns per acre receives a heavy application of fertilizer. The application is much in excess of the immediate needs of the crops and the other crops in the rotation use the residual fertilizer left by the money crop.

This system is often used with potatoes and tobacco, which require, for best returns, an excessive amount of available plant nutrients in the soil. For example, a potato crop receives 2,000 pounds of a 7-6-5 fertilizer. This quantity is in excess of the amount used by the crop and there is left in the soil a considerable residue which may be used by the succeeding crops. This method possesses many valuable features and is perhaps as good as any for field crop production.

The last mentioned system applies to our Virginia rotations better than any of the others.

Other Rotations

In our tobacco rotations where 1,000 to 1,200 pounds of high-grade fertilizer is used, it should not be necessary to fertilize the grain and grass crops which follow. However, if only 500 to 600 pounds are used under the tobacco, it will be necessary to fertilize the succeeding crops for best results.

In the livestock sections where the rotation consists of corn, small grain, grass, and clover, with no money crop, the fertilizer should be distributed over the rotation. Such a rotation should get about 800 pounds of fertilizer distributed about as follows: 300 pounds on the corn, 300 pounds on the wheat, and 200 pounds applied in the spring when the clover is seeded. On the heavy soils well supplied with potassium, superphosphate should be all that is needed in this rotation. On the lighter gray soils a combination of phosphorus and potash should give best results.

In the potato rotation where a heavy application is made to the potato crop, the succeeding crops need not be fertilized.

In a peanut or cotton rotation, the corn and cotton crops should be well fertilized. If the crop preceding peanuts is heavily fertilized, it will not be necessary to apply more to the peanut crop. However, if the crop received a light application, it will pay to fertilize the peanut crop with 200 to 300 pounds of, say, a 2-8-6 at planting time.

It should be emphasized that the rotation offers an excellent means for making the use of fertilizers more effective and economical, if they are judiciously distributed to the different crops in the rotation; but a rotation should not be regarded as a substitute for commercial fertilizers. *W. H. Byrne, Virginia Extension Division News.*

Science and the New Agriculture

(*From page* 22)

ment is a prominent feature. In fact, there can be no true experiment, at least with material things, without a check in the form of controlled conditions. When both of the conditions under experimentation are unknown, each acts as the check for the other. An instance of this is a trial of two fertilizers or poultry feeds, both of which are equally unknown to the experimenter. In such a case, the result of the experiment would obviously warrant a comparison only of the two conditions with one another. The inclusion in the experiment of a known or check condition, such as a plot with no fertilizer or a group of poultry receiving at the same time and place a feed whose effects are known to the experimenter, would serve as the check treatment for the experiment.

The purpose of an experiment is either to verify something known (or believed) or else to discover something new. In either case, the result enables the intelligent scientist to distinguish between fact and opinion, to find out what determines quality, or, when possible, to measure quantity. Usually, what is termed quality when applied to physical things—for example, the lusciousness of hay—can ultimately be reduced or related to a measure of quantity—for example, the percentage of water in the plant, or the physical condition of the soil, or the chemical composition of the fertilizer.

A fact is any impression truly perceived (not imagined) through the senses. For instance, any seeing person can detect as a definite fact both broad daylight and dark midnight. However, at about dawn or twilight, one cannot easily tell whether it is day or night. Nevetheless, the fact of passing from night to day and from day to night, although difficult of detection, is real. The point is, there are limitations to the scope and dependableness of the human senses.

Science serves to verify the impressions received through the senses, and also, when suitable instruments can be used, to detect and measure facts which are not perceptible to the senses unaided. An example of the latter is the use of a microscope to actually see what the naked eye cannot. However, there is a probable error, no matter how slight, in every scientific measurement, this being an unavoidable consequence of the general relativity and finiteness of all things physical, including instruments and man himself.

The so-called theoretical sciences had their beginning in practical necessity. Astronomy developed out of the need and desirability of ascertaining during what "moon" such operations as planting, irrigating, and fertilizing should be performed for maximum yields of grain. In fact, the earliest recorded event in all history, which occurred in 4241 B. C., is the formulation of the first Egyptian calendar in which certain of the twelve months were called "Sprouting of the Grain," "Making and Watering Barley," "Ripe Grain," "Lady of the Granary," and "Grain Gods," names which clearly indicate the agricultural origin of this calendar.

Practical Beginnings

Thus we see that astronomy was at first purely practical and agricultural, not purely theoretical. To be sure, modern astronomy would seem to be as far away from agriculture as literally "the heavens are from the earth"; and yet, it is from this theoretical astronomy that modern scientific agriculture has derived its first knowledge of meteorology, climatology, and photosynthesis with their numerous applications of a very practical nature.

What is true of the beginning of astronomy is true also of mathematics. For example, arithmetical progression was first a practical undertaking. We learn this from the Rhind Papyrus, written in Egypt about 1650 B. C., of which Problem 64 reads as follows:

Distribute 10 measures of barley amongst 10 men in such a way that the shares shall have a common difference of ⅛ measure. What is the share of each?

Problem 79 is interesting. In each of 7 granaries are 7 cats, each cat kills 7 mice, each mouse eats 7 ears of spelt, each ear produces 7 measures of grain; how much grain is thereby saved?

Geometry began with the necessity of calculating the best shape—whether cylinder, trapezoid, or parallelepiped, for an economical granary!

Virtually all the broad sciences were initially practical and economic. Theory is not imagination. Theory is the sum total of all known practice and serves as the basis for new practice, which in turn, confirms or enlarges the theory. The two are supplementary and inter-related.

In today's agriculture, theory and practice are handmaidens. Theoretical research on the taxonomy, morphology, and physiology of insects and fungi permits the ready detection of the disease-producing organisms and the determination of effective means of controlling these pests. Technical research in physical chemistry results ultimately in a practical bulletin (Texas Station, No. 490) on the effect of fertilizers upon the yield, size of boll, and earliness of cotton.

What seemed, in 1900, to be rather detached and theoretical research on substances which were then baffling mysteries, leads to practical information regarding the "Vitamin A Potency Required by Hens for Egg Production" in 1935. Extremely intricate, technical, theoretical, and impractical studies on differential calculus by "armchair" professors results, when applied by the agricultural scientist, in the intelligent planning, managing, and interpretation of grain variety tests and of fertilizer experiments. Similar examples can be quoted almost without limit.

History of Science

The preceding discussion and examples show that a science develops more or less methodically in two successive stages.

The first stage is the accumulation of information, whether true, such as the observations as to the effects of fertilizers and legumes on crop production, or imagined, such as the presumed effect of moonlight upon the viability of germinating seeds.

The second stage is the verification of observations and notions which are deliberately tested by an experiment in which there is a check in the form of a controlled or known set of conditions. Verification is necessary as a basis both for the elimination of non-factual information and for the classification and interpretation of the facts which constitute any body of knowledge.

Not every past occurrence or allegation can be verified by a present-day experiment. This is true alike of geologic volcanoes and Biblical miracles. The truth of such phenomena can generally be tested only by indirect evidence.

A scientist is not necessarily some mystical being who "talks big words" on some "theoretical" subject. Rather, a scientist is one of millions of folks who does good things well and seeks ways to do them better.

A scientist is any person who observes accurately and checks continuously both his observations and his means of observation. He endeavors to improve his knowledge of his vocation, or avocation, or aught else to which he gives attention, by planning and executing true experiments in which all conditions are the same and under his control except the one condition whose appearance will yield the unknown answer to be determined by the experiment. He has respect both for the theoretical and the practical. He seeks to distinguish facts from opinions, and yet he knows that whereas facts are beyond change or compromise, the perception of them may be inaccurate, the interpretation of them is often ephemeral and, in any event, subject always to change. He aims to express his knowledge in quantitative or at least definite terms. He knows that all truth agrees.

Thus, the true scientist not only possesses accurate knowledge, but he holds a mental attitude of open-mindedness and modesty, of progress and improvement, and of a profound love for truth.

A Good Lawn Is Its Own Reward

(*From page* 19)

is sown by crossing at right angles, north and south; the other two, by crossing the yard diagonally.

The seed may be raked in; however, this often results in the grass appearing to be sown in rows. A better method is to drag a light brush or bough of cedar or light pole covered with burlap over the yard. The yard then should be rolled with a light roller.

The first cutting of the young lawn should be done with a sharp sickle when the grass is about three inches high. A lawn-mower will pull up many of the young seedlings. It is best to remove the clippings from the young grass since they may pack down the young seedlings. As soon as the grass is established, mowings should be left on. They soon dry and disappear and help keep the soil in good condition.

Late afternoon or a cloudy day is the best time for mowing. Frequency of mowing depends upon the rapidity of growth. In summer it is well to keep the lawn one and one-half to two inches long. When the grass has grown an additional inch to one and one-half inches it is again ready for mowing. Serious injury to the grass may result if it is permitted to grow too long before mowing.

There has been considerable discussion as to whether to lime or not to lime. Suffice it to say that where soil is definitely acid, showing a pH reaction of 3.5 to 5, and Kentucky bluegrass is to be depended upon for sod, lime is needed. Bent grasses, of course, require an acid soil for best results, whereas, Kentucky bluegrass seems to do best in soil with a pH reaction of 5.5 to 6.5. Lime may be used in any form, such as hydrated, burned, or ground to correct the acidity. Send a soil sample to your experiment station and ask for a test and recommendations before applying the lime.

Weeds are the bane of the lawnmaker's existence and crab grass and dandelion are prime offenders. Sorrel or sour grass, mouse-eared chickweed, common speedwell, and moneywort are offenders but are never bad like the first two.

Crab grass is an annual, the seed starting germination in June and the plant dying with the first frost. It will not grow in shade of trees or buildings. Different methods have been recommended; however, the only successful one the author has found is to dig it out root and all, reseed the area, and watch diligently for any new seedlings. Once the lawn is freed of crab grass, and seedlings are dug out as soon as they appear, little trouble is had.

Dandelions, like the poor, are always with us. They may be dug out with a knife, being sure to get at least two-thirds of the deep root. Where a heavy infestation occurs, iron sulphate dissolved at the rate of 1½ pounds per gallon and sprayed with a fine mist under pressure may be used. This amount should cover 300 to 400 square feet of area. It is necessary to give three or four sprayings ten days to two weeks apart to give complete control. Make the first application when the plants are coming into bud.

A good stand of grass under oaks and maples can be obtained by thinning and high heading.

The author has found that the best method of weed control is to make conditions ideal for growing your principal lawn grass, be it bluegrass or bent. There will always be some weeds; however, a thick, healthy turf will do more to prevent weeds than all other methods combined.

Ants, earthworms, grubs, and moles may be serious pests in the lawn. Fortunately, there are specific remedies for all except moles. A hole punched into the center of an ant-hill into which a tablespoonful of carbon bisulfide is poured and the hole closed with wet earth will do for these busybodies. (Caution—a cigarette, cigar, or pipe should not be smoked when pouring carbon bisulfide. It is highly combustible.)

Earthworms may be controlled by spraying the lawn with two ounces of bichloride of mercury dissolved in 50 gallons of water. This should be sufficient to cover 1,000 square feet of area. The solution should be watered-in immediately after spraying. The earthworms must be raked up and destroyed to prevent poisoning birds or chickens.

Grubs may be controlled with arsenate of lead used at the rate of three to five pounds per 1,000 square feet. To give an even distribution, it should be diluted with dry sand or ashes. Water does not have to be applied; however, better results are reported when it is.

The bluegrass webworm caused severe damage to lawns in 1930. Its attacks are intermittent and it may be controlled by the same methods as recommended for grubs.

Moles are a pest for which little remedy, other than to trap them, can be offered. Trapping is not always successful.

Despite all the trials and tribulations which one may have in securing a uniform, well-grassed lawn, one is fully compensated when it is secured. Nothing adds so much to the setting of a beautiful home as a well-kept lawn.

One-third of the Nation's Celery

(*From page* 13)

heavy investment per acre, but celery growing without control of irrigation and drainage would be a failure. The proper maintenance of a suitable water table is one of the bedrocks of Sanford's success. Rainfall in Seminole county during the celery growing season is entirely inadequate.

With drainage and irrigation well under control, Seminole county growers have only to find the quantity and quality of plant foods that will grow maximum crops of high quality celery. In addition, it is a constant fight to protect this crop from diseases and insects. In this humid climate there is nothing that thrives better than insects and diseases, which prey upon an unsuspecting celery plant. Of course, there are other problems such as harmful residues accumulating in the soil, for these growers use from three to five tons of fertilizer per acre, and some of the land is double-cropped (two crops in the same season). Probably more trouble from residues would occur if this soil was not of a very porous nature. Another factor that minimizes this accumulation is the heavy rainfall during the rainy season that follows the celery harvest.

A celery crop must be constantly feeding night and day for about 90 to 120 days, and to work out a program that will keep it pushing ahead and developing is not a simple or inexpensive task. Although drainage and moisture are under control, temperature has its ups and downs, and temperature is a very important factor in growing celery. If the weather is warm, nitrification is rapid. Frequently celery grows too fast or rather faster than it can "fill out," as the growers say. Such celery, if conditions are favorable, may develop some body and quality toward maturity, but it is in no condition to stand any adverse conditions. As one grower expressed it, "Bring it along right, not too fast, filling out the growth as it appears. Once you get it out of balance, you will have difficulty making it into top celery."

The celery on the left was fertilized with 5-5-10. That on the right received 5-5-5. The additional five per cent potash produced a difference in yield of 156 crates.

This explains why most growers want to have considerable organic nitrogen in the fertilizers which they use at planting time, or early in the season. Organic materials break down gradually and feed steadily, which is essential to sustained progress. If we knew what the weather would be, we probably could feed our celery a little more economically by using more organics during the warm season and more minerals during cold seasons. But after all, safety, as far as it can be adhered to, is a good policy; and so growers use both organic and mineral ammoniates, starting with a large percentage of the former and increasing the minerals late in the season.

Yield and quality in celery are almost inseparable, that is, within limits the quality improves with the yield. A yield of 800 crates per acre is always better quality than when 400 crates are produced.

An adequate supply of potash is very essential to both the yield and quality of celery. A heavy potash ration not only increases yields and quality but is good insurance against physiological breakdown in the crop after it has been grown. In the tests conducted by the U. S. Department of Agriculture in the Sanford area, it was found that a fertilizer carrying 8 per cent potash applied at the rate of four tons per acre gave excellent results in both yields and quality.

In the muck sections of Florida, celery is planted as a spring crop, maturing in April and May. This is due to the fact that these lands are low and cold, but this proves to be a great advantage at the end of the season when high temperatures are so detrimental. In the muck areas both tile and open-furrow irrigation are practical, and where the latter is used, drainage is a serious problem.

If Florida celery growers could only buy an insurance policy of protection against insects and disease, many of their problems would be solved. No such policy is available, and toward the end of the season growers are almost constantly dusting, spraying, and looking out for blackheart and pink rot.

Notwithstanding the numerous hazards and the large capital investment, the outlook for celery growers in Florida compares favorably with other pursuits of agriculture.

Born Housewife

Then there was that five-year-old girl in Cleveland who overheard a neighborhood woman tell her mother that the stork had just brought a baby to the Joneses.

"It weighs seven pounds," she concluded.

"How much was it a pound?" asked the little girl gravely.

"As a Man Soweth"

(*From page* 21)

laboratory were acid and needed lime in order to grow alfalfa.

"As a man soweth, so shall he reap." This old saying has been repeated and repeated for countless generations, and is as true today as when first uttered. In the words of Dr. Lawrence H. Baker, "This saying calls to mind the picture of a man sowing the general acts of his life, and having them bring back in due season of human chance and destiny, a crop of fortune or of sorrow." If we would harvest good crops of alfalfa next year and the years that follow, we must sow good seed on well-fitted and fertilized soil.

Need New Potash Program

More and more our heavier silt and clay loam soils in Wisconsin are responding to potash fertilizers. Our old program for lime, phosphates, and legumes is falling short. I have previously described in this magazine the vast areas of potash-hungry sandy soils in Wisconsin, but we are testing hundreds of soil samples from the heavier silt and clay loams in the older farming sections of the state that are showing low reserves of available potash as well as low phosphorus content. These soils are definitely responding to potash treatment. We are recommending 0-20-10 and even 0-20-20 mixtures on these soils for alfalfa. In fact it is my belief that the wide-spread use of lime in Wisconsin is going to accentuate the need for potash. We have evidence to show that soils which before liming did not respond to potash treatment are now in need of potash for maximum yields of alfalfa. We have sold the liming program to farmers of Wisconsin, but the use of potash and even phosphates is still in its infancy.

Potash Helps Both Crops

The striking photograph which accompanies this article was taken on a farm in Rock county this year,—a dark-colored silt loam of the Carrington series in one of the best farming areas of the state. Potash in the mixture here made a marked showing over the straight superphosphate plot, both on the barley and the alfalfa seedlings. This field was limed at the rate of four tons per acre. Four samples of soil taken from different portions show the following analyses.

	Avail. Phos.	*Avail. Potash*
No. 1	Trace	100 lbs.
No. 2	10 lbs.	100 "
No. 3	Trace	100 "
No. 4	"	110 "

We have found that soil showing less than 200 lbs. of available potash will usually respond to potash treatment. The soil on this farm is very low in both phosphate and potash.

Tabulated below are the results of treatments on this Rock County farm:

Treatment	*Barley Yields Bus. per Acre*
4-20-10	43.7
Check	25.7
0-20-10	50.4
0-20-0	40.5

This demonstration was conducted on a farm owned by Geo. Hull of Whitewater, located near Avalon, Wisconsin, and operated by Clifford Zantone.

There was a marked difference in the growth of the alfalfa on the fertilized plots, as compared to that on plots which received no treatment. . . . The big difference will be seen on the alfalfa yields in 1936 and subsequent years.

And so whether it be a crop of boys and girls or crops of alfalfa, barley, or corn, if we would harvest good crops we must give them properly fitted and fertilized soil in which to grow.

Potash and Clover for Better Pastures

(*From page* 12)

Since there is considerable strain variation in wild white clover, it offers a fertile field for plant breeders and agronomists; but until the seed is available, the best way to obtain it is by high mineral fertilization and proper grazing management, which means close grazing and the repeated use of a mower if the vegetation gets up too high. A good mower, by the way, is a valuable asset to any pasture, because animals usually avoid the vegetation around their droppings. When cut, and the mowings are carried a short distance away and partly dried, they are relished by grazing animals. Mowing also keeps the pasturage in a succulent, vegetative stage and the weeds in check.

Functions of White Clover

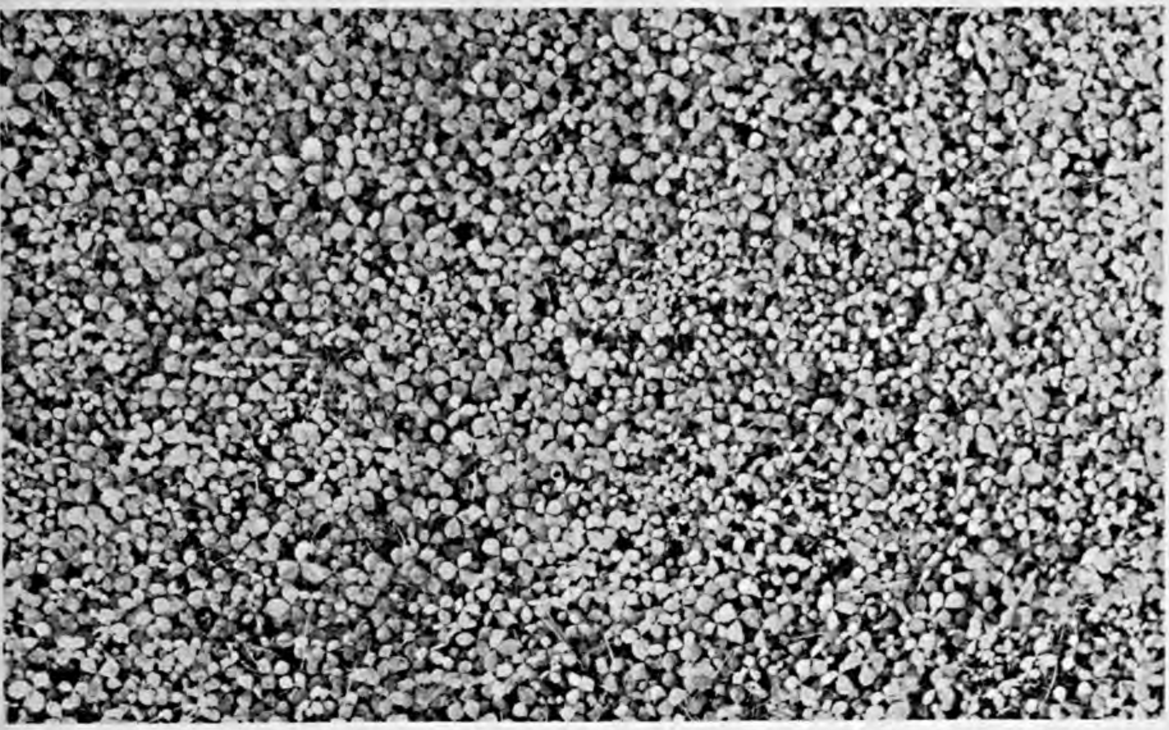
It is difficult to give wild white clover sufficient praise for its importance in making pastures productive and profitable. Some of the functions which this clover may play in pastures are the following:

1. It is higher in protein than grasses, and it is usually more palatable. Grasses growing in association with wild white clover are usually greener and contain more protein than the same grasses without this clover association. It is also quite possible that the percentage of digestible protein, in proportion to the total nitrogen, is higher in a clover-grass turf than pure grass with added nitrogen. This is perhaps even more true under close grazing, because the short grasses do not get a chance to properly utilize the high concentration of applied nitrogen before they are removed. The clover in a grass turf, however, has a tendency to supply this nitrogen more slowly and uniformly.

2. A good wild white clover turf tends to keep down the soil temperature during the hot summer months. At the Vermont Agricultural Experiment Station the soil temperature one inch below the surface averaged, during the summer months, about six to seven degrees cooler under a good clover turf than the temperature of the same soil under a fairly good timothy-bluegrass turf without clover. Usually the warmer the day, the greater the temperature differences became in favor of the clover turf. This reduced temperature is highly desirable and helps to account for the relatively good growth of pasturage during the hot summer months on a good clover sod. Under heavy rainstorms, it is also more efficient than the grass in reducing run-off, thereby helping to maintain the moisture supply.

3. In association with grasses this clover tends to produce earlier pasturage than grasses alone. This is because it helps to supply the grasses with nitrogen, thus giving the latter an earlier start in the spring. One of the main values of nitrogen on pastures is that it reduces barn feeding by allowing the animals to get out on pasturage earlier in the spring.

4. Wild white clover also has a tendency to produce pasturage later



A close-up of the wood-ash treated area shows the influence of potash in producing a thick stand of clover.

in the season than most grasses because of its period of growth. The maximum growth of most pasture grasses is early in the spring, but in the case of this clover the maximum growth is somewhat later.

5. It has a higher mineral content than grasses, and a higher proportion of calcium to phosphorus. This is desirable because it improves the mineral balance of the pasture herbage, making it more comparable to that found in milk and bone.

6. Wild white clover produces a very good turf which is firm and compact, because of its many stolons which are able to root at each node under favorable conditions, thus spreading over large areas in a short time. It has been noted that a small inconspicuous clover plant, with a liberal supply of minerals and close grazing, will often spread out and form a good turf over several square feet in one season.

7. While this pasture clover with all its stolons is considered a shallow-rooted plant, yet it has a main tap-root which penetrates the soil to greater depths than most grasses, thus being able to withstand relatively dry periods.

8. Wild white clover increases the organic matter supply of soils more rapidly than grasses alone. This is mainly due to its ability to spread and completely occupy the surface soil. Since it reduces soil temperature, the existing organic matter is not so rapidly decomposed; and since it reduces run-off, more moisture is conserved for additional plant growth.

Insure Come-back

There are no doubt other valuable characteristics which this clover possesses, yet these should be sufficient to make one desirous of increasing and maintaining it in pastures. While it is quite true that some seasons are better clover years than others, yet with proper care and management, this clover can be relied upon to increase pasture profits. The fact that it is able to produce seed even under relatively close grazing, helps to account for its rapid return after abnormal conditions of drought or winter injury, but to do this a liberal supply of minerals with lime and close grazing is very necessary.

The Inquiring Mind

(*From page* 16)

regularity, and all of the countries visited were paying great attention to this rotation, to the conservation of manures, and to fertilizing each crop according to its particular needs. Even the pastures are fertilized in much the same way as other crops. A mixture of potash and phosphate is applied at the rate of 200 to 500 pounds per acre in winter, and nitrogenous fertilizer at the rate of 100 to 200 pounds per acre is put on during the growing season. On small farms, most of this fertilizer is applied by hand.

In visiting experiment stations abroad, the party found that foreign farmers keep in close touch with the experiment stations, and are well informed concerning fertilizer needs of their land. Every branch of agriculture is making a much more complete study of the use of fertilizers than is made in the United States. The party even found that correct fertilization affects not only the yield of grapes in the vineyard districts, but also the wine made from them. In Berlin they were shown samples of wine made from grapes fertilized with a well-balanced fertilizer and from grapes poorly fertilized. The former had a degree of sprightliness and aroma not possessed by the other.

Long List of Writings

And now let us come back from Europe and look in again upon Professor Williams, methodical as usual, seldom missing even an hour from his work, supplying Editor Jeter with accurately written material whenever he needs it. His published writings cover, among many other things, "Estimation of Phosphoric Acid in Soils" (1896); "Variety and Distance Tests of Corn and Cotton" (1903); "Alfalfa Growing" (1906); "The Cotton Plant" (1906); "Effects of Applying Commercial Fertilizers to Corn and Cotton by Different Methods" (1913); "Source, Availability, and Suitability of Different Forms of Plant Food Constituents on Different Crops" (1914); "Long Staple Cotton in North Carolina" (1914); "Soybean Growing in North Carolina" (1915); "How to Use Lime on the Farm" (1916); and "Composition and Fertilizing Value of Farm Crops and Other Farm Materials" (1918).

Others are "Cultural Practices for Growing Cotton Under Boll-weevil Conditions" (1923); "Results of Fertilizer Experiments with Cotton" (1926); "Value of Lime on Cecil Clay Soil" (1928); "Results of Strawberry Fertilizer and Tillage Experiments" (1931); "Better Lawns in North Carolina" (1931); "Tobacco Fertilizer Recommendations for 1933"; and "Crop Rotation as a Material Aid to Soil Productiveness" (1932). These are but a few of the titles picked at random from the list which Mr. Jeter said is incomplete. How does one man do it all?

Knows Value of Recreation

The answer to that question goes way back to the boyhood of Professor Williams, and to the foundation for his almost perfect health. He started out, as we have said, on a farm in Camden County, where he learned to work before and after school, until it became a habit with him. But he also learned to play and to relax. As a boy he spent much of his spare time on Pasquotank River, on nearby creeks, and on Albemarle Sound ten miles away, in fishing, swimming, and sailing. On one occasion he, with two other boys, got lost for a whole night on Albemarle Sound. He became familiar with all the nooks and corners of the nearby waters, and got to know intimately Roanoke Island, where the first English settlement was made in America. He knew how to fish by hook or net, and the best places to catch crabs on the shallow sandy shore adjoining the home farm. With two others, in two days, he once caught, just below Roanoke Island, 156 sea trout and blue fish that averaged two feet in length. On another trip to Topsail Inlet, fishing from the shore of the Atlantic Ocean, he caught a drum weighing 36 pounds, the largest fish he ever caught.

From this active and busy boyhood he went to college with a great interest in athletics, especially in football, and became the first captain of his college team. During all of this time he was developing a healthy body, which has served him so well that he has seldom been sick. He is a football enthusiast and very seldom misses a game in which the State College team is engaged. From time to time he goes back to his old home in the northeastern part of the state, where he follows his favorite hobby of fishing, as he did when a boy. Professor Williams is a great walker and never rides to his office except in the worst winter weather. When he is at any one of the six branch experiment stations, he is happy to be able to walk to the various plots, examining and studying the results of the agronomy research.

All of this accounts for Charles Burgess Williams' activity and capacity for work. He is a man who is careful and cautious. He allows no "half-baked" ideas to go out from his office, and he has probably as much information concerning the crops and soils of a given state as any man in the United States. His friends agree with Mr. Jeter, who says, "He is a clean, outstanding gentleman who attends to his own business and does not meddle in the affairs of others. He is devoted to his work, and I suspect that it is this very devotion, together with his quiet, unassuming ways, that has been responsible for his success in North Carolina."

Welcome Welfare

(*From page* 6)

period of security to come. If it did, where could they get themselves a bonus for arousing the bone-heads to impossible demands? They pose as watch-dogs and pointers, but most always they turn out to be only mongrels baying at the moon.

They unleash themselves on capital and labor, on farmers and on soldiers. They always find something professionally wrong in every administration. They fly from one roost to another, as the ballots blow. They put scare-crows in every man's peaceful dooryard. They create a vast protest business for the Western Union and break the backs of mail carriers. They sneak their doctrines into newspapers under a guise of information. They plead for "more laws" and then connive to make them "scraps of paper." There is less danger of government by dictators than by demagogues and dabblers these days.

Indeed, if the present American business war-cry is to be "let us alone," then let big business and its brethren of the forge and furrow yank off a few self-imposed barnacles whose chief mission is to foment domestic discord

Instead, let there be more real "brain-trusters" — using the word

POLITICS

A man had been brought before the court charged with vagrancy. Fixing a withering glare on the culprit, the magistrate thundered: "Have you ever earned an honest dollar in all your life?"

"Oh, yes, Your Honor," the accused answered meekly, "I voted for you in the last election."

A freckled lad was asked, "What made those red spots on your face?"

He said, "I guess it's my iron constitution rusting out on me."

Lady Bountiful: "Here's a penny, my poor man. Tell me, how did you become so destitute?"

"Beggar: "I was always like you, mum, a-givin' away vast sums ter the pore an' needy at Christmas time."

The question in the physical examination read: "How may one obtain a good posture?"

The country boy wrote: "Keep the cows off of it and let it grow a while."

PSYCHOLOGY

"I wish," complained the preacher, "that I could make my flock take more of an interest in Heaven. None of them seems to want to go."

"Tell them that children under sixteen are not admitted," suggested the helpful friend.

Local Junior: "Daddy, what is bankruptcy?"

Dad: "Bankruptcy, my boy, is when you put your money in your hip pocket and let your creditors take your coat."

Professor: "Can you give me an example of a commercial appliance used in ancient times?"

Student: "Yes, sir, the loose-leaf system used in the Garden of Eden."

CHEMISTRY

A farmer visited his son's college. Watching students in a chemistry class, he was told they were looking for a universal solvent.

"What's that?" asked the farmer.

"A liquid that will dissolve anything."

"That's a great idea," agreed the farmer. "When you find it, what are you going to keep it in?"

Teacher: "Who can define indigestion?"

Pupil: "It is the failure to adjust a square meal to a round stomach."

"This stuff you sold me might be all right for some things," said the baldheaded man, "but it hasn't brung back my hair. Look at them bumps on my head."

The druggist looked at the label on the bottle.

"Great Scott," he gasped. "I've made a terrible mistake. This is bust developer."

Better Crops with PLANT FOOD

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The Whole Truth — Not Selected Truth

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Table of Contents, February, 1936

American Potash Institute, Inc.
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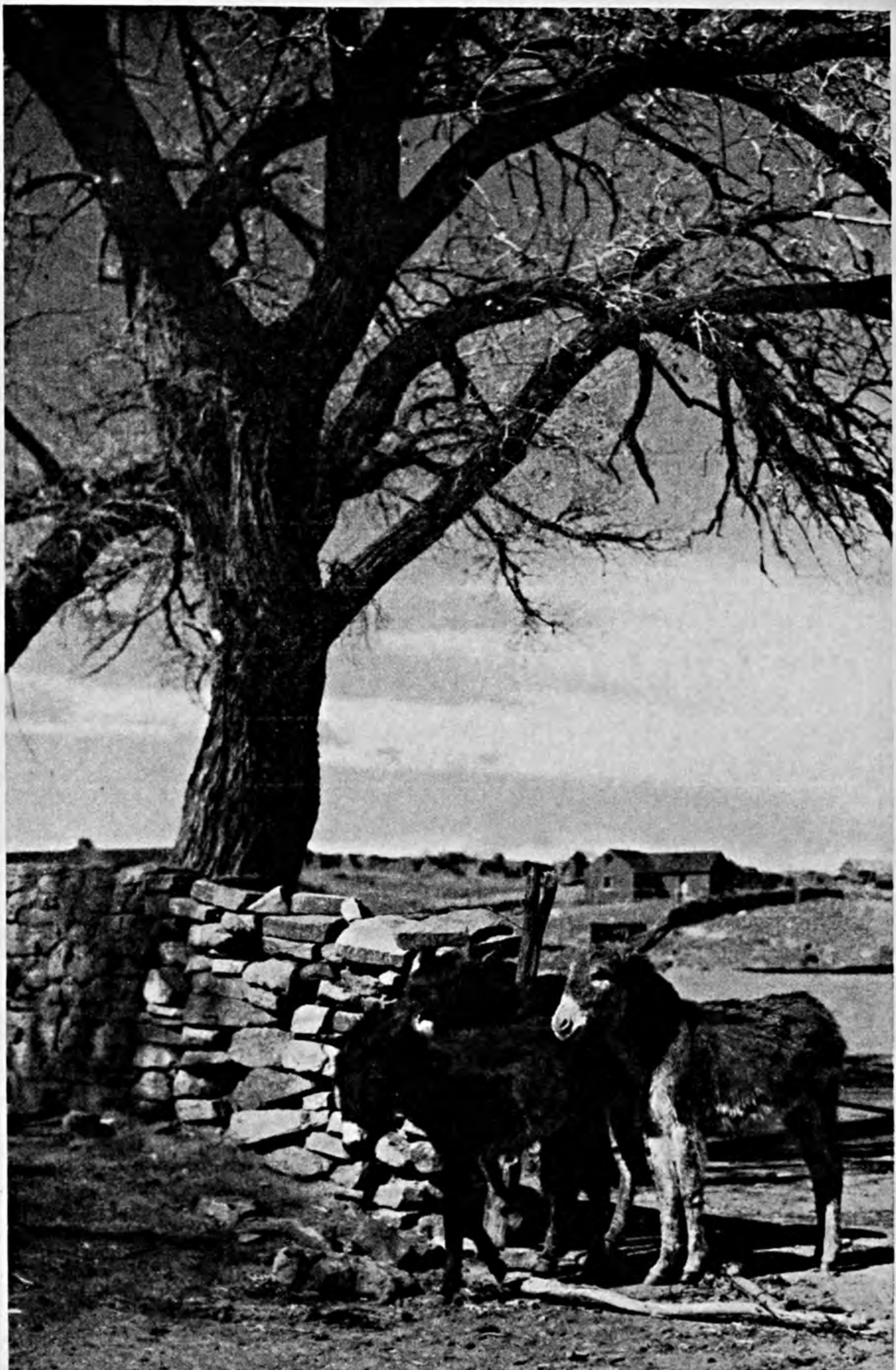

A SIESTA IN THE SOUTHWEST

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Jeff says, you can't get away from - - -

Communication

By Jeff McDermid

COMMUNICATION is so remarkably refined these days that you get an answer before your question, the hermit business is becoming dreadfully discouraging, and the words "remote" and "isolated" are being squeezed into the obsolete department of the dictionaries. Between the sign language and the smoke signal times in America and the advent of radio-television in 1936, less than a hundred years have passed. Keeping close touch by quick travel and rapid communication is the mania of the age.

To get away fast and to be aware instantly are the possessions this generation hands to the next. Yet some folks are almost frazzled-out by the speed of speech and the surfeit of song, to a point where they would like to get away from being aware. But you can't often accomplish it.

Go on the train and you have newspapers thrust at you or spread open in the seat ahead. Messengers urge you to send flowers or one last fond farewell. Move into the parlor-car and the loud-speaker is blaring. Thumb a chance overland ride and the flivver has a cute little set tuned in on the prize fight. Dive into a dining room and you'll victualize a la Vallee.

Dodge into a secluded movie and you take in the simpers and shanks of the beach beauty contest or the squeaking sentiments of the Hon. Hilatus Horseface, who wants your vote.

Run to a barber-shop and get scratched to jazz music. Step in a taxi and hear the latest crooner before the crash. Hide in a hotel lobby and the bell-hops page you with telegrams. Hustle out to Uncle Sodcorn's shack in the sticks and listen to the hog-calling contest's semi-finals, with extra selections from Major Bungle's amateur potpourri. Rush home in despair and find a bushel of accumulated newspapers at the front door, a cablegram in the mail box with the overdue bills, and the long-distance bell jangling in the study.

Of course, to a Scotchman there is a ray of comfort in it anyhow. Take a bargain-store receiving set and one can save several berries in travel and tips just by swinging through one arc of the dial pointer. And to the dumb as well as the dour, radio is a boon indeed. It doesn't require any reading or any education to enjoy most of the big-time programs. They are so very audible and the acme of relaxing simplicity! Thinking is useless anyhow in a political campaign year.

TO an occasional orator like myself the radio forum has few charms compared with getting a corner on some visible audience for half an hour's mutual endurance test. If I first see that the exits are locked, no hill-billy chorus or saxophone symphony may displace me, and my wavelength is limited solely by the length of my arms. If there are any economic enemies or other stubborn ignoramuses in the crowd I can see the effect of my galling cross-fire—but unfortunately, I can't dodge theirs! Radio audition has surely saved eggs as well as money.

Yet despite its commercial debasement, as some call it, the frills of modern communication have done wonders to us after all. It took nearly a month for Americans to know how badly Dewey licked Servera at Manila in 1898. It required six weeks to settle the Tilden-Hayes political scrap of the seventies; and some folks in the still Kentucky mountains, or even in my own metropolis, didn't hear about the Volstead law before it was repealed.

THINK of all those epochs going by unannounced by any announcer! And tonight I can hang onto the last brave words of Paulino Upsidedown before the brown bomber drops one on his konk with a resounding smack which vibrates in the serenity of my family circle! And what is still more edifying, I can sit up in the bleak hours of a summer dawn and hear the delegation from my own state join the Townsendites in a triumphal march around the stadium where they expect to pick a president. It is so realistic that I can almost feel the two hundred smackers bulging my breast pocket in a vain attempt to be spent! It's a great old life, if you'll only listen.

There are two kinds of radio rackets—the audible and the subtle. You can snap off or tune down the first kind, but I reckon the federal communications commission is the only authority left of the alphabetical family which can control the other. If the air is one of our natural resources, we'll have to keep it fresh and open and not let it go the sad way of the buffalo, the big trees, and the N. R. A. The electrical engineers have come a long ways since Ben Franklin yanked at his key and kite, but the ones who plan the programs and allocate the air lanes give us more static than the achievements of science justify.

I wonder if Heinrich Hertz and the Marches Marconi would have worked so long and patiently with world benefaction in mind had they known that Snozzle, Pop-eye, and the Tin Pan Troubadours would finally monopolize the ether. I bet they would have gone into the plumbing business. One noise is as good as another.

A feeble effort with a few courageous supporters is being made to put a little culture into the broadcasting business. It has to be done gently and slyly so as not to scare away the

dialers. If they could set calculus to music and give coupons and guessing premiums with every package of erudition, no doubt the profs might get a better chance at the microphone. If we could take our proposed colleges of the atmosphere and add a few hot-dog fraternity and sorority stunt nights interpolated into the mess, I am certain that even King David Sarnoff would admit there was something valuable in home education. As it is now, all the time the spectacled lads get in the sending room is between noon and sunset. It's better so, because they can't get used to the night life anyway, and too much "home work" is discouraged by modern theory.

I CAN recall when the rural telephone first busted up the solemn loneliness of the old farmstead. Before its advent we used to step outside and almost break our lung tissue hollering across the creek to neighbor Fish, either with the compliments of the season or a reminder for him to fetch back the cross-cut saw. My father was proud of his oral immensity, his ability to shout so loud that a deaf uncle could hear him even when he owed him fifty cents. I tried my best to imitate his vocal attainment, but only came within half the volume when he led me to the woodshed. Neither inheritance nor environment did me any good when it came to dispensing with a telephone, as he was able to for three-score years, merely on the power of his larynx. No doubt the huskiness of modern speech is traceable to the loss of some intangible factor not unrelated to the coming of the speaking wire—that and "speakeasies."

WE experienced the crank ringing era, the lightning-plug inhibition, and the community listening-in excitement, all the part and parcel of early rural telephony. Rubbering by all hands around has ceased to some extent since the radio put the world in the woman's kitchen. Check that as one more credit mark for broadcasting.

No sophisticated modern youngster with his complete home-wiring kit and latest do-dads for wireless experiments has any greater fun I am sure than my chum, Earl, and I enjoyed trying to talk to each other from adjacent barns with waxed twine and baking-powder tin receivers. That was in the days when our folks used to recite Darius Green to us, probably to remind us that he also monkeyed around the barn once too often with his flying contraption. None of us ever dreamed that before the next generation saw the light, men would be hearing the voices of daring men in the stratosphere.

Likewise if my memory serves me right, our family stood in awe of a neighbor who regularly staged spiritualistic seances. I remember standing near my mother's chair with my hair on end while a visiting "medium" obligingly invoked the aid of an Indian sachem in the happy hunting ground, to bring us messages about curing aunt's rheumatism and the outcome of the pickle harvest.

TODAY we live and move constantly in a vast realm of commonplace mystery, voices and messages from distant lands, bells from overseas, and vivid magnetism at the touch of a finger, each more marvelous and ghostly than any of the antics they used to spring upon us in the dim parlors of yore. I enter a theater and both see and hear the friendly form and accents of one of the lovable native noblemen of our times, now riding the range with the angels. I lift a disk from a dusty corner and the needle traces out the songs of a voice long stilled. The onrush of hurricane, the advent of bitter frost, and the first overture of spring's sonata are told to us in continental messages by weather men and electrical wizardry.

On Christmas day we listened with moist eyes to the grand mass chorus of Canadian choirs, swinging with perfect harmony and quality from the friendly shore of Vancouver Island washed by the Japanese current to fog-shrouded Halifax in the "Maritimes." Actually, we forgot all about the reciprocal tariff business for awhile under its spell.

They have always said with truth that "the good men do lives after them." Hitherto it has been books, music, and art objects on which we depended for silent communication with departed friends. In our present era a step ahead is taken, and we reproduce the face, the form, and the vocal pronouncements after the life is no longer ours to share. To extremely excitable or sentimental folks this may be too poignant for comfort, but at any rate, it preserves communication from complete finality in the grave. No other age of mankind has achieved that, unless the powers of the Incas and other prehistoric races are underestimated.

What challenging conceptions dare we imagine lie ahead in the eager minds and hearts of skillful scientists, never content to dawdle along in satisfaction while any haunting question stays unanswered. We are on the threshold of communication with the infinite—even though we must stand for a little punishment of evenings from the "music which goes around and 'round and comes out y'har!"

If our memories were better we might do without printed means of communication in this era of ours. I knew a sort of street-corner showman in our city who prided himself on getting dates, names, facts, figures, and other assorted jumbles fixed like cement in his cerebellum on one or two trials. Some lodges claim to have no written ritual, and several villages have dispensed with what used to be thriving newspapers. This hint seems outlandish no doubt as you scan the pink and purple rows of garish pulp magazines and tabloids in the depot. But memory experts and literary tasters have no rank in our times, hence it will be a long time before we cease to reread the radio news flashes or become communicative with ourselves under the study lamp. Besides, there are so many of us who can write—or think we can—better than we chat.

TYPE is here to stay I guess, because they have invented mystic typewriters which peck out stories and articles sent from limitless places, and supply copy hot off the griddle to the clanking Mergenthalers and the roaring Cottrels. It takes fast thinkers to keep pace with the devouring demand of the modern field of published communications. No wonder some of them have to tell sewer stories to hide their lack of real skill.

(*Turn to page* 45)

In this field of bright tobacco on the farm of H. S. Powers, South Hill, Va., the tobacco on the left received 1,000 lbs. of 3-8-3 fertilizer per acre before planting. Note the difference in growth and quality of the tobacco on the right which received 1,000 lbs. of 3-8-14.

Virginia Tobacco Needs Potash

By E. M. Mathews

Superintendent, Virginia Agricultural Experiment Station, Chatham, Va.

WHILE history records that Christopher Columbus was the first white man to introduce tobacco to the Old World, Virginians are proud to record that it was John Rolfe, husband of Pocahontas, who was the first civilized grower to raise tobacco for export, thus entitling Virginia to the distinction of "Birthplace of the American Tobacco Industry."

For more than 300 years tobacco has ranked high among the industries of Virginia. Dating from the arrival of our first permanent settlers at Jamestown in 1607, where the habit of smoking was acquired and the settlers learned from the Indians how to grow the weed, "Virginia has made tobacco, and tobacco has made Virginia." Almost every phase of her economic and social life has been enriched through the wealth created by this industry.

Some idea of the importance of the tobacco crop in Virginia can be obtained by comparison of production in this State with the United States as a whole. The total production of all types of tobacco in this country in 1933 was approximately 1,400,000,000 pounds representing an acreage of 1,757,000 or more than 11 pounds for every man, woman, and child in the country, about double the per capita consumption. This amount of tobacco, loaded 2,000 pounds to a wagon, would make a wagon train reaching from New York to California with enough left over to extend across the State of Virginia at its widest point. For the same year there were grown 83,400 acres of bright flue-cured, 32,800 acres of dark fire-cured, 2,800 acres of sun-cured, and 13,000 acres of burley tobacco in the State of Virginia.

Increased Consumption

This comparatively small Virginia crop of 132,000 acres produced 97,046,000 pounds valued at $12,416,000; 74 per cent of this total value was obtained from the 57,712,000 pounds of flue-cured leaf produced. This fact, together with the increase in cigarette consumption in the United States from 3½ per cent of the total consumption for all types of tobacco in 1900 to 40 per cent of the total in 1933, serves to emphasize the importance of Virginia flue-cured tobacco and prompts the writing of this article which, besides giving something of the history of the tobacco industry in the state, is aimed at developing a system of fertilization which will insure larger yields of better quality tobacco and more satisfactory income to tobacco growers as a whole.

In the early Colonial days Virginia produced most of her tobacco crop around Jamestown and in Tidewater Virginia. Most of this was air-cured leaf. Later curing was assisted by open fires placed in trenches in the barn directly underneath the tobacco. This developed the dark fire-cured type. The very latest process of curing tobacco leaf, that of flue-curing, was developed fairly recently, only about 70 years ago. By this method the golden cigarette leaf is cured within a few days after harvest by the use of steel flue pipes which conduct heat through the barn. This method has surpassed all others in producing mild, sweet smoking leaf, and this type has so increased in demand that today more than half of all of the tobacco produced in America is of the flue-cured type.

Industry Shifts

Since the early Colonial days of Virginia, her tobacco industry has gradually shifted from Tidewater Virginia to the Piedmont section. Today one can scarcely find a tobacco plant growing around Jamestown, while thousands of farmers throughout Piedmont Virginia depend entirely on tobacco as a cash crop. Why this shift in tobacco growing? In the opinion of the writer it was brought about principally because of the three most essential factors in tobacco growing, namely, soil type, plant food, and topography.

Tobacco is a plant which thrives best in virgin soil rich in humus and plant food. The soil must have good drainage, for the plant cannot stand wet feet. The soils of eastern Virginia are flat, while those of the Piedmont area are very rolling, thereby affording better drainage. Too, the newly cleared forests of the rolling Piedmont section were found to have sandy loam soils not only rich in humus, but with fine clay subsoils rich in plant-food elements needed for tobacco growing, especially potash. These soils were found to produce that sweet, aromatic, silky type of leaf so pleasing to the touch and tempting for its flavor, which, due to its justly earned world-wide reputation, always finds a ready market. Thus the old fields around Jamestown were abandoned for new virgin soils of the Piedmont area, soils still rich in potash content as well as other essential plant foods and organic matter, and with not so flat a topography.

The writer has often heard his father relate that 60 years ago, after he had cleared fields for tobacco, he could produce consistently finer quality crops (tobacco which was nearly all wrappers) than is possible today. His yields have been maintained and even increased through rotation and use of fertilizers, but 25 or more heavy crops of tobacco have taken more of certain plant-food elements from the soil than he has added in his fertilizers. Particularly is this true in the case of potash.

Tests have proven that an 800-pound crop of tobacco per acre removes from the soil 100 pounds of potash. The 25 crops produced on each field of the farm just mentioned averaged 1,200 pounds per acre. On the average these crops were given 1,000 pounds of a 3-8-3 fertilizer per acre. This application would supply 30 pounds of potash per crop or 750 pounds per acre during the past 60 years. Each of these 1,200-pound crops removed 150 pounds or a total of 3,750 pounds of potash per acre for the 25 crops.

If the best tobacco farmers, during their lifetime, remove five times as much potash from the soil through their tobacco crops as they replace through fertilizers, is there any wonder that thousands of Piedmont Virginia tobacco fields become deficient in potash, and that thousands of Virginia farmers lay aside fields and often whole farms for new ones where they can produce better quality tobacco, the only gold known to many of them?

Tobacco has shifted from eastern Virginia to the Piedmont; it has shifted from old fields and old farms to new fields and new farms. It has been continually in search of better soils and of new soils rich in potash and other plant foods which are so essential for producing quality tobacco. This shifting to new fields when the

The plant on the left is from a plot fertilized with 3-8-14 at the rate of 1,000 lbs. per acre; that on the right is from the 3-8-3 plot. In both cases one-half the potash was from muriate of potash, the other half from sulphate of potash.

old ones have been sapped of much of nature's vital nutrients cannot go on forever. Science must help the farmer solve this problem. He must be taught, through the results of tests conducted at experiment stations and elsewhere, how to replace all of these plant-food elements removed from the soil through continuous cropping, so that it will not be necessary for him to look for new fields and new farms. It is with a view to this type of assistance that the writer gives the following results obtained from experimental tests conducted in Pittsylvania County, Virginia, in which the value of supplying varying amounts of potash for flue-cured tobacco was tested over a four-year period by the State Agricultural Experiment Station.

These tests were conducted on Granville sandy loam soil, a typical bright tobacco soil of the Piedmont, a light sandy loam soil with fine, yellow clay subsoil. Along the ridges where drainage is good, this type of soil produces excellent quality bright tobacco.

Accurate as Possible

The plots described in the following tables were produced on a field on which tobacco had been grown for many years, and during the last three years of these tests, tobacco followed tobacco annually. All plots were duplicated each year; the four-year averages therefore really consist of eight repetitions of each test.

Table I shows the average yield per acre in pounds and the dollar value per acre for the four-year period 1931 to 1934 inclusive, for plots receiving fertilizers containing 4 per cent ammonia, 8 per cent phosphate, and potash varying from none to 20 per cent. In each case 2 per cent of the total percentage of potash shown was derived from muriate and the remainder from sulphate and sulphate of potash-magnesia. The maximum acre value was obtained when 12 per cent of potash was used. This value was 69 per cent greater than that for plots receiving no potash, about 4½ per cent greater than value for plots receiving 4 per cent potash, and a small increase of $2 per acre over plots receiving 8 per cent potash.

Still More Potash?

Although these tests show quite conclusively that at least 8 per cent of potash is profitable for bright tobacco fertilizers, yet the writer feels that an even higher percentage would have proven more profitable, if the method of application had been corrected so that all potash over the initial 6 or 8 per cent had been side-dressed just ahead of cultivation, approximately three weeks after transplanting time. The method of applying all fertilizers, including as much as 16 and 20 per cent potash, in the drill before transplanting time, resulted in a poor stand of tobacco and retarded growth in all cases of high-potash applications, thereby reducing the yield and quality for such applications to such an extent that the values shown doubtless do an injustice to high-potash applications.

In Table II it can be seen that where tobacco is topped low for harvesting by cutting the whole plants, or medium high for harvesting by priming, and spaced wide apart so as to produce large leaf, the heaviest application of potash tested, that of 7 per cent, proved the most profitable; and increasing amounts of nitrogen proved less profitable. Where the spacing was crowded, however, to 24 inches and 18 inches, increasing amounts of nitrogen proved profitable, provided ample potash was also present to insure against low quality.

The comparative results obtained from plots in Table III indicate that a continuous and large supply of potash is essential where heavy nitrogen applications are used to obtain heavy yield. These plots were spaced 24 inches and topped high (about 16 to

TABLE I. Varying Potash—Tobacco Tests, Chatham, Virginia—1931 to 1934 Incl.

		1934		4-year averages	
Plot	Fertilizer Analysis	Pounds per acre	Value per acre	Pounds per acre	Value per acre
1	4-8-0	994	$174.08	814	$94.99
2	4-8-4	1194	297.15	1002	153.60
3	4-8-8	1368	334.27	1028	158.36
4	4-8-12	1292	334.01	1088	160.38
5	4-8-16	1325	320.99	1008	149.32
6	4-8-20	1202	284.08	986	139.93

NOTE: 4 = 4% ammonia—not nitrogen; 8 = phosphate; Rate, 1,000 pounds per acre.
Above results based on duplicate plots each year. The low four-year average values included two years of depression prices together with poor yields.

TABLE II. Fertilizer, Topping, and Spacing Tests—Chatham, Virginia—1931 to 1934 Incl.

		Pounds and value per acre 4-year averages							
Fertilizer 1000 lbs. per acre		Top 10 leaves (cut) Spaced 36 inches		Top 14 leaves Spaced 36 in.		Top 14 leaves Spaced 24 in.		Top 14 leaves Spaced 15 in.	
Plot	Analysis	Yield	Value	Yield	Value	Yield	Value	Yield	Value
1	3-8-3	671	$76.40	890	$127.76	941	$143.83	1015	$150.39
2	3-8-7	753	116.52	1001	169.19	1042	158.27	1016	154.54
3	4-8-6	678	101.43	942	132.17	1095	172.67	1022	156.45
4	5-8-6	590	74.79	973	129.42	1041	156.78	1056	176.98

Ammonia—not nitrogen basis used.

TABLE III. Fertilizer, Yield, and Value Per Acre—1932 to 1934 Incl.

		1934		3-year Averages	
Plot	Fertilizer	Yield	Value	Yield	Value
1	800 lbs. 3-10-6	1285	$360.55	1154	$207.61
2	Same plus 1 T. tobacco stems	1493	429.24	1336	238.81

3 = nitrogen—not ammonia. The ton of stems added to plot No. 2 would increase the fertilizer equivalent to 800 lbs. of 4½-10-18.

TABLE IV. Fractional Applications of Fertilizers—Yield and Value Per Acre—1931-34 Incl.

		4-year Averages	
Plot	Fertilizer 1000 lbs. per acre	Yield	Value
1	3-8-5 before planting	1048	$167.17
2	3-8-5 before planting plus 0-0-5 20 days later	1324	185.11
3	1½-8-2½ before planting 1½-0-2½ 20 days later	1235	200.87

Ammonia basis used.

18 leaves). The sterilized tobacco stems, applied in addition to 800 pounds of 3-10-6 per acre, increased this analysis to approximately 800 pounds of 4½-10-18 and provided a continuous supply of both potash and nitrogen which lasted throughout the growing season.

Table IV shows just three plots taken from a series of tests conducted to determine the value of dividing the

This plant, which received a well-balanced N-P-K fertilization, was selected for seed because of fine quality, smooth leaf.

application of the different plant-food units of the fertilizer and of applying some plant-food elements about three weeks after transplanting. These tests show that extra applications of potash as well as nitrogen, about three weeks after transplanting time or when the crop is ready for the second cultivation, are very profitable. Similar tests conducted by individual farmers have proven equally as successful.

The writer in 1934 cooperated in conducting one farmer test in Pittsylvania County, Virginia, with results which concur closely to those just mentioned. This test was conducted on the farm of Eugene Carter of Dry Fork, Virginia, and on Granville light sandy loam soil. The tobacco was spaced about three feet each way and topped low for harvest by cutting. Mr. Carter used before planting 900 pounds per acre of 3-8-2 fertilizer. About 30 days after transplanting, extra sulphate of potash was applied as a side-dressing on a half acre plot of this tobacco just ahead of the cultivator to increase the potash from 2 to 12 per cent. The remaining half of the acre received no extra potash. The half acre receiving 12 per cent potash netted Mr. Carter 900 pounds and $325 per acre. The half acre receiving only 2 per cent potash produced 962 pounds per acre which sold for only $221.

Based on these tests conducted in Virginia and on similar experimental work in the Carolinas and other flue-cured tobacco-producing states, a committee of agronomists and tobacco specialists at their last annual meeting recommended in part the following fertilizers for bright tobacco for 1936:

(1) *For heavy or more productive soils:*

Three per cent total nitrogen, 10 per cent available phosphoric acid, and 6 per cent potash, to be applied at the rates of 700 to 800 pounds per acre.

(2) *For light or less productive soils:*

Three per cent total nitrogen, 8 per cent available phosphoric acid, and 6 per cent potash, to be applied at the rate of 800 to 1,000 pounds per acre.

With the above rates of fertilization where high topping is practiced and heavy yields are expected, the potash content may be increased to 8 or 10 per cent with profitable results.

(*Turn to page* 42)

Quality Celery Finds a Market

By M. E. McCollam

San Jose, California

ALTHOUGH celery growing takes on the extensive aspect in the Stockton Delta and Southern California areas, a smaller more intensively farmed center has been steadily developing in Santa Clara County during the past five years. At present, this is concentrated on from 400 to 500 acres between the towns of Milpitas and Palo Alto in the San Francisco Bay region.

Two varieties are mainly grown, the Utah type which is a green variety and the Golden Self-blanching tall type which is a white variety. The Utah type seems to be favored most by the growers, as it yields more, grows well in cool weather, and is probably more resistant to the celery mosaic disease.

This disease is the worst trouble confronting growers. Like other virus diseases of its type, it is carried by insects such as aphids and leafhoppers which are prevalent in celery fields. Infected plants are either completely stunted or develop poor heads. Proper dusting and spraying operations to reduce the insect population are the methods currently recommended for checking the disease. Because of cooler weather conditions prevailing in Santa Clara County, this district may have the advantage of a lesser insect population, but this cannot be depended upon every year. Undoubtedly, mosaic-resistant strains of celery will eventually be developed, as this work is now receiving the attention of plant breeders.

T. Takeda and one of his celery fields ready for winter harvest.

Fine quality makes its own place in any market. Celery that not only "sounds" good but really tastes good as well, finds ready favor. This new celery district is producing excellent quality, and it is not surprising to find the use of fertilizer in these fields well established.

Using plenty of plant food is considered by T. Takeda of Milpitas, California, one of the most important procedures in growing celery. He is the pioneer celery grower of the Santa Clara district and now raises about 50 acres each year.

(*Turn to page* 38)

The Inquiring Mind *and the* Seeing Eye

By Alister B. Alexander
Madison, Wisconsin

WHEN a man stands apart as a leader, as Wilmon Newell does, it is natural to ask, "What characteristics have placed him in leadership?" Those longest associated with him and who, therefore, have come to know him well, realize that while in emergencies Dr. Newell can and does make decisions quickly, in the ordinary course of affairs he reaches them only after painstaking study of problems in all their bearings. When decisions are reached, he is quick and decisive in putting plans into execution and is unswerving and determined in seeing them through. If the objective is worth while, as it must be, then nothing can stand in the way.

Qualifies as Leader

"Hew to the line and heave through to the finish," would be a good motto to attribute to this leader. Coupled with this attitude Dr. Newell is unsparing of himself, considerate of his associates, and fair-minded in all his relations. He has the ability to choose men, to win their confidence, and hold their loyal support. During the citrus canker campaign the force carried through for months without pay and without any indication that it would be forthcoming. Such esprit de corps is the mark of strong leadership.

In much this manner does H. Harold Hume, Assistant Director of the Florida Experiment Station, pay tribute to his superior officer, Wilmon Newell, who is the subject of our sketch this month.

Protege of Midwest

Wilmon Newell, Dean of the College of Agriculture and Director of the Experiment Station and Agricultural Extension Division of the University of Florida at Gainesville, was born at Hull, Iowa, on March 4, 1878, the son of William J. and Elizabeth A. Newell. After his preliminary education, he entered Iowa State College, where he was graduated in 1897, and from which he later received his Master's degree in 1899, and his Doctor's degree in 1920. After his graduation in 1897, he remained at the Iowa Experiment Station as assistant entomologist until 1899. In that year he went to the Ohio Experiment Station, where he remained until 1902.

During the following year he acted as state entomologist of Georgia, and then began a series of moves which have made him an outstanding figure in the agriculture of the South. From 1904 to 1910 Doctor Newell was entomologist for the Louisiana Agricultural Experiment Station and secretary and entomologist for the State Crop Pest Commission. He then became entomologist at the

Texas Agricultural Experiment Station and acted as state entomologist until 1915. In 1907 Wilmon Newell was married to Helen M. Mabee, daughter of Dr. and Mrs. O. P. Mabee of Galesburg, Illinois.

In 1915 Dr. Newell went to Florida as Plant Commissioner for the Florida State Plant Board, and became Dean of the College of Agriculture and Director of the Experiment Station in 1921, where we hope

DR. WILMON NEWELL

he will continue to serve for many more years. In the spring of 1915 the legislature of the state had passed the horticultural law known as the Florida Plant Act, and it was to accept a responsibility in carrying out that law that Dr. Newell moved there from Louisiana in the fall.

Florida at that time was experiencing serious outbreaks of citrus canker, probably introduced into the Gulf States, prior to 1912, by nursery stock imported from Japan. These outbreaks were serious during 1914, and within a year fruit growers and agricultural workers realized that they were dealing with a new and destructive menace, for which no remedial measure was known. Inability of private interests to properly cope with citrus canker soon became evident, and activity on the part of the state and federal governments became imperative, in order to secure destruction of all affected plants. Authority for the needed steps was sought from the Florida legislature and granted in the 1915 Plant Act. Membership of the State Plant Board was made the same as that of the Board of Control. When this board met to choose a chief administrative official, the qualifications of Dr. Newell were found to be outstanding, and he was charged with the duty of eradicating the serious pest.

Plant disease and pest control methods had not been developed to a high degree of efficiency at that time, and few advocates of eradication as the most economical and effective means were found. Dr. Newell immediately took charge of the work. Progress was slight until 1917, when an appreciable improvement in conditions was noted. The situation grew even better in 1918, 1919, and 1920, and then an increased number of infections appeared during the end of the period. A persistent recurrence took place in 1922 and 1923, and a less severe revival was recorded in 1927. Since that time, however, not a single canker-infested tree has been discovered, and in due time the menace was officially reported to have been eradicated from Florida.

Chosen Dean and Director

Confidence in the ability and the capacity of Dr. Newell grew. When the Board of Control and the Plant Board were called upon, in 1921, to choose a new dean of the College of Agriculture, who also acts as Director of the Experiment Station, they chose Wilmon Newell; but arrange-

(*Turn to page* 39)

Two Bolls Where One Grew Before

By G. A. Hale

Assistant Agronomist, Georgia Experiment Station

WITH a large carry-over and compulsory reduction in cotton production, it may seem paradoxical to some to find anyone who thinks cotton growers ought to strive to make two bolls grow where only one grew before or to increase individual output by increasing yields and by the use of modern machinery. Nevertheless, these things would prove to be very profitable on many farms as no satisfactory substitute has, as yet, been found for individual efficiency in lowering costs, increasing output, and improving the quality of American cotton.

Those familiar with our common methods of cotton growing are impressed by the lack of application of modern science and art to field practices. Just why cotton farmers are not farming in the light of present-day information and equipment and how to reform them are beyond the scope of this discussion. However, an attempt will be made to supply some more "light" with the hope that those who read may run into some useful information.

In all but the extreme western part of our cotton belt, commercial fertilizers of the right kind and amount in the hands of otherwise efficient farmers can usually be made to return a profit of from one to four dollars on every dollar invested.

Getting hold of the right amount and kind of fertilizer or "guano" for

Typical scene in the "fertilizer belt." The cotton planter follows the fertilizer distributor, and one-mule implements predominate.

a given field is complicated by both agronomic and economic considerations. The cotton-belt experiment stations recommend various kinds and amounts for the many soil types of this section. The most common amounts and kinds advised are approximately 200 pounds of 16 per cent superphosphate, 200 pounds of nitrate of soda or an equivalent amount of inorganic nitrogen from other nitrogenous materials, and 32 pounds of muriate of potash or an equivalent amount of potash in other sources, for each acre of cotton. For the sandy lands of the lower cotton belt, generally 64 or more pounds of muriate of potash are recommended. Potash is effective in reducing wilt and cotton rust damage on these soils.

Most cotton fertilizer experiments are conducted on the same land every year. Where cotton is grown in a rotation with legume crops, as is often the custom during recent years, it is likely that less nitrogen and more phosphates and potash could be profitably used on the cotton.

In recent years much attention has been given to the time of application and the placement of cotton fertilizers in the row. The results are in favor of either putting out the fertilizer several days or weeks before planting or separating the seed from it so as to avoid fertilizer injury. The "hitch" in these recommendations is that farmers are usually too busy with spring planting operations to make separate operations of fertilizing and planting and that no cheap and efficient combination distributor and cotton planter is on the market.

About as much experimental work has been done in cotton breeding and variety testing as in fertilization. Cotton varieties are generally classified according to their staple length. Breeders and growers are divided on the importance of staple length. One group thinks that American growers should improve the quality of their crop by planting longer staple cottons regardless of production cost and consumer demand factors, while another group advocates growing short staple or any other varieties that make high yields and have low growing costs. Space will not allow a discussion of these two cotton varietal "philosophies."

(*Turn to page* 44)

Mississippi Delta planters are using modern cotton machinery in order to make cotton production cheaper.

Profit Factors *in* Flue-Cured Tobacco

By J. M. Carr

Tobacco Specialist, Georgia Coastal Plain Experiment Station

WITHIN certain limits, the profit from most farm crops depends largely upon the yield per acre. This is only logical because there are certain fixed production costs, and quality usually improves with high yields. In the production of flue-cured tobacco, or tobacco of any kind for that matter, the profit per acre depends entirely upon the proper combination of yield and quality. Quality has no direct relation to yield except in the two extreme limits. Very low yields result in small, short leaves and are undesirable, while excessively high yields are made up of heavy, coarse leaves with large fibers. There is little demand for either type. In the study of the nutritional requirements of the tobacco plant from the standpoint of producing flue-cured tobacco, practically all of our effort has been directed toward producing the most profitable combination of yield and quality.

To state that highly productive soils are not desirable for a crop will no doubt shock those who are not familiar with the production of flue-cured tobacco. However, it is true that soils that will produce high yields of corn, cotton, oats, hay, legumes, or other crops without heavy applications of commercial fertilizers will not produce profitable crops of flue-cured tobacco. Such soils grow the plant too large and coarse for fine quality.

In order to produce fine quality it is necessary that the plant be fed a definite and known ration in much the same manner that high producing animals are fed. To avoid the unknown, only soils

Chlorosis or mottling, indicating potash starvation, begins at the leaf tip. Leaves curling under and localized dying of the tissue distinguish symptoms of potash deficiency from those of magnesia deficiency or sand drown.

low in natural fertility but of good physical qualities should be used. Such soils are the soft, friable, sandy loams that have good water-holding capacities and yet warm up quickly in the spring. Thus by avoiding the unknown reserve of heavy soils and using a known plant food, it is possible to govern the size of growth, maturity date, and quality of plant quite definitely. Of course, seasons are an uncontrollable factor and often confuse or completely upset our attempt to control the plant.

Fertilizer, well-balanced for the need of the crop, made profit in this field of bright tobacco.

Normally, growth of the tobacco plant under favorable conditions is rapid. The first harvesting can often be made approximately 60 days after transplanting, and almost invariably the crops that are produced in the shortest time are the most profitable. It should be stated, however, that the amount and distribution of rainfall during the growing season are the most important factors involved in early maturity.

In order to mature the crop in such a short time, the plant food applied must be in quantities and forms conducive to maximum growth without impairing the quality. The nitrogen must be limited to approximately 30 pounds per acre. One-third of this amount should be derived from inorganic nitrate nitrogen materials, or, instead of using the materials containing inorganic ammonia nitrogen, those containing nitrogen in the nitrate form may be used for two-thirds of the total nitrogen. These forms of nitrogen promote a quick start and rapid growth. The remaining third of the nitrogen supply should be derived from high-grade organic materials of plant or animal origin, such as fish scrap, cottonseed meal, and animal tankage. The organic nitrogen thus supplied helps to some extent in preventing leaching from excessive rains early in the season and also gives the mixed fertilizer the desired physical properties.

Phosphorus should be applied at rates of from 80 to 100 pounds per acre. Experiments show that 40 pounds P_2O_5 per acre will produce approximately the same yields as the 80 to 100-pound applications. However, the additional 40 to 60 pounds per acre are required to bring out quality. Superphosphate, dicalcium phosphate, and triple superphosphate are suitable sources of phosphate. Where the triple superphosphate is used, the calcium requirements of the plant must be considered.

The maximum amount of potash that may profitably be used on the Coastal Plain soils has not been determined. Experiments show that applications as high as 80 pounds K_2O per acre are profitable. It is entirely possible that even heavier applications

(*Turn to page* 35)

Alfalfa removes large quantities of potash from the soil. The field above received no potash.

A Legume Program *for* Sandy Soils

By C. E. Millar

Head of Department of Soils, Michigan State College of Agriculture

A CROPPING system which is not designed to improve the soil is almost certain to lead to soil depletion. There seems no middle ground. Crops selected because they will withstand mediocre soil conditions will be replaced shortly by crops which are adapted to yet poorer soils, and so the road to ruin is followed. The avoidance of soil-improving crops because they have rather exacting soil requirements is the first step toward soil abandonment.

Legumes require suitable soil condition for satisfactory growth. They are among the most critical of soil conditions of any of our common crops and yet they are the keystone to the soil-building program on a large acreage of Michigan sandy soils. It is difficult to find an outstandingly successful farmer on the lighter soils of our state who is not an ardent advocate of legumes and who does not attribute much of his success to his soil improvement program based on an adequate acreage of alfalfa, and the clovers.

Crop growth is limited on a large share of our sandy soils because of an insufficient supply of organic matter. The increase or even the maintenance of the supply of organic matter in the sandy and light loam soils is one of the most perplexing problems confronting farmers managing these lands. A scientific principle involved in the accumulation of soil humus requires that there must be one pound of nitrogen for every ten or twelve

Note the stimulation to growth which potash, supplied in commercial fertilizer, gave this alfalfa.

pounds of carbon. If this relation does not pertain, there will be a rapid dissipation of the carbon through decay processes, and the quantity of organic matter in the soil will be reduced in proportion. Nitrogen is the key element in humus accumulation, it is evident. Legumes are our only crops which have access to the unlimited store of nitrogen in the air. By means of the bacteria in the nodules on the roots of inoculated legumes, nitrogen from the soil air is combined into products which become food for the plants. Thus nitrogen is obtained free of cost and is built into the hay in the form of valuable protein for stock feeding, and into the roots and stubble where it increases the quantity of humus produced as the plant tissue decays. The manure produced from feeding the hay may also contribute liberally to the humus supply of the soil if it be carefully handled around the barn so as not to lose the valuable nitrogen extracted from the air by the nodule bacteria.

The value of legumes in building up the organic content of the soil is not limited to their nitrogen-acquiring ability. The root systems of alfalfa and the clovers fill the soil with small fibrous roots forming a dense sod, even though the alfalfa does produce a top root. It has long been known that crops which produce sods are superior to others in their humus-accumulating capacity. As witness of this fact we need only look at the depth and blackness of our prairie soils.

The value of legumes in increasing yields of crops which follow in the rotation and in contributing toward maintenance of soil fertility has been emphasized so frequently in writing and observed so universally by farmers that nothing further on the subject need be said here aside from pointing out that an effort to farm sandy soils without the growing of a high legume acreage goes beyond the realm of optimism. From our 20 years experimental experience in the management of sandy soils and observation of the work of many farmers operating on sandy soils extending from the Straits to the southern boundary of Michigan, we feel that putting these soils in condition to grow legumes is the first and most important point in their management.

The close relationship between lime and legumes is quite generally understood but all too frequently ignored by those who fail to plan sufficiently far in advance or those who think that if weather conditions are right they may get a stand of alfalfa or clover even if the land is sour. Others endeavor to make manure take the place of lime. Fortunately all sandy soils are not sour, and hence it is advisable to test any and every field for lime requirement a year or more before it is to be seeded to alfalfa or clover. This precaution allows of ample time to apply the lime at a convenient time so the soil will be in readiness when the legume is seeded.

Lime is a soil conditioner, and although it does enter into the life processes of the plant, it is not considered a plant food or fertilizer in the same sense as are nitrogen, potash, phosphoric acid, etc. As might be expected, valuable crops like alfalfa and the clovers are rather heavy feeders and are quite particular that their diet be balanced to satisfy their needs. They are like pure-bred livestock in this respect; they will not give their best performance unless they are well fed.

Legumes Need Potash

Recognizing the above facts, we have endeavored to determine through experiments located on farms in various parts of western Michigan, what the sandy and sandy loam soils of our state need to enable them to grow alfalfa luxuriantly. If a need for lime existed, it was supplied first as we soon learned that good weather will not correct soil acidity. A study of the chemical composition of alfalfa, clover, and sweet clover showed that these plants are unusually rich in potash. Reports of experiments in other states also showed the high potash requirement of these crops, and hence this plant nutrient was given a prominent place in our experimental fertilizer treatments. Results justified this decision, as is illustrated by the following observation.

A sandy loam soil in southwestern Michigan produced no alfalfa without lime. An application of limestone without fertilizer resulted in a yield of 2,266 pounds of hay as an average for five crops. The addition of 100 pounds of muriate of potash on the limed soil increased the average yield to 3,014 pounds of hay.

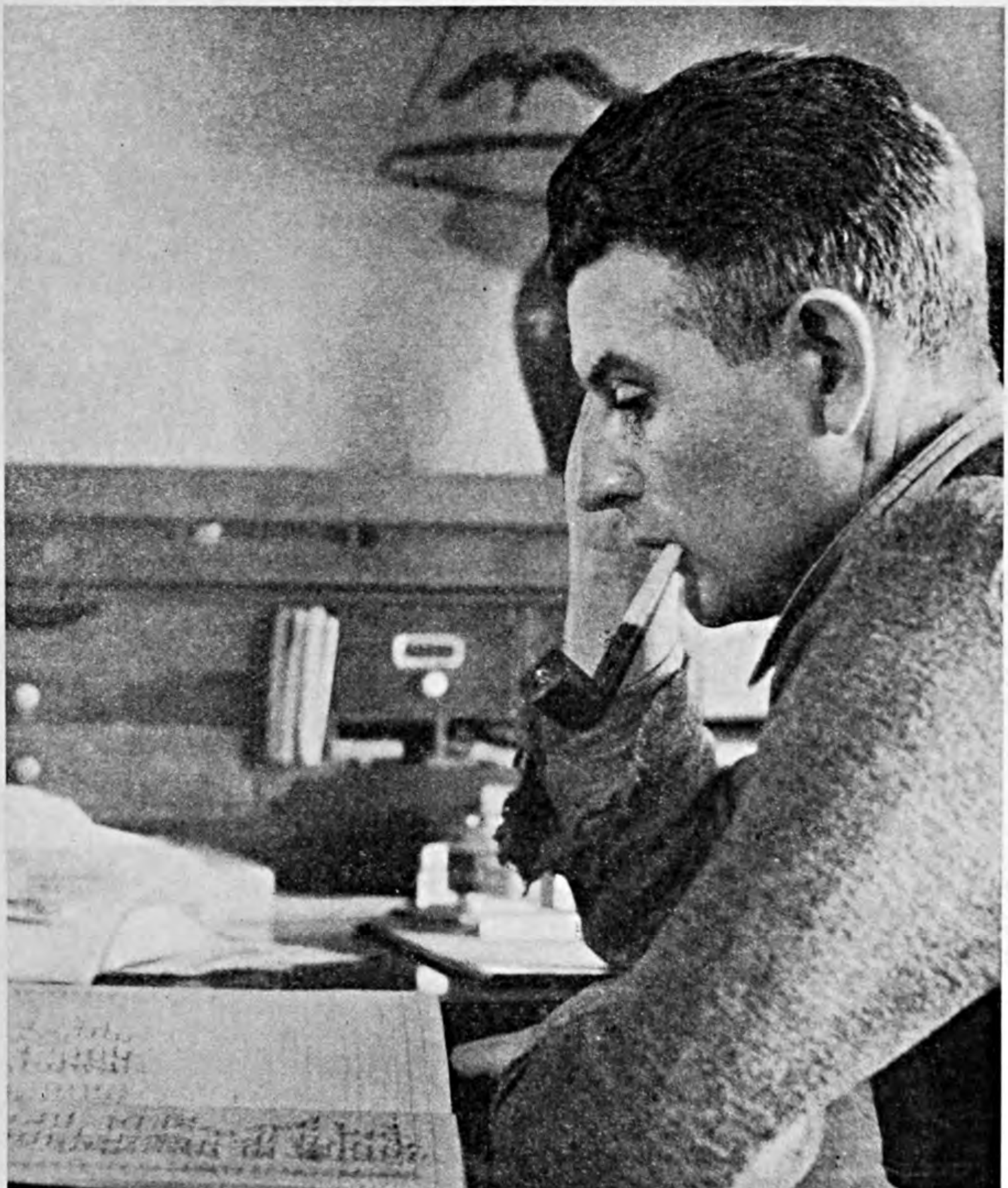
Phosphoric Acid and Lime

As alfalfa also has a rather heavy requirement for phosphoric acid, in many trials this plant food was used in conjunction with potash. The increased growth of alfalfa resulting from addition of phosphate fertilizers on soils having insufficient supply of this plant food is illustrated by the following results from tests on a Fox sandy loam soil in Kalamazoo County. Limestone increased the yield from zero to 2,333 pounds of hay as a 12-year average. Phosphate fertilizer at the rate of 200 pounds of 0-20-0, applied three times in the 12-year period, increased the average yield to 3,003 pounds. When this plant food was supplemented with three 100-pound applications of muriate of potash, the yield rose to 3,364 pounds of hay.

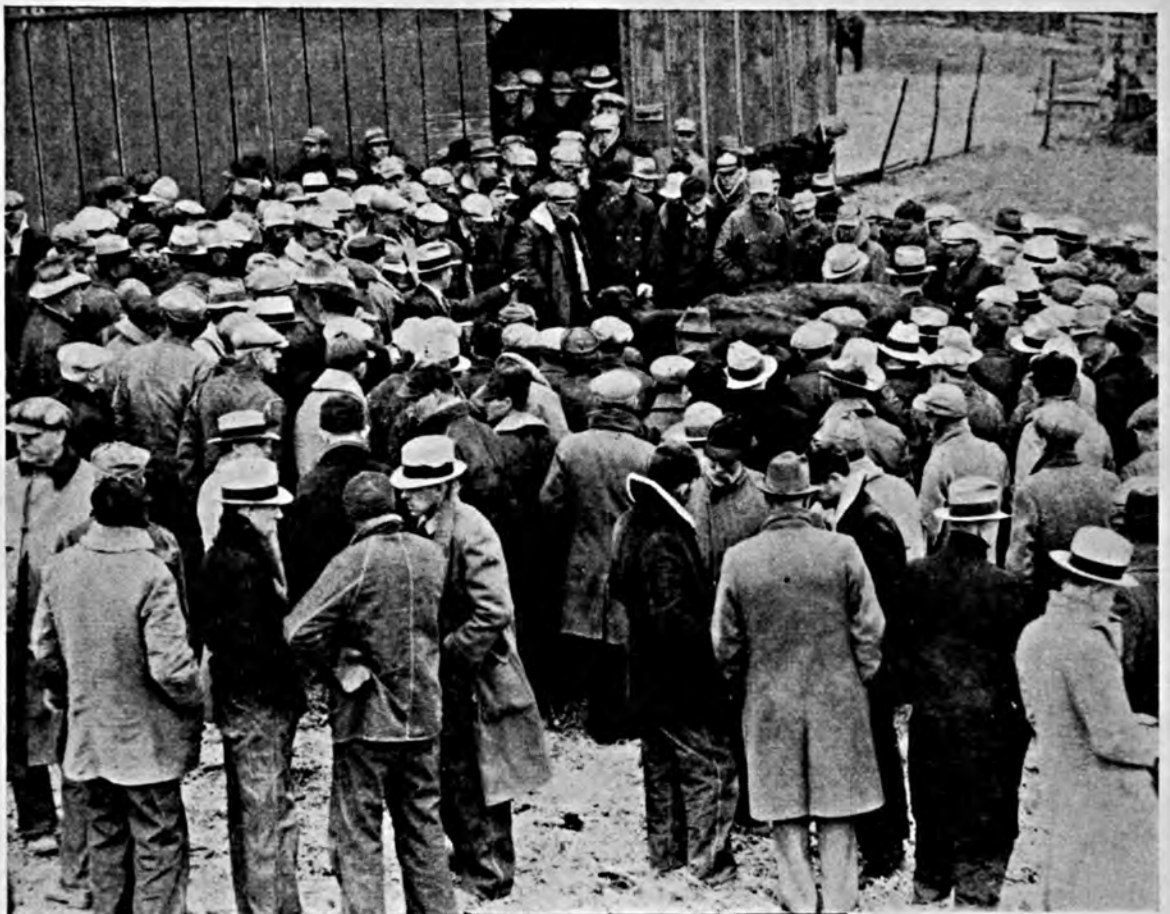
A summation of results of experiments on the sandy loam soils of western Michigan has led to the conclusion that potash and phosphoric acid should be used in approximately equal proportion for best results in the fertilization of alfalfa. The same would be true for sweet clover and red or "June clover" as it is called locally. This relationship is illustrated by a yield of 2,579 pounds of hay with phosphate alone, 3,389 pounds with about 1/3 as much potash as phosphoric acid, and 3,805 pounds of hay when potash and phosphoric acid were used in about equal quantities. These figures suggest that 0-12-12, 0-20-20, and similar fertilizer analysis be used on soils falling in the better sandy loam group.

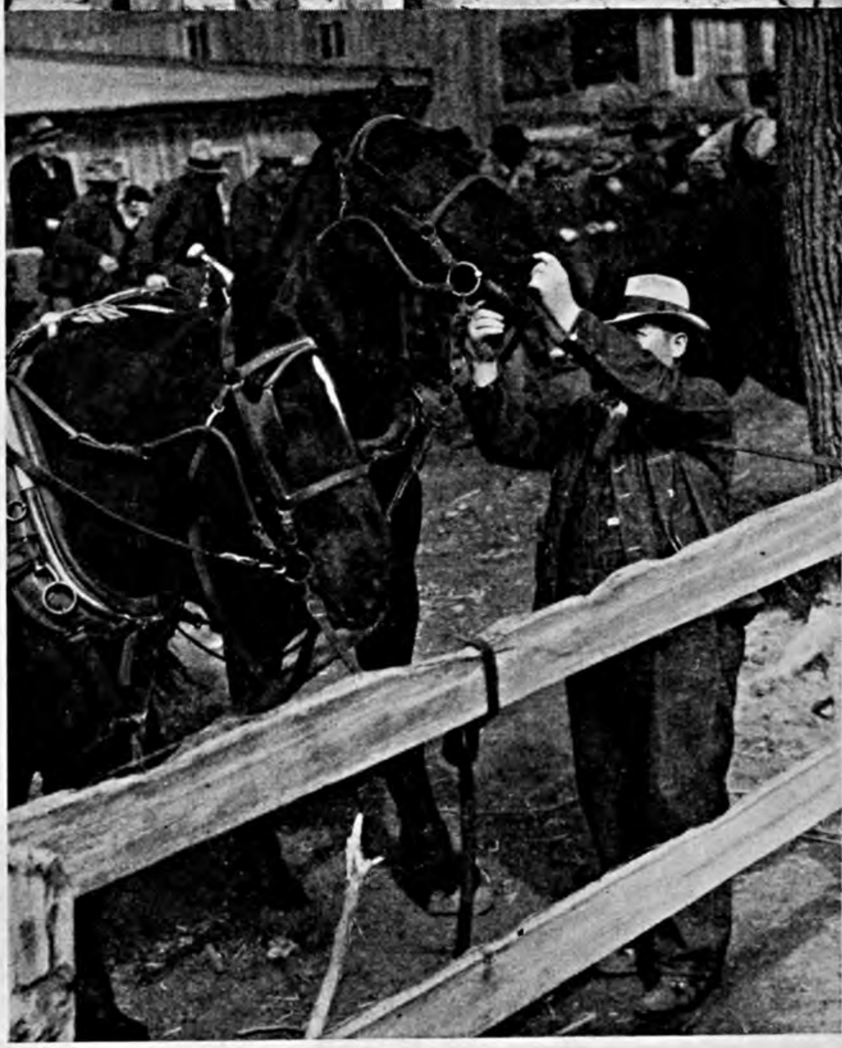
(*Turn to page* 36)

Pictorial



"I'VE GOT TO ALLOW FOR THE COST OF FERTILIZER."



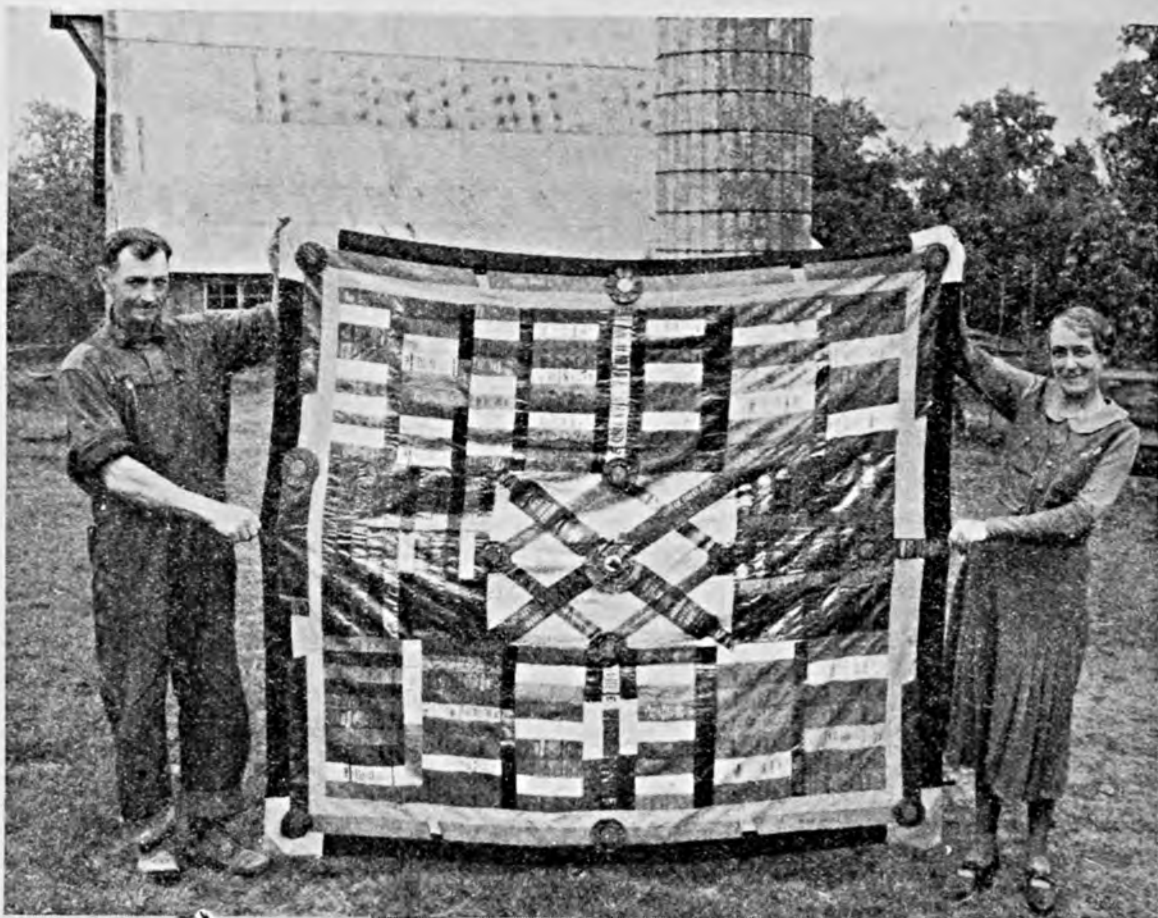


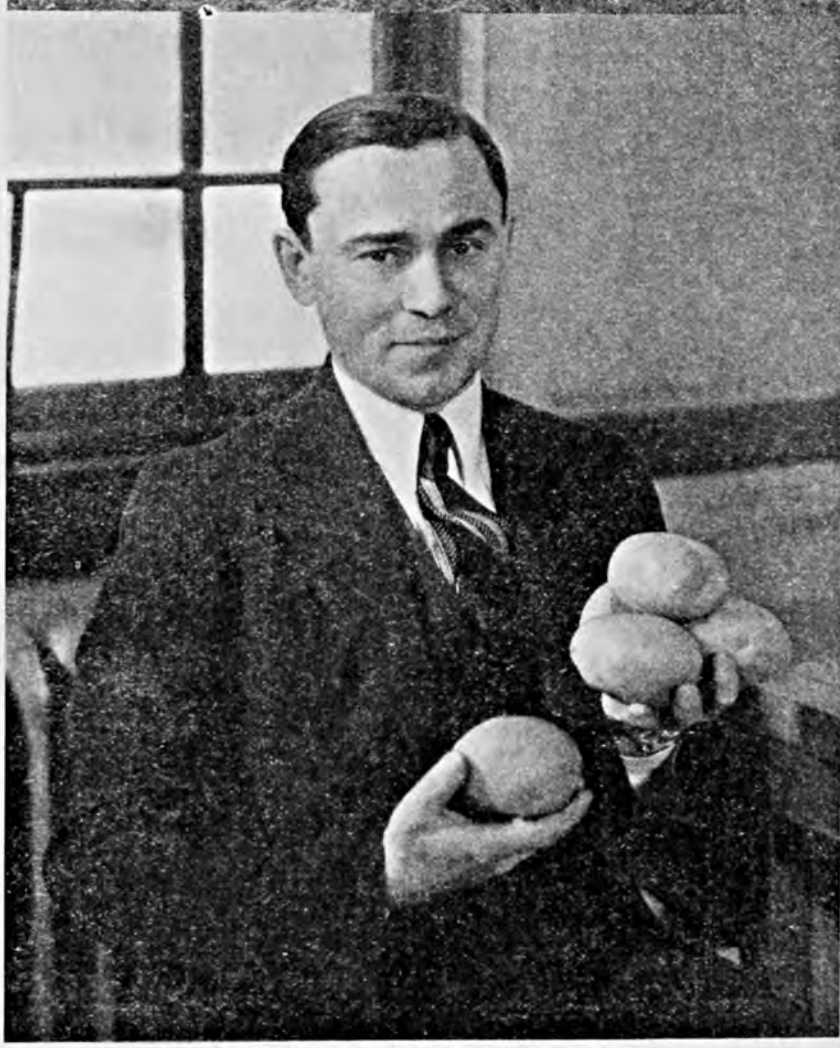
The attraction of a good farm auction isn't lessened by cold weather.

Left: Sound young horses are demanding good prices.

Right: Many farm women make money with poultry.

An important part of the winter farm ritual is butchering hogs.





Mr. and Mrs. C. E. Newson of Worthington, Indiana, have put their honors to practical use. They are exhibiting a quilt made from the ribbons won by their Jersey cattle.

Left: Perry E. Ort, Churubusco, Indiana, is Hoosierdom's 1935 Potato King. He won the 400-bushel contest with a yield of 486.9 bushels of U. S. No. 1 grade potatoes per acre. Certified Irish Cobblers were planted, and the fertilizer was 500 lbs. of 0-12-37 per acre. Cultivation was shallow, and the crop was sprayed four times with Bordeaux.

The Editors Talk

Exporting Soil Fertility

At no previous time in American history has so much been said, written, and done about soil fertility, its restoration and conservation as the nation's most important asset. At no previous time has it become a national issue, accepted as such by the American people as a whole, from the President down through the various Federal, State, and industrial authorities, to the man in the field.

The President in his statement, "We must avoid any national agricultural policy that would result in shipping our soil fertility to foreign nations," expresses an aspiration as well as a national necessity far transcending the meaning at first glance conveyed by this brief sentence. Literally, as American agriculture long has been and still is being practiced today, soil fertility is being shipped "abroad" wherever the crop is removed from the field where grown. The farmer's barn too often is synonymous with "foreign nations," for even the soil fertility in harvested crops stored in barns in too many instances never finds its way back to the soil from which it came.

Unless we adopt the type of soil fertility conservation that has maintained Chinese agriculture for 5,000 years, which we never will, our soil fertility will continue to be "exported"—a fact so obvious and inevitable as to give emphasis to this highly significant statement descriptive of a situation which actually exists. The nation's attention has been pointedly drawn to the remedy which it clearly connotes, namely, that of putting back onto the land the soil fertility which has been and is being "shipped" away, not only by the crop but likewise by leaching, soil erosion, and other avoidable and unavoidable natural and artificial agencies.

The cause of this situation is described in a few words by Dr. R. G. Tugwell in his testimony before the Special Senate Committee on Survey of Land and Water Policies of the United States wherein he said: "Vast areas of land which had been used sometimes for half a century . . . were becoming exhausted, sometimes through improper use. . . . Thereby, through erosion, exhaustion of fertility . . . much of this land had, so to speak, economically gone out from under the people that were on it."

Information on how to restore soil fertility antedates by many years any nation-wide realization of its immediate need. For many years the agricultural scientist has taught, and is still teaching by all the educational facilities at his command, the necessity of restoring soil fertility, and its impending alternative, soil exhaustion. Former generations of farmers have passed on to the present the task of putting back into the soil, as nitrate, phosphate, potash, lime, and magnesia now fortunately obtainable at lower prices and in more scientific mixtures than at any previous time in agricultural history, something more than a mere fraction of the soil fertility removed with their crops, never to return—"shipped to foreign nations."

Dr. N. A. Pettinger

On February 1, soil science lost one of its prominent and well-known workers. Dr. Nicholas Albert Pettinger passed away at his home in Blacksburg, Virginia. A victim of a long illness, his indomitable will to achieve and to render a service to American agriculture spurred this young research worker to the recognition he attained in the comparatively short span of his life.

Dr. Pettinger was born in 1901, a native of Iowa. He received his education in institutions of that state and Illinois. At the experiment station of Illinois, he worked for two years after receiving his Ph.D. degree. In 1927 he joined the staff of the Virginia Agricultural Experiment Station as Assistant Professor and Associate Agronomist, in which capacity he was serving at the time of his untimely death.

In 1934 when the American Society of Agronomy enlarged its committee on fertilizers and appointed three sub-committees—one on fertilizer application, a second to study acidity and basicity, and a third to study rapid chemical methods for determining plant-food deficiencies—Dr. Pettinger was chosen as chairman of the latter committee. He made many contributions to the scientific literature, especially on the subject of fertilizers and plant-food deficiency symptoms. He was an active worker in the field of rapid chemical methods. His efforts from the first were directed at the application of these methods to diagnosis of fertility needs of soils and the development of research that would make possible a better correlation of these tests with crops and soils.

It is workers of the sincerity and industry of Dr. Pettinger which American agriculture can ill afford to lose.

Practical Application

Every-day use of a land survey project made under the direction of the Federal Emergency Relief Administration is seen in a report issued by the South Carolina Agricultural Experiment Station. Soil acidity prevailing on farms in the various parts of the state was determined in connection with the land-use survey. Based on the condition of the soil with respect to acidity and general fertility as determined by observation and previous treatment, H. P. Cooper, Professor of Agronomy, makes recommendations for various crops, not only for the amount of lime to be used, but also for the proper fertilizer to accompany the liming to produce a profitable crop.

This type of work is an example of the practical application of funds and man-power for the accumulation of data and information of immediate value to farmers and of permanent value to investigators in enabling them to make more accurate recommendations to farmers in the future.

Post Card

Please be sure to fill out and return the postal card enclosed in this issue. We are very anxious to have this information in order to check and reclassify our mailing list. Your cooperation and courtesy in this instance will be greatly appreciated.

REVIEWS

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

Fertilizers

The Pennsylvania School of Agriculture and Experiment Station, in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture, presents a preliminary report on the effect of different fertilizer treatments on pasture grasses in Bulletin 323, entitled "Pasture Fertilization," by F. D. Gardner et al. While definite conclusions are not yet drawn from the tests, results indicate that a substantial increase in value of hay over fertilizer cost is obtained from applications of limestone sufficient to neutralize soil acidity, 64 pounds of phosphoric acid, 50 pounds of potash, and 48 pounds of nitrogen per acre. Other interesting results determined from grazing investigations, according to the authors, show the average cow will graze at least 60 pounds of pasture grass in a day, which represents about 11.4 pounds of total digestible nutrients, or a total of 342 pounds in one month. The cost of the nutrients as a result of pasture grazing is estimated to be 58 cents per 100 pounds. Comparing these values with mixed hay costing approximately $14 per ton and supplying total digestible nutrients at a cost of $1.52 per 100 pounds, the nutrients in the mixed hay cost 2.6 times as much as the pasture grass.

A mass of instructive information is contained in Bulletin 375, of the Maryland University Agricultural Experiment Station, on the nutritional responses of the tomato plant, by Paul Lewis Fisher. As suggested by the title, "Responses of the Tomato in Solution Cultures with Deficiencies and Excesses of Certain Essential Elements," the investigations should prove very valuable in solving many pertinent problems concerning fertilizer practices on this crop. Quoted in the introduction is a significant statement from McMurtrey's work on the effects of the deficiencies of certain elements on the growth of tobacco: "Once the distinctive symptoms of the deficiency of each element are known for one plant species, such as the tobacco plant, their recognition in other plants will be relatively simple. Although there may be minor variations in the symptoms shown by different plant species, the characteristic effects are likely to be essentially the same."

When the Marglobe variety of tomato plants was grown in solutions deficient in any one of the essential elements, as boron, calcium, magnesium, potassium, nitrogen, phosphorus, and sulphur, there was a decrease in plant growth, the publication shows. With the exceptions of calcium, nitrogen, and sulphur, these studies reveal a beneficial response was prevalent when concentrations double that of the control cultures were used. Excellent photographs illustrating the response of the nutrient treatments to tomatoes are contained in the bulletin.

Very interesting results from fertilizer experiments on cotton are compiled in the "Forty-seventh Annual Report of the Georgia Experiment Station," by Director H. P. Stuckey. The most profitable yields of cotton under present conditions are secured by applying 32 pounds each of nitrogen, phosphoric acid, and potash per acre. Additional field tests with 24 farmers located in different sections of the state to check these results showed that cotton fertilized according to the Station's plan made an average yield of 221 pounds of seed cotton more than that produced on plots using the farmers' plan, or a net profit of $6.84 per acre. In other cotton fertilizer experiments, results show the value of the minor elements applied to cotton on various soils in the state. It is disclosed that substantial increases in seed cotton are generally produced from the use of magnesium, with the exception of the Coastal Plain soils at Fort Valley and Carnegia. Small amounts of boron on cotton in some instances resulted in small increases, in others, decreases in yield. Investigations on sources of phosphate and nitrogen for cotton, and the use of limestone with acid-forming nitrogen in cotton fertilizers are also discussed in the report. Descriptions of many other projects, too numerous to mention here, indicate the wide range of agricultural investigations being carried on by the experiment station in this state.

"Commercial Fertilizers Report For 1935," Agr. Exp. Sta., New Haven, Conn., Bul. 377, Oct. 1935, William L. Slate, Di*rector.*

"Fertilizer, Lime, Feed, and Seed Report, Jan.-June, 1935," State Board of Agr., Dover, Del., Quarterly Bul., Vol. 25, No. 2, September, 1935.

"Manure Increases Farm Income," Agr. Exp. Sta., Lafayette, Ind., Bul. 398, Mar. 1935, A. T. Wiancko, G. P. Walker, and R. R. Mulvey.

"Rates of Solution and Movement of Different Fertilizers in the Soil and the Effects of the Fertilizers on the Germination and Root Development of Beans," N. Y. Agr. Exp. Sta., Geneva, N. Y., Tech. Bul. 231, Aug. 1935, Charles B. Sayre and Arthur W. Clark.

"Some Physiological Studies with Calcium Cyanamide and Certain of Its Decomposition Products," Agr. Exp. Sta., Wooster, Ohio, Bul. 555, Oct. 1935, R. M. Smock.

"The Reaction of Certain Ornamental Trees and Shrubs to Liming," Agr. Exp. Sta., Kingston, R. I., Bul. 250, Aug. 1935, T. E. Odland, H. F. A. North, and G. B. Durham.

"A Comparative Test of Different Bedding Materials and Chemical Supplements with Cow Manure Applied in a Three-year Rotation," Agr. Exp. Sta., Kingston, R. I., Bul. 251, Aug. 1935, T. E. Odland and H. C. Knoblauch.

"Economical Amounts of Nitrate of Soda to Apply in the Greenhouse for the Growth of Tomatoes," Agr. Exp. Sta., Kingston, R. I., Bul. 252, Aug. 1935, Basil E. Gilbert and Frederick R. Pember.

"Availability of Nitrous Nitrogen to Plants," Agr. Exp. Sta., College Station, Brazos County, Texas, Bul. 515, Oct. 1935, A. B. Conner, Director.

Soils

Quarterly Bulletin 58, Panhandle Agricultural Experiment Station of Oklahoma, "Calculated Net Income Resulting from Level Terraces on Richfield Silt Loam Soil and Suggested Lines of Defense Against Wind Erosion," by Harley A. Daniel, depicts data of much importance to that area as a result of terrace studies on this type of soil. Terraces placed about 35 feet apart on land of about one per cent slope were found to be most efficient from the standpoint of crop production. Grain tests on terraced and unterraced land conducted from 1926 to 1935, inclusive, show an average of 3.1 bushels more harvested annually from the terraced when compared with yields obtained from the adjacent unterraced area. The average cost of constructing broadbase terraces is 77 cents per acre, not including labor. It is estimated 20 to 50 cents represent the extra cost per acre to cultivate the terraced and contoured land. Deducting the total expenditure from the net income, terrace returns amount to $1.75 per acre, the report announces. Suggested defense against wind erosion is also discussed.

"A Critical Study of the Methods for Measuring Oxidation-Reduction Potentials of Soils, with Special Reference to Orchard Soils," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 625, *Mar.* 1935, *Michael Peech and L. P. Batjer.*

"Drainage of Land Overlying an Artesian Groundwater Reservoir," Final Report, Agr. Exp. Sta., Logan, Utah, Bul. 259, *Nov.* 1935, *O. W. Israelsen and W. W. McLaughlin.*

"Soil Survey of the Longmont Area, Colorado," U. S. D. A., Washington, D. C., Series 1930, *No.* 29, *A. T. Sweet and C. H. Dodson.*

"Soil Survey of Marion County, Kansas," U. S. D. A., Washington, D. C., Series 1930, *No.* 35, *E. W. Knobel and R. O. Lewis.*

"Soil Survey of Polk County, Texas," U. S. D. A., Washington, D. C., Series 1930, *No.* 36, *H. M. Smith, T. C. Reitch, Harvey Oakes, L. G. Ragsdale, and A. H. Bean.*

"Soil Survey of Crawford County, Wisconsin," U. S. D. A., Washington, D. C., Series 1930, *No.* 34, *M. J. Edwards, W. J. Geib, Olaf Larson, D. E. Wilcox, and E. H. Tyner.*

Crops

Many helpful suggestions on methods for combating the ever-menacing effects of soil erosion are given by the Tennessee Agricultural Extension Service Publication 188 entitled, "Winter Cover Crops for Pasture and Soil Conservation." Tabulated in the report are alarming statistics relative to the vast devastation caused by erosion in that state alone. Through erosion at least 126,000,000,000 pounds of plant-food elements are removed from the crop or pasture land in the United States each year. The value of the nitrogen, phosphoric acid, and potash lost through erosion is estimated at $2,000,000,000 annually. Although terracing alone materially assists in reducing sheet washing, checks head erosion (gully washing), and conserves soil moisture for plant growth, it is not an adequate prevention for erosion. Complete protection is best accomplished by having "A Growing Winter Cover Crop on Every Acre," which has been suggested as a practical slogan for Tennessee farmers. An instructive chart showing the kind of cover crop recommended, date and rate of seeding, seeding requirements, and crop uses is presented in this publication. The value of winter cover crops is expressed in terms not only of preserving the soil and its plant food but of providing winter pasture which reduces the cost of livestock maintenance.

Chief among the outstanding publications of recent release which we list under this heading is the "Report of the Secretary of Agriculture for 1935." Some of the highly interesting subjects treated in this report include: Farm Recovery Aiding General Recovery; Foreign Trade and Its Alternatives; Farm Income; Rural-Urban Balance; Land Utilization; Soil Conservation; Economic Research and Service; and general discussions of the various farm crops typical to American Agriculture. Scientific research, Secretary Wallace asserts, is the principal function of the Department of Agriculture. "All its other activities, such as weather and crop reporting, the eradication or control of plant and animal diseases and pests, the administration of regulatory laws, highway construction, and economic guidance, are the practical expression of research results," the Secretary states. The importance of agricultural research by the state agricultural experiment stations and land-grant colleges is stressed from the standpoint of contributing to social welfare.

"Chemical Investigations of the Tobacco Plant. Part V. Chemical Changes That Occur During Growth," Agr. Exp. Sta., New Haven, Conn., Bul. 374, *Sept.* 1935, *Hubert B. Vickery, George W. Pucher, Charles S. Leavenworth, and Alfred J. Wakeman.*

"Soybean Production in Idaho," Univ. of Idaho, Col. of Agr., Moscow, Idaho, Bul. 218, *Sept.* 1935, *H. W. Hulbert and H. L. Spence.*

"Pasture Improvement in Indiana," Purdue Univ. Ext. Serv., Lafayette, Ind., Ext. Bul. 205, *Apr.* 1935, *K. E. Beeson and M. O. Pence.*

"The Passing of A Decade—A Summary of Extension Activities in Maryland, 1924-1934," Univ. of Md. Ext. Serv., College Park, Md., Thomas B. Symons, Director.

"Physiological Studies on the Pathogenicity of Fusarium lycopersici Sacc. for the Tomato Plant," Agr. Exp. Sta., College Park, Md., Bul. 374, Apr. 1935, Paul Lewis Fisher.

"Forest Planting on Michigan Farms," Mich. State Col., Ext. Div., East Lansing, Mich., Ext. Bul. 147, Oct. 1935, R. H. Westveld and J. L. Van Camp.

"Pruning Young Fruit Trees," Mich. State Col., Ext. Div., East Lansing, Mich., Ext. Bul. 148, Oct. 1935, Roy E. Marshall, H. A. Cardinell, and H. D. Hootman.

"Moisture Movement in Coniferous Wood Below the Fiber-Saturation Point," Agr. Exp. Sta., University Farm, St. Paul, Minn., Tech. Bul. 108, Sept. 1935. Stan*ley J. Buckman and Louis W. Rees.*

"Winter Cover Crops in New Jersey," State Col. of Agr., Ext. Serv., New Brunswick, N. J., Ext. Bul. 165, Sept. 1935, H. R. Cox.

"A Summary of Linkage Studies in Maize," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 180, June 1935, R. A. Emerson, G. W. Beadle, and A. C. Fraser.

"Combinations of Corn and Soybeans for Silage," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 634, June 1935, R. G. Wiggans.

"A Survey of the Behavior of Cherry Trees in the Hudson River Valley with Particular Reference to Losses from Winter Killing and Other Causes," N. Y. Agr. Exp. Sta., Geneva, N. Y., Bul. 653, July 1935. L. C. Anderson.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XX, No. 177, Nov.-Dec. 1935.

"The Panhandle Bulletin," Agr. Exp. Sta., Goodwell, Okla., No. 57, June 1935, Harley A. Daniel.

"Forty-eighth Annual Report of the Pennsylvania Agricultural Experiment Station for the Fiscal Year Ended June 30, 1935," Agr. Exp. Sta., State College, Pa., Bul. 320, July 1935, R. L. Watts, Director.

"Pastures, Old and New," Agr. Ext. Serv., State College, Pa., Ext. Cir. 154, June 1934, J. B. R. Dickey.

"Transactions of the Peninsular Horticultural Society, 1934," State Board of Agr., Dover, Del., Vol. 24, No. 6.

"Fall Grain on Lespedeza Sod," Agr. Ext. Serv., Knoxville, Tenn., Ext. Pub. 189, Aug. 1935.

"Alfalfa-Seed Investigations in Utah," Agr. Exp. Sta., Logan, Utah, Bul. 258, Nov. 1935, John W. Carlson.

"Oat Varietal Tests in Utah," Agr. Exp. Sta., Logan, Utah, Bul. 260, Nov. 1935, R. W. Woodward and D. C. Tingey.

"Barley Varietal Tests in Utah," Agr. Exp. Sta., Logan, Utah, Bul. 261, Nov. 1935, R. W. Woodward and D. C. Tingey.

"Comparative Yields of Spring Wheat Varieties in Utah," Agr. Exp. Sta., Logan, Utah, Bul. 262, Nov. 1935, D. C. Tingey and R. W. Woodward.

"Relative Production of Feed Grain from Spring-Grown Cereals in Utah," Agr. Exp. Sta., Logan, Utah, Bul. 263, Nov. 1935, R. W. Woodward and D. C. Tingey.

"Relief Wheat," Agr. Exp. Sta., Logan, Utah, Bul. 264, Nov. 1935, D. C. Tingey and R. W. Woodward.

"Apple Orcharding. Winter Injuries; Grass Endurance; Irrigation and Nitrate; Twenty-sixth to Thirtieth Year of a 14-Variety Orchard," Agr. Exp. Sta., Burlington, Vt., Bul. 395, July 1935, M. B. Cummings, E. W. Jenkins, and R. G. Dunning.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 333, Dec. 1935.

"Report of the Chief of the Office of Experiment Stations, for Fiscal Year Ended June 30, 1935," U. S. D. A., Washington, D. C., James T. Jardine, Chief.

Economics

The "Report of the Chief of the Bureau of Agricultural Economics, 1935," portrays many impressive services this department renders. Concerning its functions, Chief A. G. Black remarks that "Not only has there been an increased load of special tasks, but the regular work of the Bureau—fact finding, analysis, administration in marketing, and like activities—has expanded." The work in the field of land economics has served a basis for administrative planning of the Nation's land resources, the publication explains. General information regarding the immense news-gathering agency of the Bureau, statistical methods applied to crop and livestock enterprises, outlook reports, crop-grading services, and economic research are a few prominent subjects comprising the report.

"Part-Time Farming in Connecticut, A Socio-Economic Study of the Lower Naugatuck Valley," Agr. Exp. Sta., Storrs, Conn., Bul. 204, *July* 1935, *L. A. Salter, Jr., and H. D. Darling.*

"Marketing Fruits and Vegetables in Connecticut, with Special Reference to the New Haven Market," Agr. Exp. Sta., Storrs, Conn., Bul. 205, *Aug.* 1935, *George B. Clarke.*

"Effects of Changing Economic Conditions on Farming in a Good Community in Central Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 397, *Mar.* 1935, *E. L. Butz and Lynn Robertson.*

"The Agricultural and Industrial Demand for Corn," Agr. Exp. Sta., Ames, Iowa, Bul. 335, *Aug.* 1935, *Geoffrey Shepherd, John J. Dalton, and J. H. Buchanan.*

"Index Number of Iowa Farm Products Prices," Agr. Exp. Sta., Ames, Iowa, Bul. 336, *Sept.* 1935, *Gertrude M. Cox.*

Every Soil Is Fertile; But Not for All Plants

EVERY soil is fertile. But not for all plants. Ordinarily when a soil is called "fertile" or "unfertile," reference is to crop plants—when as a matter of fact every soil is fertile to some plant. It may be corn, grass, or strawberries. Or again the plant may be cactus, jack pine, or bulrushes.

All land is not fertile, however, as all land does not have soil. Before soil can be formed rocks must be broken down by weathering. The weathered rock is made into soil by living organisms. Each soil has its own characteristics produced by the action of microorganisms. Soils and plants develop together—each influencing the other.

There are thousands of soils, each with its own characteristics developed with and by the native plants. In general, it may be said that each plant attempts to make soil from the weathered rock fertile for itself. Thus each soil is naturally most fertile for those plants most nearly like the plants with which it developed.

There are two ways—fundamental to all agriculture—to have a soil fertile for the crop which it is to produce. Man can change a soil so that it will grow some particular plant. Or, he can choose plants adapted to the soil as it already exists. Those who favor the latter—and newer—method, say it will save much labor that might be wasted upon the former.

One of the "Loose Ends" of Agriculture Is Hay

HAY, in spite of its importance to the farmer, has been referred to as one of the "loose ends" of agriculture because of the slight attention given its improvement in comparison with other important farm crops, says E. O. Pollock, hay specialist of the United States Department of Agriculture.

Losses which come from late cutting and improper curing are very real, even though not as apparent to the farmer who feeds his hay at home as to the man who makes hay a cash crop.

Early cut, well-cured alfalfa, for example, has a high percentage of leaves and green color. The leaves contain more than two-thirds of the protein of the entire plant. Green color in hay is associated with vitamin A, important in animal maintenance and reproduction. Vitamin A content is greatly reduced when hay is discolored from rain, sun bleach, or improper storage.

Alfalfa leaves left in the sun at the Arizona experiment station for less than 3 hours at noon lost 20 to 33 percent of vitamin A, compared to leaves cured in a ventilated, darkened room. Leaves lying over night lost 75 percent. A further exposure of 4 hours at noon the next day increased the loss to 84 percent. Severely bleached alfalfa exposed for a week to sun and rain lost 94 percent.

Such a prodigal waste, says Mr. Pollock, would not be tolerated in many other crops.

Believe That Potash Acts as Anti-freeze

POTASH in the soil provides an anti-freeze solution for the sap of potato vines, farmers visiting the Northeastern Minnesota Experiment Station at Duluth decided last fall.

They viewed the fertilizer experiments after frost had blackened most of the vines. But they observed that on those plots which had received potash, the vines had been untouched by the frost. The treated plots alternated with those to which no potash had been applied, making the contrast a striking one.

A number of the growers said they had noted the same phenomenon on their home fields. Some thought the fertilized vines had resisted the frost on account of being heavier and stronger. Others suggested the possibility that the potash, held in solution in the sap, had acted like alcohol in the water of an automobile radiator, reducing the freezing point. No records had been kept of the temperature in the potato plots during the night of the frost, so there is no means of knowing what degree of temperature the fertilized vines withstood.

Mark J. Thompson, station superintendent, declined to assign a reason for the difference, to which, however, he had directed attention.—*Geo. W. Kelley, Farm Editor, Duluth Herald, Duluth, Minn.*

Field Crop Values Down

THE value of field crops harvested in Canada during 1935, according to the third estimate of the Dominion Bureau of Statistics, is now placed at $506,613,900 compared with the revised estimate of $549,079,600 for 1934 and $453,598,000 for 1933. The decline in value in 1935 as compared with 1934 is mainly accounted for by the lower prices of coarse grains and forage crops. The total area under principal field crops in 1935 is estimated at 56,923,960 acres compared with

55,990,320 acres in 1934 and 58,-533,450 acres in 1933. Most of the increase in crop acreage in 1935 is found in fall wheat, oats, barley, fall rye, alfalfa and grain hay.

For all of Canada the wheat production in 1935 is now estimated at 277,339,000 bushels from 24,115,700 acres, 1,490,000 bushels above production in 1934. The average yield per acre is placed at 11.5 bushels, the same as in the preceding year. Wheat production in the three Prairie Provinces—Manitoba, Saskatchewan and Alberta—is estimated at 259,500,000 bushels compared with 263,800,000 bushels in 1934. The acreage sown to wheat in the Prairie Provinces was 23,293,000 compared with 23,-296,000 acres in 1934.

The total value of the 1935 wheat production is estimated at $169,857,-000 compared with $169,631,000 in 1934, and the average price received by growers at the point of production was 61 cents per bushel, the same as in the preceding year.

Profit Factors in Flue-Cured Tobacco

(*From page* 19)

would pay. However, we must wait until experiments now being conducted have covered a longer period of time before reaching a definite conclusion.

Until recent years 50 pounds K_2O per acre was, in most instances, the maximum amount applied and was far above the average application. In the last 10 or 12 years there has been a tendency toward the use of heavier applications of potash, which may explain to some extent the definite upward trend in the average yield per acre of flue-cured tobacco in Georgia for the 10-year period from 1921 to 1930 inclusive.

In order to produce both high yields and good quality the potash in tobacco fertilizers should be derived from both sulphate and muriate of potash. Sulphate of potash as the sole source of potash produces a leaf of good burn but lacking in size and elasticity. Muriate of potash used alone as a source of potash supplies too much chlorine. While small quantities of chlorine are beneficial, large quantities produce a poor burning leaf, which cures to a dull, muddy color.

Under limited moisture conditions excess chlorine may also cause a thick, curled, twisted type of leaf growth. The amount of muriate of potash that may be used therefore is limited by the chlorine content of this salt. Since the chlorine content of mixed tobacco fertilizers should be two per cent, the use of muriate of potash is thereby limited to approximately 80 pounds of 50 per cent muriate per ton. The remainder of the potash may be derived from sulphate of potash or sulphate of potash-magnesia.

As previously stated, flue-cured tobacco is grown on soils naturally low in fertility and must be fed artificially, that is, with commercial fertilizers. Experiments have clearly shown that on such soils fertilizers containing only nitrogen, phosphorus, and potash, which constitute what is generally known as a complete fertilizer, are not sufficient for normal growth. In order to prevent nutritional deficiencies, tobacco fertilizers should carry other elements in available forms. Among these magnesium, chlorine, and calcium are known to be important.

Magnesia (MgO) and chlorine should each be contained in tobacco fertilizers to the extent of two per cent of the total mixture. One-half of the former should be water soluble. Magnesia deficiency in the soil expresses itself in a chlorotic condition of the leaves of tobacco plants grown on such soils. The quality of these leaves is very low. While the absence of chlorine does not express itself in any abnormality of growth, the presence of this element seems to increase the water-holding capacity of the plant and results in a more succulent plant of better leaf spread. In the absence of calcium the plant fails to develop normally in the terminal bud. It is therefore necessary that calcium be supplied to the extent of about six per cent of the mixed fertilizer. Excessive quantities of sulphur impair quality by producing dark undesirable colors in the cured leaf, which makes it necessary to reduce to a minimum the sulphur contained in the fertilizers.

Other Important Factors

These complicated recommendations for flue-cured tobacco fertilizers are not caused by freakish demands of this particular plant, but by the type of soil used. No doubt other plants grown on the same depleted soils would show some symptoms of nutritional deficiences if these deficiencies were not supplied by commercial fertilizers.

Flue-cured tobacco is a highly specialized crop, and the profit per acre is doubtlessly more dependent upon the human factor than any other crop grown in the United States. The essence of good management is timeliness and thoroughness of operation.

Tobacco should be transplanted to the field as soon as all danger of frost has disappeared. An abundance of strong, healthy seedlings ready for transplanting at this time is the most important point to be considered in getting the crop started. Late plantings and irregular stands due to poor seedlings are two common causes of failure to produce a profitable crop.

The methods of cultivation used throughout the tobacco belt vary somewhat, but the ridge method is considered the most desirable. This method consists mainly of forcing the soil toward the plant with each cultivation, so that when cultivation is completed the plants will be on a high ridge.

The human factor plays a greater part in harvesting and curing than in any other operations connected with the crop. Many farmers incur losses every year by harvesting the crop too green or waiting until it is over-ripe. Such losses are avoidable. Curing is a rather complicated procedure, and good cures are dependent upon experience and good judgment.

A Legume Program for Sandy Soils

(*From page* 22)

The need for potash is more evident, however, on the more sandy soils and especially on land which has previously grown alfalfa thus reducing the available supply of this plant food. An average of eight crops of sweet clover grown on a light, sandy loam in the northern part of the lower peninsula bears out this observation. This soil was not in need of lime and produced on the average 1,574 pounds of dry sweet clover without fertilizer; 200 pounds of phosphate increased the hay yield to 1,850 pounds. When the need for potash was partially supplied by application of 50 pounds of muriate of potash, in addition to the phosphate, the yield jumped to 2,433 pounds. Further additions of potash fertilizer to make the actual potash applied 25 per cent more than the actual phosphoric acid used resulted in 2,753 pounds of hay, while increasing the potash to virtually double the phosphoric acid shoved the hay yield to 3,200 pounds. Experimental results of this kind have induced us to recommend fertilizers such as 0-10-20 and 0-8-24 for alfalfa on the lighter sandy loam soils of the state.

Sweet clover on sandy loam soil well supplied with lime. Left, fertilized with potash. Right, no fertilizer. Ample potash is essential for satisfactory growth of legumes on the sandy soils of Michigan.

Failing to realize how profitably alfalfa and clover respond to application of the right kind of fertilizer, many farmers seed these crops without addition of commercial plant food. This oversight may be remedied to a considerable extent, though not wholly, by top-dressing the established stand with fertilizer. That such a use of fertilizer is highly advisable is evident from results obtained on a good sandy loam soil in central Kalamazoo County. The alfalfa stand was established on limed soil. The plot receiving phosphate without potash yielded 2,840 pounds of hay the first cutting and 1,040 pounds the second. When potash and phosphoric acid were added in equal proportions, the first cutting of hay jumped to 4,640 pounds with an 1,800-pound second cutting. Dry weather decreased the second cutting very decidedly in this field trial. The fact that phosphate without potash is an unsafe fertilizer for alfalfa on soils of this type is brought out by the fact that the second cutting was much better on the unfertilized land than on that receiving phosphate alone.

Manure Inadequate

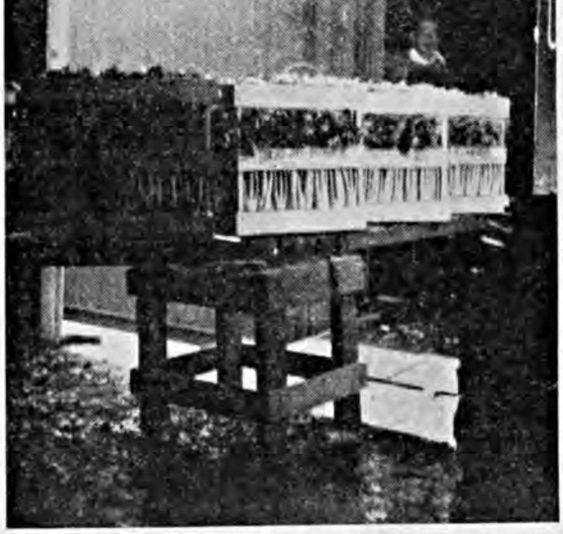
The high potash content of manure might suggest it as a suitable fertilizer for legumes on sandy loam soils. This reasoning has not been found sound, however, since manure contains as much nitrogen as potash and inoculated legumes are able to take their nitrogen from the soil air. In fact one of the reasons why legumes are grown is because of their nitrogen-fixing ability through the action of the bacteria living in the nodules on their roots. When supplied with nitrogen by application of manure, the bacteria are not so active in taking nitrogen from the air and hence the full value of growing the leguminous crop is not realized. Furthermore if properly fertilized with potash and phosphate, our experience shows that the alfalfa will make just as good a growth as if the fertilizer contained nitrogen.

This finding points out that the manure can be used to better advantage for grain crops, which must take all their nutrients from the soil. It is not recommended therefore that manure or commercial nitrogen fertilizer be used for alfalfa. The sandy soil farmer, however, who has discovered that legumes are the key to a fertility-maintaining and successful management program on such soils, and he certainly will find this out if he tries the legume system, should not fail to use fertilizer containing ample potash.

Quality Celery Finds A Market

(*From page* 13)

Mr. Takeda has recently constructed three new greenhouses in which celery and other transplants are grown. Transplanting of celery is started in March and continues to August. This makes a harvesting season from June to December. Before setting the celery plants, an application of manure is worked into the surface soil of the field. Slightly raised beds which are wide enough to carry two rows of celery are then ridged up.



Loadng a car of celery at San Jose Celery Distributors.

After setting the plants, an application of fish meal is distributed between the beds. Later on when growth of the plants is well started, chemical fertilizer is applied between the beds at the rate of 3,000 pounds per acre. This fertilizer is a mixture prepared according to Mr. Takeda's own ideas and includes generous amounts of potash, the total potash used in his fertilizing operations being from 20 to 40 tons each year.

Yields of celery obtained on this farm have been very satisfactory, the Golden tall type producing from 550 to 700 half crates per acre and the Utah type 800 to 1,000 pony crates per acre.

Mr. Takeda has made very careful observations on the effects of potash on his celery crop. He has found that land may be cropped intensively to celery for two years without potash, but after that quality begins to decline seriously. Then potash applications become very necessary and have a great effect on keeping quality.

Fertilizing with potash has enabled the celery to withstand two months of cold storage in excellent condition, whereas one month of cold storage is the usual limit. Observations on how the celery keeps in cold storage definitely indicate to Mr. Takeda the extent of quality troubles and the need for potash.

Analyses of the celery crop seem to justify the important place accorded to potash fertilizer, since these show that this crop requires three times as much potash as nitrogen and four times as much potash as phosphoric acid.

The quality of even the large outer stalks of celery grown on this farm is remarkably fine. These are not "punky" and "stringy," but for their full length are solid and crisp and nearly as tender as the heart.

Mr. Takeda's celery business has developed so satisfactorily that he has his own packing concern, known as San Jose Celery Distributors. Celery is shipped in car lots to all parts of the country, the chief market, however, being in the East. This celery has commanded a premium of 25¢ to 50¢ per create at shipping point, another proof that the quality effects of potash create a market which brings returns in real money.

The Inquiring Mind

(*From page* 15)

ments were made whereby he could also continue as Plant Commissioner for the State Plant Board.

As the principal enforcement officer in the execution of the revised Florida Plant Act, Dr. Newell had full charge of the joint federal and state eradication effort directed toward the Mediterranean fruit fly. While the activities in the warfare on this pest were regulatory in nature and hence fell within the province of the Plant Board, other divisions of the College of Agriculture contributed personnel and cooperated in several lines. Headquarters were established at Orlando, by state and federal specialists, under the direction of Dr. Newell.

Discovery of the Mediterranean fruit fly in Florida took place during April 1929. Quarantine prohibiting the movement of many grove, garden, and field products became effective on May 1. Modifications and amendments to the original quarantine were made at various times during the following year, until it became evident that the danger of spreading no longer existed, and the embargo was lifted in November 1930. A period of only 18 months was required to completely rid the state of the insect, and no cases of reinfestation have been found, although properties on which susceptible fruits and vegetables are raised have been inspected every few months.

Capacity of the fruit fly for rapidly multiplying and spreading is shown by the fact that in the area known to be free from the pest but a few months before, between April 6 and 30, 1929, infection was found on 364 properties in 51 separate localities of 11 counties. Limits of the territory affected were well determined by the middle of the following July, and after the following August no further expansion occurred. A grand total of 1,002 properties, distributed over 20 counties, was found to be infested. Within the boundaries of the section where eradication methods were applied, containing between 15,000 and 16,000 square miles and approximately 10,000,000 acres, were located some 120,000 acres of citrus groves and about 160,000 acres of other host fruits and susceptible vegetables. Interspersed were vast acreages of unimproved lands, marshes, and swamps, with considerable wild growth attractive to the pest. Natural barriers to the spread in a degree were supplied by the intervening terrain between the lands under cultivation, as this species of fruit fly seldom travels by its own power over long distances.

Eradicated Fruit Fly

Funds expended in the eradication of the Mediterranean fruit fly from Florida amounted to $6,858,636.92, as of December 31, 1930. To appreciate the magnitude of the work of Dr. Newell and his associates, it is only necessary to quote a few of the totals. Man power in labor employed reached a maximum average of 5,647 in August 1929. Field inspectors at one time numbered as high as 750. Research and administrative personnel fluctuated with the demands of the situation and the developments of the outside operations. Equipment of a mechanical character utilized in the undertaking included 187 trucks, 92 tractors, 60 sprayers, 30 stubble shredders, and 19 trailers. District and county headquarters were established as needed. Growers' organizations and civic bodies rendered helpful cooperation in keeping the public informed as to the progress of the effort.

Sentiment in favor of the program was practically unanimous in the beginning. As the necessary restrictions caused inconvenience in increasing volume, dissatisfaction developed. Politicians took advantage of the growing unrest to attempt its capitalization for ulterior purposes. Interests seeking to overthrow the government structure insinuated themselves into the agitation. Complaints and protests grew so pronounced that a sub-committee of the lower house in the United States Congress held hearings at Orlando. Testimony presented therein wholly failed to supply evidence of improper procedure. Appropriations of federal money thereafter authorized on the recommendation of this sub-committee were in excess of $3,200,000.

In all the activities, Dr. Newell was definitely on the firing line and frequently the victim of shots from snipers. In the midst of the most strenuous period, he became seriously ill and retarded his recovery by attention to important essentials from the sickbed. Winning of the fight brought Dr. Newell the plaudits of the plant pest authorities in all civilized countries, and the years since elapsed have given him an even firmer hold on the esteem and respect of intelligent Florida people.

Wilmon Newell is essentially an eradicator. He believes in eradicating pests before they become widespread and cannot be wiped out, rather than waiting until they will have to be controlled with consequent annual expense and trouble to the farmer and grower. His principal accomplishments have been the eradication of the citrus canker and the Mediterranean fruit fly; and we believe that this latter project, in which the pest was completely and successfully destroyed, is the only case on record of the eradication of a major insect pest from any area in the world.

Found Weevil Control

Another noteworthy accomplishment of Dr. Newell's is the inauguration of the practice of thick spacing cotton to avoid boll-weevil damage. Formerly cotton was chopped to three or four feet in the row and allowed to grow into large stocks. The stalks bloomed for a long time, and when final check was made, the yield was good. However, when the boll-weevil arrived in destructive numbers some 20 years ago, this pest destroyed the late crop and reduced the yield.

Dr. Newell observed that boll-weevils did not become numerous early in the season. Consequently, he devised and recommended the practice, now universally followed in cotton fields of the United States, of leaving the cotton thick in the row and planting the rows close together. In this way a much larger number of stalks is grown. They do not grow as tall as under the former method, but they set more early (low) bolls, and good yields are obtained in spite of the boll-weevil. The pest can only take the blossoms and squares on the upper half of the stalks.

In connection with the cotton boll-weevil, Dr. Newell was the first to prove that this pest can be successfully and profitably poisoned. While secretary of the Louisiana Crop Pest Commission he did this, and he was the first to prepare successfully a powdered form of lead arsenate, which was the first poison used with profit against the boll-weevil. Later this was followed by the development of calcium arsenate in powdered form, and the calcium arsenate then came into general use in weevil poisoning.

Develops Tung Oil

Dr. Newell, in addition to all these other accomplishments, has had a great deal to do with the tung-oil industry in the United States. Seeds of this tree were sent to the Florida Experiment Station in 1912 and were planted on the station grounds, where they grew and thrived probably better than anywhere else in this country. After Dr. Newell become director in 1921, this tree came into commercial development and is now successfully grown entirely around the Gulf Coast as a direct result of the Florida developments.

During all these busy years Doctor Newell has been honored at various times by organizations of which he is a member He was president of the Association of Economic Entomologists in 1920; president of the Association of Southern Agricultural Workers in 1929-1930; president of the Gainesville Rotary Club in 1920-1921; is a fellow of the A. A. A. S.; member of Kappa Sigma, Alpha Zeta, Phi Kappa Psi, Gamma Sigma, and of the Masonic Shrine.

Beekeeping Hobby

We do not know his hobbies, but think we have accidentally discovered one in connection with another of his accomplishments. Wilmon Newell is rightfully credited with the initiation of the practice now generally followed in eradicating American foulbrood in apiaries. Here again he eradicates rather than treats. His inspectors burned all infected material the day they discovered it and then buried the ashes in a pit. His fight against foulbrood brought down on his head the wrath of the beekeepers, but he got results. Today Florida enjoys the distinction of being freer from foulbrood than perhaps any State in the Union, and other states are using the method of burning on the spot.

And now for the discovered hobby! In "Gleanings in Bee Culture," published in Medina, Ohio, in December 1934, E. R. Root says, "Dr. Newell's rise in the scientific world has been remarkable if not spectacular. In the language of the late Theodore Roosevelt, he is one of the 'useful men' who has left his impress not only upon the State of Florida, but all over the United States. While Dr. Newell was connected with the Wooster Experiment Station from 1899 to 1902, he made one or two calls in Medina. Modest then as he is now, little did I think that this mere stripling of a boy, but six feet and some, would come to be one of the great entomologists and benefactors of the country. Dr. Newell was not only a practical beekeeper, but he did some research work in the Dzierson theory, in drones, and parthenogenesis. Does he have bees now? No, but his heart is in beekeeping, and some day he hopes to keep bees again."

But despite whatever outside interests Dr. Newell may have, he has never allowed himself to be drawn away from the varied and many great duties placed before him. By co-ordinating all interests, he has accomplished more, and with keener and more impartial results, as manifest in each milestone that marks his journey of progress. For these reasons it is obvious why "The Inquiring Mind" has sought out Wilmon Newell for recognition.

Virginia Tobacco Needs Potash

(*From page* 12)

Fertilizers for dark tobacco (sun-cured and shipping):

Use 10 per cent available phosphoric acid, 3 per cent nitrogen, and 4 to 6 per cent potash. Where manure is used in the rotation, 4 per cent potash in a 600-pound application of a 3-10-4 is usually sufficient.

Amount: Use 600 to 1,000 pounds per acre in the drill, thoroughly mixed with the soil about 10 days prior to transplanting.

It is hard to over-emphasize the importance of potash in producing quality tobacco. Technical Bulletin No. 12, United States Department of Agriculture, prepared by E. G. Moss et al., says, "Potash, the last constituent usually expressed in the fertilizer formula, is possibly the most important ingredient of the fertilizer mixture for tobacco when quality is to be considered. . . . Under field conditions the growing plant always shows a characteristic, more or less abnormal type of growth when this particular fertilizer constituent is deficient in the soil and not supplied in the fertilizer. The plant is smaller in size in most cases. The leaves are puckered and rough and show considerable mottling of a light-yellow color. The mottling begins at the tip of the leaf and is often followed by the appearance of small centers or specks of dead tissue. These specks later enlarge and coalesce, forming large dead areas around the margins and between the veins of the leaves."

Chlorine damage is easily recognized here.

Moss says further, "It is known that potash in some way aids in maintaining the general vigor of the plant. On those plots which were fertilized with a mixture carrying heavy rates of ammonia with little or no potash the various leaf-spot troubles have been more prevalent, causing serious damage; but with more potash added to the fertilizer there has been much less damage from leaf spot."

Potash not only contributes to the yield and aids in checking disease but also adds to tobacco that silkiness, elasticity, and fineness of texture es-

Note the rough, crinkled leaves and dead areas of the plant on the right which received no potash. These are typical potash-starvation symptoms.

sential to quality and high market value.

In conclusion the writer wishes to offer the following brief summary of what he has tried to say:

1. Since Colonial days Virginia's tobacco fields have shifted from flat Tidewater to the rolling Piedmont fields, where drainage was good, and excellent soils, rich in potash and other essential plant nutrients for tobacco, were plentiful.

2. The farmer's desire to continue to grow quality tobacco on his old farm and old fields has necessitated experimental work to help solve the problem.

3. Based on these experiments in Virginia, the writer has drawn the following conclusions relating to fertilizers for flue-cured tobacco.

(a) Ample quantity of a balanced plant food is essential for producing large yields of quality tobacco.

(b) Applications of 8 and 12 per cent potash or above those in common usage seem safe and profitable.

(c) Through medium high topping and fairly close spacing large yields of quality leaf can be obtained, provided more nitrogen is supplied and ample potash is included in the fertilizer.

(d) On sandy soils increased yields and values resulted from applying one-half of the total nitrogen and potash before transplanting and the remainder approximately three weeks after transplanting time, as a side-dressing.

4. In passing, the writer wishes to mention a phase of the tobacco industry equally as important as successful production, that of marketing. This phase, due to the antiquated system used today, is also sadly in need of research. May some of our country's best brains help us in perfecting a marketing system by which choice tobacco will bring a choice price, and common leaf a common price, and the same prices prevail for the same quality leaf at least throughout one short marketing season. This

would help to avoid the mad rush on our auction markets during October and November for the so-called "High Dollar" for mysterious classes of tobacco which, under the present lack of standard grades, no farmer knows.

Through aid of the best that scientific research can offer, Virginia will continue to hold among tobacco-growing areas that position of distinction which she acquired as the "Birthplace of the American Tobacco Industry."

Two Bolls Where One Grew Before

(*From page* 17)

Soil and climatic conditions are so variable in our cotton belt that it is impossible to develop varieties adapted to all sections. However, some varieties such as Stoneville, Delta, Pine Land, and Half and Half are widely adapted. Cottons that are early blooming and have short periods from bloom to mature boll, such as those just mentioned, and also Rucker, Cook, Acala, Mexican Big Boll, and Trice, are well adapted to the northern half of the cotton belt.

Cotton wilt is very destructive on many soils of the sandy lands of the lower South, and here wilt resistant cottons such as Dixie Triumph, Cook, Toole, and Clevewilt make the highest yields. Mississippi planters specialize in long cotton like Misdel, Express, and Wilds. Texas conditions are different from those of the rest of the belt, as the big-bolled and high-lint-percentage varieties, such as Mebane, Lonestar, Kasch, and Rowden which are well adapted to the semi-arid Texas climate, do not do well east of the Mississippi.

The late Dr. Seaman Knapp said many years ago that the use of modern farm machinery offered the greatest opportunity for cotton farmers to increase their incomes. Growers in some sections are using multiple-mule and motor-powered implements, but thousands still use one-mule implements. The enormous waste of time and man labor as a result of primitive cultural practices is one of the reasons cotton growers as a group have the lowest standard of living of any in this country. The advent of the mechanical cotton picker may force thousands to become mechanically minded, but the change is sure to prove painful to many agrarians.

Southeastern farmers depend largely on high acre yields, resulting from liberal use of fertilizers, to lower growing costs.

Communication

(From page 6)

First-class mail remains, on the face of it anyhow, the highest form of communication. "To communicate" originally meant to write personal notes. All the rest of this clutter of communication with which we are surrounded and submerged sprang from the cradle of letter writing.

I SEE many signs which remind me, "Don't write—Telegraph!" But I pay about as much attention to that as I do to the other sign, "Say it with flowers." My wife of course would be very much concerned about my health or mental state if I did either in her case. She usually is content to get my familiar scrawl on some grubby hotel letterhead, done at the day's end by a murky twenty-watt globe; and she would no longer upbraid me if certain tiny crosses were not found at the signature, a mild form of asininity which has fallen into disuse.

Tons of mail matter are carried to every pound transported when the nation was new. Yet I actually believe that the letters average much shorter and are less informative of detail than the ones produced by those prodigious writers of the quill-pen era, and the coming of the stenographer and the dictaphone have made many of us downright lazy in our personal communication. One has only to see the private papers of Washington to sense the value put upon writing when the fingers fashioned every dot and line.

Cheap postage, plentitude of materials, mechanical devices, and the speed and frequency of the mails make us forgetful and indifferent to the attempts of the pioneers to keep in touch with each other and the old homeland as they scouted, surveyed, and settled the frontier. Reminders of how precious communication appeared to them may help us to make better use of the enormous facilities we have today. In those days we didn't hear so many urgings to "write home to mother"; they risked their lives to maintain the overland mail. The "wandering boys" of those times at least had an alibi for silence. Every drug store as a sub-post-office, and two telegraph boys to every block were then unknown.

WE smile with tolerance as we read history. We say how horrid and provincial and blind to facts were the Westerners who fought the Mormons. We stand aghast at the cleavage between the North and the South during the forties, fifties, and sixties; saying that isolation, rural deprivation, crude communications, and unacquaintance with each other caused the prejudice and bitterness of those desolate days. We grin at the untidy and unbecoming dress of the folks who separated themselves from the cultured sections, and decry their careless civic conditions. In summation, we lay it all to bad opinion fostered by little communication or none at all.

MODERN communication systems spread the news of the World War in vivid detail and piled up ample evidence of the sorrow, ruin, debt, and havoc which it was destined to bring in Europe and America. No pains were spared to acquaint us with its horrors by photo, film, and story. Communication is even better today than then, yet it has not spared us the experience of another broil in foreign parts or prevented greed from speculating on the frenzy and madness of the hour.

Every morning's dispatch lists

fresh roadside casualties, and we hear the police sirens on short wave shrieking their way to the scene of some motor murder, while the daily table of auto tragedies brings the annual total to greater volume of needless sacrifice than the three-days' battle of Gettysburg and the slaughter at Antietam combined. All we do about it is to read the advertisements and phone our advance order to the garage for a new model with more git and gumption.

News-hawks and camera men risk their lives to fetch us all there is to know about the preventable disasters due to laxity in some civic or construction duty; we have most excellent means of reporting and promptly salvaging losses at sea. We are a great people to hold sensational post-mortem on those regrettable affairs, and then turn it over to some politician to remedy, if the taxpayers will stand for it later on. We are famous barn-door lockers when the nags are gone.

IN those days when communication was not so full and frank, we fellows slyly sneaked off to our rendezvous with pink barber-shop magazines replete with naughty art or perused tabooed yarns of nefarious highwaymen. Today they dish it up for us on calendared gloss paper and moronize us with reams of it on Sunday mornings in the syndicates.

It is idle for us to blame these conditions on organs of public information. That is equally silly with the belief that rapid communication has rid us of the provincialism and cleavage which we noticed with such concern as a canker on progress during pioneer times.

Not that we cannot hold agencies of communication responsible in many flagrant instances for causing abuse of power to go unchecked or laxity to go unnoticed. But one would naturally imagine that the growth of universal education, taste, and quick communication might breed a sounder sort of information system on which our feeble opinions might be based.

I HAVE hopes that it will. It will when we divorce profit as the principal motive from the art of communication—and I mean greedy propensities, not legitimate business pride. It will when we give free play to all sides of any question, even in schools. It will when we inaugurate a thorough training for our workers in the communicative arts, requiring ethical standards, certificates of capability and honesty, the vision of the true scientist, and the fine quality of open-mindedness which science maintains.

Then we will not have liars drawing cartoons for some upstairs tycoon who is willing to distort and pervert facts to influence votes or arouse prejudice. Then we will have wireless as pure as the air over a mountain top and just as clean and stimulating.

But why be so idealistic, so pedantic, and so impractical? Are we not getting our mud-guards reinforced and our ears well muffled against the bombasts of the 1936 campaign? Haven't we already made our mental crosses on the little ballots, so that all these fireworks and garbage tossing will be only a job for the street-cleaners? A little "kidding" won't get our goat!

So let's subscribe again, buy a new set of tubes, and hunt for some asbestos stationery. It's not quite reform time yet. A man can't reform until he's recovered! Meanwhile, stand by! In the long run cogitation, not communication, will clear the way.

Wise Guy (boarding a street car): "Well, Noah, is the ark full?"

Conductor: "Nope, we need one more jackass, come on in."

A L'AMERICAN!

"America is a queer country," remarked the English visitor. "You put whiskey into a drink to make it strong, water to make it weak, lemon to make it sour, and sugar to make it sweet. Then you say, 'Here's to you,' and drink it yourself."

"Was it a necking party?"

"Was it! Before it started the hostess announced, 'Everybody chews his own partner.' "

One fellow who still lives on the fat of the land is the girdle manufacturer.

INTRINSIC VALUE

"Why does a woman say she's been shopping when she hasn't bought a thing?"

"Why does a man say he's been fishing when he hasn't caught anything?"

Then there was the Scotchman who received a pair of spats for Christmas and sent them out to be half-soled.

Mrs. Brookline: "I understand the Eskimos are very keen domino players, and sometimes bet heavily, even putting up their wives and losing them."

Mr. Brookline: "Well, I'll bet there are a lot of good losers among the Eskimos."

Youth: "What do you repair these shoes with?"

Cobbler: "Hide."

Youth: "Why should I hide?"

Cobbler: "Hide, hide. Cow's outside."

Youth: "Let her come in. I'm not afraid."

BENEDICTION

A preacher walked into a saloon, ordered milk and by mistake was served a milk punch.

After drinking it, the holy man lifted his eyes to heaven and was heard to say: "Oh, Lord, what a cow!"

Tommy: "Dad, what's a paradox?"

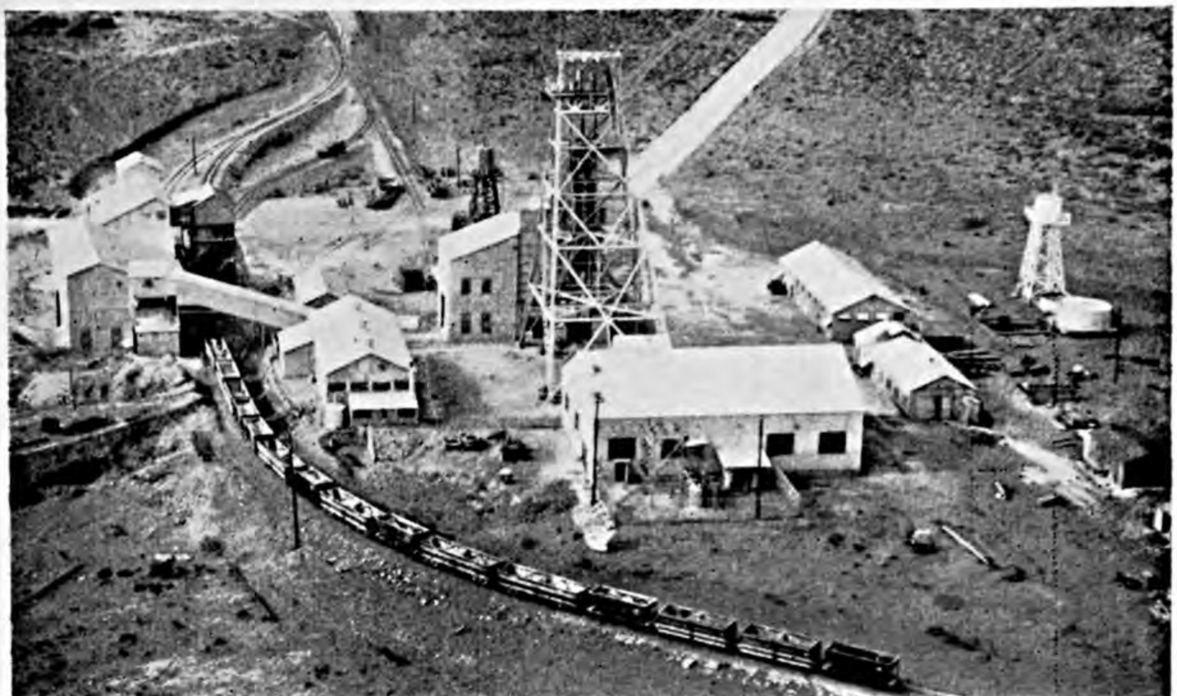
Dad: "I don't know the word, son, but I'd say it was two physicians."

A girl recently was absent from home for a couple of days, and her mother was much concerned, but everything was all right when the lass returned with a Gideon Bible under her arm.

RECOUNT

Judge: "How many children do you have, Mirandy?"

Mirandy: "Well, Judge, I has two by my first husband, one by my last husband, and then I has two of my own."



Aerial view of hoist and grinding plant at the U. S. Potash Company's mine near Carlsbad, N. M.

Better Crops WITH PLANT FOOD

March 1936 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER SEVEN

TABLE OF CONTENTS, MARCH, 1936

American Potash Institute, Inc.

Investment Building, Washington, D. C.

J. W. TURRENTINE, *President and Treasurer*

G. J. CALLISTER, *Vice-President and Secretary*

SPRING THAW—AND THE OLD MILL RUNS AGAIN.

Better Crops with PLANT FOOD

PUBLISHED MONTHLY FOR THE AMERICAN POTASH INSTITUTE, INC., INVESTMENT BUILDING, WASHINGTON, D. C. SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10c PER COPY.

VOL. XX WASHINGTON, D. C., MARCH, 1936 No. 7

Jeff says, 1936 will bring - - -

Richer Dirt

Jeff McDermid

WE have no difficulty getting more and richer dirt into our novels, pulp magazines, and dramas, but the job of obtaining a higher assay of pep and organic matter into our land (where it belongs) seems to require an act of Congress and the sacrifice of several articles of the Constitution.

Now, during the preliminary bouts, both political parties have agreed that first-class dirt is essential to success in 1936 on any agricultural front. Party leaders on all fronts are not averse. I hasten to explain that I refer to dirt in the sense of "soil" or geological residues. It is a manifestation of the return to simple fundamentals.

We have long heard the plea from classrooms and scientific sources that "the soil is the basis of agricultural regeneration," but nobody paid much heed to it when they laid the forms and poured the concrete of former party platforms. Mostly, they used gravel and sand to make up the "mud" for the political mix, so it would throw good. But everybody concedes that you can't grow crops or ideas on either. The former is too coarse, and the latter is better for glass-making than grass-making. But after the recent judicial fiat, they demanded something else to try at. And if you are looking for something reliable to stand on, earth is the natural consequence.

To date, the only criticism of soil as the catchword for 1936 comes from a solon who thinks it will not catch votes quite as neatly as "higher farm prices" might; but those with a livid eye glued to the consumers' gallery are inclined to feel that soil is relatively harmless compared to the buzz-saw of sky-high sausage and de luxe board bills. They shy away from tacking higher incomes on the R. F. D. right to the grocery bills of the proletariat. They claim with pretty good sense that it was bad psychology and maybe a durn-sight worse politics. So the soil inherits the limelight.

The court crimped the farm program on general welfare and federal authority angles. Here the good old soil returns to its heritage. Few will deny that plenty of fresh dirt connects every state in the Union as one "indivisible entity," and/or holds us together as a nation. It was there before the rivers and lakes, and expects to remain there when they dry up, as Kansas can testify.

Soil is far safer to adopt as a bond of common necessity than water, because many of us get along very well without any water, and you can't bet on water anyhow like you can on good, old reliable hard-pan or shale.

As a constitutional bulwark, hunt me up anything harder than my garden after a drought, or anything more tenacious than the South Dakota gumbo. Furthermore, it can be proved that half of the surface soil of western Iowa used to be at home somewhere in wind-blown Nebraska, while the old Mississippi takes tons of Lake State granules to Louisiana and beyond. This again clinches the interstate commerce clause on the side of the salvationists.

So probably the best the scuttled mariners can do is to leave the old hulk and get aboard the flagship Soil Saver, run by Cap Bennett, limber up the guns, and get going. Of course, I presume that his first concern is that the new crew might go in for conversation rather than conservation. I suspect that the admiral is also rather worried over the extra supercargo he may have to adopt. He hadn't sent out any life boats to collect the domestic allotment sailors when this was penned. But like all able navigators, he has to wait for orders.

THEN again, it might be better not to overload the soil barge in its dredging operations. The barkantine Resettlement is a new ship which has not come near the shoals yet or spent much time flirting with the sirens. The difference between soil conservation programs and those of resettlement is chiefly that the former tries to keep land from moving, while the latter wants to help farmers to keep moving. (Personally, I opine that we have some land and some would-be farmers which could be moved right off the hemisphere without much loss.)

Speaking of moving reminds me of a new farm plan hatched by a city friend of mine who once drove into the country for some fresh air. Without long prejudice or agrarian affiliations, he faced the problem more freely than most of us. It was plain to him what should be done. I think he wrote his congressman about it, and I anticipate seeing it spread out on the dull pages of the Record one of these days. His hunch was to send half of the southern cotton planters north to milk cows where the lactic juice freezes solid before it hits the pail, and then send the northern dairymen to Alabama to hold down the surplus adjacent to the gins. After a year or so of this mutual exchange, each faction would return home to manage what's left, wiser in geography and more content with native conditions. "Give them non-transferable transportation benefits instead of cash," my friend concluded, "and the rush of business will solve the bus and railroad problem at the same time."

Over in England when a reorganization committee deliberates on a farm problem, they are very frank about calling the result of their cogitations a "scheme." They have hops schemes, potato schemes, milk schemes, and chicken schemes, and every one of them thus far has survived our more dignified "programs." It may not be

that our plans were of a kind to court disaster, although they met disaster in the courts. Yet most of us agree that there are some inherent factors in our economy these days which present even stiffer obstacles to success than the courts.

We can't amend ourselves out of peculiar situations by a few wordy law documents, even if they bear the seal of the highest tribunal. At least two variable and vexing things intervene to mar the perfect outcome—weather and human perversity. A vehemently versatile vocabulary is our only saving grace when coping with them, although they may be a blessing in disguise, as we shall mention later.

Arriving finally at my text, it is simply that our major trouble is *to make known efficiency safe for agricultural practice.* Apply it to the new substitute farm program, and then see if I care whether you discredit my brief or not. It won't make much difference anyhow, for I intend to root for soil salvation all through the revival, whether there are any cash converts or not. Coming as I do from a farm where you either got your pants lined with sandburrs or your boots caked with muck, I am for applying everything in the w. k. "fertilizer triangle," and plowing under everything that won't get us cost of perspiration. Then, in a pinch, if all else fails, they can set up a synthetic food factory in every Ford salesroom and thus save us plenty of conventions, calculations, compound interest, and muscle grunts.

But to resume where I disconnected: Perhaps I state the case too simply by saying that we face the challenge of making agriculture a safe field for practices which we have proven to be worthy of wholesale adoption. That's the direction we took when the experiment stations were started, and again later, when our extension forces took those laboratory seeds out to broadcast among the "heather and the heathen." It's not new. It's old stuff—to the minority. The minority, I mean, who profited by these lessons—the fellows who came to winter short courses with chilblains and frosted beaks, and endured long lectures for the soil's sake, and their own success.

AS long as we faced unlimited world trade and overseas export, efficiency had a chance. The minority who used better farm management systems were the husky "specimen patients" exhibited with modest pride by the college clinics in agricultural progress. They found that it paid to be pushers and comers. Knowledge was power indeed!

But now we have gradually increased the efficiency of this minority so that they are doing the major share of food production at whatever "profit" there is left. Meanwhile, our

(*Turn to page* 44)

Typical soybean plants grown on the fertility plots of the Delaware Agricultural Experiment Station.

Soybean Trends

By Geo. L. Schuster

Agronomist, University of Delaware

SOYBEANS, a crop introduced from the Orient, are now one of the major crops in the eastern United States. There were not more than eight varieties grown in the United States prior to 1898. Since then more than 1,000 selections and varieties have been tested, and about 50 varieties are listed by seedsmen. Approximately 3,500,000 acres are seeded annually, at the present time, of which 2,250,000 acres are utilized for hay and 1,250,000 acres are harvested for seed. The area harvested for seed produces almost 19,000,000 bushels.

This crop, first introduced as a curiosity and later grown as a soil improver and forage crop, is now utilized in the manufacturing field. About one fourth of the soybean seed now harvested, yielding approximately 15,000,000 pounds of oil annually, enters manufacturing channels. The products manufactured from soybean oil and meal are numerous—too numerous to mention here. Let it suffice to say that the soybean has passed through the curiosity and experimental stage of adaptation to American agriculture and has now become one of our important cash crops for the farmer in the eastern United States.

When a farm crop passes from the role of a green manure crop or a forage crop to that of a cash crop, it usually means that at least a part of the crop is removed from the soil and never finds its way back unless it is by the way of manurial applications or a return of the straw to the land where the seed only is harvested. Smith * has calculated that a yield of 5,860 pounds of soybean hay will return to the soil in the hay and roots combined 150 pounds of nitrogen, 27 pounds of phosphoric acid, and 100 pounds of potash. Wood † states that an acre of soybeans producing 9½ tons (green weight) will return to the soil 165 pounds of nitrogen, 42 pounds of phosphoric acid, and 109 pounds of potash in the crop; and an additional 9 pounds of nitrogen, 2 pounds of phosphoric acid, and 6 pounds of potash in the roots.

These observations indicate that the removal of a crop of soybeans from the land is taking with it about 150 pounds of nitrogen, 40 pounds of phosphoric acid, and 100 pounds of potash from each acre. Probably two thirds of the nitrogen removed has been derived from the air. This still leaves 50 pounds of nitrogen and the phosphoric acid and potash to be taken from the soil when the crop is removed. The amount of plant food removed will depend upon a number of factors, such as crop growth and the available plant food.

Soil Bookkeeping

Transposing the amount of plant food removed by the harvest of an acre of soybeans into terms of the amount of fertilizer or manure required to replace this loss, one will find that it requires approximately 7 or 8 tons of manure or a fertilizer mixture containing 300 pounds of 16 per cent nitrate of soda, 200 pounds of 20 per cent superphosphate, and 200 pounds of 50 per cent muriate of potash. Soil bookkeeping will not be one of exactly balancing the debits and credits, but the soil must be looked upon as a medium of exchange where the income and outgo of plant food is about equal if crop production is not to decrease. Perhaps it does not require 7 tons of manure or 700 pounds of a 7-6-14 fertilizer to replace the plant food removed by harvesting an acre of soybeans, but at any rate some plant food has been removed and it should be replaced if the fertility level and crop yields are to be maintained.

Don't Use Reserves

Soybeans have been grown at the Delaware Experimental Farm * since 1912 in a rotation of corn, soybeans, wheat, and hay (clover and timothy). The hay crop was not fertilized. The other crops were fertilized as follows:

Plot	Total per Rotation	On Soybeans	Fertilizer
1912-1924 (lbs. per acre)			
4	270	75	Muriate of potash
7	750	250	Superphosphate
	270	75	Muriate of potash
9	350	100	Nitrate of soda
	750	250	Superphosphate
	270	75	Muriate of potash
15	25 Tons	5 Tons	Manure
1925-1932			
4	90	18	Muriate of potash
7	375	75	Superphosphate
	90	18	Muriate of potash
9	38	8	Nitrate of soda
	38	8	Dried blood
	375	75	Superphosphate
	90	18	Muriate of potash
15	10 Tons	..	Manure

The average annual yields of soybeans for the 21-year period were as follows:

* Smith, C. D., Mich. Agr. Exp. Station, Bul. 227.

† Woods, C. D., Conn. Agr. Exp. Station, (Storrs) Bul. 6.

* Delaware Exp. Station Bulletins 137, 162 and 192.

Treatment	Yield bu. per A.
No fertilizer	12.3
Muriate of potash	15.6
Superphosphate, Muriate of potash	21.3
Nitrate of soda, Superphosphate, Muriate of potash	23.3
Manure	24.7

There has been an increase in yield on the fertilized and manured plots over the untreated plots for the period under consideration, but what has been the trend of these yields during this period? Have the yields from the untreated plots gone up or down or remained about the same? Have the yields from the treated plots remained about the same throughout the period? If the 21-year period is broken down

(*Turn to page* 43)

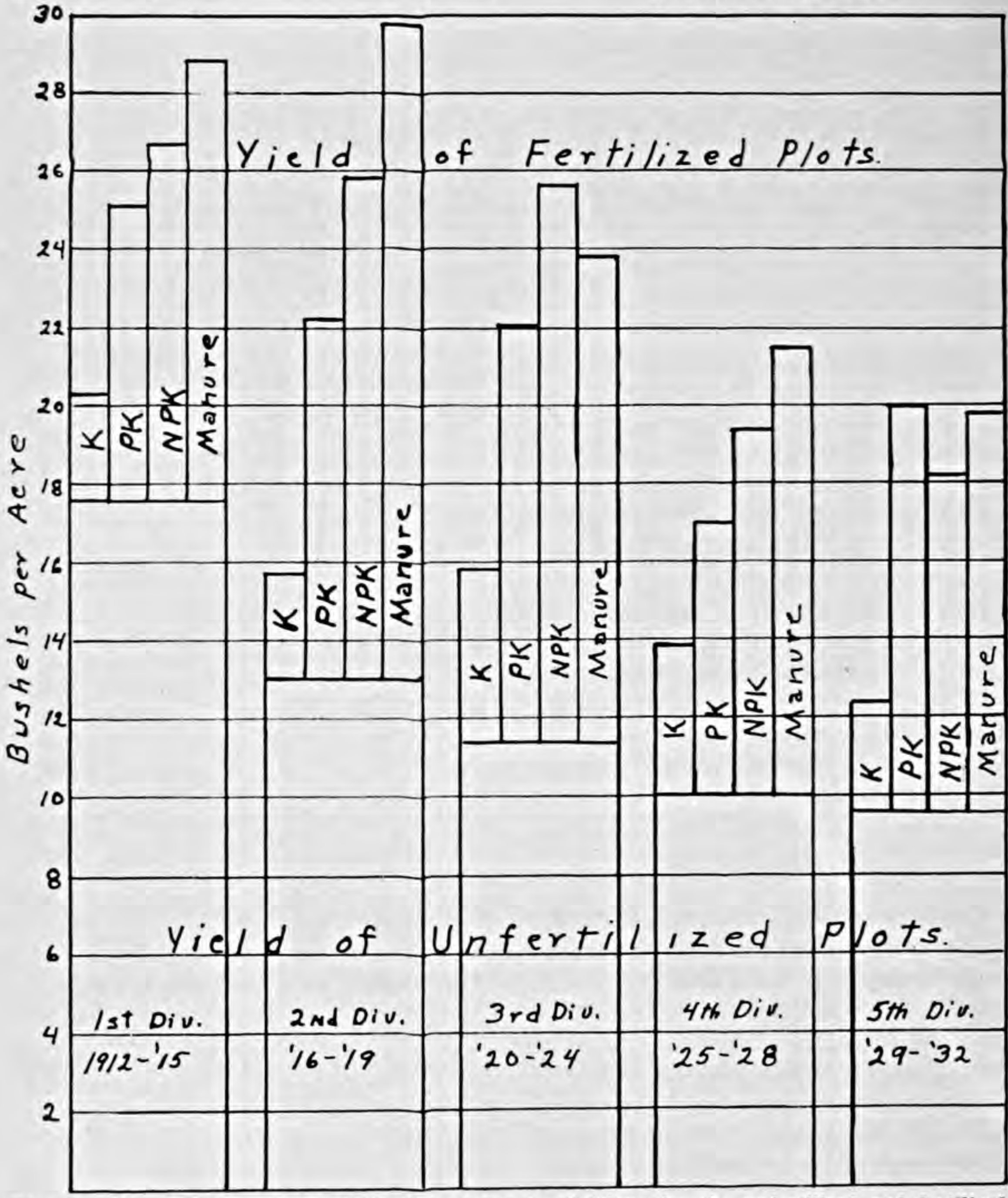


Diagram showing the average yield of soybeans by divisions for the unfertilized and fertilized plots, 1912-1932 inclusive. The trend of the yields for the unfertilized plots is downward. The trend of the yields of the fertilized plots is also downward until the highest yield from fertilizer treatment in the 5th divisions (1929-1932) was only 2 bushels above the unfertilized plot of the first division, 1912-1915. This indicates that there has not been sufficient plant-food material returned to the soil to sustain the original crop-producing power of the soil.

Tobacco plots of the three-year rotation to which fertilizers were applied broadcast in 1934. Left: 500 lbs. 6-8-12, yield 1,470 lbs. per acre. Right: 1,500 lbs. 6-8-12, yield 1,670 lbs. per acre.

Fertilizing Pennsylvania Cigar-leaf Tobacco*

By D. E. Haley

Professor of Soil and Phytochemistry, Pennsylvania State College

LANCASTER county, Pennsylvania, is one of the most prosperous agricultural communities in the United States. There are a number of reasons for this, among which are the inherent fertility of the soil, which is of limestone origin, and the high degree of intelligence manifested by the individual farmers in handling this soil. In no other farming community in the United States is more attention given to the maintenance of soil fertility, and to efficient crop production.

The agricultural background of Lancaster county farmers is an important factor in their success. In the majority of instances, they are direct descendants of the German settlers who first placed the land under cultivation more than 200 years ago, and who themselves represented the twenty-fifth successive generation of farmers in the German Palatinate. It is not unusual to find Lancaster county

* Authorized for publication on December 13, 1935, as paper No. 712 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

farms operated at the present time by lineal descendants of the pioneer settlers, never having been transferred to anyone but a member of the same family. Throughout these 200 years, a consistent effort has been made to increase rather than reduce the fertility of these soils, and with considerable success.

The system of agriculture now pursued in Lancaster county is diversified, and the rotation usually includes the raising of cigar-leaf tobacco. The center of production of this tobacco in Pennsylvania is this area. For this reason, research on this crop has been largely confined to this county.

Field experiments on tobacco are conducted on a rather large scale at Roseville, one mile north of the city of Lancaster, under the direction of the Pennsylvania State College in cooperation with the Office of Tobacco Investigations, U. S. Department of Agriculture. The work is supervised by Mr. Otto Olson, the Federal Representative, who is thoroughly familiar with agricultural conditions in the county.

The prevailing opinion of those in charge of the investigations is that it should conform to the general agricultural system peculiar to the county. This policy prevailed at the Ephrata experimental plots some years ago and is maintained at the Roseville plots. The results obtained from these field experiments, supplemented by laboratory tests and by observations of growing crops of tobacco throughout the county, now point to certain fundamental factors which should be given consideration in the production of tobacco, from the standpoint of both yield and quality. These factors may involve definite changes in farming procedure which, however, will in no way interfere with the maintenance of soil fertility.

Contrary to popular belief of some years ago, a soil does not need to be neutral or alkaline in reaction in order to insure good crop yields. Excellent yields of all of the more common agricultural crops have been obtained from slightly acid soils. Moreover, certain crops seem to be better adapted to an acid rather than to a neutral or alka-

Tobacco plots of the three-year rotation to which fertilizers were applied in the row in 1934. Left: 1,000 lbs. 6-8-12, yield 1,974 lbs. per acre. Right: 1,500 lbs. 6-8-12, yield 2,048 lbs. per acre.

line soil; tobacco appears to fall into this general class. Since legumes are common in the rotation system now practiced, a large quantity of available lime must not be present in the soil to insure the growth of the best tobacco. Although legumes are high lime "feeders," excellent yields of legumes have been obtained when the soil was slightly acid in reaction. Some soils, however, are too acid for legumes. In such cases additions of lime in reasonable amounts are to be recommended.

Because the prevailing Lancaster county system is "lime and manure" and because these soils are normally high in lime, they are usually neutral or alkaline in reaction. On the other hand, many famous tobacco soils, such as those in the Connecticut valley, are strongly acid in reaction. During 1935 an experiment was conducted on a farm near Roseville which involved the addition of elemental sulphur to the soil, in conjunction with certain fertilizer mixtures. The quantity of sulphur added was sufficient to increase soil acidity up to and even exceeding the acidity of the average Connecticut tobacco soil. The results indicate that tobacco of good quality may be grown on soils of rather high acidity.

An irrational use of lime is to be avoided on soils where tobacco is grown, for a number of reasons. Phosphorus, the chief limiting factor in plant growth on these soils, is rendered less available to the plant if the soil is alkaline rather than slightly acid in reaction. Furthermore, the absorption of potassium from the soil by the plant is much more efficient under slightly acid than under alkaline conditions. The evidence of one crop, that for 1927, indicates that when the potassium content of the tobacco is high, the lime content is low; and when the potassium content of the tobacco is low, as in the case of an ordinary "dry-year" crop, the lime content is high. When the soil is definitely alkaline in reaction, certain essential elements, such as manganese, may be rendered practically unavailable for plant growth.

Typical Lancaster county homesteads reflect a degree of agricultural prosperity, due to good soils and good management.

An application of 10 tons of manure per acre, which is the amount ordinarily used by Lancaster county tobacco growers, carries approximately 100 pounds of nitrogen, 50 pounds of phosphoric acid, and 100 pounds of potash. From a percentage standpoint, therefore, it appears to be fairly well balanced with respect to these three constituents; but since the nitrogen is more readily available to the plant than either the phosphoric acid or potash, manure is considered a nitrogen fertilizer as well as a source of organic matter.

The value of manure, from the standpoint of the maintenance of soil fertility, can hardly be overemphasized; it should be used whenever possible. From the standpoint of the most efficient tobacco culture, however, fresh manure should be applied to the crop preceding tobacco in the rotation, or it should be well rotted before being applied just before the land comes into tobacco. If fresh manure is applied directly to the tobacco crop, it should be reinforced with both phosphoric acid and potash.

The tobacco plant requires nitrogen in the early stages of its growth, and a constant supply, within reasonable limits, should be available throughout the growing season. Excellent results have been obtained without the addition of manure, when two-thirds of the nitrogen added was in the form of cottonseed meal and one-third in a readily available mineral form. Beneficial results were not obtained when these proportions were reversed. Heavy additions of nitrogen, without being properly balanced with phosphoric acid and potash, seriously affect the burning quality of tobacco. An unbalanced nitrogen supply also induces a succulent growth, which lowers the resistance of the plant to the invasion of disease organisms. A more resistant plant results when a balance of nitrogen, phosphoric acid, and potash is maintained.

Our plot results show that phosphoric acid is the main limiting factor of plant growth, and this probably holds true for all soils of this area. A poor yield invariably is associated with a low phosphoric acid content of the plants. A high yield is not possible without ample supplies of this element. As in the case of nitrogen, phosphoric acid should be balanced with the other essential plant foods. An excess of phosphoric acid, however, lowers the quality of the plants, especially the burning qualities.

Tobacco plants liberally supplied with potash are better able to withstand drought than plants having less potash, because of the production of cuticle on the surface of the leaves. Plants high in potash appear to offer maximum resistance to the invasion

(*Turn to page* 34)

Potash irons out the leaf, giving smooth surface and improved texture. Left was fertilized with 1,000 lbs. of 6-8-16 per acre; center with 1,000 lbs. of 6-8-4; right received no fertilizer.

Fertilize to Control Cotton Wilt and Rust

By Dr. V. H. Young

Agricultural Experiment Station, Fayetteville, Ark.

ALTHOUGH losses from cotton wilt and rust are still unnecessarily high, they are due mostly to the failure to follow standard recommendations, rather than to a lack of remedies to be applied.

In 1892 Professor George F. Atkinson, then at the Alabama Experiment Station, and later a famous member of the faculty of Cornell University, called attention in a series of bulletins to most of the serious diseases of cotton as we now know them. With surprising insight and thoroughness Atkinson described such diseases as the Fusarium wilt of cotton, "rust" or potash hunger, root-knot or nematode disease of cotton, and several other less important diseases. Although Atkinson's stay at the Alabama station was brief—lasting only about three years—he described these diseases so clearly and elucidated their causes and the soil conditions which favor them so fully that his work on rust, root-knot, and cotton wilt stands out as the foundation stone upon which all later work with this highly important group of diseases depends.

Atkinson's descriptions of the symptoms of these diseases are so accurate and so simple that today one may well start his education on diseases of the cotton plant by reading Atkinson's bulletins describing "yellow leaf blight," "red leaf blight" (rust or potash hunger), "frenching" (Fusarium wilt of cotton), and cotton "root gall" (root-knot or nematode disease). He noted that cotton wilt is especially a disease of sandy soils, gray lime lands, and of certain "gunpowder" land which becomes powdered and loose in dry weather. He also noted that especially severe attacks of cotton wilt result when root-knot is also a factor. His studies of rust or potash hunger showed that it was prevalent in loose, sandy soils which are lacking in humus and which we now recognize as being very subject to leaching. Atkinson's experiments showed that applications of potash in the form of kainit prevented the yellowing and reddening of the foliage, the premature maturity and defoliation of the plants, and the apparent drouth injury of cotton now known to be very largely the result of potash hunger. In his experiments, yields were often increased from 70-100 per cent through the use of potash fertilizer, particularly kainit.

Potash Controls Rust

Since Atkinson's work was published in 1892, his recommendations for the control of rust have become fully established, and for many years the use of potash fertilizers, the maintenance of humus through green manures or stable manure, and in some cases the drainage of low spots, have come to be recognized as the standard controls for this malady. The relation of root-knot or nematode disease to especially severe attacks of cotton wilt has become a matter of common knowledge; and likewise, its control through rotations with resistant crops which starve out the nematodes in the soil, such as corn, Iron or Brabham

Cotton plant seriously affected with cotton wilt before any cotton has set. Such plants often disappear before the end of the season.

cowpeas, Laredo soybeans, and certain other crops, and the eradication of susceptible weeds has served greatly to reduce losses both from root-knot itself and from cotton wilt.

Unfortunately, the Fusarium wilt of cotton has proved a much more complicated problem than either potash hunger or root-knot, and though much has been written about the disease, its cause and the conditions favoring it, the truth is that control measures have been only partly effective and in many cases have been entirely unacceptable to many cotton growers. Although the disease is of parasitic origin, the environmental factors favoring severe attacks are so complex, involving as they do the nature of the soil, the presence or absence of root-knot, soil and air temperatures, soil moisture, and no doubt other environmental factors, that ordinary control methods have not sufficed. Rotations have been of little avail against a fungus that seems able to live almost indefinitely in the soil and still retains its power to attack cotton when it is finally put back on the land. Very early the control of root-knot, as described above, became recognized as necessary for the control of cotton wilt, and this recommendation still remains the first to be made wherever it is a factor.

Soon after Atkinson's work appeared in 1892, William A. Orton and others noted the survival of certain individual cotton plants in fields badly affected with the wilt disease, and through field selection there soon ap-

Plant killed by wilt after setting a few bolls.

Plant killed by wilt late in the season.

peared varieties of cotton highly resistant to the cotton wilt disease. Although many of these resistant varieties were inclined to short staple, lateness, and difficulty in picking, they proved comparatively satisfactory until the advent of the boll-weevil. Because of the severe injury to which late fruiting cotton is subject during periods of boll-weevil damage, most of the wilt-resistant varieties were immediately abandoned for early matur-

Upper row—Leaves from cotton plant grown in sand in the greenhouse showing potash hunger induced by withholding potash. Lower row—Normal leaf from a plant grown under the same conditions except that a complete fertilizer was used.

ing varieties such as Trice, many or all of which were highly susceptible to the cotton wilt disease.

Gradually, with better methods of boll-weevil control, wilt resistance as a necessary property of a good cotton variety has again come to the fore, and many highly resistant and partially resistant (wilt tolerant) varieties have been developed. Many selections from the old Texas Rowden, Dixie Triumph, Dixie 14, Super Seven, Clevewilt, and many other wilt-resistant varieties are now available. While the problem of wilt resistance in cotton will never be a completed task, it is one in which real progress is being made and will continue to be made.

During the 43 years since Atkinson's first publication on cotton wilt, many persons have looked for simpler and more effective methods for the control of cotton wilt through soil treatments. No doubt the fact that cotton wilt so often appears on the same sandy, alluvial soils which are so apt to favor rust or potash hunger, and does not often appear on clay soils or heavy delta soils, has led many to suspect that cotton wilt is a disease of weakened or undernourished plants. Possibly the effect of the root-knot disease in breaking down the cotton plant's resistance to the disease may have strengthened this idea. To every farmer, and to every plant pathologist for that matter, the great desideratum for the control of such a soil-borne disease as cotton wilt is, of course, some simple soil treatment, such as the application of lime, stable manure, or commercial fertilizer which will not only control the disease at hand, but also bring about large and profitable increases in yield over and above those which might be expected to result from disease control alone.

At the Arkansas Experiment Station an attempt has been made since 1926 to develop a rational program for the control of the cotton wilt—potash hunger — root-knot complex, which would include the development of cotton varieties resistant to the cotton wilt disease, use of rotations for the control of root-knot, use of potash fertilizers and green manures for the control of rust, and the use of fertilizers for the control of cotton wilt.

Home-Made Evidence

The part of this program which is concerned with wilt-resistant varieties is in continuation of the early work of Orton and others and is not reported here, and the control of root-knot had already been established for many years. The results obtained through use of fertilizers for the control of cotton wilt and rust are the only part of the work considered in this paper.

Studies were carried out in the vicinity of the Cotton Branch Experiment Station in Lee county in eastern Arkansas and at 12 other points in central, eastern, and northeastern Arkansas. Recently similar experiments have been inaugurated in the Arkansas River valley in the western part of the state. In all cases land has been selected where severe losses were being experienced, generally from a combination of cotton wilt and rust or potash hunger. In one case only, root-knot or nematode disease was a further complication, and it was apparent there that the effect of root-knot was so completely to break down the resistance of cotton to the wilt disease that other control measures were much less efficient. Some of the experiments consisted only of non-fertilized plots and plots fertilized either with a mixed fertilizer containing potash or muriate of potash alone, but in most of them a series of fertilizers with increasing increments of potash was used. In a few of the outlying experiments only two series of plots were included, but at the Cotton Branch Experiment Station nine different treatments were included, in addition to non-treated checks, and each treatment was repeated at four different points in the experimental field. Some of the outlying experiments extended over only one or two years, while those at the Branch Experiment Station were inaugurated in 1929, and with the season of 1935 this work now includes data for seven years.

In every one of the experiments carried out in connection with this work, except the one case noted above where root-knot was a serious factor, the control of rust or potash hunger was outstanding in plots where potash was applied. This was shown in much thriftier, greener growth, absence of yellowing and reddening of the leaves, the power of the plants to hold healthy foliage until frost, and particularly in increased yields—in some cases amounting to a hundred per cent increase in the weight of seed cotton. In a few cases, when a high-potash mixed fertilizer was used at the rate of 600 pounds per acre, yields were nearly three times as great on fertilized as on unfertilized plots.

Potash Controls Wilt

The incidence of cotton wilt was determined by actual counts of the whole stand and of plants affected with the cotton wilt disease, and in the more elaborate experiments conducted at the Cotton Branch Experiment Station for the past seven years, wilt counts were made every 15 days from late June until September. Space does not allow a presentation of complete numerical data from all of this work, which may be found in the original publications, but the data from one of the more complete 1933 experiments are presented in the following table as being entirely typical of the results obtained.

An examination of the data reveals pronounced responses in yield to both nitrogen and potash alone and in combination, but not to phosphorus alone.

(*Turn to page 37*)

Meeting New Hampshire's Pasture Problem

By Ford S. Prince

Agronomist, New Hampshire College of Agriculture

FEW ideas advanced to farmers of the Northeast in recent years have had such widespread appeal as the one that something must be done about pastures. Back in the pre-depression era, when milk prices were favorable and a farmer could really afford to barn feed all summer long to keep his herd in high production, little was thought, said, or done about pastures. On many farms feed from the pasture was practically disregarded, and a full ration was barn fed the year round.

Post-mortems are always gruesome affairs. There is no need to trace the decline of pastures in the Northeast from the days when many of them would support a cow to the acre to the point where they now are. It takes a fertile soil to produce feed enough on an acre to support a cow. As nothing was done during the past century to replace the plant food removed in the milk and bones of the animals, the pastures suffered. It seems difficult now to believe that this could have happened in a section where fertilizers are commonly used, and where the field land on the better farms is kept in a reasonably good state of fertility.

Perhaps it is not quite accurate to say that pasture consciousness and depression milk prices were coincidental. It is probably more nearly correct to state that depression in the fertilizer industry pricked farmer minds into pasture consciousness, for

Frances Peaslu, Pittsfield, New Hampshire, divided his pastures, reseeded two acres, and top-dressed 18 acres of new pasture in 1935.

it was the representatives of these fertilizer companies who first established the fact, by demonstration, that not all of the old pastures are hopeless and that many of them can be top-dressed to the profit alike of the farmer and the fertilizer man. This gave the fertilizer companies a new outlet for their product and farmers new hope and courage to grow more of their pasture crops. It will doubtless help to lead both groups out of depressed industries.

When the human mind becomes aroused as it did in this instance, and forcibly, too, because about that time milk prices were cut almost in half, it begins to seek ways out of its dilemma. Had milk prices continued to soar, it is doubtful if much progress could have been made with this intricate problem. Perhaps farmers would have used more fertilizer on their pastures than formerly, but would they have been so eager to master every method of pasture improvement at their command? Not likely.

I have been on the "firing line" in New Hampshire for almost 11 years, before and during the depression, out of the bright years into the dusk, and now into daylight again. I have had an opportunity to study the farmer's moods and outlook. Well I remember when an intensive system of pasture management was launched in our neighboring state of Massachusetts. "That's all right for an Experiment Station," said many farmers to me in essence, "but we don't expect that we will ever divide our fields into small paddocks and fertilize heavily like they are doing." But they did and are. Answering a recent questionnaire, 493 of 1,196 New Hampshire farmers state that they divided their pastures in 1935, and most of them used fertilizer or grew for their cows special crops to be grazed during the short pasture period.

Mixed White Dutch Clover and grasses make ideal permanent pasture. This one had a complete fertilizer and made a luxuriant growth all through the season.

Allow Pastures to Rest

It now appears that this matter of dividing up the pasture acreage has probably been adopted as widely in New Hampshire as any other phase of improved pasture management. At first, supplying water and fencing costs for the smaller fields seemed almost insurmountable obstacles on many farms. A trial, perhaps just splitting the pasture into two parts, was enough to convince a man that this is one way of quickly increasing the amount of feed that he secures from his pastures, and the tendency now is to make more rather than less subdivisions. By this method the various sections of the pasture are rested from 20 to 25 days out of each month and grazed the balance, or 5 to 10 days. During the rest period, the grass has a chance to recover and make a more luxuriant growth than where the cows are allowed to roam over the whole area all of the time.

Farmers with ample pasture acreage on the heavier soil types, where feed is normally good, find that dividing the area into three or four fields is probably all they need to do to tide them over, except during the period of extreme feed shortage. Some of the very best farmers have thus been able to get by without any additional means of pasture stimulation.

Those who are not so fortunate as

to have a large area of good pasture are combining fertilization along with splitting their pastures into paddocks. Controlled grazing on heavily fertilized land is particularly important to prevent too close cropping of the highly palatable forage that is produced. Dividing allows also for an opportunity to fertilize at different times so that the forage will be produced as needed.

In any state where conditions on individual farms are as varied as they are in New Hampshire, the Extension man's pasture platform must carry several planks in order that it may appeal to all. A few farms have all the pasture they need if it is well managed. A much larger portion have sufficient pasture through May and June, very little through July and August, and a part of their needs in September and early October. In other cases there is a small amount of pasture all of the time but never enough, and on a few highly specialized farms no pasture whatsoever is available. Within these various groups are farms with a variety of soils and pastures varying from good to those in the lower stages of decrepitude, varying from some of the better tillage areas to the roughest of stony land, including that which is already so grown up to bushes and trees that it is pasture only in name.

One of the first jobs in our Extension program has been to correct the idea that some of the rough, stony, and grown-over land is pasture land. We have constantly held the idea before our farmers that a good pasture should carry in the neighborhood of a cow to the acre after it is improved, and we have tried to make them see that if they could reach that goal, they could afford to fertilize, lime, fence, bring water to the paddocks, cut brush; in fact, do everything necessary to keep the pasture thrifty and producing well.

"Treat only the best areas of permanent pasture" has been the slogan. If there is no permanent pasture worth improving, then take some of the tillage land for pasture or pasture the rotation fields, has been our advice. Even with good management it has been found necessary on the majority of farms to supplement in most seasons during part of July and August with crops grown especially for pasture. For this purpose, oats for July

(*Turn to page* 40)

These cows on the farm of E. E. Farrar, Henniker, New Hampshire, grazed on very light intervale soil fertilized with 250 lbs. of 8-16-14 per acre. Mr. Farrar top-dressed 13 acres of pasture in 1935 and plans to seed 10 acres more to permanent pasture in 1936.

The Inquiring Mind *and the* Seeing Eye

By Alister B. Alexander

Madison, Wisconsin

WAY DOWN in Texas, the largest state in the Union, the state that has flown the flag of six nations and is famous for its crops, its sacred Alamo, and its diversity of soil, climate, and resources, lives a man who is not only one of the noted chemists of the United States, but who is, we have been told, an ardent radio fan, who spends as much of his time as possible listening to his favorite programs. So. in the language of Major Bowes, this month we salute George Stronach Fraps, State Chemist of Texas, a native son of North Carolina, who moved on into new fields, and who has materially added to the soil fertility, fertilizer control, and agricultural knowledge of his adopted state.

Well Prepared

George Stronach Fraps was born at Raleigh, North Carolina, on September 9, 1876, the son of Anton Wetzel and Margaret Elizabeth Lumley Fraps. After attending the grammar and high schools of his native Raleigh, he entered the North Carolina College of Agriculture and Mechanic Arts, now part of the University of North Carolina, where he received his B.S. degree in 1896. During the years 1898 and 1899 he was a fellow at Johns Hopkins, where he was granted the degree of Doctor of Philosophy in 1899. On June 17, 1903, Dr. Fraps was married to Ellen Hale Saunders, of Durham, North Carolina, to whom were born George Saunders Fraps, Mary Brandon Tinus Fraps, and Richard Benbury Saunders Fraps (deceased).

From 1899 to 1903, Dr. Fraps acted as assistant chemist at the North Carolina College of Agriculture and Mechanic Arts, and at the North Carolina Experiment Station, and also as assistant professor of chemistry, advancing to the title of associate professor during the years 1904 and 1905. In 1905 he became State Chemist of Texas; this post he still holds. Dr. Fraps has also acted concurrently as chemist for the Texas experiment station and as professor of chemistry at the Texas Agricultural and Mechanical College at College Station. In 1927 he was appointed delegate for the United States to the First International Congress of Soil Science. He is a member of the American Chemical Society; American Society of Agronomy; Association of Official Agricultural Chemists, of which he was president in 1913; American Soil Survey Association; American Society of Animal Production; Fellow of the American Association for the Advancement of Science; and the fraternities of Phi Kappa Phi and Phi Beta Kappa.

Dr. Fraps has been a very prolific writer, and in addition to his books on "Principles of Agricultural Chemistry," published in 1913, and "Principles of Dyeing," in 1903, he has contributed over 250 bulletins and articles in chemical journals and other scientific publications.

In discussing the work of Dr. Fraps with Walter B. Griem, Chief Chemist of the Feed and Fertilizer Inspection Service in Wisconsin, we were told, "I consider Dr. Fraps a very scholarly

DR. GEORGE S. FRAPS

chemist who has done a great deal for Texas, for the fertilizer industry, and for the advancement of agricultural science. One of his outstanding accomplishments has been his untiring effort to reduce and standardize the number of commercial fertilizers offered for sale."

In this connection, it is interesting to note that at one time there were some 165 different grades of fertilizer sold in Texas. At the present time, according to an address given by Dr. Fraps at the annual meeting of the Texas Feed Manufacturers in 1935, the number now offered on the Texas market has been reduced to 23. This was accomplished through much sacrifice on the part of some of the manufacturers, who scrapped grades of fertilizer that had been sold in Texas for decades, but the results have been beneficial both to the manufacturers and consumers of the fertilizers.

The Texas manufacturers have also raised the grade of fertilizers, with the result that the purchaser gets a better fertilizer at less cost than he would otherwise. We have been told that through this effort on the part of Dr. Fraps, other Southern states have cooperated and are adopting standard grades in reduced numbers, which will benefit agriculture materially.

Urged Standardization

In the address above mentioned, Dr. Fraps also advised the feed manufacturers to adopt similar methods and to standardize on scientifically compounded feeds. He said, in part, "You, as manufacturers of feeds, like the manufacturers of fertilizer, are in a peculiar position toward your customers. The purchaser of fertilizer must get enough increase in his crop to pay for the fertilizer and to give a profit. A purchaser of commercial feeds must produce enough of livestock, eggs, milk, or other animal product to pay for the feed and to make a profit. Otherwise, neither can continue to purchase fertilizer or feedstuffs. It is to the interest of the fertilizer trade to give the most fertilizer value for the least money and to see that the fertilizer is adapted to the soil and to the crops, so that the purchaser can make his increased crop and secure his profit."

There is a great diversity in Texas climatic conditions and in Texas soils, owing to the great expanse of the state, covering as it does more than 10 degrees of latitude and ranging in altitude from the sandy Coastal Plain to the rugged ranges of the west. The soil of most of the state is susceptible to cultivation. Considerable areas of alluvial soil are found along the lower courses of the rivers, especially in the eastern part. The narrow coast belt is mainly a sandy soil, while the soil of the prairie belt is composed of some sand in the timber spots but is mostly a dark clay mingled with vegetable mold and commonly called black waxy. Farther west the soil is a composition of weathered limestone and clay, which needs only water to develop its fertility. Speaking from personal experience gained from the hurricane deck of a horse while an officer of the 14th U. S. Cavalry, we have seen some of this land produce as if by magic, when water was added; and it almost seemed as if some of the Chinese onion growers had inherited some mystic power from ancient times, when we saw what they could do with their few acres.

Judgment Based on Survey

Dr. Fraps has made a careful soil survey of a great many of the counties of Texas, and 13, or possibly more, bulletins have been published by him on this subject. In Bulletin 482, dealing with the soils of Henderson, Hidalgo, Milam, Nacogdoches, Navarro, Wichita, Willacy, and Victoria Counties, it is interesting to read his recommendations for dealing with these typical Texas soils. The following are some of the essentials to the maintenance or improvement of soil fertility advised by Dr. Fraps after many years of careful study, and should be of interest to readers everywhere.

1.—The store of nitrogen and humus in the soil should be maintained. Growing legumes in a proper rotation and turning these under or grazing them off are usually to be advised. The nitrogen of the soil may be supplemented by the use of nitrogenous fertilizers. Losses of nitrogen due to cropping eventually result in a deficiency of nitrogen.

2.—Deficiency of phosphoric acid in the soil should be corrected by the use of phosphates as a fertilizer. Losses of phosphoric acid due to cropping eventually result in a deficiency of phosphoric acid.

3.—Any acidity sufficient to be injurious to the crops being grown, if present, should be corrected by applications of ground limestone or lime. Lime and limestone are also used for the improvement of the physical character of heavy soils poor in lime and for supplying lime for crops which need a quantity of lime. Lime should be used chiefly in connection with a systematic rotation in which a suitable legume is included.

4.—Any deficiency of potash in the soil should be corrected by the use of a fertilizer containing potash. Losses of potash due to cropping eventually result in deficiency of potash.

5.—Erosion or washing away of the more fertile surface soil should be prevented.

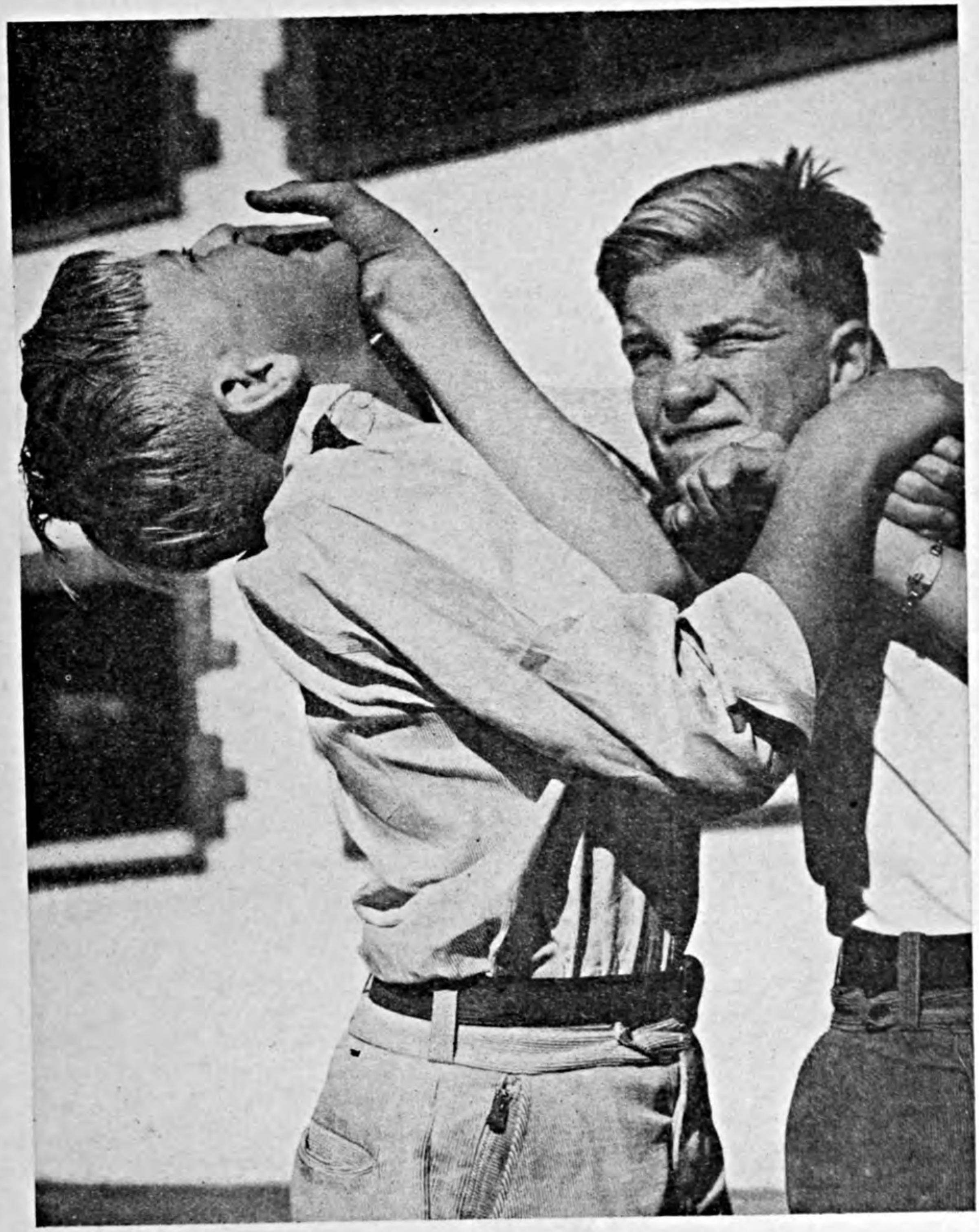
6.—Land under irrigation should have good underdrainage, either natural or artificial, so that salts dissolved in the irrigation water will be washed out and will not accumulate in the soil.

This sound advice given by Dr. Fraps has undoubtedly done a great deal of good to the Texas soils. The maintenance of the humus, produced by the partial decay of vegetable matter in the soil, aids materially in maintenance of fertility. Humus, in sufficient quantity, helps soils to hold a favorable amount of water, so as better to resist drought. It helps to give a fine, crumbly structure to clay soils and enables them to break up into good condition of tillage under the action of the cultivating implements. It checks the rapidity of the percolation of water through sandy soils, thus decreasing loss of plant food.

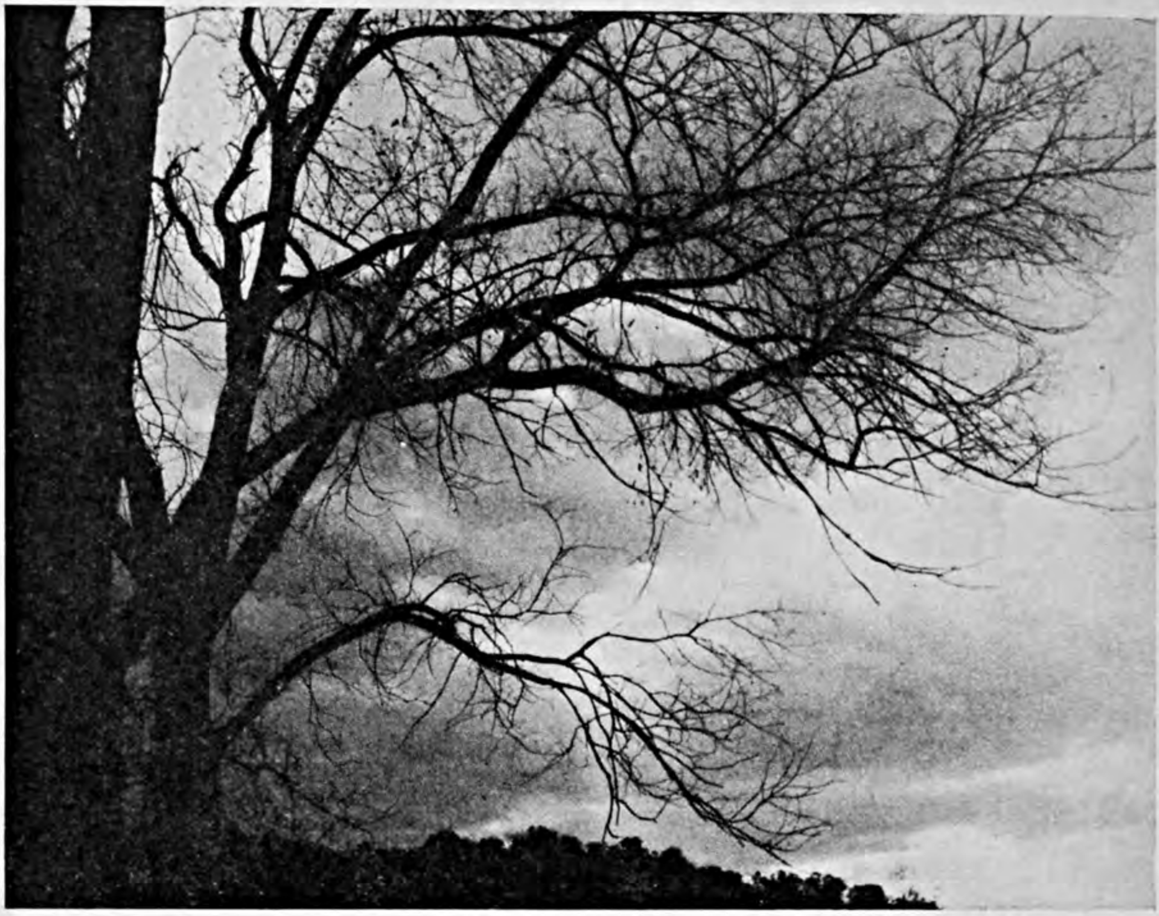
Humus is also the storehouse for most of the nitrogen of the soil. Nitrogen in humus is insoluble in water and cannot be taken up by the crops or washed out of the soil, but it is grad-

(*Turn to page 35*)

Pictorial

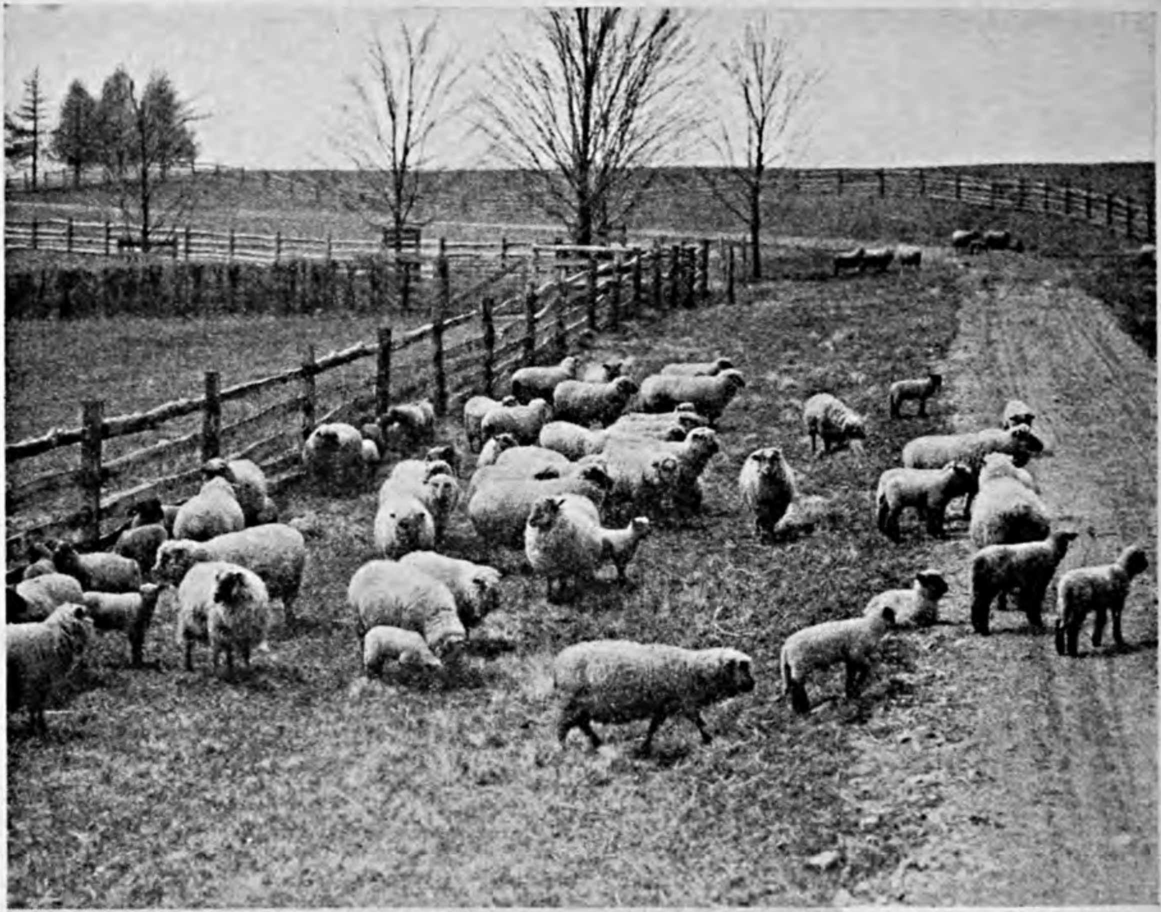


"YOU WILL, WILL YOU!"



SPRING—OVERHEAD AND UNDERFOOT . . . .

. . . . HAS ITS ATTRACTIONS AND DISADVANTAGES.



Above: The welcome accorded sunny, spring days by the farm animals adds to the enchantment of the season.

Left: Two embryo cowboys pause to face the camera. However, the pony doesn't seem much interested in the "birdie."

The Editors Talk

Soybean Trends

The soybean is America's fastest expanding crop. It is taking a place of major importance in our agriculture and last year ranked fifth among grains in farm value. That the fertilization of soybeans will receive increasing attention is inevitable. Therefore, we wish to call the particular attention of our readers to the article SOYBEAN TRENDS, by Geo. L. Schuster, of Delaware, on page six of this issue. Professor Schuster points out that even under present methods of fertilization thought to be adequate, yields have decreased.

According to the U. S. Department of Agriculture, the soybean acreage in this country has more than doubled in the last few years. It rose from 2,000,000 acres in 1924 to nearly 5,000,000 last year. Production of the beans themselves increased from 5,000,000 bushels in 1925 to last year's tremendous crop of more than 40,000,000 bushels. The 1934 crop was only a little more than 20,000,000 bushels. The reasons for this increase—in addition to the demand for beans for food, feed, and industrial uses—are immunity of soybeans to chinch bugs and other pests, good prices compared with other grain crops, drought resistance, and high seed yield.

Additional uses for soybeans are anticipated as a result of the recent establishment of a cooperative soybean industrial research laboratory at Urbana, Illinois. This laboratory has been set up by the U. S. Department of Agriculture and 12 North Central States—Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Kansas, Missouri, and the Dakotas.

The three immediate objectives of the new laboratory are: improvement of present industrial uses and development of new industrial uses for soybeans; more facts on the effects of different processes on the quality and quantity of soybean products; and facilities for testing different varieties as to adaptability for industrial use. On experimental plots nearby, plant breeders hope to grow new varieties even better suited to industrial demands.

The establishment of this new soybean research laboratory is an additional step in the new emphasis on the greater and more varied utilization of a crop. Its importance to the betterment of American agriculture is obvious and its work will be watched with keen interest.

Balanced Fertilizer

Included in a great deal of interesting work reported in the recent Annual Report of the Georgia Coastal Plain Experiment Station are many references to the efficient use of potash. Tests show that cotton needs a balanced fertilizer containing the three principal plant-food elements, or as the Report notes—a definite formula recommendation will not fit all types of soil. It is considered advisable to make general recommendations. For Coastal Plain soils in a good state of fertility, 9 per cent phosphorus, 3 per cent ammonia, and 5 per cent potash are recommended, supplemented by nitrogen when the first squares appear.

On land where cotton has a tendency to rust, the potash should be increased to about 8 per cent or an application of potash should be applied as a top-dressing just prior to the blooming period. Tests with varying amounts of potash from nothing to 10 per cent for 6 years show a marked increase in potash up to 8 per cent. Sometimes the 10 per cent over the 8 per cent produced an increase and sometimes it did not. But it should be pointed out that 600 pounds of fertilizer per acre were used, which is, of course, much higher than the average application, so that with smaller total amounts of fertilizer per acre where rust exists, it would be necessary to top-dress with potash in addition to the fertilizer used. Excellent results were obtained with top-dressing with varying amounts of muriate of potash up to 200 pounds per acre, in addition to 600 pounds of a 9-3-5.

Peanuts show less response to fertilizer application than cotton or corn, especially where peanuts follow a rotation in which other crops are liberally fertilized. On lands in a good state of fertility, fair gains may be expected from an application of 200 to 300 pounds of 10-0-4 (PNK) fertilizer per acre. On thin land, it is suggested that a 10-2-4 or a 10-2-6 be used. Sweet potatoes demand potash. Data obtained from a 10-year study of fertilizer requirements on this crop indicate that 8 per cent phosphoric acid, 4 per cent ammonia, and 6 to 8 or 10 per cent potash (the latter on light sandy soils) to be the best suited to this crop. Irish potato requirements indicate that the most desirable amount of plant food is a formula consisting of 6 to 8 per cent phosphoric acid, 6 to 8 per cent ammonia, and 8 to 10 per cent potash. The general conclusion is that under most conditions tobacco fertilizers should contain 8 parts phosphorus, 3 parts ammonia, and 5 to 8 parts potash. The formula need not be an 8-3-5 or 8-3-8, but it is desirable that these proportions of phosphorus, ammonia, and potash be maintained.

It is important to note that "potash tests show rather conclusively that the higher potash formulas are to be preferred over the 5 per cent goods."

The report is written in a very practical manner and contains a great deal of useful information not only about crops but about various divisions of animal husbandry.

Charles E. Thorne

American agriculture has lost another of its "grand old men." Dr. Charles E. Thorne, director emeritus of the Ohio Experiment Station, died at his home in Wooster, February 29.

Quoting from a fine tribute in an editorial in the OHIO FARMER, "Throughout his life Director Thorne was a constant seeker after the truth. . . . Such patience as he exhibited, both in seeking the answers to agricultural problems and in time of trouble, is a rarity in the world today and Ohio is going to miss him sorely.

"The nation will likewise miss this man who was so prominent at all gatherings of agricultural scientists. The foundation of the long-time soil fertility work that he early laid at the Ohio Station not only served its purpose in building Ohio agriculture upon a sound basis but has since become the model and forerunner of this type of work throughout the nation. Dr. Thorne's passing will be missed both at home and throughout the scientific world."

Better Crops was pleased to present to our readers in our issue of July, 1931, the late Dr. Alexander's tribute to Dr. Thorne, "Dean of American Agricultral Experiment Stations."

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

Fertilizers

A preliminary report of noteworthy interest to peach orchardists over a wide territory is given in Horticultural Circular Number 10, Cooperative Extension Work in Agriculture, The Clemson Agricultural College, South Carolina, entitled "Peach Trees in South Carolina Develop Abnormalities with Nitrogen Fertilization Alone." The authors, E. H. Rawl and W. H. Stallworth, specify that essential elements other than nitrogen must be applied to the peach orchard for normal production. The demonstration results are based on one year's work.

The abnormal condition seriously affected a 14-year-old Elberta peach orchard in the most important peach-growing section of the state in 1934, resulting in an enormous loss to the owner, according to the circular. A survey of other orchards throughout the state showed that 26 orchards of 77 inspected were affected by this abnormal condition, although orchards under 5 years of age did not indicate serious aspects of the typical symptoms.

"In the early stage of the abnormal condition the leaves first changed to a light yellowish-green color, later to a very pale yellow, followed by burning or 'scorching' of the tips and margins of the leaves," state the authors in describing the condition. "Finally, the leaves were considerably curled, showing a bronzing or browning, eventually resulting in a great scarcity of peach buds." It is further shown that this abnormality ultimately results in a very light crop of undersized fruit.

The fertilizer treatment to this Elberta orchard since 1926 has consisted chiefly of sulphate of ammonia. Fertilizer demonstrations conducted in this orchard during 1935 indicate that treatments of nitrogen, phosphorus, potassium, and dolomitic limestone or basic slag greatly improved the peach trees. Such treatments produced healthy and rank foliage, whereas the continued application of nitrogen alone reproduced the abnormality in 1935 in a more acute form. Fruit wood and bud development, fruit development, number of peaches of different sizes, and other factors determined from these demonstrations are discussed.

"Department of Agriculture of Oregon Bulletin," State Dept. of Agr., Salem, Oreg., No. 45, Sept. 1935.

"Commercial Fertilizers in 1934-35," Agr. Exp. Sta., College Station, Brazos County, Texas, Bul. 517, Dec. 1935, G. S. Fraps and S. E. Asbury.

Soils

Many important activities which constituted the principal functions of the Bureau of Chemistry and Soils and the Soil Conservation Service, United States Department of Agriculture, are summarized in the 1935 annual reports of the respective chiefs.

Included in Chief Henry G. Knight's Report of the Bureau of Chemistry and Soils are instructive discussions pertaining to the Bureau's basic research on soils, fertilizers, and agricultural products. Listed among the research work encountered during the past year are investigations of soils and peats, nitrogen, potash, and phosphate fertilizer materials and their sources, concentrated mixed fertilizers, composition of foods, utilization of wastes from crops and industries using farm products, and improvements in the technic of producing fertilizers and many other materials. Chief Knight remarks that the "Bureau of Chemistry and Soils is continually striving to give more of its attention to basic or fundamental research to develop new scientific facts and principles relating to soils, fertilizers, plant and animal nutrition . . . which facts and principles may be applied by those engaged in agriculture or industries based on agriculture."

Concerning the objectives of the Soil Conservation Service, Chief H. H. Bennett relates in his report that they are "to propagate the use of soil conservation practices in agriculture through the medium of demonstration; to effect at the same time a maximum control of erosion on as large an area of agricultural land as possible; and to ascertain the fundamental scientific facts essential to the development and improvement of soil-conservation methods and technics." Because of the vast area of erodible lands of the country, a national plan of demonstration and education to convince farmers of the necessity for practical soil protection is a logical approach by which the Service seeks to effectuate control measures. The report stresses the fundamental element of coordination of method in land treatment. The application of approved principles to correct use, the adoption of improved cultural practices, and the employment of both engineering and agronomic methods according to the peculiar needs and adaptation of the land, essentially achieve effective control of soil erosion, Chief Bennett emphasizes.

"Soil Erosion Control in Farm Operation," Agr. Exp. Sta., University Farm, St. Paul, Minn., Sp. Bul. 170, Aug. 1935, H. B. Roe and J. H. Neal.

"Peat and Muck, Character and Utilization," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Bul. 320, Mar. 1935, B. D. Wilson.

"Base Exchange Properties of Some Typical Texas Soils," Agr. Exp. Sta., College Station, Texas, Bul. 520, Dec. 1935, G. S. Fraps and J. F. Fudge.

"Soil Survey of Bourbon County, Kansas," U. S. D. A., Washington, D. C., Series 1931, No. 12, M. H. Layton and C. E. Dornberger.

Crops

Circular No. 3, Tennessee State Department of Agriculture, entitled "How to Grow Strawberries in Tennessee," by E. M. Prather, State Horticulturist, contains information that will prove very instructive to prospective growers of that state who contemplate going into the strawberry business. The publication advocates the limitation of plantings to one or two varieties most adapted to local conditions. Suggested as the leading varieties grown in the state are the Blakemore, Klondike, Aroma, Premier, and Missionary varieties. It is advised that only the very best plants obtainable should be planted, preferably those which bear a State Nursery Inspector's Certificate. Soils capable of producing 20 to 30 bushels of corn per acre are said to insure good yields of strawberries.

Soils rich in decayed plant material do not require fertilizers when the plants are set, but 400 to 600 pounds of a 4-12-4 (N-P-K) fertilizer per acre should be applied to the matted rows early in the fall. On the other hand, the author recommends the broadcast application of 400 to 600 pounds of a high analysis fertilizer per acre on soils of average fertility as they are being prepared for planting. The second crop of berries calls for an early fall application of fertilizer similar to the first, and when a third crop is attempted, the fertilizer program for it is the same as for the previous crops.

Other factors discussed in this circular are methods of soil preparation, strawberry planting, cultivating, and establishing the matted row, mulching the strawberry field, and control measures for insects and diseases.

The University of Florida Agricultural Experiment Station Bulletin No. 288, "A Wilt-Resistant Watermelon for Florida," by M. N. Walker, portrays the development of a superior melon variety which may be planted on wilt-infested soil. The report discloses that this important development will permit the re-utilization of thousands of acres of land once used for melon production which are now considered unsafe. This variety has been designated as "Leesburg," and was originated from the Kleckley Sweet variety. Through continued self-fertilization and selection, the new melon is claimed to possess certain characters not conspicuous in the Kleckley Sweet. Of these the report mentions, in addition to its resistance to wilt, that the Leesburg has increased toughness of rind and is lighter in color than Kleckley. It is believed the high quality of this melon will justify its general planting, judging from the promise it has shown as a result of experimental observation at Leesburg, Florida. The bulletin describes the nature of wilt disease and a summary of the work at Leesburg.

"Asparagus Production in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 91, June 1935, G. C. Hanna.

"Spinach Production in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 92, July 1935, G. W. Scott.

"Dahlia Variety Test, 1935," Ga. Exp. Sta., Experiment, Ga., Cir. 105, No. 1935, W. D. Armstrong, H. L. Cochran, and David D. Long.

"A Year's Progress in Solving Farm Problems of Illinois, 1933-34, Forty-Seventh Report," Agr. Exp. Sta., Urbana, Ill., H. W. Mumford, Director.

"Effect of Soybeans on Corn Yields," Agr. Exp. Sta., Baton Rouge, La., Bul. 265, July 1935, H. B. Brown.

"The Forty-Eighth Annual Report of the University of Maryland, Agricultural Experiment Station," Agr. Exp. Sta., College Park, Md., H. J. Patterson, Director.

"Killing Weeds with Chemicals," Agr. Ext. Serv., Amherst, Mass., Ext. Leaf. 78, Rev. May 1935, Orton L. Clark.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 18, No. 2, Nov. 1935.

"Growing Good Crops of Oats in Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 359, Jan. 1936, W. C. Etheridge and C. A. Helm.

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"Random Notes on Fruit Tree Rootstocks and Plant Propagation, II," Agr. Exp. Sta., Geneva, N. Y., Bul. 657, Oct. 1935, H. B. Tukey and K. D. Brase.

"Peony Growing," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 321, Apr. 1935, A. M. S. Pridham, C. E. F. Guterman, and Grace H. Griswold.

"Lespedeza and Alfalfa Hay for Dairy Cows," Agr. Exp. Sta., State College Station, Raleigh, N. C., Bul. 302, Oct. 1935, C. D. Grinnells.

"An Opportunity—Use Rented Acres to Build Fertile Soils," Agr. Ext. Serv., Raleigh, N. C., Ext. Misc. Pamphlet 24, Dec. 1935, E. C. Blair.

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"Forty-Eighth Annual Report of the South Carolina Experiment Station for the Year Ended June 30, 1935," Agr. Exp. Sta., Clemson, S. C., Dec. 1935, R. A. McGinty, Acting Director.

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"The Digestibility of Artificially Dried Roughages," Agr. Exp. Sta., Burlington, Vt., Bul. 400, Nov. 1935, J. A. Newlander.

"Studies of Ripening of Sugarcane in Louisiana and of Effect of Topping upon Yields of Cane and Sugar per Acre," U. S. D. A., Washington, D. C., Cir. 368, Oct. 1935, George Arceneaux.

"A Practical Laboratory Method of Making Thin Cross Sections of Fibers," U. S. D. A.,

Washington, D. C., Cir. 378, Nov. 1935, J. I. Hardy.

"Reducing Decay in Citrus Fruits with Borax," U. S. D. A., Washington, D. C., Tech. Bul. 488, Oct. 1935, J. R. Winston.

"Alfalfa Experiments at Stoneville, Mississippi," U. S. D. A., Washington, D. C., Tech. Bul. 495, Sept. 1935, Paul R. Henson and H. L. Westover.

Economics

Results of a thorough study of cost records on 40 farms for the years 1931 and 1932 in La Crosse county, Wisconsin, are interpreted in the Wisconsin Agricultural Experiment Station Bulletin 431 entitled, "How Farmers Adjust When Prices Fall," by D. R. Mitchell. The publication gives an excellent presentation of many significant facts uncovered by these economic investigations.

When farmers decrease their production of crops or livestock, they increase their investment costs per unit of product produced, as a smaller number of units must then carry as large an expense load as before. This is due to the farm investment costs, depreciation, repairs, taxes, and insurance, which comprise about two-thirds of all costs. The importance of a knowledge of investment values and requirements of each individual farm is emphasized. Costly mistakes necessarily must be averted; furthermore, farmers should learn to look upon investments as purchases of future income, the author suggests. The report concludes that some cost adjustments increased efficiency of operations, while other cost reductions are expressed as undesirable. An improvement in efficient feeding of livestock and increase in farm labor efficiency are termed as significant. While short-time reductions in expenditures for commercial fertilizer, cow-testing, and veterinary services generally did not reflect on immediate crop yields and livestock production, a prolonged curtailment of these reductions would mean reduced efficiency in the farm programs.

The bulletin states, "When prices of milk and many other farm products touched bottom as they did in 1931 and 1932, farmers were forced to reorganize their business on a lower cost basis. They soon discovered that many of their costs could not be reduced, and that in the case of others, it was a real problem to distinguish between what constituted a real and a false saving."

The principles of sound business management derived from the studies reported in this bulletin will apply equally well to other farms.

"Agricultural Research for the Alabama Farmer," Agr. Exp. Sta., Auburn, Ala., Sp. Cir., Apr. 1935, M. J. Funchess, Director.

"The Production-Consumption Balance of Agricultural Products In Michigan. Part 1. Fruits and Vegetables," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 263, Oct. 1935, G. N. Motts.

"Factors Affecting Farm Land Values in Missouri (From an Appraisal Viewpoint)," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 229, Sept. 1935, Conrad H. Hammar.

"Readjusting Montana's Agriculture. (1. The Need and Basis for Readjustment)," Agr. Exp. Sta., Bozeman, Mont., Bul. 306, Dec. 1935, Roland R. Renne.

"Farm Economics," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., No. 92, Dec. 1935.

"Prices of Vermont Farm Real Estate," Agr. Exp. Sta., Burlington, Vt., Bul. 391, June 1935, T. M. Adams.

"Let me show you something new in a snappy sedan," suggested the salesman.

"It won't do you any good," she replied, "and besides, I don't think you could."

"I see the jury acquitted the girl who killed her employer, on the ground of insanity."

"Yes, and quite right, too. Anybody who kills an employer these days is certainly crazy."

Survey Shows Too Many Fertilizer Grades Sold

MOST farming areas which use large quantities of commercial fertilizer could be supplied by a dozen or so properly selected grades such as 4-8-4, 2-12-6 and others. Yet, farmers as a whole must choose from more than a thousand grades when they buy fertilizer.

Almost 40 per cent of the three and a quarter million tons of fertilizer sold in 1934 was of five popular grades, 3-8-3, 3-8-5, 4-8-4, 2-12-6 and 4-8-7. The remainder, a little more than 60 per cent, was divided among more than 900 grades, according to a joint survey by the Bureau of Chemistry and Soils and The National Fertilizer Association. This information, the investigators say, might well be used as a basis for reducing the number of grades.

Only 21 grades were sold in Mississippi—the smallest number in any state using large quantities of fertilizer—as compared to 425 grades sold in Florida. In Mississippi 85 per cent of the fertilizer was of one grade. In Florida, total sales for each of more than 200 grades were 25 tons or less.

"In most states fertilizer manufacturers are compelled by competition and other circumstances to make and stock many grades," says Dr. W. W. Skinner, assistant chief of the bureau. "Fertilizer bags and tags have to be printed, chemical analyses made, and storage space provided for each grade. The cost of these items is about the same whether 5 or 5,000 tons are sold.

"Farmers can help eliminate many unnecessary grades by finding out the few well-selected grades that will serve their needs. This would help the local fertilizer manufacturer to produce tonnage instead of grades and sell his products for less money."

Results of the joint survey are summarized in a report, Plant Food Consumption in the United States in 1934. Copies may be obtained as long as the supply lasts from the Bureau of Chemistry and Soils, Washington, D. C.

Sixty-six Million in Smokes

WHILE "cigarette money" may be small change to the average Canadian, the amount spent on tobacco in the Dominion as a whole during a year is a very substantial sum and supports an industry of major importance. According to a report issued by the Dominion Bureau of Statistics, the output of the Canadian tobacco manufacturing industry in 1934, including excise duties, was valued at $66,400,493, which represents an increase of $2,165,734, or about 3.4 per cent, over that of the previous year. Cigarettes formed the main item of production with an output of 4,843,470 thousand valued at $38,182,600. Smoking tobacco was next in importance with an output of 19,916,321 pounds valued at $19,939,514. This was followed by cigars with a production of 116,858 thousand valued at $4,557,959; chewing tobacco, 3,118,235 pounds valued at $2,642,751, and snuff, 788,913 pounds valued at $1,063,449.

Tobacco has been grown in Canada since the early French colonial days. At that time tobacco smoking was general among the natives, but the white people did not acquire the habit quickly as the use of tobacco was frowned upon in the best circles. Due to public sentiment and governmental opposition some time passed before the farmers began to grow the plant. It was not until 1735 that the government gave any encouragement to tobacco growing. Times have changed since then and today the tobacco industry contributes materially to the agricultural economy of the Dominion. Materials used in the industry in 1934 had a value of $18,629,615, of which $14,164,681 was for raw leaf tobacco. All told, the industry consumed 36,100,480 pounds of raw leaf tobacco, of which 26,927,337 pounds with a cost value of $7,521,936 were of domestic origin. During the year under review there were 127 establishments engaged in the tobacco industry, representing a capital investment of $51,546,009 and providing employment for 8,150 workers. The value of production, less excise duties, is placed at $37,489,025.

Vegetation Is to the Soil What Skin Is to the Body

VEGETATION on the earth is likened to the skin on our bodies by Federal erosion-prevention workers. Remove a large portion of the skin and terrible sores result. Reckless denuding of millions of acres of the richest land in the country has resulted in erosion; huge sores upon the earth.

"Recovery from the disease of erosion is not a simple matter," says H. H. Bennett, of the Soil Conservation Service. "Obviously we cannot return to presettlement conditions. The nation has its roots in agriculture and if the nation is to continue, agriculture must continue. We cannot raise corn and tobacco and cotton in the woods. We cannot harvest a wheat crop from the unbroken prairie. But we must make some concessions to nature, whose laws we cannot repeal even if they are irksome.

"Protection and production are not necessarily incompatible. With a system of correct land use we can farm much of our soil and keep it, too. We cannot safely farm all of it to clean-tilled, erosion-producing crops. Some of the steeper and more erosive land must be in trees or grass. These crops anchor the soil. Like the skin on our bodies they protect the earth from the disease of erosion."

Fertilizing Pennsylvania Cigar-leaf Tobacco

(*From page* 12)

of disease organisms. This is a factor of great importance; in many cases, entire crops have been destroyed by disease. Heavy rains reduce the vitality of the plant, rendering it more susceptible to leaf-spot diseases, especially wildfire, unless the plant is fortified with potash. In addition, no element surpasses potassium in enhancing the burning quality of tobacco.

The soils of Lancaster county lack available potash. During the season of

1935 crops were observed which showed pronounced symptoms of potash deficiency in the early stages of plant growth, as evidenced by the characteristic mottled appearance of the leaves. Later, an unbalanced condition with respect to nitrogen and potash was observed in many mature plants throughout the county, as evidenced by the characteristic "stem-bound" condition of the leaf. Such a leaf is thicker than a normal leaf and contains more organic matter in proportion to the quantity of potash. This is undesirable from the standpoint of the manufacturer, since it is difficult, if not impossible, to "ferment" smoking qualities into such tobacco.

The problem of potash fertilization is of paramount importance to the tobacco industry of Lancaster county. Notwithstanding the fact that these tobacco soils are deficient in available potash, little potash fertilizer has been used, on some farms none at all. In many cases, fertilizers which are not well balanced with respect to nitrogen, phosphoric acid, and potash have been used. More attention appears to have been given to additions of nitrogen than to additions of either phosphoric acid or potash. This practice must be changed, if the tobacco industry of Lancaster county is to be profitable.

It is difficult, if not impossible, to recommend a fertilizer mixture that will satisfy all conditions in Lancaster county. The field experiments, however, have yielded results which are applicable, in large measure at least, to other parts of the county as well. An application of 1,000 pounds, or more, of commercial fertilizers per acre is desirable in all cases, but the units of nitrogen, phosphoric acid, and potash may vary to some extent on different soils. The nitrogen may vary from 3 to 6 per cent, the phosphoric acid from 5 to 8 per cent, while the potash may vary from 10 to 12 per cent. Potash should be the predominating element. It must be used in a form other than the muriate. The phosphoric acid content should be, on the average, somewhat greater than that of nitrogen.

Excellent results have been obtained on the experiment plot soils, from the standpoint of both yield and quality, when a 6-8-12 mixture has been applied broadcast or to the row in quantities varying from 1,000 to 1,500 pounds per acre, and without manure. Satisfactory results likewise have been obtained on the plots and on different farms located throughout the county when either a 3-5-12 or a 3-8-12 mixture in like quantities has been used in conjunction with stable manure.

The Inquiring Mind

(From page 22)

ually changed by soil organisms to nitrates or ammonia, in which forms nitrogen may be taken up by the plants. Some soils produce good crops for a long time without additions of vegetable matter, but for permanent productiveness on most soils, vegetable matter must be added sooner or later. Vegetable matter may be supplied from barnyard manure, from leaves, straw, or similar waste material, or from legume crops which have power to take nitrogen from the air.

Legume crops may be grown in rotation with other crops, and if either grazed off or turned under will introduce vegetable matter into the soil. If the crop is heavy, it is best to allow it to become nearly mature before turning it under. To graze off the crop is better than to turn it under, as some of the feeding value of the crop is secured when it is grazed, while the droppings of the animals, together with the liquid excrement, return to the soil the bulk of the plant food taken away by the crop. When the legume is made into hay to be sold, however, the land probably gains little nitrogen and actually loses phosphoric acid and potash.

Many of the Texas soils are rich in potash, but there is a variation among the different types and some need potash as a fertilizer. While in many cases the total potash is high, a large part of this is locked up in insoluble silicates and may not become available for the use of plants in centuries. The total amount does not, therefore, indicate how much is available for use by the immediate crop, and potash must often be added in the form of commercial fertilizer.

A Sound Adviser

All of Dr. Fraps' published articles and bulletins concerning fertilizers contain the same sound advice, and we are certain that such recommendations have, and will do, a great deal toward improving the fertility of Texas lands.

As stated previously, in his address to the Texas Feed Manufacturers in 1935, Dr. Fraps recommended the establishment of rigid standards for mixed feeds. The adoption of such measures will do a great deal for Texas, and Dr. Fraps is to be commended for his work in determining scientific and balanced rations. For more than 100 years chemists, biologists, and other research workers have been studying to find out what ingredients are necessary and how great are the requirements to produce the best results in the feeding of domestic animals.

A great deal has been discovered, and a great deal remains to be done; but the proper use of the information already available, the proper compounding of feeds that will adequately serve the needs of domestic animals and manufacturing and selling under strict laws will be of great benefit to the users. A portion of the energy in the feed eaten by the animal passes through in the undigested compounds found in the solid and in the liquid excrement. Some energy is lost in fermentation in the intestines, and a portion is consumed by the work of digestion. The net energy-producing feed which remains is the part which can be used for the maintenance of the animal, repair of the animal body, and for the production of fat, milk, eggs, work or motion.

It is important, therefore, that feeds sold should be properly made and compounded to produce the greatest amount of energy and body-building ingredients, and Dr. Fraps' research and his published findings will be of great benefit in establishing correct grades and suitable laws for the sale of feeding stuffs.

Interested In Many Projects

These are just a few of the projects which have made Dr. Fraps' name so well known in the field of agricultural chemistry. In addition to his soil and feeding research, he has found time to give a great deal of time to other agricultural needs. He has published bulletins on "The Composition of Rice By-Products" (1904); "The Chemical Composition of the Cotton Plant" (1919); bulletins dealing with wheat, peanuts, corn, cottonseed meal, oats and oat by-products, prices of feed utilities, digestibility and production coefficients of poultry feeds, and hundreds of other interesting and instructive offerings.

Professor A. D. Jackson, editor of publications at the Texas Experiment Station, says, "For more than 15 years Dr. Fraps has taken a vigorous part in the editing of all the publications of the Texas Station. His wide knowledge of the current status of the scientific progress in all branches and his practical understanding of the elements of correct publications have enabled him to be of great assistance to authors, especially to young authors, and his advice is universally sought by all members of the staff, numbering at present around 125.

"As chief of the Division of Chemistry of the Station, his work touches vitally that of all the other divisions. Dr. Fraps is either author or joint author of a large proportion of the nearly 600 publications issued by the Texas Station, as well as a large number of articles published in scientific journals. His studies of the composition of the soils of Texas and his administration of the Texas fertilizer laws have enabled him to render invaluable service to farmers seeking to make an intelligent use of their lands and of the fertilizers required for the best performance of the land.

"His studies of Texas feeding stuffs and their composition and utilization have led to a more correct evaluation of various feeds and their productive value. His work in this field ranks with that of the greatest students in the world dealing with feeding stuffs. His publications dealing with feeds are the handbooks of feeders, and serve as a guide in the establishment of standards required in the Texas feed-control service.

"The intimate ramifications of chemistry into all of the problems of agriculture have called forth unusual activity on the part of this great chemist and the large and competent staff which he directs. He finds time to advise many students each year in their studies at the Texas college, although he has not attempted to do any regular teaching for many years. His personal and official mail is large in volume and always receives his most careful attention, and his replies are always considered absolute."

Enjoys Social Activities

A tribute such as this gives a fine impression of the character and ability of the man. Dr. Fraps still finds time to take a fairly active part in the social activities of the campus. The family maintains its membership in the Episcopal Church, where it is active and liberally contributes to its support.

Dr. Fraps is active in the meetings and scientific work of the many societies of which he is a member. He has paid small attention to the matter of amassing money and lives modestly, but in his hospitable home visitors feel an unusual freedom. In his gardens he has developed a number of fine roses, and some of the finest and rarest specimens may be seen there. And, as we said in the beginning, he is an ardent radio fan, and spends a great deal of his spare time listening. To again quote the great Major Bowles, and we hope Dr. Fraps is listening, "All right, all right, with a record like yours will wil never get the gong."

Fertilize to Control Cotton Wilt and Rust

(*From page* 16)

From the point of view of the control of the cotton wilt disease, the striking result is the very pronounced effect of high-potash fertilizers in very greatly reducing the incidence of cotton wilt—even as little as 40 pounds of muriate of potash per acre in a 4-10-4 fertilizer resulted in a reduction in the incidence of cotton wilt from about 37 per cent to about 20 per cent, and an application of 144 pounds of muriate of potash alone resulted in a decrease to less than 7 per cent. The application of 300 pounds of superphosphate alone actually

EFFECT OF VARIOUS FERTILIZERS ON THE INCIDENCE OF COTTON WILT AND YIELD OF SEED COTTON, COTTON BRANCH EXPERIMENT STATION, LEE COUNTY, ARKANSAS, 1933. (EACH TREATMENT WAS REPEATED FOUR TIMES IN THE EXPERIMENTAL FIELDS.) VARIETY TRICE 304.*

Plot Treatment		Percentage of Wilted Plants					Acre Yield of Seed Cotton
Formula	Amount Applied to the Acre	July 5	July 20	Aug. 5	Aug. 20	Sept. 5	Pounds
Check	No fertilizer	4.0	10.5	13.3	20.6	37.2	644
6-0-0	Nitrate of soda, 240 lbs.	2.1	7.0	9.7	17.9	31.8	1,123
6-8-0	Nitrate of soda, 240 lbs.; Superphosphate, 300 lbs.	2.8	6.2	12.4	22.2	37.2	994
6-8-6	Nitrate of soda, 240 lbs.; Superphosphate, 300 lbs.; Muriate of potash, 72 lbs.	.8	2.8	4.5	8.2	13.3	1,665
6-8-12	Nitrate of soda, 240 lbs.; Superphosphate, 300 lbs.; Muriate of potash, 144 lbs.	.9	4.1	5.3	7.0	8.1	1,813
Check	No fertilizer	4.4	7.4	10.5	16.3	28.2	692
4-10-4	Nitrate of soda, 133 lbs.; Superphosphate, 313 lbs.; Muriate of potash, 40 lbs.	1.5	4.2	6.7	10.2	20.1	1,344
0-0-12	Kainit, 15 percent, 480 lbs.	.8	3.1	5.6	6.5	8.5	1,075
0-0-12	Muriate of potash, 144 lbs.	1.1	3.9	5.1	6.0	6.9	1,138
0-8-0	Superphosphate, 300 lbs.	5.9	12.7	16.5	23.9	40.1	672
Check	No fertilizer	6.1	14.0	16.8	23.2	37.6	643
	Manure, 10 tons	3.2	10.4	11.2	15.0	18.9	1,624

* This table is reproduced from Arkansas Agricultural Experiment Station Bulletin 308.

seemed to increase the incidence of both rust and the cotton wilt disease.

The numerical data shown do not tell the whole story, since the incidence of rust or potash hunger cannot easily be expressed in figures except as it is expressed in yields. Very pronounced control of this trouble was obtained through the use of potash-containing fertilizers, including manure, and was evidenced by the absence of all the typical symptoms of the disease. On the other hand, it is interesting to note that in this experiment, as well as in practically all others where nitrogen and phosphorus were applied alone or in combination, but without potash, the symptoms of potash hunger were actually even more striking than on non-fertilized plots, and in practically every case the incidence of cotton wilt remained as high as though no fertilizer were used.

In another series of experiments extending over a three-year period, it was found that cottonseed meal equivalent to that contained in 600 pounds of a 6-8-6 fertilizer applied just prior to planting, gave only small yield increases and had almost no effect on the amount of rust or wilt.

From the practical point of view, a series of later experiments similar to the 1933 experiment mentioned above, but in which half of each series of treatments was planted to Misdell 2 (a highly wilt-suspectible variety) and half to Rowden 2,088 (a moderately resistant variety) indicates that cotton wilt and rust can be almost completely eliminated, provided root-knot is absent, if a resistant variety is em-

Showing the effect of a complete fertilizer (600 lbs. of 6-8-12) versus no fertilizer on cotton wilt and "rust." Note premature defoliation and poor growth in the no-potash plot. There was about three times as much wilt in the no-potash plots as on the fertilized plots and the yield of seed cotton was about one half as great.

ployed, and enough potash is applied to control rust or potash hunger.

The results from this series of experiments lead us to the conclusions regarding the practical control of the cotton wilt—rust—root-knot complex in Arkansas, which are the basis of our present recommendations. In substance they are as follows: We advise our farmers that they must first control root-knot. Fortunately, only a small proportion of them are as yet faced with this problem so far as cotton is concerned. If we are able to

Showing the effect of potash fertilizer alone versus phosphate alone on the incidence of cotton wilt and rust. Note healthy foliage on the potash plot and the defoliation and poor growth on the phosphate plot. The potash plot showed an incidence of 3.88 per cent on the phosphate plot.

eliminate root-knot from consideration, we then turn our attention to rust or potash hunger. If it is present, we recommend its control through adequate potash fertilization and the building up of the humus of the soil. Finally, with these two phases of the problem under control, we recommend not necessarily the most wilt-resistant variety of cotton available, but rather at least a moderately resistant variety which best suits the general situation. Under our conditions these recommendations have never failed to give satisfactory commercial control. We make no such recommendations for any parts of the State except those sandy, alluvial lands where our experiments have been tried and where they have been remarkably successful.

We believe that there are many other parts of the South where such a program will succeed; indeed, recent reports from both the Mississippi and Tennessee Experiment Stations indicate that their results with potash-containing fertilizers for the control of cotton wilt are substantially in accord with those secured by the Arkansas Station. However, actual experience in the particular locality under consideration will be the only safe guide for the individual cotton farmer.

Meeting New Hampshire's Pasture Problem

(*From page 19*)

and Japanese millet or Japanese millet and Sudan grass for August have been most useful. Reseeding the run-out areas in pastures that are tillable also has been advocated.

These have been the planks in our Extension platform in New Hampshire. As I have already indicated, a recent check-up was made by County Agents to determine how far we had gone along the road of pasture improvement and management. The results for those dividing their pastures have already been given, and there was no small amount of surprise when we found that 43 per cent of the dairymen who replied to the questionnaire had practised some method of dividing their pastures.

It should be stated also that answers came from but about 10 per cent of the dairymen of New Hampshire. Those who threw the letter up on top of the kitchen clock and forgot about it are not included in the summary. It may be true that only the better farmers answer questions like this, but after two decades spent in work of this sort we suspect that a great many good farmers laid the letter aside until they had more time to answer it or filed it in the wastebasket when it came. To get an estimate of progress, perhaps we should multiply the information by three or four or five. But that would still be an estimate, and so we will confine our story on progress made to the reports of those who actually did send back the information; then we will know what happened on these farms, anyway.

Fourteen hundred and twenty-four acres of pasture were top-dressed by farmers reporting. This does not mean that every dairyman fertilized an acre of pasture. Some men did nothing, while others fertilized on rather a large scale, one large herd owner reporting a total of 60 acres so treated.

The top-dressing idea is gaining ground. Farmers have been somewhat skeptical about treating some of their old pastures, fearing that they will not get value received for the money spent. There is a dividing line, and it takes some experience to know what kind of pasture will and will not pay. When the facts are better known, and money gets a shade more plentiful, this phase of the program will go forward more rapidly. There is plenty of interest now. All that is needed is courage to make progress.

A Few Simple Rules

Much experimental work has now been done in the Northeastern states on pasture fertilization. The conclusions that have been drawn from this work are so impressive and clear-cut that there is little need for making mistakes when undertaking a top-dressing scheme.

A few simple rules about where and how to begin and what to use may not be out of place.

(1) The best areas in the pasture should be top-dressed first. Top-dress the best sections at the start, for all of the pasture area will not be needed when it responds to fertilizers.

(2) Top-dressings should be applied from two to eight weeks before grazing is to begin, depending upon the nitrogen carrier used.

(3) An application of 500 to 600 pounds of a 4-8-7 or 4-8-8 or other analyses in this ratio will usually prove ample in amount at the start. If double strength fertilizers are used, the rate of application should be reduced so as to apply the equivalent amounts of plant food. This will stimulate the grass for early grazing and will encourage White Dutch clover which will be productive during the summer and fall months, provided the soil is heavy enough to support a stand of Dutch clover. It should be, if the most profits are to be obtained from top-dressing.

(4) On better sods and in more intensive systems of dairying, a 1-1-1 ratio may be used in place of the 1-2-2 ratio mentioned. This will give more early stimulation and, if used, should be followed by heavy and controlled grazing.

(5) In fact, any system of fertilization should be coordinated with proper fencing so as to control the grazing. Less fertilizer need be applied if this is done, and the fertilized areas will not be injured by too close cropping if grazing can be controlled.

(6) Lime may be applied at any time at the rate of ½ to 1½ tons ground limestone or ½ to 1 ton hydrated lime per acre. If a farmer's money is limited, he should fertilize first and lime after he has had some profit from the top-dressing. In any event liming should not be delayed too long, as fertilizing may increase the need for it.

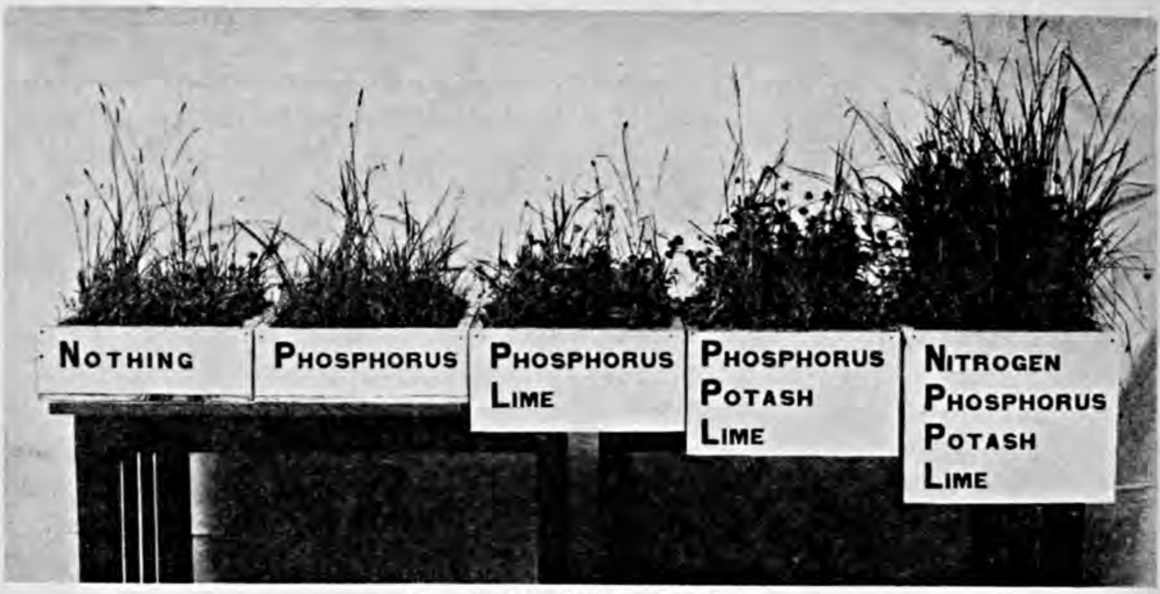
What results may be expected from top-dressing planned out along these lines? The National Fertilizer Association published the results of 103 carefully conducted trials in 1929, indicating that a sod yielding about ½ ton of dry matter could be reasonably fertilized and made to produce 1¼ tons of dry matter per acre during the pasture season. Protein was increased from 171 to 488 pounds per acre, a somewhat greater ratio because the protein of fertilized grass is higher than that not treated.

In 1930 these same investigators, in cooperation with farmers in nine Northeastern states, reported a profit of $29.62 an acre from top-dressing where the work was carried out on a field scale and the results checked in actual milk produced.

Top-Dressing Pays Profits

In our trials in New Hampshire we have produced feed, by top-dressing in the pasture with fertilizer, much cheaper than we could buy the same amount of feed at the grain store. In fact, we secured from 2 to 11 times as much feed with our money invested in fertilizers, carefully applied, on reasonably good sods, as we would have had we taken the same amount of money to the grain store and spent it there.

103 PASTURE TOP-DRESSING TESTS IN 15 STATES AND THE PROVINCE OF ONTARIO IN 1929 GAVE THE FOLLOWING AVERAGE YIELDS:



Pounds Dry Matter Per Acre				
1,051	1,392	1,548	1,850	2,501
Pounds Crude Protein Per Acre				
171	235	266	344	488

There are very few farmers in New England, and perhaps in the Northeast, who cannot afford to top-dress some pasture land. Fertilized pastures are profitable because of the response obtained. They save buying grain, reduce the necessity for feeding so much hay and silage and green feed in the barn, reduce the labor necessary in caring for the herd, increase the palatability of the pasturage, boost its mineral content; in short, they make dairying easier and keep more of the money at home.

Even with properly fertilized pastures it will still be necessary for most farmers to grow some emergency crops for late July and August.

Emergency pasture crops utilized on the farms reporting total almost 2,000 acres. The crops utilized were oats and Japanese millet. A few years ago no one had thought of pasturing oats. One farmer alone last season fed off 50 acres of oats on his Connecticut valley farm and states that he will never return to the old method of haying the oats, and meanwhile, feeding his cows in the barn during July and August. Pasturing the oats means better stands of clover than where the oats are mowed for hay. This fact is now conceded by those who have tried the system. Better hay crops following will tend to make up for the lack of cured fodder in the barn by not harvesting the oats, and the most difficult part of haying is eliminated when the oats crop is turned over to the cows.

One question asked was in regard to the number of acres of rowen pastured after early haying and after top-dressing hay land in the spring. This method of increasing August and September pasture has an extremely wide appeal, for 7,265 acres of second crop were utilized in this manner.

One reason this question was asked was because we had staged a rather active campaign in the winter of 1935 to influence farmers to use chemical fertilizers on thin hay land, to increase the yield and quality of the hay, as well as to give better rowen crops. The farmers who reported indicated that they top-dressed 3,495 acres of hay in 1935 as against 1,580 acres in 1934, which accounts to some extent for the wide utilization of the second crop for pasture.

On the farms reporting, there are more than 5,000 acres of tillable pasture. Approximately 10 per cent of this was plowed and reseeded to a permanent pasture mixture during the year. If every farm had an equal acreage of tillable pasture, the matter of pasture improvement would be quickly solved, but it hasn't been distributed in this manner.

No data are available on cutting brush, renovating cut-over land, or other means of improving grazing land. We are aware of the fact that there is an increasing effort in this direction, particularly in the removal of hard hack and other brush and weeds from desirable pasture lands.

It appears too early yet to predict when all the farmers who care to will have available pasture all through the summer season. Progress has been made. Many farmers have already achieved the goal for their individual farms. The stage is set for a violent offensive, and that there are plenty of campaigners no one can deny.

Soybean Trends

(*From page* 8)

into five divisions and the average yield for each division determined, a more complete picture of what has happened may be obtained. The results of these calculations are given in the accompanying diagram.

The trend of the yields for the unfertilized plots has been downward from 17.6 bushels per acre for the first division (1912-15) to 9.6 bushels for the last division (1929-32). All the fertilizer and manure-treated plots increased the yield over the untreated plots in each division, but the general trend of the yield also has been downward. This indicates that the soybean crop was removing more plant food from the soil than was returned by applications of manure or fertilizer, and that the crop was drawing upon the plant-food reserves of the soil.

It will be noted in the table of treatments that the plots received about three times as much plant food during the first three divisions as they did during the last two divisions. Considering the first three divisions alone, where the larger amounts of plant food were returned, it will be observed that the trend of the yields was downward from the first division to the third division. Where the smaller amounts of plant food were returned to the soil during the last two divisions, the yield of soybeans has gone down until the highest yield from the fertilized plots in the fifth division was only 2.4 bushels above the yield of the unfertilized plots of the first division and nine bushels below the highest yields of the treated plots of the first division. Examining the diagram still further one observes that muriate of potash alone has not sustained the yields as well as a combination of superphosphate and muriate of potash or nitrate of soda, superphosphate, and muriate of potash or manure.

The amounts of fertilizer and manure that were applied to these plots per rotation were thought to be large at the time the plots were laid out, and yet the return of 16 pounds of nitrogen, 40 pounds of phosphoric acid, and 37 pounds of potash on the NPK plot or the return of approximately 50 pounds of nitrogen, 25 pounds of phosphoric acid, and 50 pounds of potash on the manure plot for each soybean crop removed during the first three divisions (1912-1924) has not prevented the yields from taking a downward trend. Where the amount of plant food returned was reduced to about one third of the above amounts, as it was in the fourth and fifth divisions, there has been a further decline in the yield until the yields of the treated plots of the fifth division approximate the yields of the untreated plots of the first division.

Analyses of the fertilizer constituents in the soybean crops that were removed are not available, but if the analysis of the fertilizer constituents in a crop of soybeans, as given by Smith and Woods, is compared with the amount of fertilizer materials returned to the soil on the Delaware treated plots, the calculations will show that for the 21-year period there have been removed 1,050 pounds of nitrogen, 840 pounds of phosphoric acid, and 2,100 pounds of potash by the cropping of soybeans, and that there has been allotted for this removal a return of 128 pounds of nitrogen, 616 pounds of phosphoric acid, and 559 pounds of potash on the NPK plot. These calculations show that the soil book has not been balanced. The trend of the yields indicate the same thing. Will the future grower of soybeans accept a decreasing yield or will he be returning to the soil 500 to 1,000 pounds per acre of a 5-5-10 fertilizer or the equivalent?

Richer Dirt

(*From page 5*)

career of food expansion is about over, both as to foreign outlets and domestic consumption—under our present general consumers' wage scale.

Not in terms of stomach capacity or fulfilled desires, but in terms of old technocracy, the machine age and jobs and buying power. It's more than a fence-line, quarter-section question, despite the court's decree to the contrary. Why, it's even beyond Walter Winchell!

You and I can't get up any heated argument over the common sense involved in the soil program or better farming which accompanies it. There isn't any between trained friends on that score.

Erosion is wrong, wasteful, hateful, ugly, and a dirty discredit to us. Wire grass and tumble weeds should give ground to legumes. The torrential rains we get in the Mississippi valley area, followed by heat waves of blistering severity, burn up the soil chemicals faster than biology can function to restore fertility. (That's another place where Europe has it "on us." They don't get such extremes to oxidize the wealth of organic matter.) Green manuring for humus and nitrogen is a greater gospel than the dictums of the Supreme Court, and mending our miserable runaway lands means more than amending the Constitution.

There is no turning back, no chance for debate when it comes to that issue. Any other course is defeatism.

So bring on your limestone, your cultures, and your minerals to aid the bacterial symbiotic processes at the roots of lupines, lespedeza, and lucerne. Get it by grants or tackle it with taxes—only get it done! Then what?

It's just what we know should be done and what should have been done years ago, if we had had the cash and the conviction. So it's all to the good —amen from all corners! And yet?

Project yourself into the future. Here's a lush field of legumes, the ideal of anybody's ruminants. It grows on a third of the crop land worth cropping in America. Cut it for hay, and the tonnage of rank, leafy, vitamin-filled, high-protein forage bursts the nation's mows and even crams the silos! But I can't eat any of it. It's a juicy job for the critters —meaning more critters, more milk, wool, pork, and beef.

Use it for pasture, and the lambs and piglets wax fat and more numerous. Again the farmer finds his carrying capacity far ahead of his herd, and he breeds some more. If our consumers earn enough to keep step, we will be in clover in more ways than one. Here's hoping for an industrial renaissance to match the coming soil renovation!

BUT that's not the whole story. Here's another field of legumes, ripe and well established. Humus is lacking in the soil. Turn under the whole plant, start the nitrogen factory working, aerate the soil, stop leaching and baking; then rotate with cereals, cotton, corn, tobacco, cabbages, and even artichokes if you like them. How much more of these cash crops will one acre thus improved over four or five years bring forth?

Plenty is the answer—plenty! We only hope it won't be the tortured plenty we had in 1932, which sent us to the purple bow-wows. Again we turn our sweaty eyes to behold the road over which those better paid and more numerous and ravenous cash customers must come to glean what we have provided at a goodly stipend. But unfortunately, we have been so all-fired busy in the corn rows and the pumpkin vines that we could not spare time to regulate the production of the tycoons of industry; and to them we must look for succor or else again be suckers.

Somehow, by these devious meanderings I have come to adopt the hunch that this whole mess is, after all, a national problem at least. I know some jurists do not agree, but I was always a stubborn cuss, and one devoid of precedent. It is not a case of "cheap food" for the masses, but one of plenty of food at prices which do not put eternal mortgages on the soil. If the soil is worth saving, by gracious, it is worth redeeming by decent installments to the husbandmen. Otherwise, sooner or later we don't eat.

Of course, there is one flaw, and a big one at that, in my little thesis. I have inferred that the "Guv'munt" could induce practically all farmers to become efficient farmers—and thereby ruin the business for the whole kaboodle. But it won't happen.

There must always be a residue at the bottom of the kettle out of which to make good, thick, pasty political soup. I don't know what would happen to campaign orators without an issue, in case this incorrigible group of non-conformists suddenly took the government seriously and began soil improvement simultaneously.

Then there is always a fringe of individualists who subscribe to day-old metropolitan newspapers, calling themselves the "world's greatest." They delight in seeing farm leaders damned by two-bit scribes or distorted by subsidized cartoonists, all in the interest of low-cost loins and high-cost dividends. You can bank on those boys hanging onto gullies and marsh hay for a couple of centuries, or until the sheriff pushes them off so the insurance company can speed the plow. They swallow the "con" handed to them and are proud to be con-servatives ne plus ultra forever.

Then, arrayed on the side of delay in reaching the ultimate in agricultural efficiency are the many pests not heretofore mentioned—the bugs and the bad bacteria. There's many a slip between twenty pounds of scarified seed and an acre of legumes, not to mention the gibbering "Gibberella," or whatever it is that haunts the springtime corn fields, lying in wait to nip the germ in the bud.

SO we can thank our stars for weather vagaries and human frailty. It's about the only antidote we have in our purposeful pledge to make America "soil conscious." We can depend on the floods and the drought and the sulkers and the kickers to keep us prosperous in the minority—simply by not doing the right thing by the land. The fellows who built the poor-houses knew human nature pretty well, I reckon. They knew we wouldn't all have sense enough to become prosperous at the same time. Not even when we pay taxes to hire folks to teach us how to get that way.

By degrees, prior to the fateful January sixth, we had been edging away from the old philosophy of scarcity in farm production, always rankly distasteful to men of the land. It has not been so horrid to other gainful enterprises in America, and the old law of S. and D. was erected on that sacred precept. Yet in spite of that, we rural fellows sort of apologized for copying the tricks of the traders when we held a few of their trumps ourselves in 1933 and 1934. They couldn't take it like we took it, and so the game ended—to be resumed directly in a different room with a new deck.

Now the gratifying thing to me lies in that when we begin this game of old sledge-hammer again, after Congress finishes its frothing, we will have with us a corps of experienced players who refused to "sit in" on the *contract* game. They were used to auction or something else. They hated "reduction and scarcity," and wanted "efficiency and progress" to have a big hand in solving the riddle. Some of them were great old agrarians too, robust and courageous—just as "sold" on a national farm policy as the rest of us.

TO them the soil improvement idea is a godsend. It enables them to grab their overalls and pitchforks and holler for belt grease and spliced rope. Most of these old-timers are to be trusted throughout the coming tussle, and because they can see daylight ahead and a chance to create plenty instead of less, they are as enthusiastic as we are—maybe a shade more so, to be frank.

We can excuse some of them because they are not economists. I don't know just how much we are going to need the economists in soil mapping and seed testing, but we better ship a few of them in case we sight a school of sharks again. As for the lawyers, well, we still have the agreements! That is, for the time being, as long as cases can be postponed. But without contracts per se, I see little vital need for so much legality. We might as well get bumped for too much as for too little infringement. And minus the lawyers we would have the plea of ignorance to soften the sentence, although we'd hate to admit it.

OF course, there yet remains outside the pale of our new hegira the lost tribe of dairymen, the never-satisfied, restless yearners for satisfaction and justice. They are dumbfounded one way and damned the other way. I wish we might enlist their power and vigilance in a good cause. But they prefer to shadow-box and burn straw men, choose to hunt for goblins and search for scarecrows. Reduction burned them up in a couple of directions, and soil rejuvenation in wholesale fashion finds them hostile and haggard. Mayhap by pressing on along an independent route, the milkers may discover and meet the hordes of longed-for ultimate consumers, to whose coming under higher living standards we all look for the justification of farm progress. The original dairymen were roaming, pastoral independents, and so they remain today. Selah!

And so, as the heaping snows melt and move away the top soil, and the mystic alchemy of nature renews its ceaseless summer wasting and restoring, let's be up and doing anyhow; for it's mostly an educative process as of old. Forget the mistakes of the past and scorn the muck they slather at us during the campaign to come.

Theirs may be a period of mud slinging, but ours will be a permanent piece of soil building. When *we* call for *more and richer dirt,* even the lilies of the field look up and smile!

A Few Whinnies

Curious Old Lady: "You've lost your leg, haven't you?"

Cripple (looking down): "Well, damned if I ain't."

Matrimony puts an end to more petting than all the police put together.

EATING PROFITS

"I sent my little boy for two pounds of plums and you only sent a pound and a half."

"My scales are all right, madam. Have you weighed your little boy?"

If your face can't get your picture in the papers, write a patent medicine testimonial; maybe your kidneys will.

A bewildered man entered a ladies' specialty shop. "I want a corset for my wife," he said.

"What bust?" asked the clerk.

"Nothin'. It just wore out."

Usher: "How far down do you want to sit, Madam?"

"Why, all the way, of course."

Father: "Willie, while you were away playing a new sister came."

Willie: "Where did she come from?"

Pa: "Oh, from a land far away."

Willie: "Gawd, another foreigner."

Reno, they say, now claims to be an important factor in the dairy industry. That's where the cream of the country goes to get separated.

NET RETURN

"So you met Alice today?"

"Yes, I hadn't seen her for ten years."

"Has she kept her girlish figure?"

"Kept it? She's doubled it!"

Small Girl Friend (to 8-year-old son of auto salesman): "Oh, I think you're lots better looking than your daddy."

Son: "I ought to be. I'm a later model."

"What kind of a fellow is William?"

"Well, the other night the lights went out in his girl's parlor and he spent the rest of the evening tinkering with the fuses."

FLUCTUATING MARKET

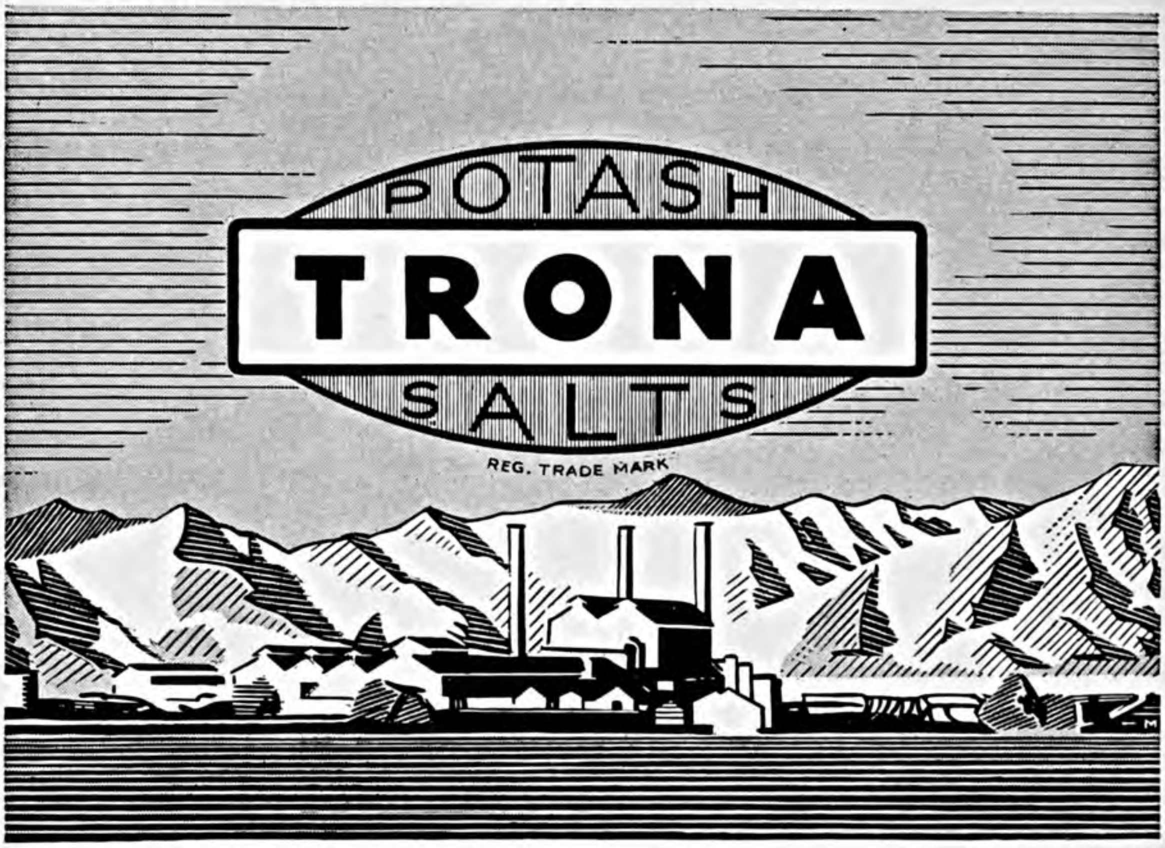
"Does your wife ever brag about you?"

"Oh, sometimes out in company; but she always goes to a lot of trouble to deflate me when I get home."

"Pa," expostulated Granny, on a visit to the city, "the way you stare at them gals legs is scandaleous. Them city folks thinks you'd never seen legs before." "Well, old lady," says Pa, "I wus jist beginnin' to think so myself."

"What is the difference between a model woman and a woman model?"

"One is a bare possibility—the other a naked fact."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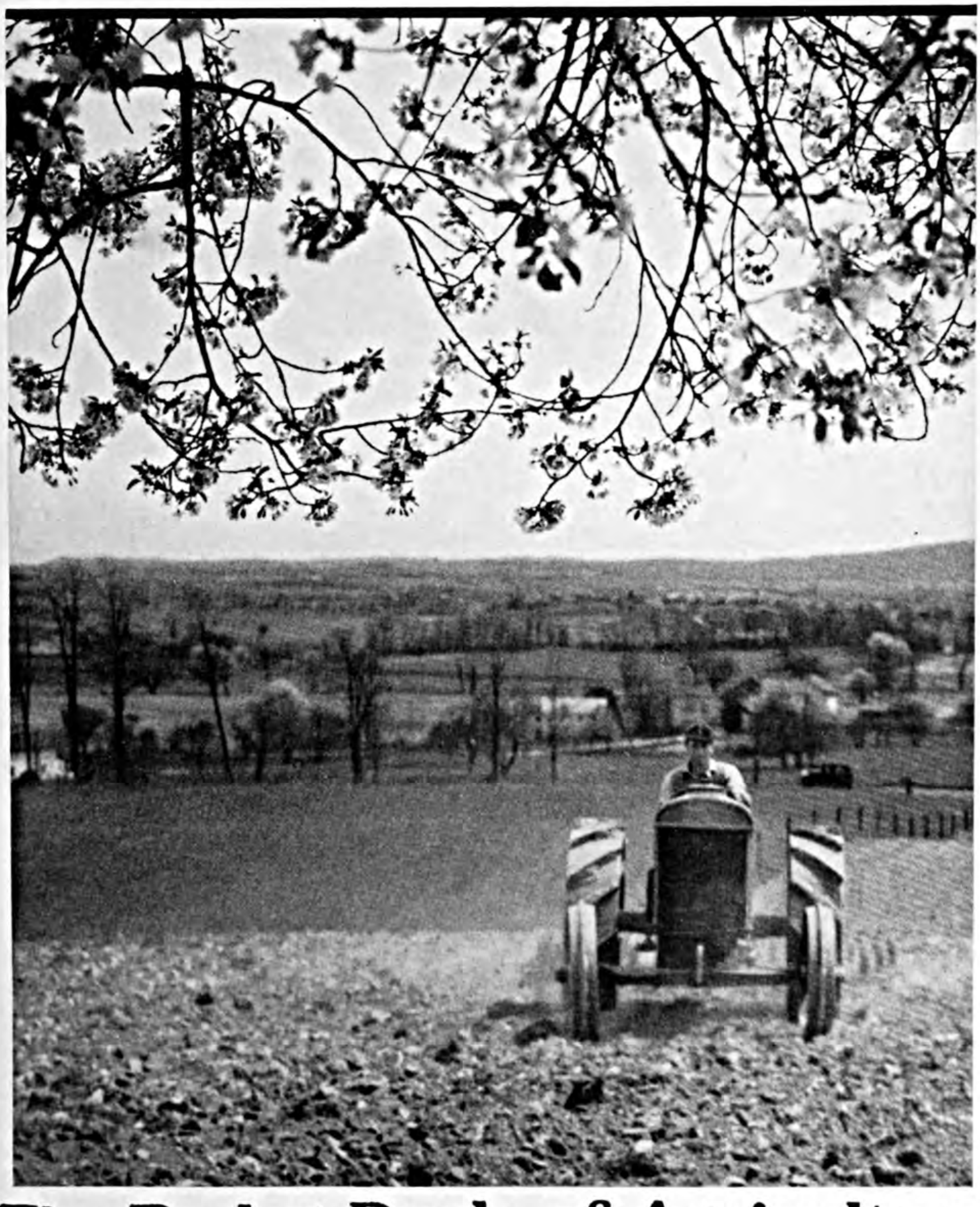

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

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TABLE OF CONTENTS, APRIL, 1936

American Potash Institute, Inc.

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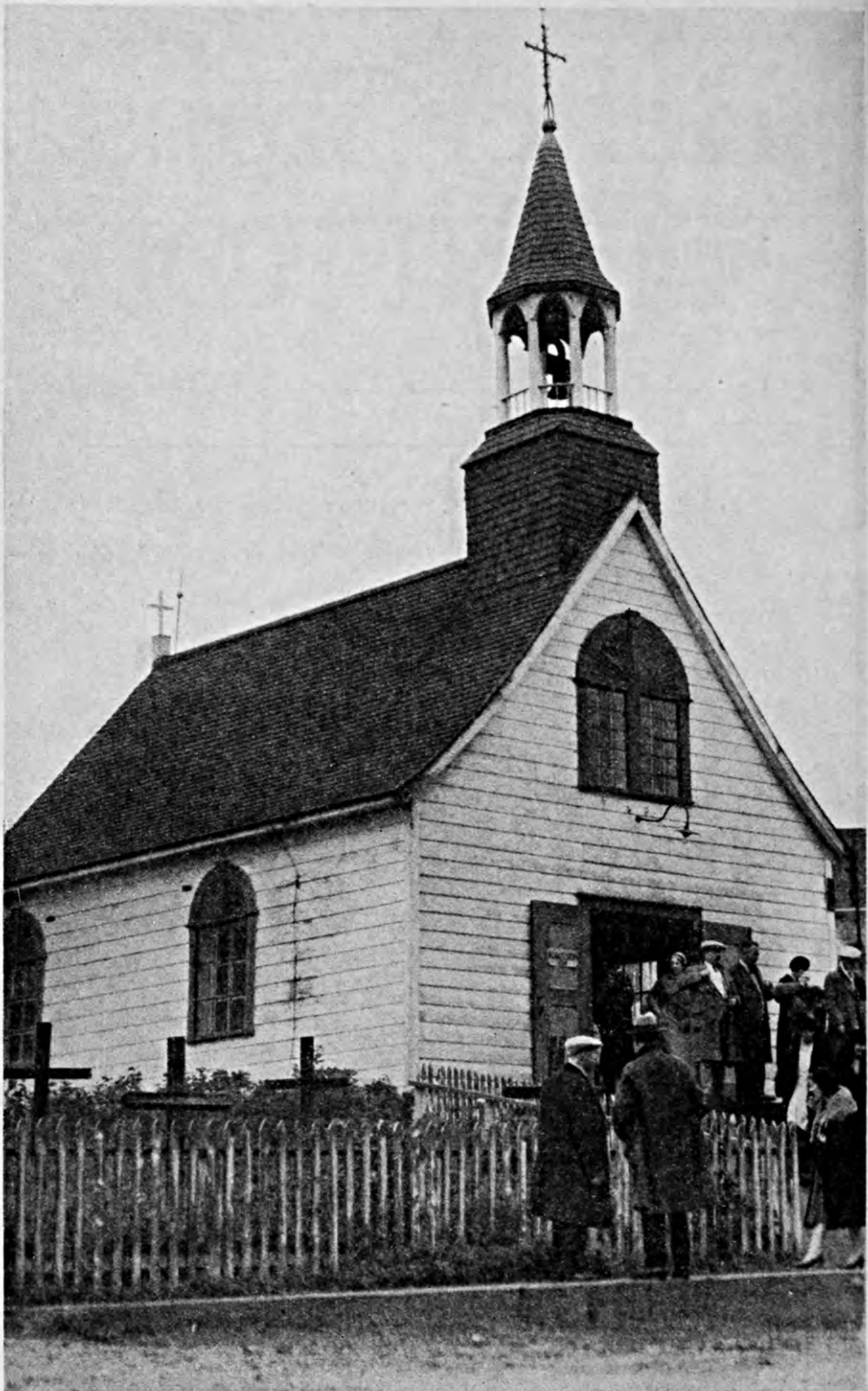
G. J. CALLISTER, *Vice-President and Secretary*



Services are still held at the oldest church in North America—Tadoussac, Quebec.

Better Crops with PLANT FOOD

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Showers, gullies, ditches, and mud—

Soaked Again

Jeff McDermid

APRIL puts one in a moist and spongy mood. It is then that we usually get the greatest abundance of one of the best public utilities which the world gets for nothing—rain water. While too much water in any one place at any one time is objectionable, there are plenty of folks who seem to thrive without it in any form, and who refuse to get into it or let it get into them.

Water reflects things, of course, and one of the things it reflects is the inconsistency of human impulses and the opposite extremes of life. My young son is perhaps as good a case as any, when he comes home with his neck neglectfully sooty and his feet efficiently soaked. Next summer he will show up every day with moist hair and clammy wrinkled hands, whereas no amount of colored porcelain, foamy tinted soap, and parental urging have overcome his sense of injustice toward the "plotters' Saturday night."

Until the summer dry wave of 1934, a favorite quotation of the meek and lowly was that "water from heaven falls alike on the just and the unjust." Since that memorable season we are apt instead to discount the effect of penitence and prayer in behalf of moisture, regardless of the certified credentials of the suppliant or his importunate endurance.

Absence of normal waterfall on our

continent in 1934 did more than curl my shingles, parch your parsley, and reduce the flowage of Niagara Falls. It turned benefit payments into crop insurance. It shook the foundations under planful economists and loosened the bolts in their comptometers. It shocked the "regimentors" and boosted the stock of soil science. It turned the distorted laments of consumers over fancied food scarcity through contracts into equally extravagant predictions of a universal desert and cacti in the corn-belt. It put the flustered weather bureau at the apex of the leased wire service. It forced Congress to admit that here was an emergency, my friends, which could not be alleviated by short debate and sudden voting.

PERHAPS it was that whimsical and disconcerting philosopher Xenophon Caverno of Missouri, whose remark at the Chicago soil conservation conference got me all stirred up, merely on water.

I cannot vouch for the idea's origin, there being so many of us engaged in tooting our horns in that hour of auspicious overture. At any rate, this solemn voice with the timber of the tundras and accents of alkali reminded the earnest foes of soil depletion and consumer deflation that crops wouldn't grow well where it is a case of considerable mileage to moisture, up, down, or sideways.

He did not exactly pronounce any doxology on the whole revival meeting, but he did inject the hunch that two crops of cowpeas after seven crops of cotton do not make a successful summer, unless you have a water table handy for the plant food to be spread out upon.

He probably didn't quite figure out how we can reduce plant water loss and conserve soil moisture capacity by shifting to hay crops, unless we do a generous amount of plowing them under. Although there isn't a single guarantee clause for a water supply in the new law, it can be locally administered so as to make it easier for plants to get what there is of it. Yet we must remember 1934. They can't turn on any spigots at Washington.

UP here in my state we get about a yard of rain-water during *almost* every year. Not a few of the sages up here decry the terrific waste of energy and enthusiasm, not to mention cash and cuss words, of trying to make chlorophyl and vitamins by arid agriculture. They forget that neither the Federal Government nor the states have any right to obstruct, interfere, interrupt, or otherwise deter or prohibit the sacred liberty of every American to call himself a farmer and to sow whether he reaps or not. Being thus unable to divert the playful propensities of such people from attempts at crop production, it becomes the duty of the republic to build dams so that water may sometimes be available and lend them money at fractional interest and no net security, so they can buy drought-resistant seeds and pay their water-rent. I predict that there will be worse and more of it when the high and dry states obtain fuller control of their soil-conserving funds. Local option, wet or dry, is sure to bring action.

But we can best approach this topic by what might be termed a sentimental seminar. A little review is not taboo.

THE supply of water in the soil itself and in the atmosphere in the form of humidity are the chief limiting factors in plant culture. Specialists tell me that there is usually plenty of sunlight, oxygen, and carbon dioxide, and that countless tons of the best mineral fertilizer are within command. Temperatures of air and soil water and the rate of wind velocity, of course, play a major role in the absorption and respiration rate of water in plant cells. The intake and outflow of moisture from root hairs to leaf stomata, both in degree and in volume, determine the adaptability of plants to environment all over the world.

Now men are inclined to insist on living where they choose, where land is cheap, or where elbow room is plentiful. Being thus located, they demand results when they stick something into the dirt. They prefer to pray for rain or sweat themselves into

a lather to save what few drops there are rather than to pay off the railroads' mortgages and salary sinecures for hauling them grapefruit, apples, cabbage, melons, and oranges, which are 90 per cent aqua pura.

DRY-LAND irrigators are as prone to follow certain ways of soil baptism as the other sinners who belong to various denominations. We have, therefore, those who believe in flooding, others who are saved by furrow pouring, and yet a third group whose faith lies in sprinkling. I may digress here to reveal that my own sturdy northern empire of rural integrity and agricultural acumen has irrigators in its midst!

One sect floods and the other sprinkles. Another group tried subirrigation, but they inadvertently struck an Artesian well strata, and now live by renting boats and selling bait. The flooding brethren operate sanded cranberry marshes and keep old Jack Frost guessing by the hydraulic method, unless they happen to oversleep some critical morning. They enjoy a benevolent sort of monopoly and actually have their business headquarters rather close to Wall Street—which information to the prejudiced may be like letting cats loose.

OUR sprinkler clan afford an interesting case. They grew bowlegged staggering around trying to add to the blotting qualities of their building-sand estates through a process of rapid feeding and drenching of livestock, and the subsequent incorporation of the alimentary residues to their granular ground. They even tried geese knee-deep in June grass and the lonely but talented bittern, to no avail. Their patient process of adding elemental excreta to make those thin soils spongy, so that symbiotic and anaerobic bacteria might hit their stride, in order that *Medicago sativa* would shove *Agropyron repens* off the premises and thus provide cheap protein for more animal metabolism, was—to come up for breath—a practical fizzle. It was not even as profitable as riding a whirligig with brass rings.

Finally, after thirty years of a misspent life, one man with vim and vision installed about 25 miles of overhead pipes and squirters, pumping his water from a reedy lake into storage tanks, and raising such truck as you never saw outside of nursery catalogs. His neighbors joined in to some extent, and today this community sells its lake water at fancy prices, wrapped up in nature's packages. They have quit hauling manure and use concentrated fertilizers to grow fruit and maintain their rotation meadows for plowing under.

Having disposed temporarily of the chaps who stay in places which require more water than the clouds pro-

(*Turn to page* 44)

Side-dress Corn With Potash

By Herbert L. Garrard

Lafayette, Indiana

PROFITABLE yields of improved quality corn have been obtained by side-dressing corn plants after the symptoms of potash hunger appeared in fields in northern Iowa and southern Illinois. The question as to whether remedies can be applied during the same growing season, when injuries due to potash starvation of young plants occur, seems to be answered in these experiments. Although in several cases the side-dressings of muriate of potash were made much later than would be done in ordinary practice, the starved plants recovered and yielded well in comparison with the untreated.

These results are, therefore, of interest, because increased attention is being given to the study of plant-food deficiency symptoms for many agricultural crops. Usually these deficiency symptoms are used to diagnose troubles and to suggest treatments for the next crop. In this report it will be shown that, if the symptoms of potash deficiency are recognized sufficiently early in the season, potash can be applied profitably to the crop on soils similar to those on which these tests were made.

Fig. 1—W. G. Meyer field, Webster City, Iowa, at the time of side-dressing with muriate of potash, July 15, 1935.

If the supply of available potash in a soil is very low, corn plants will become damaged very early in their growth and development, whereas, if the supply is relatively greater, the plants apparently may grow normally at first but will show signs of a failing supply of potash at any time up to the formation of the ears. Even during the maturation of the ears, the supply may become depleted and immature ears which display definite characteristics of potash starvation will result. Consequently, the symptoms may be seen in young plants or may not become strikingly evident until harvest time.

When young corn plants are growing without sufficient potash, the lowermost leaves become yellow, which is followed by a dying of the tips and edges of the leaves. This type of injury is commonly referred to as "marginal firing, or scorch." Often the starved plants die in this early stage. They may fail to grow into anything more than severely stunted and barren plants. The fields for the potash side-dressing experiments were selected when these early symptoms were found, as shown in Figs. 1, 4, and 6.

Fig. 2—W. G. Meyer field, August 31, 1935. Left: All plants stunted and showing brown marginal leaves. Right: Response to 200 lbs. muriate of potash applied as a side-dressing. All plants have normal green leaves.

If the supply of available potash proves inadequate for the increasing demands of larger plants later in the season, the older leaves will show injuries similar to those described above. The lower leaves develop the brown, marginal firing, and this injury may progress upwards and include most of the leaves on the plants. If the plants are still able to produce ears, they are usually chaffy and of low feeding quality, due to the failure of the kernels to fill out with starch. Such ears are short and tapering, with the tip kernels shrivelled. The plants frequently die prematurely. They become weak and may lodge or lean badly. The shanks bearing the ears become brittle and break easily, even under the weight of the immature ears or nubbins.

In order to determine whether or not potash would be beneficial when applied during the same season to corn plants showing signs of potash hunger, 15 experiments were inaugurated in Iowa, and 3 in Illinois. Fields were selected in each case where the young corn plants showed unmistakable signs of injury due to potash starvation. Figs. 1 and 4 show two of these fields at the time the potash was applied as side-dressing.

The problem of how to apply potash most effectively in the high-lime soils in Iowa is not definitely determined. It depends on whether the field is relatively uniformly "alkaline" throughout, or whether the high-lime areas occur scattered irregularly in the field. In most fields where the high-lime areas exist, the whole field will be benefited by the potash in the fertilizer used at planting time; but where the higher-lime areas exist, more potash is needed. This extra amount may determine the profits obtained from the crops in such fields.

These experiments were planned, not to find a supplementary method of applying fertilizers, but merely to discover whether potash could be sup-

Fig. 3—W. G. Meyer field. Response to 500 lbs. muriate of potash per acre 47 days after side-dressing. Very little effect on adjacent row.

Fig. 4—Henry Cahill field, Mason City, Iowa, at time potash side-dressings were made, July 16, 1935.

Fig. 5—Corn from 100 hills, October 20, 1935. Marketable corn in sacks; poor quality on ground. (See Table I.)

plied profitably to corn starving for this plant-food. Accordingly, the experimental side-dressings were made with a small hand drill on both sides of each row, following the marks of the inside shovels of the cultivator. The potash was located at a depth of 2½ to 3 inches. This approximates the placement which would be obtained by using the regular fertilizer attachment on a corn cultivator. The potash must be applied close to the plants in moist soil, if it is to become effective quickly. Surface applications of potash require time to become available for absorption by the plant roots.

In these experiments the side-dressings were made three to four weeks later than would be recommended practically. Much of the corn was knee high when side-dressed, and all of it showed medium to severe symptoms of potash hunger.

Within a month to six weeks the effects of the extra potash were very striking. The four rows which were side-dressed with muriate of potash grew rapidly and became tall and green between the rows of stunted corn, in which all of the lowermost leaves were badly "fired" and many of the upper, younger leaves showed the characteristic brown marginal "scorch."

One of the questions which arose during the progress of this work was "how close to the row and how much potash per acre could be used to side-dress the corn before injury to the plants might occur?" In these high-lime soils this question was practically answered on the farm of W. G. Meyer, near Webster City, Iowa. One row of corn was selected, and muriate of potash was applied as close to both sides of the row as it was possible to cultivate, at the rate of 500 lbs. per acre. Fig. 3 shows the very beneficial effect 47 days after the side-dressing was applied. You will note (in Fig. 3) that the row to the right of the treated row was not benefited. The side-dressings help mostly the treated rows of corn.

(*Turn to page* 40)

Fig. 6.—Henry Bruhn field, Cylinder, Iowa, at time of applying side-dressings of muriate of potash.

Negro farmers are interested in the fertilizer experiments at the Georgia Experiment Station.

Fertilizing Georgia's Cotton Crop

By R. P. Bledsoe

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FOR the past eight years the Georgia Experiment Station and the Division of Soil Fertility, U. S. Department of Agriculture, have conducted experiments in six locations in the state with different kinds and amounts of fertilizers. Forty-three different fertilizer treatments were used in the experiments. It will not be possible in this article to give more than a brief summary of the results obtained.

As would be expected, the application of increasing amounts of fertilizer resulted in increased yields of cotton. Taken by themselves, yields per acre had little practical significance, as the increased cost of the fertilizer often exceeded the value of the increased yield of cotton. Interpretation of results was, therefore, based on the profit obtained from the fertilizer and the profit per dollar invested. Costs based on present-day prices were as follows: nitrogen, 10.31 cents per pound; phosphoric acid, 6.62 cents per pound; potash, 3.43 cents per pound; seed cotton, 4½ cents per pound. The cost of hauling, handling, and applying the fertilizer was not included in the cost figures.

The average Georgia farmer applies about 261 pounds of a 4-8-4 (N-P-K) fertilizer (including top-dressing) per acre, which cost approximately $2.81, and obtains a yield of about 525 pounds of seed cotton. There is no direct way of telling how much profit

TABLE 1.—RATES OF APPLYING FERTILIZERS.

Fertilizer per acre	Pounds seed cotton per acre	Increase per unit of fertilizer	Profit per acre from fertilizer	Profit per dollar invested	Cost of fertilizer
No fertilizer	458	...	....	...	....
400 pounds 4-8-4* ...	733	275	$8.59	$1.87	$4.32
800 pounds 4-8-4	1,006	273	16.02	1.85	8.64
1,200 pounds 4-8-4	1,111	105	16.43	1.27	12.96
1,600 pounds 4-8-4	1,161	50	14.36	0.83	17.28
400 pounds 8-8-8	1,002	...	17.96	2.75	6.52

* N-P-K.

he obtains from this fertilizer. However, by using the figures in Table 1 it is possible to estimate that 261 pounds of fertilizer increase the yield 178 pounds of seed cotton and net him a profit of about $5.15 per acre. Of course, there is no such farmer as the "average farmer." This is merely a composite picture to show the general fertilizer condition in the state. Some Georgia farmers are using much more fertilizer than this, many are using less, some none at all, and a few too much.

Compare the figures given in the above paragraph with those given in Table 1. Four hundred pounds of a 4-8-4 gave a profit of $8.59, and 800 pounds gave a profit of $16.02 and a return per dollar invested equally as good as the 400-pound rate. With the above 800 pounds the profit per acre was good, but the profit per dollar invested decreased sharply.

A 4-8-4 fertilizer (without top-dressing) is not the most economical fertilizer to use under cotton, but when used at the rate of 800 pounds per acre is fairly satisfactory, except for its high cost. When used at any other rate it is not satisfactory. It is evident, therefore, that the rate per acre and the analysis must be considered together in evaluating fertilizers. In other words, we must consider pounds of plant food per acre which combine both rate per acre and the analysis. The number of pounds of plant food in 800 pounds of a 4-8-4 can be obtained by multiplying pounds of fertilizer per acre by the analysis of the fertilizer and pointing

These plots have been well supplied with nitrogen, but are lacking in potash and phosphate. Note the poor stand of cotton.

off two decimal places. Thus 800 pounds of a 4-8-4 contains 32 pounds of nitrogen, 64 pounds of phosphoric acid, and 32 pounds of potash.

In Table 2 is given a brief summary of the results obtained in the experiment. The table shows that the greatest increases were obtained from nitrogen. Where only 16 pounds of nitrogen were applied per acre, the profit per acre was only \$8.89 as compared with \$15.67, where 32 pounds of nitrogen were used. Where 48 pounds of nitrogen per acre were used, a small increase in profit (\$1.54) was made. However, this increase was obtained only where the phosphates were also increased to more than 32 pounds per acre, which greatly lowered the profit per dollar invested.

The application of sufficient nitrogen is the key to the proper fertilization of cotton. When applied at the rate of 16 pounds per acre, there was no combination of phosphate or potash which would give a profit per acre as compared with those obtained from 32 pounds of nitrogen. Judging by the results obtained from 48 pounds of nitrogen per acre, 32 pounds appear to be about the minimum for best results, and a slightly heavier rate between 32 and 48 may be the best.

Nitrogen applied after chopping will often cause the cotton to grow too big and to fruit late. This can be avoided by applying all top-dressing nitrogen on or before chopping time.

The best rate of applying phosphoric acid was 32 pounds per acre. Applying more phosphate than this did not increase the profit per acre and greatly decreased the profit per dollar invested and the cost of the fertilizer.

It should be remembered in considering the results obtained from potash, that 16 pounds of this element now cost only about 55 cents. And there are many soils both in the Piedmont and the Coastal Plain which will not respond properly to other fertilizers, unless a liberal application of potash is used. In the soils used in this experiment the first 16 pounds of potash gave a profit of 300 per cent, the next 16 pounds gave a profit of 50 per cent, and the next two 16 pounds paid for itself. It seems, therefore, safe to recommend 32 pounds of potash for average conditions.

Results obtained in Table 2 indicate that an application of 32 pounds of nitrogen, 32 pounds of phosphoric acid, and 32 pounds of potash is the most profitable fertilizer combination

(*Turn to page* 43)

TABLE 2.—RATES OF APPLYING NITROGEN, PHOSPHATES, AND POTASH. AVERAGE OF 918 EXPERIMENTAL TRIALS.

Rate of fertilizer in pounds per acre	Pounds seed cotton per acre	Increase per unit of fertilizer	Profit from fertilizer	Profit per dollar invested
No fertilizer	458	...	...	...
Av. all plots receiving 16 lbs. nitrogen*	811	178	\$8.89	\$1.27
" " " " 32 " "	998	+187	15.67	1.81
" " " " 48 " "	1,069	+ 71	17.21	1.67
" " " " 32 " phosphoric acid	922	43	14.38	2.21
" " " " 64 " " "	963	+ 41	14.11	1.63
" " " " 96 " " "	992	+ 29	13.28	1.23
" " " " 16 " potash	943	50	13.75	1.70
" " " " 32 " "	961	+ 18	14.00	1.62
" " " " 48 " "	974	+ 13	14.02	1.53

* Equivalent to 19.5, 39, and 58 pounds ammonia.

The Inquiring Mind *and the* Seeing Eye

By Alister B. Alexander

Madison, Wisconsin

"LAST year I visited the birthplace of my parents in the mountainous section of Switzerland, and now I realize why my father thought Iowa was too flat." As we sat in his office in the Soils Building at the University of Wisconsin, Emil Truog told me of his early life and of his work in soil science.

"I was born on a farm at Independence, in Trempealeau county, Wisconsin, on March 6, 1884. My father, Thomas Truog, was born in Switzerland and, after coming to the United States, worked as a carpenter up and down the Mississippi River. In the 1850's long before there was a railroad in many parts of Iowa, he and a companion walked across that state from east to west, looking for suitable land on which to settle. But the Iowa prairies seemed too level after the native Switzerland, and they came to Wisconsin where my father finally bought a farm in a rolling section of Trempealeau county. He married Magdalena Keller, who also was born in Switzerland, had come to this country at the age of 11, and who still lives on the old home farm with one of her sons." Thus we introduce to you Emil Truog, the son of this pioneer Swiss couple in northern Wisconsin.

Emil Truog, while attending the district schools of Trempealeau county, worked on the farm between times and liked it. After finishing the grades he went first to the Independence High School, which at that time offered only a junior high school course, and then to the one at Arcadia, where he finished his high school work. During all of this time the boy helped with the farm work and dreamed of the time when he might be able to attend the College of Agriculture, which he read about constantly in the farm papers. He learned the different problems that arise on a general farm but always was more interested in plants than in animals and developed a great desire to study soil science, a desire in which he was encouraged by his teachers. With that thought in mind he enrolled in the Wisconsin College of Agriculture at Madison and received the degree of Bachelor of Science in Agriculture in 1909. From 1909 to 1912 the young student acted as an assistant in the Soils Department, carried on graduate studies, and was granted his Master's Degree in 1912, from which time until 1916 he was an instructor. In 1917 he became an Associate Professor, and in 1921 Professor of Soils, the position he now holds.

Famous for Soil Test

In 1925 Professor Truog was married to Lucy Price Rayne, the daughter of a pioneer lumber family of Madison. In the living-room of their home, which is a large Colonial house built by the Rayne family, are pictures of their three attractive children, Nancy Price, who is eight, and the twins, John Rayne and Martha Rayne, who are six years old.

One of the earliest outstanding soil projects with which Emil Truog's name is associated is his soil acidity tester, first developed in 1911. In this device, known as the Truog Test,

EMIL TRUOG

he devised a portable soil acidity tester which could be used for making tests on the farm. The apparatus is composed of: (1) A brass alcohol heater, consisting of an alcohol lamp with a three-ply wick and a circular wind guard, which also acts as a support to hold the flask at the proper height from the flame. The lamp has a perforated disk radiator which protects it and the alcohol from undue heating. (2) A 300-cc. pyrex glass Erlenmeyer boiling flask with a 100-cc. capacity mark. The inside diameter of the neck is one inch. (3) A soil measuring cup or scoop having a capacity of 9 cc. (4) A brass spoon having a capacity of 0.8 cc., for measuring chemicals. (5) An iron spatula for mixing and measuring soil samples and chemicals. (6) A container for distilled water. (7) A set of chemicals consisting of a bottle containing an intimately ground mixture of 10 parts of neutral barium chloride to 1 part of neutral zinc sulfide, and a vial containing strips of lead acetate test paper. (8) A towel. (9) A box of matches. (10) A standard acidity and lime chart for determining degree of acidity and amount of lime needed under different conditions. (11) A carrying-case.

The entire apparatus fits into a small, wood carrying-case and can be used under field conditions anywhere. The test made with this equipment indicates not only the presence of acidity, but also the degree of acidity and amount of lime needed.

Simple to Use

In using the apparatus, the operator selects a representative patch of a few square rods and takes a little soil from the plowed layer in 5 or 10 places in this small area, making altogether a sample of about one-half cupful. Samples are placed in clean paper or cloth sacks which may be marked. Grass, manure, and surface rubbish are scraped off before the sample is taken. When fields vary widely in fertility or have many knolls and low places, it is best to take several entirely separate samples from different parts of the field. If part of a field is high and part low, separate samples should be taken, and in no case should soil from the high land and the low be mixed in making up a sample. Different parts of a field often vary greatly in acidity. When the samples have been taken, the operator removes the water can and brass heater from the case, adjusts the wick, places the lamp in the heater, with the perforated disk radiator over the neck of the lamp, and hooks the triangular flask support over the top of the heater, and the tester is ready for use.

In making a soil test with the Truog tester, a mixed and pulverized soil sample is placed in the flask. To this is added a level spoonful of chemicals. Enough distilled or rain water is added to bring the contents of the flask up to the 100-cc. mark. The flask is then shaken and placed on the heater, and it begins to boil in about 5 to 7 minutes. After the contents have boiled exactly 1 minute, a strip of lead acetate paper, which has been moistened with two drops of water, is pressed firmly over the top edges of the flask and is allowed to remain in place while the contents of the flask boil another 2 minutes. The test paper is then removed. If the soil is acid, the under side of the paper will be darkened. The greater the acidity the darker will be the paper. The test paper is dried by placing it on the partly cooled flask-support. It is then compared with the standard acidity and lime chart, and the degree of acidity and the amount of lime needed can be accurately determined.

By making field tests possible, and with a procedure so simple that almost anyone can operate the device, the Truog Test has done a great deal to promote the testing of soil. If Emil Truog had done nothing else of importance, this apparatus alone would survive as an important aid to the American farmer.

Fertilizer Application

Among the many theories advanced by Professor Truog was his idea that the broadcast method of applying fertilizer was wrong for many crops. During his studies he found that fertilizers for corn applied in the hills or drill rows gave much better results, as did the same methods applied to potatoes. He also found that the broadcast method gave better results for certain other crops. In 1925 the National Fertilizer Association provided a fellowship for research work in this connection. The studies were carried out by Emil Truog and associates, and the findings published in Bulletin 65 of the University of Wisconsin. In this we find that "fertilizers are added to soils for the purpose of supplying plant-food elements which are present in too small an amount or in an unbalanced proportion. Aside from increasing yields, fertilizers when properly used may produce a number of desirable results, as follows:

1. The quality of the crop may be improved.

2. An early growth, root development, and hardiness may be promoted.

3. Lodging may be lessened.

4. Maturity may be hastened.

5. Danger of injury from frosts and other unfavorable weather conditions, as well as from insects and diseases, may be lessened.

"The present investigation was undertaken for the purpose of studying the various effects which fertilizers have on crops. It was soon found that the method of applying the fertilizer has a very important bearing on the results that may be obtained, and hence a considerable portion of the present investigation may be devoted to a study of methods of application.

"Fertilizer usage may be divided into two kinds. There is first the use of fertilizers, especially phosphates, in comparatively heavy broadcast applications for the purpose of building up the basal supply of essential elements which are known to be too low in the soil under consideration for practically all crops. Second, there is the use of fertilizers in a concentrated way in the hill or drill row to supply special needs of certain crops and conditions, so as to produce the various favorable effects mentioned. By using a fertilizer according to the second method it is possible to surround the young plant with a much higher concentration of essential elements than is practicable with the ordinary broadcast applications, and hence it should be possible to promote early growth and some of the other favorable effects on the young plant with much less fertilizer and at a less cost than with the broadcast method.

"The use of fertilizer in the hill or drill row, however, involves certain problems which must be recognized if

(*Turn to page 35*)

Improving Pastures In New Brunswick

By C. F. Bailey

Superintendent, Experimental Station, Fredericton, N. B.

PASTURE investigations at the Dominion Experimental Station, at Fredericton, have provided rather surprising results. When they were begun in 1923, basic slag was being advertised extensively as a pasture fertilizer. At that time there did not seem to be any reason for doubting the value of this product, because the soils in the Maritime Provinces are practically all low in phosphorus and have a low pH. It also had been used extensively in Europe as a pasture fertilizer.

The tests first started at Fredericton were designed to determine the value of basic slag, superphosphate, and lime as pasture dressings. Ground limestone was used alone at 2,000 and 4,000 lbs. per acre; basic slag was applied at rates ranging from 250 to 1,000 lbs. per acre; superphosphate was applied at rates providing the same quantity of phosphorus as the slag. Similar quantities of superphosphate were used in combination with 1,000 and 2,000 lbs. of limestone per acre. All plots were in duplicate.

While the yields were slightly larger than the checks in all cases, the increases were not sufficient to justify the use of basic slag, superphosphate, or lime; also the stand of plants remained weak and thin, and a heavy stand of moss gradually became established. A grazing experiment was established adjacent to these plots in which basic slag was used at the rate of 750 lbs. per acre the first year; three years later an additional 750 lbs.

Pasture with the forage kept under proper control throughout the grazing season.

of basic slag were applied. Four years' records showed practically no difference between the treated and untreated fields.

Immediate Results

In 1929, a new series of plots was established to determine the value of slag, superphosphate, and lime when applied to newly seeded areas, with the results much the same as in the former experiment. One range of these plots was top-dressed with 100 lbs. of nitrate of soda, 280 lbs. 20% superphosphate, and 100 lbs. muriate of potash per acre before the 1932 grazing season. These plots improved almost at once, and produced 1,424 lbs. of dry matter per acre in excess of the checks that year, and an average increase of 1,219 lbs. of dry matter for the past four years.

The results from the use of nitrogenous fertilizers alone on pastures also have been disappointing. A top-dressing of 100 lbs. of nitrate of soda per acre, applied each spring for four consecutive years, gave an average increase over checks of only 70 lbs. of dry matter per acre. Adjoining plots, with 280 lbs. 20% superphosphate and 100 lbs. potash per acre added to the nitrate of soda each year, produced an average over the checks of 1,315 lbs. of dry matter per acre during the same period. It is also of interest to note that when these minerals were applied without the nitrogen, the yields over the check averaged 898 lbs. of dry matter per acre. To put it another way, if we value the fertilizer used at 1935 prices, the increase of dry matter over the check, from plots treated with nitrate of soda alone cost $50 per ton, as compared with $8.71 per ton dry matter when a complete fertilizer was used. When only superphosphate and potash were used, the increase of dry matter over the check cost $8.86 per ton.

In 1932, a project was begun to determine the amount of potash required per acre in a complete fertilizer for best results when applied to pastures. Results of four years' work would seem to indicate that an annual application of 100 lbs. of muriate of potash will give somewhat better results than when 50 lbs. are applied annually. For example, the yield of dry matter over the checks when 100 lbs. were applied, was an average of 1,587 lbs. whereas, the yield of dry matter when 50 lbs. were applied, was 1,151 lbs. If put on a basis of cost, we find that the increase of dry matter over the checks cost $7.22 per ton in the former case and $8.65 per ton in the latter.

Apply Potash Annually

When 280 lbs. of 20% superphosphate and 100 lbs. of nitrate of soda were used without the addition of potash, the yield over the check was only 589 lbs. of dry matter per acre, and the cost of the dry matter produced over the check was $14.36 per ton. This experiment also seems to indicate that there is very little residual effect from potash the second year. In other words, it would appear to be good practice to apply small amounts of potash every year rather than liberal amounts every two, three, or four years.

Earlier in this article the writer referred to an unsatisfactory response received from lime when applied to pasture plots alone and in combination with superphosphate or slag. Later investigations seem to indicate that more encouraging results may be secured from the use of lime on pasture lands with a low pH, provided a complete fertilizer is being used.

In 1930, one half of each of the experimental paddocks used for grazing experiments was limed at the rate of 2,000 lbs. of ground limestone per acre. While no improvement has been observed by the naked eye, the caged areas gave an average yield of dry matter for three years of 7,652 lbs. per acre on the limed area, compared with 6,804 lbs. per acre on the unlimed area. The same results have been secured from mowed plots where a complete fertilizer was used, but in no case has a satisfactory response been secured from lime when applied alone with superphosphate.

the season's growth is secured during the flush period of growth, whereas, the year the complete fertilizer is applied, the yield of grass will be much better distributed over the pasture season. The following table giving

This pasture illustrates the effects of under-grazing.

While the results of the work at Fredericton are quite definitely in favor of a complete fertilizer for pastures, yet it is difficult to state the proper amount that should be applied per acre for the most economical results. Up to the present time this station has been applying 280 lbs. of 20% superphosphate and 100 lbs. of muriate of potash per acre every two years, and 150 lbs. of nitrate of soda annually to all experimental paddocks used for securing grazing records. While these pastures have been developed to a high state of perfection by this treatment, there is experimental evidence to show that the present fertilizer treatment could probably be improved upon.

To begin with, potash should be applied annually, if we are to be guided by the results of experiments previously referred to. It is also found that the year the nitrate of soda is applied alone, a larger percentage of

the results secured from plots top-dressed with 240 lbs. superphosphate 20%, 75 lbs. of muriate of potash, and the equivalent of 160 lbs. of nitrate of soda in 1933, and the same amount of nitrogenous fertilizer alone in 1934, illustrates the difference in growth which is apparently due to the fertilizer treatment.

1933 COMPLETE FERTILIZER

Date Cut	Pct. total increase in each cutting
June 6	48.46
June 29	24.01
August 5	17.87
September 14	9.66

1934 NITROGENOUS FERTILIZER

Date Cut	Pct. total increase in each cutting
June 7	88.94
June 28	3.05
July 30	7.46
September 15	0.55

NOTE: Both 1933 and 1934 were dry summers.

(*Turn to page* 38)

Mr. Ebe's Side-line Is Certified Seed

By C. A. Whybark
Puyallup, Washington

POTATO growing is one of the leading agricultural industries on the Pacific Coast, and requires seed potatoes of highest quality. This need is being met by numerous growers who now produce certified seed by keeping their fields free from disease and pests, and producing uniform, well-shaped stock which is true to type.

Oscar Ebe, of Custer, Washington, is one of the outstanding growers of certified seed potatoes in the Pacific Northwest. For a number of years he has been growing the crop as a side-line on his dairy farm in Whatcom county, Washington, a locality well suited because mosaic and other virus diseases are easily detected and insect pests are not numerous.

Oscar Ebe, showing his alfalfa field before first cutting.

Mr. Ebe has made a practice of using a clover or other meadow for potatoes, as he finds they do better following sod than following either small grain or corn. Best results have been obtained by plowing the land twice. The first plowing is done in the fall, to a depth of about three inches. In the spring the land is double-disced as soon as it can be worked. The second plowing is done shortly before planting, at a depth of about eight inches. The land is then disced again and harrowed until in good condition for planting.

The seed is treated with corrosive sublimate and cut in 2-oz. pieces. About 1,000 lbs. of seed are used per acre. The crop receives shallow cultivation as often as necessary to conserve moisture and keep down weeds. When plants are from 4 to 6 in. high, they receive their first roguing. Every doubtful plant is removed during the growing season.

Mr. Ebe grows both certified White Rose and Irish Cobblers. He prefers the White Rose, as this variety yields more heavily, keeps longer in good condition, and is adapted for both late and early planting. Enough seed is planted in units to furnish seed for his next season's crop, and special care is given this plot. Through hill selecting, unit planting, and careful roguing, he has built up a high-yielding strain of both varieties.

The use of fertilizers high in potash

A perfect stand and uniform growth of certified White Rose potatoes on the Oscar Ebe farm.

has proven a very favorable influence on the production of certified seed. Applications of such fertilizers help the potato plants to resist diseases and produce uniform tubers of true type.

Mr. Ebe says, "I have been using commercial fertilizer containing potash for the past 10 years and have always found good results on my upland, sandy loam soil. Very good results have also been obtained on alfalfa with fertilizer containing a high percentage of potash. I now have 10 acres of alfalfa where a few years ago it was thought alfalfa could not be grown."

His convictions about the use of potash and fertilizer in general are not based on guesswork, but upon fertilizer tests which he has made in the past. The results of one of these tests on potatoes are shown below.

The present fertilizer program on this farm consists of 9 or 10 loads of farm manure supplemented with 1,000 lbs. of 3-10-10 mixed fertilizer per acre. The manure is spread as convenient, and is plowed under at the time of the second plowing. The commercial fertilizer is applied at planting time with a fertilizer attachment.

"Since using mixed fertilizer high in potash together with certified seed," Mr. Ebe states, "I find my yield is about double that which I used to consider an average crop. I get a yield of 10 or 12 tons per acre, and the potatoes are smoother and more uniform than I can get without the use of potash. I also find that the plants withstand dry weather better."

Local demand for the certified seed produced on this farm has always been good, and Mr. Ebe is now developing a fine reputation in outside markets, such as Eastern Washington and California, for his Irish Cobbler and White Rose varieties. He has recently acquired a warehouse and storage facilities in the city of Bellingham, Washington, to accommodate this profitable side-line of his, which the intelligent use of fertilizer has helped to establish.

Per Acre Treatment	Yield Per Acre in Lbs. Marketable	Culls	Per cent Culls	Increase Lbs. Marketables
Without fertilizer	7,922	1,281	14%	....
800 lbs. 3-10-10	10,500	1,190	10%	2,578
800 lbs. 3-10-15	11,610	300	2½%	3,688

Harvesting operations in southern Indiana. The sweet potatoes are field graded—the No. 1's are picked up first, and after curing are graded again before going on the market.

Hoosier-grown Sweets Meet Market Demands

By W. B. Ward

Extension Horticulturist, Purdue University

VARYING amounts and analyses of fertilizer have been used from time to time on sweet potato soils, and various results have been obtained. Perhaps no two sections of the sweet potato area in the United States have the same soils or climatic conditions and, therefore, the fertilizers and the amounts applied per acre differ.

For a number of years the general recommendation for Indiana sweet potatoes has been 500 to 600 lbs. of 2-8-16 or 3-9-18 per acre applied in the row. This amount of fertilizer, as a rule, is applied from 3 to 10 days before plant-setting time, yet occasionally some grower omits the row application and side-dresses the plants 10 days to 2 weeks later with 750 to 1,000 lbs. of the same analysis. Good results have been obtained through these methods of fertilization. Some soils, however, require a different treatment as to the amount and analysis of fertilizer, depending somewhat upon the soil-building program used by the grower. A good yield of quality sweet potatoes is what the grower desires.

The most commonly grown variety in Indiana from the commercial standpoint is the Little Stem Jersey, and the yields have been comparable to the yields from other states and other varieties. When the average grower uses average methods, the results are easily tabulated, as the yields will be in the 100-bushel group with about 50% of the potatoes saleable as No. 1's. The better grower uses better methods, studies his market, takes better care of his crop, and in the end, for a few extra dollars spent for fertilizer, his yields are in the 300-bushel class with the sweet potatoes grading from 75 to 90% No. 1's.

Alfred Owen, Poseyville, is a contractor and, as a side-line in 1934, planted 22 acres to sweet potatoes. His sand farm was better than the average for fertility, yet at harvest time he gathered only 800 bushels of what he called "miserable" potatoes. Owen knew that in his contracts business methods had to be used, and that some slip on his part might spell disaster. After the experience with his sweet potato crop, he wondered why the same business principles used in his other work couldn't apply to sweet potato production.

One field of 8 acres looked promising for his 1935 crop, but he didn't think he could get enough sweets from that small an acreage. He wanted about 2,000 bushels of marketable sweets, and unless better methods of growing would help insure a good yield, he was going to plant more acres. In going over the past history of one field, it appeared as if here was a place for a good demonstration on the uses of additional fertilizers. This 8 acres was in pasture in 1932 and 1933, and sand pasture is not much. During late fall of 1933 and the spring of 1934, 110 loads of manure had been scattered over the field. This field was then plowed and planted to cowpeas. The peas grew well, rotted down in the late summer, and in early fall a cover crop of rye was seeded to keep the sand from blowing and for additional organic matter. This culture looked promising for a high yield in 1935.

Samples of sand were taken in March and tested for acidity, available phosphoric acid, and potash. The pH was 6.5, phosphorus medium, and potash high plus. At this point Owen made the remark that it would be nice if he could raise 2,200 bushels from the 8 acres and just reverse the conditions of the past year when it was 22 acres and 800 bushels. The question then was what to do next, what to fertilize with and how much, or was any additional fertilizer necessary. The recommendations were a mixture of 200 lbs. of 20% phosphate and 300 lbs. of muriate of potash per acre

Our cooperator, Alfred Owen, with a sample of his sweet potatoes. Although higher yields were produced in Indiana in 1935, no other grower got the thrill from his crop that Owen did.

The mulched area is in the foreground. The light spot to the right shows the straw.

drilled in on the rye and plowed under. Owen wanted to mix his own fertilizer in his concrete mixer, and an 0-8-30 resulted. Six hundred pounds per acre were drilled in on March 5, with the exception of three drill widths wide. The field was plowed the first part of April, and planting operations began on May 10. A transplanter was used.

To aid in the control of stem rot or wilt, all rooted stems were treated with an organic mercury compound. This gave a uniform stand throughout the season, as only four infested plants were found in the 8 acres. These plants may have resulted from a few transplants that did not receive the root treatment.

The unfertilized area was plotted with (a) 3 rows, no fertilizer; (b) 3 rows, 600 lbs. of 2-8-16 fertilizer per acre. Three rows on one side had the same application in the row plus the previous 600-lb. application of 0-8-30. One hundred feet of two plots (a and b) were mulched with straw on June 17. Previous records on mulching sweet potatoes with straw gave very promising results.

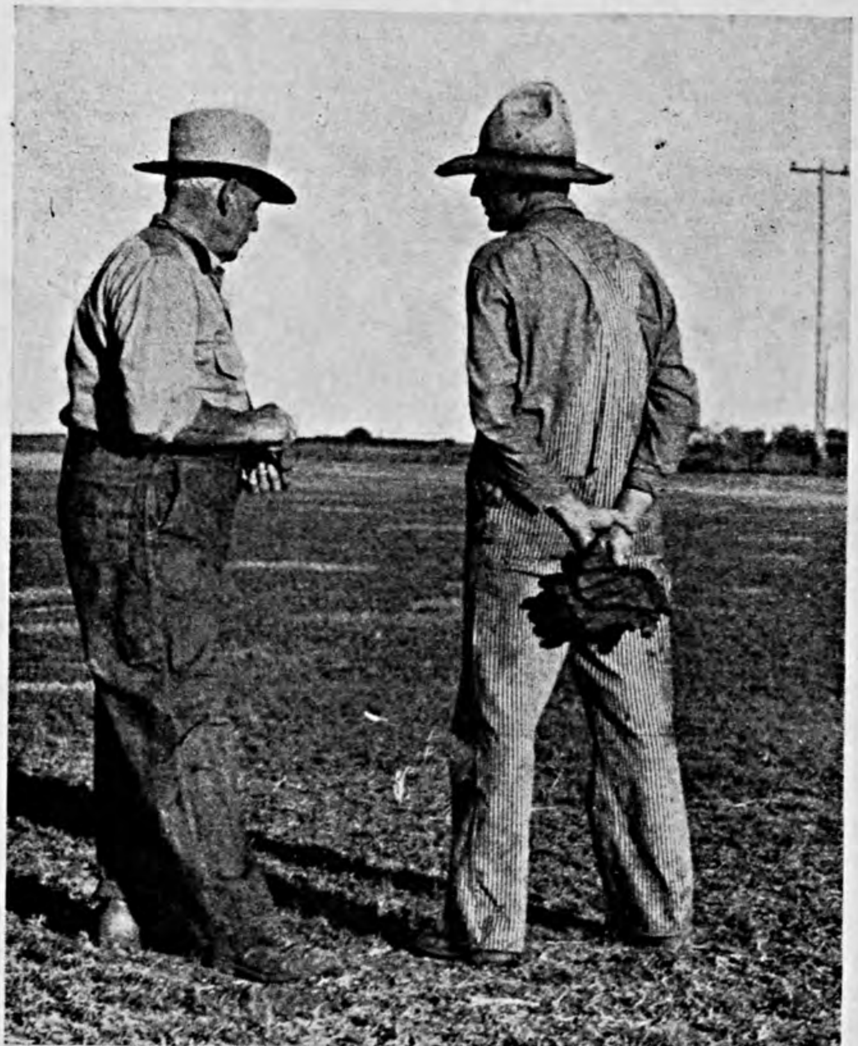
The 1935 growing season was not very favorable because of the lack of rainfall in this section and also some exceptionally warm weather. Very little difference was noted in the growth of vines throughout the summer, and the plant-tissue test, August 22, indicated all plots low in nitrogen but high in potash and phosphorus. One good rain came in early September, but an uncalled-for and unexpected frost the first of October stopped further development of the roots. Harvesting operations began on October 14. As the plow was turning out the first rows on the far side of the field, Owen knew that his ambition was a reality or so close to it that it would make but very little difference. Bright, smooth, chunky sweet potatoes began to show up on top of the sand—a high percentage of No. 1's and not many 2's. The field averaged 271 bushels per acre and came so close to the 2,200 bushels that Owen made this remark, "The only way to grow a good crop of sweet potatoes is to have a crop failure the year before."

The sweepstakes ribbon for the bushel exhibit at the Tri-State Fair and Sweet Potato Show at Evansville, Ind., last fall was awarded to Owen, and the same sample won sweepstakes over all sweet potato entries.

(*Turn to page* 34)

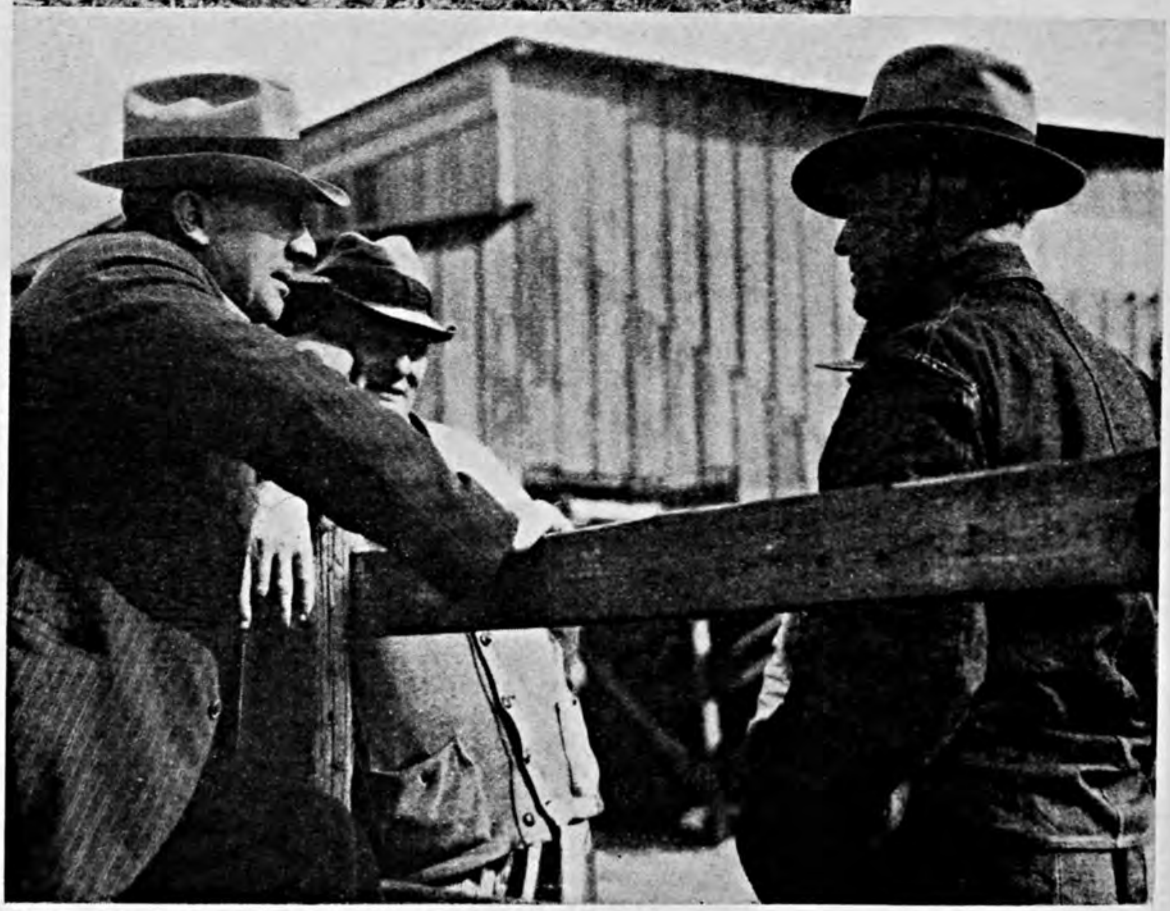
Pictorial

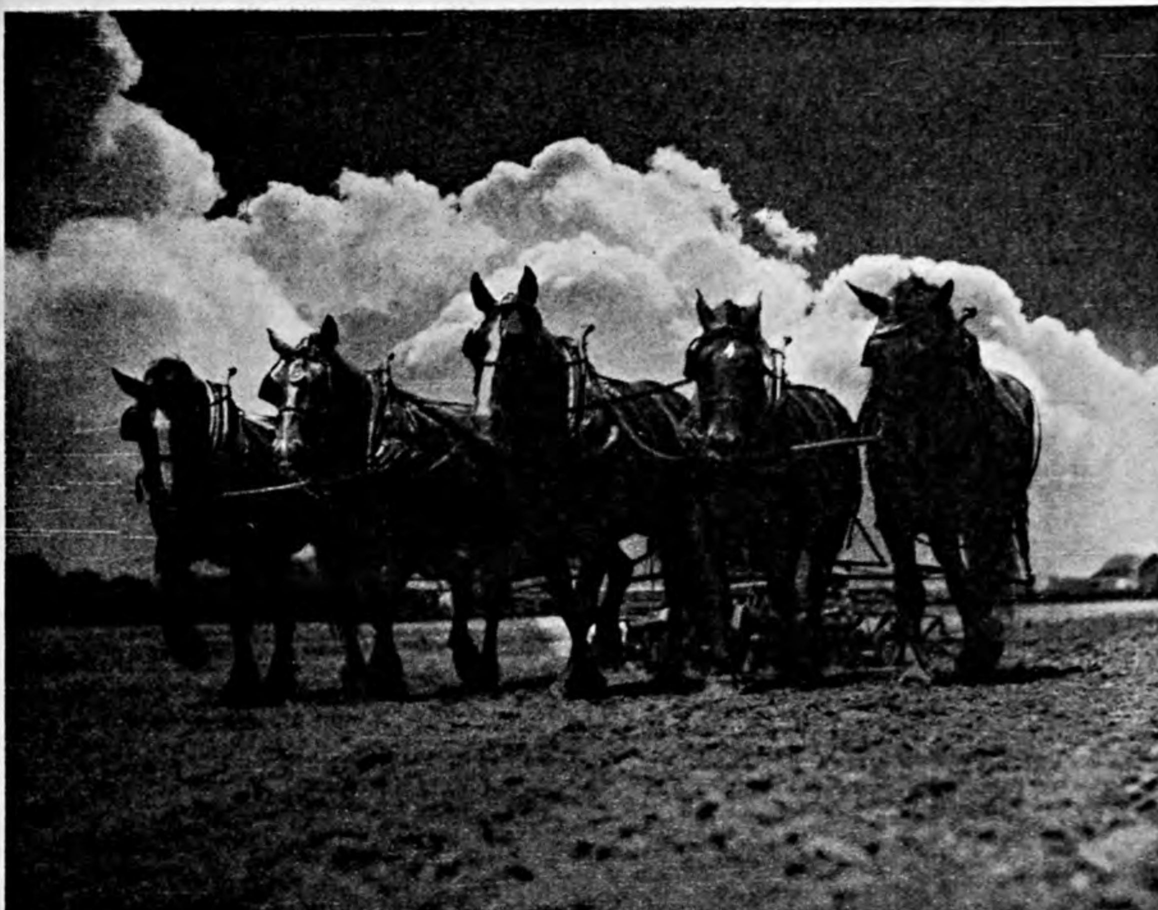
"WANNA BUY A DUCK?"



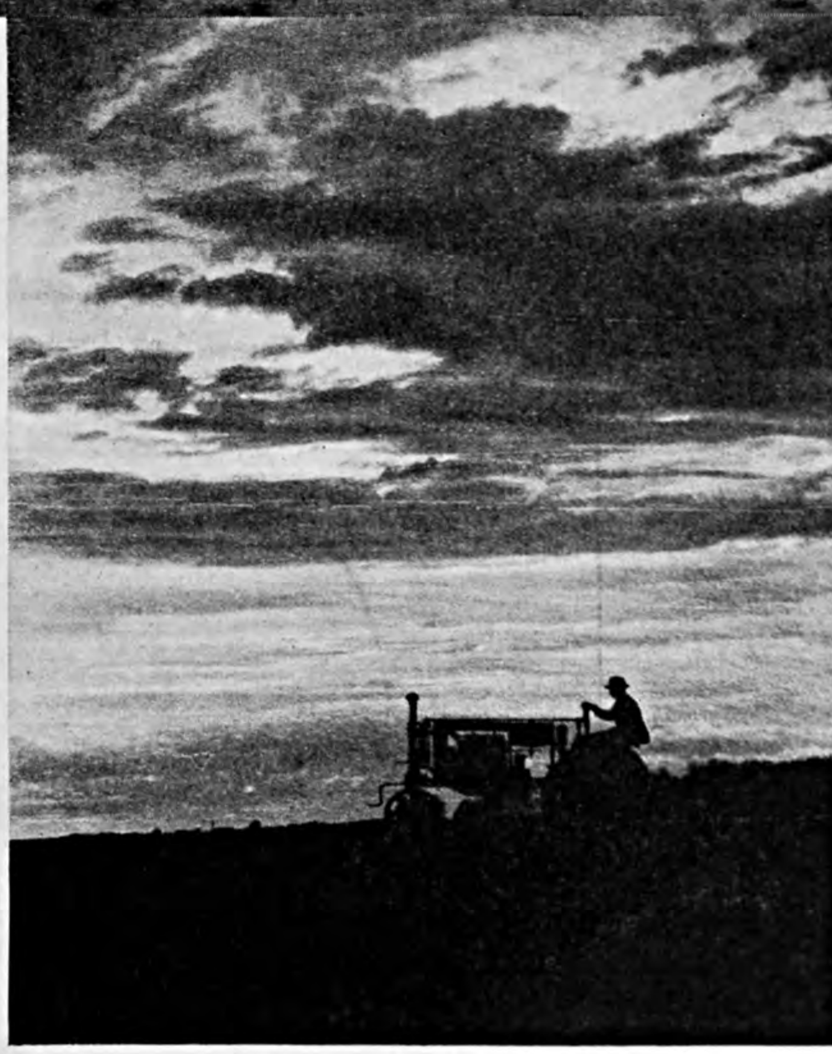
Left: "Well, I don't know, John, I believe I'd have used more fertilizer."

Below: "I'm willing to bet he'll carry this county by eighty votes."

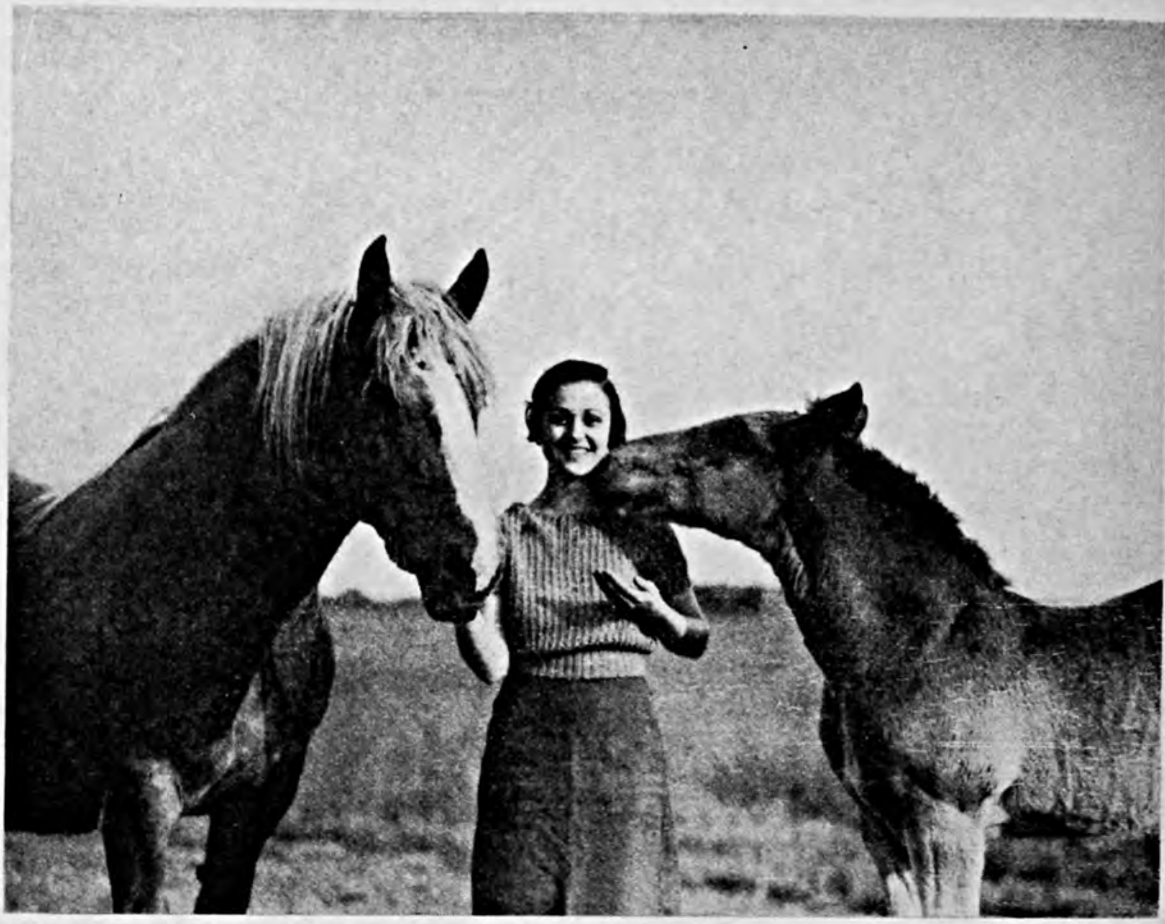




Above: Horse power at its best—perfect coordination and efficient results.

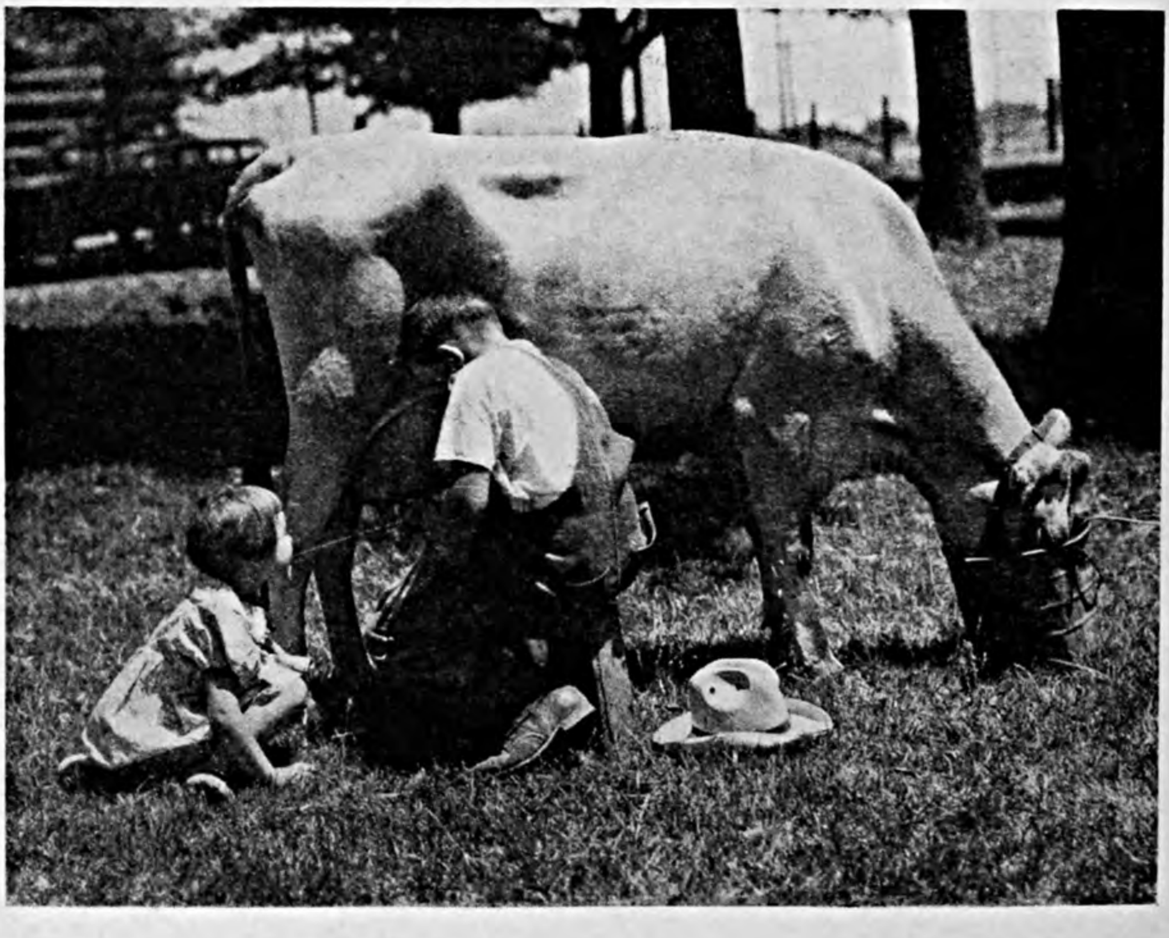


Right: Horse power and man power lengthen days in busy seasons.



Above: A friendly triumvirate.

Below: Direct to the consumer.



The Editors Talk

Potash Prices

A statistical study of potash prices over the past few years shows that the price level of potash salts dropped much below that of general prices. During the recent period of rising prices, potash prices still held at a much lower level than that of other materials the farmer buys or sells. Potash is now relatively one of the cheapest products which a farmer buys, a situation strongly favoring recommendations for adequate usage to insure profitable yields of quality crops.

In 1929 and 1930 prices in general began a steady decline, which reached the depression low in March and April, 1933, and then began the gradual rise which brought them in March, 1936, to 79.6% of the 1926-1928 average. The level of prices of commodities purchased by farmers followed the same course, reaching its low point in 1933 and advancing to 78.3% of the 1926-1928 average in March of this year.

Potash prices in March, 1935, reached their lowest point in history and in March of this year stood at 64.2% of the 1926-1928 average, approximately half the price levels of January, 1931.

In general, prices paid by farmers tend to lag during a period of falling prices and tend to rise faster during a period of rising prices. Potash prices, however, are an exception to this rule in that the rise has been much slower than that of other materials the farmer buys or of the products he sells.

It is a well-known fact that for many years American agriculture has been removing from our soils much more potash than has been added in fertilizers. In addition to this, almost unbelievable amounts of plant food have been lost through soil erosion. The depletion of the natural fertility of our soils cannot continue indefinitely in this manner, and this is being reflected in lower yields of poorer quality crops on many soils that formerly were considered to contain practically unlimited supplies of potash. Furthermore, many soils which showed by analysis large amounts of total potash have now been found to be lacking in available potash necessary to support the demands for profitable yields.

The present relative cheapness of potash, together with the increased farm income makes most opportune the sufficient use of potash not only on this year's crops, but for rebuilding the fertility of run-down soils.

Midwest Improves

Farmers in the Midwest are in a more favorable financial position than for some years, according to numerous indications. The Bureau of Agricultural Economics of the U. S. Department of Agriculture reports that the cash receipts of farmers in this section of the country have increased about 20% in 1935, compared to 1934. The significance of this improvement is emphasized when it is considered that the nine states included in these figures had a total income from sales of farm products and benefit payments this past year of more than $2,400,000,000, representing about 35% of the farm receipts for the whole country.

This improved situation in agriculture is being reflected in general business conditions in the Midwest. Sales of farm equipment, fertilizers, and general merchandise are ahead of last year; sale of farm land is improving; collections are very good; loans are being repaid. All of these are signs of improved times for the farmer.

"Another Sign of Better Times" is the title of a short editorial which appeared in the March 14 issue of the Wisconsin Agriculturist and Farmer, and which we quote below:

> "One of the best barometers we know about to indicate the trend of popular opinion on agricultural extension, which rises and falls in turn with the economic condition of the times, is the recorded votes of county boards of supervisors on county agent work.
>
> "Only a glance shows this clearly. The percentage of total favorable votes to the entire membership of the county boards thus voting on county agent work in the past six years is as follows: 1930, 93 per cent favorable; 1931, 85.5 per cent; 1932, 73.5 per cent; 1933, 86 per cent; 1934, 94.5 per cent; 1935, practically 95 per cent favorable.
>
> "When times got tough in 1931, 1932 and 1933 the opposition to extension work increased and the defense became less vigorous. With the return of better prices and conditions to farming, we see the recorded votes of supervisors in more than 45 counties of Wisconsin in 1935 sweep up again to the 95 per cent mark, favorable to retaining the county agent's services. This is a fine thing after all, for it makes the county agent system instantly responsive to and ready to aid all practical programs having prosperity as the ultimate goal. If county agents were appointed for life, like the supreme court, their community of interest with the farmer and his family would be considerably less effective."

True of Wisconsin, this situation undoubtedly is true of what is happening in other states and speaks promise for the continuation of the improvement in agricultural conditions.

Pasture Progress

During recent years a great amount of work and interest in the improvement of pastures has been done and recorded. Relatively young in its inception on the American continent as compared to Europe, "pasture consciousness" can be traced back to our pre-depression days when milk prices forced dairymen into a more intensive study of the economics of milk production. However, much credit has been accorded the fertilizer industry, which in seeking new outlets for its products closely cooperated with agricultural institutions on projects and investigations that have resulted in making good pastures a profitable crop for farmers.

Better Crops With Plant Food has always been interested in the pasture movement, and we have published many articles by prominent authorities on pasture problems. In this issue we are pleased to present to our readers another article, "Improving Pastures in New Brunswick," by C. F. Bailey, Superintendent of the Experimental Station, Fredericton, New Brunswick. This story details practical experience and results which will be of interest to many other regions.

REVIEWS

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

Fertilizers

"Substitution of Commercial Fertilizers for Manure in Vegetable Production," by J. W. Lloyd and E. P. Lewis (University of Illinois Agricultural Experiment Station Bulletin 421), reports very valuable information for growers engaged in intensive vegetable production. Eight years of experimental work with fertilizers for 10 market-garden crops are summarized. In a previous bulletin published by this Station, Number 377, results for five years of work were given. The present bulletin, however, affords a more comprehensive basis for conconclusions regarding the use of fertilizers for vegetable crops. The crops used in these experiments were spinach, lettuce, beets, peas, beans, potato, tomato, pepper, cauliflower, and carrot. The experiments were conducted at the Cook County Experiment Station.

In spite of the scarcity and high price of manure, the authors state yields of vegetable crops need not be seriously affected, as commercial fertilizers are capable of replacing manure to a large extent. They point out that one half the manure replaced by commercial fertilizers resulted in even higher yields than those obtained from the full manure treatment. It is also shown that when all the manure was replaced by commercial fertilizers, although the yields were smaller at times, such a treatment was more economical with most crops studied than the basic manure application. Complete fertilizers were more conducive to high yields than incomplete fertilizers when no manure was used. For most crops complete fertilizers, such as 4-8-6 or 6-8-6, applied at the rate of 1,000 pounds per acre, gave good results. When manure is not economical, it is believed complete fertilizers may be used just as effectively, provided organic matter is supplied in the form of cover crops.

"Official Inspections, Commercial Fertilizers, 1935," Agr. Exp. Sta., Orono, Me., No. 157, Oct. 1935, Elmer R. Tobey.

"Commercial Fertilizers, Commercial Feeds and Agricultural Liming Materials," Univ. of Maryland, College Park, Md., Control Series, No. 155, July 1935, and No. 157, January 1936.

"Fertilizer Analyses and Registrations, 1935," Dept. of Agr., Div. of Feed and Fert. Control, St. Paul, Minn., H. A. Halvorson.

"A Compilation of Experimental Data on Cotton Fertilizers Applicable to the Hill Sections of Mississippi," Agr. Exp. Sta., State College, Miss., Bul. 309, Mar. 1935, C. F. Clark.

"Fertilizer Placement for Cannery Peas," Agr. Exp. Sta., Geneva, N. Y., Bul. 659, Jan. 1936, Charles B. Sayre and G. A. Cumings.

"Fertilizers for Different Crops Including the Best Percentages of Water-Insoluble Nitrogen of Total in Fertilizer Mixtures," Agr. Exp. Sta., State College Station, Raleigh, N. C., Agron. Information Cir. 96, Nov. 1935.

"Suitable Fertilizer Mixtures for Different Crops Including the Functions of Chief Plant Nutrients," Agr. Exp. Sta., State College Station, Raleigh, N. C., Agron. Information Cir. 97, Jan. 1935, H. B. Mann and W. H. Rankin.

Soils

Many useful suggestions for growing onions on muck soils are contained in Michigan State College Extension Bulletin 123 (revised) entitled "Muck Soil Management for Onion Production," by Paul M. Harmer. Discussed in the bulletin are practical methods on soil management, varieties, seeding and transplanting, insect pests, and harvesting and storing. One of the chief requisites to successful onion production on mucks is a satisfactory soil reaction. Testing the soil to determine its reaction is strongly advised. Extremely acid soils may not produce well, even after liming. Moderately acid as well as slightly to strongly acid mucks show beneficial responses from applications of copper sulphate when lime is required. Sulphur and manganese sulphate used on alkaline mucks result in increased yields, better maturity, and better keeping qualities of the crop. Fertilizer mixtures and the method and rate of application best adapted under different circumstances are given, both for broadcast fertilization either on the surface or drilled uniformly over the field, and for row application. The author relates that generally the amount of fertilizer which can be safely put in the row is insufficient for producing optimum yields, and should be supplemented by enough fertilizer broadcast before seeding to bring the total application to 600 to 800 pounds per acre. In the opinion of the author, on fields which ordinarily require 900 to 1,000 pounds of a 2-8-16 mixture, it is frequently advisable to use one mixture for broadcasting and another for the row application. Thus, using 300 pounds of 3-12-15 or 2-8-16 in the row and 300 to 500 pounds of 0-8-24 broadcast cuts down the cost of fertilizer and also the required amount per acre. Other mixtures of similar ratios which might be used are given.

"Oxidation of Sulphur in Arizona Soils and Its Effect on Soil Properties," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 59, Dec. 15, 1935, W. T. McGeorge and R. A. Greene.

"Sand Culture of Seedlings," Agr. Exp. Sta., New Haven, Conn., Bul. 380, Jan. 1936, A. A. Dunlap.

"Relation of the Degree of Base Saturation of a Colloidal Clay by Calcium to the Growth, Nodulation and Composition of Soybeans," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 232, Jan. 1936, Glenn M. Horner.

"Broad Relationships Between Microorganisms and Soil Fertility," Agr. Exp. Sta., New Brunswick, N. J., Bul. 595, Nov. 1935, Jacob G. Lipman and Robert L. Starkey.

"Soils of Orleans County, New York, in Their Relation to Orchard Planting," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 637, Sept. 1935, A. T. Sweet.

"Lysimeter Investigations, IV. Water Movement, Soil Temperatures, and Root Activity Under Apple Trees," Agr. Exp. Sta., Geneva, N. Y., Tech. Bul. 237, Oct. 1935, R. C. Collison.

"Soil Fertility in Relation to Productive Land Value," Agr. Exp. Sta., Corvallis, Oreg., Sta. Cir. 113, Oct. 1935, W. L. Powers.

"Relation of the Occurrence of Cotton Root Rot to the Chemical Composition of Soils," Agr. Exp. Sta., College Station, Texas, Bul. 522, Dec. 1935, G. S. Fraps and J. F. Fudge.

"Soil Moisture and Irrigation Investigations in Eastern Apple Orchards," U. S. D. A., Washington, D. C., Tech. Bul. 491, Oct. 1935, J. R. Magness, E. S. Deman, and J. R. Furr.

"Soil Survey of the Lovington Area, New Mexico," U. S. D. A., Washington, D. C., Series 1932, No. 2, W. G. Harper and L. H. Smith.

"Soil Survey of Kiowa County, Oklahoma," U. S. D. A., Washington, D. C., Series 1931, No. 14, A. W. Goke and C. A. Hollopeter.

Crops

According to the Iowa Agricultural Experiment Station Bulletin 339, entitled "Effect of Harvesting, Spacing, and Age of Plants on Yields of Asparagus" by E. S. Harber, plant spacing has a direct effect on quality of asparagus spears. The type of soil, fertility, and cultural operations influence the spacing distance, asserts the author. Under Iowa conditions, results show that a 3-foot spacing is best, while spacing 1 foot apart decreases average weight of spears. These investigations indicate one-year plants are slightly better than two-year plants for starting a plantation, especially considering the higher price for the older plants. One-year-old transplanted plants gave superior results over seed sown in the field where the plants are to grow permanently, or seed sown in pots and transplanted to the field. It is generally conceded that when asparagus is planted in the spring, the spears should not be cut the following season. Cuttings of the second season should be limited to a short period, and it may pay to wait two years to start commercial cutting, the publication concludes.

In Extension Circular 207, North Carolina State College of Agriculture, entitled "Approved Practices in Handling Tobacco Beds," the Department of Agronomy, Botany, and Zoology explain briefly, yet concisely, the considerations which are necessary for obtaining healthy tobacco plants.

"The first step in the production of a successful tobacco crop is to have thrifty, healthy plants ready when the proper time for transplanting arrives," the authors stress. Among the chief causes of plant-bed failures given are poor plant-bed sites, inadequate soil preparation, improper fertilization, diseased seed and/or plants, incorrect handling of beds during the growth period of plants, and insects. The value of selecting good varieties, proper seed-bed fertilization, good care of the beds throughout the growth period of plants, and other important phases of ideal management include the major topics embracing the discussions. It is advised that tobacco trash should not be placed on plant beds because it may carry such diseases as mosaic, black root rot, or Granville wilt.

"Twenty Years of Agricultural Extension Work in Arizona," Agr. Ext. Serv., Univ. of Arizona, Tucson, Ariz., Ext. Proj. Cir. 15, June 1935, P. H. Ross, Director.

"Irrigation Experiments with Wheat," Agr. Exp. Sta., Tucson, Ariz., Bul. 151, Dec. 15, 1935, A. T. Bartel and Charles Hobart.

"Some Aspects of Citrus Tree Decline as Revealed by Soil and Plant Studies," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 60, Feb. 15, 1936, W. T. McGeorge.

"Forty-seventh Annual Report for Fiscal Year Ending June 30, 1935," Agr. Exp. Sta., Fayetteville, Ark., Dec. 1935, C. O. Brannen, Acting Director.

"Sulfuric Acid for Control of Weeds," Agr. Exp. Sta., Berkeley, Calif., Bul. 596, Nov. 1935, W. E. Ball and O. C. French.

"Cutting Experiments with Bahia Grass Grown in Lysimeters," Agr. Exp. Sta., Gainesville, Fla., Tech. Bul. 286, Nov. 1935, W. A. Leukel and R. M. Barnette.

"Pasture Value of Different Grasses Alone and in Mixture," Agr. Exp. Sta., Gainesville, Fla., Bul. 289, Jan. 1936, Geo. E. Ritchey and W. W. Henley.

"Comparative Productiveness of Missionary Strawberry Plants from Arkansas and Maryland," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 489, Mar. 1936, A. N. Brooks.

"Fifteenth Annual Report, 1934-1935," Coastal Plain Exp. Sta., Tifton, Ga., Bul. 25, S. H. Starr, Director.

"Grape Growing in Kansas," Agr. Exp. Sta., Manhattan, Kans., Cir. 177, Aug. 1935, R. J. Barnett.

"Practices in Seeding Meadow and Pasture Crops," Univ. of Kentucky, Agr. Ext. Div., Cir. 242 (3rd Ed., Rev.), E. J. Kinney, Ralph Kenney, and E. N. Fergus.

"Report of the Director for the Year Ending June 30, 1934," Agr. Exp. Sta., Columbia, Mo., Bul. 358, Dec. 1935, F. B. Mumford and S. B. Shirky.

"Korean Lespedeza in Rotations of Crops and Pastures," Agr. Exp. Sta., Columbia, Mo., Bul. 360, Feb. 1936, W. C. Etheridge and C. A. Helm.

"Sweet Clover in Missouri," Agr. Ext. Serv., Columbia, Mo., Cir. 329, Oct. 1935, W. C. Etheridge and C. A. Helm.

"The Relation Between the Vitamin A Content of the Dairy Ration and of Milk," Agr. Exp. Sta., New Brunswick, N. J., Bul. 592, Sept. 1935, Walter C. Russell, M. W. Taylor, D. F. Chichester, and Logan T. Wilson.

"Early Results of Peach Breeding in New Jersey," Agr. Exp. Sta., New Brunswick, N. J., Bul. 599, Jan. 1936, M. A. Blake and C. H. Connors.

"The Home Vegetable Garden," Agr. Ext. Serv., State College, N. Mex., Ext. Cir. 126, Mar. 1933 (Rev. Aug. 1935), G. R. Quesenberry, Director.

"Forty-eighth Annual Report, 1935," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Carl E. Ladd, Director.

"Burley Tobacco Culture," Agr. Ext. Serv., Knoxville, Tenn., Rev. Pub. 161, Mar. 1935, Roy H. Milton.

"Forty-seventh Annual Report, 1934," Agr. Exp. Sta., College Station, Texas, A. B. Conner, Director.

"Twentieth Annual Report, Cooperative Extension Work in Agriculture and Home Economics for Year 1934," Agr. Ext. Serv., Burlington, Vt., Ext. Bul. 20, June 1935, J. E. Carrigan, Director.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 334, Feb. 1936, and Bul. 335, Mar. 1936.

"Forty-fifth Annual Report for the Fiscal Year Ended June 30, 1935," Agr. Exp. Sta., Pullman, Wash., Bul. 325, Dec. 1935, Edw. C. Johnson, Director.

"Top and Double-Working Apple Trees," Agr. Exp. Sta., Madison, Wis., Bul. 432, Jan. 1936, R. H. Roberts.

"Report of the Chief of the Bureau of Plant Industry, 1935," U. S. D. A., Washington, D. C., Frederick D. Richey, Chief.

"Vernalization Experiments with Forage Crops," U. S. D. A., Washington, D. C., Cir. 377, Nov. 1935, Roland Mckee.

Economics

One of the most interesting new publications under this division is Florida Agricultural Experiment Station Bulletin 287, entitled "Economic Study of Absentee Ownership of Citrus Properties in Florida." H. W. Hawthorne of the U. S. D. A. and J. E. Turlington of the University of Florida, co-authors, present worthwhile data concerning out-of-state ownership. These data also will be of interest to those contemplating the purchase of citrus property in the future. The information is compiled from the response of 477 absentee owners who replied to a complete questionnaire sent them. The records gave a vivid picture of methods employed in caring for the groves, harvesting, packing and marketing, size of properties, age of trees, cash costs and receipts, taxes, fertilizers, and other pertinent facts of interest to this class of ownership. The report shows that the absentee owners reporting reside in 35 states of the United States, in the District of Columbia, the Territory of Hawaii, the Dominion of Canada, and in Cuba.

"Agricultural Outlook for Illinois, 1936," Agr. Exp. Sta., Urbana, Ill., Cir. 442, Dec. 20, 1935, H. W. Mumford, Director.

"Prices of Illinois Farm Products, 1931-1934," Agr. Exp. Sta., Urbana, Ill., Bul. 422, Dec. 1935, L. J. Norton and T. R. Hedges.

"Types of Farming in Kentucky," Agr. Exp. Sta., Lexington, Ky., Res. Bul. 357, June 1935, Bruce Poundstone and Walter J. Roth.

"Part-time Farming in Four Representative Areas of Kentucky," Agr. Exp. Sta., Lexington, Ky., Bul. 358, Aug. 1935, Merton Oyler and W. W. Rose.

"New Jersey Prices of Hired Farm Labor, Feedstuffs, and Fertilizer Materials, and Their Index Numbers, 1910-1934," State Dept. of Agr., Trenton, N. J., Cir. 252, June 1935, D. T. Pitt.

"Farm Economics," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., No. 93, Feb. 1936.

"Wholesale Prices at Cincinnati and New York," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 182, Oct. 1935, H. E. White.

"Cotton Marketing Practices in North Carolina," Agr. Exp. Sta., State College Station, Raleigh, N. C., Tech. Bul. 51, Dec. 1935, Glenn R. Smith.

"A Planned Farm Program," Agr. Ext. Serv., Knoxville, Tenn., Rev. Pub. 187, Jan. 1936, J. H. McLeod and H. C. Holmes.

"Prices of Farm Products in Vermont, 1932-1934," Agr. Ext. Serv., Burlington, Vt., Ext. Cir. 84, June 1935, H. C. Norcross and A. A. Brown.

"Financing Cooperative Marketing of Farm Products in Washington," Agr. Exp. Sta., Pullman, Wash., Bul. 322, Oct. 1935, E. F. Dummeier.

"The Agricultural Outlook for 1936," U. S. D. A., Washington, D. C., Misc. Pub. 235, Nov. 1935, Bureau of Agr. Economics.

"The Farm Real Estate Situation, 1934-35," U. S. D. A., Washington, D. C., Cir. 382, Dec. 1935, B. R. Stauber and M. M. Regan.

Record Tobacco Crop

CANADA'S tobacco crop was exceptionally good in 1935, when the production rose from thirty-nine million pounds in 1934 to fifty-four and one-half million pounds, the highest output ever recorded in the Dominion. The total acreage increased from 40,963 acres to 46,870 acres.

The greater part of the increase occurred in Ontario where there was a rise in the production of all types of tobacco. Flue-cured tobacco, the principal crop, advanced from twenty-two million pounds to thirty-five million pounds. The seasonal conditions in Ontario were very favourable and there was practically no loss from hail or frost. In Quebec there was a reduced acreage in all types of tobacco grown, particularly in the large pipe varieties, since many growers were induced to change over from these to the production of cigar leaf on account of the higher prices paid for this type in 1934. The net result was a higher total production of cigar leaf in 1935, although from a somewhat reduced acreage. Production in British Columbia last year was practically negligible owing to the great flood at Sumas Prairie during the preceding late winter.

Jefferson Knew Value Of Farming on Contour

THOMAS JEFFERSON — third President of the United States—whose birthday is April 13, was a practical farmer. He knew conservation of soil is of vital importance to lasting and successful farming. In 1813, writing about his farm in Albemarle county, Va., he said:

"Our country is hilly and we have been in the habit of plowing in straight rows, whether up or down hill, or however they lead, and our soil was all rapidly running into the rivers. We now plow horizontally following the curvature of the hills and hollows on dead level, however crooked the lines may be. Every furrow thus acts as a reservoir to receive and retain the waters, all of which go to the benefit of the growing plant instead of running off into the streams."

Many farmers are learning today, as Jefferson learned, the value of contour plowing and planting to check serious soil losses by wind and water, reports the Soil Conservation Service.

Fruit Growing in Ontario

GENERALLY the fruit-growing areas of Ontario are in close proximity to the large bodies of water constituting the Great Lakes, and extending north to the southern part of Georgian Bay.

The northern district from Collingwood to Owen Sound is devoted mainly to apples, although small fruits are increasingly important. Apples are the main fruit crop along the east shore of Lake Huron, with some peaches in the Forest district. All along the north shore of Lake Erie fruit is extensively grown. The apple is the main crop, but in addition are other tree fruits and small fruits; in recent years peaches and grapes are being planted in considerable acreage. In the Niagara Peninsula the so-called tender fruits—peaches, pears, plums, sweet and sour cherries, grapes, small fruits—are grown in abundance, as well as a very considerable apple production. Again, fruit is a main agricultural crop all along the north shore of Lake Ontario from Hamilton to Kingston and even extending along the shores of the St. Lawrence River to Quebec Province. Certain inland counties, such as Brant, Oxford and Middlesex, also grow fruit, apples particularly, in quantities. Prince Edward county, in addition to apples, is a heavy producer of sour cherries. Strawberries and raspberries are grown practically all over Ontario.

10,000 Unpaid Volunteers Are Aid to Weather Man

A COMPLETE picture of North American climate is possible only because of the great mass of fundamental facts furnished by 5,000 volunteer weather observers. Each unofficial observer, says W. R. Gregg, Chief of the Weather Bureau, really runs a small field station, at no expense to the Government, except for the few instruments and blank forms used.

This system of augmenting official weather records began in 1891, when the newly created Weather Bureau was charged with the duty of "taking such meteorological observations as may be necessary to establish and record climatic conditions in the United States." The cost of maintaining thousands of stations to make these observations all over the country was prohibitive.

About 300 members of the present volunteer force have served for 25 years or longer. Three have been keeping records for more than 50 years and 54 for between 40 and 50 years. There are 300 women observers, three with more than 40 years of service. To prevent breaks in the continuity of the daily records, each observer has a substitute, which means that 10,000 persons are ready to give their services at any time.

Every day at a fixed time—usually around sunset—the observer records the maximum and minimum temperature, the precipitation, and such unusual conditions as wind, dust, or thunderstorms, fog, and frost. At the end of the month the record goes to the Weather Bureau in Washington, D. C., for tabulation and filing.

From millions of these records, meterologists work out the answers to countless questions on climatology. Recently these questions have dealt largely with land policies, for land is "conditioned by the sky under which it lies and by the climate which is proper to it."

Hoosier-grown Sweets Meet Market Demands

(*From page* 22)

The results of the other plots were as follows: (Approximately 14 tons manure per acre were added to all plots).

Treatment	U. S. No. 1 (bushels)	U. S. No. 2 (bushels)	Total Yield (bushels)
No fertilizer, no mulch	149	37	186
No fertilizer, mulched	178	70	248
600 lbs. 2-8-16 in the row, no mulch	236	25	261
600 lbs. 2-8-16 in the row, mulched	285	32	317
*600 lbs. 2-8-16 in the row plus 600 lbs. 0-8-30 broadcast, no mulch	176	25	201

* A very heavy set was noted on these rows. Had they been mulched or had sufficient rainfall, the results might have been by far the highest.

650 Times More Soil Loss When Rows Follow Slope

A SLOPING plot of ground near Ithaca, N. Y., planted last summer to potatoes in rows up and down hill, lost 650 times as much soil and 14 times as much water from July 7 to November 15 as two adjoining plots planted to potatoes, oats, and clover in strips across the slope. The three plots—at the Arnot erosion experiment station of the Soil Conservation Service—were each 21 feet wide and 311 feet long, with a slope of 7 per cent on the upper half and 14 per cent on the lower.

The plot planted up and down the slope lost almost 14 tons of soil per acre and nearly 14 per cent of 18 inches of rainfall. The two strip plots each lost only 43 pounds of soil per acre. The run-off was 1.1 per cent on one plot and only 0.35 per cent on the other.

The Arnot station, first in the Northeast, has completed its first year of operation.

The Inquiring Mind

(*From page* 14)

the use in this way is to be successful. The problems are: (1) The danger of delaying or even preventing germination if too much fertilizer is improperly placed near or in contact with the seed. (2) The danger of producing too much top growth in comparison with the root growth, causing what is called "firing" (a drying up of the leaves) in time of drought. (3) The danger of making a field uniform in fertility, causing the succeeding crop to be streaky and patchy. (4) The problem of knowing the best fertilizer for use in each particular case. These four problems as well as others were studied and are discussed in the report. The investigation was conducted in the laboratory, greenhouse and field, for a period of five years. A large portion of the investigation was carried on with corn because of its great importance as a crop and adaptability to special fertilization."

It is impossible in the space available to give a detailed report of the findings in this research work, but a few will undoubtedly be of interest. Field peas, cowpeas, navy beans, and soybeans were found to be very sensitive to the applications of fertilizer in contact with the seed, but that application above or below the seed largely eliminates the detrimental effect. Because of convenience and practicability, application above the seed is advisable with these four plants when fertilizers are applied in the hill or drill row. The germination of lettuce and carrots is affected and delayed most by the application of fertilizer near the surface. For these plants it is best to work the fertilizer into the soil several inches prior to planting. Squash, cucumber, watermelon, and muskmelon are quite sensitive to fertilizers, and for these it is best to apply the fertilizer about one-half inch above the seed if the fertilizer is applied in the hill.

Potato sprouts are very sensitive to fertilizer, and hence, in potato fertilization the fertilizer should be placed either to one side or else below the seed, so that the sprouts will not come in direct contact with high concentrations of fertilizer in coming up through the soil. Corn seed require considerable water to germinate, and if fertilizer is applied in direct contact with the seed, the taking up of the water is either prevented or delayed so much by the attraction of the fertilizer salts for the water, that the corn germinates slowly or not at all. When the corn once sprouts, the sprout, unlike that of the potato, is able to pass through a considerable concentration of fertilizer, and hence, application of fertilizer above the seed for corn is a very successful method in hill and drill row applications.

The marked difference in sensitiveness of corn and potato sprouts to fertilizer raises the important question as to why this is the case. It was thought that, possibly, the sap of the corn sprouts has a higher osmotic pressure than sap of the potato sprouts, making it more difficult for the fertilizer salts to draw water out of corn sprouts, and thus cause them to lose turgidity and shrivel up. Freezing point determinations gave an osmotic pressure of 7.18 atmospheres for corn sprouts and 6.15 atmospheres for potato sprouts, indicating that the possibility just mentioned was probably true. Another factor in this connection is the amount of proection which the epidermis may give, and besides having a more protective epidermis, the corn sprouts probably have a protective sheath which the potato sprouts do not have.

Instigates Further Study

As a result of the work quoted, a great many changes were made in the recommended methods of fertilizer application, and further studies were, and are being made. In the course of an address at the first annual convention of the National Fertilizer Association, held at White Sulphur Springs, W. Va., in June 1925, Dr. J. G. Lipman, Director of the New Jersey Agricultural Experiment Station, called attention to the necessity of making a careful study of the various methods of applying fertilizer and of the machinery used for its distribution, and suggested the formation of a joint committee of agronomists, agricultural engineers, and representatives of the fertilizer and farm industries to undertake that study.

Headed Committee

In accordance with this suggestion the National Fertilizer Association, in July 1925, appointed three of its members to represent the industry on such a committee. Dr. Lipman's suggestion was conveyed to the American Society of Agronomy, the American Society of Agricultural Engineers, and the National Association of Farm Equipment Manufacturers, and each of these organizations named representatives to serve on the committee. Professor Truog was named and acted as General Chairman of the committee. In the committee report published in July 1928, special credit is given to him and to Ove F. Jensen, who acted as General Secretary, for the preparation of the report. In this report, which is very comprehensive, the great need for further investigation is shown, in order to arrive at definite regulations regarding the proper methods of application of fertilizer and the proper machinery with which to apply it. This committee still functions and is still making great progress under the direction of Chairman Salter, who now heads it.

During his period of service at the University of Wisconsin, Emil Truog has studied and taught, and he has written a large number of papers for the various scientific journals. He has been interested in the utilization of phosphates by agricultural crops, and published a bulletin on that subject in 1916. Professor Truog has also done a great deal of work in connection with the factors influencing the availability of rock phosphates, in the feeding of plants, methods of determining the fertilizer requirements of plants, tests for determining such requirements, tests for soil reactions, quick tests for phosphates and potash, and in the advancement of the use of correct, fertilizer-distributing machinery. In his report at a meeting held in Chicago on Nov. 17, 1927, in speaking for his committee, he stated that at the time he felt that on the basis of present data certain definite conclusions in the methods of fertilizer application may safely be made. These are:

1. Barring serious injury to germination, the nearer fertilizer is placed to the seed the more effective is the fertilizer in promoting early growth.

2. Of the individual carriers, those carrying nitrogen are most apt to cause injury to germination; those carrying potash stand intermediately; those carrying phosphates are least apt to cause injury.

3. For practically all intertilled crops, the safest method of hill and drill row applications is to apply the fertilizer in bands along both sides of the seed and at a depth varying with the crop.

4. A placement of fertilizer, which is safe under all conditions of weather and soil, will not give maximum results in many cases.

5. Before definite and comprehensive recommendations can be made, it will be necessary to do much more experimental work.

At the present time Professor Truog confines his work mostly to research and to work with graduate students, although he does some undergraduate teaching, and conducts some classes with the Short Course in Agriculture. Wisconsin has been fortunate in turning out excellent soil scientists, and many of these are now teaching and doing research work in widely separated areas, some as far away as China and Hawaii. In his research work Emil Truog is now devoting a great deal of his time to soil colloids and will be able to report some interesting and unusual developments later.

While rather small in stature, Professor Truog is stocky, and being stocky he is naturally interested in athletics. His attendance at the football and basketball games of the University of Wisconsin has been so regular during the past 20 years, or more, that the cheerleaders know just where to find him at every game. When I asked Mrs. Truog about his hobbies, she said, "Well I guess football and baseball just about cover them all, except that he is a radio bug." So he goes about his work in a methodical way, drives a car that is not streamlined, enjoys his children, and likes his work with the graduate students. He is a member of Sigma Xi, Alpha Zeta, Phi Lambda Upsilon, Gamma Alpha, and of various scientific societies.

Esteemed by Associates

An interesting sidelight on his work came when I asked his associate, Professor Graul, to tell me something about his work and found that both of these soil scientists, working together in the same building, came from the same part of Trempealeau county in northern Wisconsin, and both grew up with the same desire to learn about the soil. Edward J. Graul says of his associate and boyhood friend, "The State of Wisconsin, the Nation, and the World have been enriched because of the work, the inspiration, the devotion, the life of Professor Emil Truog in affairs of research and in the relationships among men. A man inspired by high ideals, a man with ceaseless ambition to find the truth, a man devoted to the service of mankind, a man loved and admired by all,—this is Professor Truog."

Although Truog has done admirable work in several avenues of research, particularly in the field of soil acidity, soil phosphorus and potash, soil colloids, and related fields, and has published many papers of importance, he is perhaps even better known among graduate students as a counselor, a leader, and an executive of the highest type. His graduates are found today in all corners of the world, from the Atlantic to the Pacific, from England to Japan and Australia, in positions of the greatest responsibility and highest executive authority.

Not alone is Professor Truog a

scientist; he is also a practical farmer, putting into practice the theories that he teaches. He translates the most difficult theories into terms understood by the man at the plow. Thus farmers have confidence in his theories. When one thinks of the life and career of Professor Truog, one is reminded of the saying, "Truth is greater than fiction," and to that one can add, "Quality surmounts quantity."

Improving Pastures in New Brunswick

(*From page* 17)

It is true that the heavy growth secured in June when nitrate of soda is applied may be eaten by stock during the period when pastures are short, yet it would seem desirable to distribute the growth of grass throughout the season, so that a more nutritious and palatable grass may be provided. Perhaps a better practice for this station would be to treat the grazing paddocks referred to above with a complete fertilizer annually, reducing the amount used each year to one-half or possibly one-third the amount used the year the complete fertilizer is being applied, as at present.

Plans are now under consideration to conduct a project—using dairy cattle—to determine the best rate to apply the complete fertilizer to these pastures for maximum returns. It is proposed also to include in this project paddocks treated with superphosphate alone.

We hear a great deal today about the importance of good farm management, and it applies to pastures as much as it does to any other part of the farm. In practically all European publications on pasture improvement, a considerable amount of emphasis has been put on the importance of rotationally grazing pastures. These pastures are grazed quite heavily for a few days by cows in milk, for example, and in some cases these cows are followed by dry cows or young cattle. Each field is then rested for a period of from 10 to 20 days, depending upon the season of the year or some local condition. The number of fields may vary from three to eight. This system is no doubt the ideal way to operate a pasture, as it provides an excellent opportunity for keeping grass under control. There is also experimental evidence to show that the carrying capacity of these pastures is somewhat increased by rotational grazing, as against the continuous method of grazing.

At the Fredericton Station a project has been conducted continuously since 1929, to determine the relative merits of these two systems of grazing. During this period the continuously grazed field has an average carrying capacity of 195.84 cow days per acre, as compared with 205.57 cow days per acre on four adjoining fields that were rotationally grazed, or an increase of 4.97 per cent over the continuously grazed field. While seven years' work has shown a slightly greater carrying capacity for the rotationally grazed pasture, the advantage is not sufficient to justify the extra expense entailed in the construction of fences, not to mention the difficulties to be encountered on the average farm in supplying water and shade for stock. The writer prefers to recommend that the farmer establish a small pasture near the farm buildings, say one-half acre for each milch cow. If this pasture is fertilized and properly managed, it should provide an early pasture for milch cows some days before the main pasture is ready. During the June flush the improved pasture should be rested and all stock put on the main pasture. When the main pasture becomes short, the improved pasture may be used at night for the milch cows. As soon as aftergrass can be provided, the improved pastures should be relieved until fall, when it should again provide good pasture for the milch cows.

While much can be done to improve pastures and increase their carrying capacity, it has not been possible to have a pasture produce uniformly throughout the summer months. Several methods of bridging the period when pastures are short have been suggested. All are helpful but none is perfect. The Fredericton Station is making a study of this problem and may have some recommendations to make in a year or two.

Fertilizer should be applied as soon as possible after the first signs of growth in the spring; care should be taken, however, to avoid cutting the sod with horses' feet or machinery. This station has applied minerals in the fall and spring. Fall applications may be preferable if the field is level; however, it is doubtful if farmers will go to the expense of making two applications in one year, especially when the advantage is not particularly marked. It is a good practice to harrow pastures in the fall to spread the droppings and loosen the sod; this should be done when the field is comparatively dry. Pastures should not be under or over-grazed; if they are over-grazed in the fall, they will be slow in making growth the following spring; if they are under-grazed in the spring, a poor quality of grass will be produced, and the bottom grasses and clovers will not develop properly. The aim should be to keep the grass in pastures from three to five inches high at all times; grasses must not be allowed to head out. If the grass gets out of control, it may be advisable to cut it with a mower—the cut grass will be readily eaten by stock.

The writer has attempted to touch upon a few rather important factors relating to pasture improvement. Some of the findings made at Fredericton are out of line with those secured elsewhere. This is not surprising, as soil and climatic conditions, even within the Maritime Provinces, differ considerably. However, the statements made in this article are based on several years of careful work and should apply to many sections of this country.

Left: Largely weeds and moss. Right: Brown top, Kentucky bluegrass, and wild white clover.

Side-dress Corn With Potash

(*From page* 8)

Table I gives the results of the side-dressing experiments in Iowa. The dates of application are shown in each case. Some were made as late as the middle of July. Certain of the fields received more rainfall than others. Then, too, others were frozen earlier in the fall, and for these reasons we are making no attempt to interpret the data statistically, or otherwise. Each experiment is of value so far as the conditions in that particular field are concerned. The trend, however, in all of these tests showed that the corn plants were very decidedly benefited by these extra potash applications. In most cases the benefits were obtained not only in increased yields but in the amounts of marketable corn produced. Figs. 2, 5, 7, and 8 show the results of the tests on the farms of several of the cooperators.

At harvest time the corn was sorted, usually by the cooperating farmer, into marketable and poor quality ears. The effect of the potash on quality was quite marked in nearly every field. Most farmers estimated that the corn classified as of poor quality was worth less than half price, so far as feeding value was concerned. Corn was selling at about 50 cents per bushel at that time.

A 100-lb. application of muriate of potash would have cost about $2.33 in Iowa and $2.28 in Illinois, at 1935 prices. Thus, an increase of about 4¾ bushels of corn at 50 cents a bushel would be sufficient to pay for the cost of potash; or an improvement in quality of 9½ bushels of corn per acre, that is, changing the quality from poor to marketable, would pay for the potash regardless of yield. High yields and good quality usually go together.

The "feed value per acre of corn," which depends on both yield and feeding quality, is more important than most corn growers realize. For instance, about 84 per cent of all Iowa corn is marketed as meat, and not as corn. The farmers who feed their own corn should be more certain that

Fig. 7—Henry Bruhn field, August 30, 1935. Left: Without potash, lower leaves of plants showed severe brown marginal firing. Right: Response to 100 lbs. of muriate of potash seven weeks after side-dressing.

they are getting maximum yields of feed from each acre. They should ask themselves the question, "How many potential pounds of beef or pork am I growing on each acre?"

The proportion of higher quality corn on the potash-treated plots would have been higher in several of the tests had the season been longer and the corn matured better. With the early

TABLE I—RESULTS OF SIDE-DRESSING TESTS IN IOWA, 1935

Cooperator, location, treatment, and date of side-dressing with muriate of potash	Yield Records			Increases due to side-dressing	
	Bushels corn per acre	Per cent market-able	Bushels market-able	Total bushels corn	Bushels market-able
H. Lindhorst, Algona:					
No potash	26.4	13.9	3.7	...	...
100 lbs. potash July 12	54.1	42.9	23.2	27.7	19.5
200 " " " "	53.2	43.6	23.2	26.8	19.5
Henry Bruhn, Cylinder:					
No potash	27.5	30.5	8.4	....	....
100 lbs. potash July 12	41.9	55.4	23.2	14.4	14.8
200 " " " "	42.9	66.8	28.7	15.4	20.3
Henry Cahill, Mason City:					
No potash	47.6	37.5	17.9	...	...
100 lbs. potash July 16	57.0	49.2	28.1	9.4	10.2
200 " " " "	73.2	68.2	49.9	25.6	32.0
W. G. Meyer, Webster City:					
No potash	13.3	18.8	2.5	...	...
100 lbs. potash July 15	29.2	41.5	12.1	15.9	9.6
200 " " " "	30.7	41.5	12.7	17.4	10.2
R. J. Abels, Ellsworth:					
No potash	28.3	40.0	11.3	...	...
100 lbs. potash July 9	48.1	40.0	19.3	19.8	8.0
200 " " " "	50.8	44.7	22.7	22.5	11.4
Isaac Gressley, Williams:					
No potash	17.9	9.2	1.7	...	...
100 lbs. potash July 9	33.8	50.8	17.2	15.9	15.5
200 " " " "	36.6	55.4	20.3	18.7	18.6
B. T. Calkins, Webster City:					
No potash	32.9	57.3	18.9	...	...
100 lbs. potash July 9	41.7	60.9	25.4	8.8	6.5
180 " " " "	41.6	52.6	21.9	9.7	6.0
No potash	31.9	49.9	15.9	...	...
Ray Baird, Webster City:					
No potash (lowland)	65.7	75.3	49.5	...	...
200 lbs. potash July 15	80.5	72.3	58.2	14.8	8.7
No potash (upland)	70.8	78.8	55.7	...	...
200 lbs. potash July 15	82.9	87.9	73.8	12.1	18.1
C. J. Skow, Wesley:					
No potash	39.1	33.2	13.0	...	
100 lbs. potash July 13	45.4	34.4	15.6	6.3	2.6
200 " " " "	47.8	50.0	23.9	8.7	3.8
No potash	39.1	51.4	20.1	...	..
Schuler Bros., Wesley:					
No potash	25.7	43.6	11.2	...	
200 lbs. potash July 13	44.5	56.8	25.3	18.8	14.1
August Vaudt, Whittemore:					
No potash	48.9	60.8	29.7	...	...
200 lbs. potash July 12	63.2	73.8	46.7	14.3	17.0
George Fandel, Rodman:					
No potash	29.4	48.8	14.3		
200 lbs. potash July 12	35.0	50.5	17.7	5.6	3.4
H. S. Kooker, Cylinder:					
No potash	22.2	25.3	5.6	...	
200 lbs. potash July 10	35.6	35.3	12.6	13.4	7.0
C. R. Booth, Mason City:					
No potash	18.1	9.6	1.7	...	
200 lbs. potash July 16	38.2	9.4	3.6	20.1	1.9
Dell Stafford, Blairsburg:					
No potash	35.7	61.4	21.9	...	
150 lbs. potash July 15	48.2	65.4	32.2	12.5	10.8

Fig. 8—Henry Bruhn field, corn from 100 hills, October 18, 1935. Marketable corn in sacks; poor quality on ground. (See Table I.)

frosts and the relatively late application of potash in some cases, a larger proportion of immature corn was produced than would be obtained in an average season. Nevertheless, the results on the whole show that higher yields of better feeding quality corn can be produced profitably, when the plants showing hunger signs for potash are supplied during the earlier part of the growing season.

The soils in southern Illinois, where a distinct need for more potash is developing, are entirely different from those in northern Iowa. These Illinois soils are very acid, level and drained with difficulty. They are called "old" soils by the soil survey folks. The subsoils are heavy and rather impervious to drainage and root growth. They need lime and phosphates also. When, however, lime and phosphates are supplied, the need for potash soon becomes a limiting factor for production.

Of interest regarding these soils, is a recent report from the University of Illinois. The following figures on yields of corn are from the fertility plots at their Toledo farm.

Treatment	Av. Yield 1914-1931	Yield 1932
R	18.5	31.1
RL	26.0	28.9
RLrP	26.5	31.5
RLrPK	40.6	61.8

R—residues; L—limestone; rP—rock phosphate; K—potash.

These data show that potassium is the important material needed in this soil to increase the yields of corn.

Originally, the plans for demonstrations in Clark county, Illinois, were made to assist Farm Adviser R. E. Apple in conducting fertilizer demonstrations using potash on the corn just after it was planted in fields where lime and phosphate had been used for some time, and particularly where sweet clover had been plowed under as a green manure crop. Due to excessive spring rains the corn was planted late, and as a result the potash applications were not made until July 5. In fact, the Shawver test had the potash applied on July 25.

On July 5, however, corn in several

TABLE II—RESULTS OF SIDE-DRESSING TESTS IN ILLINOIS, 1935

Cooperator, location, treatment, and date of side-dressing with muriate of potash	Yield Records: Bushels corn per acre	Yield Records: Per cent marketable	Yield Records: Bushels marketable	Increases due to side-dressing: Total bushels corn	Increases due to side-dressing: Bushels marketable
Osby Claypool, Marshall:					
No potash	18.9	55.8	10.5	...	...
50 lbs. potash July 5	27.7	66.1	18.3	8.8	7.8
200 " " " "	28.3	64.7	18.3	11.7	10.0
Without potash	16.6	52.7	8.3	...	...
John Ross, Martinsville:					
No potash	16.3	64.0	10.5	...	...
200 lbs. potash July 5	21.6	75.0	16.2	5.3	5.7
E. A. Shawver, Casey:					
No potash	21.6	48.8	10.6	...	...
200 lbs. potash July 25	30.6	65.6	20.1	9.0	9.5

fields had already begun to show the characteristic marginal firing of the lowermost leaves. This indicated "potash hunger," and therefore these tests also showed what can be done with potash supplied after the symptoms of injury appear early in the season.

In Table II the results of these three tests are given.

In studying the results of these tests, it cannot be recommended that side-dressings should replace hill or row applications of potash fertilizers. Sufficient potash supplied at planting time will no doubt produce the maximum growth response, because the damaging effects of stunted growth and injured leaves would not occur early in the season. Side-dressings with potash, on the other hand, may enable a corn grower to save his crop on areas in his fields where these early symptoms of potash starvation injury occur.

For the alkaline or "high-lime" soils in Iowa and these acid soils in southern Illinois, side-dressings are a means of supplementing the regular fertilizer treatment with extra potash when needed. The most important point is that it is not too late to supply potash after the symptoms of potash starvation damage appear on the leaves of young corn plants early in the growing season. This extra potash may determine whether a profitable crop is produced.

Fertilizing Georgia's Cotton Crop

(*From page* 11)

to use on cotton. The results obtained from the plots fertilized in this way are given on the last line of Table 1. The profit per acre was $17.96, and the profit per dollar invested was $2.75. This was the best combination of these two figures obtained from any treatment and for all practical purposes the "high" for both of them.

In order to test out the above recommendation, the Georgia Experiment Station located a number of demonstrations on widely scattered farms in 1934 and 1935. One acre was left as the farmer fertilized it and another acre was top-dressed so as to bring the application up as close as possible to the Station's recommendation. The results are given in Table 3. The extra nitrogen and potash used cost $2.24, gave an increase of 192 pounds of seed cotton per acre, and paid a profit of $6.26 per acre.

TABLE III—BALANCED FERTILIZER DEMONSTRATIONS, 1934-35.*

Regions in Georgia	No. of locations	$N-P_2O_5-K_2O$ Ck. acres farmer's treatment	Total lbs. plant food on treated acres	Seed Cotton per A. Check acres	Treated acres	Inc. from treatment	Profit per A. from treatment	Return per dollar invested on additional plant food
Northern	27	12-28-12	29-28-29	827	1,006	+179	$5.82	$2.60
Coastal Plain	22	13-24-14	31-24-31	889	1,093	+204	6.78	2.83
Av. for state	49	13-26-13	30-26-30	858	1,050	+192	6.26	2.63

* Nitrogen, 10c per lb.; potash, 3.2c per lb.; seed cotton, 4½c per lb.

There are any number of ways in which the above fertilizer may be applied. Four hundred pounds of a 4-8-8 can be top-dressed with 100 pounds of nitrate of soda, a 4-8-4 can be top-dressed with 100 pounds of soda and 32 pounds of muriate of potash, or a 3-9-3 can be top-dressed with 125 pounds of nitrate of soda and 40 pounds of muriate of potash.

The above recommendation will apply only to average conditions and should be modified for special soils and for special conditions. More phosphates can often be used to advantage on soils well supplied with moisture, or on new ground, and on soils which have not been fertilized for a number of years. Less nitrogen and less potash will be needed where barnyard manure is used. Where green manure crops are used, less nitrogen is needed. The use of lime or limestone will increase the need of potash. On some of the grey, pebbly soils and heavy, red soils of the Coastal Plain and some of the sandy soils of the Piedmont, more potash will often pay.

Soaked Again

(*From page 5*)

vide, we next consider the in-between fellows who use methods intended to reduce the loss of water already generously supplied.

Weed destruction, litter mulches, and surface cultivation are among these methods. If a soil's vegetation is thin or quite depleted, the reserve water which gravity pulls to lower levels is not rapidly lost; and an area covered with rank vegetation, such as weeds, increases the drawing off of such water from the land. As weed removal is certainly a more direct means of halting water loss than tillage mulching, then there is every reason why in time the Government will find grants for weed eradication of real community benefit.

If we can afford to pay for legume sodding to hold water or legume turning to build organic matter, surely the weed in its fearful flights abroad affords ample reason for a bonus to retard it. I know it's going to be irksome to aid the kind of farmers who prefer weeds, but if we're in for real reform, let's make it practical. Education doesn't seem to have done the trick—maybe we can pay them to be good, while the money lasts! The only drawback in sight is whether Congress will be able to find enough taxes to cover the cost of a finish fight on quack grass! Maybe if we taxed public nuisances for that purpose it would be elemental justice without political repercussions. Send in your ideas and become famous. It will be your sole reward, because we have no cash contest going.

"Light showers of frequent occurrence are thought to form a surface crust that affords capillary connection with lower soil levels and thus causes constant water loss."

When I first heard this statement about 30 years ago, it fell on deaf ears and stubborn mind. I owned no land, had no objective in life except to go swimming and rabbit hunting, hence I imagined such doctrine was only used to force my unwilling hands to grasp the cultivator handles and my sunburnt neck to feel the chafe of the reins. My only relief when assuming these irksome tasks was to jump into the shady spots under the alders at the end of the row, just to feel the sweeping thrll of a cool foot-kiss, after striding ankle deep in scalding sand for 40 rods. And often I would duck into the thicket for plums, while the mare swished flies and chewed corn tops. But sometimes since when I recall that father, meanwhile, was pitching beyond his aged strength in the meadow for a few skimpy loads of timothy, my self-pity turns to blasts of belated anger for that witless wight that once was I.

Extremes in the land's water-holding capacity often show up in the same township. In one place in my state thick clay soil holds 40 per cent of its water supply in April against Newton's law, and the spring work thus gets a set-back. A few miles away beds of loose sand act like a sieve, and the farmers spread out tons of calcareous clay to stop up the porous leakage. The just and the unjust both get the rainfall, but there is no justice in what happens afterward.

And finally, we reach the third class of tormented tillers, those who have excess water troubles or who possess water in the wrong places. If their heavenly petitions are pitted against those who bemoan lack of water, it isn't any wonder that the only answer seems to be that the Lord helps those who help themselves.

IT CAN'T shine and shower at the the same time and then leave results which amount to anything either way. And if one season is dry everywhere and the next one correspondingly damp, neither season will satisfy all of us. Nature won't cater and compromise, so her partners must.

Take those old familiar gullies in the fields 40 years ago. They didn't alarm us much because it was taken as testimony that we had heaps of rainfall in our favored section. "Better'n alkali flats anyhow," said our old uncle who squatted for a season in the Panhandle, only to return with more remorse than results.

We kids used the gullies for miniature ski-jumps or bob-sled thank-you-ma'ams in winter. In summer they were handy places to cast away the outworn and outmoded riff-raff of the machine shed, including tin cans, wash boilers, and other rusty relics of a ruthless race. Yet gradually, those gaps became cavernous and finger-like, until, like some giant claw of evil omen, they clutched the heart and sinew of the soil in their grasp, and in some cases drove the owners of the farms to utter abandonment.

NOW in the dawn of a determined era cometh the erosion engineer and the terrace tinker to see that we farm our hillsides more wisely and keep our top-soil from emigrating to grow rice in Louisiana. This is another drive that has my powerful endorsement. Yea, forsooth, soil-saving dams are "damn-saving" for soils and for those who have to work them.

I have yet to hear anybody connected with the new soil conservation law mention anything about grants for drainage. Far be it from me to suggest any further ways to deplete the 500,000,000, less uphead and overkeep. It came pretty hard and filled enough pages of the w. k. Record anyhow, so I am not inclined to ask for more new ways to help it trickle out of Washington.

Were there ample funds—which there never are—I would at least whisper a word about drainage, that is, of a special and particular kind. I know plenty of farmers who cannot grow alfalfa because agronomists say it won't stand wet feet. There are areas of low-lying flat and crusty spots on many farms which cause almost as much trouble as rocks and stumps when it comes to doing a genuine wholesale job of tillage and crop raising. I am not for going into this in a reckless way, and after I had secured a few hunks of persuader for the project, I would bar certain highly ambitious gentlemen who want tile laid and ditches dug under and around every acre in America. From my own limited local observation of what drainage districts turned out to be in parts of certain northern states, some of those hawk-eyed predatory promoters would find excuse to drain the bad lands of Dakota if any Federal funds were afloat.

IF YOU really want to see the product of some of these fancy, giltbond investments, ask one of the field men for the Resettlement Administration to pilot you. Trying to farm on peat petered out after fortunes were sunk in the venture, and mostly because they failed to provide a way to keep the frost from killing truck crops in midsummer, and trying to grow potatoes on prehistoric lake beds, are my idea of stultified science and persecution of coots and herons.

But as we stand on the threshold of another growing period with its simple wonders and commonplace mysteries, the signs augur well for a season of plenty and a harvest of great joy. Snows have covered many farms in the North and protected the new seedlings from winter harm. The tilth and texture of the land will respond to the penetration and chemical virtues of snow water, and root establishment should be easy and deep in the next two months. If, as some weatherwise old-timers aver, the hard winter of sleet and gale is apt to usher in a genuine, well-balanced summer of thunder storms and great corn-growing interludes, we shall see what we shall see along about September.

If there is anything more snug and enjoyable for a born-and-bred farmer than to listen to a steady, gentle rain falling on the roof and to see it seeping into the land and renewing the hopes of the harvest, find it for me. In the towns they do not accept it so kindly, unless perchance they are small towns, or big towns with a few land-dreaming people peering at the storm from an office window. The folks in the small places still rely on the good gifts of nature for their sustenance and success, being themselves akin to the farmer. The wayward exile from the soil who lingers in some metropolitan scene does not growl quite as much if he loses his umbrella or forgets his galoshes as the city-bred chap who thinks Henry Ford makes soybeans or something, and who doesn't realize that milk is over 80 per cent water.

So whether we have had to bolster up our farms with balanced plant food or not, the coming of the rain is welcome indeed, for in any case it furnishes the final touch to a certain return for family labor and much planning.

I shall never forget a rousing farm assemblage in a big auditorium in Washington one day in March 1935. You could tell without a doubt that the 5,000 men in that great hall were farmers. From a rear seat high in the gallery I could detect it, and how? By the color of their necks! No, not from lack of water, but from a healthy combination of sunshine and rain, and constant outdoor communion with the surging life in abundance, from which America gets its power and purpose.

FARMERS are partners with the rain and the dew and the dust. They mingle with it and make use of it long ere the parson thumbs the final handful which he tosses on their tombs. Here's to 1936, and many succeeding seasons! Let your job be to conserve what water we get and lay up enough crops from each season of plenty to keep the drought demons from scaring and scorching us as they did two years ago.

Beyond that we are arrant gamblers no doubt, but after all the game is a heady one and a healthy one. It is indeed proof of the relation of our life and our language when "rain" rhymes with "grain" and "shower" with "power." My best wish for 1936 is that your rain barrel be full and your land fertile. And on your part congratulate me that I have not resorted to the flippant synonym, "H_2O."

FREE LOVE

Judge: "What do you wish to charge against your husband?"

Wife: "Free love, your honor, he ain't supported me for eight years."

"Do you believe in clubs for women?" asked the reporter of the local newspaper, interviewing the visiting celebrity.

"Yes," he replied judiciously, "if kindness fails."

An old German and his wife were given to quarreling. One day, after a particularly unpleasant scene, the old woman remarked with a sigh:

"Vel, I vish I vas in heaven!"

"I vish I vas in the beer garten," groaned her husband.

"Ach, ja!" cried the old wife. "Always you pick out the best for yourself!"

He (at the phone): "I want to insert a notice of the birth of my twins."

Girl (at the newspaper office): "Will you repeat that, sir?"

He: "Not if I can help it."

AT IT AGAIN

An American, "doing Scotland," expressed his great admiration for Loch Katrine. "I guess we could do with that strip of water in Noo York," he said. "There should be nae trouble in gettin' it over there," replied the Scot to whom he addressed the remark. "Wall, stranger, an' how could you do that?" questioned the Yank. "Easy enough," replied the Scottie, "a' ye need is a few miles o' pipes, an' if ye can sook as well as ye can blow, it wad be ower the Atlantic in nae time!"

NO DIPLOMAT

History Prof.: "Who was Talleyrand?"

Student: "A fan dancer, and cut the baby talk."

A party of tourists were being shown over the cathedral by a guide.

"Behind the altar," he told them, "lies Richard the Second. In the churchyard outside lies Mary Queen of Scots, also Henry the Eighth. And who," he demanded, halting above an unmarked flagstone, "who do you think is a-lying 'ere?"

"Well," answered a nearby tourist, "I don't know for sure, but I have my suspicions."

Nurse: "Junior, I have a surprise for you."

Junior: "I know all about it. I even know their names."

Nurse: "Why, Junior!"

Junior: "Yes, I do. When the doctor told Daddy, he said, 'Twins! Hell and Blazes!' "

Teacher: "What is a censor?"

Oswald: "A censor is a man that goes from house to house to increase the population."

"Drink," said the Irish lecturer, "is the greatest curse of the country. It makes yer quarrel with yer neighbors. It makes yer shoot at yer landlord, and it makes yer miss him."

Printed in U. S. A.

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VOLUME XX NUMBER NINE

TABLE OF CONTENTS, MAY 1936

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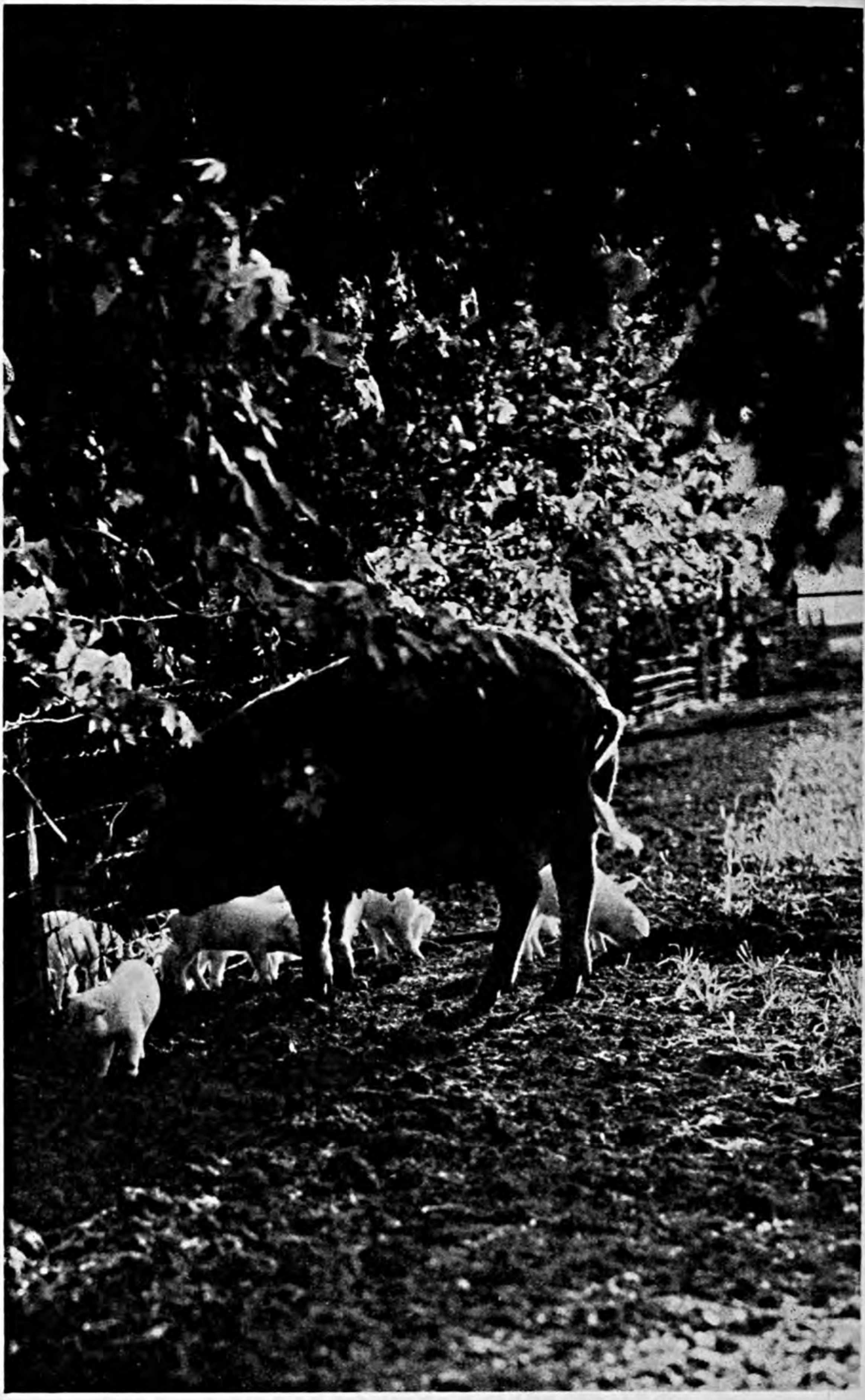

THE SEARCH FOR "GREEN PASTURES" BEGINS EARLY.

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A Discussion of Poetic Moods—

Spring Song

Jeff McDermid

THE vernal urge to bust out into verse usually carries its own immunity to those for whom its perusal is intended. Spring on the farm is such a busy season that actions in overalls speak louder than words in meter. Hence the punishment falls mostly on the readers who are paid for their pains, like editors, school-ma'ams, and postmasters.

In my rasher moments I have considered the plan of doing a Walt Mason piece of prancing prose for the edification of my essay classes, now scattered from Palo Alto to Penobscot; but even hardened criminals oft have their qualms of conscience and their modicum of forbearance.

Reinforced with that bulky handbook for the poem foundry known to the ancients as Walker's rhyming dictionary, no doubt your tormentor of many pages could have scattered iambics, dactyls, and spondees on paper better suited for potassium and photosynthesis. But as my contract calls for the relatively strait-jacket of prosody, I shall not violate its sanctity or victimize our cash customers by any disguised attempts to lead them into the realms of rhyme in cunningly contrived sentences arranged in ordinary paragraphs.

I have wondered betimes why amateur poetic effusions are irrevocably associated in the public mind with the spring equinox. Searching the signs of the zodiac in my swamp-root almanac yields me no cogent reason, so I fall back upon perusal of other authorities or perchance on my own conjectures. It sums up something like this, to wit:

The languorous climate in which the romantic and vocal Latin races abound is one long period of idyllic nature; while we of the temperate zones are besieged for almost nine months of the year by weather conditions which keep us constrained, cramped, and chilled. Thereupon, at the first signs of the north-bound sun and its summons to arboreal delights, we lav away our roast beef and smoking punch-bowls and proceed to live on garden salads washed down copiously with bock beer. This change of weather and diet and the simultaneous change from ankle-lengths to knee-shorts combine to arouse the latent and winter-benumbed impulses which soon find glorious outlet in scribbled sentiments.

No matter about the technical quality of the product. This is no course in the art of articulation in the merry month of May. If only those who *can* sing did all our singing, it would indeed be a solemn and a relatively quiet world. We have too long allowed athletics and sports to get into that stilted professional state of affairs. We have seldom played ourselves, on the grounds that the experts could play much better. I hold that it's better to play or sing or write poetry ourselves as the mood hits us than to reserve those pleasures entirely to the big leaguers.

REMEMBER, I defend the taking part in sports, song or poetry for their own sake. Of course, the audience or the reader presents a different and, in this connection, usually an heroic picture. I freely admit that seeing an amateur ball game is a bit more entrancing than scanning a volunteer tyro's verse or enduring amateur concerts.

But then, after the agony is over, ask yourselves these two pointed questions: No. 1, Why do people who are not poets or ball players try to write poetry or play baseball? No. 2, Why do people who are reputed to be excellent poets or cagey ball players frequently fail to write good poetry or play good ball?

I maintain that both are so clearly excusable as manifestations of human vanity and vagary that we must resign ourselves to fate and accept them, until some politician or Federal judge gives us relief through statute or injunction.

AS a reason for using poetry as a subject when there are so many weighty economic problems begging for my attention, I advance the claim that there are more otherwise sane people engaged in writing poetry than many of us dare admit; and by this I do not mean the kind of verse that smudges the wash-rooms in railroad depots, signed "Oklahoma Oscar."

Before me as I spoil good paper there lie about twenty verses done to a turn by an Irish farmer who emerges from a hard winter of frozen spuds and high taxes with the usual burst of bucolic fervor on farm life's compensations. It has four lines to a verse and is arranged like poetry commonly is constructed, but beyond that I have reserved a few wholesome doubts, albeit I am not a literary critic. Only three of the stanzas are appended by way of partial experiment before the gong:

"The farmer's life is a hard one,
It sure is no joke,
If he don't watch his points
He is apt to go broke.

"It can't be denied he has compensations
That make it worth while,
Tho in raiment neither he nor his wife
Can follow the style.

"Of course, the farmer needs money, with
The interest and mortgage to pay,
To help him 'tis puzzling the best minds
To find the right way."

At least for the last stanza, we can all testify that there is indeed "more truth than poetry." I know he thoroughly enjoyed putting this all down on paper just as much as I do reproducing a fraction of it, and I believe there is a vast deal of saving grace in

doing that rather than committing mayhem or grand larceny in revenge for the things he missed.

So much for the kind of folks who write poetry without a license. Next, as outlined, I turn to the licensed poets, the laureates of our land, who sometimes vex us by jobs which seem tedious, awkward, outre, and supererogatory, to say the least. They, too, sometimes strike out!

Take this poem of two lines entitled "The Ranger's Hound Dog" by a noted American "free verse" writer, as taken from his bound works in almost any library, namely: "Guarding the shack from poacher and thug, the hound dog sits on the bearskin rug." That's all to the poem, if such it be.

Then a famous woman poetess of the Imagist school writes on Whitechapel thus: "Soot, mud, noise, iron, smoke; iron, iron, iron." And of an orchestra overture, she says:

"Thin-voiced, nasal pipes
Drawing sound out and out
Until it is a screeching thread,
Sharp and cutting, sharp and cutting;
It hurts
Whee-ee!
Bump, bump, tongti-bump,
There are drums here banging."

That was no doubt the precursor of the jazz-band song about the music going 'round and 'round and coming out here, but it never attained such popular favor somehow.

Robert Frost, the New England poet, has really outdone some of my humble neighbors in their metrical evenings after chore time, when he describes a wood-pile with mathematical accuracy, thus:

"It was a cord of maple, cut and split,
And piled, four by four, by eight."

In closing out my job-lot of remnants one last gem from a modern celebrity is submitted—one complete poem called "The Well":

"He found it very cold and deep,
With a queer niche in one of its walls,
From which he hauled forth buckets of bricks and dirt."

There must be some reason why, next to Tennyson, Whittier, and Longfellow, the western versifiers like Riley, Field, and Guest "take holt" of plodding people a little tighter than do the modern purveyors of real imaginative, classical, accepted, certified, and water-marked Poetry, with a capital letter. Yea, this statement is heresy and displays a maudlin mind with no conception of how deep the Victorian poets sunk when measured in the standards of Greenwich Village or other cubistic, communistic, or impressionistic culture centers.

To many of the devotees of ultra-modern poetry one must be drunk to drink in their meaning, and like the topsy-turvy paintings by their fellow sufferers in the arts, one should tie up

(*Turn to page* 44)

Potash for Cotton Wilt and Rust in South Mississippi

By Dr. L. E. Miles

Agricultural Experiment Station, State College, Mississippi

COTTON wilt, caused by *Fusarium vasinfectum,* is without doubt the most important disease of cotton in the United States and causes the largest annual loss to that crop. It is coextensive with cotton culture in this country, with the exception of certain localities characterized by heavy soil types, as for instance, the waxy, black lands of Texas and parts of the Mississippi Delta. Even on those soil types it is found to occur occasionally, though on such the damage caused is usually of minor consequence. The trouble also occurs in several other important cotton-growing countries of the world and in those, as in the United States, the resulting losses are high.

In 1892, George F. Atkinson, then at the Alabama Experiment Station, first called attention to the disease. His description of the symptoms of wilt, rust, root-knot, and other troubles of cotton was so simple and accurate that it has served as a basis for all work done on those diseases in this country since its publication. It has been clearly evident to every one concerned, including the growers, since Atkinson first called attention to it, that cotton wilt is commonly more prevalent and destructive on the lighter soil types. This is amply demonstrated by a consideration of its distribution in Mississippi. Scarcely a field can be found in the southern and central sections and in the interior portions of the northern section, in which the disease cannot be observed. These areas are all characterized by soils which are rather light in texture.

The rust disease, frequently designated since the work of Atkinson as potash hunger, is coextensive in distribution with wilt and is usually found occurring in the same fields. Experiments of Atkinson and later workers have clearly demonstrated that ample applications of potash will completely control rust and will entirely eliminate the damage and loss in yield caused by it. This fact, together with the concurrence of wilt and rust on the lighter soil types, has influenced many in the belief that wilt is a disease of weakened, devitalized, or undernourished plants. The fact, again first called to attention by Atkinson and later confirmed by other workers, that infestation with nematodes was a predisposing factor to severe wilt damage undoubtedly played a part in establishing this belief.

Many growers have maintained for years that fertilizers containing potash have a beneficial effect in the control of cotton wilt. This was long held as one of the "superstitions" of practical growers by the so-called initiated, who knew that the disease was caused by an organism and who consequently sought for control measures along the orthodox and established lines of investigation which had previously been productive against diseases of the same type. As has been found on other occasions, however, such "superstitions" frequently have a substantial basis in solid fact, if only one digs deep enough to find it.

A number of workers have made some investigation of the effect of fertilizers on cotton wilt in past years, but the evidence secured has been contradictory. In 1907 Fulton in Louisiana reached a conclusion that fertilizers had no effect on wilt. Orton, working in the light soils of the southeastern states, in 1907 stated that wilt is "not due to the continued use of commercial fertilizers, nor to the exhaustion of any element of plant food." In 1908 he stated that he found no benefit for wilt control from any type of commercial fertilizer. He pointed out, however, that efforts to control wilt by other measures were frequently rendered negative by the presence of nematodes. The probable presence of severe infestations of nematodes undoubtedly detracts from the results secured from his tests with commercial fertilizers. Lewis in 1911 studied the effects of fertilizers on the disease in Georgia and came to the conclusion that none of them were of any benefit in combating it. However, his plats were not replicated, and there is evidence in his paper that the presence of nematodes might have been a disturbing factor in his experiments as well.

On the other hand, Rast, a plant-breeder in Arkansas, taking cognizance of the firmly held belief of many growers in the beneficial effect of potash in 1922, reported highly successful results from the use of kainit both in controlling wilt and in increasing yields. Neal in 1927 secured evidence from pot and field tests conducted at the Mississippi Experiment Station that potash might be beneficial in the control of wilt. In 1928 he reported that field tests conducted both in north-central Mississippi and at Poplarville in south Mississippi showed a marked reduction in the incidence of wilt when fertilizers were used, particularly those containing some form of potash.

From these data, available at the inception of the work reported herein, it appeared that there was a decided lack of unanimity of opinion with respect to the effect of fertilizers on cotton wilt. For this reason it was decided to continue the work begun by Neal and to follow up the leads which he had initiated, following the

A bad wilt spot. This needs a wilt-resistant variety of cotton and ample amounts of a fertilizer high in potash.

TABLE I.—EFFECT OF POTASH ON COTTON WILT AND YIELD OF SEED COTTON AT THE POPLARVILLE BRANCH EXPERIMENT STATION IN 1929 AND 1931-33

Treatment Lbs. per acre	1929 % wilt	1929 Lbs. seed cotton	1931 % wilt	1931 Lbs. seed cotton	1932 % wilt	1932 Lbs. seed cotton	1933 % wilt	1933 Lbs. seed cotton
Check—No fertilizer	23.4	400.5	34.6	211	16.6	107	13.5	320
N-200 P-400 K-0	45.8	1,269	56.5	1,017	21.1	346	22.5	1,294
N-200 P-400 K-50	17.6	1,458	17.0	1,058	6.0	343	8.5	1,890
N-200 P-400 K-100	2.6	1,728	3.0	1,224	10.7	378	4.7	1,949
N-200 P-400 K-150	4.3	1,692	6.3	1,237	10.4	404	5.7	1,940

TABLE I-a.—FOUR-YEAR AVERAGE (SUMMARY OF TABLE I)

Treatment Lbs. per acre	% wilt	Lbs. seed cotton	Av. % decrease in wilt infection	Av. % increase in yield
Check—No fertilizer	22.02	259.6	—42.35	—73.54
N-200 P-400 K-0	36.5	981.5	......	......
N-200 P-400 K-50	12.3	1,187.3	—65.18	+20.96
N-200 P-400 K-100	5.30	1,319.7	—86.12	+34.45
N-200 P-400 K-150	6.70	1,318.2	—82.46	+34.30

suggestive work of Rast with respect to the effect of potash. Accordingly, a series of field tests were begun on various soil types in different parts of the state, in which the effects of potash used alone and in combination with other fertilizer elements were tested with regard to wilt control. These tests extended from 1928 through 1934, some for shorter periods and others throughout the entire time. On account of limitations of space only those conducted on the light, sandy soils of south Mississippi will be discussed at this time.

A test was begun in 1929 to determine the effect of varying amounts of potash in a mixed fertilizer on the control of wilt and on the yield of seed cotton at the Poplarville Branch Station. It was omitted in 1930 but resumed in 1931 and continued through 1933. The variety, Lone Star 65, which shows only a moderate degree of resistance to wilt, was planted on heavily and uniformly infested soil which was of a light sandy nature, of low water-holding capacity, and of a low natural fertility. The fertilization applied is indicated in Table I, which presents the results secured over the 4-year period in which the test was conducted. The nitrogen used was in the form of nitrate of soda, the phosphorus was derived from superphosphate, and the potash from muriate of potash.

It is clearly evident from an examination of the table, that with the

(*Turn to page* 41)

Renovating Pastures

By Arthur O. Braeger

Wisconsin College of Agriculture, Madison, Wisconsin

"LIME, phosphate, and potash for pastures is proving a good slogan," declare crop specialists at the Wisconsin College of Agriculture, who have had years of experience in helping farmers solve their pasture problems.

Bluegrass, the hardy pasture grass which covers over 100,000,000 acres in the north-central and eastern states, is especially in need of help, says L. F. Graber, professor of agronomy. He maintains that declines in soil fertility, drought, over-grazing, and white grubs have severely injured this once hardy grass, especially in pastures in southern and western Wisconsin.

The renovation of such pastures consists of establishing dry-weather legumes—sweet clover, alfalfa, and red clover—in bluegrass sods without plowing, Graber has found. By disking and cultivating, the legumes are seeded without serious hazards of erosion. Once established in bluegrass sods, these dry-weather legumes repel egg-laying June beetles, eliminate weeds, and provide nitrogen to thicken and promote the growth of the grass. In addition they enhance the production of the pasture and supplement it with succulent growth when bluegrass becomes dry and tough from summer drought.

But such a plan can succeed only if the soil has an abundance of lime, phosphate, and potash, either naturally or by application, Graber declares. They help make clovers succeed. He suggests that farmers have the soil tested to find out if it needs

Where white clover grows like this, renovation with dry-weather legumes is not needed.

either lime, phosphate, potash, or any combination of these soil-building materials for the abundant growth of the three dry-weather legumes, and believes in applying fertilizers, as needed, before cultivating the sod. He would proceed as follows:

Burn off accumulations of old grass and weeds with care.

Cut up the sod thoroughly with a disk soon after the frost is out of the ground and when it is dry enough to work up well.

Level and smooth soil with a harrow.

Sow as early as possible in the spring—preferably before sowing oats. Use no nurse crop.

Disk early and again later if ragweeds and horseweeds, and others are plentiful.

Inoculate the seed before sowing.

Seed heavily, as 20 to 25 pounds per acre are not too much.

Harrow or roll in the seed after seeding.

Fence the seeded area.

Regulate grazing of the young legumes by removing cattle when the first abundant fall rains occur.

Use biennial sweet clover. It is the cheapest and safest legume to sow on light, thin, or stony soils.

"In 1934, a year of most intensive drought, 14 old, grub-injured, and weedy bluegrass pastures were selected in southern and western Wisconsin for renovation," Mr. Graber says. "Permanent pasture areas from 3 to as much as 22 acres were fenced, limed, and fertilized as needed and then disked, harrowed, and seeded to dry-weather legumes in April and May. Unprecedented heat and drought prevailed, yet the legumes pulled through with excellent stands. In only two instances did the seedings fail, and they were reseeded that same season with remarkable success. In 1935 12 additional pastures were renovated without a single failure. Prior to 1933, three pasture areas in southwestern Wisconsin were successfully renovated and grub-proofed with dry-weather legumes."

This wet, boggy pasture will produce canary grass when potash is applied.

There is no need to work on good pastures, according to Graber. But relatively few pastures will qualify as such. Many of them are weedy, unproductive, thin-sodded, grub-injured, and without clover. These are the ones that need help.

"It would be useless to attempt to establish dry-weather legumes in any pasture without liming and without fertilization, where the soil was seriously lacking in mineral requirements. Lime, phosphate, and potash as needed had best be put on the pasture just before the sod is scarified in preparation for seeding with dry-weather

(*Turn to page* 34)

Morgan's Method

By W. B. Ward

Extension Horticulturist, Purdue University, Lafayette, Indiana

RAY MORGAN, Knightstown, Ind., is a potato grower. We might go further and say that he is a good grower of quality potatoes, as year in and year out his yields have been around 200 bushels per acre. Occasionally, scab, wireworms, and weather held the "winning hand," and consequently the yield was reduced.

Mr. Morgan has always taken an active part in Indiana's potato program, learning from this one or that one, telling his experience to others, and when some new practical idea came to his attention a conference was called to see whether or not this new practice could be worked into his potato program.

A few years ago Dr. Bushnell, from Ohio, talked before our Indiana potato growers upon the aeration of soils. He thought all soils should have more air in them for best results and went into great detail regarding this soil-improving theory. Results in Ohio favored corn as a green-manure or soil-improving crop for potatoes, particularly upon the heavier soils similar to those of central and southern Indiana. Morgan has ever been sold upon any soil-improvement program for his farm and has kept up the fertility far better than most farmers. This corn idea appealed to him, so in 1934 plans were made to include the corn green-manure crop as part of his program for his next year's potato crop or for the 1935 season.

A field that was well drained and contained about 20 acres was selected. This field had been in potatoes several years before and produced about 200 bushels of potatoes and 100 bushels of corn per acre during the corn rotation. The soil test upon this field indicated that it was slightly acid, pH 6.7, and high in available phosphoric acid and potash.

This field was planted to corn during the early summer of 1934, six pecks drilled in per acre. About September 1, when the corn had become fully grown and while in a more or less succulent condition, it was plowed under 10 inches deep. After the plowing of the corn cover crop, a

(*Turn to page* 38)

The State Federal Inspection Service lends a hand and educates growers as to what constitutes a No. 1 potato.

Fertilizer Needs of Red Raspberries

By A. E. Stene

Pomologist, Agricultural Experiment Station, Kingston, Rhode Island

A FEW years ago a review of the literature of raspberry growing indicated more or less uncertainty regarding the nutritional requirements of this fruit. Experimental work had been recorded from various sections of the country, and the practices of successful growers had been studied; but conclusions varied considerably and resulted in a general agreement only on one point, namely, that red raspberries require an abundance of humus, and that whenever available, barnyard manure should be applied liberally, especially in preparing the field for planting.

Opinions regarding chemical manures ranged from a general statement that they were of little value, to a suggestion that in some cases, where the need was clearly indicated by the condition of the plants, annual applications of nitrogen might prove profitable. Phosphoric acid and potash, though mentioned, were considered by a majority of writers as of doubtful value. Inquiries from growers regarding the fertilization of other brambles and grapes were nearly as difficult to answer on the basis of available information. This led the Rhode Island Experiment Station, in 1926, to plan experimental work which might throw some light on the questions, at least on Rhode Island soils, and when barnyard manure is not readily available.

It was decided to follow a plan found useful in earlier experiments in ascertaining the relative lime requirements of different crops, which consisted in planting several crops on a level piece of land as uniform as possible in original fertility and giving them identical lime treatments in order to ascertain their relative response to lime additions. It was felt, that a similar knowledge of comparative requirements for the three elements, nitrogen, phosphoric acid, and potash would be helpful even on other soils, or under climatic and site conditions differing from those presented at the Rhode Island Station.

Plan of Experiments

The soil was a sandy loam of average fertility which in growing other crops had indicated no marked deficiency in any of the three principal elements. Red raspberries, black caps, blackberries, and grapes were chosen for the test. Four plats were allotted to each fruit, one plat receiving a 4-10-6 fertilizer, at the rate of 500 pounds per acre, the others, the same amount of two ingredients but none of the third. Each plat contained 1/30 of an acre, and the raspberry plats were planted with 4 rows, 5 feet apart, each of a different variety; viz., Latham, June, Herbert, and Cuthbert. The outside rows in adjoining plats were 7 feet apart.

Fertilizers were broadcast between rows early in the spring, and the soil cultivated until picking time. Old canes were removed, and a cover crop of barley was sown about the second week in August after the last picking. The plants were given a dormant spray with lime and sulphur in the

Fig. 1—Left, no fertilizer; right, complete fertilizer. The difference in height to be noted in this picture gives inadequate indication of the great difference of vigor of plants in the two plats.

spring and a like spray, summer strength, after the fruiting canes of the season were cut out. Earlier experiments at the station had shown red raspberries to be relatively intolerant of acid soil conditions, and lime was therefore applied to the plots so as to establish a soil reaction only slightly on the acid side.

Unfortunately, plants other than red raspberries suffered set-backs from winter-killing, due to the flat site and consequent lack of good air drainage. The results with red raspberries were, however, sufficiently striking, so that fruit yields and cane growth were recorded. There were some very interesting and, in some cases, unexpected differences in hardiness, yield, etc., of the different varieties, but as these variations apparently were not correlated to any significant degree with differences in fertilizer treatment, they will not be further discussed

TABLE I. YIELDS IN KILOGRAMS AND QUARTS AND PERCENTAGE REDUCTION IN YIELDS AS COMPARED WITH COMPLETE FERTILIZER PLAT

Treatment	Year	Total yield per plat, all varieties (4 rows)	Total yield per plat Latham (1 row)	Average yield per plat All Varieties	Average yield per plat Latham only	Average yield in quarts per acre based on Latham yields	Percentage reduction in yield
N-P-K Complete Fertilizer	1928 1929 1930	22.7 19.4 9.0	16.5 10.0 3.3	17.0	10.0	2,069	Base
N-K No Phosphoric Acid	1928 1929 1930	17.2 17.3 7.8	11.7 10.2 4.0	14.1	8.6	1,779	17
P-K No Nitrogen	1928 1929 1930	10.2 16.3 9.1	6.7 8.7 5.3	11.9	6.9	1,447	30
N-P No Potash	1928 1929 1930	11.6 9.6 2.9	9.7 6.0 1.5	8.0	5.7	1,179	53

here except to note that the Latham out-yielded its nearest competitor two to one, or better. This bears out the claim of the Minnesota Experiment Station, where it originated, that this variety, since its introduction, has increased the income of growers of this kind of fruit by a total amount sufficient to pay the cost of the Minnesota fruit-breeding substation from its beginning. Table I summarizes the yield results of this experiment. These results indicate that plats receiving only phosphoric acid and nitrogen gave the poorest yield; complete fertilizer, the best; and the other two gave intermediate yields. Leaving out phosphoric acid and nitrogen decreased the yield 17 and 30 per cent respectively, but leaving out potash reduced the yield 53 per cent.

From an examination of plants in outside rows of one plat, it was apparent that plants were able in some degree to profit from needed fertilizer elements applied to adjoining plats. Yields were therefore calculated for the two inside rows containing the Herbert and June varieties, and the results for all plats are compared in Table II.

It will be noted from this table that the percentage of yield for two varieties, as compared with the yield of all four varieties, ran quite close together except in the case of the no-potash plat, where inside rows yielded proportionally much less than outside rows. The outside row of this plat on one side ran alongside a field getting 1,000 pounds of a complete fertilizer per acre and the opposite, outside row grew next to the plat which received 500 pounds of a complete fertilizer. It would appear from these results that the omission of potash would have reduced the yield even more than indicated in Table I, had the plants been unable to draw plant-food from land adjoining this plat.

Measurements of cane height gave similar indications of nutritive deficiency where one element of the three was left out, but the figures were not quite so striking, possibly because it was impracticable to correlate with height, differences in total number of canes, diameters of canes, and leafiness. In fact, height measurements gave very inadequate indications of the great differences in vigor of plants in the plat receiving a complete fertilizer and in the plat receiving fertil-

(*Turn to page* 39)

Fig. 2—View of one series of plats in the second experiment. Plat in foreground received no potash. Plat in background received a complete fertilizer. Height indicated by nail kegs in front and a 10-ft. pole in the center rear.

Strawberries—Can Be Profitable

By Clayton A. Bunting
Selbyville, Delaware

THE strawberry industry of the eastern section of the United States is wide, varied, and interesting. It is also in too many instances conducted on a slipshod basis, resulting in little if any profit rather than the handsome $509 net per acre which we realized last year from a rather large test plot of the variety, Dorsett, being grown for market. The firm with which I am associated is primarily engaged in the production of plants, millions of which have been supplied to the market growers of the country in the past few years. This test planting in 1935 was the result of a desire to test both our product and the methods we advocate in the growing of this plant into a money crop.

On the DelMarVa Peninsula where our farms and nursery are located, strawberries as a crop have declined somewhat during the past few years, as a result of the wearing out of strains rather than from the non-existence of good productive varieties. Such varieties as the United States Department of Agriculture Blakemore will be in the limelight for years; and certainly Big Joe, Lupton Late, Chesapeake, Gandy, Premier, and Missionary are all good varieties if properly grown.

New Varieties Introduced

But it remained for the United States Department of Agriculture to present to the growers of the country Dorsett and Fairfax, without a doubt, the two finest strawberries for any purpose in our generation. Both varieties are very good, and not until last season under the test of market production did the writer finally arrive at a decision as to the better of the two. This conclusion may apply only to our peninsula, for so similar are the two varieties that it is easily possible for one or the other to lead, depending on the section of the country. Both varieties are very productive, and their fruiting season extends over a good three weeks or longer. It is necessary to pick fruit from the plants about 10 times during the season, which just about doubles most varieties in this respect.

Low Acidity Plus Flavor

Prior to the introduction of these two varieties, it was necessary to grow varieties highly acid in their content to assure shipping quality. Of course, this resulted in a sacrifice of flavor in distant markets in favor of shipping quality. The fact that both varieties have low acid content, yet ship well, will no doubt result in an expansion of distant markets to the ultimate benefit of all growers.

There is much to be said for and against various methods of growing strawberries as a market crop. Intensive cultivation of a piece of land prior to its receiving a planting of strawberries is a necessity if you are to realize a weed-free strawberry field the following year. It is impossible to grow a bumper crop of berries amidst a bumper crop of weeds, for not only will they interfere with production of the plants, but with their ability to ripen the fruit as well. Most any type of well-drained soil can be made almost weed and grass-free over a period of three years of intensive cultivation to any other

should be cultivated in immediately. Applied at this season, potash has plenty of time to get into action and will result in a heavier root system and stronger fruiting buds.

A typical scene in Delaware during strawberry-picking time.

crop. Thus, for best results, one should plan ahead for this crop. Set your plants in this type of soil. Give them frequent cultivation and use hand and hoe to keep plants free from all other vegetation.

Potash a Necessity

Now comes the vital point of plant feeding. During the war years, due to scarcity of potash, this element became a forgotten product for the growing of farm crops; in fact, many growers of strawberries located in poultry-raising sections have gone so far as to use exclusively the almost free chicken-manure that can be obtained for the hauling. This manure contains, of course, lots of nitrogen in ammonia form, but is relatively low in potash, a vital necessity to successful strawberry culture.

An application of potash at the rate of 10 lbs. to every 100 yards of row should be made in September. Apply this along the side of the row, being careful not to let any hit the plants, particularly if they are damp. It

Another fault to be found is in the method of spring fertilization which is generally applied along in April, too late to realize the return that would be possible if it was applied earlier and was of the right content.

The proper procedure of the so-called top-dressing of strawberry plants is to apply a fertilizer analyzing 4 per cent ammonia, 8 per cent phosphoric acid, and 10 per cent potash. Instead of being broadcast in the strawberry rows in April, this application should be made not later than the early part of March, and preferably in January or February, in order to give the potash ample time to act. Potash disseminates slowly and here on the Peninsula and in most of the sections of the East and Central West, when applied in April it has little value to a crop which ripens in May and early June.

With the more balanced plant-food containing the much needed potash, one will get instead of a rank, heavy

(*Turn to page* 33)

Mangels Respond To High Potash

By Maynard S. Grunder

Agronomist, Western Washington Experiment Station, Puyallup, Washington

THERE are, without question, many instances where the failure of the commonly recommended rates of application of the various fertilizer elements to show appreciable results, is due to the tying-up of the element in the soil in a form not available to plants, rather than to a lack of need for that element. Much more information on this subject is needed. The data following are presented not as conclusive evidence nor even as a recommendation for high applications, but to suggest that an experimental procedure involving higher applications than those commonly used may be productive of some valuable and interesting results.

There is, in my opinion, considerable danger in using single rates of application of the several fertilizer elements as a basis for definite recommendations, especially when those rates are relatively small. This would be especially true where the use or non-use of the element studied is to be based on the result obtained. Such a test may be decidedly unfair to the element studied and, still more important, it may delay adequate study of the element where small applications fail to give results.

It is evident that the rate of fertilizers commonly recommended for and applied to various crops may not always be that which will give the highest yields or the largest net return per acre of crop yields. It seems reasonable to suppose that in many cases, much greater return might be secured from larger applications of certain fertilizer elements than those ordinarily applied, especially in cases where the crop grown is a heavy feeder of the element in question. Even in cases where there is apparently a sufficient supply for the needs of the crop, the element may not be available in sufficient amount for rapid growth.

With this in mind an experiment was started to determine the response of mangels to varying quantities of potash (when an abundant supply of nitrogen and phosphorus were applied). The plots used in this experiment were 1/10 acre in size. Plots receiving no potash were located at intervals in the series to serve as checks. All plots (checks and potash) received the same applications of nitrogen and phosphorus.

A 3-Year Experiment

Potash was used as the variable factor in the present studies, although similar studies involving the use of phosphorus and nitrogen, as well as the rarer elements, are of equal importance. Potash was selected because extensive field plots over western Washington, using small, single rates of applications of potash on various crops, either failed in many cases to give favorable responses or actually appeared to depress the yield of various crops.

The potash applications (muriate of potash) varied from 300 to 1,000 pounds per acre. The potash and phosphorus were broadcast on rough plowed ground several weeks in advance of seeding the plots, while the nitrogen (nitrate of soda) was applied immediately previous to seeding the mangel crop.

The experiment was continued with this set-up for three years. The data obtained were in some cases quite variable, and the average yields varied widely in different years. However, during the three years there were few instances when the potash-fertilized plots failed to produce a substantial increase in yield over the check plot. In some cases remarkable increases in yield were secured by the use of potash. In one case the yield over the nitrogen-phosphorus fertilized check plot was increased 76 per cent, or more than 20 tons per acre by the use of 600 pounds of potash per acre.

High Yield and Economy

During the first year of the experiment, the results were favorable to higher applications of potash, from the standpoint of yield, although the trend toward higher yields did not correlate closely with the increasing applications of potash. For example, the 300 and 400-pound applications increased the yield between 2 and 3 per cent, while the 500-pound application jumped the yield 22 per cent. The 600 and 800-pound applications increased the yield by 9 per cent, while the 700-pound application resulted in an 18 per cent increase. The 900 and 1,000-pound applications were very similar with 28 and 26 per cent increases respectively.

Considered from the standpoint of economical production, the lowest costs per ton the first year (including the cost of the fertilizer and other production costs) were secured on the plots receiving 500, 900, and 1,000 pounds in the order given.

The average of all potash-fertilized plots was 30.87 tons as compared to 26.85 tons for those not receiving potash, an average increase of 4.02 tons or approximately 15 per cent.

The second year of these experimental plots showed remarkable results of the effect of higher concentrations of potash. The 300 and 400-pound applications showed comparatively small increases. The 500-pound application resulted in an increase of almost 30 per cent, while the 600-pound application made the remarkable increase of 76 per cent over the check plots receiving no potash. The 700, 800, and 900-pound applications showed successively less effect than the 600-pound application in increasing the yield, while the 1,000-pound application, strangely enough, again showed a considerable increase.

No Depressive Effect

These results are remarkable in that the increasing concentrations of potash gave increasing yields up to a certain point, after which a decreasing effect was secured. (It is significant, however, that in no case was there a depressive effect observed on the mangel crop as a result of the application of high concentrations of potash when compared with the check plot.)

Largest yields as well as lowest cost of production per ton (including fertilizer cost) were obtained from 600, 700, and 800-pound applications in the order given. The average yield of all potash-fertilized plots was 36.34 tons per acre as compared to 27.24 tons for the check plots, an increase of 9.1 tons per acre or more than 33 per cent.

During the third year of these experiments, yields were very low, due to an unfavorable season and to the fact that the soil on which the crop was planted was somewhat more sandy than that used in previous years. With one exception, large increases were secured from all potash applications. This exception was the 600-pound application which for some reason showed no effect this year. The high peak so evident last year did not show up this year.

Because of the low yields the cost per ton of producing the crop was

(Turn to page 35)

We Did "Sumpin" About It

By F. H. Jeter
North Carolina State College of Agriculture

ROBERT said we had to do "sumpin" about it and Robert knows, because he has been on the farm for 15 years. I inherited him along with the land back in the early part of 1932 when my father's cotton plantation was divided into 12 parts. My share was 216 acres of a tract known as the Lyles Place. It was set apart for me because, as a young chap, I had often wished that the particular farm were mine, but in those days the tract contained 700 acres and was too valuable for my slender earnings.

When an older brother, who is one of the administrators of the estate, wrote me that I had been given a part of the farm that I had so desired, I immediately set out from Raleigh to drive the 240 miles to see my new possession. The brother had mentioned that Robert was on the farm and that I would probably have to fix up his house a little, buy a few implements, and perhaps a mule. He also said I would have to "advance" Robert for making the crop, but that he, the brother, would help me in my long-distance farming.

A Forlorn-looking Place

The farm that I knew as a kid was no longer there. In my rather infrequent visits to the home place, I had not inspected this particular farm with any critical eye, and I was unprepared for the waste of eroded land, the red clay showing above the warm sandy loam, the gullies which ravaged the principal field, and the tumbled,

Mr. Jeter standing in field of corn which yielded well after "we did sumpin about it."

forlorn buildings. So busy in my own job in North Carolina, I had forgotten that the cotton farmers of South Carolina also had suffered through the years of low prices and were lucky to hold their farms together, to say nothing of keeping them in a state of improvement.

Robert had been farming with two, old, worn-out plug mules and a little fertilizer. He had planted each year about 30 acres of cotton and had harvested from these acres such as the land would yield with indifferent cultivation. But he met me with a smile, and we drew up a contract. We shook hands, and I told him I would stick to him as long as he stuck to me and did the things I told him to do as well as he could. That's the only contract we ever had. We went over every foot of the land and decided where we would plant cotton, where corn, and what we would need in the way of implements and other equipment.

Robert Goes to Work

Robert went to work fixing up the terraces, stopping gullies, repairing the houses, and hauling woods-mold both to the barn and to the "galded" spots in the fields. I bought some ground limestone and got him to bed his cotton land on this and to put some under the corn. We decided to use a 3-9-3 fertilizer and to top-dress both the cotton and the corn with nitrate of soda. Then, we secured a bushel of Mexican Big Boll seed from Paul Kime of the North Carolina Experiment Station. We got a bushel of Latham's Double corn from the originator, bought some soybeans from eastern North Carolina, and started to work.

I suspect the limestone helped to pull still more of the feeble remnant of soil fertility out of the land, because at any rate, we had a good season and our crop looked good. Our one-acre seed patch of "fine cotton" grew splendidly, and apparently we would make enough money to pay our bills. We did pay out in spite of cotton at five cents a pound.

The next season, 1933, we did better because we had plowed under a cover crop of vetch, had started lespedeza on the small grain, had rotated our crops, bought some pure-bred Rhode Island Red chickens, built a new fireplace and chimney in Robert's house, and had purchased a new fertilizer distributor and planter. I think our profit after all the bills and taxes were paid amounted to $16. No great amount, but a sign of progress.

Increased Fertilizer

In 1934, we signed a contract and reduced our cotton acreage 35 per cent. That meant that Robert would have to do a little more intensive farming. We changed our fertilizer formula to a 4-8-4 and continued to top-dress with nitrate of soda. But Robert was beginning to get interested, and so one day he took me over to a part of a field where he made the statement with which I opened this article. He repeated that we had to do "sumpin" about that spot. The cotton turned red and lost its leaves, and even corn was streaked and didn't do so well.

So we got a sack of 20 per cent

(*Turn to page* 34)

Robert standing in a field of cotton which later had to be topped because "sumpin" had been done about it.

Humus, Fertilizers, *and* Plant Nutrition

By R. E. Stephenson

Oregon State Agricultural College, Corvallis, Oregon

SCIENTISTS have emphasized at different periods the humus and the mineral theories of soil fertility. Enthusiasts for both concepts have doubtless gone to the extreme in propounding arguments and seeking proof for their own point of view. Their various arguments have been considerably analyzed, and perhaps we are now ready for a rationalized interpretation of those somewhat elusive soil properties that constitute fertility.

Humus has special functions in plant nutrition, and these perhaps deserve all the emphasis one is capable of giving. Humus is not itself a direct plant nutrient, but it is the seat of many and sometimes only too slightly familiar biological and chemical processes. These processes are essential to the growth of plants.

Humus Makes Soil

Common-place is the function of humus in supplying nitrogen; in furnishing solvents, such as nitric, sulfuric, and carbonic acids; and in maintaining a granular, permeable, mellow soil structure. Humus is that component which ultimately makes soil out of mineral matter.

Everyone now believes in a class of substances essential in animal nutrition, which for lack of sufficient identification are called vitamins (meaning essential to life). Many believe that plants require for their growth substances similar in function but differing in identity from the vitamins of animal nutrition. These substances by one worker (Bottomly) were designated "auximones" or growth promoters. The "bioses" necessary for the growth of yeasts are similar substances.

Plant Vitamins

The first question we should like a definite answer for is, whether such substances really are essential to plant growth as they are in animal nutrition; and if so, the second question is the source of the "auximone." Must one lay aside the concept of a certain number of elements that are essential to plants, and with these provided, there is nothing more that can be done in the way of soil fertilization?

The first question can be answered partially with the ever-increasing evidence that plants do need something in the nature of vitamins for normal growth. The latest bit of evidence is a fine piece of work (Williams, in Oregon) in isolating from many sources a substance that functions perhaps as a universal growth promoter for plants. This substance, designated pantothenic acid (from everywhere), has shown profound effect upon the carbohydrate metabolism of alfalfa. Even uninoculated alfalfa plants, treated with the minutest quantities of the pantothenic acid, made more growth than the inoculated alfalfa with the "nutrilite" omitted. Dr. Williams suggests the name "nutrilite" to distinguish the plant-growth promoters from the vitamins, or animal growth promoters. The name implies only that the substance, pantothenic acid or what not, functions in some way that is important to the nutrition of plants. The "auximones" of previous studies, and the "bioses" of yeast nutrition belong to this class of entities.

Sources of "Nutrilite"

An important source of the "nutrilite" appears to be the organic matter of the soil. The pantothenic acid or other "nutrilite" is generated by soil bacteria and fungi which break down organic matter. Aspergillus niger, very abundant in soils, is especially capable of synthesizing the "nutrilite." Williams believes that higher plants are not able to synthesize the "vitamin-like" substances so important to their own growth, but that they are dependent entirely upon the soil micro-organisms in this respect, just as the animal is dependent upon the plant for synthesis of the vitamins needed for animal growth.

These interpretations based upon a limited number of established experimental facts give new importance to the function of humus in plant nutrition. Bottomly's "auximone" concept was similar to this. He believed that bacteria in the soil generated the "auximone" by breaking down organic matter. Bottomly somewhat wrecked his whole contribution by commercializing what he considered a great discovery. His bacterialized peat, sold under the trade name "humogen," failed to do what was claimed for it. A little sphanium peat inoculated with azotobacter perhaps could hardly make much of a showing on soils already containing humus and micro-organisms capable of synthesizing the "auximone" that he believed so important to good crop yields.

Need More Study

This new and rather elusive field of research has received only too little study up to the present time. Definite proof of what appears a reasonable conclusion is hard to obtain. The exact identification of "nutrilites" as to chemical composition and formula has so far eluded all workers. The extremely small quantities of such substances, which act catalytically as growth promoters, make them difficult to isolate, and their functions hard to follow. The future has much to reveal as to their identity and properties.

Some workers stress the importance of humus as a carrier of the rarer, less abundant, but none the less important minerals of the soil. Humus has the property of combining with and holding in soluble form, such metals as copper, iron, nickel, cobalt, manganese, zinc, aluminum, chromium, and titanium, many of which in small amounts may have important functions in the nutrition of plants. McHargue postulates that the plant absorbs these rarer elements that are important growth stimulants, and synthesizes them into the "vitamins" so necessary to animal nutrition. He thinks the same rarer elements in organic combinations serve as growth stimulants in both the plants and animals. As evidence of his claims, he cites the relatively high manganese and copper content of those parts of the plant and those organs of the animal that are especially prized for their vitamin potency.

Significance of Humus

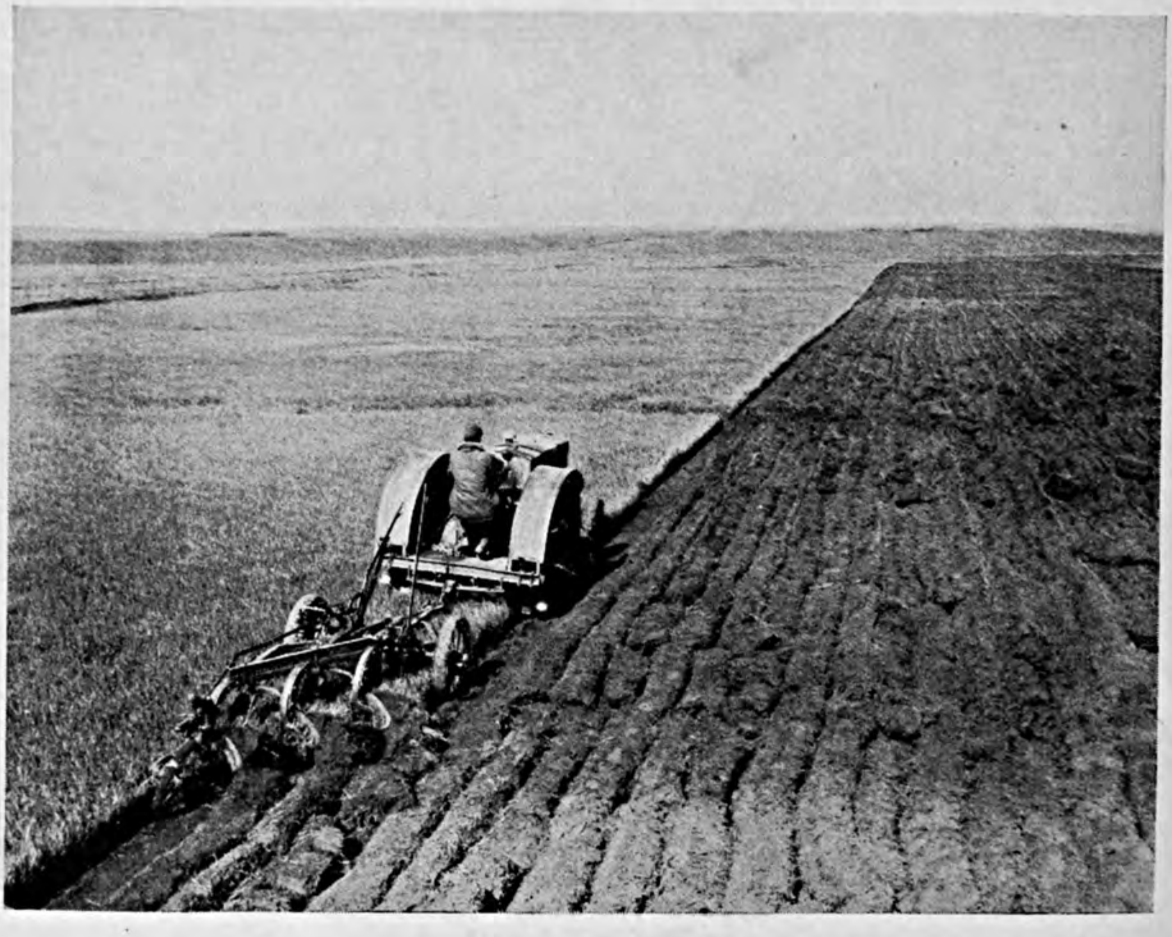
The particular significance of humus, as related to these rarer minerals, is in the capacity of humus acids to combine with the metals and hold them in forms that are acceptable to plants. Burk found that a humus-iron combination could be used in culture solutions as a source of iron more satisfactorily than any mineral form of iron. The humus-iron is not precipitated by the phosphates of the culture solution as the mineral form of iron is precipitated. A small quantity of humus-iron added once or twice during the growth period of culture plants, proved more effective than mineral forms of iron added in small amounts every other day. The significance of the minor elements in

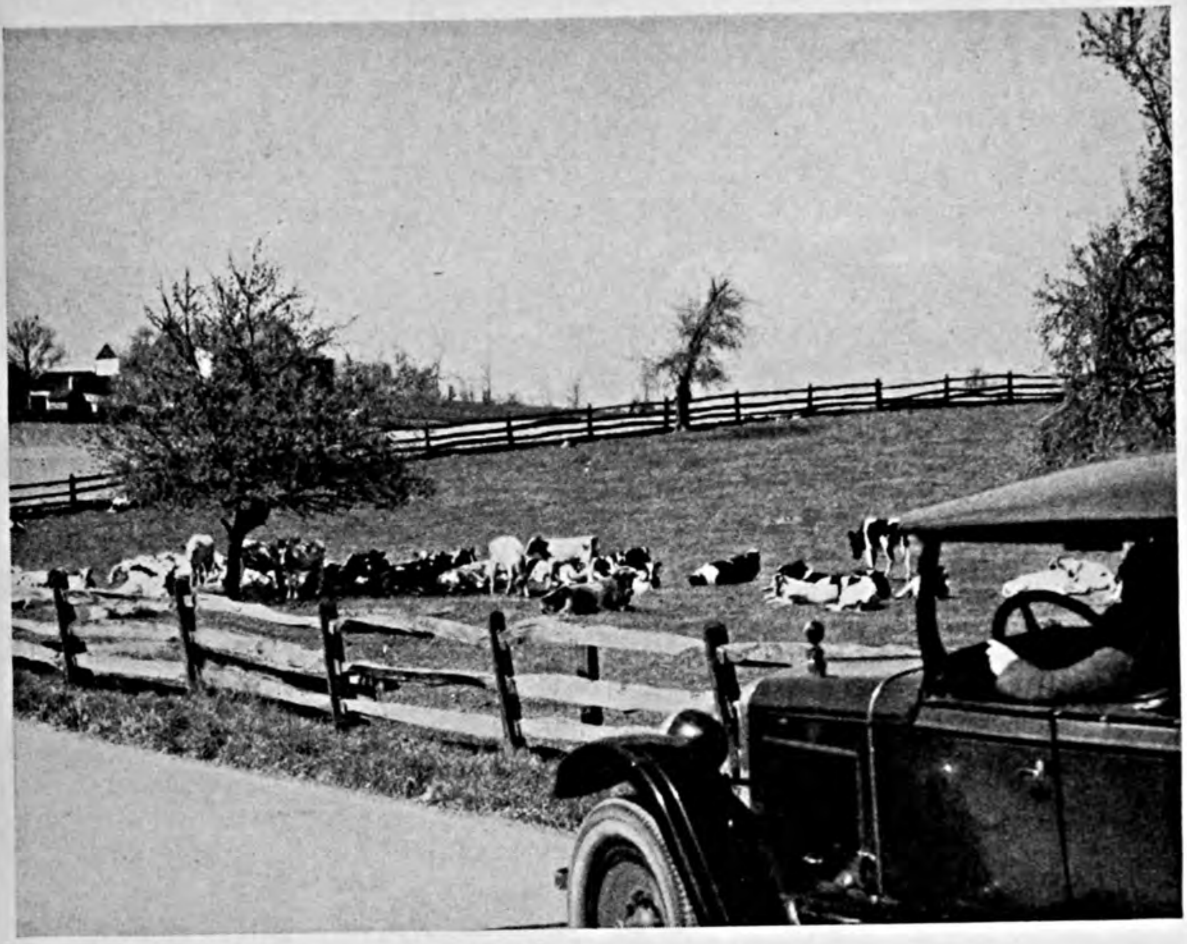
(*Turn to page 37*)

PICTORIAL

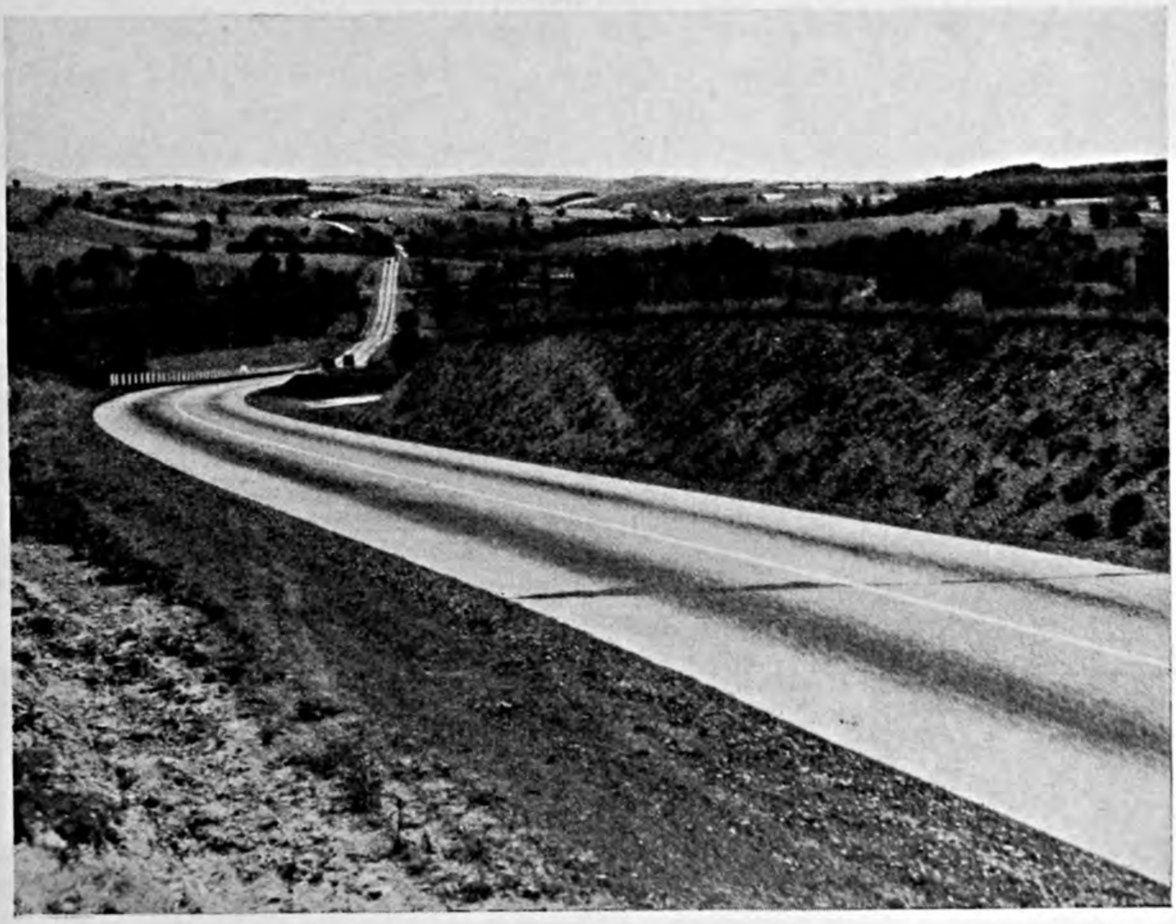
TROUBLE AFOOT.

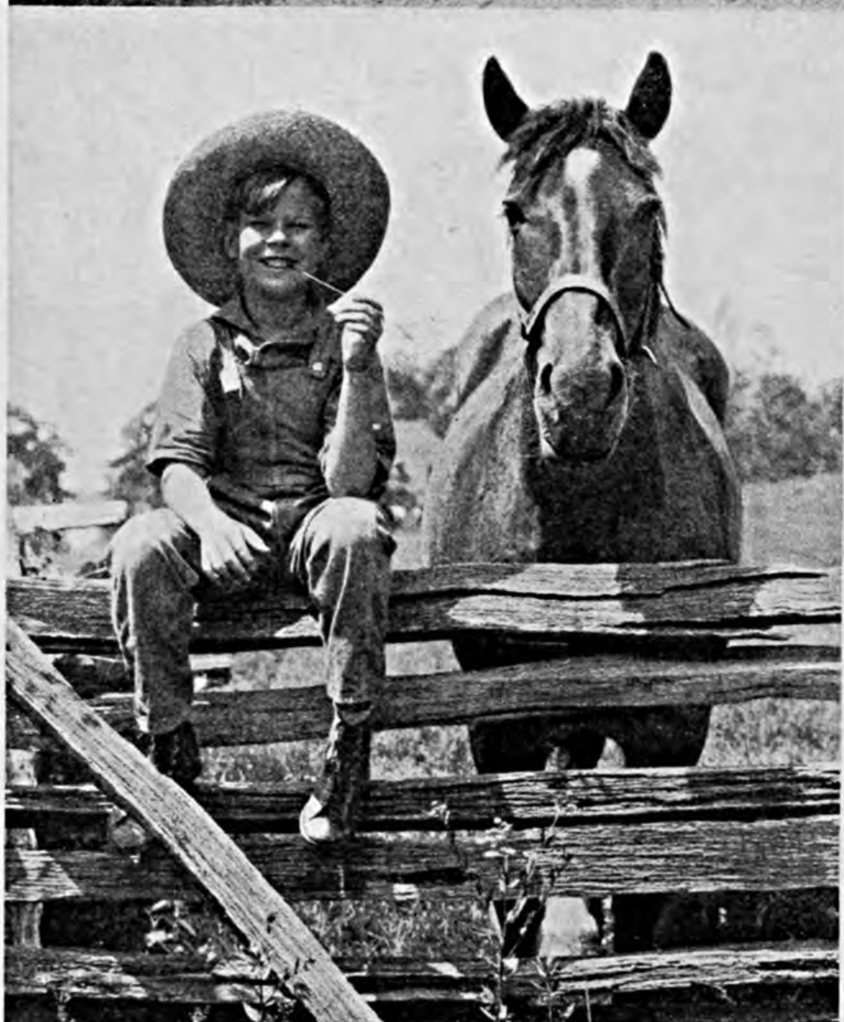
The Call of the Open Fields





The Call of the Open Roads





School busses save rural children many miles of weary trudging and give them more time and energy to enjoy farm pets and wholesome work and play.

The Editors Talk

S. D. Conner

Agricultural scientists were grieved as word of the sudden death of one of their prominent members, Professor Samuel D. Conner, of Purdue University, on April 20, became known. His death was a severe shock to his family and friends as he had been ill only since the afternoon of April 17, when he left his laboratory because of illness.

The passing of Professor Conner marked the end of a career devoted to the general welfare of agriculture, a career which had brought scores of contributions that have meant much to the progress of farming. He was known the world over in the field of science because of his soil fertility studies which began in 1899 when he joined the staff at Purdue as deputy state chemist, a post he held for eight years. He then was assistant professor of agricultural chemistry for six years, but since 1913 he had been soils and crops chemist on the Experiment Station staff and for some years had been in charge of the research chemical laboratory of the station. His studies of soil acidity, its causes, and methods of testing for acidity had become standard in the entire field of scientific agriculture. Professor Conner was perhaps the principal figure in developing the muck lands of northern Indiana, as his discoveries in the use of potash on those soils pointed the way toward their profitable management. He was author of more than 100 articles and bulletins reporting on different phases of his work at Purdue, the institution from which he was graduated in 1894.

For many years Professor Conner had either tested personally or in cooperation with his colleagues, from 2,000 to 3,000 soil samples sent to Purdue each year by Indiana farmers so that he could advise them on limestone or fertilizer needs. He also helped develop simple methods of testing soils and was associated with other Purdue men in putting out a soil and plant tissue test put up in a convenient kit for field and laboratory use, which last year resulted in from 35,000 to 40,000 samples of soil being tested over the state and hundreds of thousands of tests in other states.

Besides several fraternal organizations, Professor Conner held membership in many learned societies, including the Indiana Academy of Science, Sigma XI, American Chemical Society, American Society of Agronomy, American Soil Survey Association, American Association for the Advancement of Science, and the International Society of Soil Science.

The early passing of men of such calibre—Professor Conner was only 63 years of age—is a distinct loss to the advancement of agriculture. Their contributions are and will continue to be appreciated highly, but to be deprived of their further work and the confidence to be placed in their years of experience and sound judgment is a misfortune which will be widely felt.

A Million in 4-H Clubs

A recent news release of the U. S. Department of Agriculture quotes Dr. C. W. Warburton, Director of Extension Work for the Department, as saying that there are now nearly one million boys and girls enrolled in 4-H clubs as shown by the tentative figures recently compiled for 1935. The agents reported an enrollment of 997,457 club members in the United States, Hawaii, Puerto Rico, and Alaska. This is 81,395 more members than in 1934 or about a 9 per cent increase. The largest increases in enrollment are in the southern states which supplied more than half of the total increase.

These young people are studying improved methods of farming and homemaking and are learning cooperation and good citizenship under the direction of extension agents cooperatively employed by the U. S. Department of Agriculture and the state agricultural colleges. National figures were compiled from the reports of county agents who organized and carried on the clubs with the help of 106,215 local volunteer club leaders. Club work is carried on in 2,960 counties.

In addition to the 4-H clubs, nearly 45,000 other rural young people have organized groups to study with extension agents their problems on the farm and in the home. This group shows an increase in membership of 7,728 young farmers and homemakers over the 1934 figures.

These figures are significant, especially when tied up with some remarks recently made by Dr. O. E. Baker, Senior Agricultural Economist of the Department, in an address "Why I Want My Boy to Be a Farmer," delivered at the University of Wisconsin. Dr. Baker pointed out that on the farm, population is increasing rapidly. Already more than 2,000,000 youth are backed up on farms, who would under predepression conditions have migrated to the cities. These young people are marrying and starting homes. More than 500,000 new farms have been started since 1930, according to the census.

Dr. Baker believes that although the problems of land utilization and maintenance of the standard of living on farms seem likely to become more acute with the passage of time, these will prove less difficult to solve than the problems that are facing the cities. The farmer accumulates more property—becomes a wealthier man than the average city person.

The farmer is more likely to rear a family and do his part to promote the welfare of the Nation and the race. The family is becoming smaller and weaker in the cities. Only two-thirds enough children are now being born in our large cities to maintain their population permanently. Dr. Baker comes to the conclusion that in considering the problems of conserving the soil resources of the United States, the problems of land utilization, and more recently, the problems of agricultural prosperity and of national welfare, there is no substitute for the institution of the family. It is becoming clear, he says, that the land is the foundation of the family, and that the family is the foundation of the state.

The increasing interest of farm families in solving farm problems, as shown by the increase in 4-H membership, bolsters faith in the advancement of our agriculture. Land utilization is of vital importance and with a younger generation, both out of necessity and natural liking, learning improved methods and striving to excel in profitable management, we are well along on the right road.

REVIEWS

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

Fertilizers

Reporting results of five years' investigations on "Cabbage Fertilization in Southwest Virginia," Bulletin 88 of the Virginia Truck Experiment Station contains many significant details relating to cabbage production in this important area. According to the author, M. M. Parker, the commercial crop is principally confined to two typical mountain counties in the southwestern section of the state, comprising the mountain and fertile valley soils. The bulletin states that 2,600 acres as an average for the past two years are devoted to this crop annually. During this same period the average yield is recorded to be 5.5 tons to the acre. Much of the land employed in cabbage production had been in native bluegrass pasture, which had caused a scarcity of one or more of the important plant nutrients. The lack of these nutrients has frequently been indicated by the failure of the cabbage crop to produce maximum yields.

The investigations emphasized the importance of applying ample amounts of phosphoric acid in the fertilizer mixture. Supplying sufficient phosphorus increases the amount of nitrogen and potash that can be advantageously utilized by the plant. It was determined that a 4-8-12 analysis when applied at the rate of 1,000 pounds per acre before planting gave best results, and is recommended for soils of average fertility. The more fertile soils which have received stable manure or a leguminous crop turned under respond satisfactorily to an 0-8-12 or 2-8-12 at 1,000 pounds per acre before planting, supplemented with nitrate of soda, or an equivalent amount of quickly available nitrogen, when the plants begin to head. Although the soils used for cabbage production in this section are apparently well supplied with potash, results showed that relatively large amounts (120 pounds K_2O per acre) gave substantial increases in yield, as obtained by the use of a 4-8-12 mixture applied at the rate of 1,000 pounds per acre.

The suitable varieties of cabbage described in the bulletin are Copenhagen Market for the early crop, Wisconsin All Seasons for the medium, and Wisconsin No. 8 or Penn State Ballhead for the late crop. Mentioned as the most common rotation practiced is corn, cabbage, wheat, and grass or clover. Many impressive illustrations depicting the crop response to the various treatments are contained in the bulletin.

"A Study of Some Trace Elements in Fertilizer Materials," Agr. Exp. Sta., Gainesville, Fla., Tech. Bul. 290, Feb. 1936, L. W. Gaddum and L. H. Rogers.

"The Use of Zinc Sulphate Under Corn and Other Field Crops," Agr. Exp. Sta., Gainesville, Fla., Bul. 292, Mar. 1936, R. M. Barnette, J. P. Camp, J. D. Warner, and O. E. Gall.

"Maryland Fertilizer Facts for 1935," Inspection and Regulatory Service, College Park, Md., Mar. 1936, L. E. Bopst, Associate State Chemist.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 81, Dec. 1935, H. D. Haskins.

"Fertilizer Experiments in the Morganthau Orchard: Six Years' Results with Nineteen

Treatments," Agr. Exp. Sta., Geneva, N. Y., Bul. 661, Jan. 1936, R. C. Collison and L. C. Anderson.

"Spring and Fall Fertilizer Sales in Ohio—1935," Dept. of Agronomy, Ohio State University, Columbus, Ohio.

"Inspection of Fertilizers," Agr. Exp. Sta., Kingston, R. I., Ann. Fert. Cir., Sept. 1935, W. L. Adams and A. S. Knowles, Jr.

"Results of Fertilizer Grade Survey by Counties in Rhode Island, 1935," Dept. of Agr. and Conservation, Bureau of Markets, Providence, R. I., Russell C. Hawes, Chief.

Soils

"Our Heritage—the Soil," is the appropriate title of Bulletin 175, Agricultural Extension Service of Ohio State University, by R. M. Salter, R. D. Lewis, and J. A. Slipher. Interesting discussions on what is happening to the soils of Ohio farms, factors involved in soil deterioration and improvement, using the soil productivity balance in evaluating and adjusting farming systems, and many other related topics are the subjects contained in the publication. From the introduction the following is quoted: "We are told that, in the United States, farm lands equal to five times the cropped area of Ohio already are ruined beyond hope of redemption, and that a vastly larger area is rapidly approaching this unhappy state. Truly, this is a dismal picture, and, if true, a damaging indictment of the system that has permitted the exploitation of the nation's most valuable material heritage, the soil."

That evidence of soil deterioration in Ohio may not be alarming if crop yields are indicative of this condition is suggested by the fact that all yields are equal to or slightly above what they were 60 years ago. However, this interpretation does not reveal that the many improved farming methods introduced and partially adopted within the past half century, including tilling, improved varieties, more lime and fertilizers, etc., should have increased the acre yields 40 to 60 per cent. Furthermore, it must be considered that thousands of worn-out areas in eastern Ohio have been discarded for more productive land, which is another factor which maintains the yield level in Ohio. The inherent potential capacity of the land has been deteriorating almost fast enough to offset all the improvements made in soil and crop management.

The cropping system is termed to be the dominant factor in soil deterioration and its opposite, soil improvement. Liming the acid soils for legume crops, the use of manure and fertilizers, and special management practices for controlling soil erosion are very important soil-improvement processes. Adjustments of the conservation balance are reached by a reduction of rotated area planted to intertilled crops such as corn, an increase in the proportion of rotated area in sod crops, and by increasing the use of biennial and perennial legume sod crops, as clover, alfalfa, and mixtures containing alfalfa. Some of the present farm land should be removed from agricultural use. Much of the rotated area might well be transferred to permanent pasture, the bulletin concludes.

"Soil Blowing and Its Control in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Bul. 419, Jan. 1936, J. F. Brandon and Alvin Kezer.

"Twenty Years of Soil Fertility Investigations," Agr. Exp. Sta., Manhattan, Kans., Tech. Bul. 40, Oct. 1935, R. I. Throckmorton and F. L. Duley.

"Inspection of Agricultural Lime Products," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 82, Dec. 1935, H. D. Haskins.

"The Composition and Constitution of the Colloids of Certain of the Great Groups of Soils," U. S. D. A., Washington, D. C., Tech. Bul. 484, Dec. 1935, Horace G. Byers, Lyle T. Alexander, and R. S. Holmes.

"Soil Survey of Franklin County, Massachusetts," U. S. D. A., Washington, D. C., Series 1929, No. 9, W. J. Latimer, L. R. Smith, and Carey Howlett.

"Soil Survey of Valley County, Nebraska," U. S. D. A., Washington, D. C., Series 1932, No. 4, R. L. Gemmell, E. A. Nieschmidt, R. H. Lovald, F. A. Hayes, and S. Rankin Bacon.

Crops

Circular No. 15, Louisiana State University and Agricultural and Mechanical College, entitled "Pasture

Production and Management," by R. H. Lush, offers many practical suggestions on how to "help the land to grow more nutritious grass." The success of permanent pastures depends on types of land used, method of soil preparation, liming and fertilization, and proper care of the sod after it becomes established. The most economical pastures are found to exist on the best land, judging from the experiences of dairymen. Proper drainage is essential on alluvial land, and terraces are necessary on hill land. The more sandy types of soil cannot be easily made to grow productive pastures, the author states. It is generally advised to apply a ton of finely ground limestone per acre for each pH below 6.0. From 200 to 400 pounds per acre of a 4-12-4, or less amounts for higher analysis fertilizers, worked in before seeding will prove a good investment on poorer hill or prairie land, while good soil or first bottom land does not need commercial fertilizers. Grazing tests on old pastures in 1935 which had been top-dressed four years with 400 pounds per acre of 4-10-5 resulted in 82 per cent more milk than was obtained from grazing the unfertilized pasture. Suggested as the logical time to top-dress with a complete fertilizer is late winter just before dragging to spread manure. Pasture mixtures and the rate of seeding are listed with respect to their adaptations for different soil classifications of the state. Temporary pastures, management of livestock on pasture, and other subjects are also discussed in the circular.

"Sugar-Beet Production in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 95, Jan. 1936, W. W. Robbins and Charles Price.

"Forty-Eighth Annual Report, For the Fiscal Year 1934-35," Agr. Exp. Sta., Fort Collins, Colo., E. P. Sandsten, Director.

"Lawns, Planting and Maintenance in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Bul. 420, Feb. 1936, George Beach.

"Report of the Director For the Year Ending October 31, 1935," Agr. Exp. Sta., New Haven, Conn., Bul. 381, Feb. 1936, William L. Slate, Director.

"Pasture Investigations, Sixth Report, Seasonal Variations in the Reaction, Nitrates and Ammonia of Soil from Differently Fertilized Permanent Pastures," Agr. Exp. Sta., Storrs, Conn., Bul. 206, Sept. 1935, Henry Dorsey and B. A. Brown.

"Tomatoes," Ga. Exp. Sta., Experiment, Ga., Cir. 106, Jan. 1936, J. E. Bailey.

"Report on Agricultural Research For the Year Ending June 30, 1935," Agr. Exp. Sta., Ames, Iowa, R. E. Buchanan, Director.

"Tree Fruits for Iowa," Agr. Exp. Sta., Ames, Iowa, Bul. 341, Dec. 1935, H. L. Lantz.

"The 1935 Iowa Corn Yield Test," Agr. Exp. Sta., Ames, Iowa, Bul. 343, Feb. 1936, Joe L. Robinson and M. M. Rhoades.

"Management of Kansas Permanent Pastures," Agr. Exp. Sta., Manhattan, Kans., Bul. 272, Sept. 1935, A. E. Aldous.

"Seed Inspection," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 80, Nov. 1935, F. A. McLaughlin.

"Dahlias, Their History, Classification, Culture, Insects, and Diseases," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 266, Dec. 1935, C. E. Wildon.

"Garden Flowers," Agr. Ext. Div., Mich. State Col., East Lansing, Mich., Ext. Bul. 155, Feb. 1936, C. E. Wildon.

"Forty-Sixth Annual Report," Agr. Exp. Sta., State College, N. M., Fabian Garcia, Director.

"Varieties of Vegetables for 1936," Cornell Univ., Agr. Ext. Serv., Ithaca, N. Y., Bul. 343, Mar. 1936, Paul Work.

"Fruits and Nuts for Home Use," Agr. Ext. Serv., Raleigh, N. C., Ext. Cir. 210, Mar. 1936, H. R. Niswonger and E. B. Morrow.

"The Use of Artificial Light and Reduction of the Daylight Period for Flowering Plants in the Greenhouse," Agr. Exp. Sta., Wooster, Ohio, Bul. 559, Nov. 1935, G. H. Poesch and Alex Laurie.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXI, No. 179, March-April 1936.

"The Root-Weevils Injurious to Strawberries in Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 330, June 1934, J. Wilcox, Don C. Mote, and Leroy Childs.

"Lawns," Agr. Exp. Sta., State College, Pa., Ext. Cir. 160, Jan. 1936, Fred V. Grau.

"Gladiolus Culture with Special Reference to Winter Forcing," Agr. Exp. Sta., Kingston, R. I., Bul. 255, Dec. 1935, Basil E. Gilbert and Frederick R. Pember.

"Renovating Bluegrass Pastures," Agr. Ext. Serv., Madison, Wis., Cir. 277, Jan. 1936, L. F. Graber.

"The Carbohydrate-Nitrogen Relation in Symbiotic Nitrogen Fixation," Agr. Exp. Sta., Madison, Wis., Res. Bul. 129, Oct. 1935, P. W. Wilson.

"Forty-Fifth Annual Report, 1934-35," Agr. Exp. Sta., Laramie, Wyo., J. A. Hill, Director.

Economics

The Aroostook County Council in its recent publication, "Long-time Agricultural Program for Aroostook County," has given us an interesting picture of the many economic problems confronting the potato farmers of that section of Maine. Aroostook produced 15.3 per cent of the total 1934 United States potato crop. Soil and climatic conditions have been favorable to the production of good potatoes and have been responsible for the popularity of the crop. At the same time, these natural conditions have limited the production of other cash crops. The prosperity of the county fluctuates with the prosperity of this one crop, potatoes.

Due to the extremely low prices that have prevailed during the past few years, Aroostook has piled up large financial losses. It is concluded that unless something is done to meet this situation, the county will eventually face financial ruin.

In order to solve the problem it is proposed that the potato growers reduce production costs by following very closely the recommendations of their experiment stations; that a study of the marketing costs be made in an effort to turn a higher percentage of the consumer's dollar to the producer; that the quality be improved by more careful handling at digging time, by better grading and more efficient storage and shipping.

It was found that in October of 1935, the producer was receiving 33.03 per cent and the transportation companies 46.51 per cent of the consumer's dollar. The other 20.46 per cent went for sacks, loading costs, brokerage, and miscellaneous costs.

The first problem, that of production costs and better farm organization, is up to the individual, and the marketing problem can only be solved by cooperative action on the part of all concerned.

The Agricultural Extension Staff of the North Carolina State College has published an interesting and comprehensive program for improving North Carolina agriculture in Extension Circular No. 208, "Agricultural Program for North Carolina." This is a revision of the Program adopted in 1929. It is pointed out that "for a long time North Carolina has grown too many acres of cash crops and not enough feed and soil improvement crops." This system has been gradually changing for the better. The depression accelerated the change, especially with respect to feed crops.

The change should not be radical in nature and the general types of farming now in vogue should be continued with adjustments in acreage to provide for better crop rotations, more feed crops and greater numbers of livestock, fewer acres of row crops and a careful system of soil management. The state is divided into areas and a suggested farm management program is given for each area and each soil type.

"Type of Farming Areas in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Bul. 418, Sept. 1935, Byron Hunter, L. A. Moorhouse, R. T. Burdick, and H. B. Pingrey.

"Illinois Farm Economics," Agr. Exp. Sta., Urbana, Ill., No. 10, Mar. 1936.

"Part-Time and Garden Farming in Iowa," Agr. Exp. Sta., Ames, Iowa, Bul. 340, Dec. 1935, Ray E. Wakeley.

"Seasonal and Short-Time Fluctuations in Wheat Prices in Relation to the Wheat-Price Cycle," Agr. Exp. Sta., Manhattan, Kans., Tech. Bul. 39, Sept. 1935, R. M. Green.

"Readjusting Montana's Agriculture," Agr. Exp. Sta., Bozeman, Mont., II. "Montana Farm Prices," Bul. 308, Jan. 1936, P. L. Slagsvold; III. "Population Resources and Prospects," Bul. 309, Jan. 1936, Roland R. Renne and Carl F. Kraenzel; IV. "Land Ownership and Tenure," Bul. 310, Feb. 1936, Roland R. Renne; V. "Economic Changes in Montana's Range Livestock Production," Bul. 311, Feb. 1936, M. H. Saunderson.

"Farm Economics," N. Y. State Col. of Agr., Ithaca, N. Y., No. 94, Mar. 1936.

"Home-Grown Roughage and Milk Production Costs," Agr. Exp. Sta., Kingston, R. I., Bul. 254, Dec. 1935, J. L. Tennant.

"Milk-Production Costs in West Virginia, I. A Study of the Costs Incurred by 51 Farms in the Morgantown and Fairmont Markets in 1934-35," Agr. Exp. Sta., Morgantown, W. Va., Bul. 268, Feb. 1936, L. F. Herrmann, R. O. Stelzer, and G. A. Bowling.

"Forces Affecting Wisconsin Agriculture with Resulting Types of Farming," Agr. Exp. Sta., Madison, Wis., Res. Bul. 131, Nov. 1935, P. E. McNall and W. J. Roth.

"Car-Lot Shipments of Fruits and Vegetables from Stations in the United States for the Calendar Years 1932 and 1933," U. S. D. A., Washington, D. C., Stat. Bul. 50, Jan. 1936.

Extra Citrus Uses

BY-PRODUCTS that may make use of surplus citrus fruits in favorable crop years are being developed by the Department of Agriculture's Citrus Products Laboratory at Winter Haven, Fla.

In the four years since the laboratory was established, chemists there have shown that high quality salad oils, as well as solid fats, may be obtained from grapefruit seed, which is about one-third fat or oil. They have made splendid wines from citrus juices by adding sugar. They have made brandies and cordials from the wines. They have developed a method for canning orange juice with a "bite" approaching that of fresh juice, a method which also greatly improves the flavor and keeping quality of canned grapefruit juice.

"Whether or not major industries will come from these discoveries is a matter of economics," says Dr. Henry G. Knight, Chief of the Bureau of Chemistry and Soils.

Strawberries Can Be Profitable

(*From page* 16)

foliage a more moderate leafage which will admit both the light and air so necessary to the good development of fruit. The potash will also result in a tougher foliage less likely to suffer from dry periods and will add firmness and color to the fruit. Not to be discounted is the more sturdy root system that will develop from the addition of potash, a root system that will carry the plant over periods of weather stress in good order.

Mulching with wheat straw, salt, hay, or even pine needles, which are plentiful in most sections, will be found profitable and is of vital importance. It will keep the soil cool, which is most desirable with a plant as shallow rooting as the strawberry, and will prevent splashing of sand or other soil on the fruit during hard showers, resulting in clean, attractive fruit which commands better prices.

The package in which the fruit is shipped to market is of great importance. It has been customary for years to ship in a crate containing 32 to 60 quarts. Today the practical package contains 16 to 24 quarts. The smaller package is much easier to handle and less subject to shakeup and damage. Further, the trade that wants fancy fruit much prefers a smaller package. I used 24-quart crates when marketing Dorsett and Fairfax last spring and labeled each crate with an attractive label in actual color. This served as a trademark and held customers throughout the season. The "would be" new customers were unable to get our special mark, the result being that prices held remarkably well even in the face of general market decline.

In my judgment, the future holds much for the market grower of strawberries, if he will do the little important things and grow the right varieties, and right varieties at our place now mean Dorsett and Fairfax, after a most profitable experience from growing them. I now lean to Dorsett as the leader of the two, at least for our section of the country.

Renovating Pastures

(*From page* 10)

legumes. There is some advantage in top-dressing with ground limestone a year in advance of the time of seeding, but this is not necessary except where the soil is extremely acid. Even in such a case, supplementing ground limestone with a quick-acting form of lime, such as limate (400 to 600 lbs. per acre), will eliminate the necessity of liming far in advance of seeding. Likewise, if marl or very finely ground limestone is applied, its reaction on very acid soils is sufficiently rapid for application just before cultivation of the sod. Lime, phosphate, potash, and other fertilizers are spread on top of the sod to be disked into the soil when the sod is worked up."

Reed canary grass, as a pasture and hay crop, is being grown successfully on lowland soils through the use of potash. E. D. Holden, crop specialist at the Wisconsin College of Agriculture, points out the necessity for supplying potash to the soil for getting good stands of canary grass. Mr. Holden says that on acid peats and mucks of the sandstone area, small applications of lime and fertilization with phosphate and potash, such as 0-9-27 or 0-8-32 at the rate of 300 to 400 pounds per acre, are desirable. On high-lime peats and mucks common in eastern Wisconsin, 200 pounds of 50 per cent potash per acre are usually enough to establish a stand.

Later applications can be made as top-dressings in early spring or just after cutting, when poor growth indicates the need. The requirement is likely to be at the rate of 75 to 125 pounds per acre a year, and this may be applied every two or three years. Some marshes may need phosphates.

We Did "Sumpin" About It

(*From page* 20)

manure salt and used it lightly over the spot. I had been skeptical about this side-dressing with potash but thought it wouldn't hurt to try in a small way. We did get some results but nothing to shout about. I know now that the land was so poor that it would have taken five times as much as we used to make any impression. The next year this field went to corn, and we did not bother about using any potash in side applications. But in the meantime, we planted the field to rye when the cotton had been picked, and plowed under the cover crop the next spring before planting the corn. There was a heavy crop of soybeans planted in with the corn and a great mass of stuff to plow under when we got the land ready for cotton in 1935.

That year, we top-dressed all of our cotton and corn with an application made up of 100 lbs. of nitrate of soda and 50 lbs. of muriate of potash. We had again used a 4-8-4 fertilizer before planting, and on the 18 acres of land to cotton we made 12 heavy bales of lint and one good remnant. We have enough corn in the crib to last us through until corn is harvested again in 1936. Some of our cotton had to be topped, and all of it produced a staple of over 15/16 of an inch in length. The sample was fine, creamy, and of a high quality.

The Problem Solved

It looks as if Robert and I have found out what to do about that field. We are not out of the woods yet, but we have pure seed for the whole farm; three young mules are paid for; there is a new mowing machine; we have some blooded Hampshire hogs and a purebred Guernsey bull; and this year we plan to fence in a good pasture. We have adopted the plan of seeding lespedeza on our small grain; rotating our crops each season; planting kudzu on our gullies; and planting a good crop of soybeans and cowpeas. Robert enjoys sweet potatoes, peanuts, wheat bread, black-eyed peas of his own production, and meat from his own pigs. I also have shared in some of these.

But we are building up our place. When we signed the adjustment contract, the committee searched our records and allowed us 147 lbs. of lint cotton per acre as our base. If Robert attends to all the spots, we shall make a bale to the acre this year. We didn't miss this goal very far last year in spite of a long, dry season followed by heavy rains and disastrous boll-weevil damage in September. I do not say that top-dressing with the potash and nitrate did all of this, because we have been putting something back into the land these past four years. Neither do I definitely promise to continue the use of potash in our side applications, because a farmer cannot always do all the things he thinks ought to be done.

But Robert told me last fall when we settled accounts, "Mr. Jeter, I think we got just about the kind of fertilizer and the acres to cotton and such that we want to grow on this farm. It suits me to keep on like we are going now, and if you can get some more of that potash to mix with our soda, it would be good." I told him I would, and I am, because what he has found out also has been learned by the agronomy department of the North Carolina Experiment Station in its research studies of potash deficiency or rust in the peanut belt and in other places over the state.

Mangels Respond to High Potash

(*From page* 18)

very high. It is significant, however, that with only one exception, the cost per ton of producing the crop on the potash-fertilized plots was considerably lower than that on the plots receiving no potash.

With the exception of the 600-pound application, the increases on the potash-fertilized plots ranged from 20 per cent to 50 per cent. The average yield of potash-fertilized plots was 19.94 tons per acre as compared to 14.69 for the check plots, an increase of 5.25 tons or over 35 per cent.

Taking into consideration the average figures for the three years, it is worthy of note that the smallest increases in yield were secured on the plots receiving the lowest applications of potash, namely, the plots receiving 300 and 400 pounds of potash. The increases in yield on these plots were 8.8 per cent and 14.7 per cent for the two plots. Aside from these two plots, the next smallest increase was 24.1 per cent over the check plot, on the plot receiving 900 pounds of potash. There has apparently been no depressing effect on the yield as a result of the higher concentrations of potash. The lowest production costs per ton secured were on the plots receiving 500, 600, and 700 pounds of potash.

The potash applications giving the smallest increases in yield were far in excess of the amount usually applied or even recommended in western Washington. The 300 and 400-pound applications would be equivalent to 1,500 and 2,000 pounds of a complete fertilizer containing 10 per cent K_2O. Those applications giving the most economical production, namely, the 500, 600, and 700-pound applications, would be equivalent to 2,500, 3,000, and 3,500-pound applications of a complete fertilizer containing 10 per cent K_2O.

For the three-year period, all the check plots averaged 22.94 tons per acre as compared to 28.98 tons for all plots receiving potash. This is an increase of 6.04 tons per acre, or 26.3 per cent.

Data showing the yield, the relative production compared with the check plot, and the cost of production per ton of yield are presented in the accompanying table.

The data obtained in this study indicate that possibilities exist in securing economical results from the use of larger amounts of the fertilizer elements than those ordinarily used. The most important fact brought to light, however, is the importance of studying various concentrations of the several fertilizer elements, to and beyond the commonly accepted limit of economic value (since the light concentrations may prove less valuable than the heavier concentrations). It is only in this way that the real importance of the various elements to crop production can be determined. Conclusive results should not, however, be expected when only the chemical fertilizers are considered. It is important to determine the relationship of the chemical fertilizers to other phases of good soil management.

Organic materials, especially manures and cover crops, should form the basis for a soil fertility program, and for this reason a comprehensive study must consider not only the amounts of the various chemical elements which will give the most economical returns when used alone, but these elements as they may be needed to supplement the organic materials, and their place in the fertility program over a period of years.

YIELD OF MANGELS WHEN FERTILIZED WITH NITROGEN AND PHOSPHORUS PLUS VARYING APPLICATIONS OF POTASH

(Average of Three-year Period)

Pounds Muriate of Potash per Acre	Yearly Yield in Tons Per Acre 1st Year	2nd Year	3rd Year	Three-year Average Tons per acre	Tons Increase	% of Check	Cost Per Ton
Check	26.85	27.24	14.69	22.94	....	100.0	$5.88
300	27.47	29.55	17.66	24.96	2.02	108.8	5.80
400	27.63	29.14	21.64	26.30	3.36	114.7	5.65
500	32.86	35.38	21.70	30.20	7.26	131.7	5.11
600	29.29	47.84	14.68	30.62	7.68	133.5	5.14
700	31.73	43.75	22.14	32.51	9.57	141.7	4.97
800	29.45	38.30	19.62	28.89	5.95	126.0	5.60
900	34.58	29.77	20.46	28.46	5.52	124.1	5.77
1,000	33.96	36.88	21.60	30.60	7.66	133.4	5.51
Average of All Potash Plots	30.87	36.34	19.94	28.98	6.04	126.3	$5.44

Humus, Fertilizers, and Plant Nutrition

(From page 22)

plant nutrition and the relation of humus to their functions have only recently been appreciated.

Fertilizer Theories

The old-time concept of a complete fertilizer was based upon the theory of ten essential elements, with three of them likely to be short in cultivated soils. With these three (N-P-K) supplied in the form of commercial fertilizer, in more or less standardized and acceptable ratios, the end of fertilization was supposedly complete. This mineral theory of fertility, to the extent that the number of minerals is limited, and the significance of humus in plant nutrition is overlooked, is inadequate. And that statement does not detract in any way from the importance of N-P-K in plant nutrition. Neither does it disregard the importance of lime in the nutrition of higher plants.

In modern terminology the reactive portion of the soil is a colloidal complex of mineral and organic matter in combination with the important nutrient bases, calcium, magnesium, and potassium. In normally good soils calcium is the dominant base in the complex. As long as there is enough calcium to maintain the complex near neutrality, the soil remains satisfactorily responsive to fertilization, crop rotation, and good management.

Strong soils carry not only a relatively high humus content, but a large percentage of reactive mineral complex. These soils are capable of holding a large reserve of nutrient material, and of giving up these nutrients as crops need them in growth.

Good soils due to bad management may become temporarily "run down," so that yields are unsatisfactory. Usually the "run-down" condition is principally a loss of humus, following too continuous cropping. Legumes and manure comparatively easily correct such a condition, and the soil becomes productive again.

But more serious things can happen to soils than simply loss of humus. Soils, like people, become aged and incapacitated. Old age in soils is partly physical, with the development of clay pan subsoils, associated with a general slowing down of processes and functions within the soil profile.

Old age brings on detrimental chemical changes in soils also. Due to prolonged leaching, the reactive mineral complex loses its bases, particularly the calcium and potassium. The bases are lost by replacement with hydrogen, resulting in soil acidity. As long as these exchanges of bases for hydrogen have not gone too far, the condition can be corrected by the addition of some form of lime.

Reclaim Degenerate Soils

But old age as applied to soils covers thousands of years, sometimes perhaps, millions. Some of our older soils were leached and wasted long before the coming of the white man. Aging is associated with excessive leaching and chemical weathering. The neutral calcium complex is quite stable, but the hydrogen complex at high acidities is unstable. Like a rotten house that finally collapses from its own decay, the hydrogen complex falls to pieces and cannot be restored. Such soils are not "run down," but the effect of evil days is deeper seated. The soil has "degenerated." Plant nutrients are gone, and the capacity to hold nutrients is likewise gone. This wasting process is carried to the extremest form in the humid tropics, where leaching has long continued. In the end little remains but the inert oxides of iron and aluminum.

Can "degenerated" soils be restored to fertility? To some extent and for certain uses. However, youthful virility can no more be restored permanently to old soils than to old people. But the effects of age can be considerably alleviated. Along with the development of acidity in soil aging, there often occurs the liberation of toxins and phosphate precipitants which interfere with the nutrition of crops. Ferrous iron and aluminum may function in these capacities. Liming to some extent corrects these undesirable conditions. Where "degenerated" soils do not contain toxins and when the physical conditions are favorable, the soils have similar values for crop production as sands, and probably can be made productive by similar methods. Crops grown on sands because of their naturally low fertility must be largely hand fed, each crop fertilized liberally with complete fertilizer to insure good growth. An upbuilding program to raise such soils to a permanent, high-fertility level is impracticable.

Both sands and "degenerated" soils are effectively improved by attention to the renewal of the humus and lime. The most stable form of humus is calcium humate. Likewise, calcium humate is well suited to those processes and ends that favor the growth of higher plants. Rotting plant materials diluted with a certain amount of inert minerals, such as sand, and supplemented with such additional mineral nutrients as may be deficient, provide as nearly ideal conditions for the growth of crops as any medium yet observed. Peats are the most valuable garden and truck soils in existence. Moisture, aeration, permeability, penetrability, and biological activities all are very favorable for crop growth on peat soils.

Adequate humus renewal helps keep soils young. Humus helps hold fertility and makes fertilizers more effective. Humus holds the lime and keeps mineral plant foods circulating. Lime, likewise, helps to hold the humus and to preserve the neutrality and the integrity of the complex, thus maintaining its vigor and virility. Soils that are only "run down" are quickly brought back to productivity. Cropping "degenerated" soils necessitates more hand feeding, more liberal fertilization. Fertilization with mineral fertilizers and lime is necessary to grow more humus and to assure success with legumes. Adequate fertilization makes more roots, bigger stubble, and large crop and weed residues to return to the soil. Perhaps humus and fertilizers should be considered as complements rather than supplements in the scheme of fertility. Each has a specific place in the soil-building program, which the other cannot fill.

Morgan's Method

(*From page* 11)

few more acres were added in order to square off the field, and the entire acreage was then seeded to rye for a winter cover crop. The rye crop was turned under the following spring, being plowed the opposite way of the corn. No other preparation was made until the time for planting.

A comparison between fertilized and unfertilized rows, as well as small whole vs. large seed cut into good sized seed pieces, was planned. The variety used was Rural, and 500 pounds of a 2-8-16 per acre applied in the row was the fertilizer. A 2-row potato planter was used which spaced the potatoes evenly in the rows and at the same time distributed the fertilizer in narrow bands about 2½ inches away from the seed. The rows were 2½ feet apart, and the planting was completed on June 28. Small seed, No. 2 size, were used, and they were planted whole.

The first cultivation and spray followed after the plants were up about five inches, and a regular spray schedule was in force for the rest of the season. The vines remained green until killed by an early and unexpected frost the first of October.

Harvesting operations began on October 7, and a check was made on the corn plus rye vs. rye alone, the fertilized and unfertilized areas, and the small whole seed vs. large cut seed. Unfertilized potatoes yielded 136 bushels, cut seed 125 bushels (poor stand), rye alone (small whole seed) 280, and the corn plus rye 448 bushels. Very little scab or wire-worm damage was found in the corn plot.

Another interesting feature of the corn and rye plot was that over 82 per cent of the field-run potatoes graded U. S. No. 1's. No grade records were kept upon the other plots. His average was 367 bushels of No. 1's per acre from this method of growing potatoes.

Fertilizer Needs of Red Raspberries

(*From page* 14)

izer without potash, differences which can be noted even in the rather inadequate picture shown in Figure I.

The results secured in this preliminary experiment were sufficiently unexpected and striking, so that it seemed desirable to check results by a more elaborately laid out experiment on a somewhat different soil. Accordingly, a field was chosen on a farm two miles away, presenting a different site and a heavier type of soil.

Sixty 1/60-acre plats with greater intervals between plats were used, and check plats receiving no fertilizer were provided. As in the first experiment, there were unit series of four plats with a plat receiving complete fertilizer, and three plats receiving the same amounts of two fertilizer ingredients, but omitting in turn the third. Each series also had a check plat, and there were series providing for three levels in fertilizer applications; viz., 500, 1,000, and 1,500 pounds per acre, and three replications of each treatment.

Replications of the different treatments were located to take cognizance of known differences in natural fertility of the land and so that each treatment would be represented in the better portions of the field as well as in the poorer. Cultural methods, spraying, etc., followed the plan laid out for the first experiment. Only one variety, the Latham, was planted.

TABLE II. COMPARISON OF YIELDS IN KILOGRAMS OF TWO CENTRAL ROWS WITH TOTAL YIELDS FOR EACH PLAT.

Treatment	Total yield 3 years 4 varieties	Total yield two middle rows June and Herbert	Relative yield of central rows to total yield, in per cent
N-P-K All Three Elements	51.1 Base	13.2	26
N-K No Phosphoric Acid	42.3	10.5	25
P-K No Nitrogen	35.5	8.4	23
N-P No Potash	24.1	3.5	14

TABLE III. AVERAGE YIELD OF PLATS RECEIVING THE SAME FERTILIZERS, GENERAL AVERAGE AND 3-YEAR AVERAGE YIELD IN QUARTS PER ACRE AND PERCENTAGE OF YIELDS, UNDER DIFFERENT TREATMENTS, USING THE COMPLETE FERTILIZER PLATS AS THE BASE

Fertilizer treatment	Year	Yield per plat in kgms. for 3 levels of per acre applications 500 lbs.	1000 lbs.	1500 lbs.	General average for 3 years	Equivalent in quarts per acre	Per cent reduction
N-P-K Complete Fertilizer	1933 1934 1935	32.4 25.1 23.0	35.6 27.1 24.9	33.3 19.2 27.0	27.5	2,845	Base
N-K No Phosphoric Acid	1933 1934 1935	26.2 24.8 21.9	28.0 26.6 25.7	31.2 15.7 26.2	25.1	2,600	9
P-K No Nitrogen	1933 1934 1935	25.2 16.3 18.6	25.3 13.9 19.2	19.0 9.9 10.7	17.6	1,816	36
N-P No Potash	1933 1934 1935	19.9 13.9 12.9	17.4 7.2 8.2	17.7 8.9 6.5	12.5	1,294	55
Check No. Fertilizer	1933 1934 1935	16.7 8.5 10.1	9.7 7.8 9.7	11.4 7.6 6.0	9.7	1,005	64

In this experiment crops have been secured and results calculated for the years 1933, 1934, and 1935. These are summarized in Table III.

If we again take the plats on which a complete fertilizer was used as a base, we find that there is a 9 per cent decrease where phosphoric acid was left out, 36 per cent decrease where nitrogen was left out, and 55 per cent decrease where potash was omitted. There was a reduction of 64 per cent where no fertilizer was applied. Combining percentage results of the two experiments we have the comparison shown in Table IV.

After the second experiment was laid out, similar but more extensive experiments at the East Malling Station in England came to the writer's attention. This work was carried on between 1927 and 1931, and is reported by T. N. Hoblyn in the Journal of Pomology and Horticultural Science (Published in England) for December 1931. The opening sentence in this paper indicates that, regarding the status of their knowledge of raspberry fertilization, the author has arrived at a similar conclusion for England as that expressed for the United States in Bulletin 229 of the Rhode Island Experiment Station. To quote from page 303 of the Journal: "The manuring of raspberries is a subject concerning which there exists little experimental evidence. Although most textbooks recommend heavy dressings of organic manures, the evidence afforded by the few elementary

TABLE IV. COMPARATIVE YIELD IN KILOGRAMS AND PERCENTAGE OF REDUCTION DUE TO DIFFERENT TREATMENTS IN TWO EXPERIMENTS

Treatment	First experiment, Reduction in yield (Per cent)	Second experiment, Reduction in yield (Per cent)
Complete	Base	Base
N-K	17	9
P-K	30	36
N-P	53	55
Check	—	64

trials in which artificials are included, is not very illuminating."

The English experiment here referred to considered the growth of two varieties regarded as offering definite contrasts in growth habits, and used a total of 7½ acres as compared with a little over one acre in the second Rhode Island Experiment, and much less in the first. Further details of the English experiment cannot be given here, but the following statement from the summary, p. 329 of the Journal, indicates conclusions quite similar to those arrived at from the Rhode Island investigations.

"The results indicate that on this soil, with two varieties of very different habits, a proper balance between nitrogen and potash is the secret of successful manuring of raspberries. Nitrogen may up to a point produce more cane by itself, but has never increased the crop except in the presence of potash. Indeed, alone it has been depressing in both cases."

Results of the two Rhode Island experiments indicate quite definitely that on two soils of fair, natural fertility, growth and yield of raspberries under different fertilizer treatments show a very definite need of potash. Since these two types are fairly representative of Rhode Island soils, and as nearly identical results also have been secured from English experiments, it would seem reasonable to conclude that raspberries suffer decidedly from potash deficiency, and that this element should not be left out of the fertilizers unless careful experimental checks indicate that the soil to be used contains the requisite amount. Nitrogen is second in importance, and the current advice to apply it should be heeded. Phosphoric acid is of least importance, but since this element is relatively cheap it should be added if for no other purpose than to help produce a good cover crop, which is essential unless barnyard manures can be applied from year to year.

Potash for Cotton Wilt and Rust in South Mississippi

(*From page* 8)

addition of potash to a fertilizer containing adequate amounts of nitrogen and phosphate, the percentage of wilt was greatly reduced. The 50-pound per-acre application of muriate of potash in combination with nitrate of soda and superphosphate brought about a reduction in wilt infection of 65.18 per cent, but it was only when 100 pounds of muriate were used that the maximum reduction, 86.12 per cent, was reached. Increasing the application of muriate to 150 pounds per acre did not in this plat result in a further material reduction in infection, indicating that under the conditions of the test, 100 pounds were enough to satisfy the potash deficiency present.

The plat receiving no fertilizer whatsoever had a 42.35 per cent lower wilt count than did the one receiving both nitrate and phosphate but no potash. This may be accounted for, in all probability, by the explanation that the normal potash resources of the soil had been more rapidly depleted in the latter plat by the increased vigor and growth of the plants receiving the unbalanced fertilizer. This is, in itself, a further indication of the value of the potash in wilt control.

In consideration of yields secured, the exceedingly low yield of the check or no-fertilizer plat may be accounted for by the fact that it had received no fertilizer whatsoever since 1919. With each increase in potash up to 100 pounds per acre the yield was

TABLE II. EFFECT OF AMOUNT OF POTASH ON YIELD OF SEED COTTON AND ON WILT INFECTION AT THE POPLARVILLE BRANCH STATION, 1930-1932

Treatment: 800 lbs. per acre	Lbs. seed cotton per acre 1930	1931	1932	3-yr. av.	% wilt infection 1930	1931	1932	3-yr. av.
6-8-0	884	944	477	768.5	22.1	22.0	18.2	20.85
6-8-4	926	1,096	555	859.0	12.8	7.0	9.8	9.85
6-8-8	908	1,114	565	862.3	7.1	6.9	8.4	7.46
6-8-10	982	1,060	547	863.0	8.7	6.2	11.0	8.63
6-8-12	982	1,087	528	865.7	8.7	3.9	10.6	7.73
6-8-14	966	1,146	629	913.6	13.2	5.0	9.4	9.20

materially increased, that application giving an increase of 34.45 per cent over the plat receiving nitrate and phosphate but no potash, as compared with 20.96 per cent increase in yield for the plat receiving the 50-pound application of muriate. These results indicated clearly that with a variety of cotton which showed a moderate degree of resistance to wilt, the trouble may be largely overcome on the light soils of south Mississippi by the use of a sufficient amount of potash in a properly balanced fertilizer.

In Table II are presented the results secured from another test conducted at the same station designed to determine the amount of potash in combination with other fertilizer elements which would be most effective for wilt control in south Mississippi. A basic fertilizer, analyzing 6-8-0, to which muriate of potash in the proportions of 0, 4, 8, 10, 12, and 14 per cent was added, was applied at the rate of 800 pounds per acre. Nitrate of soda and superphosphate supplied the respective elements, nitrogen and phosphorus. The test was begun in 1928 and continued through 1932. The data for 1928 and 1929, however, in which years soil inoculations were made by the application of copious amounts of inoculum prepared by growing the wilt organism on wheat bran, were omitted, due to the fact that infection was not uniformly distributed in all plats.

Examination of the table shows that the difference in yield for the 3-year period on all plats receiving potash were not significant. Moreover, the variation in percentage of infection on the same plats is too small to have any particular significance. However, on the other hand, the reduction in wilt

In the foreground where no fertilizer was applied, the wilt infection was 42.2% and the yield only 180 lbs. of seed cotton. In the background on the left where 200 lbs. nitrate of soda, 400 lbs. superphosphate, and 100 lbs. muriate of potash were applied, the wilt infection was only 3% and the yield was 1,224 lbs. of seed cotton.

infection over the check plat, which received no potash but which in other respects was treated in identically the same manner, was quite marked in the case of each and every plat treated with potash. The indication was, therefore, that the 6-8-4 mixture at the rate of application used, namely, 800 pounds per acre, contained sufficient potash to reduce wilt infection to the approximate minimum to which it was capable of being reduced by the use of potash on the variety, Lone Star 65, under the conditions of the test. The plants receiving more than 4 per cent of potash did, in fact, show a slightly lower amount of wilt, but the differences were not large and the yields were not increased accordingly.

This test shows agreement with those previously discussed in indicating that, even with a resistant variety of cotton, the damage from wilt can be further reduced by the use of potash in the fertilizer mixture. Kainit showed the greatest decrease in wilt infection and also the largest increase in yield among the four potash sources tested, and the differences were large enough to be significant. This is especially true when taken into consideration with the fact that it has given similar results in other tests, conducted in a similar manner, but not reported herein. Kainit, being a natural mineral, contains as impurities the salts of several other elements in addition to potash, and it is entirely probable that these may have had an effect in stimulating the cotton plant and thereby affecting the yield and the reduced incidence of wilt.

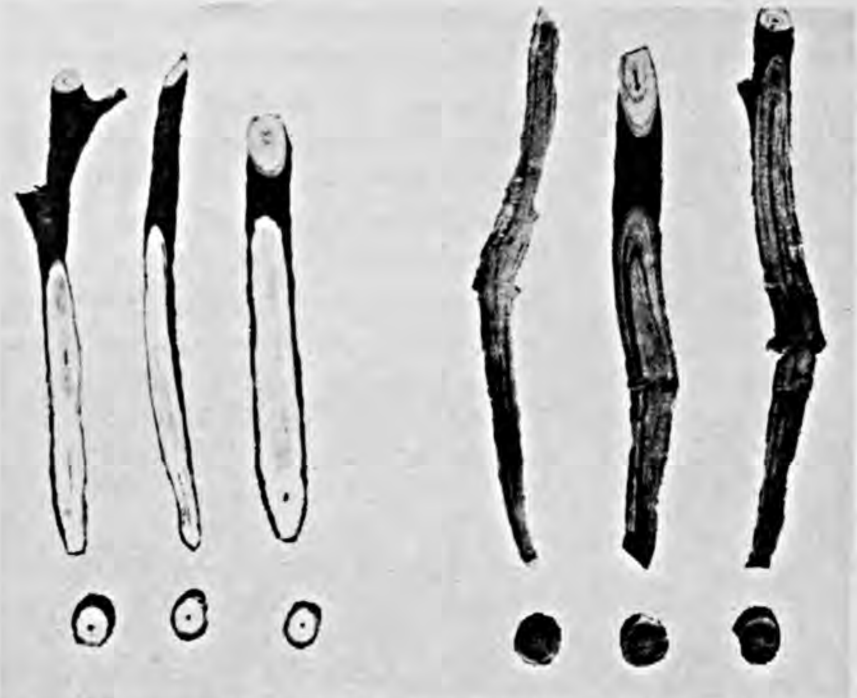
TABLE III. POTASH SOURCE TEST WITH REFERENCE TO COTTON WILT CONTROL AT THE POPLARVILLE BRANCH STATION, 1930-1932

Analysis	Source of potash	Lbs. seed cotton per acre 1930	1931	1932	3-yr. av.	% wilt infection 1930	1931	1932	3-yr. av.
6-8-0	....	1,025	1,059	590	891.3	8.5	12.9	9.8	10.43
6-8-4	Muriate	1,090	1,243	448	927.0	1.2	5.0	5.3	3.83
6-8-4	Sulphate	1,164	1,142	660	988.6	1.6	8.5	2.0	4.03
6-8-4	Kainit	1,198	1,195	657	1,016.7	1.7	1.3	1.5	1.50
6-8-4	Sulphate of potash-magnesia	1,164	1,102	639	968.3	1.8	4.8	6.5	4.36

Table III presents the results secured in another test conducted at the Poplarville station between 1928 and 1932, inclusive, to determine whether any particular source of potash was more effective in the control of wilt than was another. Four sources of potash were tested, namely, muriate of potash, sulphate of potash, kainit, and the double salt, sulphate of potash-magnesia. The basic fertilizer was a 6-8-0 mixture applied at the rate of 800 pounds per acre, and the potash added from the various respective sources was always in the proportion of 4 per cent. Results for 1928 and 1929 were omitted from the table for the same reason as recorded in the previous test. The variety used was a strain of D. & P. L. cotton which was relatively resistant to wilt, consequently the percentage of infection on all plats was rather low.

The land selected for the tests was that on which severe losses had been experienced in previous years from a combination of wilt and rust or potash hunger. Nematodes were not present to an extent that they might become a complicating factor in the interpretation of the results secured. In each case rust was controlled by applications of potash, as was evidenced by the thriftier growth, deeper green color of the cotton, and by the absence of defoliation. In each case where nitrogen and phosphorus were applied without potash, the symptoms of rust were even more severe than on the non-fertilized plats.

The results secured from the series



Showing the internal discoloration of cotton stems due to wilt: Left—healthy; right—diseased.

are also beneficial in the control of rust. For wilt control a suitably adapted variety of cotton should be selected which shows at least a moderate degree of resistance to wilt. Other factors being equal, the higher the degree of resistance shown by the variety used, the more satisfactory will be the control of the wilt which is secured. If wilt is present a larger proportion of potash in the fertilizer mixture than that required for the control of rust alone will be found to be beneficial.

of tests and from others of a similar nature which are not reported herein present a sound basis for practical recommendations for dealing with the combination of wilt and rust, which is so troublesome to cotton growers in south Mississippi. Rust can be controlled by the use of a fertilizer containing an adequate amount of potash. Other tests have indicated that measures to increase the humus content of the soil, such as the use of barnyard manure and the growing and plowing under of leguminous cover crops,

If these recommendations are generally followed throughout the region indicated, losses from rust and wilt of cotton should be held in check and should become of negligible importance. A continued high loss from these troubles on the part of a grower or a community will merely mean that adequate use is not being made of remedial measures already available with which to combat them.

Spring Song

(*From page 5*)

one's pockets and stand on his head to make them out.

One reason for the persistent popularity of our midwest minstrels lies in their direct simplicity and their musical rhythm. Leave out financial reward altogether, please, as I speak of satisfaction begot by understanding and something else linked with the folk-lore of our land. I must call in a stauncher authority than myself to support and clarify my claim. No other than Gilbert K. Chesterton, English scholar and critic, has written the following, and as I cannot beat it myself, here it is:

"The historical point about rhyme is that it rose out of the Dark Ages with the whole of this huge popular power behind it—the people's love of a song, a riddle, a proverb, a pun, or a nursery jingle; the sing-song of innumerable children's games, the chorus of a thousand camp-fires and a thousand taverns. When poetry loses its link with all these people, it loses all its power of giving pleasure."

GOOD poetry in any season is an expression of mood or state of mind, and it should not require a piece of research in order to get its effect. I blame some of my diligent high-school teachers for getting the "college analysis" habit too early when they helped us out of short pants into the charmed circle of Shakespeare, Sir Walter Scott, and Milton. Many a fellow with an ear for good poetry and a flair for metrical excellence has had it all dusted out of him after a high-school course in English literature. Not hankering for history or archeology, he had to swallow so many foot-notes and hunt up so many tedious explanatory references that he missed the pleasant sailing of the poem itself.

Too frequently we regard poetry as a distasteful task involving too much mental strain, and I fear a reason for much of that avoidance of verse among us adults lies in those unhappy experiences of our adolescence.

If the small town high school had its shortcomings, these were often offset by the policy of the local newspaper. Rural weeklies used to welcome the home-town bard, if he kept his outpourings within decent space limits.

I understand, however, that things are different now, and that cash column rents are charged to poets on the same rate-card basis with baby-chick and ash-hauling notices. It is hard to tell whether this denotes poorer production or better public taste, and it may even afford grounds for political platforms designed to free genius from the shackles of capitalism. I may interview one of my old printshop foremen some day and get his reactions on the matter.

I find this an interesting study, for my first job was taken with the thought that the open door of the country printing office would give free rein in time to my muse and enable me to compose verse and actually see it in type. Bret Harte tells the same story in his yarn about the Poet of the Sierras, who lingered around the local sanctum with sentimental ballads for possible publication. For a time it was my privilege—amounting to license—to run a column of town topics layered in among the boiler plate of our weekly beacon. Standing at the case with stick and rule, I composed couplets and stuck up sonnets for my little world to read. I have no doubt that the citizens read them because there wasn't much else in the sheet except medicine ads which carried any degree of literary abandon or creative imagery. Not being a true Bohemian, I got no further in the fields of rhetoric and soon turned to facts instead of fancies—a plan I now adhere to most of the time.

PERHAPS my only sore spot as regards the whole poesy business has its roots in a winter I spent imprisoned in a claim shanty on the Dakota plains, with a retired circuit-riding widower, an elder of some kind of reformed church or other, as my nearest neighbor.

He did not play solitaire or read French novels, so it was his custom to while away his hours of weary waiting for preemption day in a highly ingenious way. That is, he arose early along with the prairie larks, and gulping a hasty breakfast, he brought himself and his satchel of unpublished poems over to my cloister for a day of indulgence—for him. I can see him yet, lean and ascetic, with a prodigious beard that would have made Aaron look like one of the quintuplets, gesturing grandly as he chanted aloud to me his cantos and his octosyllabic quatrains. His age and calling saved us both that winter from the horrid effects of sudden violence.

Long before spring I had thought of a better way to save myself. It simply consisted of feverish night work building back-fires of verse gleaned partly from imagination and somewhat from the aforesaid novels; and after I insisted on reading them to him repeatedly, he withdrew in dudgeon and never returned. I do not know to this day whether it was the raw state of my muse or his own being drowned out that turned the tide for me.

HOW any minister of the gospel could substitute his own feeble efforts for the noble verses in the Book with which he must have been familiar, is another thought, and one which takes me into my final theme.

In naming any poem as one's favorite, some logical reason may or may not be required. I shall give a reason in my case because the particular verses connect themselves with a major part of my life work, and besides, the ones I shall quote reflect the spirit of this present season in a way that most of our clients will appreciate for the same reason that I select them.

To one whose privilege it has been to go afield each spring seeking the wisdom of the farmers and taking their problems to heart without any of the financial risks or rewards, but purely in quest of truth for others to read, the selection below is doubly appealing.

I nominate the following from the Songs of Solomon as worthy of new reading and perhaps as the best of all Bible verses to ask the dominie to read for us "extension" men when we leave for our last trip, because it will express smoothly and poetically the animating force that kept us akin to agriculture. And moreover, it is another "spring song," and therefore welcome for the time and purpose in hand.

"My beloved spake, and said unto me, Rise up, my love, and come away. For lo, the winter is past, the rain is over and gone;

"The flowers appear on the earth; the time of the singing of the birds is come, and the voice of the turtle is heard in the land.

"The fig tree putteth forth her green figs, and the vines with the tender grape give a good smell. Arise, my love, my fair one, and come away.

"Awake, O north wind; and come, thou south wind, blow upon my garden that the spices thereof may flow out. Let my beloved come into his garden and eat his pleasant fruits.

"Come, my beloved, let us go forth into the fields; let us lodge in the villages.

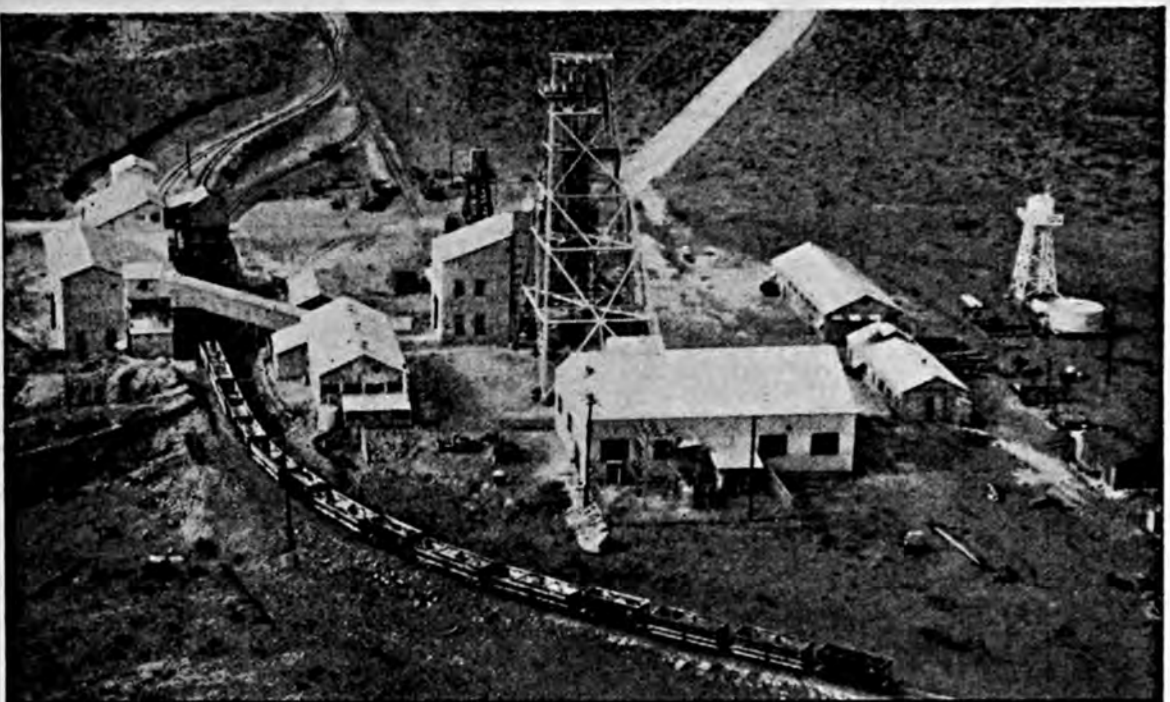
"Let us get up early to the vineyards; let us see if the vine flourish, whether the tender grapes appear, and the pomegranates bud forth; there will I give thee my love.

"And at our gates are all manner of pleasant fruits, new and old, which I have laid up for thee, O my beloved."

And after all, writing good poetry is not perhaps as hard as living it. We who foregather with the best farm folks under the sun know that they are the salt of the earth and the spice of our living. If faith and nobility have any place in rating good poems, I am sure that hosts of our familiar friends are standing like heroic stanzas themselves.

But this year as we hear the opening chords of the agricultural overture across the meadows and in the rural meeting places, there seems luckily and happily, a sweeter and a more lilting cadence in the melody than we heard last year and for several years.

I have it at last! There is less of the *penseroso* and more of the *allegro* in the Spring Song of 1936.



Aerial view of hoist and grinding plant at the U. S. Potash Company's mine near Carlsbad, N. M.

"ALREADY BLOWED"

A certain middle-aged spinster has a vivid memory of Texas courtesy.

She was struggling with a hot cup of coffee in a small-town railway station, trying to gulp it before the train pulled out. A cowboy, seated a couple of stools away, noted her plight, and seeing the guard waving to the woman, came to the fore.

"Here, ma'am, you can take my cup o' coffee. It's already saucered and blowed."

"Well, Mose, how is your better half this morning?"

"She's better, thanks, sah; but boss, you shore is careless with your fractions."

She was young and attractive and spending her vacation in the country.

Walking in the woods one hot summer's evening she came to a beautiful lake. It looked so cool and inviting, and so isolated from the village that she decided to take a chance and go for a swim.

Presently a rustling was heard in the bushes along the bank. "Who's there," she called nervously. "Willie Smith," came back the reply in a high pitched voice. "How old are you, Willie?" she asked.

"Eighty demmit!" the voice replied.

A new clerk dictating a few days ago, was in doubt as to the use of a certain phrase, so he said to the stenographer: "Do you retire a loan?" And the wistful eyed one replied rather sleepily:

"No, I sleep with mama."

Traffic Cop: "Don't you know what I mean when I hold up my hand?"

Lady-driver: "I should. I've been a school teacher for 25 years."

"He was kicked out of school for cheating!"

"How come?"

"He was caught counting his ribs in a physiology exam."

WHY NOT?

Sandy joined a golf club and was told by the professional that if his name was on his golf-balls and they were lost, they would be returned to him when found.

"Good," said the Scot, "put my name on this ball."

The pro did so.

"Would you also put M.D. after it?" said the new member. "I'm a doctor."

The pro obeyed.

"There's just one more thing," went on the Scot. "Can ye squeeze 'Hours 10 to 3' on as well?"

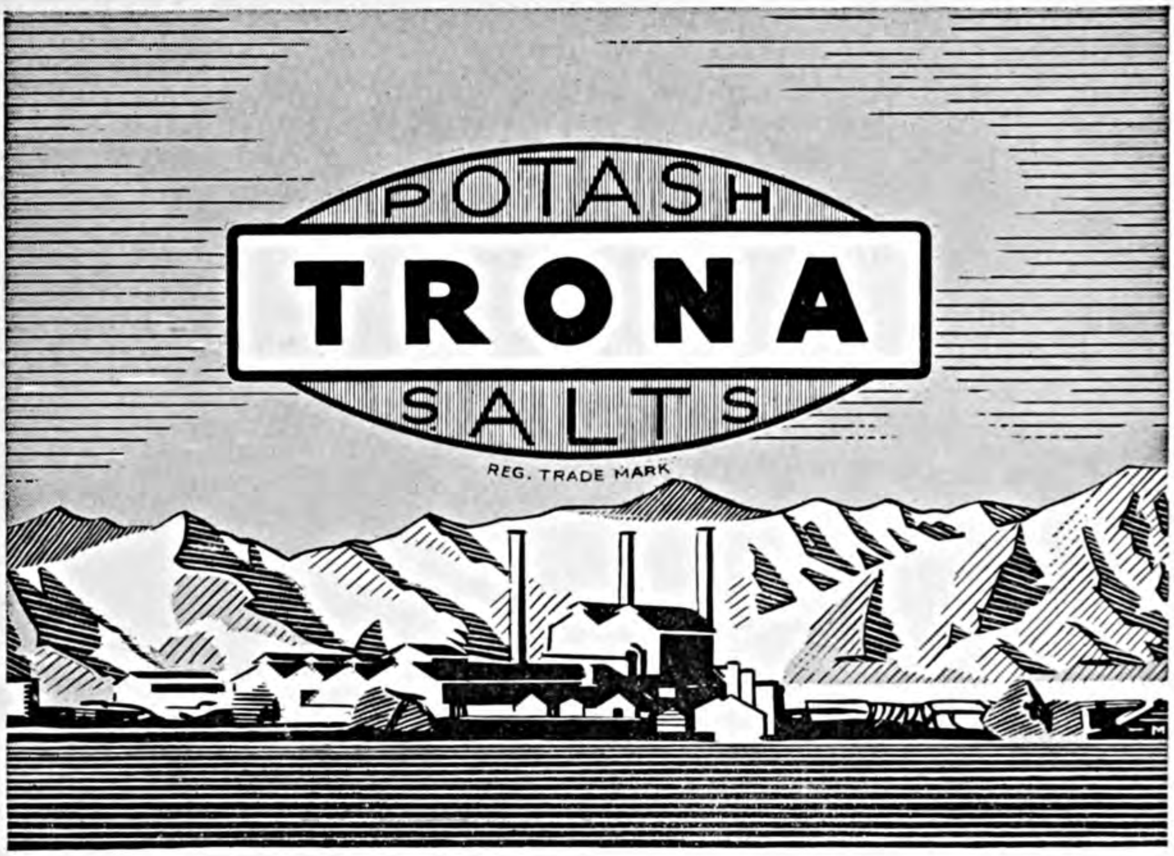

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TABLE OF CONTENTS, JUNE-JULY 1936

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VOL. XX WASHINGTON, D. C., JUNE-JULY 1936 No. 10

*Jeff Opines That—
Graduation Is Not*

"Quit-uation"

Jeff McDermid

GLANCE back with me to those days of peg-top pants and pompadours. Remember how the old high-school bunch of the nineties lightly referred to June diploma-time as "quit-uation" day? We were panting for the final release from discipline amid a sticky season when indoor tasks were irksome; and many a useless discussion arose over why they called the end of formal schooling, "commencement."

I am sure we little realized that it *was* commencement, and that we would quickly assume duties to deprive us of the fish pond and the ball grounds with sterner routine than any we had encountered within the classroom.

No doubt a majority of that thoughtless generation has since yearned for more learning, and we look back upon many a crabbed teacher as one does upon blessings lost before they are appreciated. Yet I do know that there was no such youthful protest over lack of educational opportunity as we have today, nor such a compelling sense among elders that one need not stop mental growth after squeezing through high school or college with small margins to spare. In those days schools were not so pleasantly conducted, and the world had not found its need for living facts and varied experiences so imperative.

But with much more knowledge to acquire in 1936 than in 1906, and more need for better training to keep youth abreast of the mighty waves of progress and invention, what do we find upon delving into a few recent pages of that amazing daily storehouse, the *Congressional Record?*

From five million to eight million young people between the ages of 16 and 25 are wholly unoccupied in this land of ours. They are neither working nor attending school. This means that idleness through no fault of their own possesses a mass of young folks equal in number to the whole population of this country in 1800 and about that of the present residents of New York City. Seven hundred thousand young folks had to stop their high school courses last year for lack of funds, despite the National Youth Administration. What will the labor market offer for the thousands of graduates released from academic gates this summer?

We will either do something for our young people and do it soon, or else they will do something to us.

Speaking out in meeting is a new habit with the folks who were infants a few years ago and were told to be "seen but not heard." At a Detroit youth congress last July, their ringing declaration of independence called for "guarantees of a full educational opportunity, leading to a happy, useful, and creative life, employment at adequate wages, security in time of need, civil rights, peace, a free press, freedom of speech, and rights of assemblage." If anybody thinks that is bumptious stuff, turn back to the American revolution.

MEMBERS of Congress are awake to the fact that we must apply remedies to this condition in two ways. We must cause our youth to remain in educational institutions longer and enter the labor market later; and we must provide for an adult educational system which will enrich our public opinion and help to deliver us from dogma. For we now know that there is no such thing on earth among sane citizens as a "quit-uation" time.

Go through a modern steel plant. Note carefully the exactness and marvels of metallurgical chemistry, the tests made of every conceivable kind in the laboratory, and the delicate precision of the equipment therein; and from there visit the Bessemer furnaces and observe what mammoth and ponderous weights of white-hot flux are handled by a few tiny men. If men can conquer such vast odds, why can't some genius forge the link between those who need education and work and the potential demand necessary to put the economic world into gear again?

THIS perplexity keeps bobbing up as a challenge to us all, and it reaches its crest as the hopeful graduates march down to get their parchments from the school board this pleasant June time. Even though a temporary improvement in conditions has come, the same old threat is with us, like buried roots of quack grass, ready to bud and sprout unless heroic measures are taken to prevent it. It's our job to see that the high-school and college commencement means just that, and not stagnation.

I wonder if there was anything "wistful" about me or my chums when we "quit-uated" that day in June three decades ago. I know there has been since, but that's another matter. Last night my wife rigged up our eldest girl in her dotted Swiss commencement gown. Somehow I could see something sort of wistful in both of them, standing there in the twilight. One was happy, flushed and radiant over the truce following her French conquest and a couple of rows of other A marks (which she could trace to hard work rather than inheritance), and the other was hiding some of her feelings in that matronly reserve and dignity which endears her to us all.

When daughter was in the lower grades she found us of some help when the road to erudition was a little rough in spots. I am still able to do my fractions and I have a faint glimmer of grammar. The things I absorbed from 10 to 15 have stuck with me, but it's not so good for the upper teens and twenties. So when our girl began toting home algebra, geometry, classic poetry, and medieval history, with a few tomes on social problems thrown in besides, my ability to graze in old pastures watered by Pierian springs was blocked by mental indigestion. It was like going hand-in-hand with a friend along an ascending path toward a summit where glorious scenes abound, and then being stricken blind when you expected to point out vistas dimly recalled as being wonderful to behold.

So I think I need to be re-educated. How about you?

Too many parents send their children on to college so that the offspring may get polished, and sometimes in the case of the boys, all they get is a good shine. When the youngsters return and fail to adapt themselves properly to a ready-made niche cut out for them, a universal howl soars aloft that the academies are a failure and a waste of hard-earned cash.

We razz the courses with frills and exclaim that such trash is of no use in a practical world. How do we know, to be exact about it, whether the college or the world is at fault? Maybe it's the older folks who are out of tune and maybe it's the lack of culture, inspiration, and intellect in our everyday lives that withers the fruit of our colleges as soon as it is harvested. Yes, indeed, too many of us just "quit-uated" one summer day and never resumed where we left off. If elders wish to be companions and friendly, understanding guides for newly graduated youth, their job is to cultivate the mind while they are raising the mazuma.

Cultural education for folks past school years can be amply defended on other grounds than its value as an aid to growing and developing youth. That is, we can be a little selfish about it, too. Our zeal to provide opportunities for polishing off the youngsters need not preclude us elders from imbibing some generous quaffs of elixir ourselves. Apparently, vocational courses are paving the way.

I think it is nothing to be wondered at that so many young people are impatient to study along lines leading them to greater and steadier earning power. Maybe if we couple that up with adult education later in life, they can get the practical stuff first and the fancier courses later, if necessary.

It is astonishing to note the enrollment in 1935 simply in those schools teaching courses of a practical nature which received Federal aid. About 1,200,000 persons studied in vocational and continuation schools last year. Wage-earning youths over 14 years, learning while earning in cities, and farm boys in rural high schools each comprised 18 per cent of the total. Wage-earning adults in city evening schools numbering 155,000, or 13 per cent of the total; 135,000 rural and urban women training for better home-making, or 12 per cent of the total; together with 175,000

(*Turn to page* 44)

The Role of Potassium *In* Plant Nutrition

By Dr. W. L. Powers

Soil Scientist, Oregon State Agricultural College, Corvallis, Oregon

POTASSIUM has long been included among the more important fertilizer constituents although most soils are relatively higher in their content of total potassium than of nitrogen or of phosphorus, and less potassium is removed in the marketable portions of plants or retained by animals. However, it has been the experience of farmers that continued cropping for half a century may result in a deficiency of readily available potassium.

A small amount of potash is present in the soil solution and is readily available to plants. A somewhat larger supply of potassium exists in association with the ultra-clay fraction of the soil in nearly available or exchange form. It is this form largely that replenishes the soil solution of normal soils. There is a reserve supply of potassium present in the soil in relatively insoluble soil minerals, principally feldspars. Water-soluble potassium tends to be absorbed or fixed in the clay fraction, and it is thus retained against leaching, while erosion, upward leaching, or translocation by plant roots from the subsoil into the surface may tend to replenish soil potassium-supplying power. The roots of certain plants may etch out potash directly from the fine feldspars, and this potash returned as crop residue may be absorbed and held in exchange form in the soil.

There are two classes of soils of considerable extent that may be expected to be naturally deficient in potash, namely, sands and peats. Sand soil high in silica may contain some potassium in insoluble or undecomposed silicate form. Peat soils are generally low in minerals, being made up largely of plant remains and the potash therein contained is rather subject to leaching. The conditions under which peat occurs are favorable for leaching. Two soil areas in the Northwest that have been found to be relatively low in available potassium are certain

Mint response to potash—left, untreated; right, potassium sulfate.

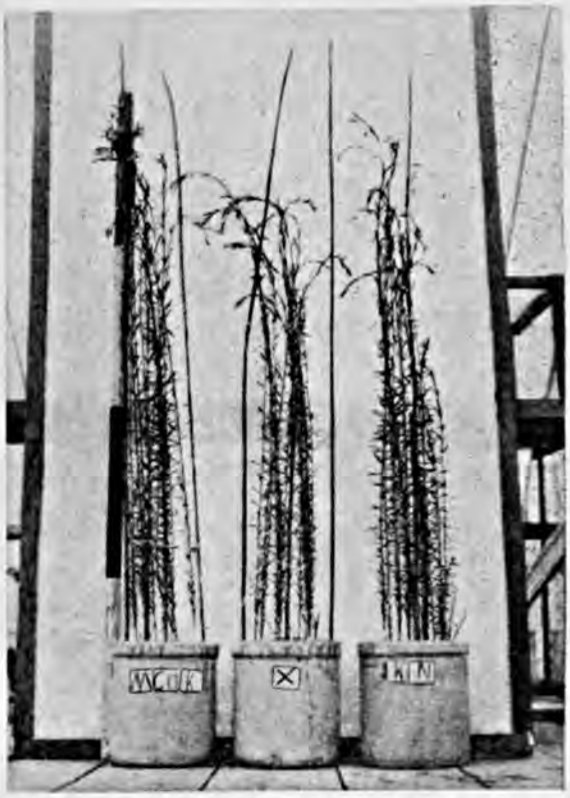
sandy soils and the peat and muck soils, especially in the humid sections of the Pacific Northwest. The average total potash content of peat in the Willamette Valley, Oregon, is approximately 2,000 pounds in the plowed depth of an acre; whereas, the adjacent bench land of Willamette silt loam, which is one of the most representative soils of the Valley, contains an average of approximately 33,000 pounds of potassium. The sandy Deschutes, Oregon, soils contain a fair total supply of potassium, or on the order of 20,000 pounds to plow depth of an acre, which is 1%.

The readily available replaceable or base exchange potassium in peat soils is very low, although the exchange capacity of these soils is very large. The sandy Deschutes soils, on the other hand, have a low clay content and only a medium capacity for exchange bases. They are subject to leaching where irrigated. It may be expected that on such a soil a light application of potash might be more effective than on peat, unless there be an absolute deficiency in the peat before treatment.

In some soils potash added will enter into a replaceable form. In other soils much of the potash added may become non-replaceable. Availability of exchange potassium will be affected by the kind of crop, stage of growth, proportion of other exchange bases present, constitution of the exchange complex, and the amount of wetting and drying as affected by climate and season, potash being more effective in unfavorable seasons. Crops also vary in their ability to secure potassium directly from fine particles of feldspar. Potassium is an essential plant nutrient and is radioactive.

Potassium is known to go to the stems, increases mechanical strength, and is returned to the soil largely in the straw.

It has been found to increase the sugar content of berries, grapes, and



Fiber flax—left to right: manure, lime, and potash; untreated; potash and nitrate.

beets in experiments in Michigan, England, and Germany, respectively.

Increases in starch in rice and bulbs have been reported, and potash is probably essential for carbon dioxide assimilation.

Increased oil content of pecans due to potash was reported by the Bureau of Chemistry and Soils in Louisiana experiments.

Potash was found to make peas more tender at the New York State Experiment Station.

It caused stronger epidermis with better protection from infection.

Potash is reported to increase the keeping quality of oranges and cabbages.

It is supposed to be a promoter of color, cell division, synthesis of proteins, and activity of enzymes and nitrifying micro-organisms.

Deficiency of potash may cause leaf scorch and tip burn, or spotted leaves.

In Oregon experiments potash seems to increase the length and strength and proportion of fiber in flax, and its resistance to wilt.

Potash has trebled the yield and im-

The mint at the left received no treatment; that at the right had potassium sulfate.

proved the quality of mint oil by all the standard chemical tests for the three years where mint was grown on Oregon peat.

Potash has increased the yield, firmness, and the starch and dry-matter in potatoes on certain Oregon mucks.

Where the supply of available potassium is unfavorably low, potash fertilization tends to increase the potash content of the plant. Where the supply of available potassium is large, "luxury" consumption may occur.

Potassium is absorbed best from a neutral solution and by young plants. A low concentration is adequate, if maintained.

The effect of using different kinds of potash carriers upon the quality of potatoes is shown in the data presented in Table I. Tables II and III show the effect of potash fertilizers on the yield and composition of mint oil.

In connection with potash trials on sandy soils in the Deschutes Valley, Oregon, some studies of various potash carriers and also the rate of application were made. A further trial of potassium sulfate at different rates not in-

(*Turn to page* 34)

TABLE I. FERTILIZER TRIAL WITH POTATOES ON MUCK
(From J. Lewis Plots—Clatskanie, Oreg., 1928)

Treatment	Yield bushel acre	Cooking test relative rank (Av. 5 tests)	Moisture in potatoes, per cent	Pressure test (Av. of 31 trials) lbs. causing rupture
Checks (Av. of 5)	126.6	5th	75.9	36.7
K_2SO_4	180.0	1st	75.5	37.9
K_2SO_4, Superphosphate, and $(NH_4)_2SO_4$	160.0	4th	78.5	35.2
KCl, Superphosphate, and $(NH_4)_2SO_4$	172.5	3rd	77.7	36.5
Manure, Lime, KCl	339.5	2nd	79.4	38.2
1929				
Checks (3)	153.3	4th	79.0	30.0
KCl	200.0	2nd	79.3	35.3
K_2SO_4	195.5	1st	79.1	36.9
Manure	236.6	3rd	79.2	35.5

Keeping Up-to-Date With Potatoes

By Arthur O. Braeger
Wisconsin College of Agriculture, Madison, Wisconsin

THE "latest thing" in potato raising is the use of fertilizers high in potash and phosphate. Since 1929 high-potash fertilizers have come into favor, and at the present time the 3-9-18 mixture is the most widely used.

The first widely used mixture of the old eastern potato regions was the 5-8-7. Wisconsin potato growers in 1929 used about 8,000 tons of commercial fertilizer. Of the mixtures distributed that year, the 3-10-10 and 3-10-12 analyses were well in the lead.

Nearly 80 per cent of the Wisconsin farms are growing potatoes to some extent. Many farms mean many soil types. Different soils, in turn, mean different growing practices. The farmer raising potatoes on a peat soil will use a fertilizing program different from that used by the sandy soil potato-raiser.

J. G. Milward and J. W. Brann, potato specialists at the Wisconsin College of Agriculture, and A. R. Albert of the Hancock Experiment Station have conducted numerous trials on raising potatoes in light sandy soils. These men have found that fertilization of the preceding legume crop is the best and safest practice for potatoes on light sandy soil. If the legume crop is partly used for live-

In general the double strength mixtures produce equally good yields as compared with the single strength where the ratio of plant food is the same. In using these higher analyses fertilizers, care should be taken to distribute well in the soil because of possible injury to germination.

This excellent stand of potatoes on the farm of E. E. Webster in Oneida county shows what can be done with a 3-9-18 fertilizer on sandy soil.

tion a few days after planting.

In seasons of adequate rainfall and fair prices, row fertilizer application for late potatoes on sandy and sandy loam soil, which has been well prepared otherwise, will usually give good returns, according to these men. They believe that over a period of years the average increase is not likely to pay for the cost. If manure is plowed under with a good legume sod or green manure, adequate rainfall will insure a good crop of late potatoes. If the season is very dry, the additional row application of fertilizer will not be profitable. These specialists say that the better the water-holding capacity of the soil, the more desirable are row applications.

Early potatoes that make growth before ample plant foods are available are benefited by row application and usually bring better prices.

stock feeding, the fertilizer charge falls less heavily on the potato crop. Enough but not too much lime for the better legumes, potash and phosphate for all legumes, and a complete high-nitrogen fertilizer or manure for the non-legumes are their recommendations.

Milward explained that direct commercial fertilizer, carrying nitrogen, phosphorus, and potassium, should be applied along the row as deep as and beside the seed pieces at planting, or side-dressed later, or both. On sands and sandy loam soils the potash ratio may be about 1-3-4 on manured, legume-fertilized sod; 1-3-6 for manured, legume-unfertilized sod; 2-3-8 for unmanured, legume-unfertilized sod; 2-3-4 on unmanured, legume-fertilized sod. On loams and silt loams, the potash may be reduced 25 to 50 per cent.

Brann pointed out that depending on soil fertility, grade of fertilizer, moisture supply, and prospective potato prices, the application may range from 250 to 750 pounds an acre. On light soil no more than 400 pounds per acre of the common grade of fertilizer should be applied at one time. If more is to be used, side-dress half the application at the second or third cultivation and apply the other half at planting or side-dress with a blind cultiva-

Success Due to Potash

Some of the well-known potato producers in Oneida county, Paul Bonach, Thomas Meredith, and E. E. Webster, have been using a 3-9-18 fertilizer on their sandy soils. They report excellent results from this mixture.

It is estimated that there are about 2,000,000 acres of peat soils in Wisconsin. Through the use of potash, potatoes have been grown very successfully on this soil. In recent years there has been a large investment in potato planting on a commercial scale on this type of soil. James Isherwood, Plover, and the owners of the Turtle Valley Farms, Delavan, raise excellent crops of potatoes on peat soils with an 0-9-27 fertilizer.

On medium loam soils in Langlade

(*Turn to page* 37)

Potash & Cotton Wilt In Central & North Mississippi

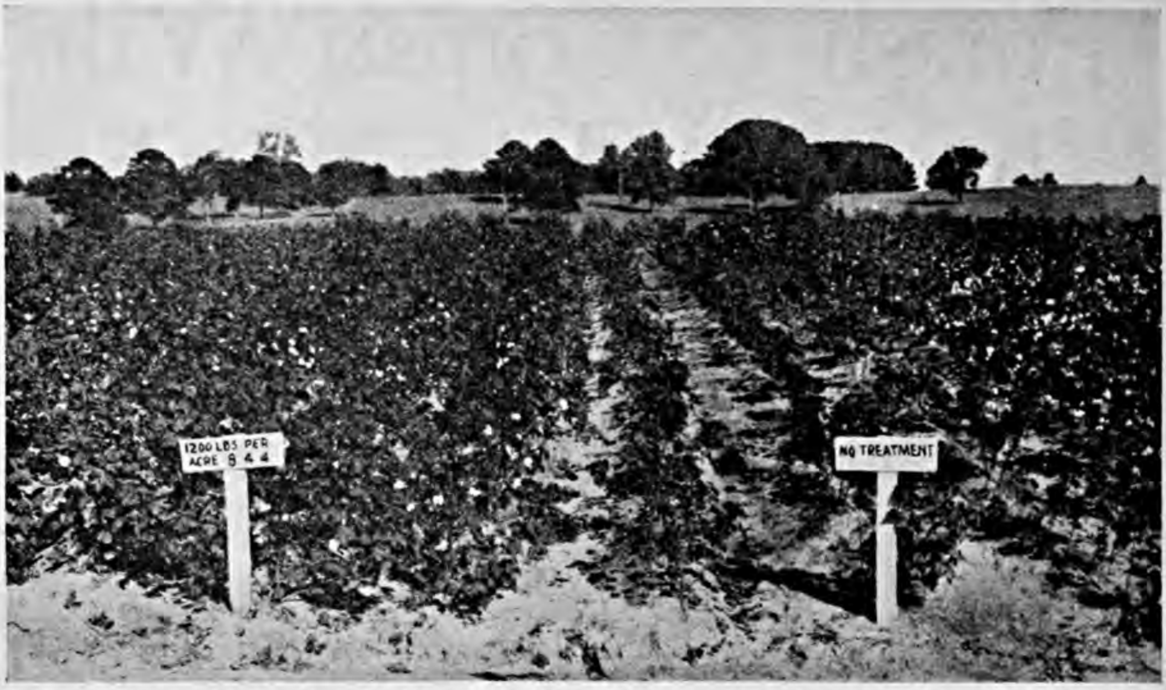
By Dr. L. E. Miles
Agricultural Experiment Station, State College, Mississippi

THE toll of cotton wilt, caused by the soil-borne parasite, *Fusarium vasinfectum*, has been experienced personally by a large majority of the cotton growers in Mississippi. On some this toll has been extremely heavy. On others, more fortunate in that their soils were less heavily infested, or in that they happened fortuitously to be growing a variety more resistant to the attacks of the fungus, or more provident in that they have sought for and, having secured it, followed advice regarding these resistant varieties, the levy has been lighter, though in most cases, still evident.

Crop rotation, a sanitary, precautionary measure usually recommended as sound practice against many plant diseases, is scarcely practicable with such a crop as cotton. Cotton is generally planted on large acreages, and, even were rotation practicable, it has been shown to be ineffective against the wilt organism which seems to be able to live almost indefinitely in the soil once it has been introduced, retaining its ability to attack cotton when it is eventually put back on the land.

Many varieties of cotton highly resistant to wilt have been developed. Other varieties less resistant but tolerant of wilt are available. Many growers, however, are indisposed to the use of these varieties for the reason that they do not possess in a high

Left (no fertilizer) wilt infection, 39.9%—yield, 199 pounds seed cotton. Right (600 pounds 4-8-4) wilt infection, 13%—yield, 987 pounds seed cotton.



Left (1,200 pounds 4-8-4) wilt infection, 5%—yield 1,125 pounds seed cotton. Right (no fertilizer) wilt infection, 23%—yield, 395 pounds seed cotton.

degree certain other characteristics which they consider essential to a good cotton. Progress is being made, and within a few years one may expect to secure varieties of cotton possessing a high degree of wilt resistance in combination with other desirable characteristics to suit the demands and idiosyncrasies of most growers.

Search Simple Treatment

The ideal control measure for such a soil-borne disease as cotton wilt would be, of course, some simple soil treatment, such as the application of some relatively inexpensive material in amounts within the range of economic practicability, which would not only control the disease but would also produce increases in yield, large and profitable, over and above those which might be expected from disease control alone. Cognizance has been taken of the desire for such a control measure, and tests have shown that the result aimed at has, in some measure at least, been attained.

In a previous article appearing in the last issue of this publication it was shown that potash, in combination with the necessary fertilizer elements in a balanced ratio, was instrumental and quite effective in reducing the incidence of and the damage from cotton wilt in the light soils of south Mississippi. In this article tests will be presented to show that the same effects are produced by potash on soils of various types in other parts of the state.

In 1928 a test was begun at the Main Experiment Station at State College to determine the effect of various fertilizer elements on cotton wilt under the soil conditions prevailing at that place. Nitrogen, provided by nitrate of soda, was varied through 0, 4, 5, 6, and 8 per cent. Phosphorus, from acid phosphate, varied through 4, 6, 8, and 10 per cent, and potash in the form of muriate of potash, through 0, 4, 5, 6, and 8 per cent. The basic rate of application of the respective fertilizer mixtures was 600 pounds per acre. One plat was given, in addition to the 4-8-4 mixture, an application of lime at the rate of 2 tons per acre. Two other plats were treated with a 4-8-4 mixture at the rate of 900 and 1,200 pounds per acre. Lone Star 65 cotton was planted, and all plats were run in triplicate. The test was continued

Left (no fertilizer) wilt infection, 40%—yield, 199 pounds seed cotton. Right (600 pounds 4-6-4) wilt infection, 11%—yield, 856 pounds seed cotton.

through 1932. It became necessary, however, to change the location of the plats in 1931 and, since the distribution of the wilt organism in the soil in the new location was not sufficiently uniform, the data secured in the new location have been omitted from consideration in the results presented. Wilt counts were begun shortly after chopping was completed and were repeated at approximately monthly intervals throughout the season.

In the first wilt counts each year there was very little infection in evidence, and the difference between the amounts in the various fertilizer treatments was too small to have any significance. There was invariably, even in these early counts, more wilt infection on the check plat and on the no-potash plat than on any other. It was only in the later readings that the amounts of wilt present and the differences in amount between the various fertilizer treatments began to be significant.

In Table I are presented the results secured over the 3-year period from

(*Turn to page* 40)

TABLE I. FERTILIZER ANALYSIS TEST WITH REGARD TO WILT INFECTION, MAIN EXPERIMENT STATION, STATE COLLEGE, 1928-30

Treatment	Per cent Wilt Infection 1928	1929	1930	3-yr. ave.	No. Lbs. Seed Cotton per Acre 1928	1929	1930	3-yr. ave.
Check ..	39.9	23.12	15.8	26.28	199.4	395.6	212.5	269.12
4-8-0 ...	60.0	23.00	12.0	31.67	462.0	728.7	300.0	496.90
4-8-4 ...	13.0	9.08	8.3	10.13	987.0	1,135.0	487.5	869.83
4-8-8 ...	15.7	3.40	4.3	7.81	990.0	1,207.5	491.2	896.25
0-8-4 ...	18.0	8.23	8.3	11.52	777.0	875.0	353.7	668.58
6-8-4 ...	13.5	5.55	8.0	9.02	987.0	1,135.0	491.2	871.08
8-8-4 ...	15.2	6.03	5.0	8.74	1,008.0	1,135.0	433.7	858.91
4-4-4 ...	17.3	7.67	8.5	11.18	915.9	1,145.4	441.2	834.18
4-6-4 ...	11.0	4.06	6.0	7.02	855.9	1,250.0	395.0	833.63
5-10-5 ..	8.3	4.43	10.0	7.57	1,032.0	1,322.5	512.5	955.66
4-8-4 lime .	15.0	7.15	8.3	10.17	783.9	1,135.0	395.0	771.30
4-8-4 900 lbs.	15.0	4.97	6.7	8.87	1,063.9	1,291.2	482.5	945.86
4-8-4 1200 lbs.	17.3	5.10	2.7	8.35	933.2	1,125.0	495.0	851.07

The Inquiring Mind And the Seeing Eye

By Alister B. Alexander

Madison, Wisconsin

WE HAVE all heard of the work that is being done in soil erosion control, but few of us probably realize the magnitude of the problem, nor do we realize the tremendous losses that take place each year as a result of the washing away of valuable topsoils. For that reason we are visiting this month the man who has done more to make the United States "soil erosion conscious" than anyone connected with soil control work—H. H. Bennett, Chief of the Soil Conservation Service of the United States Department of Agriculture.

Resourceful Upbringing

Hugh Hammond Bennett was born on a farm near Wadesboro, N. C., on April 15, 1881. The soil was none too good, lying as it did in the Triassic sandstone region of the Piedmont, but the senior Bennett, who had come out of the Civil War with plenty of land and very little of anything else, managed to make the farm pay and to put nine children through college. Those were the days when farms were self-sustaining.

There was a cotton gin on the place, and young Hugh used to perch proudly on the arm of the cog wheel and drive the mule power around. The farm blacksmith shop made its own bolts, nuts, plows, and tools, and even did its own horseshoeing. Equipment was given new parts when needed from the farm shop. Socks were home knitted; shoes were made on the farm from leather obtained from the near-by tannery. Homespun cloth was dyed bluish with copperas and tulip-poplar bark.

Good things to eat were produced at home—corn, wheat, potatoes, milk, butter, chickens, turkeys, eggs, hogs, beef, honey, and vegetables. Cotton was the money crop. Flour was ground at the community grist mill. "Big hominy" was made at home, and the smokehouse produced hickory-smoked hams, sausage, and bacon. Pepper, sage, horseradish, and other condiments came from the home garden. The persimmon trees of the neighborhood produced possums, and the draws furnished snapping turtles.

In this atmosphere of plenty of simple home food, and simple home-made clothes, Hugh Bennett grew and thrived. He even rode 4 miles to school each day on a mule, with a fertilizer sack for a saddle. And out of this atmosphere has come Hugh Bennett the soil expert, 6 feet and 1 inch tall, who loves his native Carolina, loves his food, and loves his work.

H. H. Bennett received his Bachelor of Science degree from the University of North Carolina in 1903 and immediately entered the Bureau of Soils of the United States Department of Agriculture as a soil chemist. He was temporarily assigned to field duty on one of the soil surveys in Tennessee, and liked the work so much that he asked to be left on field duty. Although he has done soil survey work in scores of counties of the United States, his field of operations has not been limited to this country. He spent two years making soil surveys in Alaska, additional years in Cuba, parts of South America, the West Indies, and the whole of Central America and the Canal Zone.

In 1909 he was made a member of the committee appointed at the re-

HUGH HAMMOND BENNETT

quest of Gen. Goethals to report on the agricultural possibilities of the Canal Zone. In 1914 he took charge of an agricultural expedition to Alaska to explore the agricultural possibilities of the regions being considered for the location of a Government railroad, and in 1916 was a member of the Chucagh National Forest Commission in Alaska. During 1918 Hugh Bennett served as an engineer officer in the World War and, upon his return in 1919, became a member of the Guatemala-Honduras Boundary Commission.

In 1923 and 1924 he explored the possibilities of rubber production in the Americas and went on to Cuba in 1925 to make a 2-year soil survey in cooperation with the Tropical Plant Research Foundation, following this trip with further cooperation with the same commission until 1932. He directed classification of lands and reorganization of plantation procedure on land use on the principal sugar centrals of Cuba, including about 80 plantations representing some of the largest farms in the world. In 1934 Mr. Bennett was appointed Director of the Soil Erosion Service of the Department of the Interior and remained as chief of the service when the work was transferred to the Department of Agriculture in 1935.

Early Interest in Soil-saving

During all of these years Hugh Bennett devoted a great deal of time to studies of soil erosion and methods of erosion control. He is the author of numerous technical and popular articles on the problems of accelerated erosion, and of two books dealing with the subject of land, "The Soils and Agriculture of the Southern States" and "The Soils of Cuba." He is a member of the American Society of Agronomy, the International Society of Soil Sciences, American Forestry Association, American Soil Survey Association, Association of American Geographers, and the Southwestern Soil and Water Conservation Conference.

In an address given before the North Carolina Crop Improvement Association at High Point, N. C., on February 13, 1936, Hugh Bennett gives an excellent story of his interest in soil-erosion work, and his early interest in the problem. He said at that time, "I remember when I was 9 years old helping my father lay out our first terrace. We used a wooden-horse with a water level on it. I dug the holes to guide his one-horse plow. I remember asking him what we were doing all this for. 'To keep the land from washing away,' he said. That failed to impress me. The land, to my boyish eyes, was there, just as it always had been.

"In 1896 when I was 16, I stayed out of school a year to make enough money to go to college. I worked with an ax all that winter, whacking away at a beautiful stand of native hickory, oak, pine, and dogwood on Rocky Ford farm. There must have been 20 or 25 acres in the tract. I laid bare 7 inches of topsoil, underlain with about 2 feet of subsoil, or rock. I put it all in cotton. That field was used for cotton year after year. Most of the land lay on a slope of about 12 per cent. Nobody told me it was wrong to use it that way. That was 40 years ago.

"It is shocking to see that field now. The topsoil is gone, and in many places the subsoil has been bitten through and deeply gullied right down to the rock. Most of it is abandoned land now, growing up to piney scrub, gashed, ugly, all but worthless for generations to come, because of my ignorance as a boy. My brother did the same thing with another piece of ground. There were 30 acres in that piece. It is abandoned now, and some of the gullies are 15 feet deep. There were no courses or books about soil conservation then. We thought we had all the land in the world. Now we know that we have not.

Extent of Loss

"To correct the false philosophy of land use which has developed out of former conditions in this new America, it is necessary first to drive home the fact that erosion can be controlled, and then the fact that it *must* be controlled. Of the 1,906,000,000 acres of the United States, some 555,000,000 acres are crop and pasture land, good, bad, and indifferent. After only two centuries of white occupation, 50,000,000 acres of this land have been essentially ruined by accelerated erosion for farming purposes. Another 50,000,000 acres is in bad shape. In all, that means enough land gone, or nearly gone, to provide homes for 1,250,000 farm families. Besides that, still another 100,000,000 acres, still largely in cultivation, have been seriously damaged by sheet erosion, and on still another 100,000,000 erosion has just started. That leaves just about half of our farm land on which erosion has not been permitted to take toll.

Realization Important

"Those who take comfort in the thought that erosion has been with us a long time, ever since the first raindrop fell on the earth, fail to differentiate between the slow processes of geological erosion, under conditions of natural balance and cover, and accelerated removal which starts when soil is bared and tilled. It took around 400 years to make each inch of topsoil, for instance, over the greater part of northern Missouri; yet under conditions of undisturbed cover that was fast enough to replace and keep stationary that soil. Some of it slipped away from under its forest and grass cover, but it did not go away any faster than it was being made."

We all know of cases in our own memories similar to the cases quoted by Mr. Bennett. On our own farm in Wisconsin we built a hunting shack during our high-school days. The shack was set on a river-front pasture next to a hilly cornfield. When we built it—probably about 1910—we set it on cement posts, with the floor about 18 inches above ground. Over a period of years the space under the floor gradually diminished, until, in 1919 upon our return from war service, we found that the mud was above the floor level, the sills were rotted, and the door would not open. And all of this extra soil came from one small cornfield behind the cottage.

The severest loss of rich agricultural soil ever recorded took place in a bean district of California during one rain

(*Turn to page* 38)

Fig. 1—Insuring proper distribution of fertilizer salts with soil injection rods.

Prune Die-Back

By Dr. Omund Lilleland

California College of Agriculture, Davis, California

THE sudden scorching of leaves and the dying back of limbs of well-grown Agen (French) prune trees in certain areas in the Sacramento Valley were first noted in 1917. The trouble continued to occur in the increasing acreage planted during the World War and has caused serious losses and, in many cases, the abandonment of this land for the production of prunes.

The College of Agriculture has been actively engaged in a solution since 1927, and it is my intent in this paper to discuss some of the phases of this study which may be of interest to students of plant nutrition in general, and the nutrition of fruit trees in particular.

One of the many baffling points in the early stages of the investigation was the suddenness with which the symptoms of leaf scorch and dying of twigs and often entire trees took place. In this respect the behavior was similar to that produced by a bacterial or fungous disease. In general, nutritional deficiencies are not manifested by as sudden a collapse and death as was the case with these prune trees. Nutritional deficiencies are usually associated with slow or stunted growth and often manifest themselves while the trees are still young. Leaf deficiency symptoms appear gradually.

In the case of Prune Die-back the young trees grew rapidly and were considered large for their age. There were no symptoms during the first five to eight years in the orchard. The

Fig. 2—An 8-year-old Agen prune orchard. The soil is low in potassium, yet these trees have made good growth. The picture was taken in May 1930.

first symptoms of leaf scorch often appeared rather suddenly during the summer when the trees were bearing their first heavy crop. The rapid dying of these trees is shown in the photographs in figures 2 and 3. The pictures were taken in the same orchard. Figure 2 presents the trees as they were in May 1930, healthy, uniform trees. Figure 3 presents their condition in August 1931, dead, or nearly so.

Tests of soils from Die-back areas indicated a lack of potassium. Not only were the soils low in potassium, but they exhibited a marked ability to absorb or fix this element. Fruit trees in California readily deplete the soil moisture to a depth of 4 feet, which fact indicates that soil nutrients should be distributed throughout the soil mass surrounding a fruit tree to the above depth to be most effective. The fixation of potassium by the

Fig. 3—The same orchard shown in Fig. 2 one year later. The trees are dead or almost so. The picture was taken in August 1931.

surface soil when the fertilizer was broadcast over the ground indicated the improbability of accomplishing a distribution of potassium in the tree-root zone by surface applications. The rapidity of the decline of the trees stressed the necessity of accomplishing this. The problem was solved by the development of a soil injection method using ordinary pipe fittings and a spray-rig, such as most orchardists use in the spraying of their fruit trees. With adequate pressure it was possible for two men with one spray outfit to distribute 50 gallons of a potash solution over 200 square feet at the approximate rate of one hole to every square foot to a depth of 3 feet. The time consumed was 15 minutes. The method is illustrated in Figure 1.

The results of treating trees in the manner just described are illustrated in Figure 4. The trees on the left received 10 pounds of sulfate of potash, which were dissolved in 75 gallons of water and injected into the soil in January 1927. The picture was taken in June 1929. The trees on the right received no potash. Surface applications of similar amounts failed to produce as marked a response.

While the differences produced by the application of potash to prune trees in these Die-back areas are striking, potash applications have not in any instance maintained the productivity of the orchard. The trees in Figure 4 continued to decline, those treated with potassium at a slower rate than the untreated trees.

There are evidently other contributing factors besides the potassium content of the soil to be considered in the Die-back problem. One of these is the marked tendency of trees in the Die-back areas to set very heavy crops of fruit. It has been possible in the better orchards, where the soil potassium is moderately high, to prevent a development of the scorching and dying back by merely removing the entire crop rather early in the season while the fruits were immature. The initial symptoms in an orchard are often associated with its first heavy crop.

When the potassium content is not

(*Turn to page* 37)

Fig. 4—The prune trees on the left received 10 pounds of sulfate of potash per tree injected with 75 gallons of water into the soil in January 1927, before any injury had developed. The row on the right was untreated. The picture, taken in June 1929, shows that the addition of potassium has delayed the development of serious Die-back symptoms; however, both treated and untreated trees succumbed later.

Meet Our Old Friend *TIMOTHY*

By Ford S. Prince

Agronomist, New Hampshire College of Agriculture, Durham, New Hampshire

HISTORIANS tell us that timothy was first grown in the United States by one, John Herd, about 1747 along the banks of the Piscataqua River between Portsmouth and Dover, New Hampshire. Whether he imported the seed from England or some other European country, or whether he first found it growing wild, we are not quite certain. About this time, Timothy Hansen introduced the crop into Maryland from somewhere in New England, and while Hansen does not appear to have been the first grower, he nevertheless bequeathed his name to the crop. However, in some parts of New England and New Hampshire in particular, "Herd's Grass" it is to this day.

These men could not possibly have foreseen the importance timothy was to assume in the agriculture of the Northeast. It is the most common hay species and the most generally seeded in all hay-land and pasture mixtures. It is well adapted to the soils in the humid Northeast, and its development as an important farm crop is based upon several characteristics. It is a productive hay crop; has an excellent record in persistence; once seeded, is not subject to winter-killing; is responsive to fertility; has a longer cutting period than most hay crops; and makes excellent fodder.

As a horse hay its virtues have been widely extolled, and although many fanciers feed some clover and others feed alfalfa, timothy still holds first place in the minds of most horse men. So important did it become in the horse age that it formed the principal hay of commerce in Eastern cities, and growing hay for the market was a profitable business.

Then came the automobile. The market for hay dwindled until it is now probably not more than one-tenth its former volume. Farmers who had made a business of selling all or part of their hay must feed it on the farms, but not to horses, the class of livestock for which it had been grown.

For Dairy Cattle

As an energy-producing forage, timothy and related grasses cut after the period of bloom are second to none. But fed to cows, with milk and growth the dominant objectives, hay cut at this period under ordinary farming methods is not ideal. It has, therefore, been necessary for farmers to change their habits formed through years, from making good horse hay to making the crop more suitable for dairy cattle, to which it is now mostly fed.

With 85 per cent of the tillage land in New Hampshire in hay, and with most of this hay composed of timothy and other grasses, it seemed advisable for the New Hampshire Station to study the problem of how timothy and other grasses can be made most suitable for cow feed. Accordingly, studies have been made on the composition of hay cut at different dates and the digestibility of the crop harvested at different intervals. We also are studying the effect of different nitrogen carriers on yield, comparing the quantity of hay is sufficient, so that an improvement in the quality of the crop will be reflected in the necessity for buying less grain on the farm during the winter months.

On these small plots at the New Hampshire Station, timothy has been cut at different dates for five years.

them with complete fertilizers, and checking up on the influence of topdressing on the composition of the hay produced. Our aim has been to find out how to make the best cow feed from timothy hay, causing it to be as near like alfalfa and clover as possible, by modifying harvesting practices and growing methods.

It was not difficult to find inspiration to do some experimenting with timothy by cutting at different dates. More than 40 years ago Professor Morse of the New Hampshire Station had harvested the crops at different stages of maturity and determined the protein content at the various stages. Moreover, a few farmers had adopted early cutting as standard practice on their farms, but the rank and file of folks in New Hampshire oiled up the mower and went into the field to cut their first swath the day after the Fourth of July unless that fell in the middle of the week, in which case they deferred the evil hour until the following Monday. Now on most farms

The peculiar thing about many crops, and it holds true with timothy, is that the total protein content per acre is as great in the early stages of growth as it is after the crop is past the blooming period. In fact, we have found in our trials that there is a somewhat greater amount of protein per acre in the early than in the later stages, using the period of bloom as the dividing line. This means that where the volume of hay is not a factor the earlier a farmer gets his hay into the barn the better, not only for its protein content, but for its palatability and digestibility so far as the cows are concerned, and for the man's pocket-book as well.

Actually, the way this has figured out over a five-year period in our time-of-cutting trials, where we have cut hay every 10 days from June 10, at which time the heads of the timothy are appearing, until June 30, when the seed is almost ripe, is this: the weight of the hay per acre has increased from 1,880 pounds to 2,803, while the protein content has decreased from 212 pounds per acre at the earliest date to 153 at the latest. The gain in weight has been rather constant to July 10, after which there is no gain in total yield in these trials, and the decrease in total protein has been consistent and even more rapid after July 10 than it has prior to that date.

The percentage of protein in the dry hay decreased rapidly, varying from 11.26 per cent on June 10 to 9.06 on June 20, 7.57 on June 30, and finally to 5.46 per cent on July 30.

Bulk vs. Protein

What this means is that if a farmer is willing to disregard his former habits of haying in July and cut his grass when it makes the best cow feed, he will sacrifice about 25 per cent in bulk by averaging to cut June 20, but gain 25 per cent in total protein, using July 20 as the average late haying date. His hay if carefully fertilized will carry about 9 per cent protein, which comes closer to that of good clover.

Digestibility trials conducted at the Animal Nutrition Laboratory of the New Hampshire Station indicate that the cows actually digest 62 per cent of the June 20 hay and but 47 per cent of the July 20 harvest, which is a further argument for early harvesting where the hay is to be fed to cows. When these two factors are added together, we find that the June 20 hay is about 50 per cent more valuable per acre for its protein content, cut at the earlier date. The digestibility of the carbohydrates is also better in the early hay.

Objections to the early cutting data have come from farmers who are short of bulk for their cows and also from folks who believe that the weather is better for haying in July than it is in June. To the former objection we have maintained that there is plenty of land that can be rented in the state and on which hay can be grown. To the latter we have cited rainfall records which show over a 40-year period that the June rainfall at Durham has averaged 3.57 inches, while the July precipitation has totaled 3.36 inches for the same period. This almost eliminates rainfall as a factor. We do admit that July is a little warmer on the average. The real reason, however, why June cut hay is more difficult to cure is that it carries more water in its tissues, varying from 68 per cent on June 20 to 49 per cent on July 20 according to our data. This means a little more time and a little more turning, but isn't it worth while for the cows? At any rate more than 50 per cent of all our New Hampshire farmers have shifted from July to June haying, which seems to be proof enough that the practice is sound. This end has been achieved only after five years of extension work based on the experimental data cited above.

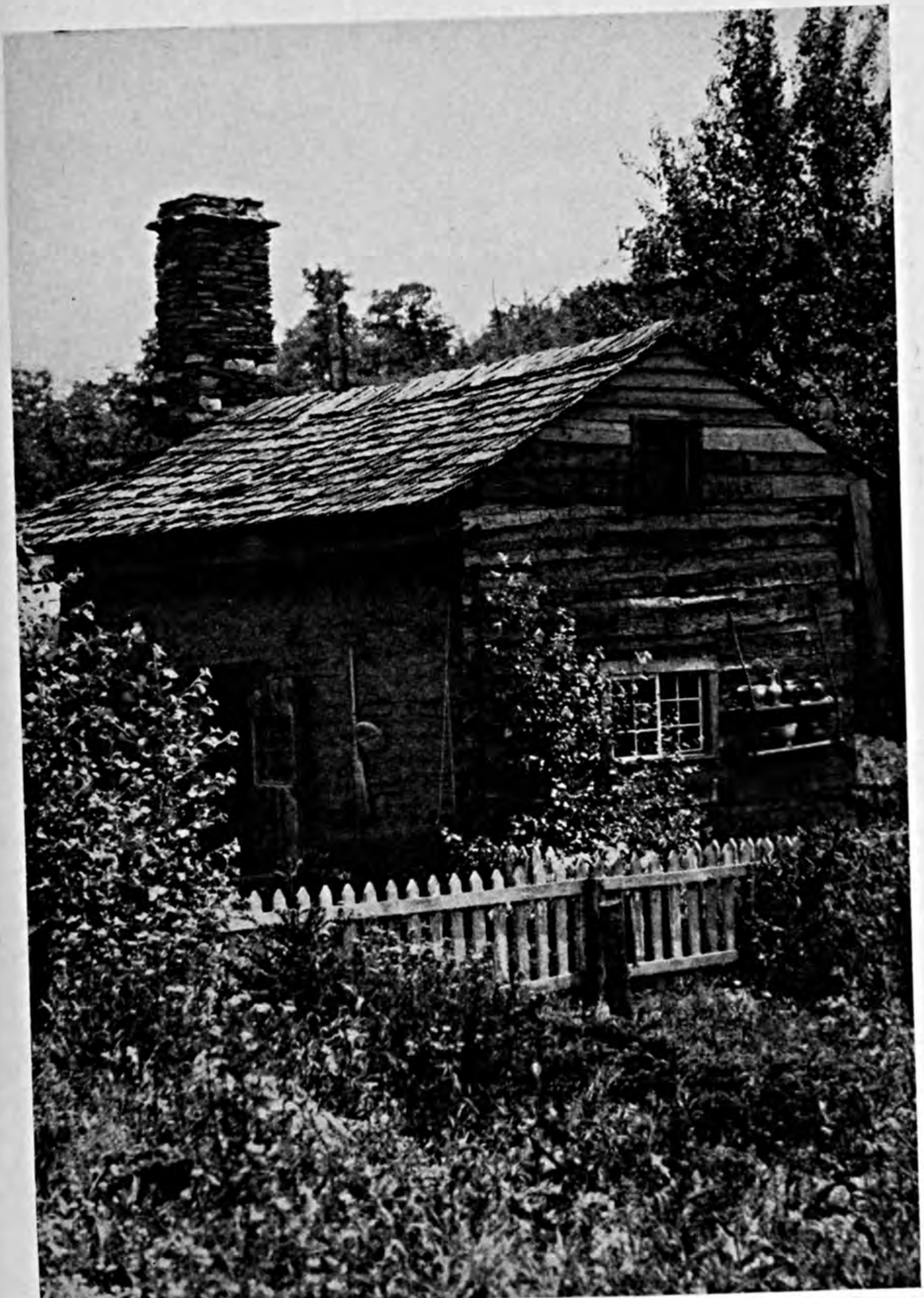
Equal to Clover

Even with the data secured from these plots, the extension work might not have been so effective had it not been for the influence of early cutting on second crop yields. As might be supposed, the plots harvested early yielded much more bulk and considerably more protein than those harvested in July. Second crop from the earliest plots yielded at double the rate of the late cut sections, and although the percentage of protein was not so high, the total yield of protein was 60 per cent greater than in the late cut parts.

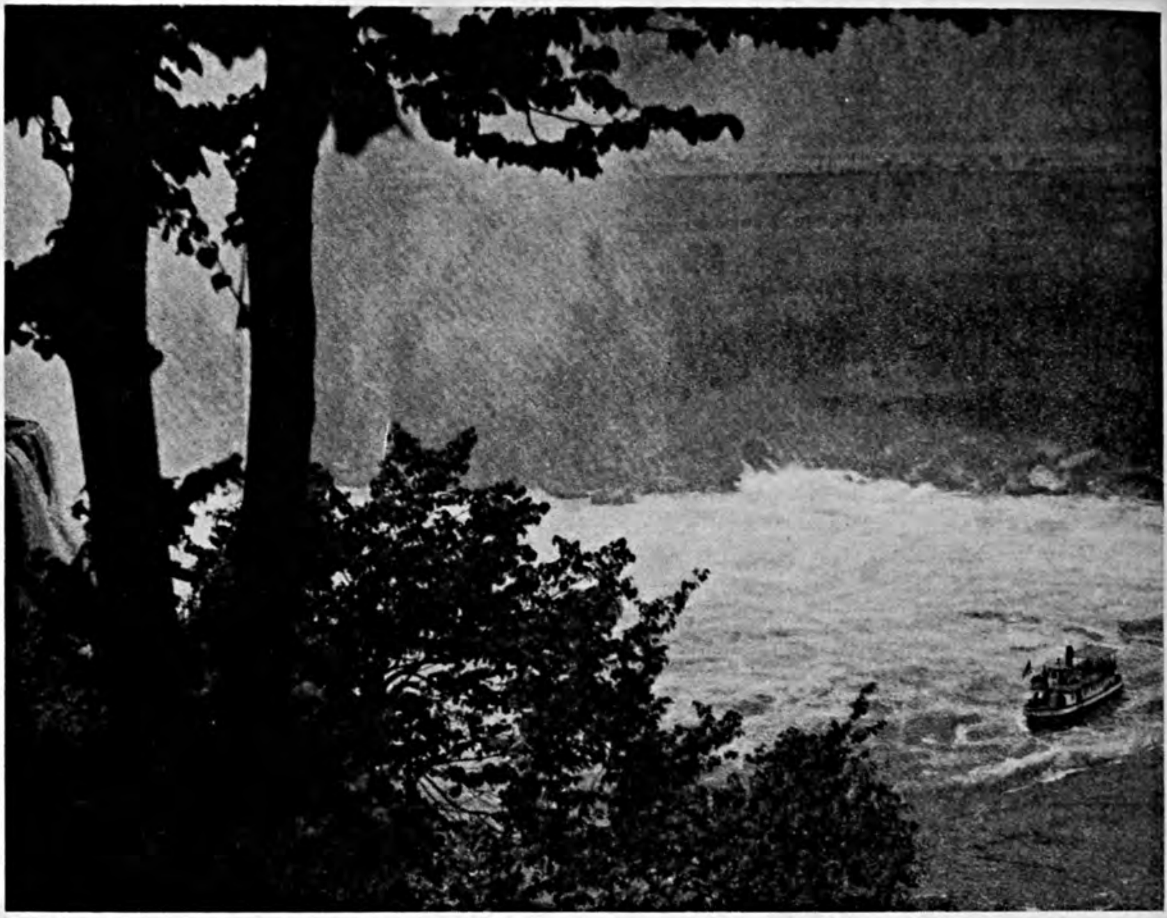
Hence, the second cutting tends to boost the yield of timothy if hayed early up to within striking distance of the yield where the crop is allowed to approach maturity, with the result that all of the hay if the first harvest is made in June carries an average of 10 per cent of protein, as against an average of about 6 per cent if haying operations do not begin until July. A farmer thus has the chance to conduct his haying operations so as to make

(*Turn to page* 35)

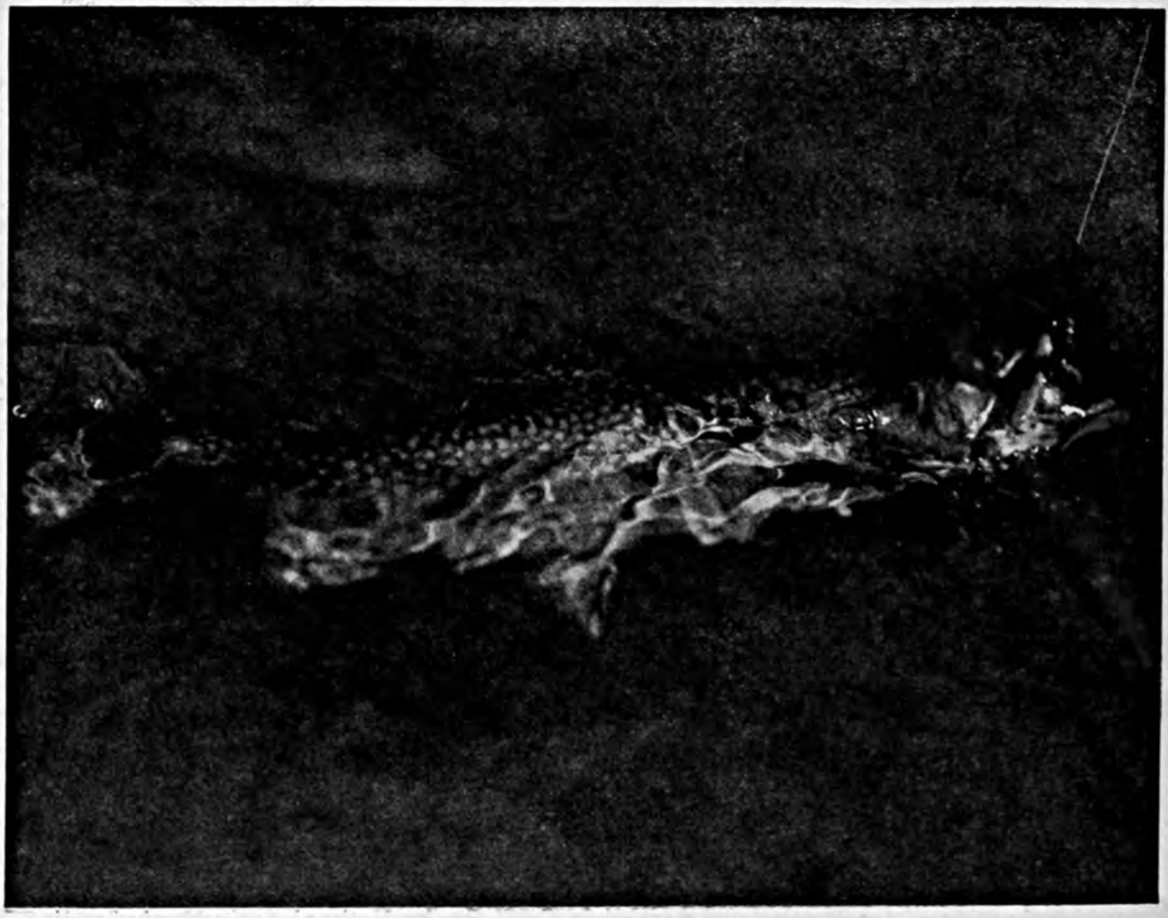
PICTORIAL

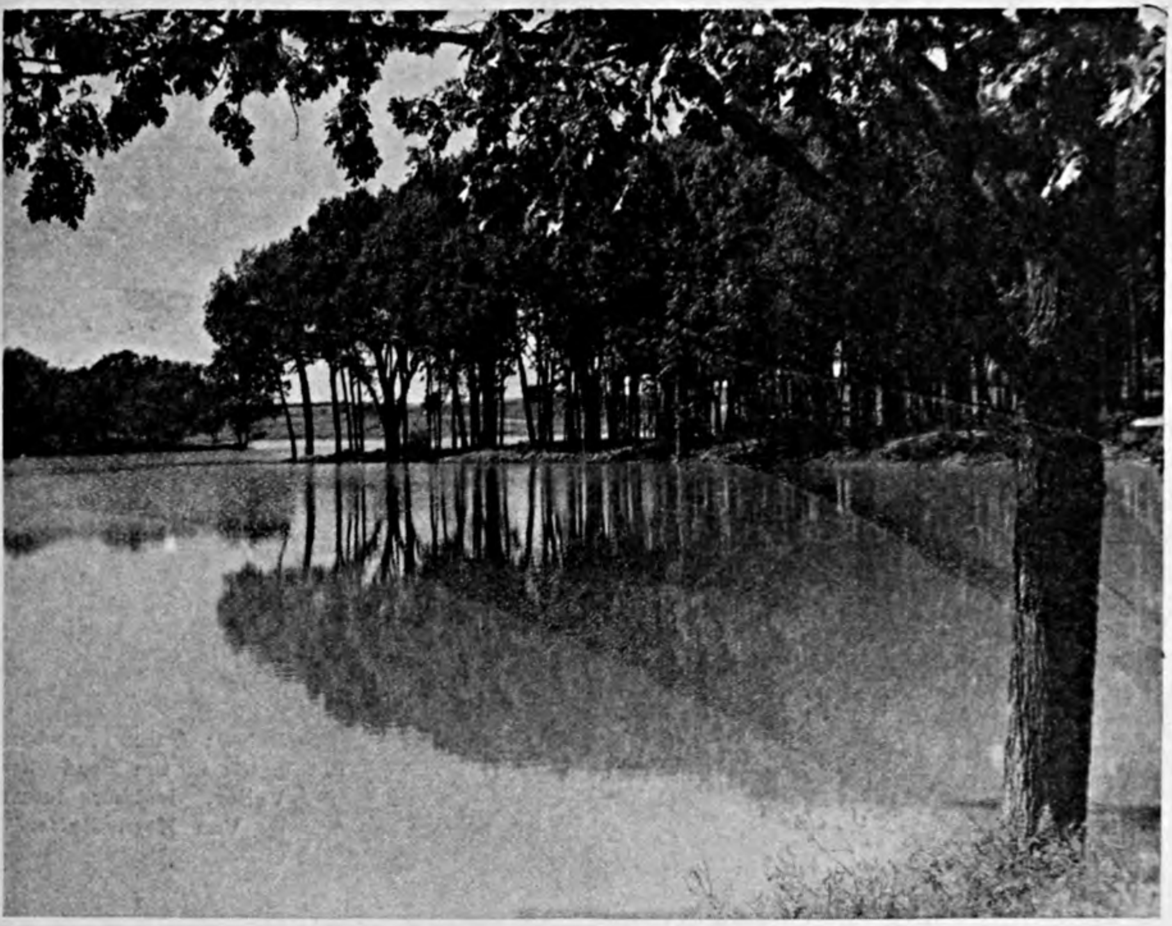


An historic cabin of the Revolutionary period in Great Smoky National Park, North Carolina.



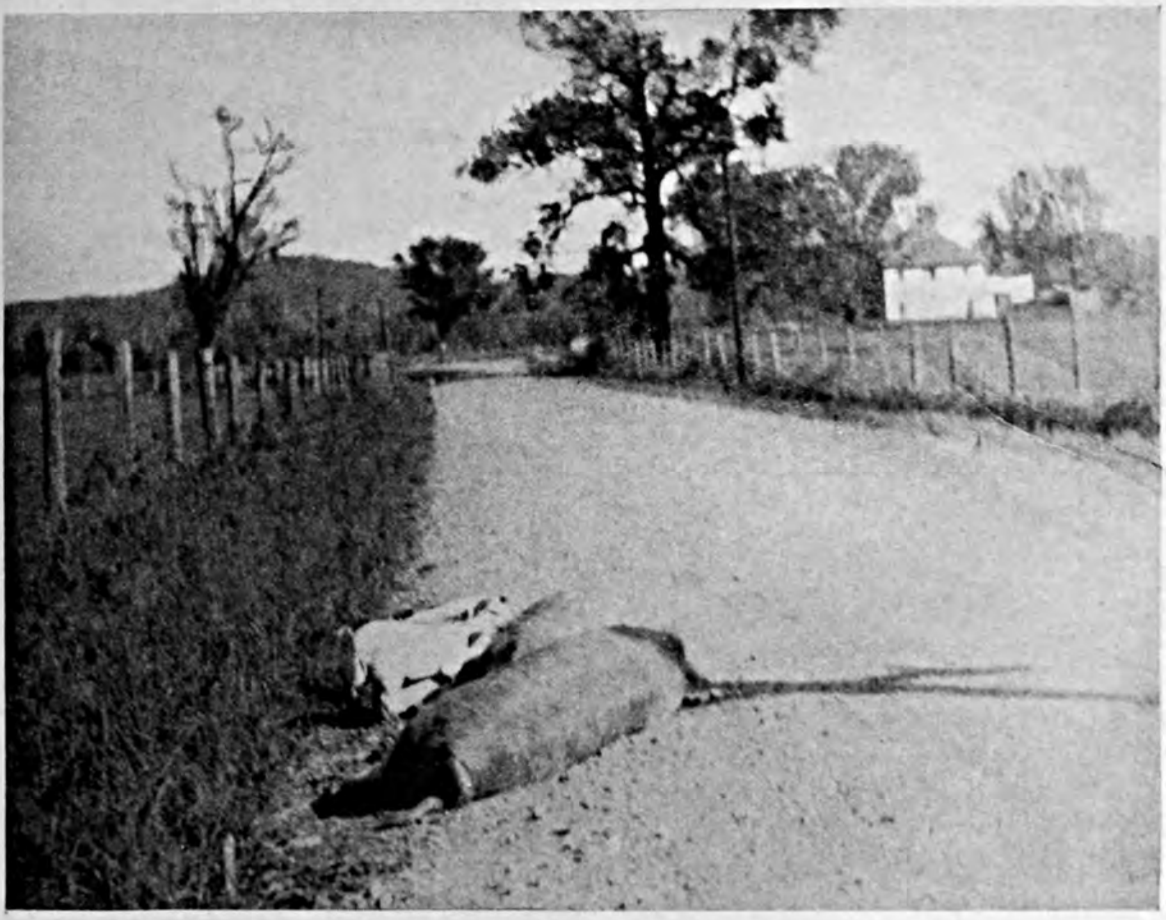
Above: Niagara Falls—Mecca of June Honeymooners.
Below: All June thrills are not confined to Niagara.





Above: July reflections in a quiet spot in the Midwest.

Below: A road-side lunch stand in full working order.



Left: A fair "Badger" makes a raid on a Wisconsin strawberry patch.

Below: A fine strawberry patch in the Hood River Valley, looking toward Van Horn Butte.

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The Editors Talk

Cheap Insurance

It takes much less produce to pay for the potash in the fertilizer today than it did four years ago. Not only have potash prices greatly decreased, but prices of farm products have increased during this period. The index number of farm prices at the present time is 104 as compared to 65 in 1932, while potash is now only 45 cents a unit as compared to 70 cents in 1932.

In terms of unit values, one unit of potash (20 pounds K_2O) at the current prices can be purchased with a little more than one-half bushel of wheat, three-quarters of a bushel of potatoes, or four pounds of lint cotton. In 1932, it required more than 11¼ pounds of lint cotton to purchase 20 pounds of potash. This is 7¼ pounds more than it required to purchase the same amount of potash in March 1936. During the same period the amount of corn needed decreased from about 2¼ bushels to .8 bushel, wheat from about 1.58 bushels to ½ bushel, and potatoes from 1.53 bushels to .62 bushel.

The decrease in the price of potash which occurred almost simultaneously with the increase in agricultural prices has brought the potash-crop ratio down to a point extremely favorable to the more extensive use of potash. It is quite obvious that when 11¼ pounds of cotton are required to buy a unit of potash, its intensive use cannot be as profitable as when only four pounds are required for its purchase.

It takes only 2 additional pounds of lint cotton per acre to pay for an additional 2 per cent of potash in a 600-pound application of cotton fertilizer. Extra potash in the fertilizer can be purchased at about the wholesale price. Therefore extra potash is a very cheap insurance against low yields which can be traced directly to a deficiency of potash. This relatively low price of potash represents an opportunity for the farmer to build up the potash deficiency content of the soil in line with the policy enunciated and put into practice by the Soil Conservation Program.

Soil Fertility and By-products

The publicity given the Second Dearborn Conference of the Farm Chemurgic Council has again stimulated the attention and interest of the public in the industrial use of farm crops and their by-products. The press has been full of speculations as to the role chemical research, with resulting industrial usage, will play in the solution of our agricultural economic difficulties. Farmers, with good reason because of the research work already done, are looking confidently to industry to increase its use of materials which can be grown on the farm.

Some stress, but entirely not enough, on the importance of building up and maintaining soil fertility to further this new interest has been given. A greater realization of this importance must be attained before success to any marked degree can be achieved.

It has been generally accepted that one of the most acute of the current ills of agriculture is the use of marginal land. With this poor land being taken out of production, both of the Soil Conservation Program and the natural working of economic pressure, considerably greater demands will be made upon the soil fertility of the land remaining in production. Profit in the growing of food crops depends upon low-cost production. To a much greater degree will any extensive use of industrial crops and crop by-products depend upon low-cost production because of the competition they face with other low-cost materials now being used by manufacturers.

There may be a general idea that industry is to be interested in any old farm "wastes." Such will not be the case. Quantity, quality, transportation, and cheapness will be factors which will determine the practicability and rapidity with which the farm chemurgic enterprise makes use of farm by-products and crops grown for purely industrial purposes. Already there are instances where costs of collection and purification and the lower yields of desired ingredients of farm wastes have kept them from being used industrially.

In the growing of industrial crops, the same principles apply as in the growing of food crops with the important addition that in the former, crop standards will receive more attention, since the manufacturer quite probably will be much more exacting in his requirements than the casual purchaser of food. This already is being demonstrated, notably in the use of tobacco, and those crop-feeding methods that influence quality will have to be given careful study in the farm chemurgic program.

If industry begins using farm products, it will demand a high and especially a uniform quality to meet the requirements and standards of manufacturing methods. Manufacturers are accustomed to industrially controlled materials in their plants, and if agricultural materials are to compete with these, they will have to be equally uniform. Experience has shown that uniformity of production of farm crops is best obtained by the use of approved varieties, advanced cultural methods, and the proper fertilization of the crop.

On the other hand, as a practical factor in farm chemurgic research there must be a recognition of sufficient return to the farmers to enable them to keep their soils in a high state of fertility. Only with such insurance can any degree of the reliability on supplies of raw materials, so essential to the development of a new industry, be reached. Therefore it is just as important, and perhaps more fundamental, for farm chemurgic interests to concern themselves with soil fertility as with chemical utilization, for the two are closely allied.

Vacation Time

Because so large a percentage of the readers of BETTER CROPS WITH PLANT FOOD are teachers of vocational agriculture and county agents whose time in the summer when not taken up by vacations is largely devoted to field work, we shall publish only two issues of the magazine during the summer months. You will note that this is the June-July issue. In August will appear the August-September number. Our subscription price is based on 12 issues of the magazine, so that no one will miss copies of the magazine for which they have paid.

REVIEWS

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

Fertilizers

A great deal of information that should aid Michigan farmers in determining the most profitable use of fertilizers for their crops is found in Michigan Extension Bulletin No. 159, entitled "Fertilizer Recommendations for 1936," by C. E. Millar, G. M. Grantham, P. M. Harmer, and R. L. Cook. According to the writers, the method of applying the fertilizer as well as the plant-food content has much to do with the returns received from fertilizer applications. Since various soils have markedly different plant-food deficiencies, the bulletin gives several well-defined charts denoting suitable fertilizer analyses and rates per acre for the different crops grown on sand, sandy loam, loam, silt loam, clay loam, and muck soils. "The increasing use of commercial fertilizers is sufficient evidence that Michigan farmers are finding their use profitable," the authors believe. They state that the fertilizers containing much higher percentages of plant food which have appeared on the market in the past few years supply plant nutrients at a lower cost than the lower analysis goods and are more economical because smaller applications are required. In order to use fertilizers efficiently it is advocated to fertilize the more valuable cash crops heavily in a rotation and supplement the fertilizer remaining in the soil with smaller applications for the less valuable crops which follow. Growers must not expect fertilizers to take the place of organic matter or lime in soils deficient in these materials. In addition to listing the special fertilizer practices recommended for the different classifications of muck soils, the use of lime, sulphur, copper sulphate, and salt in mixtures high in potash is explained. The mixed fertilizers recommended for Michigan crops include 2-12-6,4-16-4, 4-10-6, 0-12-12, 4-16-8, 3-12-12, 2-8-16, 2-14-4, 0-10-20, and 0-8-24 analyses.

An interesting summary of results obtained when different fertilizer materials and mixtures are used for tomatoes is given in Maryland Agricultural Experiment Station Bulletin 386, "Effect of Fertilizer Treatments of Soil on the Quality and Yield of Tomatoes," by R. P. Thomas. This study involved five years field work beginning in 1927 and ending in 1931, and periodic laboratory determinations to measure the influence of fertilizer on canning quality, sugar content, and other fruit characteristics conducive to quality tomatoes. Sassafras loam and sassafras sandy loam soils were used during the progress of the experiment. The author mentions that it has previously been shown that tomatoes respond to fertilizer treatments on Maryland soils; however lower increases in yield may not mean more profits to the grower unless the quality of the fruit is maintained or increased.

Results of the different fertilizer treatments show that a complete fertilizer high in phosphorus and potassium gives most satisfactory returns. Manure alone at the rate of 20 tons per acre gave the highest yields of the single fertilizer materials used, while a combination of manure and superphosphate resulted in the highest yields on the two soils tested. A 4-16-14 fertilizer applied at the rate of 1,000 pounds per acre was next in yield to treatment which received manure. Because it is often impossible for the tomato grower to obtain adequate amounts of manure, the author suggests a complete fertilizer approximating a 1-3-2 ratio produces most satisfactory yields, which is in line with the recommendations of many other experiment stations.

Laboratory tests indicated that the use of unbalanced fertilizer, such as manure, nitrogen, or potash alone, produces fruit of slightly lower quality when canned. The bulletin concludes that a complete fertilizer treatment that produced high yields also resulted in tomato fruit of good quality.

"Fertilizer and Fertilizer Material," Dept. of Agr. and Industries, Montgomery, Ala., Dept. Bul. 29, Fiscal Yr. 1934-35, R. J. Goode, Commissioner.

"Fertilizing Fruit Trees with Nitrogen," Agr. Exp. Sta., Columbia, Mo., Bul. 363, Apr. 1936, A. E. Murneek.

"Analyses of Commercial Fertilizers, Fertilizer Supplies, and Home Mixtures for 1935," Agr. Exp. Sta., New Brunswick, N. J., Bul. 597, Nov. 1935, Charles S. Cathcart.

"Analyses of Commercial Fertilizers and Ground Bone; Analyses of Agricultural Lime, 1935," Agr. Exp. Sta., New Brunswick, N. J., Bul. 600, Dec. 1935, Charles S. Cathcart.

"Onion Fertilizer Experiments," Agr. Exp. Sta., State College, N. Mex., Bul. 233, Dec. 1935, A. B. Fite.

"Official Report on Feed Stuffs, Commercial Fertilizers, and Agricultural Lime and Limestone—1935," State Dept. of Agr., Columbus, Ohio, Bert V. Leas.

"Commercial Fertilizers—1936," Wis. Dept. of Agr. and Markets, Madison, Wis., Bul. 172, Apr. 1936, W. B. Griem.

Soils

California Agricultural Experiment Station Bulletin 599, "A rating of California Soils," contains systematic ratings of each soil type found in each of 59 soil-survey areas in California, in accordance with the Storie index method of soil evaluation, by Walter W. Weir and R. Earl Storie. The ingenious method of rating these soils consists of a numerical expression of the relative agricultural value of the various soils on the basis of character of the profile, surface texture, and conditions that modify the agricultural uses of the soils. Numerical values assigned to the factors are given in percentages of what may be considered as "ideal" or "most ideal." Numerous tables depicting composite ratings of soil types and phases of the different areas show the grouping of soils, i. e., Grade 1 refers to rating of 80-100 which includes "excellent soils"—above the average; Grade 2, "good soils"—usually suitable for most crops of the region; and so on to Grade 6, which is the index rating less than 10, designated as "non-agricultural areas" such as rough, mountainous land, scabland, and tidal marsh. A brief description of each area is given for the major soil series by groups. The descriptions also name the principal crops of the area. "The tables and descriptions contained in this bulletin," the authors state, "are designed particularly for use in connection with corresponding soil surveys." Soil maps accompany the bulletin.

"The Solubility of Applied Nutrients in Muck Soils and the Composition and Quality of Certain Muck Crops as Influenced by Soil Reaction Changes and Moisture Conditions," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 147, Dec. 1935, W. S. Ligon.

"Liming Lawn Soils," Agr. Exp. Sta., New Brunswick, N. J., Cir. 362, Jan. 1936, Howard B. Sprague.

"Revised Nomenclature of Soil Type Names Used in Ohio Soil Surveys," Agr. Exp. Sta., Wooster, Ohio, Sp. Cir. 47, 1936, G. W. Conrey and E. M. Burrage.

"Graphic Summary of Agriculture and Land Use in Oregon," Agr. Exp. Sta., Corvallis, Oreg., Sta. Cir. 114, Dec. 1935, H. D. Scudder and E. B. Hurd.

"Muck-soil Management and Crop-production Studies, Sanpete County Experimental Farm, 1927 to 1933, Inclusive," Agr. Exp. Sta., Logan, Utah, Bul. 267, Feb. 1936, Le Moyne Wilson.

"Soil-management and Crop-production Studies," Agr. Exp. Sta., Logan, Utah, Bul. 270, Feb. 1936, I. D. Zobell.

"Fertility Maintenance by Rotation and Manure," Agr. Exp. Sta., Logan, Utah, Bul. 271, Mar. 1936, D. W. Pittman.

"The Chemical and Physical Properties of Dry-land Soils and of Their Colloids," U. S. D. A., Washington, D. C., Tech. Bul. 502, Dec. 1935, Irvin C. Brown and Horace G. Byers.

"Soil Survey of Ohio and Switzerland Counties, Indiana," U. S. D. A., Washington, D. C., Series 1930, No. 37, B. H. Hendrickson, T. M. Bushnell, H. P. Ulrich, and D. R. Kunkel.

"Soil Survey of Greene County, Mississippi," U. S. D. A., Washington, D. C., Series 1932, No. 5, J. W. Moon and S. Rankin Bacon.

Crops

Growers of asparagus in Texas will profit materially from Texas Agricultural Extension Service Circular C-82, "Growing Asparagus," by J. F. Rosborough. It is declared that asparagus is well adapted to Texas climate because it will stand heat. Neither drouth, high water, nor rather large amounts of alkali affect the crop seriously. Plantings in the winter months are satisfactory where there is no danger of freezing the roots, although spring plantings are recommended. Asparagus will grow on practically any type of soil, but prefers a sandy or sandy loam soil, the author states. Many helpful suggestions pertaining to proper planting are given. Where utmost care in preparing the bed for planting is taken, the crop will normally remain on the soil for 10 to 20 years. An application of 500 pounds of a fertilizer analyzing 6-10-7 per acre at the close of the cutting season is said to be an excellent treatment. Several satisfactory varieties for Texas are listed. Helping hints on harvesting are explained, as are requisites for growing fall asparagus and methods to control insects and disease.

"Grape Growing in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Bul. 424, Feb. 1936, George Beach.

"A Study of Some Abnormalities Occurring in Certain Potato Varieties in Colorado," Agr. Exp. Sta., Fort Collins, Colo., Tech. Bul. 16, Mar. 1936, Rudolph Daniel Anderson.

"Report of the Director for the Year Ending June 30, 1935," Agr. Exp. Sta., Storrs, Conn., Bul. 207, Nov. 1935, William L. Slate, Director.

"Lawn Management," Agr. Exp. Sta., New Haven, Conn., Cir. 113, Apr. 1936, M. F. Morgan, E. M. Stoddard, and R. B. Friend.

"4-H Corn Club Manual," Agr. Exp. Sta., Lafayette, Ind., Ext. Bul. 157 (Third Revised Edition), Jan. 1936, A. T. Wiancko and W. R. Amick.

"Irish Potato Investigations," Agr. Exp. Sta., New Orleans, La., Bul. 272, Jan. 1936, Julian C. Miller and W. D. Kimbrough.

"Annual Report of Maine Extension Service for Year Ending June 30, 1935," Agr. Ext. Serv., Orono, Maine, Ext. Bul. 217, Dec. 1935, Arthur L. Deering, Director.

"Wormseed Oil Production," Agr. Exp. Sta., College Park, Md., Bul. 384, July 1935, G. S. Weiland, L. B. Broughton, and J. E. Metzger.

"Hardy Shrubs for Landscape Planting in Michigan," Michigan State Col., East Lansing, Mich., Ext. Bul. 152, Rev. Nov. 1935, C. P. Halligan.

"Tomato Growing in Michigan," Michigan State Col., East Lansing, Mich., Ext. Bul. 156, Feb. 1936, H. L. Seaton.

"Muskmelon Reminders," Michigan State Col., East Lansing, Mich., Ext. Bul. 157, Mar. 1936.

"Timely Tomato Topics," Michigan State Col., East Lansing, Mich., Ext. Bul. 158, Mar. 1936.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 18, No. 3, Feb. 1936.

"Thatcher Wheat," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 325, Jan. 1936, H. K. Hayes, E. R. Ausemus, E. C. Stakman, C. H. Bailey, H. K. Wilson, R. H. Bamberg, M. C. Markley, R. F. Crim, and M. N. Levine.

"Heart Rot of Balsam Fir in the Lake States, with Special Reference to Forest Management," Agr. Exp. Sta., University Farm, St. Paul, Minn., Tech. Bul. 110, Sept. 1935, Frank Kaufert.

"Vegetable Gardening," Univ. of Minn., University Farm, St. Paul, Minn., Sp. Bul. 174, Mar. 1936, A. E. Hutchins.

"Culinary Herbs," Univ. of Minn., Cir. 54, Mar. 1936, A. E. Hutchins and L. Sando.

"Better Practices in Oat Production," Agr. Ext. Serv., Columbia, Mo., Leaf. 35, Feb. 1936, Ide P. Trotter.

"Rape for Pasture; Oats and Canada Field Peas for Hay," Agr. Ext. Serv., Columbia, Mo., Leaf. 36, Feb. 1936, Ide P. Trotter.

"Seeding Meadows and Pastures," Agr. Ext. Serv., Columbia, Mo., Cir. 335, Feb. 1936, C. A. Helm.

"Forty-ninth Annual Report," Agr. Exp. Sta., Lincoln, Nebr., W. W. Burr, Director.

"Grape Growing in New Hampshire," Univ. of N. H., Durham, N. H., Ext. Cir. 173, Dec. 1935, L. P. Latimer.

"Lawns, Their Building and Maintenance," Univ. of N. H., Durham, N. H., Ext. Cir. 177, Jan. 1936, Ford S. Prince.

"Planning the Garden," Univ. of N. H., Durham, N. H., Ext. Cir. 180, Feb. 1936, J. R. Hepler.

"Twentieth Annual Report of the New Jersey State Department of Agriculture, July 1, 1934 to June 30, 1935, State Dept. of Agr., Trenton, N. J., William B. Duryee, Secretary.

"Soil, Field-crop, Pasture, and Vegetable-crop Management for Delaware County, New York," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 639, Nov. 1935, A. F. Gustafson, D. B. Johnstone-Wallace, F. O. Underwood, C. S. Pearson, and F. B. Howe.

"Fifty-fourth Annual Report, 1934-1935," Agr. Exp. Sta., Wooster, Ohio, Bul. 561, Jan. 1936, C. G. Williams, Director.

"Iodine Content of Oklahoma Vegetables," Agr. Exp. Sta., Stillwater, Okla., Bul. 229, Nov. 1935, V. G. Heller, Maurine Jones, and Lee Pursell.

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Economics

"An economic Study of the Potato Enterprise in Michigan" is the title of a recent publication (Sp. Bulletin No. 267, by P. F. Aylesworth of the Department of Farm Management of Michigan State College. The study should attract wide attention in view of the importance of the crop in the state and the high ranking position of Michigan in the potato industry. From 1925 to 1934 Michigan had an average of 246,400 acres in potatoes and produced about 24,000,000 bushels.

There has been no trend in potato production in the United States, however, production has fluctuated widely. During years of comparatively stable commodity prices, potato prices varied inversely with production. Potatoes do not enter into international trade to any extent, and there is no carry-over into the next crop year. The demand for potatoes does not change greatly from year to year, therefore small crops consistently return higher gross income to farmers than large crops.

One of the most significant aspects of the potato price situation is the tendency for prices to be higher at the end of the marketing season when the crop is small and to follow the opposite course in large crop years.

Records were secured from the eastern, western and northern areas of the state and from table stock producers and certified seed producers. It was found that the table stock producers had a total production cost of \$43.22 per acre, a yield of 126 bushels, and a cost per bushel of 34 cents for field run potatoes at the farm. The yield varied from 24 to 381 bushels. The cost per acre varied from \$19.48 to \$134.55.

The average cost per acre for the certified seed growers was \$82.81, the yield 241 bushels, and the cost per bushel 34 cents for field run potatoes at the farm. The range was from \$29.38 to \$154.96 per acre for costs and 75 to 615 bushels for yield.

Factors of efficiency which the producers are able to control are: fall plowing when land is not subject to erosion, early planting, the use of good quality seed in sufficient quantity, seed treatment, proper use of fertilizers, use of barnyard and green manure, efficient use of power and labor, and thorough methods of culture.

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One Plowing of Potatoes Enough, Except for Weeds

IF WEED control in potatoes is not a major problem, the extra work of more than one good, deep cultivation probably will not pay. In a 3-year test by the United States Department of Agriculture at Presque Isle, Maine, one-cultivation potatoes yielded slightly more on the average than potatoes cultivated five times.

In both cases there was a light cultivation 2 weeks after the potatoes were planted and before they were up. The one-cultivation potatoes were well ridged. The potatoes cultivated five times were ridged moderately. Both plots were hand-hoed once to kill weeds.

When cultivation is necessary to control weeds, it should be shallow. Deep cultivation prunes the potato roots and the freshly-tilled soil loses moisture. These cultivation experiments were on fall-plowed sod land fitted in the spring for a good seed bed.

Up to 10 or 15 years ago, farmers and crop specialists believed that row crop tillage aerated the soil, conserved moisture, increased availability of plant food in the soil and suppressed weed growth. Other studies besides those on potatoes indicate the fallacy of some of the supposed benefits from frequent tillage.

Pasture Use Cuts Feed Costs on Cotton Farms

THE cotton farmer who makes the greatest possible use of good pasture in keeping his mules, feeds about one-third less hay, as well as less grain, per animal than is eaten by the average cotton-farm mule, on the basis of a survey by the United States Department of Agriculture on 161 Arkansas and Mississippi Delta plantations. Feed costs for work animals can be lowered in many sections by more use of improved pastures, say Department men.

In addition, pasture improves and saves from erosion land retired from clean cultivated crops for soil conservation purposes.

The average work mule on the plantations studied by the Department, in cooperation with the Arkansas and Mississippi experiment stations, eats about 6,000 pounds of hay and about 3,000 pounds of grain a year. He works the equivalent of one hundred and twelve 10-hour days each year, most of which is during the grazing season of about 224 days. Some farmers extend this grazing season with winter-growing forage.

On the days on which the average cotton plantation mule is NOT working he generally should be on pasture and usually could be. As a matter of fact he is pastured only about 34 days a year. If he were pastured on the days when he is not used as well as at night during the working season, it is estimated that one-third the hay and forage now fed during a year—as well as much grain—would be saved. On many plantations this would be cash saving, because most of the hay and grain fed is bought and shipped in from other States.

The Role of Potassium in Plant Nutrition

(*From page* 8)

cluded here was made on the S. D. Mustard place near Powell Butte, Oregon, in the Deschutes region, giving further indication that the economic rate of potash application for potatoes was nearer 80 pounds per acre than 160.

A summary of fertilizer trials in the Deschutes Valley, Oregon, indicates that potash can be used on staple field crops in the Deschutes section when crop prices are good. The soils there respond to sulfate so that the sulfur in sulfate of potash has some value on that soil.

TABLE II. MINT YIELD AND OIL CONTENT WITH DIFFERENT TREATMENTS
(The Hayes Ranch, 1929)

Treatment	Lbs./Rod raw green	Lbs./Ac. green	Oil per cent in green mint	Oil per acre, lbs.
None	20	20,000	.289	57.8
KCl and Manure	24	24,000	.293	70.3
KCl and $NaNO_3$	24	24,000	.311	74.7
Complete (N-P-K)	23	23,000	.235	54.1
KCl	23	23,000	.287	65.1
None	21	21,000	.280	58.8
K_2SO_4 and Magnesium Limestone	28	28,000	.328	91.9
K_2SO_4	29	29,000	.253	73.4
Inoculated with upland soil	28.5	28,500	...	...

TABLE III. MINT FERTILIZER EXPERIMENT
(The Herrold Ranch, 1932)

Treatment	Oil c.c. per 10 lbs. hay	Fresh hay 1 sq. rod, lbs.	Sp. gr. 25° C.	Ref. index at 20° C. Abbe	Optional rota at 25° C.	Esters as menthol ester by sapon., per cent	Total menthol per cent
None	2.4	16	.9050	1.4642	—25.0°	6.88	53.12
KCl	2.35	92	.9040	1.4838	—32.25	6.66	58.39
KCl and K_2SO_4	2.20	96	.9065	1.4645	—29.7	7.94	55.08
KCl and Manure	2.85	58	.9050	1.4642	—30.7	8.16	56.70
KCl, Manure, Lime	4.45	136	.9040	1.4641	—34.0	8.18	58.58

The placement of potash fertilizer with deep-rooted crops may be a factor in its effectiveness. Certain northern California soils that are high in calcium and have been employed in the growing of nuts and stone fruits show high fixing-power for potassic salts. Deeper application under such a condition is reported to be helpful.

Lysimeter data indicate that from 40 (Oregon) to approximately 100 pounds (New York) of potash may be leached from an acre of soil in a year. A 4-ton crop of alfalfa may remove 96 pounds of potassium; 4 tons of clover will remove 120 pounds; 15 tons of corn fodder, 120 pounds; 10 tons of sugar beets, 157 pounds.

Barnyard manure supplies about 8 pounds of potash per ton. Sulfate and chloride of potash each contain 850 pounds or more of potassium per ton. Wood ashes may contain 100 pounds of potash per ton. Full returns from potassic fertilizers are usually realized only when an adequate supply of nitrate nitrogen is present to accompany potassium ion into the plant. Crop rotation with legumes such as clover helps supply the nitrogen needed and its growth and decomposition, and helps in making soil potassium available.

Meet Our Old Friend Timothy

(*From page* 22)

timothy practically equal to clover in feeding value.

There is also a direct relation between the feeding value of the hay and the fertility of the soil on which timothy is grown. A soil well stocked with available nitrogen and other mineral elements not only produces more hay but hay of higher feeding value.

The importance of having an abundance of nitrogen present during the growing season is of paramount importance, since this element causes greater stimulation to growth under most situations than does any other element. A short rotation, frequent manuring, and the utilization of crop residues to maintain the organic matter supply are of great help in promoting good yields with high protein content.

The relation between protein value in fertilized and unfertilized hay may well be illustrated by data from our hay project already cited. The first year these plots were cut at different dates, no fertilizer was used. The following spring they were top-dressed with 240 pounds of calcium nitrate per acre. The percentage of protein at the different dates for the two seasons are given in the following summary:

Date cut	Per cent protein in timothy: 1930, not top-dressed	Per cent protein in timothy: 1931, top-dressed
June 10	10.01	11.77
" 20	8.03	9.01
" 30	6.65	7.28
July 10	5.60	6.38
" 20	5.09	5.92
" 30	4.74	5.83

Even though the data are for different years, the variations in protein at the different dates are so striking and conclusive as to leave no doubt about the effect of available nitrogen on the analysis of the crop. We might cite other data to prove this point, but the figures we have obtained all lead us to the same conclusion. Inasmuch as protein must be purchased in our Northeastern agriculture, it seems advisable to keep grass yields at a high level in order to raise the feeding quality of the hay and reduce cash expenses.

There is some question about what fertilizer should be used on timothy hay to give the largest yields with greatest economy. There appear to be some situations where nitrogen alone gives the greatest economy. Where the soil is high in minerals and the organic supply plentiful, this is likely to prove true. On the other hand, there are soils where potash is practically as necessary as nitrogen for grass stimulation, judging by certain results we have secured on pasture sods from some of our experimental work.

Data on the kind of fertilizer to use are now accumulating in an experiment at Durham, in which different nitrogen carriers are compared along with an equal quantity of nitrogen in complete fertilizers. The results to date for this test are here given:

One "square yard" of timothy, that on the left fertilized with 400 pounds of 12-4-4, that on the right unfertilized.

Treatment	Yield cured hay, lbs. per acre	Per cent increase over check
200 lbs. nitrate of soda	2,595	31
400 lbs. 8-6-6	3,046	54
400 lbs. 8-6-6 (all water soluble)	3,800	92
Nothing (check plots)	1,979	..

The land was seeded identically, plots being laid out afterward and top-dressed annually. These data indicate not only good stimulation from nitrogen, but from the other elements as well. So far, the response on this grass land appears to indicate a greater stimulation from top-dressing with water soluble materials. They also seem to prove the need for elements other than nitrogen.

Lime, likewise, is necessary to stimulate timothy yields where the pH of the soil falls much below 5.6. We have secured paying returns for a two-ton application on land with a pH 5.2. While we have not been able to check on the feeding value of the hay grown on limed land, it would seem that the calcium from the lime might in itself be a valuable factor. This would hold true for other minerals, especially phosphorus, where used.

Making timothy hay as valuable as clover requires certain changes in farming practice. Chief amongst these are earlier cutting, annual top-dressing, and maintaining the fertility of the soil at a high level with fertilizers, lime, manure, and reasonably short rotations. Farmers who do not believe this might well give it a trial. Others who are skeptical might look into the experimental data having to do with feeding trials.

While this is not an argument against seeding legumes for hay, a practice that is well established, it does provide a way whereby all the hay that is now grown on our Northeastern dairy farms will have the maximum feeding value.

Keeping Up-to-Date With Potatoes

(From page 10)

county near Antigo, farmers Felix Zeloski, Prosser Bros., and Joe Igl and Sons raise from 150 to 500 acres of potatoes every year on their farms. They apply from 500 to 1,000 pounds of a 3-12-12 or a 3-9-18 fertilizer per acre.

On heavier soils in the more humid areas, Milward and Brann point out that practically all the fertilizer is drilled along the row at planting by means of a fertilizer attachment to the planter. The fertilizer is fed in an even flow along each side of the row and mixed with the soil on a level with or slightly below the seed tuber. These improved attachments place the fertilizer where it is most readily available to the roots and where it avoids direct contact with the seed tuber. Fertilizers should never be deposited in contact with or directly over the seed tubers, these men say.

Milward and Brann found that the rate of application of complete fertilizer where growing conditions are favorable ranges from 600 to 1,000 pounds per acre. On the lighter sandy soils, in regions where moisture is likely to be deficient, not more than 500 pounds per acre are considered safe.

Where potatoes are planted by hand in check rows, it is also possible to apply fertilizer along the row with cultivators equipped with fertilizer attachment. These machines deliver the fertilizer on each side of the row just behind the tip of the inside shovel. The first application can be made when the field is blind-cultivated. A second may be made during the early cultivation period. Growers on sandy soils who use machine planters, but do not desire to fertilize heavily at planting time, may apply part of the fertilizer during the cultivation period by the above method.

The broadcasting of fertilizers directly to potato land is not generally recommended by Milward and Brann, but is done occasionally where potash and phosphate are used.

Prune Die-back

(From page 19)

too low, it has been possible to prevent serious Die-back injury by preventing over-cropping by more severe pruning. The heavy yields in these Die-back areas compared to other prune districts have been definitely traced to the greater percentage of flowers which set and develop into fruits.

Another interesting field observation is the lack of marked symptoms on other fruit trees growing in these soils in which prune trees fail. Peaches and almonds are widely planted, yet exhibit no definite signs of injury. However, when almond or peach trees are grafted to prunes and these subsequently come into bearing, symptoms of Die-back become manifest. The trouble is distinctly a nutritional trouble of the prune tree.

Many trials with other fertilizer salts and such soil amendments as lime, iron sulphate, sulphur, applications of barnyard manures, and other organic materials have been made, but any beneficial effect has been distinctly limited to those materials containing potassium.

In order to be doubly certain that the Die-back symptoms were due to a soil condition, a 7-year-old prune tree with a Die-back history was boxed in the orchard, moved 100 miles to the

Experiment Station at Davis, and replanted in a better soil. The tree has continued to improve and exhibits no symptoms of scorch.

Professor D. R. Hoagland, of the Plant Nutrition Division, has independently demonstrated that potassium corrects the scorching of prune trees growing in these soils with tank experiments. Soil was removed from the field from Die-back orchards and placed in large containers. Prune trees were planted, scorch symptoms became evident, and were corrected by potassium additions to the soil. There is, therefore, much evidence that Die-back of prune trees is a potash deficiency, and yet the case is not closed. The failure to secure complete recovery in the field by applications of potassium salts is still a challenge.

The heavy bearing of the trees may be the explanation in the experiments to date. Heavy cropping may result in a weakened root system deficient in carbohydrates and lacking sufficient energy to extend and avail itself of the potassium added.

The investigation is being continued. The original experimental orchard shown in Figure 2 has been replanted and some of the trees are receiving potassium fertilizers from the time of planting long before any injury may become apparent. Whether this and other early treatments will give us the complete solution can only be answered at some future day by these prune trees.

The Inquiring Mind

(*From page* 16)

in 1934. During that one rain one farm on those fertile slopes lost 500 tons of top-soil per acre. An acre-inch can be computed as weighing 167 tons, so this farm lost nearly 3 inches of its top-soil in one rain! It is bewildering and terrifying how fast soil goes out once erosion gets really accelerated. Consider the San Simon wash in Arizona. Plowed out in 1889 as a little ditch, it got going strong by 1900, and today that wash is 75 miles long, and as much as 400 feet wide and 30 feet deep in places. Besides that, about a quarter-mile strip of soil along both sides of the wash has been ruined.

In 1929 soil surveyors had just finished a detailed survey of the Rio Grande of New Mexico and Arizona. A very heavy rain threw the Gila River into a flood that destroyed towns, lives, and property and inundated a stretch of country 40 miles long and 2 miles wide. The deposit of clay from that one flood was 14 inches deep over a large part of this region of 80 square miles. The soil surveyors had to start all over again. Types which had been mapped as Anthony sandy loam had to be remapped as Gila clay, and in some cases where there had been clay before, there was a deposit of 7 feet of sand, all from one flood.

Eight miles west of Lumpkin, Ga., is the largest man-made gully in the world. This chasm is 200 feet deep. And how do you suppose it started? It started from the drip from the roof of a barn 50 years ago! Since then it has swallowed the barn, a schoolhouse, a tenant house, and a graveyard with 50 graves. In addition to this huge gulch there are thousands of others nearly as large, with the result that 70,000 acres of the best farm land in the region have been destroyed in one county.

We could go on and on, quoting an almost endless list of instances similar to those mentioned, but space does not permit. From these statements it can be seen, however, that the problem of erosion is not only one of extreme gravity, but a problem the nation has taken very little interest in. At the present time numerous areas which are entirely too steep and erosive for safe tillage, even with the best protective measures we know, are being cultivated throughout our farming regions. These, of course, should be used only for pasture or for trees. Vast areas of eroding lands, which could be given efficient protection with cheaply constructed field terraces or contour embankments, are in cultivation. This implement of soil conservation is now being extensively used in parts of the southern states. In 1927, 494,000 acres were terraced in Texas alone, and a drive is on to largely increase the yearly program. The farmers there have been shown what terracing means in saving fertile soil and in storing moisture in the ground for subsequent crop use.

Not a New Idea

Field terraces have been in use in parts of the older southeastern states for 75 years and, when properly constructed, have saved a great deal of land. At the Spur Erosion and Water Conservation Station in western Texas the yields of cotton have been greatly increased by the use of terraces. With level terraces all the rainwater was held in the fields in 1927 and 1928 on slopes ranging from 4 to 5 per cent, and with it, of course, all the soil that would have been washed away on unprotected areas. The yield of alfalfa also was largely increased. Terracing has been emphasized as a means for saving soil and water because these structures are efficient for many kinds of land, and also because they can often be cultivated over about as easily as any other part of the field.

Under the direction of Hugh Bennett the work is now going on in practically every part of the country. And in his tireless way he is experimenting, making speaking trips, trying new methods, teaching his efficient helpers the best known methods of preventing erosion, saving thousands of acres of land that would soon be worthless—going on and on in the work that he has loved since he was that little boy with the mule in North Carolina. A great deal remains to be done. There must be employed, as a matter of course, various types of dams and flumes to check the expansion of various types of gullies. Grazing must be regulated on the ranges and in the pastures. Trees and grass must be resorted to in order to save the steeper slopes. Certain vines, grasses, and trees will be needed to save the steeper slopes. Even chemicals will be used in some cases. There is still a great need for improved terracing implements. And there is vast need, too, to obtain fundamental data relating to the physical processes involved in erosion, and about which so little has previously been done—for instance, why some soils erode faster than others, why a terrace that functions admirably in one place fails in another with the same slope and rainfall, why vast areas of formerly cultivated land are now lying idle. We need additional information relating to the connection between eroding lands and floods.

Hat on—Ready to Go

The task of putting chains on the evils of soil erosion on a large scale is a mammoth undertaking. It is taxing the best efforts of Hugh Bennett, even with the widespread cooperation of soil scientists, practical agriculturists, extension agencies of the nation, bankers who are insisting on erosion control work before they will make farm loans, merchants who have suffered losses of income because of unproductive lands, railroads which have lost traffic—and in many instances have lost their roadbeds—because of the ravages of nature. The program should have started years and years ago, and we all certainly are indebted to Hugh Bennett for his untiring efforts to get the program under way, and for his mammoth attack on the forces that have done so much damage.

And now to return for a minute to the man who is in back of all this soil control work. Wellington Brink, writing in the January 1936 number of *Holland's Magazine*, says of Hugh Bennett, "They didn't give him much time to rest on his laurels or become acquainted with his wife, his son, and his daughter. Bennett had a set of golf clubs once, and he broke them all. He goes hunting, and the birds, he says, are usually safe. He gets his excitement as he goes along, whether it be buying parched beetles at 5 cents a bag on a village street in Ecuador, as one would buy peanuts in Birmingham or Atlanta, or watching a duel between a hairy tarantula and the *caballo de diablo* in Cuba.

"His vision has ample outlet. As I write this, 40,000,000 acres on 40 great watersheds are being used to demonstrate approved methods of erosion control, involving engineering, forestry, contour planting, restoration of native vegetation, and a great deal else. Men have been sent to foreign lands to bring back plants of promise for barren areas. A natural leader, organizer, a blazer of trails, Bennett has his work cut out for him for the next decade or so. It is up to him to shut the vault door, to find a way to prevent continued staggering theft of the nation's basic wealth—the wealth on which the whole future prosperity of our people depends."

So we take leave of Hugh Hammond Bennett—the epicure, the Carolina mountain boy, the world traveller, the worker—and we show him to you with his hat on, ready to go anywhere at any time to further his great work of Soil Erosion Control.

Potash & Cotton Wilt in Central & North Mississippi

(*From page* 13)

1928 to 1930. The average wilt infection on the check plat which received no fertilizer whatsoever over the 3-year period amounted to 26.28 per cent. That on the plat receiving nitrate and phosphate but no potash was still higher, averaging 31.67 per cent for the three years. This tendency to increased susceptibility over the checks of the plants receiving an unbalanced fertilizer, from which the element lacking was potash, was most evident in 1928, when the former plat showed 60 per cent infection at the end of the season as compared with 40 per cent for the check.

Splitting up Table I into sections on the basis of the fertilizer element in which a variation in amount used occurred, brings out the results secured much more clearly than does Table I taken as a whole. Table I Section A presents an analysis of the effect of varying amounts of potash on wilt infection and yield. It will be observed that, with an increase in potash from 0 to 8 per cent, the proportion of nitrogen and phosphorus

TABLE I SECTION A. POTASH ANALYSIS

Treatment	Per cent Wilt Infection 1928	1929	1930	3-yr. ave.	No. Lbs. Seed Cotton per Acre 1928	1929	1930	3-yr. ave.
4-8-0 ...	60.0	23.0	12.0	31.67	462.0	728.7	300.0	496.90
4-8-4 ...	13.0	9.08	8.3	10.13	987.0	1,135.0	487.5	869.83
4-8-8 ...	15.7	3.40	4.3	7.81	990.0	1,207.5	491.2	896.23

Table I Section B. Nitrogen Analysis

Treatment	Per cent Wilt Infection 1928	1929	1930	3-yr. ave.	No. Lbs. Seed Cotton per Acre 1928	1929	1930	3-yr. ave.
0-8-4 ...	18.0	8.23	8.3	11.52	777.0	875.0	353.7	668.58
4-8-4 ...	13.0	9.08	8.3	10.13	987.0	1,135.0	487.5	869.83
6-8-4 ...	13.5	5.55	8.0	9.02	987.0	1,135.0	491.2	871.08
8-8-4 ...	15.2	6.03	5.0	8.74	1,008.0	1,135.0	433.7	858.91

remaining constant at 4 and 8 per cent respectively, the average wilt infection was reduced from 31.67 per cent to 7.81 per cent. The yield was increased from 496.9 pounds of seed cotton per acre to 896.23 pounds, an increase of over 80 per cent.

Likewise, Table I Section B presents the results of variation in the nitrogen count. It will be observed that changing the amount of nitrogen from 0 to 8 per cent brought down wilt infection only from 11.52 per cent to 8.74 per cent, or less than 3 per cent, while the yield was increased by only 28.46 per cent.

No plats were included in the test in which phosphate was omitted entirely, but increasing the phosphorus from 4 to 10 per cent appeared to have relatively little influence on the amount of wilt infection. The effect on yield, as well, appeared to be relatively insignificant. These facts are brought out in Table I Section C.

In Table I Section D is presented an analysis of results secured by varying the rate of application of a 4-8-4 mixture through 600, 900, and 1,200 pounds per acre, respectively. Increasing the rate to 900 and to 1,200 pounds did result in a slight decrease in amount of wilt infection, but it was scarcely large enough to be of significance, and the relatively small difference in yield would not render such increased application practicable.

Summarizing the results secured from this composite fertilizer analysis test with respect to wilt control, it will be observed that the average yield records for the 3-year period corresponded closely with the degree of wilt control secured, with the exception of the plat which received nitrogen and phosphorus but no potash. On this plat the wilt infection was higher than on the check, though, on the other hand, the yield also was higher. This may be accounted for by the very marked increase in vigor and size of the plants on the former plat, due to the nitrogen and phosphorus, which more than compensated for the increased wilt infection. These results would indicate, there-

Table I Section C. Phosphorus Analysis

Treatment	Per cent Wilt Infection 1928	1929	1930	3-yr. ave.	No. Lbs. Seed Cotton per Acre 1928	1929	1930	3-yr. ave.
4-4-4 ...	17.3	7.67	8.5	11.18	915.9	1,145.4	441.2	834.18
4-6-4 ...	11.0	4.06	6.0	7.02	855.9	1,250.0	395.0	833.63
4-8-4 ...	13.0	9.08	8.3	10.13	987.0	1,135.0	487.5	869.83
5-10-5 ..	8.3	4.43	10.0	7.57	1,082.0	1,322.5	512.5	955.66

Table I Section D. Analysis of Rate of Application of a 4-8-4

Treatment	Per cent Wilt Infection 1928	1929	1930	3-yr. ave.	No. Lbs. Seed Cotton per Acre 1928	1929	1930	3-yr. ave.
600 lbs. 4-8-4 ...	13.0	9.08	8.3	10.13	987.0	1,135.0	487.5	869.83
900 lbs. 4-8-4 ...	15.0	4.97	6.7	8.89	1,063.9	1,291.2	482.5	945.86
1200 lbs. 4-8-4 ...	17.3	5.10	2.7	8.36	933.2	1,125.0	495.0	851.06

TABLE II. EFFECT OF POTASH ON COTTON WILT AND YIELD AT ENTERPRISE, MISS., 1929

Treatment	Per cent Wilt Infection Ser. I	Ser. II	Ser. III	Ave.	No. Lbs. Seed Cotton per Acre Ser. I	Ser. II	Ser. III	Ave.
Check	29.0	30.5	24.0	27.8	538	580	560	559.3
4-8-0	20.4	16.8	23.5	20.3	836	894	860	863.3
4-8-2	18.0	16.4	18.5	17.6	900	940	876	905.3
4-8-4	10.0	12.5	17.4	13.3	938	980	950	956
4-8-6	7.0	8.5	9.0	8.1	954	856	980	930
4-8-8	8.0	6.0	5.3	6.4	1,074	1,100	1,050	1,074
4-8-10	10.5	8.0	5.5	8.0	1,050	896	1,000	982

fore, that under the soil conditions at State College, an increase in potash content of the fertilizer mixture to 8 per cent would be justified from the standpoint of wilt control, at least, at the 600-pound-per-acre rate of application of a mixture containing 4 per cent of nitrogen and 8 per cent of phosphorus.

In 1929 a test was conducted in a field at Enterprise, Mississippi, which showed a relatively high percentage of wilt infection rather uniformly distributed over the entire area. A series of seven 1/20-acre plats were laid out in triplicate. A basic fertilizer analyzing 4-8-0 was applied, to which potash was added in amounts varying through 2 per cent intervals from 0 to 10 per cent. The rate of application was 600 pounds per acre. All plats were run in triplicate. The nitrogen was provided by nitrate of soda, the phosphorus was derived from acid phosphate, and the potash from muriate of potash. The results are presented in Table II.

It will be observed that wilt infection decreased with each increase in the amount of potash up to the 4-8-8 mixture, and that yields were increased in direct proportion with the decrease in wilt. There was only one variation from this, and that occurred in the 4-8-6 plat in the second series, in which case the yield was lower than on any other plat in the series with the exception of the check plat, which received no fertilizer. This can be accounted for by the fact that at this point in the field there was a slight depression which allowed water to

Left (600 pounds 4-8-4) wilt infection, 13%—yield, 987 pounds seed cotton. Right (600 pounds 4-8-0) wilt infection, 60%—yield, 462 pounds seed cotton.

stand during certain periods, resulting in a slightly poorer stand of cotton.

The test is in agreement with the one reported above from State College in indicating that where wilt occurs in the soils of central and north Mississippi, the potash content of the 4-8-4 fertilizer mixture, which is probably more generally used on cotton in this area than any other, could profitably be increased to 8 per cent from the standpoint of both wilt control and yield increase, at least at the 600-pound-per-acre rate of application.

In 1929 and 1930 a test of the effect of varying amounts of potash in a mixed fertilizer on wilt control was conducted on the property of Fletcher Norman, Houlka, Mississippi. This was located on what is commonly termed flatwoods or "sticky flatwoods" soil, a Lufkin clay for which the customary recommendation for cotton is a 600-pound application of a 6-8-4 fertilizer mixture. Five plats were laid out, the first as a check with no fertilizer, and the others with a 600-pound-per-acre application of a mixture varying through 4 per cent in potash content from 6-8-0 to 6-8-12. Nitrate of soda, superphosphate, and muriate of potash provided sources for the various elements, nitrogen, phosphorus, and potash, respectively. All plats were replicated three times. The results are presented in Table III.

The highest wilt infection over the 2-year period occurred on the plat receiving the 6-8-0 fertilizer. Its percentage of infection was 51.55 per cent as compared to 39.05 per cent for the check. With the increase in the potash content of the fertilizer the amount of wilt decreased consistently, the percentage of infection becoming less with each increase in potash up to 12 per cent, which was the highest rate used. The yield also responded very favorably to the use of additional potash, increasing with each increment of that element in the fertilizer mixture. The largest increase of all, 624 pounds per acre of seed cotton, an increase of 168.19 per cent over the check, occurred on the 6-8-12 plat. This was an increase of 225 pounds or 24 per cent over the next highest potash rate, the 6-8-8 mixture. This indicated that on this particular soil type and under the conditions of the test 12 per cent potash was not too high, but that on the contrary even higher potash applications would probably have proven profitable.

Low-cost Production

It may seem anomalous and paradoxical, in these days of production control and acreage reduction, to advocate measures to increase cotton production. This viewpoint, however, is without adequate basis of reason and logic from the standpoint of the individual grower. His sole recourse, with the reduced acreage allowed him for cotton, is to produce the maximum yield possible on his remaining acres with the minimum amount of expense. This can be done in a very great number of cases by the prevention of losses due to rust and wilt.

The results presented in this article and in a previous one dealing with

TABLE III. EFFECT OF POTASH ON YIELD AND WILT CONTROL IN FLATWOODS SOIL, HOULKA, MISS.

Treatment	Per cent Wilt Infection			No. Lbs. Seed Cotton per Acre				
	1929	1930	Ave.	1929	1930	Ave.	Ave. No. Lbs. Increase	Ave. Per cent Increase
Check	41.2	36.9	39.05	382	360	371.0		
6-8-0	50.0	53.1	51.55	647	445	546.0	175.0	47.17
6-8-4	30.1	31.9	31.00	801	588	694.5	323.5	87.19
6-8-8	20.0	16.2	18.10	962	639	800.5	429.5	115.77
6-8-12	14.0	12.3	13.15	1,111	879	995.0	624.0	168.19

tests in south Mississippi show that these losses may be very materially reduced in the soils of south, central, and north Mississippi by the use of a suitably adapted variety of cotton which shows a relatively high degree of resistance to wilt, and by using a fertilizer which contains an adequate amount of potash in proper balance with other necessary fertilizer elements. In most cases this will mean that the percentage of potash in the fertilizer mixture should be materially increased over that ordinarily used.

"Quit-uation"

(*From page 5*)

rural and urban girls doing the same thing; and 132,000 city boys over 14 in regular trade schools, afford a slight statistical picture of the popularity of vocational guidance. Yet after all, this whole business gets in its work on only about a fifth or less of the youth of school age who sit with empty hands and drifting minds. And if we reckon in the oldsters who could well stand a little new light in their lives, this whole enterprise is just a good nibble and no more. But let's be happy that a start has been made. It's better to go along carefully than to botch the job with incompetent teachers.

From any sound point of view the vocational trend in public education is wholesome, yet the art of manual and physical science cannot satisfy and round out our lives completely. I feel, as you do, that what society seems to stand in need of now is far-sighted, cool, logical, and ripe thinkers. We need ideas and ideals, well blended and balanced. Riveting attention alone on a nail-head well driven or a seam well made may be the basis of our every-day happiness, but there are indeed other requirements.

Training a series of extra-competent specialists carries its own bag of dangerous dynamite. Too often such folks have no common meeting point except trivial trumperies. Dare I list any of them for fear of offending the golfers, the bridgers, and the quaffers? Many an evening is devoid of conversation and exchange of thought because those present cannot talk, and they abhor thinking—except to pronounce dogmatic and prejudiced fiats on subjects only hastily skimmed. Do we not need some mature thought and adult attention to political science, American problems, literature, art, and perhaps human psychology?

We have had a riot of fun since 1933 with the coterie of alleged possessors of corners on brains. The administration had its quota of them, and now the critical opposition gathers in a group of brain-trusters. Is their function to get new facts not yet known, or is it to fan our prejudices and strengthen our dismal dogmas? If the former is the objective, I am for it on general grounds of more adult education pleasantly partaken; but if their utility lies in substituting somebody else's brains for our own, then please pass the ketchup! Unless we are trained and ready to engage in some constructive thinking for ourselves, a few men with doctors' degrees can't cure us.

It has been said with some truth that our present situation is to learn how to live well amid abundance, and then to devote our leisure time to something besides barren amusements, many of them taken by proxy.

One of the hardest jobs, as we have seen in the AAA efforts, has been to get farmers to accept the theory of leisure. Hard work, long hours, and manly endurance were the symbols of pioneer effort, and many a household motto over the clock shelf has planted those precepts firmly in the fabric of American principle. As I see it, the dread men had of leisure was that they held idle hands before them. Women usually picked up their knitting or darning, hooked rugs or weaving; but the poor old helpless men folks were up against it on a rainy day. Nobody thought of study, until recently. But as machinery grows in efficiency and land does not expand, there is a time ahead when leisure will be forced on the American farmer whether he wants it or not—and to some extent also on the industrial worker. Are we getting ready to afford mental occupation or new and inspiring tasks for people to do when that time comes?

NOW we need not make any excuses for adult education. It is not true that education belongs to kids and is only a special favor to grownups. This idea is something foreign to older ages when adults were scholars. In the spread of Christianity, beginning with Jesus Himself, the rule was to reach adults first and foremost. I believe Socrates and Mahomet did likewise. The Stoic teachers, Abelard, Erasmus, all of the pioneer missionaries, and even Doc Townsend, by gravy, have approached the path of propaganda through the adult route. The people who should be able to make the most of education are the ones right in the front-line trenches. Why should there be any "quit-uation" time?

In going my rounds of modest duties I have often been discouraged about the fixity of ideas in the skulls of some folks. Yet I have not despaired about somebody's eventually overcoming that stubborn and dogmatic adherence to a vacuum of notions. I am not a teacher and can't undertake to argue anybody into reform myself, but I feel that a lot of this rigidity of mind is a surface blemish only. History shows that.

IF WE imagine adult voters don't alter their hunches under continued demonstration that they are wrong, just glance at a few national occurrences. We had liquor definitely barred by national law and constitutional edict, then in a decade we shifted around and repealed the law and amended the Constitution to let "nature take its course." Then I recall how vehemently my old uncle and a lot of my other kith and kin raved in anger over the mere idea of a skirt coming sailing into the sacred fifth ward polling place, where a lot of men smoked campaign cigars and told dirty stories. "Let 'em do their mopping at home; we'll mop up at election time," chortled the old anti-feminines. Our state voted it down a couple of times, and so suffrage for women had a long, hard battle, but finally won.

The income tax, unemployment insurance, old age assistance, and even good roads and automobiles once faced majority opposition, where today they are favored for the most part by our adult citizens. We might add something about face paint, finger-nail polish, and mere loin cloths for female bathing suits being accepted in good form, where once such carryings-on were marks of idolatry. The only regret is that the adult mind changes so slowly! Think of the things we missed! They even have courses in prize-fighting at our big universities. Yes, adults can be educated if properly approached!

One other thing that deters adults from getting their full of life's marvels is an idea that such pursuits are akin to boondoggling. They don't like to be caught learning how to sing, playing the jew's-harp, or dancing the ha-cha-cha. Adults are far more self-conscious than some young folks that way. Yet I have a friend in the late sixties who insists that we sleep too long, and so he rises at 5 or so each morning, seizes a set of oil paints and an easel, and hikes out to put what he sees, or thinks he sees, on canvas. Another good sign is the hobby show, where mature exhibits range alongside the callow efforts of beginners in their teens. I feel much encouraged over the fact that old folks are forgetting how to "retire" these days. They don't know when they are licked, and believe me that's something. It may even bear some indirect relation to the fact that in my state the average life expectancy has climbed from about 40 years to 55. In other words, there is a wealth of worth in the sentimental song now current to the effect that "if you can't do this or you can't do that, there is one thing we can do, and that is wah-hoo, wah-hoo, wah-hoo!"

Extending our alertness a few years will help us solve some grave problems. We cannot expect the rising generation to do all that alone. As previously stated, if science finds a way to solve the unknown, social and economic problems must yield in time to keen analysis and proper remedy.

THERE is this difference between the two, however. Your soil specialist goes his way without disturbance to find better methods of treatment for the land. Your physicist rises into the stratosphere or splits the atom, and few would hinder him. Your AAA program turns to conservation and nobody's toes are tramped. But when a sociologist or a trained economist has all the facts worthy of winning a case at the bar of public opinion, he has to struggle against stiff odds. He has to educate a mass of adults and get their consent, or the approval of their elected representatives, before any experiments may be performed.

I am not herein defending any and all novel plans of the reform order, but I wish to convey the thought that our children in school are getting more economic and social data as the basis for clear thinking than we used to get, and far more than we absorb ourselves systematically. Sure, we grab hunks of it out of the financial pages or read prejudiced editorials now and then, but how much time do we give to it personally and with an open mind? How much background do we possess for some of our random conclusions?

AND then, when a new law of this character is finally enacted, its future again rests with the proletariat. It is well used or misused, according to the degree of trained sense we have acquired in drafting it and applying it. The Utopia of perfect fool-proof legislation cannot come until adults are in shape to build and use it.

I would depart from common custom now and quote from another noted authority besides myself. This educator writes:

"More mind is the supreme requirement of the present. Mankind is no longer handicapped in its pursuit of welfare by inadequate food supplies, raw materials, or technical devices. It is not for want of these that millions of men are suffering, but from inadequacies in the minds that should dominate these instruments of welfare. And mind is not something unattainable, but something each one of us has in us as a seed or a shoot, eager to grow if we give it light."

In conclusion I would urge us all to be up and doing in behalf of adult education, so that there shall be fewer "quit-uation" days. Yes, even if all talents or sciences are already acquired and stored away. In that case, like myself, perhaps there are certain skills which you have never quite mastered and which since marble-time you have wanted to perform. Such, for instance, as wiggling your ears or whistling through your fingers!

1,265 pounds of seed cotton per acre, at right, where 200 pounds of **NV** Muriate of Potash was used as top-dressing. Only 625 pounds of seed cotton per acre, at left, where no potash top-dressing was used. The whole field got 300 pounds of 8-3½-5 **PNK** fertilizer per acre at planting.

1,293 pounds of seed cotton per acre, at right, where 200 pounds of **NV** Muriate of Potash was used as top-dressing. Only 665 pounds of seed cotton per acre, at left, where no potash top-dressing was used. The whole field got 250 pounds of 10-5-5 **PNK** fertilizer per acre at planting.

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ACCOMMODATION !

House Mother: "Young man, we turn the lights off at 10.30!"

Freshman: "Oh, boy! That'll be keen."

Then there was the Irish tramp in London who consented to give blood to the then very ill King of England. After the transfusion the king was better. A second dose of the Irishman's blood and the king could sit up. With the third dose, he exclaimed: "To hell with the king, anyhow!"

"Henry," said his nagging wife, as he prepared to retire, "is everything shut up for the night?"

"That depends on you," muttered Henry, "everything else is."

SCOTCH DOCTOR

MacGregor and MacPherson decided to become teetotallers, but MacGregor thought it would be best if they had one bottle of whiskey to put in the cupboard, in case of illness.

After three days, MacPherson could bear it no longer and he said, "MacGregor, I'm not verra weel."

"Too late, MacPherson, I was verra sick mesel' all day yesterday!"

Father: "Fancy a big boy like you being afraid to sleep in the dark."

Five-Year-Old: "It's all very well for you; you've got mother to look after you."

Pretty Young Thing: "Are you sure these curtains won't shrink? I want them for my bedroom windows."

Candid Clerk: "Lady, with your figure you should care—you should care."

NATURAL DEDUCTION

The motorist whose car had suddenly come to a standstill quickly diagnosed the trouble, and then applied at a neighboring cottage for assistance.

"Pardon me," he said to the old lady who answered the knock, "do you by chance have any lubricating oil?"

The old lady shook her head.

"Any oil will do," said the motorist, hopefully—"castor oil, if you have any."

"I ain't got it," said the old lady regretfully, "but I could fix you up with a dose of salts."

"You'd better marry me—eligible men are scarce."

"I suppose I could offer that as an explanation."

A clergyman accompanied by two charming girls stood admiring the beauties of a little stream. An angler passing by said, "Any luck, pardner?"

"Sir?" replied the parson with dignity, "I'm a fisher of men." "Well," retorted the fisherman, glancing admiringly at the girls, "you have the right bait."

"You're quite right, grandpa, about the 'Music Goes 'Round' thing. But 'Ta-ra-ra-boom-de-ay' was no intellectual treat."

Better Crops WITH PLANT FOOD

Aug.-Sept. 1936 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER ELEVEN

TABLE OF CONTENTS, AUG.-SEPT. 1936

American Potash Institute, Inc.

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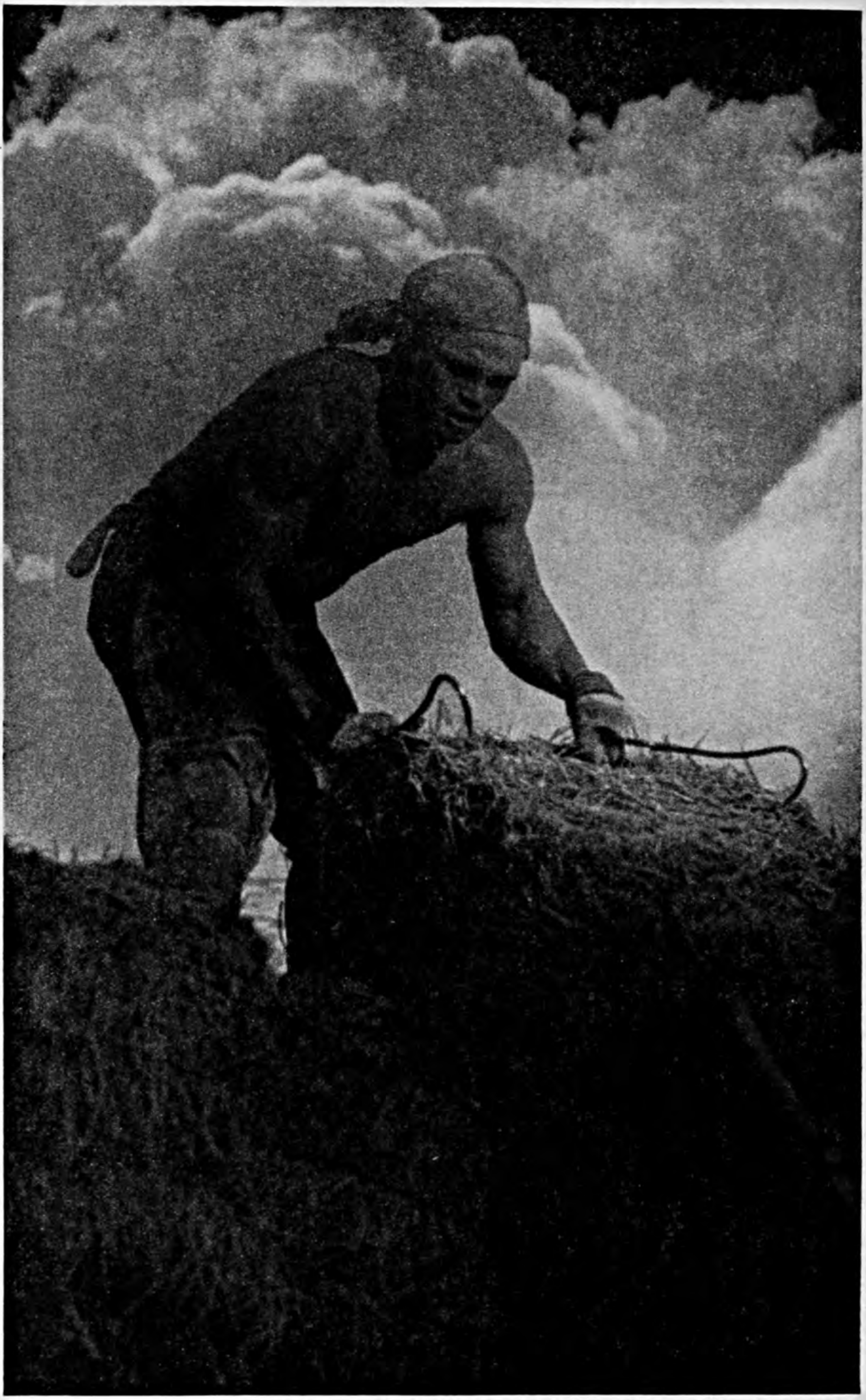

A swarthy contestant in action in the alfalfa loading race at the annual Frontier-day Celebration at Lancaster, California.

Better Crops with PLANT FOOD

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VOL. XX WASHINGTON, D. C., AUG.-SEPT. 1936 No. 11

Folks these days, says Jeff, are—

Gas Gadding

Jeff McDermid

IF SCADA paid its obligations in midsummer, three farmers out of five in my neighborhood would grab the grants and go gas gadding. Your humble husbandman is no longer a local yokel tied with the apron strings of tradition to his maternal heath. His own outdoors is too small for him. He has to borrow from somebody else. He has a "riding habit" like any lordly feudal squire, habitually acquired on the tractor, the sulky plow, and the manure dispenser; and when he gets calloused riding over bumpy home acreages he shifts to a new six or eight cylinder car and glides immeasurably further beyond the court house and the market square than his father before him dared to venture.

My uncle used to spend hours telling gaping groups about the wonders of Howe's moving pictures, seen by him for one simoleon at the Berryville lyceum, including the final spectacle of Yosemite falls running backwards.

Now his son Jake heads a rural rollers' club which has collected fake Indian trinkets, ptomaine poison, police tags, and chigger bites in every sizeable canyon between Watkin's Glen and Logan Pass. They stretch a sheet across one end of the school-house and display their own colortone jerkies of Maw and the kiddies wading in the Walla-Walla or eating hamburgers on the White House steps. That's why Burton Holmes and the other globetrotting spellbinders no longer make the big killings of yesterday in the cow-pasture Chautauquas. And you can blame part of this to the propaganda of the A.A.A.—not the one on skids, but the one on wheels. (*Original joke copyrighted.*)

WANDERLUST is as much a part of the rural setting as wienerwurst. Time was when no farmer who respected his profession ever recognized there were such words as "leisure" or "recreation." Theirs was a life of utter renunciation, and today the only remnant of that flinty spirit of self-abnegation survives in a rugged township of New Jersey where in May every farmer therein refused to bilk the United States treasury for conservation benefits on grounds of self-reliance, hard work, and soils made perfect by strict attention to home affairs. One doesn't need to bemoan the "lost horizons" of such intrepid folk. They never had any to lose. Save your sobs for those who would like to go somewhere, but can't.

The aforesaid A.A.A. claims that the general touring fever is due entirely to better tires, larger maps, more powerful motors, and keener roadbeds. Granting this as a predominant cause of urban restlessness, it does not completely answer the question concerning the faring forth of farmers. Away in the background I suspect the other A.A.A. had something to do with the new models many of our farmers are tuning up for the big get-away, but this is not my point after all.

The real reason is that farmers are so well equipped with science, machinery, and fertilizers that they are able to raise more than enough for consumers without spending every daylight hour from last frost to first frost trying to coax dinners out of the dirt.

So naturally, hearing quite some chatter about erosion, they go in for a glimpse of it in a big way and nose out overland to the Grand Colorado chasm. Or being in an alfalfa mood, they sputter up the valleys of Idaho to see how it grows under irrigation. Or being weary of the current molehills of politics transformed into mountains by newspaper and radio, they step on the throttle and head for Ranier, Baker, Shuksan, and Hood, where the air is fresher and the obstacles more real than fancied.

Cancel that old wham about getting shut of home's carking cares, so often quoted as the city man's cause of exodus into the ozone. It doesn't fit in the farm flivver parade, because wifey and mother-in-law usually rumble along, too. They're a great help on traffic signs!

And frequently there is a trailer on behind with room and equipment for all the 4-H handiwork projects that must be completed in time for the county fair. The only drawback to continental passage these days compared to the Forty-niners is that you can't hook on a cow! They don't make roller skates big enough.

PRESUMING that most farm sightseers choose a convenient travel period between haying and corn cultivation and the ensuing days of harvest and fall plowing, there remains one ancient argument of the standpatters to settle. Croakers claim that gadding makes one discontented. They say one should not go abroad and covet other people's lands. My experience with farm wanderers is that they sum up their impressions when they tumble out at the journey's end with a rousing phrase: "I wouldn't trade all those places for one acre of good old Minnesconsin."

Had they stayed quietly on their own soil-depleting bases and not made a glorious home-run, would they be more content or less? Probably the latter, if they trusted to real estate literature and alluring prospectuses to inform them of other fields afar. It takes a heap of seeing to overcome a native's solicitude for the old lanes and hills. Education often consists of learning exactly how well off we are, judged by our own standards and not by the distant preference of somebody else.

Dropping into meter for a change, we hear them say:

'Cause I come back home contented
Do not think I've gone insane,
For the eagle loves the mountain
But the chicken likes the plain.

Then there are also a number of folks in my state who profit by the gas gadding of other people. There are many degrees to this business. Some, who are sort of apprentices, merely knock a piano-box into a roadside stall and set forth rows of bitter cucumbers, droopy apples, squash-like melons, infertile eggs from the incubator, broilers with the blues, and No. 1 throwing tomatoes. Another group of used-to-be farmers turn their homesteads into ramshackle ritzies and mix gasoline, grog, and gravy for the passers to get pizened and pie-eyed. Talk about the safety of the highway and the crass ugliness of city slums! I can show you spots in our wilderness that would make the Bowery look like fifth avenue. The curse of debauched commercialism is one stench that is hard to stifle, even with oodles of ozone to spare. It's simply the "better business" blot.

Some day the enraged town selectmen in many a vacation zone will get up some morning and vow to do a little night-riding. If ordinance can't blast such sinks of effluvia out of the landscape, then try ordnance!

YET I am pleased to assure my peregrinating readers that my state still boasts some clean and cozy tourist homes and camp cabins, managed by thrifty farm women who cater to travelers in summer and spend their winters either in Florida or the hospital.

Credit for putting "winged wheels" under the farm population can be summed up thus: (1) Familiarity with machinery acquired through use of complex farm implements and the new leisure afforded thereby, and (2) Gradual abandonment of the farmer's botchy attempts to locate, construct, and maintain local links in the transportation routes of America.

Those who followed the patient ox and used the flail were indolent and conservative as to rates of travel and fearful of intricate machinery. The advent of the horse in farm work and the coming of the McCormick reaper marked the first breaking of the age-old slavery of agriculture to years of toil and utter provincialism.

TO me nothing shows the vast pace forward we have established in this century better than the history of about one hundred miles of public highway lane between Chicago and Milwaukee. Just ninety-odd years ago they surveyed the first crude wagon route along that trail, bordered by a few rude clearings cultivated by oxen. Today we see four or five steam railroads, a couple of electric lines, a dozen bus lines, thousands of private cars and trucks, the latter running on broad cement pavements that cost better than fifty thousand dollars a mile; and in the fields are rubber-tired

(*Turn to page* 44)

Chrysanthemums Thrive In Sand Cultures

By H. Hill and M. B. Davis

Central Experimental Farm, Ottawa, Ontario

THE foliage of greenhouse-grown chrysanthemums is extremely sensitive to relatively small disturbances in the nutritional balance, causing mottling or burning of the lower leaves often followed by partial defoliation. Such foliage disfigurement renders the plants unsuitable for show or exhibition purposes and also impairs the efficiency of the plant in the production of number and quality of bloom.

A series of nutritional experiments over a period of several years has resulted in the accumulation of sufficient knowledge to make possible the growing of this plant to perfection in pure sand cultures on a commercial scale. Sand cultures offer certain advantages over regular greenhouse soil composts. The concentration of the different elements available to the plant at a given time can be more easily controlled; this is particularly true of nitrogen.

Fig. I—The smaller size of this leaf, its yellowish-green color, and reddened veins indicate that it comes from a very low nitrogen plant.

In a compost, possessing as it does large amounts of organic matter, the liberation of nitrogen may be a rather slow and continuous process and is frequently accompanied by periodic deficiency of the mineral elements. It is easier in sand cultures to use the appearance of the plant as a means of judging fertilizer requirements, since superabundance of plant nutrients can be more readily washed from the growing medium, and deficiencies can more easily be corrected due to the quicker availability of the various elements.

It has been noted that varieties differ in their nutritional requirements, and these may be more easily catered to in sand cultures due to the advantages set forth above. Further, with the increasing cost and difficulty in obtaining manure and fibre for a suitable compost, the sand culture offers a cheaper medium in which to grow the plant. Another factor affecting the cost of production in soil culture is the fact that it has been found necessary to empty and refill the beds after growing one or two crops. It appears reasonable to assume that the same sand can be used for several successive crops, since all nutrient residues and

Fig. II—The early stages of excess nitrogen are expressed as a faint marginal chlorosis.

Fig. III—A more advanced stage in which the chlorosis has increased and spread inwards.

toxic materials can be eliminated by thorough leaching with water.

The chrysanthemum has proved to be a plant fairly well adapted to such treatment, and one which very quickly reflects faulty nutritional practice.

The following plant-symptoms have been found useful in determining the fertilizer requirements of chrysanthemums when growing in either soil or sand. As in many other plants the ratio between nitrogen and potassium is of particular importance in the feeding of the chrysanthemum, which gives an added advantage over a crop like tomatoes, in that high-level feeding of both nitrogen and potassium can be practiced with a greater degree of safety, since there are no fruits which might be affected with physiological disorders. Chrysanthemums receiving an excess of nitrogen will soon commence to indicate the trouble by a faint yellowing on the margins of the lower leaves, which gradually spreads inwards between the veins until a very marked chlorosis of the leaf is noticed. This continues until curling of the leaf takes place, followed rapidly by browning and death.

Whilst many a fairly good bloom has been produced on a chrysanthemum plant with almost one half of its foliage gone from the base upward, there is no reason why such a condition of foliage should exist. The ill effects of high-nitrogen feeding are easily overcome by increasing the amount of potassium fed. As the nitrogen is increased, so should the potassium be increased. Chlorosis of the lower leaves, dropping of the lower leaves, curling, and death all indicate either potassium starvation or nitrogen excess.

Deficient nitrogen, unlike excess of that element, produces leaves which do not burn or show marginal chlorosis. Here the leaves may be somewhat small, pale green to yellowish green, and in extreme cases show reddened veins, but the leaf always remains entire and not mottled or scorched. Fig. I shows a leaf from a very low nitrogen plant; Fig. II, the early stages of excess nitrogen expressed as a faint marginal chlorosis; and Fig. III, a more advanced stage of excess nitrogen in which the chlorosis has increased and spread inwards.

The chrysanthemum is particularly susceptible to excess phosphorus feed-

Fig. IV—Slight yellowing and the appearance of maroon-red blotches on the margins of the leaf, with the centre remaining a normal green, are evidence of excess phosphorus feeding.

ing, and peculiarly enough this is an element that many greenhouse men do use to excess in the form of bone meal and superphosphate. To the casual observer excess phosphorus symptoms resemble excess nitrogen symptoms, but there is a very distinct difference noticeable upon close examination. In the case of excess phosphorus feeding the trouble commences around the margins of the leaves in the form of a slight yellowing, as in the case of excess nitrogen feeding. This is very quickly followed by the appearance of maroon-red blotches following the margins rather closely and leaving the center of the leaf a normal green. Fig. IV shows the location of these maroon patches. This symptom is exceedingly valuable in the growing of chrysanthemums and should be carefully studied in contrast to the deficient potassium or excess nitrogen symptoms.

Lack of phosphorus is characterized by a great reduction in vigor, plants spindly, leaves small and sparse with internodes farther apart. In color, the leaves are at first a dull, deep green, with the older leaves becoming a dull reddish purple. The lower leaves which die from phosphorus starvation are reddish purple in color and not yellowish or light brown as in the case of excess nitrogen.

The symptoms described above refer to foliage conditions only, but quantity and quality of bloom are also greatly influenced by feeding practices. The following table gives the number of blossom buds per plant and the average size of bloom of a variety of chrysanthemum grown under varying nutritional conditions.

It will be noticed by examination of the table that the largest number of bloom was secured from the luxury feeding of high nitrogen and high potassium, and that the largest size of bloom was secured from the same treatment. High feeding of phosphorus even in the presence of ample potassium and nitrogen resulted in a marked decrease in the number of blossoms and some decrease in size. As might be expected, deficiency of either phosphorus or potassium brought

(*Turn to page* 36)

Treatment	Average no. of blossom buds per plant	Average size of bloom in inches
Excess nitrogen	109	2.5
Low nitrogen	68	2.75
High nitrogen and high potassium	170	3.25
Excess phosphorus	61	2.75
Deficient phosphorus	48	2.25
Low potassium	56	2.00
High potassium	129	3.00

Dry-weather Profits *from* Garden Irrigation

By W. B. Ward

Extension Horticulturist, Purdue University, Lafayette, Indiana

MANY years ago James Whitcomb Riley thought we people in the Hoosier State were getting too much rain and wrote: "When God gives out the weather and sends rain, why—rain's my choice!" For the past several years commercial gardeners in Indiana have found that during the growing season, from April to October, the rainfall has been deficient or so spotted that many of their crops were lost due to the lack of moisture and the exceptionally high temperatures during June and July. The season of 1936 seemingly broke all records for drought duration, as very little rain fell during May, June, July, and up until the middle of August. Those gardeners that were equipped for irrigation to meet such conditions fared very well, as the scarcity of many of the vegetable crops created higher prices. Some few gardeners watched the vegetables burn up, while some few others reversed Riley's saying and hurriedly put in an irrigation system in order to save their crops—and it worked.

It may be a long time before such conditions will again arise, when the extended drought and heat wave damages the vegetables in the Middle West like it did this year, yet the experiences gained were valuable to the gardeners and to neighbors. Each year there will be a period of a week or ten days, or perhaps longer, when there will not be sufficient rainfall for the maturing of certain crops, and a little water at such a time will no doubt be the difference between profit and loss. Water when you need it should be the foremost thought in the minds of our gardeners, as they may easily arrange to carry off the surplus water by tile drainage or raised beds and the open furrow.

Three Workable Systems

Various systems of irrigating have their champions. Some think that the overhead is the better, others like the furrow method, and still some prefer subirrigation. For low-lying fields close to drainage ditches, subirrigation works to a good advantage for smaller areas. Overhead irrigation or the sprinkler system is also limited to smaller acreages, 10 to 30 or 40 acres, and the water is applied the same as rain falling. More equipment and expense is necessary with the overhead system, yet this added expense seemingly has not cut in very deeply on the profits derived.

One grower in northern Indiana has 23 acres of various vegetables under this type of irrigation, using a stationary tractor engine and double centrifugal pumps furnishing 30,000 gallons per hour. Automatic turning equipment is on each line of sprinklers, and the line carries 90 pounds of pressure. The water supply is pumped directly from a small stream into the lines. Ten acres are watered at one time. It was very interesting to note the differences between irrigated and

Fig. 1—A centrifugal pump on the Terpstra farm, Hammond, Indiana, was mounted on an automobile chassis and attached directly to the drive shaft, resulting in 20,000 gallons per hour capacity.

non-irrigated crops, especially beans. For the past six years a quarter-acre patch has not received the regular applications of water and has depended upon the rainfall. Sometimes there was a crop, and again it was a waste of time in preparing the ground and planting seed. This year this patch was in snap beans, and the difference was that of no crop compared to what may yield six tons or better, as he was still picking beans at the time of our visit, which was the middle of August.

Flooding or furrow irrigation as practiced here is a little different from the open, gravity-fed irrigation ditch of the West. Our open water must be pumped into pipe lines of various kinds and distributed where needed. Most generally four or five-inch metal tubing, in short, medium or 20-foot lengths, with quick fastening connections, or occasionally porous canvas hose is used. The water is piped to the higher spots and then gravity carries the water between every other row. When sufficient water has been applied to a certain area, the supply is cut off and the pipes moved elsewhere if desired. One grower is irrigating 76 acres of potatoes, and the total cost of equipment (pumps, pipe, and engine) was $1,700. What may be the increase in yield on this acreage will not be known until harvest time, but a preliminary estimation places the yield increase at 275 bushels per acre.

Old automobile engines connected directly to centrifugal pumps and run at a speed of 30 miles per hour furnish good power. The engine and chassis are placed close to the water supply and the pump securely fastened to the frame. This type of pump discharges between 20,000 and 25,000 gallons per hour through a four-inch pipe. This method of irrigation seems quite successful in getting the water on in a short time and has proven very economical on cost of equipment and time. An acre inch (27,000 gallons) of water is applied about once a week.

When the water table is close to the surface, 6 to 15 feet, open wells are dug and lined with brick or sand points are driven into the ground. These wells are from 6 to 8 feet in diameter and from 12 to 20 feet deep. They are partially filled, 6 to 10 feet, from the seepage water and may be emptied twice daily, furnishing enough water to run continuously for 4½ to 5 hours' time. One gardener has a 3 HP electric motor running his pumps and found that only 12 KWH were used in emptying this well 15 times.

In Fig. 2 three sand points were driven into the ground 9 feet, and a good water supply was found. The

(*Turn to page* 35)

Fig. 2—Ray Bailey, Lowell, Indiana, invested $50 in equipment (exclusive of power) and 600 feet of canvas hose. Five acres of potatoes and a large home garden were irrigated.

Southern Peaches Need Potash

By E. H. Rawl

Extension Horticulturist, Clemson College, South Carolina

TO PEACH growers of the South, the disease which has developed in their orchards and which is commonly known as "leaf scorch" is nothing but "cotton rust" (potash deficiency) spread to the peach trees. Ten years' treatment with nitrogen only in the Tinsley 14-year-old, 25-acre Elberta peach orchard about two miles from Inman, South Carolina, is responsible for the conclusion. So similar to "cotton rust" are the abnormalities developed in this orchard that lack of potash is being credited with the problem which has been threatening the peach industry of South Carolina.

The Tinsley orchard is in Spartanburg county which is one of three (Spartanburg, Greenville, and Laurens) counties in the Piedmont area—the most important peach section of South Carolina. In July 1934, about two weeks before harvesting, there developed in the Tinsley orchard a serious abnormal condition. This condition was observed very closely by many growers, plant pathologists and physiologists, horticulturists, and others in addition to the writer. Many of the observers were suspicious that the trouble might be due to a virus or other disease. The owner now estimates that in 1934 and 1935 the trouble caused him a net loss of $3,000 and believes that in previous years it reduced the size of fruit and total yield.

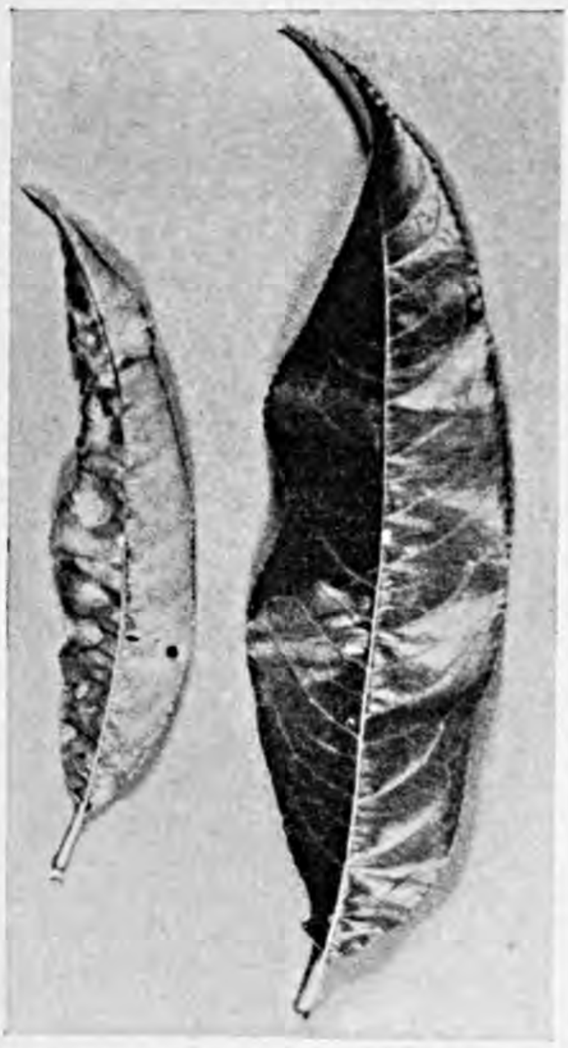


Fig. 1—Peach leaves from fertilizer demonstration plots: Left, fertilized with nitrogen only. Note small size, unhealthy color, and "scorching" of margin and tip. Right, fertilized with nitrogen, phosphorus, potassium, and limestone. Note large size, healthy color, and no "scorching." Photo August 15, 1935.

The soil on which this orchard is planted is classified as Cecil sandy loam. A small portion of the soil varies somewhat, ranging toward the clays.

During the period October 12 to

19, 1934, representatives of the South Carolina Crop Pest Commission made a survey in certain sections in the state to determine the extent of the abnormal condition in other orchards throughout the state. This survey did not cover all the counties of the state, nor all the orchards within each county; but of the 77 orchards which were inspected 33 per cent showed the abnormal condition. In no case, however, were any orchards affected as seriously as was the Tinsley orchard in Spartanburg county. It was found also that orchards with trees under five years of age, even though they were in some cases planted adjacent to the old trees which were affected, did not show the typical abnormality.

Disease Symptoms

In the early stage of the abnormal condition the leaves first changed to a light, yellowish-green color, later to a very pale yellow, followed by burning or "scorching" of the tips and margins of the leaves. Finally the leaves were considerably curled, showing a bronzing or browning, and eventually resulting in a great scarcity of peach buds. Many of these buds were so weak that at blooming time the majority shed, thereby finally resulting in a very light crop of undersize fruit. This unnatural condition occurred in the orchard in a patchy manner, in some cases trees adjoining abnormal trees appeared perfectly healthy until after harvesting. In 1934 about two weeks previous to the ripening of the fruit, approximately 25 per cent of the trees showed the condition described above, and almost all of these abnormal trees failed to develop their fruit to marketable sizes. The size of the majority of the peaches from these abnormal trees at harvesting was from 1½ to 2 inches in diameter, whereas fruit from healthy trees ranged in size from about 2 to 2½ inches in diameter. On some of the abnormal trees pre-ripening dropping was a pronounced tendency.

It is well at this point to compare these symptoms with the observations of potash deficiency symptoms recorded by various research workers. For instance, M. B. Davis in Quebec Pom. and Fruit Growing Soc. 40th Ann. Rept. 1933 says, "Potash deficiency is first noticed by a very dark leaf, generally lacking lustre; this condition may be overlooked but is soon followed either by a faint chlorosis around the margin or at the tip or sometimes by a slight scorching or burning of the tip of the leaf. In bad cases the scorching is around the entire margin, and when it reaches that stage cannot be mistaken."

Again, in Nova Scotia Fruit Growers' Ass'n Proc. 70th Ann. Rept. 1933, "The first and most marked symptoms were those due to excess nitrogen. Where this element was fed in large amounts the first response was rapid growth, large plants, and very large luxuriant leaves of very dark green coloration. As the feeding of high nitrogen continued, the lower leaves began to get chlorotic, or pale, around the margins, and sometimes along the veins. Later the margins began to turn brown and then scorch, or burn, until in cases where very large amounts of nitrogen were fed the entire leaf area of the lower portions of the plant was out of commission, leaving only the younger foliage in good condition, but even this showed signs of the trouble with slightly pale or yellow margins of the leaves.

"Closely allied to these symptoms were those of the low potassium plants, for it was almost impossible to tell plants fed with potassium from those fed high nitrogen. The two symptoms were the same. . . .

"The symptoms for high nitrogen and low potassium are similar, viz., a pale yellowing of the leaf margin, followed by a burning or scorching, or in some cases, an immediate scorching of the edge of the leaf, worse on the older than on the younger leaves of the plant."

W. M. Munson, in Maine Agr. Exp. Sta. Bul. 128 (1906), reports: "In August, when about the size of walnuts, the fruits (apples) began to crack and to drop. Marked indentations, somewhat similar to those made by curculio, were abundant. No evidence of insect work could be discovered, however. When the fruit was opened, the tissue under the indented parts was found to be dry and brown. Most of the fruit ceased to grow, and by the first of September the larger part of it was on the ground; though early in the season all the trees were well loaded. The leaves, however, appeared perfectly healthy. Though a small portion of the fruit was on the trees at harvest time, it dropped so easily that no attempt was made to save it for packing. The slightest jarring of the limbs would cause it to fall. . . .

"It was then observed that the condition existed only on certain trees included in a fertilizer experiment in which an excess of available nitrogen is applied every year. The first tree noticed was in the plat which received nitrate of soda and acid phosphate, and later it was found that every tree on this plat, as also on the adjoining plat which received nitrate only, was affected as described. In one or two instances check trees which adjoined the nitrate plat, and received no direct application of fertilizer, showed a tendency in this direction. None of the other trees in the whole orchard, however, gave the least indication of the trouble. A fertilizer plat on which were muriate of potash and acid phosphate, and another on which was muriate only, separated from the first by only a single row of trees, were entirely free from disease.

"The supposition was therefore made that the trouble was physiological and due to the excessive amount of available nitrogen and the lack of potash."

Figs. 2-3—Abnormal foliage affects the production of fruit buds. Note enlarged flowers without pistils, and sepals grown into nearly full-sized leaves. Insert: Peach bud with leaf-like sepals. Photo April 3, 1935.

A. E. Murneek and E. J. Gildehaus in Missouri Agr. Exp. Sta. Bul. 310 (1931) state, "Groups of semi-dwarf apple trees have been planted in quartz sand in loose soil in tubs. These trees have been fertilized with increasing and decreasing amounts of nitrogen and potassium, while the phosphorus content of the fertilizer has been kept constant. When the nitrogen was increased without a corresponding increase in the potassium supply, marginal scorching of leaves was induced. Increasing the potassium content obviated this harmful effect of the fertilizer."

In Mass. Agr. Exp. Sta. Bul. 305 (1934) J. K. Shaw states, "These trees (apple) have not been doing well, and crops have been small. Increasing the supply of nitrogen seemed to injure rather than to improve the condition of the trees. . . . Observations suggest that the leaf burn and general poor condition of the trees in this orchard may be due to lack of potash in the soil."

T. Wallace—Journ. Pom. and Hort. Sci. (Eng.) IX (2): 111-21 (1931) —observes, "It has been shown that potassium deficiency in fruit trees is an extremely serious problem in the important fruit areas of this country. As a result of this deficiency, fruit plants such as the apple, gooseberry, black currant and red currant exhibit the condition known as "leaf scorch," whilst certain varieties of plums, e.g., Purple Pershore, develop a chlorotic appearance in addition to showing the marginal scorching of the foliage. . . .

"Trees on the nitrate of soda plot have been shown to be suffering from potassium deficiency by treating a portion of the plot with sulphate of potash, the potash treatment having produced a marked growth response and resulted in the elimination of leaf scorch in three seasons. . . .

"Potassium deficiency usually occurs in the field in a patchy manner, and in examining such cases it has been usual to find that soil differences can be recognized between healthy and 'scorch' areas. . . . A very large number of cases have been investigated and, *in every one*, it has been found that the healthy trees were high potassium trees and the scorched trees of low potassium content, thus showing the patchy nature of potassium deficiency in the field."

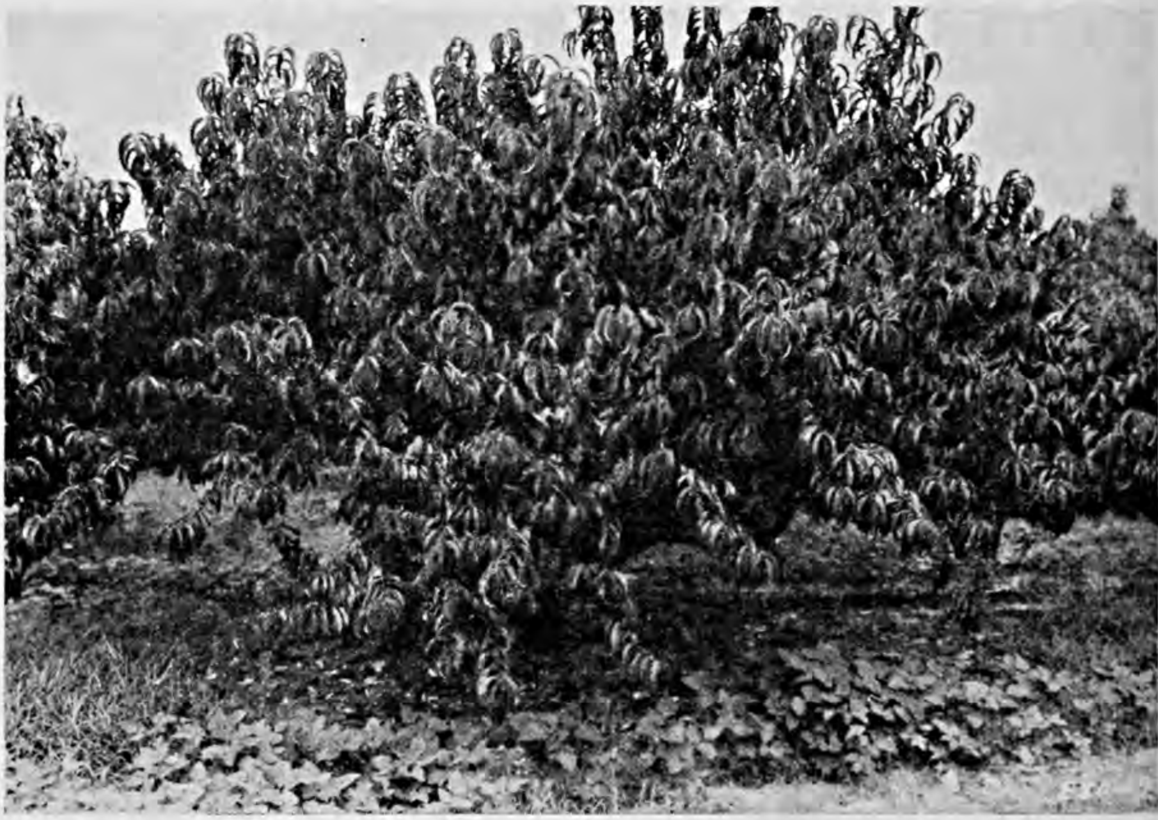


Fig. 4—This peach tree was fertilized with nitrogen, phosphorus, potassium, and limestone. Note the dense and healthy foliage of the tree and the good stand of cowpeas under the tree. Photo Sept. 3, 1935.

Coming back to the Tinsley orchard, soon after harvesting the abnormal foliage condition gradually developed throughout the entire orchard, affecting some trees seriously, and others only slightly and very late in the season just before frost. This abnormal condition, of course, seriously affected the production of fruit buds, especially on trees which showed the disorder early in the season, these trees producing only a scant quantity of weak buds.

The trees which were seriously affected in 1934 produced a very light crop of weak fruit buds, and the following spring (1935) the majority of those weak buds failed to set fruit. In some extreme cases not more than one dozen peaches per tree finally matured. Some of the buds and flowers upon affected trees assumed unusual forms. There were abnormal unopened peach buds with leaf-like sepals, enlarged flowers without pistils, and sepals grown into nearly full-sized leaves. In no case were these abnormal buds and flowers found on vigorous, healthy trees.

Previous to 1925 the Tinsley orchard was fertilized with 4-8-4 (NPK) fertilizer with additional light applications of sodium nitrate. Since 1924 the orchard has been liberally fertilized with nitrogen, but during this 10-year period has had only 43 pounds of potash (K_2O) and 112 pounds of phosphoric acid (P_2O_5). The reason that phosphorus and potassium were generally omitted was that recommendations (though not of the writer) based on experimental data indicated that nitrogen only was essential in peach-orchard fertilization.

During the 10-year period little limestone or other basic material was applied, but great quantities of acid-forming materials, as ammonium sulphate, were applied annually. A total of 3,240 pounds of ammonium sulphate per acre were used, and it would have required a total of almost two tons of dolomitic limestone per acre to have neutralized the acidity caused by the ammonium sulphate. Yet during this period only 500 pounds of dolomitic limestone were used.

Fig. 5—This peach tree was fertilized with nitrogen only. Note scant, unhealthy foliage. The leaves of the tree were yellow and badly "scorched," and cowpeas under the tree failed to grow. Photo Sept. 3, 1935.

The soil also received annually considerable sulphur from the dormant and summer sulphur sprays that were given the trees for the control of insects and diseases of the trees and fruits. All of these practices had a decided influence in increasing soil acidity.

In late fall (1934) many samples of soil were collected and tested for

(*Turn to page* 39)

Oregon has approximately 7,000 acres devoted to onion bulb raising.

Oregon Onions

By Albert E. Wilkinson

Extension Vegetable Specialist, Agricultural Extension Service, Storrs, Connecticut

WHEN you see some extra fine, large, reddish-brown, globe-shaped onions on our markets, look on the original bag and chances are that you will find that the onions have come from Gervais or Brooks, Oregon. Rightly called Onionville are these two towns, as they are the center of the large, onion production region, the farms of Oregon globe onions. Acres and acres and acres are devoted only to onion raising.

The soil out there where I visited is muck, probably an old lake bed, now drained and cropped. No one that I questioned could really tell me just how many hundreds of thousands of acres there are suitable for onion raising. My friend, John Banick, of Gervais, told me that at least 7,000 acres were used for onion bulb raising. This area is entirely away from the markets. Their best markets, according to several growers, are New York City and adjacent states.

They are, then, forced to ship all the onions raised. The growers also told me that they are very much interested in increasing their eastern shipments, largely because of better prices, but somewhat due to a more steady demand. They are all interested in the Connecticut Valley crop, its condition, and probable extent of sales. Several growers told me they had been East in order to see this area and to weigh its importance.

This soft, black muck is very easy to work, requires only a medium amount of fertilizer, about 1,000 to 1,200 lbs. of a 13-10-20 being used per acre. It's all located in a mild climate with a long growing season. Planting is mostly in March, and the crop is in the storehouse by the first of November or earlier.

Storehouses have sprung up all over the area. One large grower in Brooks has five or six 40 by 100-foot houses that I saw loaded with crates of choice onions.

The crop is grown much as it is in the Connecticut Valley, in Wethersfield, or East Hartford. The main difference is that more seed per acre are used, and more or all seedlings are allowed to develop. Thinning or spacing in the row, as practiced in Connecticut, is not needed at all, because in this soft, spongy soil with its high-water table the onions can and do develop and push out, so that each row may be from five to eight onions wide. These come to full size, too.

The onions at harvest are thoroughly dried in the field and then placed in crates and somewhat cured. Later they are brought into the storehouses and held in the crates. Because of the warm climate most of the storage plants have only one wall of boards. A few of the better houses have two layers and paper on the outside layer. Using these storages in Connecticut with our cold winters would mean frozen onions and losses.

At shipping time the onions are run over a topping and grading machine. The dry tops are cut off and the netted bags of uniform size, stamped with the name and address of grower or brand, are filled with onion bulbs quite uniform in size. It does not take long to run through a carload of these large, reddish, globe onions.

In addition, my friend Banick told me that there are about 1,000 acres on higher soil nearby that are used for growing onion seed of the highest quality. Most of this acreage is controlled by one of Connecticut's leading seedsmen. Therefore, we in Connecticut have a finger in the pie out there in Gervais and Brooks, Oreg.

Friend Banick was kind enough to take me to many of these seed growers' farms. One of these places impressed me very much because of the care taken in the work. Much to my surprise I found it was operated and managed by a Japanese woman. She had lost her husband through a runaway horse accident, but she carried on. In one of her fields I found about 100 people working. Rows in this field were more than 2,500 feet

(*Turn to page* 33)

Fields like this one bring 1,500 bus. per acre. The onions have been pulled and are ready for drying in the field.

Mr. Ben Qualifies *As* Truck "Planter"

By G. Chalmers McDermid
Charleston, South Carolina

"WHY shouldn't my tomatoes be good? They were fertilized with a 4-8-10 fertilizer, and when they have that much potash under them, they've got to be good." Such was the answer this writer received, when he commented on the beautiful tomatoes W. B. Seabrook of Mount Pleasant, South Carolina, was shipping from his 1935 crop.

"We had a terribly rainy season," Mr. Seabrook said, "and to all outward appearances, we should have had a crop failure. But somehow or other, the elements let up on us, and we made the largest crop we have had in years. I have used a 10 per cent potash fertilizer for tomatoes for a long time, and feel that in spite of bad weather, year in and year out, it rather equalizes things for the crop. I find that when I put out this high-potash analysis I get a smooth-skinned tomato, fewer catfaces and splits, and practically no 'nail-head rust,' the bane of the tomato grower's existence. I find that my bushes are healthy from the start, and keep their thrifty condition all through the growing season. Potash makes a better shipping tomato, the skin is tougher, and the tomatoes fill out well. They don't bruise easily, and carry to the markets in first-class shape."

If this writer had been penning a testimonial for some fertilizer manufacturer just about this time, he could not have asked for a better break than Mr. Seabrook's statements given above; but testimonials do not interest him these days. He was interested in securing first-hand information on why Mr. Seabrook always made good crops, good seasons and bad, wet weather and dry, year in and year out.

To get this information our conversation had to go back to the old days of sea island cotton on the South Carolina coast, the days when cotton farmers were cotton "planters." (And by the way, many of them rather resented the term "cotton farmer." They were "cotton planters.") Gentlemen of the old school, we might call them, studious of the needs of their crops, avid readers, conductors of experiments on their own farms, really getting somewhere with their private research. There are only a few of these old-time gentlemen left, and our good friend, Mr. Ben, a cracking good farmer who has kept abreast, and even ahead of the times, is one of them.

Resourceful Farming

Ever since his younger days, he has had the "yearn to learn." In riding through his sea island cotton crops, he noticed certain fields that each year shed their leaves prematurely. They looked rusty, bolls didn't fill as they should. "Something must be wrong with that piece of land," thought he, "perhaps it lacks some kind of plant food. Maybe if I put some of that 'pluff mud' in the rows it will help it out for another year." Suiting the action to the thought, the next winter he had his carts go out into the tough, greasy mud of the near-by salt marshes and bring it into the "rust spots." Next summer he noticed a marked difference in the cotton. It remained healthy all during the growing season. It didn't rust. It made a plumper boll and a silkier staple.

spread the kainit than it was to haul cart load after cart load of the mud to his fields.

Naturally he was interested in this radical new departure. He had used the "pluff mud" on sweet potatoes in former years, so he decided also to put out some kainit for them. A marvelous crop resulted. His potatoes were chunky, fist-sized roots which the markets wanted immediately. Needless to say, Mr. Seabrook was sold on the idea of a kainit salt fertilizer, and he began using it on still more of his crops. It seemed to him like an Arabian Night's tale. He had found the "open sesame" to what his plants needed.

Courtesy Agr. Dept., Seaboard Air Line Railway.

Tomato pickers waiting to be checked—a familiar scene in the "low country."

Why was this? He and his friends "racked their brains" and figured it out as salt, but what kind of salt? Common table salt put on the lands would ruin a crop, so what could it be? Hardwood ashes gave similar results on tests run by some of his friends. "Perhaps," he reasoned, "there was some connection between the salt in the ashes and the salt of the 'pluff mud.' "

Then along came a fertilizer salesman with a sample of kainit salt. He told of certain tests that had been made on other crops which had proven that this material had rust-controlling features. Mr. Seabrook easily put two and two together and made four. He tried this kainit salt (as it was then known) on a small plot of sea island cotton and found that he had the same protection against rust that the "pluff mud" gave him, and how much easier it was to

That was many years ago, but if we say "many years ago," one may get the idea that Mr. Ben is a long-bearded Santa Claus. Such, however, is not a fact. He is considerably older than this writer, but still has many years of usefulness left to him, in which he can teach his neighbors a thing or two about crop fertilization.

About 1918, the boll-weevil came to coastal South Carolina and wiped the sea island cotton crop off the map. Planters, who had made themselves

(*Turn to page* 35)

Fertilization and Care *of* Peat Soils

By R. E. Stephenson
Oregon State Agricultural College, Corvallis, Oregon

PEAT in the raw represents plant materials more or less embalmed in wax and preserved in humic acid water. The degree of preservation is sometimes so complete in the case of sphagnum moss peats, that the moss when dug and dried is used for packing material as a substitute for excelsior. Such material is not yet peat soil. These peats even after becoming soil require more than average liberal fertilization with potash, lime, nitrogen, and phosphate.

Peat soil represents plant materials in the process of decay. When the water is first removed from raw peat, rotting is slow and several years may be required to make productive soils. The more decomposed the original peat materials, the more quickly productive soils are formed. There are so few micro-organisms in raw peat that inoculation is helpful in speeding up rotting or humification.

Influenced by Vegetation

The type of plant growth from which peat is formed influences the productive value of the peat soil. Sphagnum moss makes poor soil. Sedges, reeds, grasses, with some woody growth make better soils. Presence of woody growth in the peat indicates that at some period in the peat accumulation there has been partial drainage. The aeration afforded by the limited drainage stimulated a certain amount of decomposition, and a peat of higher protein and nitrogen content was formed. There was also during the period of partial drainage a better type of vegetation for making peat soil.

Southern peats, formed under low rainfall and high evaporating conditions, are likely to prove more fertile. They contain more mineral matter. Peat on a lime substrata may be neutral in reaction and is better than the acid, leached peats of the North. The latter are slow to become soil and need a lot of fertilizing to make them productive. High-lime and low-lime peats are sometimes classed as good or poor soils, respectively.

Drainage Essential

In reclaiming peat land the first thing is drainage, to remove excess water, admit air, and promote oxidation. A light application of manure is helpful to introduce micro-organisms. Drainage should not be too deep, or capillary water cannot rise to the roots of crops. Drains placed too shallow are soon within reach of the plow because of the shrinkage of the peat as it dries and decomposes. Shrinkage of a foot or two in a few years is probable.

The drains for common crops should not lower the water table more than two and a half or three feet below the surface after settling. Tiles originally placed four and a half or five feet deep probably will work out about right.

Raw peat at the beginning of decomposition is somewhat comparable to the raw materials from which compost is made, except that there is usually a greater deficiency of potash. Composting is an aerobic process carried on by micro-organisms in the presence of moisture and nutrients. The nutrients needed by the compost organisms are nitrogen and carbon for protein synthesis, carbon to supply energy by oxidation, and phosphorus, potassium, and other minerals. The organisms require a neutral reaction which necessitates the use of lime on acid peat.

Supply Deficiencies

Raw peats are deficient in minerals for two reasons. Water plants, out of which peat is formed, are naturally low in mineral content. The mosses are especially deficient in minerals. Likewise sedges, rushes, tules, and water grasses are low in minerals. Then since peats accumulate in water, the plant materials of their origin have been extremely leached for ages. Nearly everything that water can dissolve has been removed. Except in the presence of an alkaline substratum, this leaching is bound to produce base deficiency and high acidity. Hence the necessity for liberal liming and mineral fertilization, adding sometimes such rarer elements as copper, manganese, and zinc to the usual formula.

Since peat is mostly organic matter, sometimes ninety per cent or more, casual consideration might lead to the conclusion that nitrogen which is supplied by organic matter would not need consideration in a fertilizer program for peat soils. Such is not the case, at least so far as the raw peats are concerned. The same leaching which removed soluble bases removed also the soluble proteins, and amino acids. The nitrogen of these has long since disappeared as the result of anaerobic decomposition. The nitrogen which remains is in the form of resistant, slowly decomposable products.

Peats normally contain from less than one to perhaps three or four per cent nitrogen. The raw peats contain less nitrogen than those in the more advanced stages of decay. Humus of mineral soils, on the other hand, carries five or six per cent of nitrogen. As peat decomposes or humifies, it becomes more and more of the nature of real humus. The micro-organisms that break it down build new proteins, comparable to those of the humus of mineral soils. In time, most of the peat material is humified, and the nitrogen content, availability, and general properties approach those of real humus.

One requisite of raw peat decomposition, therefore, is a treatment with nitrogen fertilizer, or perhaps a complete fertilizer carrying a goodly content of nitrogen. The nitrogen fertilization is less needed on the better decomposed peats. Ultimately, therefore, nitrogen fertilization may be reduced or perhaps eliminated.

Potash for Quality

Mineral fertilization must always continue on peat soils. Phosphate and potash treatments cannot be eliminated. Liberal use of potash may make the difference between crop failure and good yields. Potash not only increases yields but improves the quality of crops grown on peat soils. Potatoes may blacken at the base in cooking due to lack of potash, this is the result of the accumulation of amino acids which turn black due to the heat of cooking. Liberal mineral fertilization is necessary to assure normal quality of crop products.

Burning is sometimes practiced as a substitute for fertilizer treatments. By burning a few inches of the surface, enough ash, including lime, potash, and phosphate is liberated to produce a crop. Since peats are limited in depth, such a practice is shortsighted and wasteful. A few fires and there is no more peat soil. The valuable peat goes up in smoke. The practice is nearly as senseless as burning stable manure or a compost heap.

A strong feature of peat soil is its favorable moisture condition. Peats hold more water useful to plants than do mineral soils of similar depth. Crops grown on peat do not suffer as soon in drought as on mineral soils. Peat is easily penetrated and permeated by roots of crops which are seeking moisture and nutrients. The combination of high moisture capacity and excellent aeration cannot be duplicated in any other soil. Garden crops grow quickly and continuously, and are tender, juicy, and delectably flavored.

Seed-bed preparation in peat soils is no problem. Clods cannot form. There are no crusts, and no packing and puddling with the rains. Tillage is easy, and the minimum amount is required. New peat is sometimes too loose and must be compacted by heavy rolling. Surface tillage is all that is necessary in any case. No other soils are as well adapted to producing big yields of high quality truck and garden crops. The Delta peats of California are reported to have returned an average of $100 an acre for 10 years over the entire area cultivated (some 225,000 acres). Potato yields of 1,000 bushels an acre are attainable. These are perhaps the most productive peats.

Possibly three fourths of the 100,000,000 or more acres of peat in this country may sometime be utilized for purposes of agriculture. As yet the greater portion is undrained and unutilized. Some of the area supports a poor growth of timber. Other areas return a little low-grade pasture or swamp hay. Still other areas contribute practically nothing of economic importance except perhaps a home for wild life.

Commercial Future?

Difficulties of drainage, slowness of decomposition of raw peat (in part due to lack of understanding of its fundamental properties), the expense of reclaiming and placing peat under cultivation, all are factors retarding the general program of peat utilization. Climate, markets, and many other things must of course be considered in planning a peat utilization program. Perhaps some day considerable peat will find its way into commercial uses. Ammoniated peat, and perhaps complete fertilizers formed with peat as a carrier of nutrients and a conditioner of the mixture, may sometime become popular on the markets.

At present, however, peat as soil deserves the chief consideration. A peat agriculture is now gradually developing, not only with such specialized crops as mint, celery, and potatoes, but with general farm crops. There are few farm crops that cannot be successfully grown on good peat soils, and with the minimum of physical effort. Even legumes are grown and are needed to supply fresh humus material that is easily decomposed in so large an inert mass.

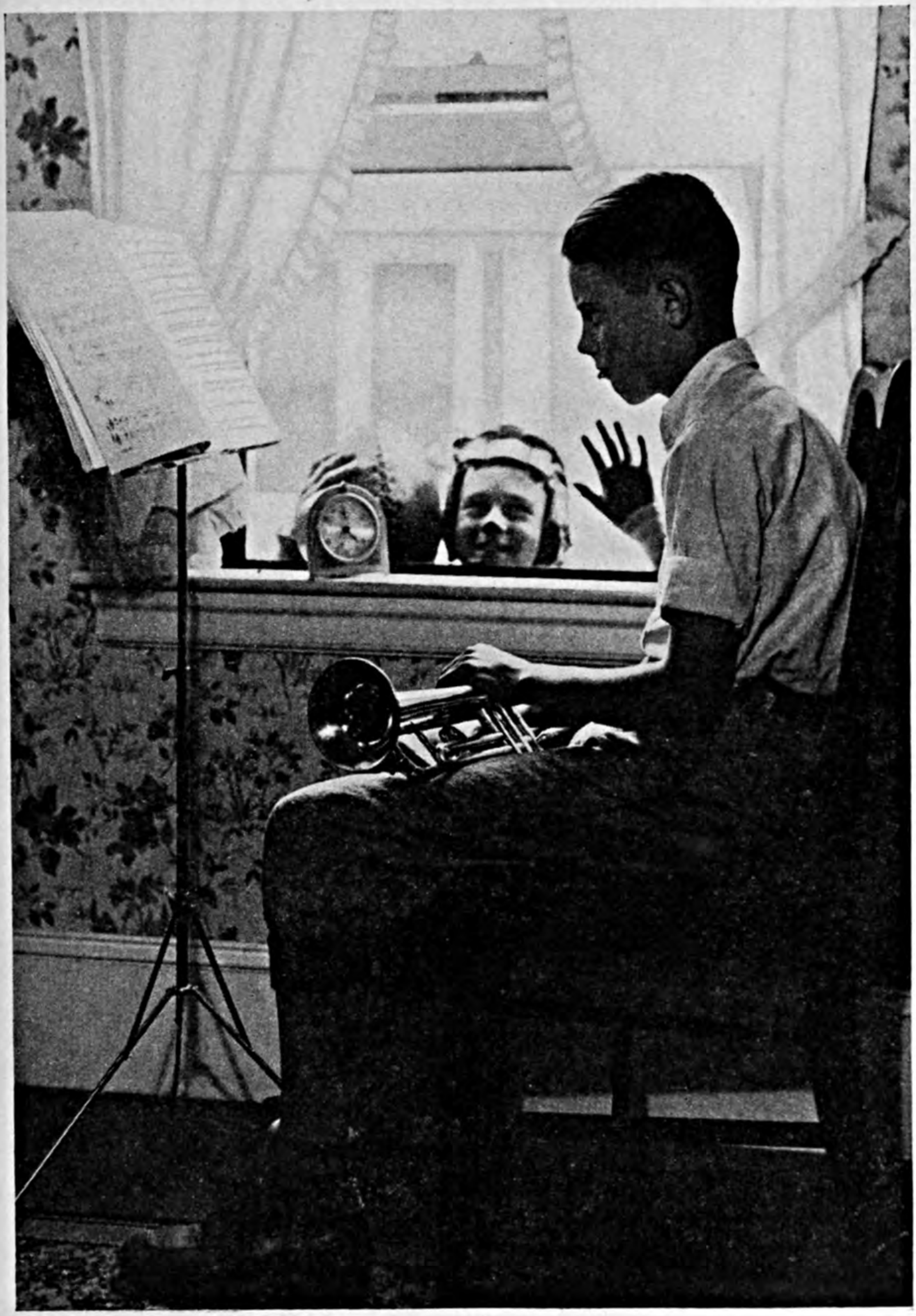
Peat Will Pay

Successful peat management demands simply a fundamental knowledge of the origin and nature of peat materials and the processes through which raw peat changes to productive peat soils. The almost universal need of peat soils for potash fertilization is easily understood by a common sense consideration of the problem. Potash in plant material is practically the most soluble constituent found. Even the dead leaves of growing plants in the field have their potash more or less leached out by the rains and returned to the soil. Why should not the plant materials of peat, immersed in water for centuries (as they are during the period of accumulation) lose practically all their potash? They do lose most of it.

This argument applies to all other nutrient constituents to the extent of their solubility. The least soluble constituents, lignin, waxes, and cellulose

(*Turn to page 35*)

PICTORIAL



TEMPTATIONS IN THE LIFE OF A MUSICIAN.

Above: Disgruntled over the job which kept him from going to the community picnic.

Below: Sea-gulls take to land when rice binders offer an invitation to dine.

Above: Lima beans for winter dinners are harvested near San Diego, California.

Below: Lively music strengthens the patience of any crowd for tedious political harangues.

Good advice tendered from experience and received with discrimination builds progressive farmsteads.

The Editors Talk

Top Quality on Display

Interspersed with war news, political happenings, and other items of major importance, comes publicity directing attention to the First International Horticultural Exposition at the International Amphitheatre in Chicago, September 12-20. The significance of this exposition is far-reaching. Held on the site of the great International Live Stock Exposition and Hay and Grain Show, inaugurated 36 years ago and now grown into one of the largest agricultural functions in the world, the new exposition marks the growing importance being accorded the "garden" side of agriculture.

We do not have to go back many years to find conceptions of our agricultural wealth defined almost solely in terms of live stock, cotton, wheat, and corn. It will surprise many to know that today the combined value of our fruit and vegetable crops is only slightly less than the combined value of our cotton and wheat crops.

Considering the differences in acreages involved and the increasing distances between production areas and consuming centers, with all the attendant problems of getting a quality product to the consumer, the necessity for improved methods, varieties, etc., as epitomized by the interest culminating in an International Exposition, is seen. Probably in no other line of competitive production does quality play so great a part in the ultimate profit to the grower as it does in the fruit and vegetable industry.

Success in Farming

It has been said that success in farming is dependent upon three primary things—the man, the land, and the market. Each factor is variable, making success a goal, the attainment of which employs the constant search for the optimum balance between the three.

Knowledge and experience are probably the two most valuable assets of the man. A farmer has no more important use for knowledge than in connection with the management of his land. Profitable crops cannot be produced without adequate supplies of plant food, and these cannot be provided without knowledge as to the needs of the various crops and the capability of the soil at hand for providing them. Experience is an efficient teacher, storing up as it will, knowledge from personal experiences and from the experiences of others. A successful man keeps his mind open to any new developments which he can utilize toward his own success.

Well along on the road to success were those growers who started with land in a high state of natural fertility. However, the best of land cannot meet the demands of growing season after growing season and maintain its level of fertility. Fortunately, years of research work, experimentation, and survey have provided information on the application of fertilizers necessary to keep the land producing profitably. It remains for the individual farmer to adapt this information to his own soil and crop needs.

An intelligent man farming productive land will find a good market. Nearness to market, in these days of varied means of rapid transportation, isn't a limiting factor to the extent it was a few decades ago. The pathway beaten to the maker of the "best mouse-trap" has not only wound around to take in the grower of quality produce, but quality produce reaching large markets in good condition is demanding a premium.

Recent reports of soil-testing trains touring important agricultural sections in the service of the farmer give further credence to the man, land, and market formula for success. In Indiana in August a soil-testing train on the B. & O. railroad, under the direction of the agricultural agent for the railroad and with agronomists from Purdue University doing the testing, was run from the western to the eastern side of the state. During the two-weeks tour nearly 1,300 farmers registered for the lectures and 950 fertility tests and 1,500 lime tests were made. Many soils showed a great need for fertilizer and lime and recommendations for treatment and cropping were given.

The agricultural agent for the railroad said that the railroad was interested in the welfare of the farming populace, as more than 60 per cent of the freight traffic and the welfare of the railroad was directly dependent upon the farming occupation.

Agriculture needs more of such cooperation with other industries. Man, land, and market can well be transcribed into people, countries, and commerce.

The Best Story

Our congratulations go to F. H. Jeter, editor of the North Carolina State College of Agriculture and Engineering for the signal honor bestowed upon him at the 23rd annual convention of the American Association of Agricultural College Editors held recently at Madison, Wisconsin. Among the exhibits in the feature story classification at this convention, Mr. Jeter entered "We Did 'Sumpin' About It," and when the critical committee had completed its judging, the blue ribbon was awarded Mr. Jeter for this story, acclaimed the best written by an agricultural editor this past year.

There were delegates from 36 states, Hawaii, and the District of Columbia at the meetings, and "We Did 'Sumpin' About It" competed with feature stories which had appeared in the *Country Gentleman, Progressive Farmer*, the *Chicago Tribune*, and various other farm papers and feature sections of daily papers. Adding to the honor of the blue ribbon, F. R. Beckman, managing editor of "Farmer's Wife," who was chairman of the judging committee, told the Association that the article was a complete feature story.

Mr. Jeter also was awarded second prize for syndicated items to the weekly papers and third prize for brief news items, thus giving North Carolina three ribbons, more than any other college or university won in the contest.

Along with the congratulations which we are according Mr. Jeter, we cannot help but congratulate ourselves a little for the fact that this excellent story was published in BETTER CROPS. It appeared in the May 1936 issue and at the time created such comment that reprints of it were made for wider distribution. It would seem that in some degree we were achieving our constant aim to provide our readers with the best articles possible in our particular field.

REVIEWS

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

Fertilizers

An insight to the typical fertilizer practices employed by the early Market Irish potato growers in Florida is among the many interesting topics discussed in Bulletin 295, "Potato Growing in Florida," by W. M. Fifield of the Florida Agricultural Experiment Station. Since nearly all Florida soils are deficient in nitrogen, phosphoric acid, and potash, an abundant supply of available nutrients is furnished the plants in the form of commercial fertilizer. Muck soils ordinarily contain appreciable amounts of nitrogen but are notably lacking in other essential plant foods, and some muck types situated near Lake Okeechobee are also deficient in manganese and copper. Because manure costs more than resultant yields justify, the author states that only a few growers apply stable manure to their land. In many cases farmers in the leading potato sections plow under soil-building crops to add organic matter and nitrogen to the soil.

Growers in the largest potato area, known as the Hastings district in North Florida, usually apply a fertilizer analyzing 4-7-5 (N-P-K) at the rate of a ton to the acre. Most farmers in this area apply the fertilizer in one application, usually two to six weeks prior to planting. A few growers have found high-analysis inorganic fertilizers give satisfactory results. In the Homestead or South Allapattah district, a 4-8-5 fertilizer with applications of a ton per acre are generally used. Some growers apply about two thirds of the fertilizer at planting time with the planting machine and the rest as a side application four to six weeks later, while others use the total amount when the potatoes are planted. The former practice of dividing the application is considered more efficient during rainy seasons. From 100 to 200 pounds of 65 to 83 per cent manganese sulfate per ton are mixed with the potato fertilizer. For the Everglades soils such standard commercial fertilizers as 0-10-12 and 0-8-16 are commonly applied in one operation at planting time at from 200 to 500 pounds per acre. Most of the fertilizer used in this area also contains manganese sulfate, and the author mentions that 50 to 100 pounds of copper sulfate broadcast over sawgrass land before the initial cultivation have been found beneficial. Fertilizer practices in other areas of the State are quite similar to those of the Hastings and Homestead areas. Fertilizers such as 4-8-5, 3-7-5, 3-10-7, and 6-11-10 analyses are frequently used on the farms of West Florida. Soil preparations, adaptable potato varieties, cultivation requisites, and spraying and dusting include other subjects discussed in the publication.

"Commercial Fertilizers, Agricultural Minerals 1935," State Dept. of Agri., Sacramento, Calif., Sp. Pub. 139, Dr. Alvin J. Cox, Chief, Div. of Chem.

"State Board of Agriculture Annual Report for 1934-35," St. Bd. of Agr., Dover, Del., Quarterly Bul. Vol. 25, No. 3.

"Tonnage of Different Grades of Fertilizer Sold in Michigan in 1935," Soils Dept., Mich. St. Col., East Lansing, Mich.

"Michigan Fertilizer Bulletin, Fall Season 1934, Spring 1935," St. Dept. of Agr., Lansing, Mich., Bul. 7, W. C. Geagley, P. O'Meara, H. E. Schlichting, and M. M. Nasif.

"Registration, Labeling, and Inspection of Commercial Fertilizers; 1935," Agr. Exp. Sta., Columbia, Mo., Bul. 361, Mar. 1936, F. B. Mumford, L. D. Haigh, and E. W. Cowan.

"Fertilizers for Early Cabbage," Agr. Exp. Sta., State College, N. M., Bul. 235, Feb. 1936, A. B. Fite.

"Department of Agriculture of Oregon Bulletin," St. Dept. of Agr., Salem, Ore., Bul. 53, May 1936.

"Fertilizer Experiments with Yellow Bermuda Onions in the Winter Garden Region of Texas," Agr. Exp. Sta., College Station, Brazos County, Texas, Bul. 524, Mar. 1936, Leslie R. Hawthorn.

Soils

"Results of Erosion," Numbers 6-9, Volume 12, issued by the Department of Agricultural Education of the Clemson Agricultural College, S. C., will prove instructive to the farmer and farm boy interested in knowing the different types of erosion and their effects. Edited by W. G. Crandall, T. L. Ayers, J. B. Monroe, B. H. Stribling, and Dorothy Cary, the publication contains excellent material on the subject of soil and water conservation, resulting from the findings of Federal Soil Conservation and state experiment stations, and also valuable contributions from a host of soil and engineering scientists of agricultural colleges and other agencies. According to the editors, this is the first of a series of publications on soil conservation they plan to publish. "It is hoped that this issue of Agricultural Education will stimulate active participation on the part of students of vocational agriculture in determining the degree and extent of erosion on individual farms," the authors declare. Illustrations and data to portray the results of erosion on several types of soils are given.

"A Study of the Uniformity of Soil Types and of the Fundamental Differences Between the Different Soil Series," Agr. Exp. Sta., Auburn, Ala., Bul. 244, Feb. 1936, Franklin L. Davis.

"Soils for Azaleas," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 496, June 1936, R. M. Barnette and Harold Mowry.

"Soil Moisture and Winter Wheat with Suggestions on Abandonment," Agr. Exp. Sta., Manhattan, Kans., Bul. 273, Jan. 1936, A. L. Hallsted and O. R. Mathews.

"Changes in the Oxidation-Reduction Equilibrium in Soils as Related to the Physical Properties of the Soil and the Growth of Rice," Agr. Exp. Sta., Baton Rouge, La., Bul. 271, Jan. 1936, M. B. Sturgis.

"Soil Building Practices in Maine," Agr. Ext. Serv., Orono, Me., Ext. Cir. 118, May 1936, A. K. Gardner.

"Soil Conservation in an Improved Agriculture," Agr. Exp. Sta., Columbia, Mo., Bul. 362, Mar. 1936, M. F. Miller.

"The Management of Nebraska Soils," Agr. Ext. Serv., Lincoln, Nebr., Ext. Cir. 133, Sept. 1931 (Rev. Mar. 1936), P. H. Stewart and D. L. Gross.

"The Relationship Between Tree-growth and Stream Runoff in the Truckee River Basin, California-Nevada," Agr. Exp. Sta., Reno, Nev., Bul. 141, Jan. 1936, George Hardman and Orvis E. Reil.

"An Economic Study of Land Utilization in Chemung County, New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 640, Jan. 1936, T. E. LaMont.

"An Evaporation Survey of Ohio," Agr. Exp. Sta., Wooster, Ohio, Bul. 564, Mar. 1936, J. D. Wilson and J. R. Savage.

"Lime for Sour Soils," Agr. Ext. Serv., State College, Pa., Ext. Cir. 159, Nov. 1935, J. B. R. Dickey.

"Irrigation, Portable Overhead," Agr. Ext. Serv., State College, Pa., Leaf. 37, Nov. 1935, W. B. Nissley.

"Lime—Its Need and Use in West Virginia," Agr. Exp. Sta., Morgantown, W. Va., Cir. 71, Mar. 1936, W. H. Pierre and G. G. Pohlman.

"Development and Significance of the Great Soil Groups of the United States," U. S. D. A., Washington, D. C., Misc. Pub. 229, Apr. 1936, Charles E. Kellogg.

"Soil Survey of Montmorency County, Michigan," U. S. D. A., Washington, D. C., Series 1930, No. 39, J. O. Veatch, L. R. Schoenmann, C. E. Millar, and A. E. Shearin.

"Soil Survey of Chemung County, New York," U. S. D. A., Washington, D. C., Series 1932, No. 3, C. S. Pearson, W. W. Reitz, John Mack, Ward Ellsworth, and James Schwartz.

"Soil Survey of Le Flore County, Oklahoma," U. S. D. A., Washington, D. C., Series 1931, No. 15, E. W. Knobel, C. B. Boatright, and W. C. Boatright.

"Soil Survey of Scurry County, Texas," U. S. D. A., Washington, D. C., Series 1931, No. 13, E. H. Templin and T. C. Reitch.

Crops

The Seventh Report of "Pasture Investigations" of the Storrs, Connecticut, Agricultural Experiment Station in Bulletin 208, by B. A. Brown and

R. I. Munsell, outlines several ideal pasture mixtures that should prove beneficial under varying soil conditions. The authors point out that moderately acid soils dry enough for corn and having a pH of 5.2-6.0, a mixture of red clover, Ladino clover, and either orchard grass or timothy should give good results for five years. If the soil is above pH 6, it is believed alfalfa should be included in the pasture mixture, in which case timothy rather than orchard grass is preferred because, among other reasons, less competition for alfalfa may be expected from timothy. For two-year stands, data indicate red clover and orchard grass or timothy mixture produce superior results on moderately acid soils, while a mixture of biennial white sweet clover and orchard grass or timothy is very satisfactory on slightly acid soils. Land in southern New England is too steep for tillage purposes and hence pastures should be permanent, according to the authors. Seedings for permanent pastures comprising red clover, timothy, Kentucky blue grass, Ladino clover, and wild white clover are recommended. Alsike clover, Ladino clover, and redtop or reed canary grass are better adapted for poorly drained soils. Lime and phosphoric acid are usually deficient on livestock farms, and potash gave a marked response on most species in a field where the soil had been impoverished by many years of mowing for hay. Where one-third or more of the stand is composed of legumes or if manure is available for top-dressing, the authors state nitrogenous fertilizers should not be required.

"Efficiency of Single and Double Restrictions in Randomized Field Trials with Cotton When Treated by the Analysis of Variance," Agr. Exp. Sta., Fayetteville, Ark., Bul. 326, Feb. 1936, O. A. Pope.

"Walnut Culture in California," Agr. Exp. Sta., Berkeley, Calif., Bul. 379, June 1924, Rev. Jan. 1936, L. D. Batchelor and O. Lee Braucher.

"Peach and Nectarine Growing in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 98, Mar. 1936, Guy L. Philp and Luther D. Davis.

"Transactions of the Peninsula Horticultural Society, 1935," St. Bd. of Agr., Dover, Del., Vol. 25, No. 5.

"Annual Report for the Fiscal Year Ending June 30, 1935," Agr. Exp. Sta., Gainesville, Fla., Wilmon Newell, Director.

"Feeding for Milk Production," Agr. Ext. Serv., Gainesville, Fla., Bul. 82, Apr. 1936, Hamlin L. Brown.

"Blight—A Non-parasitic Disease of Citrus Trees," Agr. Exp. Sta., Gainesville, Fla., Bul. 296, Apr. 1936, Arthur S. Rhoads.

"A Cover Crop Program for Florida Pecan Orchards," Agr. Exp. Sta., Gainesville, Fla., Bul. 297, May 1936, G. H. Blackmon and R. M. Barnette.

"A New Squash from Africa," Agr. Exp. Sta., Gainesville, Fla., Pr. Bul. 490, Apr. 1936, Geo. E. Ritchey.

"Grade and Staple Length of Cotton Produced in Georgia, 1928-35," Agr. Exp. Sta., Experiment, Ga., Cir. 107, Mar. 1936, N. M. Penny.

"Growing Tomatoes in Illinois, Problems in Producing for Market and Canning," Agr. Exp. Sta., Urbana, Ill., Ext. Cir. 451, Mar. 1936, W. A. Huelsen.

"Eighteenth Annual Report of the Department of Agriculture," St. Dept. of Agr., Springfield, Ill., Walter W. McLaughlin, Director.

"Twenty-fourth Annual Report of Purdue University, Department of Agricultural Extension," Purdue University, Lafayette, Ind., J. H. Skinner, Director.

"Flax as an Iowa Crop," Agr. Exp. Sta., Ames, Iowa, Bul. 344, Mar. 1936, Chas. S. Reddy and L. C. Burnett.

"Asparagus Investigations in South Louisiana," Agr. Exp. Sta., Baton Rouge, La., Bul. 270, Jan. 1936, W. D. Kimbrough.

"Summary Report of Progress, 1935," Agr. Exp. Sta., Orono, Me., Bul. 380, Dec. 1935, Fred Griffee, Director.

"Annual Report for the Fiscal Year Ending November 30, 1935," Agr. Exp. Sta., Amherst, Mass., Bul. 327, Feb. 1936, Fred J. Sievers, Director.

"Heavy Mulching in Bearing Apple Orchards," Agr. Exp. Sta., Amherst, Mass., Bul. 328, Mar. 1936, J. K. Shaw and L. Southwick.

"Alfalfa in Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 154, Jan. 1936.

"Seventy-fourth Annual Report of the Secretary of the State Board of Agriculture and Forty-eighth Annual Report of the Experiment Station," Lansing, Mich.

"Ornamental Trees," Agr. Ext. Serv., East Lansing, Mich., Ext. Bul. 160, May 1936, Charles V. Barr.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 18, No. 4, May 1936.

"Quadrennial Report of the South Mississippi Branch Experiment Station," Agr. Exp. Sta., State College, Miss., Bul. 310, Dec. 1935, J. C. Robert and S. R. Greer.

"Plant Propagation by Seedage, Cuttage,

Layerage, and Separation," Agr. Exp. Sta., Columbia, Mo., Cir. 191, Apr. 1936, T. J. Talbert.

"The Agricultural Extension Service, Missouri College of Agriculture; Annual Report for 1935," Agr. Ext. Serv., Columbia, Mo., Cir. 344, May 1936, J. W. Burch, Asst. Director.

"Feeding Turf Grasses on Lawns, Parks, and Recreation Fields," Agr. Exp. Sta., New Brunswick, N. J., Cir. 365, May 1936, Howard B. Sprague.

"Results of Bean Experiments on the Storrie Irrigation Project, Las Vegas, N. M.," Agr. Exp. Sta., State College, N. M., Bul. 236, Feb. 1936, Fabian Garcia and Shelby Utz.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXI, No. 180, May-June 1936.

"The Influence of Climate, Soil and Fertilizers Upon Quality of Soft Winter Wheat," Agr. Exp. Sta., Wooster, Ohio, Bul. 563, Mar. 1936, E. G. Bayfield.

"Factors Affecting the Yield of Kraut Cabbage in Ohio as Determined by a Survey and Cooperative Field Tests," Agr. Exp. Sta., Wooster, Ohio, Bul. 566, Apr. 1936, Cecil Wadleigh, H. D. Brown, and Robert Young.

"Root Crops," Agr. Ext. Serv., State College, Pa., Cir. 166, Feb. 1936, J. M. Huffington.

"Soybeans in Pennsylvania," Agr. Ext. Serv., State College, Pa., Leaf. 36, Nov. 1935, J. B. R. Dickey.

"Growing Early Vegetable Plants Under Glass," Agr. Ext. Serv., State College, Pa., Leaf. 38, Nov. 1935, W. B. Nissley.

"Control of Tobacco Wildfire," Agr. Ext. Serv., State College, Pa., Leaf. 39, Jan. 1936, W. S. Beach and O. D. Burke.

"Control of Broom Sedge," Agr. Exp. Sta., Knoxville, Tenn., Cir. 57, Feb. 1936, L. R. Neel.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 338, June 1936.

"Quality Barley—how to grow, how to handle," Agr. Ext. Serv., Madison, Wis., Cir. 278, Mar. 1936, B. D. Leith, H. L. Shands, and R. A. Moore.

"Growing Respberries & Blackberries in Wisconsin," Agr. Ext. Serv., Madison, Wis., Cir. 280, Mar. 1936, J. G. Moore.

"The Chinese Jujube," U. S. D. A., Washington, D. C., Dept. Bul. 1215, Apr. 1924 (Rev. Mar. 1936), C. C. Thomas.

"A Digest of Pasture Research Literature in the Continental United States and Canada," U. S. D. A., Washington, D. C., Jan. 1, 1936, A. J. Pieters.

Economics

Following the approval of the Spencer region in West Virginia as a soil conservation area, it was felt that a survey of the social and economic conditions existing within the area would be of considerable value in carrying out the work and serve as a basis for formulating measures of improvement as a result of work carried on under the program. A cooperative project was approved between the U. S. Department of the Interior and the West Virginia Experiment Station with the view of carrying out the above objectives.

The results of the study have been summarized by F. D. Cornell, Jr., in Bulletin 269, entitled "A Social and Economic Survey of the Spencer Soil-Conservation Area." The study presents an interesting cross-section picture of the social and economic conditions existing in the agricultural areas of this section of the United States. The Spencer region lies within the Appalachian plateau and the topography is rough and broken, with narrow ridges and V-shaped valleys. For the most part it is subject to erosion.

About 94 per cent of the farms in this area were operated by owners and in the majority of the cases were either secured by inheritance or purchase at the time of marriage. The two steps, farm laborer and tenant operator, which so many farmers go through in other sections of the country before becoming farm owners were practically eliminated in this section.

The number of farms and the total population of the section has decreased since 1900. The roads servicing the territory were mostly dirt and in poor condition. Most of the farms are located on dirt roads and more than one half of the farms were more than five miles from any market. Elementary schools and churches were fairly well distributed throughout the district; however high schools were not so easily accessible. Many of the farms were 10 miles or more from the nearest high school. A very small percentage of the operators and their wives had attended more than elementary school.

Few of the farms had modern conveniences, such as running water, bath, electricity, etc. It was found that only 20 out of 772 farm operators had not been reared on a farm. The average size of the farming area was 134.5 acres with a capital investment per farm of \$3,613.06 of which 85 per cent was represented by real estate. Only 18 per cent of the land area in farms was in crops, 59.9 per cent being in pasture and the other 19.9 per cent being in woods. Due to the fact that a large part of the crop production is on steep slopes, the majority of the work was done by hand labor, necessitating only a small amount of farm machinery.

Crop yields for the most part were very low and the average total farm receipts were \$387.35, of which 32 per cent came from non-agricultural sources. The average labor income per farm after interest on investment and other expenses had been taken out was a net loss of \$9.93. In many cases the income from the farm was not sufficient to furnish subsistence to the family, and 16 per cent of these families had found it necessary to apply for and obtain direct relief. Many others had augmented their income through C.W.A. and P.W.A. work relief.

The writer concludes that "with present incomes it is going to be difficult for a large number of these farmers to meet mortgage obligations and at the same time provide adequately for their families. . . . Some portions of the area have little prospect of ever yielding much more than subsistence from an agricultural standpoint. . . . Methods that must be employed in much of the area and the returns obtained from farming are not particularly alluring to the younger generation. . . . Farmers in the Spencer area are not now obtaining sufficient income to maintain and conserve soil fertility and enjoy with their families a desirable standard of living."

"Outlook for Georgia Agriculture in 1936," Agr. Ext. Serv., Athens, Ga., Bul. 455, Dec. 1935, Kenneth Treanor.

"Illinois Farm Economics," Agr. Ext. Serv., Urbana, Ill., Nos. 12 and 13, May and June 1936, H. W. Mumford, Director.

"Report of the Kansas State Board of Agriculture for the Quarter Ending December 1935," St. Bd. of Agr., Topeka, Kans., Vol. LIV, No. 216-B, J. C. Mohler, Secretary.

"The Kansas Agricultural Outlook for 1936," Agr. Ext. Serv., Manhattan, Kans., Ext. Cir. 122, Jan. 1936, H. Umberger, Director.

"Farm Prices and Quality of Missouri Cotton," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 233, Jan. 1936, L. D. Howell, John S. Burgess, Jr., and F. L. Thomsen.

"Wisconsin Agricultural Statistics," Wis. Crop and Livestock Reporting Service, State Capitol, Madison, Wis., Bul. 150, Walter H. Ebling, E. S. Kimball, and W. D. Bormuth.

Oregon Onions

(*From page* 17)

long. I did not measure them. They were too long. The field was about 75 acres in size. The onion bulbs for seed raising are placed in shallow furrows, four to five inches deep, onions four to five inches apart. It required 100 bushels of bulbs for an acre. Labor used is anyone that wants a job. It's all piece labor, 8 cents a bushel for planting. A good worker earns from \$1.60 to \$3 a day, and it is a back-breaking job.

At harvest time the heads of the onion stalks are cut off. In these heads are found the seed. The heads are stored and dried in the onion storehouse, and when dry are threshed. The seed is fanned, and in some cases partly water-cleaned. The product obtained as I saw it, felt of it, and tested it in several ways is a heavy, plump, black, choice seed, that seemed to me had much vitality and should give results.

Corn Needs Man Just as Much as Man Needs Corn

Students of genetics in the United States Department of Agriculture call maize, or Indian corn, "the most completely domesticated grain, quite incapable of maintaining itself without man." None of the Old World cereals such as wheat, barley, or rice has reached this high degree of dependence on human care, says J. H. Kempton, Bureau of Plant Industry.

"How, when, and where corn was domesticated are three questions often asked but never answered," he says. "Though there is corn of primitive people, there is no such thing as primitive corn. The oldest ears known are as highly developed botanically and as completely divorced from wild plants as the best of our varieties.

"The most ancient corn known is that of the pre-Incas of Peru. Well preserved ears in the graves of these people duplicate the varieties grown in the same region today. A thousand or more generations have made no changes. Charred corn from the Mound Builders of the Ohio Valley resembles corn grown by Indians in the Middle West."

The nearest relative to Indian corn known to botanists is the grass generally known by its Aztec name of teosinte. But if corn developed from teosinte, Mr. Kampton says, the manner of development can only be surmised. It is believed, however that the advance of genetic knowledge may unravel the mystery of maize.

Versatile Soybean Makes Tasty Food When Cooked

It all depends upon taste—so soybeans are being cooked and tasted in the United States Department of Agriculture to determine which varieties may be used as edible green beans.

The green beans resemble young, tender lima beans, but they have a richer, more nutty flavor. The pods, too tough to be eaten as food, may be easily shelled after a 3-minute boiling.

About 60 edible varieties were brought from Japan and planted at the Department's experimental farm at Arlington, Va., and at several State experiment stations. Each week, as they ripen, a number of varieties are cooked and tasted.

From 75 to 170 days are required for the green beans to mature. They differ markedly in flavor, ease of cooking, and respond differently to soil and climatic conditions. A number of very promising early, medium, and late vegetable types for regions adapted to the soybean have been found. The Hahto, a medium variety, is the only green vegetable variety handled by growers. The Rokusun, a late type, and two or three early Japanese varieties should be in the hands of growers and seedsmen next season.

Common varieties also may be used as green vegetable beans, but they are smaller, do not cook as easily, and usually lack the distinctive flavor.

As green vegetable beans, soybeans should be picked when they reach full size and are still green and succulent. They may be cooked about the same way as fresh lima beans or green peas. Many persons prefer to boil them in salted water from 20 to 30 minutes.

Fertilization and Care of Peat Soils

(*From page* 22)

remain—therefore, the inertness of raw peat and the slowness of soil-forming changes after drainage. The fertilizer and management program must give due consideration to these fundamental facts. This done, peat areas that are now more or less waste may gradually become prized crop-producing centers, and the returns from peat lands already under culture may be boosted to higher yields and more profitable production levels.

Dry-weather Profits from Garden Irrigation

(*From page* 10)

farthest pipe was 1¼ inches, next 1½ inches, and nearest the piston-type pump a 2-inch pipe, the discharge was through a 2-inch pipe into 12-ounce porous canvas hose. These three sand points furnished water for 130 hours of continuous pumping, and seemingly the supply was inexhaustible. The power used was the farm tractor. This shows that almost any kind of power used proved very economical.

Growers this year paid for their irrigation outfits from the added profits due to watering when water was needed. What might be the trend for another year is rather hard to say, but the grower should first consider the cost and the crops that he will grow and then weigh the normal profits under ordinary years. Intensive planting of good paying crops should also be included in the garden plan.

Fig. 3—The furrow method of irrigation. Eight rows were irrigated at one time through four 4-inch discharge openings.

Mr. Ben Qualifies as Truck "Planter"

(*From page* 19)

financially independent growing this silky staple for the French and Belgian lace-makers, were reduced to a state of panic. Their living had been taken away from them by a pesky bug. "What can we get to take the place of our cotton?" was the thought on everyone's mind. For a year or two they cast about rather hopelessly, but finally settled down to vegetable raising. A great many growers had already shifted to these crops, partially from economic reasons, and partially because their lands were not suited to the culture of sea island cotton.

Mr. Seabrook had considered the probability of the weevil's relentless march and the possibilities of making some money from green crops, so he joined the parade and went to it. He applied his hard-earned principles of crop feeding to these crops with marked success. Spinach, beans, squash, potatoes, and tomatoes were planted on lands which had formerly grown the "sea island." Doubts which arose in his mind as to whether or not the soils were too light for vegetables, vanished after a crop or two, and he settled down to the business of learning all over again.

Leaving the very lightest lands for cowpeas and velvet beans, he planted the others. What fertilizers to use, what soils would suit various crops, what plant foods to use, all these were questions which had to be answered. His neighbors, and he also, had begun using a 5-7-5 analysis mixed fertilizer. Why, they didn't know, but they were satisfied. They were making good crops, but Mr. Ben figured that good crops could be made better, so he again asked his fields to show him, as they had shown him their needs with the sea island cotton.

He experimented with additional nitrate of soda, kainit, muriate of potash cottonseed meal, and other fertilizing materials. On some crops he found that a mixture of 100 pounds of nitrate of soda worked wonders, on another crop he used the soda and 100 pounds of muriate of potash and found that it was still better. The results from still another crop showed him that 100 pounds of muriate was just "what the doctor had ordered" and he didn't need the additional soda. So, after several years of try-outs, he made up his mind that no matter what the vegetable crop he planted, he must be long on potash to get "Seabrook Quality" into the harvest baskets.

Today, he is known throughout South Carolina as one of the best tomato growers in the state. His crop gets annually from 1,500 to 2,000 pounds of 4-8-10 fertilizer per acre. His reputation on other crops is likewise an enviable one. Buyers in the big markets know what "Seabrook Quality" is and call for his shipments. His lima beans get a ration of 800 to 1,000 pounds of 3-8-8, his spinach is fed on 1,800 to 2,000 pounds of 8-7-8, and other minor crops are similarly fertilized. These analyses may seem strange to farmer folk in other sections of the country, but in coastal South Carolina many growers are thinking independently and are calling for the plant foods they feel that they need to make quality crops.

W. B. Seabrook, "Planter," Gentleman of the old South, is still in the game. Instead of being just another truck farmer, his knowledge of plant-food requirements, of soils, and of fertilizer materials has elevated him to the rank of "Truck Planter" par excellence. His fields are always a joy to behold, in growing season or at harvest time, and we trust that some day you who read this will be fortunate enough to make the acquaintance of our good friend "Mr. Ben."

Chrysanthemums Thrive in Sand Culture

(*From page* 8)

about a marked reduction in the number and size of bloom.

One of the most outstanding features of these experiments was the effect of the feeding on the color of the bloom. In one variety which should normally produce bloom ocherous orange in color, the feeding of excess nitrogen resulted in the production of bloom Empire yellow in color. The same result was produced by a reduction in the amount of potassium fed or by increasing the amount of phosphorus in the solution. Further increases of potassium intensified the ocherous orange, producing a more deeply pigmented bloom.

This same effect on color-intensity was noted with another variety normally producing pink blossoms. With high nitrogen feeding, blooms almost pure white in color were produced;

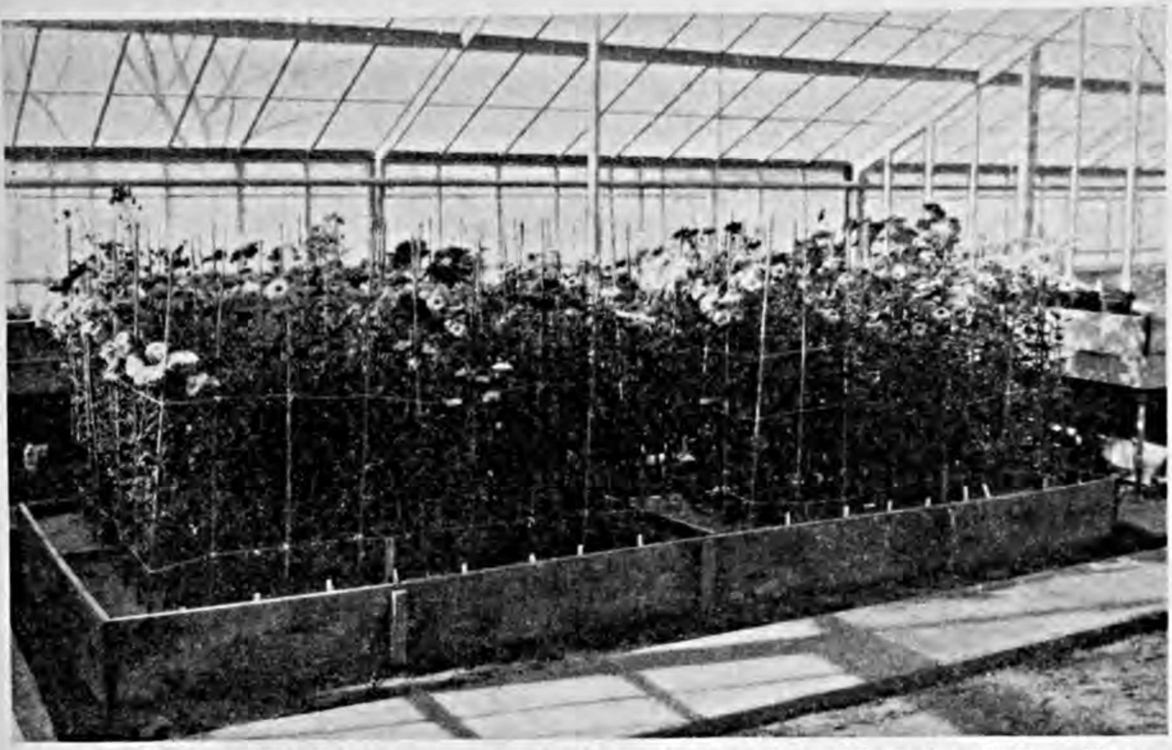


Fig. V—A bed of chrysanthemums grown in river sand and fed nutrients in solution. Most of the soil is removed from the roots before transplanting.

the same effect was produced with high phosphorus feeding. On the other hand, increasing the amount of potassium intensified the pink to a much deeper shade. In both varieties the production of a large number of blooms of good size and deep color was made possible by increased feeding of nitrogen accompanied by high feeding of potassium. It would appear that the development of a suitable intensity of bloom-color in chrysanthemums is dependent on an adequate supply of potassium, not only in total amount but in its relative concentration to nitrogen or phosphorus. The amount of nitrogen fed should not exceed twice that of potassium.

Fig. V shows a bed of chrysanthemums grown in river sand and fed nutrients in solution. Before transplanting into sand most of the soil is removed from the roots. Until the plants are about half-grown, nutrient solution is applied at the rate of ¾ of a pint per plant or approximately one gallon per square yard once a week. The application of solution is then increased to 1½ pints of solution per plant or approximately two gallons of solution per square yard once a week. In addition to the nutrients the plants are watered when necessary but do not require any appreciable increase in attention over soil-grown plants. In order that harmful accumulation of salts does not occur, the bed is thoroughly drenched with water at biweekly intervals. The frequency of solution applications may be regulated to some extent by weather conditions, being made less frequently during dull, cloudy weather.

The following amounts of salts are dissolved in 50 gallons of water:

Magnesium sulphate 247.2 grams or approximately 8.7 oz.

Potassium phosphate (monobasic) 134.5 grams or approximately 4.75 oz.

Calcium chloride 275 grams or approximately 9.7 ozs.

Potassium nitrate 300.6 grams or approximately 10.5 oz.

Ammonium nitrate 675 grams or approximately 23.75 oz.

If a necessity for iron is indicated by the yellowing of the foliage, a few drops of a one per cent solution of ferric chloride applied when watering will supply ample. It will be noticed that this solution does not contain any of the minor elements, such as boron or manganese. Apparently, enough of these elements for the healthy growth of the chrysanthemum occurs in the sand or as impurities in the salts employed. However, if successive crops are grown on the same sand, deficiencies of these elements might be a factor which would have to be considered. Plants grown by this method were strong and vigorous with excellent flower production, and they were likewise free from foliage mottling and burning.

From a practical or commercial standpoint it was considered that the use of nutrients in solid form might have more appeal. Fig. VI shows a bed of chrysanthemums grown in river sand and fed nutrients in solid form, using sand to spread the fertilizer evenly. Fertilizers applied in the solid form are less quickly available to the plant than when applied in solution, so that it is necessary to make an application of fertilizer some 10 days to two weeks before setting out the plants. During this period the sand is kept moist but not watered to such an extent that leaching of the salts would occur. Before transplanting into sand most of the soil is removed from the roots of the plants. In order that the fertilizer may be applied evenly, it is thoroughly mixed with a liberal quantity of sand. Applications of fertilizer are made every three weeks at the rate of one oz. per two square yards. Watering is given when necessary and is also supplemented by a thorough drenching or leaching before each application of fertilizer.

The following fertilizer formula was used to make up approximately 25 pounds of fertilizer:

Ammonium nitrate 11 lb. 14 oz. or 19 lb. 13 oz. of ammonium sulphate.

Magnesium sulphate 5 lb.

Muriate of potash 4 lb. 14 oz.

Superphosphate (16%) 3 lb. 3 oz.

A few drops of a one per cent solution of ferric chloride used occasionally when watering will provide all the iron necessary.

Plants grown in this manner proved entirely satisfactory. They obtained excellent growth and vigor with no foliage disfigurement, and there was a large production of fine quality bloom.

Fig. VI—Chrysanthemums grown in river sand and fed nutrients in solid form, using sand to spread the fertilizer evenly.

Southern Peaches Need Potash

(*From page* 15)

pH values. The surface soil under the trees where most of the ammonium sulphate was applied and where the sulphur sprays eventually came in contact with the soil tested pH 4.70 to pH 5.30, while the subsoil ranged from pH 4.15 to pH 5.30. The soil reaction of the surface soil from the middle of the rows between the trees ranged from pH 5.70 to pH 6.10, and the subsoil from pH 5.00 to pH 5.30.

Since this orchard had been fertilized with practically nothing but nitrogen, carefully planned demonstrations were set up to demonstrate if possible the influence of nitrogen alone as compared with the combination of nitrogen plus phosphorus, potassium, and dolomitic limestone, and with the combination of nitrogen plus phosphorus, potassium, and basic slag. An area of approximately 2½ acres in the orchard was set aside for these demonstrations in early October 1934, before the leaves were shed. These demonstration plots were in a section of the orchard where the abnormal condition, as indicated by the foliage, was severe, and the affected trees were fairly uniformly distributed over the three plots.

Detail information on the fertilizer treatments of the three demonstration plots is given in Table I. Plot 1 received nitrogen (total for the season) at the rate of 66.66 pounds per acre. (This is equivalent to 417 pounds of nitrate of soda or 324 pounds of sulphate of ammonia.)

Plot 2 received per acre rates of: Nitrogen (N), 42.67 pounds; phosphoric acid (P_2O_5), 126.36 pounds; potash (K_2O), 116.64 pounds; and, dolomitic limestone, 1,080 pounds. (This is equivalent to: 267 pounds of nitrate of soda or 208 pounds of sulphate of ammonia, 790 pounds of 16 per cent acid phosphate, and 233 pounds of muriate of potash.)

Plot 3 received per acre rates of:

TABLE I.—FERTILIZER TREATMENTS ON DEMONSTRATION PLOTS

Date of Application	Materials and analyses of each	Pounds of materials per tree	Pounds of materials per acre	Lbs. nutrients per acre: Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)
	Plot 1 (46 trees)—Nitrogen only:					
1935						
Mar. 14	Sulphate of ammonia 20.5%	2	216	44.44	0.0	0.0
Mar. 25	Sulphate of ammonia 20.5%	1	108	22.22	0.0	0.0
		Total		66.66	0.0	0.0
	Plot 2 (101 trees)—Nitrogen plus phosphorus, potassium, and dolomitic limestone:					
1934						
Oct. 30	Dolomitic limestone	10	1,080	0.0	0.0	0.0
Oct. 30	Acid phosphate 16%	3	324	0.0	51.84	0.0
Oct. 30	Kainit 20%	2	216	0.0	0.0	43.20
1935						
Jan. 11	Kainit 20%	1	108	0.0	0.0	21.60
Jan. 11	Nitrate of soda 14.81%	½	54	8.0	0.0	0.0
Mar. 14	Nitrate of soda 14.81%	1	108	16.0	0.0	0.0
Mar. 25	Acid phosphate 16%	4	432	0.0	69.12	0.0
Mar. 25	Muriate of potash 48%	1	108	0.0	0.0	51.84
Mar. 25	Nitrate of soda 14.81%	½	54	8.0	0.0	0.0
Mar. 25	Sardine meal 9.88-5-0%'s	1	108	10.67	5.40	0.0
		Total		42.67	126.36	116.64
	Plot 3 (91 trees)—Same as Plot 2, except 756 pounds of basic slag substituted for the dolomitic limestone.					

Nitrogen (N), 42.67 pounds; phosphoric acid (P_2O_5), 126.36 pounds; potash (K_2O), 116.64 pounds; and basic slag, 756 pounds. (This is equivalent to: 267 pounds of nitrate of soda or 208 pounds of sulphate of ammonia, 790 pounds of 16 per cent phosphate, and 233 pounds of muriate of potash.)

Figs. 6-7—Excellent rye cover crop resulted on the demonstration plot receiving a complete fertilizer and limestone (left), while a very poor stand grew on the plot fertilized with nitrogen only (right). Weight of green matter on the former plot was 8,076 lbs. per acre in comparison with 653 lbs. for the latter plot. Photo March 25, 1935.

On October 30, 1934, all three of these demonstration plots were planted to rye for a cover crop, seeded at the rate of one bushel per acre. This rye was planted after the fertilizer materials in Plots 2 and 3, as shown in Table I, were applied broadcast and disked into the soil. Soon after the planting of the rye, rains aided in bringing the rye up to a good stand.

This cover crop grew very satisfactorily on Plots 2 and 3, whereas on Plot 1, where no phosphoric acid or potash was applied, the rye commenced dying soon after it came up.

The first results secured from these demonstrations were on the growth and yield of rye. There was no appreciable difference in growth in rye on Plots 2 and 3, which indicated that during the first season there was no significant difference between dolomitic limestone and basic slag insofar as these materials influenced the growth of the rye cover crop. Soon after the rye in Plot 1 came up, the effect of the lack of available phosphoric acid and potash was manifested. Most of the rye in this plot died and that which did not die made very poor growth (see Fig. 7). The yield of green matter from this plot, as determined by sample areas of 100 square feet which were cut and weighed, was 653 pounds per acre on March 25.

On Plots 2 and 3, which had complete fertilizer and lime, an excellent rye cover crop growth was secured (see Fig. 6). The average yield on March 25 (the date of disking down the rye) was 8,076 pounds per acre.

Plots 2 and 3 produced during the growing season of 1935 normal, healthy, and rank foliage on the trees. In these plots not a single tree developed the typical characteristic abnormal foliage symptoms that were so generally displayed on the same trees the previous summer (1934). However, in Plot 1, which was fertilized with nitrogen only, as has been the orchard fertilizer practice for many years, the characteristic symptoms which have been described were reproduced in 1935 in a more acute form. Figure 1 shows representative peach leaves, illustrating small size, unhealthy color, and "scorching" of margin and tip of leaf with nitrogen fertilization only; and large size and healthy color and no "scorching" with nitrogen plus phosphorus, potassium and dolomitic limestone fertilization. For an excellent illustration of a tree with dense and healthy foliage and no "scorching," see Figure 4. This tree was fertilized with nitrogen, phosphorus, potassium, and dolomitic limestone. Figure 5 shows a tree with an abnormal foliage condition in an advanced stage which illustrates scant, unhealthy foliage, with leaves yellow and badly scorched. This represents a typical tree in Plot 1, which was fertilized with nitrogen only, yet it was given 56 per cent more nitrogen than was the tree shown in Figure 4.

It will be noted by again observing Figures 4 and 5 that cowpeas failed to grow in Plot 1 fertilized with nitrogen only.

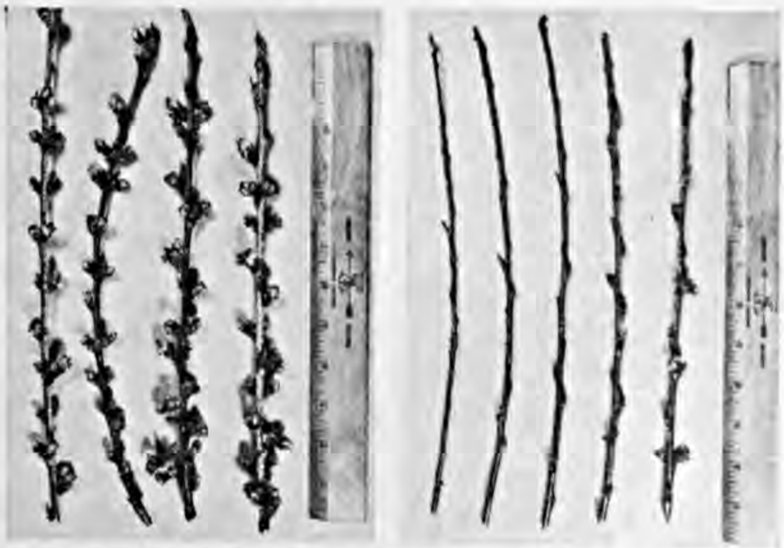
These demonstrations, therefore, even though conducted for only one year, do very clearly indicate that nitrogen only is an improper fertilization practice in the Tinsley peach orchard, and that significant responses were obtained from the addition of phosphorus, potassium, dolomitic limestone, and basic slag.

Peach growers appreciate the importance of securing an abundance of healthy leaves for the growth of ample new wood and the development of an abundance of strong fruit buds. Figures 8 and 9, well illustrate the effectiveness of phosphorus, potassium, and limestone in addition to nitrogen in the production of fruit buds, as compared with the nitrogen only fertilization in the Tinsley orchard.

As was to be expected, trees on Plots 2 and 3 produced very satisfactory new wood and fruit buds. Trees of Plot 1 fertilized with nitrogen only produced very inferior new growth and a relatively small number of fruit buds, and these buds apparently were not as large and plump as normal buds should be. The new wood growth on these trees (even though the trees received 56 per cent more nitrogen than did the trees of Plots 2 and 3) was scant and of relatively small diameter measurement.

The development of the fruit was probably the most striking phase of these fertilizer demonstrations. The impressions of hundreds of peach growers and others upon walking through these demonstrations at and just before harvesting of the fruit were that Plots 2 and 3 produced practically 100 per cent of fruit of desirable marketable sizes, as contrasted with almost 100 per cent of fruit of undesirable marketable sizes on Plot 1 fertilized with nitrogen only.

Estimates of the percentage of normal crop for each tree in all three plots were made before harvesting, and variations ran from less than 10 per cent of normal to about normal. These variations were due to the previous condition of the trees in 1934, with its influence upon subsequent development of buds and, finally, the setting of crop in 1935. On account of this variation in number of peaches,



Figs. 8-9—The fruit wood on the left resulted from applications of a complete fertilizer plus limestone and showed heavy bud development, while that on the right with nitrogen only showed a scarcity of bud development. Photo March 27, 1936.

or size of crop per tree, records were not taken in 1935 on the entire production of the trees in each plot. However, accurate records were taken from one representative tree each of Plot 1 and Plot 2 in order to secure some preliminary information on the sizes and yield of fruit. Table II presents the yield records from these trees.

superior sizes of peaches obtained from the tree fertilized with nutrients in addition to nitrogen.

A comparison between the size and weight of peach and pit under different fertilizer treatments also was made. With nitrogen only the average weights were: Peaches, 2.39 ounces and pits, .25 ounce; while with complete fertilizer and limestone the average weights were: Peaches, 5.21 ounces and pits, .37 ounce. It is evident that there is a relationship between the size of pits and the size of peaches (small pits and small peaches, large pits and large peaches). This is significant when we realize that the pit in the Elberta peach is formed six to eight weeks before the peach is ripe.

TABLE II.—YIELD RECORD FROM DIFFERENT FERTILIZER TREATMENTS

Size	Nitrogen (1 tree)		Nitrogen, phosphorus, potassium and dolomitic limestone (1 tree)	
	Number of peaches	Pounds of peaches	Number of peaches	Pounds of peaches
Under 1¾″	255	28.0	0	0.0
1¾ to 2″	277	46.0	11	1.75
2 to 2¼″	97	20.0	65	15.0
2¼ to 2½″	0	0.0	234	69.5
2½″ and up	0	0.0	301	113.0
Totals	629	94.0	611	199.25

It may be seen in Table II that the trees in the two plots had practically the same number of peaches—629 in one case and 611 in the other. However, the tree treated with nitrogen only produced 94 pounds of peaches with only 20 pounds that were of 2-inch minimum size, while the tree from Plot 2 which had complete fertilizer and limestone produced 199¼ pounds of peaches with 197½ pounds that were of 2-inch minimum size. In other words, the tree receiving the nutrients in addition to nitrogen produced almost 10 times as many peaches of desirable marketable sizes as did the tree treated with nitrogen only.

It is interesting to note that with the nitrogen only treatment 84.6 per cent of the peaches were under two inches in diameter (undesirable marketable sizes), while with nitrogen, phosphorus, potassium, and dolomitic limestone 98.2 per cent of the peaches were two inches or more in diameter, with 49.2 per cent even 2½-inch minimum diameter. Figure 10 strikingly illustrates the greater yield and

Claims were made that the flavor of the peaches from the trees completely fertilized was much superior to the flavor of the peaches from the trees fertilized with nitrogen only. Professor J. H. Mitchell, chemist of the Experiment Station, kindly consented to run some fresh peach analyses. Table III gives the results of these chemical analyses.

These analyses show that the fruit from the completely fertilized trees contained 21.7 per cent more total sugars and 31.7 per cent more sucrose than did the fruit from the trees fertilized with nitrogen only. These samples of fruits were taken from peaches of the trees from which the yield records were secured, and these

TABLE III.—CHEMICAL ANALYSIS OF FRESH PEACHES

Fertilizer treatments	Total sugars	Sucrose	Reducing sugars
N. only	5.30%	1.42%	3.80%
NPK & limestone	6.45%	1.87%	4.43%

peaches analyzed were not tree-ripened, but were picked in the "hard ripe" stage, the same as for commercial shipments. Had they been tree-ripened, the percentage of sugar probably would have been higher.

For the proper development of cover crops, and the foliage, twigs, fruit buds, and fruit of trees in the Tinsley orchard, it is clearly apparent that the practice of applying nitrogen alone as a fertilizer is improper. "Leaf scorch" is a deficiency of potash; and since "leaf scorch" has been commonly observed in South Carolina in many orchards, liberal applications of potash should be made regularly by all peach growers.

Until more complete information is available, the following recommendations are made to the peach growers of South Carolina:

Apply the proper amount of dolomitic limestone or basic slag to correct excess soil acidity and to supply calcium and magnesium as plant nutrients. For sandy soils, basic slag is especially desirable because of the minor plant nutrients which it contains in addition to calcium. For satisfactory growth of cover crops and peach trees it is necessary to correct excess soil acidity. Do not apply limestone or basic slag to soils already testing pH 6.0 or above as serious trouble is caused by excess liming.

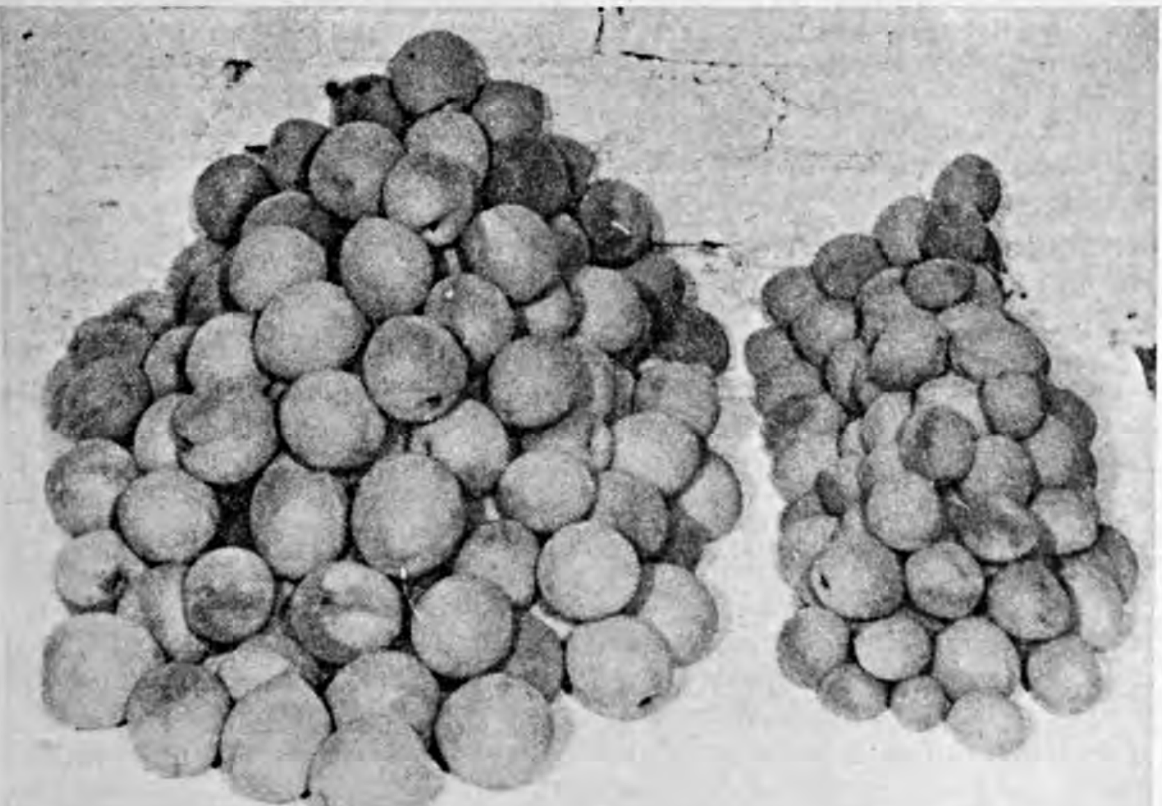


Fig. 10—Harvest of one day, July 29, 1935. Left: From one tree fertilized with nitrogen, phosphorus, potassium, and limestone—135 peaches, 42.75 lbs., 5.06 oz. av. wt. per peach, 98.52% of 2-in. minimum size. Right: From one tree fertilized with nitrogen only—86 peaches, 14 lbs., 2.6 oz. av. wt. per peach, 26.74% of 2-in. minimum size.

Plant in bearing and non-bearing orchards each fall a winter crop of rye or Austrian peas; and in non-bearing orchards a summer cover crop of velvet beans or pure brabham peas (or Crotolaria on sandy soils). No discussion will be given here of the many important functions of soil organic matter or humus, that good cover crops would supply orchard soils.

The following fertilizer treatments are recommended:

1. Fall application for bearing and non-bearing trees: 300 pounds of acid phosphate (16%) per acre; 100 pounds of muriate of potash (50%) per acre.

These amounts of materials should be mixed and applied broadcast (from tree to tree in all directions) and disked or plowed thoroughly into the soil during late September or early October before the planting of Austrian peas or rye cover crops. *Note:* On very poor soils (low in nitrogen) it probably would be desirable to also add about 50 pounds of nitrate of soda (or its equivalent) per acre to the fall mixture shown above.

2. Spring application for bearing trees: 100 pounds of muriate of potash (50%) per acre; 100 pounds of nitrate of soda (19%) per acre (or equivalent amount of nitrogen from other suitable sources).

These materials should be mixed and applied broadcast in late February or early March. If a heavy growth of Austrian peas be produced and disked into the soil, probably no additional nitrogen would be needed. But if rye cover crop be produced, or no cover crop at all, then additional nitrogen should be given as needed. In the past, bearing orchards with no cover crops probably were given on the average the equivalent of three pounds per tree, or 300 pounds per acre, of nitrate of soda.

3. Spring application for young non-bearing trees: The same fertilizers as suggested above for bearing trees are recommended, but the amount should be decreased in proportion to the age of the trees to avoid injury or even killing of trees. The spring applications for young trees should not be broadcast (from tree to tree in all directions) but should be scattered reasonably near the trees, within reach of the roots.

Gas Gadding

(*From page 5*)

tractors and gang plows. Of course one doesn't always have to go a mile off that line of modern marvels to get stuck in the mud, but now that the commercial travelers and pleasure-seekers are taken care of perhaps we can finish the job for the other taxpayers and make satisfaction unanimous. Let's not make the error of making it convenient for folks to go from Maine to California in a week by motor and then overlook and neglect our chances of visiting a sick neighbor without using a caterpillar tractor or a stone-boat. We can overdo this business of overcoming provincialism.

In scanning the history of road-making in America, I detect two ironies worth passing on. First, the farmers once hated and feared the automobile and discredited better roads because of selfish motorists; and second, the steam railroads once boosted for improved highways in every state, and now they find keen competition using routes kept up at public expense. I quote our own state highway engineer of thirty years ago:

"There is a strong prejudice in many parts of the state against the building of good roads, because as soon as such roads are built automobiles drive the farmers off and compel them to use the back roads. The auto is here to stay, and before long they will be adopted by farmers themselves just as the bicycle has been. But there are unfortunately too many road hogs who think it is a great joke to scare some staid farm horse into jumping the fence and smashing the farmer's rig. Something must be done by the state to protect the farmers so that roads will be safe to travel upon after they are built or we will not have any comprehensive program for highway improvement."

IN A report of 1906, a statement appears that "railroads have been so much interested in building of roads that they have sent out experts and trains of machinery to build sample roads in districts along their lines. Good roads would mean an increase in railroad traffic of several hundred per cent." Now the railways get their best business when winter snows blockade the highways. Such is life, with or without virtue of constitutional privilege! In those days three decades ago, railroad magnates had to argue with farmers to get them het up for better roads and farmers wanted every motorist consigned to hell-and-gone. I guess they almost wrote party platforms on those issues, too; but wouldn't they look gosh-awful ornery today? What the people want predominates. You can't talk 'em out of real progress. Maybe some of these summer speeches of 1936 protesters will pan out that way.

THE sum total of our local lanes under permanent improvement now constitutes our national trunk lines of super-luxury private travel. Over the painful miles that the old conestoga wagon creaked we now glide smoothly, and we kick if there is a dip that spills our ice-cream cones. But if the states had not grabbed fast hold of the road business we would still be making inches instead of miles, and an entirely revised system of cuss words would be necessary.

New Jersey and Vermont take rank as first states to set up highway departments, offering tentative and feeble aid, amid resentment, to county boards for better roadbeds. By 1900 Massachusetts, New York, Connecticut, and Maryland had come to the pioneer rescue of the traveler, who usually became mired within a mile after he left the wood-block pavements of the city. It was quite a novelty to put engineers to work on county road systems, using "bribery" from state taxes to pay a third of the cost. Most of the counties still stuck to rollicking labor by adjacent farmers in what was regarded as a "picnic mixer" when farm work was slack.

THEY stuck rigidly to section lines regardless of drainage or hills. They heaped dirt, weeds, grass, and brush in a sort of windrow in the center of the roads. Grades and foundations and surfaces meant nothing. Political appointment for short terms by county commissioners put the town road boss in the padrone's position with his neighbors. He was easy on some poll taxers and hard on others, depending how they voted. He knew about as much about real highway construction as I know about the solution of the public debt. When one road tinker lost his job in an election upheaval another rival started in and tore up every mile previously botched together and laid a worse one.

Just about thirty years ago the state control idea got going west of the Alleghanies. It had a tough time of it out here at that. They said it was "regimentation" and probably it would have been dubbed "brain trusting" if there had been so many brains those days to talk about. To pay in cash for making places over which to send kids to school, when they ought to walk like Abe Lincoln, was a plain case of snooty interference with personal rights. Road-making cooperatively was probably the first instance where local pride and isolation gradually found it paid in the long run to surrender and become a real portion of an American state. From that starter it was easy to broaden out and get federal aid, but we need not introduce such a painful subject at such a critical juncture when people are making up their minds against November. State highway aid also marks the close of an epoch in our agricultural policies. Before that era farmers adhered to the philosophy of the hobo—that it always paid to "work it out" instead of paying cash for doing it right.

While the farmer road-botchers stuck to section lines or the easiest grades, the railways didn't. The consequence was a number of hairpin turns and dangerous junction points. An Iowa publisher familiar with locations south of Des Moines once showed me several re-located lines of rural highways of that nature where recent state-federal-local funds with competent engineering have taken the crazy, break-neck, hidden hazards out of country journeys. Now, if we could succeed by careful driving in reducing the smashes on straight-away avenues there wouldn't be so many widows and orphans in the wake of peaceful travel.

BEFORE they hasten to economize on auto fuel made with corn alcohol let them find a speedy way to keep the alcohol away from the front seat occupants. This only shows that social control will be of more value to gas gadders than scientific progress. Savings in mileage and motor cost are not so vital as saving of human life.

When the followers of Kit Carson and of Ezra Meeker hit the lonesome, tribal-haunted fastness over unknown paths of peril, history records them as heroes. Yet today countless confident families start overland with demons more cruel and stealthy lurking on the concrete vistas ahead. Danger lies as much or more perhaps in luxury and ease of motion than it once did in trackless wastes and sheer privation. So far lax laws or illustrated horror stories have not reduced the casualties.

ABOUT the only handicap to the farmer in this motor age of ours lies in the fact that he cannot tote tons of oats to town for drayhorse consumption and haul back loads of manure from the livery stables. But this is a minor adjustment, after all, and one that is hardly missed by the rising generation on the farm, who prefer shorter hauls for such a pungent commodity.

Thanks to the motorized rural mail, the farmer gets his newspaper as quickly and as regularly as the business man in town; and it takes him but half a jiffy to jump in his car thereafter and punish the local editor for fancied aspersions. Only he won't use the traditional horse whip any more. It's more apt to be a tire wrench!

The American farmer's only distinguishing mark from that of his city relative these days is in his coat of tan, and even that is being imitated by urban vacationists and in beauty shops. This amalgamation of rural, village, and metropolitan types into the average alert American, with nary a clue for the Hawkshaws, is as much due to gas gadding as to the improvement of educational facilities at school. And it's a college the whole family can attend together if the bus is big enough!

Perhaps when there is more than one car to every five persons as we now boastfully claim, as compared to one car for every thirty in England, we shall be ready to forget state pride and prejudice, and really become residents of the U. S. A.—that is, if we keep our tires repaired, our heads clear, and our brakes working!

A FRIEND INDEED

"Sir, I wonder if you'd help a girl in trouble?"

"Sure, what sort of trouble do you want to get into?"

"I hear that Admiral Byrd took his dogs to the South Pole with him."

"Yes. I understand it was really the dogs that first discovered the pole."

REALISTIC

"Smell anything, grandmother?" asked the youngster who was lying on the floor drawing.

Grandmother assured him she did not.

The young artist gave a few finishing touches and repeated his question. Grandmother sniffed the air, and again declared she smelled nothing.

"Well," said the boy, "you ought to, I have just drawed a skunk!"

Dad's theory of relativity is . . . don't let 'em live with you.

Villager to Editor: "Do you think you boosted circulation by giving a year's subscription for the best peck of potatoes raised in the country?"

Editor: "Maybe not, but at least I got four barrels of samples."

An old lady, while on a vacation in the country, heard somebody say the mails were irregular. "Just like in my young days," she said. "You can't trust none of them."

ON ACCOUNT OF

"John, I bought some sheets, pillow cases and blankets today."

"What about it, dear?"

"Shall I put them down in my budget book as cover charge or overhead?"

Old Lady (to street car motorman): "Please, Mr. Motorman, will I get a shock if I step on the track?"

Motorman: "No, lady. Not unless you put your other foot on the trolley wire."

NEW ANGLE

A school teacher trying to impress her class with the destructive effect of alcohol, procured two earth-worms, one of which she dropped in a bottle of alcohol and the other into a bottle of water.

Next day the worm in alcohol was dead; the one in water, still alive.

"Now children," she said primly, "you see what happened here. What do you think alcohol does to a man?"

Silence and deep thought—maybe—by children. At last one youngster hazarded.

"Well, he wouldn't have worms, that's sure!"

Better Crops WITH PLANT FOOD

October 1936 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*
Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER TWELVE

Table of Contents, October 1936

American Potash Institute, Inc.
Investment Building, Washington, D. C.

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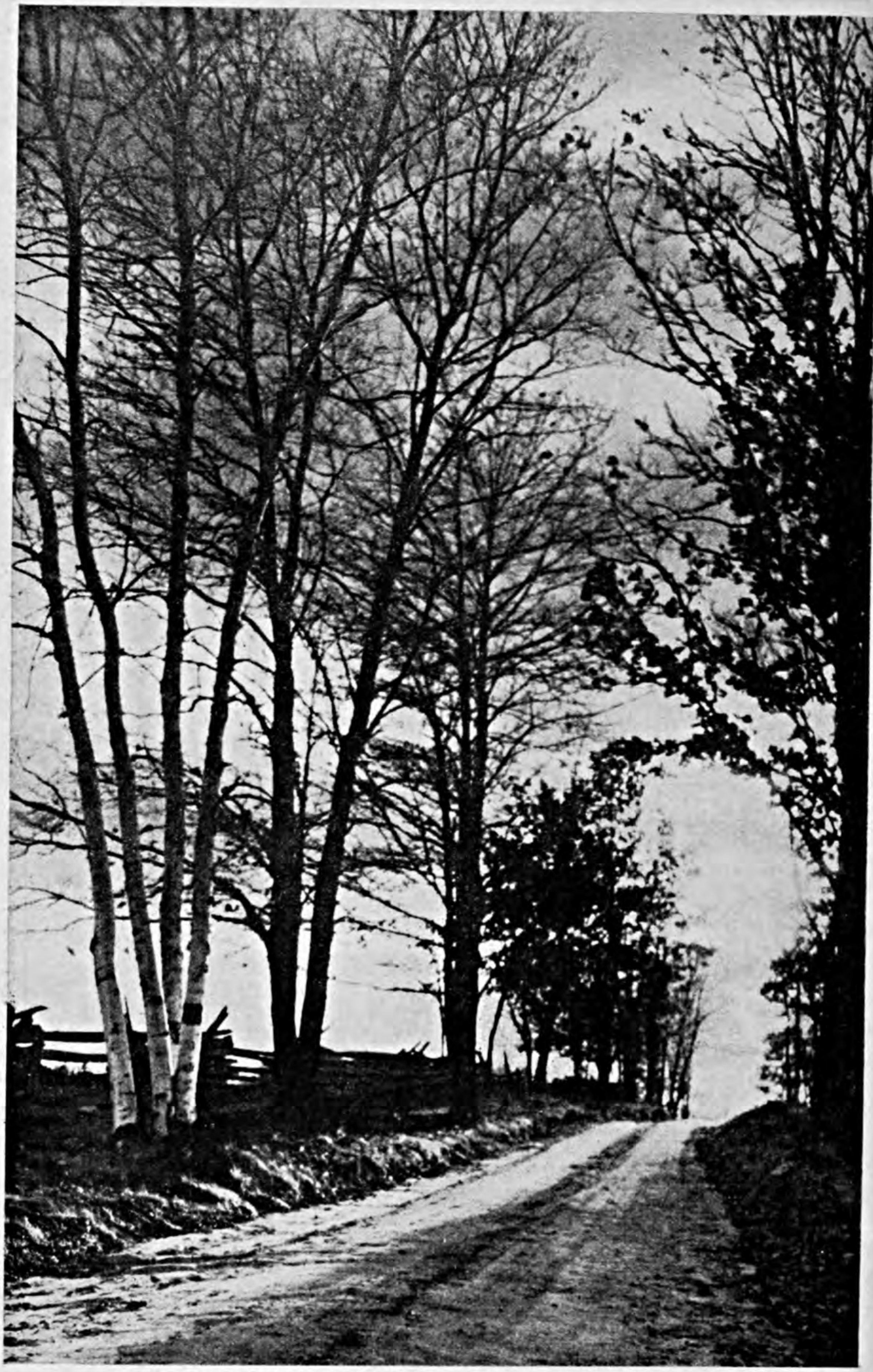


AN AUTUMN BYWAY HIGH UP IN THE HILLS ABOVE AMHERST.

Better Crops with PLANT FOOD

PUBLISHED FOR THE AMERICAN POTASH INSTITUTE, INC., INVESTMENT BUILDING, WASHINGTON, D. C. SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10c PER COPY.

VOL. XX WASHINGTON, D. C., OCTOBER 1936 No. 12

Jeff Casts a vote for...

Crop Insurance

Jeff McDermid

RAISING the subject of crop insurance may cause ardent admirers to quit quoting me for fear I may have joined the Something for Nothing party, which stands for all you can spend and a double bonus for bankruptcy. Still another set of friends may yet have faith in my intellect even after uncommonly high temperatures, but they will put a droopy wet blanket on any more dry talk—whether from the Weather Bureau, the American Economic Society, or the Prohibition party survivors.

And perhaps rightly so, for we have observed with alarm this summer (over sundry ice-cold concoctions) that there is a certain amount of "drought defeatism" psychology permeating the public press, causing some jittery souls to go into a panic over provisions. If this persists I shall expect them to give canned tomatoes and grape-nuts for bridge prizes, if we don't get a cloudburst before frost.

Howsumever, and just to be contrary, I intend to wade right into the puddles of tardy rainwater and hold aloft that underprivileged infant, crop insurance, so that it may not get washed away in the coming flood of old-age rewards, never-due loans, universal relief, and the gilt-edged nickel.

As a friend of crop insurance, I am assured before election that all parties are for it, which means that they don't know anything about it. I can't say I do either, which puts us all in an equally receptive state of mind to draft a law which ought to last until we get another one.

In the words of the colored dialect writer, when you take up crop insurance coverage of a universal nature you talk about something "t'ain no sech thing as." When everybody needs it there isn't any, and when it isn't needed nobody wants it. It's talking about something conditional on weather vagary in terms of fixed equations.

BUT I think we can safely assume that ordinary risk companies and their actuaries (barring Doc Townsend and Lloyds of London) are going to sit in the Capitol galleries and give the government a pretty free field to test it out; and that before we set up monetary benefits on a national scale for staple crop insurance, a trial of the ever-normal granary proposal of making premiums and benefits payable in kind for the respective commodities must be expected.

The ever-normal granary intrigues us. It brings up the same old truism that the world often re-discovers means and methods under the common belief that they are new inventions. Sometimes a method used in a primitive state of society and then discarded may return to popularity among complex civilizations, under the pressure of fundamental human needs. Such is the ever-normal granary. This form of agricultural insurance is almost as old as agriculture. No present-day party can put a patent on it, but those who advocate it most have been smart enough to go back further than the Federal Farm Board to check upon government attempts to solve the surplus situation.

In the late seventies and eighties there lived a royal, Prussian, political science professor who made such a study of agricultural insurance in connection with rural credit and the remission of taxes that he was loaned to the Japanese government as what probably was the original "brain-truster." This learned savant, named P. Mayet of Tübingen, established the agricultural distress-fund law of Japan enacted in 1880 at the request of Count Okuma Shigenobu, minister of finance.

During the first five years this law aided 800,000 farm families with money for houses, implements, seed corn, and the payment of the land tax; and it provided three and a half million people with money for the necessaries of life. Mayet became an expert on Oriental famines caused by flood and drought, and out of his experience came a notable work of that day, translated from the German in 1893 by a Canadian doctor. It is from this old document that I find some of the traces of ever-normal granaries in the earliest eras of recorded history. Maybe some of the anxious legislators of 1937 may find a dip into Mayet of more than momentary interest.

NOT that I imagine that we have had or may have an actual famine in America, or that we could live on a few kokus of rice without kicking—but despite the meager conditions then and the luxury now, perhaps a germ of that policy may survive even as a kernel of wheat may send forth a green spear after centuries of sleep in the crypt of an ancient king.

Mayet says that funds to alleviate agricultural distress through reserve granaries may be traced from China through the early ages in Japan, with roots of the system extending into France, Westphalia, and the Rhine countries. He mentions five kinds of granaries.

First, the tax receiving granaries, where the people paid their obligations to the government in kind rather than in cash. During the Tang dynasty in China, or in the period about the year 750, there were 42,126,000 kokus of rice stored in these tax bins. As one koku equals 4.96 bus. of our measure, we can see that the tax tithes of rice at that time amounted to some considerable heap. Funny no wise spellbinder has yet come out for payment of American farm taxes in bales of cotton or bushels of grain! Or have they?

In the second place, they had transport granaries or exchange piles of rice and other nonperishables, so that

the taxes might be carted from one province to another or taken to the capital when the big shots wanted an extra big banquet.

In the third instance occurred certain granaries used for steadying prices. They were filled by buying rice in cheap years and emptied by selling it in years of scarcity or in years of firm price levels. That is, they were intended to raise the price to growers in cheap years and to lower the price in dear years for the consumer benefit. We find this idea repeated by our friend, the Secretary of Agriculture, who knows that to have a contented nation we must preserve a balance between producer and consumer. Believe it or not, such price-stabilizing granaries existed as early as 55 B. C.

THESE price steadying bins were first introduced to Japan by Emperor Junjin Tenno, who bossed the little intrepids from A. D. 759 to 764. But with the growth of feudalism in the Middle Ages these systems disappeared. (Excuse me if I seem a trifle duller than usual in reciting dusty facts, but I may get somewhere if I keep on.)

Glimpsing the result when the price stabilizing bins were in the discard, say about 1321, under the rule of Emperor Godagio Tenno of Japan, we hear on good authority that this monarch had to use the sheepish expedient of a proclamation to the wealthy brokers and warehousemen, asking them to "please sell their extra stores of rice to the starving farmers and the poor." (This is surely far enough in antiquity not to get me boiled up in the present seething economic debate over who is to handle the swag from 1937 to 1941.)

NOW return with me to the fourth type of public rice bins. These were knowns as "village relief" granaries. They were filled by levying an extra tax in kind on rich harvesters and during years of abundance, in proportion to the crop surplus. Under the Sui dynasty of 589-618 all any one family had to fork over for these village heaps was one koku of barley or millet per annum. Then right in the very next reign, that of the Tang crowd, the annals state that the size of the landed property was taken as the scale for making village storehouse tithes. (Like the parties today, they both seemed to believe in agricultural relief but did a little experimenting here and there, and a few new wrinkles crept in—perhaps not without some grumbling over dictatorship.) Persons with land paid two "sho" (about 4.3 pints) of rice for each one tenth of one "tan" (a fortieth of an acre) which you may translate, if you have the time, into Yankee yields and doles.

The economic wizards of that long-ago epoch kept crop registers. When the harvests were 40% under the

(*Turn to page* 44)

Flower Symptoms Warn of Food Deficiency

By E. W. McElwee

Assistant Professor of Horticulture, Alabama Polytechnic Institute

THE intensive and restricted method used by the flower grower, whether florist or home flower grower, in growing flowers in beds, pots, and benches increases the possibility of damage to the plants from a deficiency of essential plant foods in the soil. The three essential nutrients most generally found deficient in the soil are nitrogen, phosphorus, and potash. A deficiency of one or more usually causes chlorosis, burning, spotting, or discoloration of the leaves of the affected plant. This damage is very important to the flower grower, because good foliage is essential to the proper appearance of the cut flower or pot plant. These deficiencies may also cause stunted plants and a lower yield of poor quality flowers.

The results presented here are from experiments conducted in the Department of Floriculture, Ohio State University, Columbus, in an effort to accurately establish the visual symptoms of plant-food deficiencies in a representative group of greenhouse crops. These symptoms are intended to serve as a guide in aiding the flower grower to diagnose nutritional troubles in time to correct them before they become acute. Several other conditions, such as overwatering, placing plants in drafts of cold air, sunscald, dry soil, insect injury, and spray injury, may cause a condition of the leaves similar to those given below for symptoms of nutrient deficiencies, and these possible causes must be eliminated before the condition can be attributed to a deficiency of plant food.

The experiments were conducted in a mixture of two-thirds sand blast and one-third fine quartz sand in glass pots to reduce the possibility of fixation of nutrients by the growing media and to eliminate the possibility of entrance of foreign nutrients. The complete nutrient solution used was adjusted to contain the following concentration of elements:

	P. P. M.
Nitrate (NO_3)	256
Phosphorus (P_2O_5)	65
Potassium (K_2O)	108
Calcium	30
Magnesium	28
Chlorine	74
Sulphur	28
Boron	1
Manganese	0.7
Iron	1.4

All other nutrient solutions contained identical concentrations except for the element omitted to give the deficient nutrient solution for a specific element. A constant renewal drip was used in supplying the nutrient solutions.

Begonia, Calceolaria, Cineraria, Fuchsia, Geranium, Rose, Primula, Poinsettia, Snapdragon, and Sweet Pea were used in the experiments, and the following nutrient deficiency symptoms were noted for nitrogen (N), phosphorus (P), and potassium (K).

Begonia

Complete—The plants were vigorous, growing plants with many flowers and normal, dark, glossy, green foliage.

Without Nitrogen—The plants were stunted in growth, with few flowers and brick-red foliage.

Without Phosphorus—The plants were normal in color but stunted and did not show any tendency to produce new side shoots.

Without Potash—The plants were almost normal in growth and color. The older leaves showed a definite burning along the margins, later turning brown and falling.

Calceolaria

Complete—The plants were large, with leaves of normal green color, and good flower cluster.

Without Nitrogen—The plants were very stunted in growth, and the flower cluster was small. The old leaves were almost white in color with light-brown, dead margins; and the young leaves were very pale yellowish green in color.

Without Phosphorus—The plants were very stunted in growth, of an unusually dark-green color, and without a flower cluster. The old leaves showed some yellowing around the margins.

Without Potash—The plants were only slightly stunted, but the flower cluster was poorly developed and the flowers faded in color. The older leaves were brittle, crinkled between the veins, and of a normal green color except for the affected areas. The margins of the older leaves and the area around the petiole died and dried to a dark-brown to black color, with the centers showing large spots with neurotic centers. The young leaves were light green to yellowish green in color.

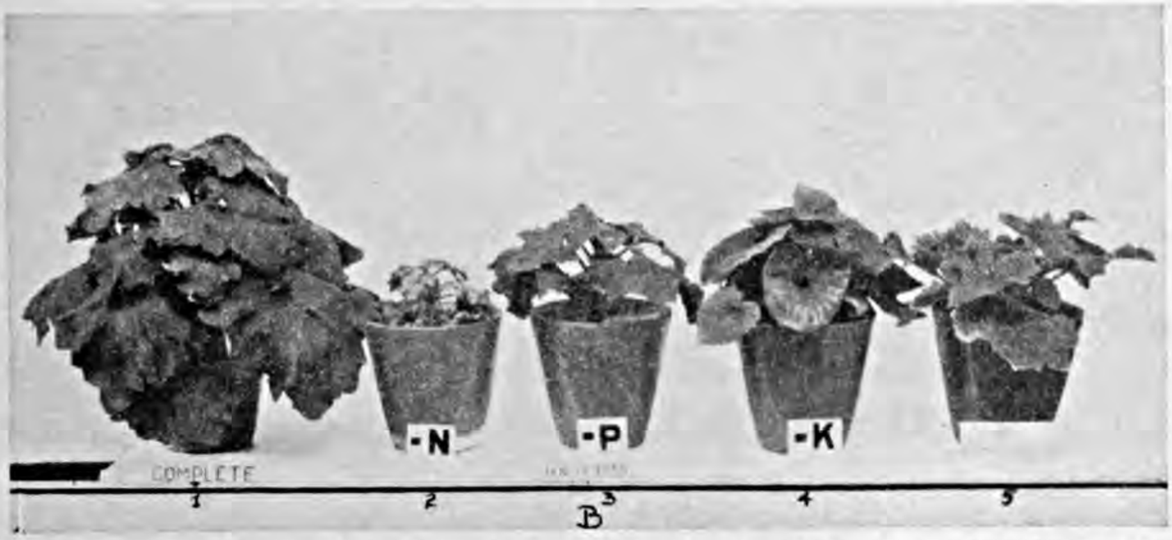
Cineraria

Complete—The plants were vigorous in growth with large leaves of a normal green color.

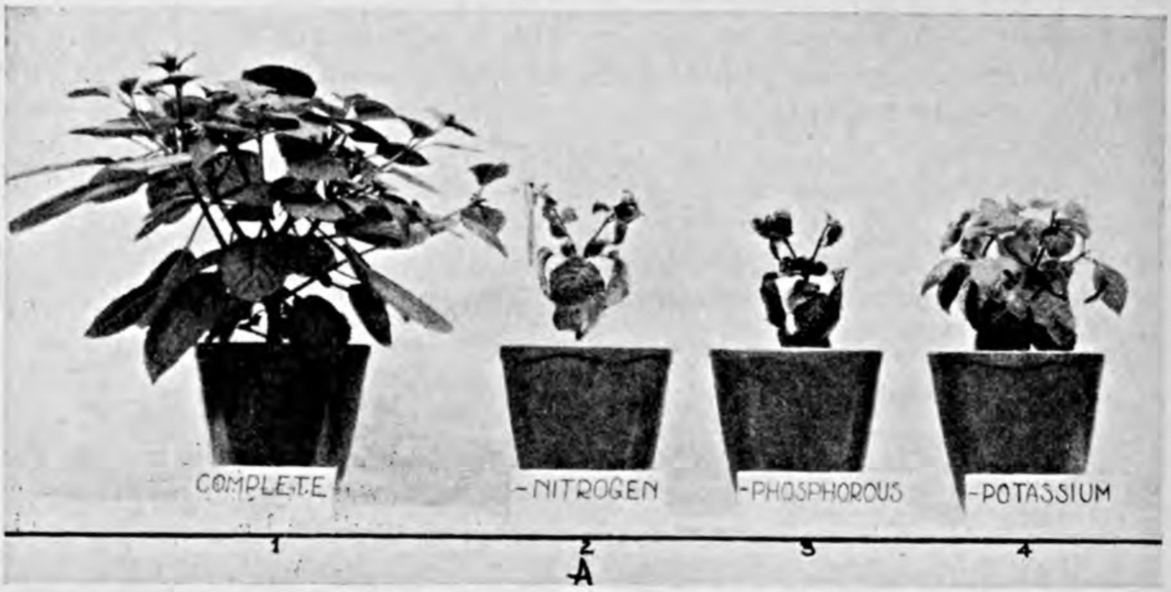
Without Nitrogen—The plants were stunted and grew very little after the experiment was started. The flower buds were small and poorly developed. All of the leaves were rusty yellow in color and remained attached to the plant for a long time after drying.

Without Phosphorus—The plants were about one-half as large as the check plants, with smaller leaves of an abnormally dark-green color above and tinged with purple beneath. The older leaves began to turn yellow and die, but usually dropped before becoming completely yellow.

Without Potash—The plants were slightly stunted in growth. The older leaves were mottled with whitish-yellow markings between the veins and along the margins of the leaf. The margins later turned brown. All the leaves in this treatment showed a deep purple color on the underside as distinguished from the purplish tinge exhibited by those without phosphorus.



No. 5 shows the recovery of the Cineraria from acute potassium deficiency symptoms in 6 weeks after receiving a complete nutrient solution.



Nutrient deficiency symptoms for the Fuchsia.

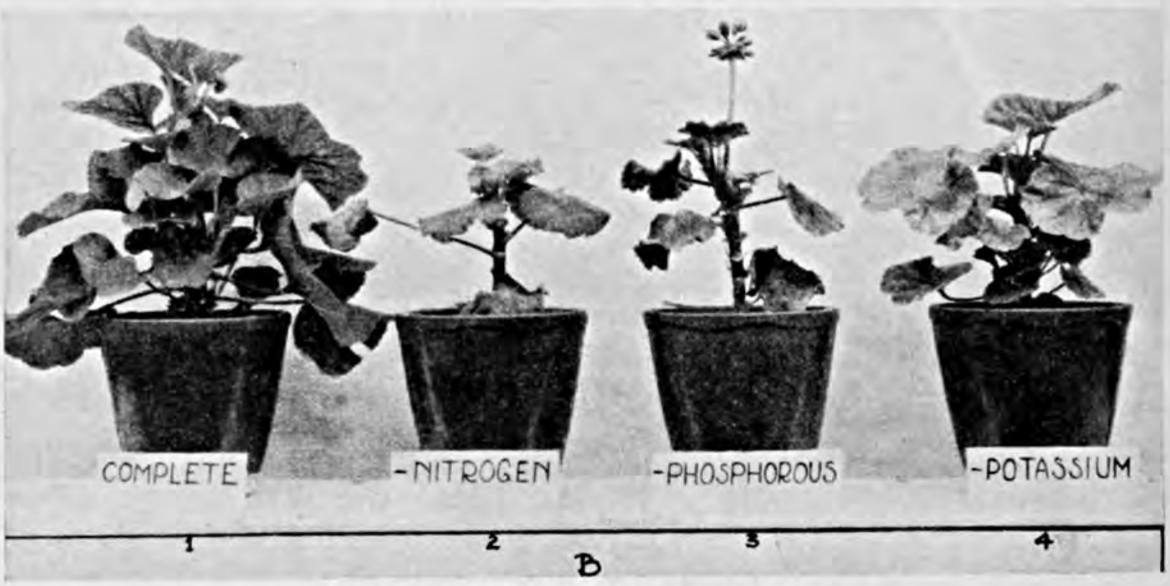
Fuchsia

Complete—The plants were vigorous in growth, dark green in color, with large flower clusters, and showed a quick response in producing new growth after being pinched.

Without Nitrogen—The plants were very stunted and produced only two new shoots after the first pinching. All of the leaves gradually turned yellowish green in color, and the older leaves finally turned to an orange color and dropped before completely dying. The plants produced a flower cluster prematurely with abnormal flowers.

Without Phosphorus—The plants were very stunted in growth. The older leaves were of an abnormally dark-green color, and the young leaves of a bronze-purple color, crinkled, and rosetted. The plants did not lose their foliage or produce flower buds before the experiment ended.

Without Potash—The plants were only partially stunted in producing shoots after pinching. The older leaves were dark green in color and showed some browning in spots between the veins and along the margin of the leaf. The young leaves were slightly yel-



Geranium exhibiting plant-food deficiencies.

lowish green in color and rolled inward along the margins.

Geranium

Complete—The plants were vigorous-growing and well branched. The leaves were of a normal green color with very little indication of the colored ring on the leaf.

Without Nitrogen—The plants were very stunted in growth, with only a central stem and no flower clusters. The young leaves were very light green in color with a definite reddish-bronze ring around the center. The older leaves turned a brilliant red except for a yellowish-red area around the petiole, dried up, and remained attached to the plant for some time.

Without Phosphorus—The plants were stunted almost as much as those in the treatment without nitrogen, but showed a well-developed flower cluster of good color. The young leaves were dark green in color and showed a distinct chocolate-brown ring around the center. The older leaves turned a dull, dark red, progressing from the margin toward the petiole, and dried and dropped from the plant early.

Without Potash—The plants were only slightly smaller than those in the check treatment and produced several side branches and flower clusters. The young leaves were a pale, yellowish-green color with dark-green veins. The older leaves were grayish yellow between the veins and along the margins, with some yellow and brown spotting between the veins, and showed a distinct, rusty-brown ring around the center. There was some yellowing and brown spotting between the veins of the old leaves.

Rose

Complete — The plants produced long, vigorous shoots with many side shoots and flower buds and leaves of a normal, dark-green color.

Without Nitrogen—The plants were very stunted in growth and did not show any tendency to produce new bottom shoots. The foliage was yellowish green in color, stiff, and brittle.

Without Phosphorus—The plants produced a few new shoots that did not produce flower buds. The foliage was grayish green in color. This differs from the other plants studied, most of which showed an unusually dark green color in the treatment without phosphorus.

Without Potash—The plants produced several new shoots after pinching early in the experiment. This tendency to produce new shoots decreased later, and the total growth was reduced. The foliage was lighter green than normal, and the older leaves showed light colored spots between the veins and dark-green veins. The new leaves were bright red in color but showed the same spotting between the veins as shown by the old leaves.

Poinsettia

Complete—The plants were vigorous in growth, of a normal, dark-green color, and showed no loss of leaves.

Without Nitrogen — The plants showed a uniform yellowing of all leaves, beginning with the bottom leaves and progressing to the top leaves. The older leaves turned pale yellow and dropped before becoming completely dead.

Without Phosphorus—The plants grew very little after being placed on this treatment. The older leaves began yellowing from the margins toward the center of the leaf and dropped before becoming completely yellow. All leaves dropped in succession until only the young bud leaves remained, which were very dark green in color.

Without Potash—The plants were only partially stunted in growth. The older leaves began to turn yellow along the margins, and finally the entire leaf turned yellow except the veins which remained dark green in color. Browning along the margin began after the leaves became completely yellow, and the leaves remained attached to the plant for some time after dying. All the leaves were finally affected except the young bud leaves at the tip. These remained dark green in color after most of the other leaves were yellow or dead. The plants produced several side branches that developed normally for a short time and then began to turn yellow and turn brown along the margins.

Without Potash—The plants were almost normal in size with a normal flower cluster that was faded in color. The young leaves were normal in color, but the older leaves were yellow in spots over the leaf and along the margin. The veins of the affected leaves remained green until the leaf died.

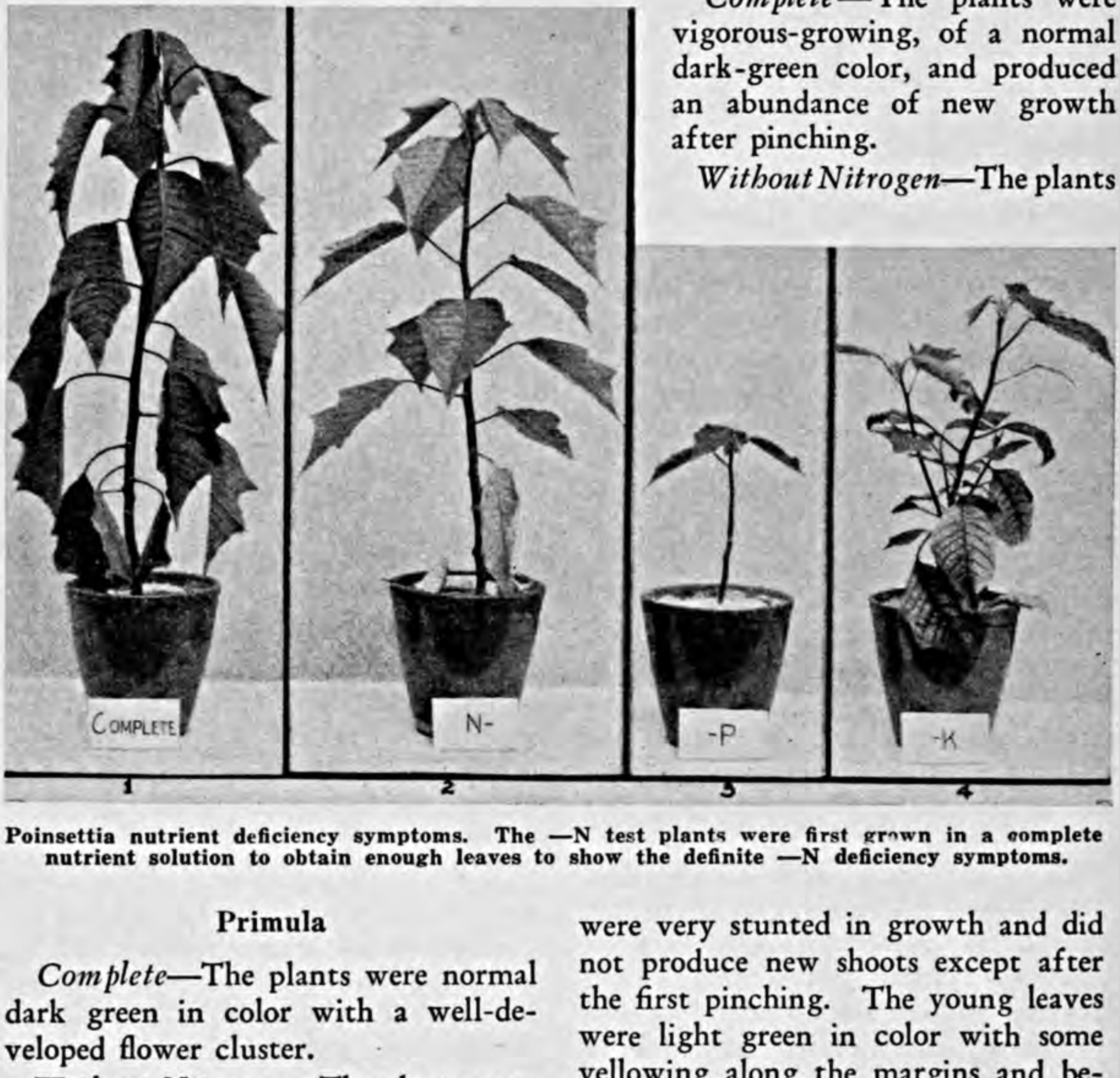
Snapdragon

Complete—The plants were vigorous-growing, of a normal dark-green color, and produced an abundance of new growth after pinching.

Without Nitrogen—The plants were very stunted in growth and did not produce new shoots except after the first pinching. The young leaves were light green in color with some yellowing along the margins and between the veins. The old leaves were rusty-yellow to rusty-yellowish-green color. After dying, the old leaves remained a rusty color and clung to the plant for some time.

Without Phosphorus—The plants were stunted as much as those in the minus-nitrogen treatment but differed in being unusually dark green in color.

(*Turn to page* 39)



Poinsettia nutrient deficiency symptoms. The —N test plants were first grown in a complete nutrient solution to obtain enough leaves to show the definite —N deficiency symptoms.

Primula

Complete—The plants were normal dark green in color with a well-developed flower cluster.

Without Nitrogen—The plants were very stunted in growth with all the leaves small and light yellowish-green in color and showed no indication of flowering.

Without Phosphorus—The plants were normal in size but without a flower cluster. The leaves were an abnormally dark-green color, deeply crimped, and yellow along the margins.

Potassium Availability in Illinois Soils

By R. H. Bray

Soil Analyst, University of Illinois, Urbana, Illinois

THE facts of research when viewed separately are often so dry and uninteresting that it is useless to try to interest others in them. Occasionally, however, the facts fit together like the pieces of a jigsaw puzzle and give a clear-cut picture, interesting to both the layman and the scientist. We believe this to be the case with our researches into potassium availability pursued at the Illinois Agricultural Experiment Station and presented in part at the Chicago meeting of the American Society of Agronomy, December 1935, by E. E. DeTurk and the writer.

Within the last few years these pieces representing isolated facts have been fitting together, giving us a picture of potassium availability which has explained the significance of many facts formerly known but not clearly understood. That some of the results can be applied to a wide variety of soils is, no doubt, true, but others may be limited in their application to soils similar to the soils of the corn belt included in the study.

Terms Defined

First, let us begin without apologizing for using the term "available potassium." It is a good term, one we have been brought up with; and even though it never has been clearly defined, it always puts over the idea we are trying to express as no other term can. We know now that so far as our soils are concerned "available potassium" is practically synonymous with "replaceable potassium," and that practically speaking the amount of replaceable potassium present at planting time determines the crops' need for extra potassium in the form of fertilizers.

We found this out by comparing the amount of replaceable potassium present on the RLP plots* of 25 different soil experiment fields, representing as many or more soil types with the response to applied potash on the RLPK plots. On all fields that averaged around 140 pounds or more of replaceable potassium per acre in 2,000,000 pounds of surface soil, the crop increase for potash fertilizer did not pay for the potash used. All fields which averaged less than 90 pounds of available potassium per acre gave a profitable response to potash. Fields averaging between 90 and 140 pounds gave erratic responses, although in general the responses were profitable. This calibration holds for the silt loam and clay loam soils of Illinois.

This checking against the experimental field plots of known performance was started in the fall of 1930 and the spring of 1931, and the data secured seemed sufficiently convincing to warrant beginning the use of this information as a basis for potash recommendations. However, Plot No. 108 and No. 308 of the Dixon field did not give a high test (140 pounds or over), and since the Dixon field had never responded significantly to

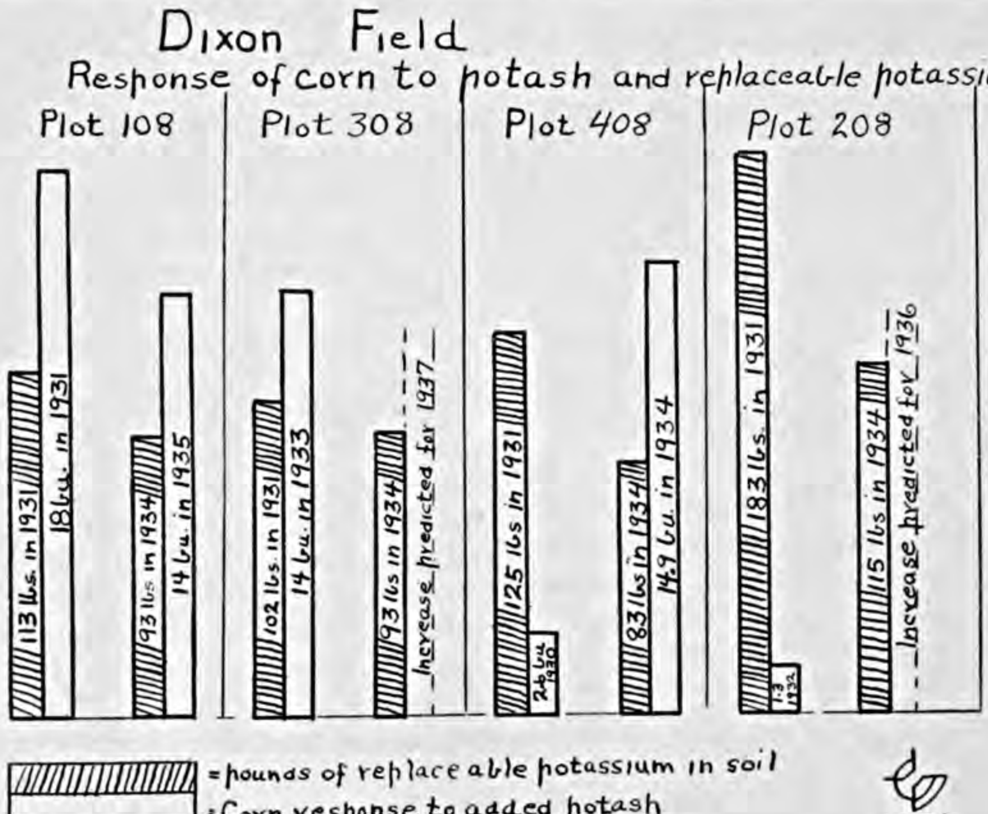
* R = residues; L = limestone; P = rock or superphosphate; K = potash as kainite.

potash, and as it represented one of our important soil types supposed to be inexhaustible as far as potash was concerned, we held up the release of the soil test we had devised to measure the replaceable potassium until the crop returns were in for the fall of 1931. Of course, we were gratified to obtain an 18-bushel increase in corn on the No. 109 plot and a 0.54-ton increase in clover on No. 309, and no significant increases on the other two plots testing high in replaceable potassium. Those two responding plots, 109 and 309, have continued ever since to be responsive to potash for the corn and clover crops.

This experience, together with the data from the other fields, satisfied us that the total amount of replaceable potassium was the one thing to measure in order to separate the low responders from the high responders. We have accordingly been recommending the use of our test, which measures the replaceable potash present, along with any which is water-soluble, as the first step to be taken in determining the need for potash in Illinois soils.

Interpreting Results

Since our farmers and farm advisers were mostly interested in the grain and hay crops, we adjusted the ratio of extracting solution to the size of soil sample used in the test, so that the test would give a high reading on the potash-rich soils, a low reading on the deficient soils, and a medium reading on the semi-deficient soils. This was called our 10-10 calibration, and it involved a direct reading in terms of crop response. It is also possible, by means of a scale we have prepared, to read the test in terms of pounds per acre from 40 pounds up with practically quantitative accuracy. We have confidence that with sufficient work calibrations can be found for other crops so that "pounds per acre" can be interpreted. Merely knowing



This map shows that over a period of only 5 years the Dixon field has been converted from a non-responsive to a potash-responsive field, and the decrease in the replaceable potassium values reveals the reason for this.

the "pounds per acre" present without its significance in crop response is not sufficient. To establish this significance is just as much the work of the crops man as it is of the soils man.

Now let us consider some other aspects of the potassium fertility problem. Are we justified, for example, in calling the replaceable potassium the "available potassium"? Another way of stating this question is, "does the amount of replaceable potassium so dominate potassium fertility that other factors are of minor importance?" We believe that "yes" is the answer to this.

There are other sources of potassium besides that which is replaceable. A very small amount occurring in the soil solution need not be considered since it is measured along with the replaceable potassium. This leaves the potash minerals as the only other source of supply. Potash minerals are not soluble; they have to decompose or alter to new forms before the potash becomes liberated. This is the reason why farming practices, such as green manuring, have little if any effect on potash liberation.

Duration of Richness

The rate of liberation from the mineral forms determines the continued potash richness of the soil. A high rate of liberation will maintain a high level of replaceable potash, and vice versa. Withdrawal of replaceable potassium by the crop may speed up this rate. In general, the rate of supply of available potassium through the alteration of minerals on many of our soils which are not deficient is just about enough to keep the soils out of the deficient class, as shown by the fact that the level of replaceable potassium present is often very close to the critical level (140 pounds). Only a minor part of this new supply which is being slowly liberated from the minerals is available to this year's crop, as will be shown later. This leaves the replaceable potassium as the largest source of available potassium for the plant.

Replaceable Potassium

Another factor to be considered is the availability of the replaceable or available potassium. The idea that the term "available" implies 100 per cent availability is not correct. Attempts to measure directly the availability of a fertility element by chemical tests alone must result in failure, even though the form being measured is the only form present. The reason for this is that the plant itself has a voice to be heard in establishing the availability of a given form of plant food. By cooperative work with Dr. S. F. Thornton, of the Purdue Experiment Station, we have established the fact that, regardless of the magnitude of the base-exchange capacity or amounts of replaceable magnesium, calcium, or hydrogen present in our soils, the replaceable potash is, under the conditions of the Neubauer pot-test method, 100 per cent available. On some potash-treated soils even more than the replaceable potassium was removed by the plants grown in Neubauer tests.

Why, then, do we say that around 140 pounds of replaceable potassium per acre is necessary in the surface 7 inches of soil for our hay and grain crops, when the crop may actually require only 30 to 60 pounds, which it obtains from the soil area contacted by its roots? The answer is that while complete, effective contact of the replaceable potash may result under the conditions of the Neubauer method which was designed especially for this purpose, effective contact of the root system of a crop with the whole soil mass does not occur in the field.

I use the term "effective contact" because the feeding roots actually contact only an extremely small amount of the surfaces of the soil colloids where this reserve supply of replaceable potassium resides; and the great bulk of the replaceable potassium taken up by the roots has had to go through the soil for some distance in the dissolved condition before contacting the feeding roots. The effective distance these ions can travel is limited. We must, therefore, consider the replaceable potassium as 100 per cent physiologically and chemically available, with its "positional availability," to use a term applied by Spencer and Stewart to an old concept, varying according to root development, nature of the soil solution, and other factors.

Positional Availability

The effecive positional availability of replaceable potassium, theoretically, can be calculated for a given plant. The largest factors concerned are usually the rooting system and water relationships during a given season. Let us take corn as an example and assume an average requirement of 1 pound of potash per bushel of corn produced. Our better soils produce 60 bushels an acre without added potash and have present 140 or more pounds of replaceable potash in the surface-plowed layer. Using the surface 14 inches as the average feeding range, this makes 280 pounds of replaceable potash present that might be drawn upon. The 60 pounds taken up by the corn is 21 per cent of the total amount present, or an average positional availability of 21 per cent.

The soils in our semi-deficient areas average around 230 pounds in the first 14 inches and yield around 52 bushels. That represents an average positional availability of 23 per cent.

The soils in our deficient areas average around 120 pounds and yield around 30 bushels, showing a 25 per cent positional availability. Although these percentages are based on an assumed utilization of 1 pound of potash per bushel of corn, they illustrate the principle involved, and the values necessary for accurate calculations can all be obtained. Furthermore, the above relation between the corn yield and replaceable potassium is a relationship based on actual determinations involving no assumptions.

We can now see why the rate of supply of available potassium from the potash minerals, although important to next year's crops, is of very small importance to the present crop. In the first place, the plant roots effectively contact only a limited soil area. Next, they contact this only for a limited time. To be of practical importance the supply from the potash minerals in this limited area and limited time must be very much greater than appears at present to be the case. In the above case, about 20 per cent of the soil area would have to supply 60 pounds of potash during four months of the year. This would be equivalent to 600 pounds in the whole soil area during the eight months of open weather. Our studies indicate no such large rate of supply of potash to the replaceable condition from the soil minerals; in fact, the soil does well to replace the amount lost each year.

As I have said, the renewal from the minerals is important to next year's crops because, while the plants are feeding in the area effectively contacted by the roots, this renewal is going on, not only in the contacted area but also in the non-contacted area. For this reason the decrease in replaceable potassium during crop growth is not as great as might be expected, since some renewal is always occurring. This is one of the reasons why pot experiments cannot be directly interpreted in terms of field behavior; i. e., the positional availability and associated relationships are not the same in the two cases.

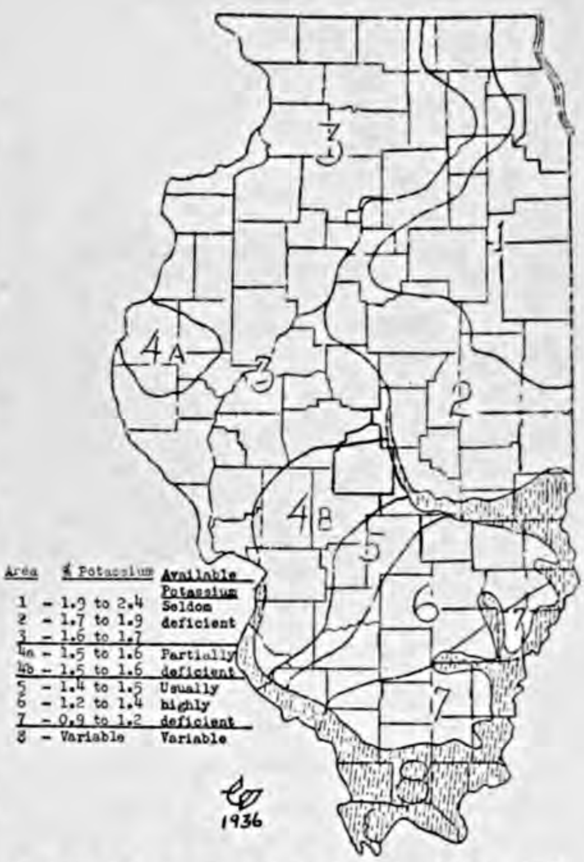
Plowing the land mixes the root-contacted and non-contacted areas leaving, in general, the replaceable potassium fairly well distributed throughout the soilmass, except in the vicinity of organic residues which still have potash to be released.

Potassium in crop residues, manures, or added in fertilizers is not evenly distributed throughout the soil but is almost all fixed in the replaceable form in the soil area which first receives it. For this reason it will have an increased positional availability over the well-distributed, original replaceable potassium, provided the plant roots contact these areas in which the potash is more concentrated. This, of course, is the basis for "hill-dropped" fertilization. This difference in the availability, however, does not interfere in the calibration of our test, since we test the soil before planting the crop and adding the potash fertilizers, not afterward. Before the next year's planting time comes around, cutivation and plowing will have distributed the added potash, more or less, throughout the surface soil. Since our test is calibrated against crop response as well as pounds per acre, we do not have to concern ourselves especially with the positional availability of the naturally occurring replaceable potash or that from the residues of last year's potash application, as the calibration takes this into account.

Determining Factors

The crops grown, as well as the level of productivity of the soil, with respect to other plant-food elements or conditions which could limit the yield, determine the level of replaceable potassium required. Since corn requires the highest level, clover next, and wheat and oats the lowest, we consider a soil to be potash-deficient when corn begins to give profitable responses to potash applications, but only on the low-testing soils (90 pounds or less) do we regard potash generally necessary for all crops. The level of replaceable potassium necessary for any given crop varies both with that crop's needs and its ability to go and get it. These levels for the different

TOTAL POTASSIUM CONTENT OF ILLINOIS SURFACE SOILS



The map shows areas deficient in potash, areas which will soon become deficient, and areas where potassium deficiencies will not generally occur in the near future, although a few deficiencies have shown up in local areas.

crops will have to be established under practical conditions. We can see, therefore, that although different levels may be required by different crops, the amount of replaceable potassium still remains the measure of "available" potassium.

There are other factors which we have not considered as yet. For example, does liming affect the replaceable potassium in any way? The Neubauer tests told us that liming did not affect in any way the availability to the plant under Neubauer conditions of the replaceable potassium present. Other work we have done indicates that liming will help decrease leaching loss of replaceable potassium without any practical decrease in its availability in the field. Still other work has shown that saturating a soil with calcium does not

(*Turn to page* 36)

Here's where the phosphate-potash mixture ran out, showing a remarkable difference. Same seed, same land, same cultivation, and same amount of superphosphate, but the corn on the left had 25 lbs. of muriate of potash in addition to the 175 lbs. of 16% superphosphate.

Mr. Nat Stafford Learns About Potash

By F. H. Jeter

North Carolina State College of Agriculture

ONE knew instinctively that Mr. Stafford was a bachelor. There was an air of competent untidiness about the place which proclaimed this in terms not to be misunderstood.

Mr. Stafford lives in the old home house back from the main road in about the center of the 108 acres which became his part of the ancestral estate. He takes his meals with a married sister who lives in a modern home up on the highway. This newer home has a beautiful lawn and well kept grounds. Where Mr. Stafford lives is—well, not so nicely kept.

As one walked with him about over his farm, the impression persisted that he was not so concerned about how his place appeared to eyes of the visitor, but rather he was concerned with the profits which it would produce. His full name is T. N. Stafford, but he is known as "Mr. Nat" and he lives on rural route 1 from Graham in Alamance County. He is 60 years of age and a sturdy member of an excellent family.

N. C. Shiver, county agent of Alamance County, says "Mr. Nat" has made money on the farm and, in a quiet way, has promoted soil building and dairy cattle in the community. He has saved money and has helped his sister's children in obtaining blooded

Jersey calves of their own in order to become members of the well-known Alamance 4-H Jersey Calf Club. It is a pleasure to walk with him over the old home place and hear simple tales of his boyhood, and of the efforts to win a living from the old worn-out, washed fields of the family farm.

Practices Rotation

Mr. Nat makes more corn and wheat on a small field than his widowed mother made on her whole place. He learned about lespedeza and crop rotations a good many years ago, and largely through these he has built his soil. There are only 59 of the 108 acres in yearly cultivation, and these are planted to corn, oats, wheat, and lespedeza.

"My rotation is corn the first year, followed by wheat over which I sow lespedeza in the late winter," Mr. Nat said. "I mow this lespedeza for hay in the fall or gather the seed and then pasture it the next year. I grow no cotton or tobacco."

Mr. Stafford said his main income is from the sale of lespedeza seed and wheat. He keeps two heavy brood mares and sometimes has a colt or two for sale, and he also owns about 10 milk cows that he rents for cash and sells the calves. Some of the young animals are sold for veal on the nearby Burlington market. Being a bachelor there is no need for milk in his establishment, but since he has plenty of pasture, largely based on lespedeza and orchard grass, there is ample grazing for the cattle. A tractor is used to do the heavy plowing in preparing the land for seeding, and the two brood mares handle the work for the remainder of the year. Occasionally, Mr. Stafford rents out a small acreage to a neighbor who may need additional crop land. The soil is principally of the Alamance Loam, a slaty soil, on which lespedeza flourishes and which benefits greatly through the legume.

To be strictly truthful it must be recorded that Mr. Stafford knows very little about fertilizers in the sense that the great plantation owners of eastern Carolina know about them. But he is learning fast, and in a measure he is stumbling upon some valuable facts. He stumbled upon one such fact during the crop season of 1936, and that was the reason for my visit.

Five years ago, he planted a field of 25 acres to corn. The corn was followed by spring oats, and then the field was planted to lespedeza to be mowed the first two years and grazed for the following three years. Believing that the land was then ready to go back under the plow, Mr. Stafford broke the field thoroughly with his tractor in early April and made ready to plant corn. However, it was unusually dry in North Carolina during the spring of 1936, and so the corn was not planted until June. As he waited for the rains to make planting possible, Mr. Stafford mixed about 175 to 200 lbs. of 16% superphosphate with 25 lbs. of muriate of potash to go under his corn. He used no nitrogen because the land had been in lespedeza pasturage for several years.

Accidental Experiment

Anyway, the rains came unexpectedly, and in the rush to plant Mr. Stafford had only enough of the phosphate-potash mixture ready for about two thirds of his field. When the mixture ran out, he continued his plantings using the phosphate alone, until the whole field was seeded. In the extreme end of the field, however, where no potash was used, he did manage to get some manure broadcasted.

"I ran out of a job one day, and while the boys were plowing I threw 10 quarts of the muriate of potash on parts of 6 or 7 rows ahead of the plows. The corn was then about knee high," he said.

All the while I was learning these

(*Turn to page 35*)

Potash for Cotton Wilt in the Mississippi Delta Region

By Dr. L. E. Miles
Agricultural Experiment Station, State College, Mississippi

COTTON wilt caused by *Fusarium vasinfectum* is usually of but minor importance in the Yazoo-Mississippi Delta. The soils of that area are in the main of a rather heavy nature, in which the organism does not thrive and spread rapidly. However, in certain localities in the Delta, local areas occur in which the soil is of a different nature, and in some of these Fusarium wilt is found to do a great deal of damage. These areas may be of small size, making up only a part of a field, or they may extend for considerable distances.

The wilt situation is complicated somewhat in the Delta by the presence there of a second type of cotton wilt caused by another fungus, *Verticillium dahliae* Kleb. These two wilts are very similar in their symptoms and are difficult to differentiate under field conditions. This second wilt occurs more commonly on the heavier soil types, though it may sometimes be found on lighter soils as well. The presence of the two in the same localities makes it compulsory to determine which may be responsible for the damage inflicted, since they do not respond to the same control measures.

In 1931 experimental tests were begun in three areas in different parts of the Delta to determine the effect, if any, that potash might have in the control of wilt under the respective conditions pertaining to each. The test was continued for three years in two of these localities and for two years in the other. As a preliminary measure it was first carefully determined that the damage present was due to the Fusarium wilt and not to the one caused by Verticillium.

Tests Supply Data

The first test to be reported was located near Paynes, Miss., on the property of Spencer J. Brown, Cascilla, Miss. This was in the eastern edge of the Delta, within one half mile of the abrupt bluffs which limit it at that point. The soil was not typical of the Delta but was a brown silt loam, similar in characteristics to that found on the bluffs above it. In fact, there is little doubt but that it originated in that upland area and was removed and deposited in its present position by the action of water erosion. Cotton wilt was generally prevalent and destructive throughout all the strip of land on the eastern edge of the Delta adjacent to the bluffs, as was also the condition commonly known as rust or "potash hunger."

Two fertilizer elements only were used, namely, nitrate of soda and muriate of potash, though it is extremely probable that phosphate also would have been beneficial from the standpoint of yields, since it has proven so on the uplands immediately adjacent which possess similar soils. The general fertilizer practice of the area, however, has followed that of the remainder of the Delta in the use of nitrate alone, if any fertilizer at all was used. It was considered advisable, therefore, to eliminate phosphate from the test in order to avoid possible confusion in the interpretation of results.

Each plat consisted of 10 rows, 218 ft. long, and constituted one sixth acre. One plat served as a check and received no fertilizer. Another received 200 lbs. of nitrate of soda. Two others received the 200 lbs. of nitrate and in addition muriate of potash to the amounts of 50 and 100 lbs. per acre, respectively. Three other plats received no nitrate but were given respective per-acre applications of 50, 100, and 200 lbs. of muriate of potash alone. Each treatment was replicated three times with the exception of the 200-lb. application of potash, which occurred only once and was omitted entirely in 1931. The fertilizer was weighed and applied by hand on March 22, 1931, and the cotton was planted two weeks later on April 5. In 1932 the fertilizer was applied in the same manner on April 20, and the cotton was planted the same day. In 1933 the fertilization and planting were done on April 11. The cotton used was the same each year, namely, Missdel No. 2, which is a quite susceptible variety.

Wilt counts were taken three times in each of the three years. The first was made about the middle of July. At this time any plant which showed any typical sympton of wilt was recorded as infected. Any plant which was so badly infected that it seemed probable that it might not survive until the next count was removed and so recorded. This was done in order that such plants might not be lost and that they might appear in subsequent counts and in the final record. Another count was made in a similar manner approximately one month later. The final count was made as soon as harvest was completed, somewhere between the first and middle of October. At that time 400 stalks were cut in each plat, and the percentage of infection was determined from those which showed typical discoloration of the vascular tissues. The 400 stalks were taken from certain

This plat shows the effect of no fertilizer (left) in contrast to the use of 200 lbs. of muriate of potash (right).

definite areas, uniformly distributed over the plat, and their locations were the same in each plat respectively.

The results are presented in table I. Wilt counts showed a comparatively light infection in July over all plats, the heaviest being on the check plat and on the one which had received nitrate of soda but no potash. In August of each year the infection was found to have increased greatly in all plats. It was still much heavier on the check plat and the nitrate of soda plat, being approximately the same on each. Infection was very materially lower on those receiving muriate of potash, the lowest occurring on those receiving 200 lbs. of nitrate of soda and 100 lbs. of potash and on the one receiving 200 lbs. of potash alone. At the final count in October the percentage of infection was higher but was relatively in the same proportion as in the August count. The average of the October or final count for the 3-year period showed 45.45% infection for the check or unfertilized plat and 40.35% for the one receiving 200 lbs. of nitrate of soda alone. The plat receiving 200 lbs. of potash alone showed the lowest wilt infection for the 2-year period in which it was included. It will be recalled that this plat was not replicated as were all the others. The next lowest infection was recorded on the plat treated with 200 lbs. of nitrate of soda and 100 lbs. of potash. Its wilt percentage for the period of the test was 16.05%, while that for the 200-lb. application of muriate of potash was 15.25%.

The highest average yield of seed cotton, 1,072 lbs. per acre, was recorded on the plat receiving 200 lbs. of nitrate of soda and 100 lbs. of potash. The plats receiving 200 lbs. of soda and 50 lbs. of potash, and 200 lbs. of soda alone, were tied for second place for the 3-year period with a yield of 992 lbs. The plats to which

TABLE I. SECTION A. WILT FERTILIZER TEST. PROPERTY OF S. J. BROWN, CASCILLA, 1931-1933

Treatment	1931 July	1931 Aug.	1931 Oct.	1932 July	1932 Aug.	1932 Oct.	1933 July	1933 Aug.	1933 Oct.
	Percent wilt infection								
Check no fertilizer	6.4	33.7	52.50	5.7	30.1	42.7	5.8	28.4	41.16
Nitrate of soda—200 lbs ...	6.3	30.0	40.28	6.1	30.7	44.5	7.1	24.1	36.30
Nitrate of soda—200 lbs. and muriate of potash—100 lbs.	2.8	9.8	15.07	2.3	8.2	14.5	2.1	8.0	18.61
Nitrate of soda—200 lbs. and muriate of potash—50 lbs.	2.5	12.1	20.54	3.4	11.6	23.5	2.8	10.3	22.83
Muriate of potash—50 lbs	3.7	15.0	26.58	4.4	13.3	25.5	4.3	10.1	25.00
Muriate of potash—100 lbs	3.5	13.7	24.53	3.0	10.1	23.0	3.7	11.6	25.67
Muriate of potash—200 lbs..	..	...	...	2.9	9.2	14.0	1.6	6.8	16.50

TABLE I-a

Treatment	Av. pct. wilt infection July	Aug.	Oct.	Lbs. seed cotton per acre 1931	1932	1933	Av.
Check no fertilizer....................	5.8	30.73	45.45	1,002	648	590	746
Nitrate of soda—200 lbs..............	6.5	28.26	40.36	1,234	842	900	992
Nitrate of soda—200 lbs. and muriate of potash—100 lbs..............	2.4	8.66	16.06	1,194	870	1,164	1,076
Nitrate of soda—200 lbs. and muriate of potash—50 lbs	2.9	11.33	22.29	1,190	826	962	992
Muriate of potash—50 lbs	4.1	12.80	25.35	1,028	726	714	822
Muriate of potash—100 lbs	2.4	11.80	24.40	1,022	760	744	842
Muriate of potash—200 lbs.	2.2	8.00	15.25	....	750	804	777

potash alone was applied ranked lower in yield than either those receiving nitrate alone or those receiving nitrate and potash combined. Though the plat treated with 200 lbs. of potash alone showed the lowest percentage of wilt for the two years in which it was included, the yield, 777 lbs., was second lowest in the entire series, that of the check plat alone being lower. However, if the average yield for the same two years is taken without reference to 1931, it is found that both the other plats receiving potash alone have lower yields than it. As compared with the 777 lbs. for the 200 lbs. of potash plat, it will be found that the yields for the same two years for the plats receiving 50 and 100 lbs. of potash, respectively, were 720 and 750 lbs.

The plat on the left received 200 lbs. of kainit, while that on the right received no fertilizer.

This test showed that a combination of 200 lbs. of nitrate of soda and 100 lbs. of muriate of potash per acre gave best results in the control of wilt as reflected in the percentage of infection and the yield of seed cotton. Fifty lbs. of muriate of potash in combination with 200 lbs. of nitrate of soda seemed to provide an insufficient amount of potash. The 200-lb. application of nitrate alone, though it produced very vigorous plants, showed a very high percentage of wilt which was reflected in the yield. On the other hand, applications of potash alone, though giving considerable reduction in wilt infection, failed to produce correspondingly increased yields. Even with the most favorable rate of application of both nitrate and potash in combination, the percentage of wilt infection was rather high for the 3-year period. This would indicate that on land as severely infested with wilt as was that used in this test, in addition to the use of a fertilizer mixture containing a sufficient amount of potash in combination with other necessary elements, a wilt-resistant variety of cotton should be planted as well. It is, of course, possible that inclusion of phosphate in the fertilizer mixture might have further reduced the amount of wilt infection by more adequately balancing the essential fertilizer elements.

The same test reported above was repeated on the property of F. T. Withers, Lake Cormorant, Miss. The plats were located on land which is within the Mississippi Delta area but very near the northeastern edge. The soil differed somewhat from the typical Delta soil in that it had more of a loess character, derived from the adjacent hill lands on the east which limit the Delta at that point. On account of the fact that wilt failed to develop to a sufficient extent in 1931, the location of the plats was changed in 1932 to another field on the same property, in which it was observed that the trouble was much more uniformly distributed and severe. The results secured in 1931 are, therefore, omitted, and only those for 1932 and 1933 are presented.

In 1932 the fertilizer was weighed out and applied by hand on April 10. The cotton, Missdel No. 2, was planted the same day. A good stand was not secured and all plats were replanted on April 21. In 1933 the fertilizer was applied two weeks in advance of planting. The lay-out of the plats was the same as in the test previously reported. Wilt counts were taken three times during the season as in the previous case. The results secured are reported in table II.

On July 14 wilt was found to be showing up fairly abundantly for so early in the season. Infection, however, was much more evident and severe on the check plat, and on the plat which had received nitrate but no potash, than on any of those which had received potash. This same thing was found to be true in the July count in 1933. At the second wilt count in August rust was quite prevalent on the check and nitrate plats. As shown by the table, wilt infection on these two plats was practically the same for the 2-year period. Infection on the other plats which had received

(*Turn to page* 41)

TABLE II. SECTION A. WILT FERTILIZER TEST. PROPERTY OF F. T. WITHERS, LAKE CORMORANT, MISS., 1932-1933

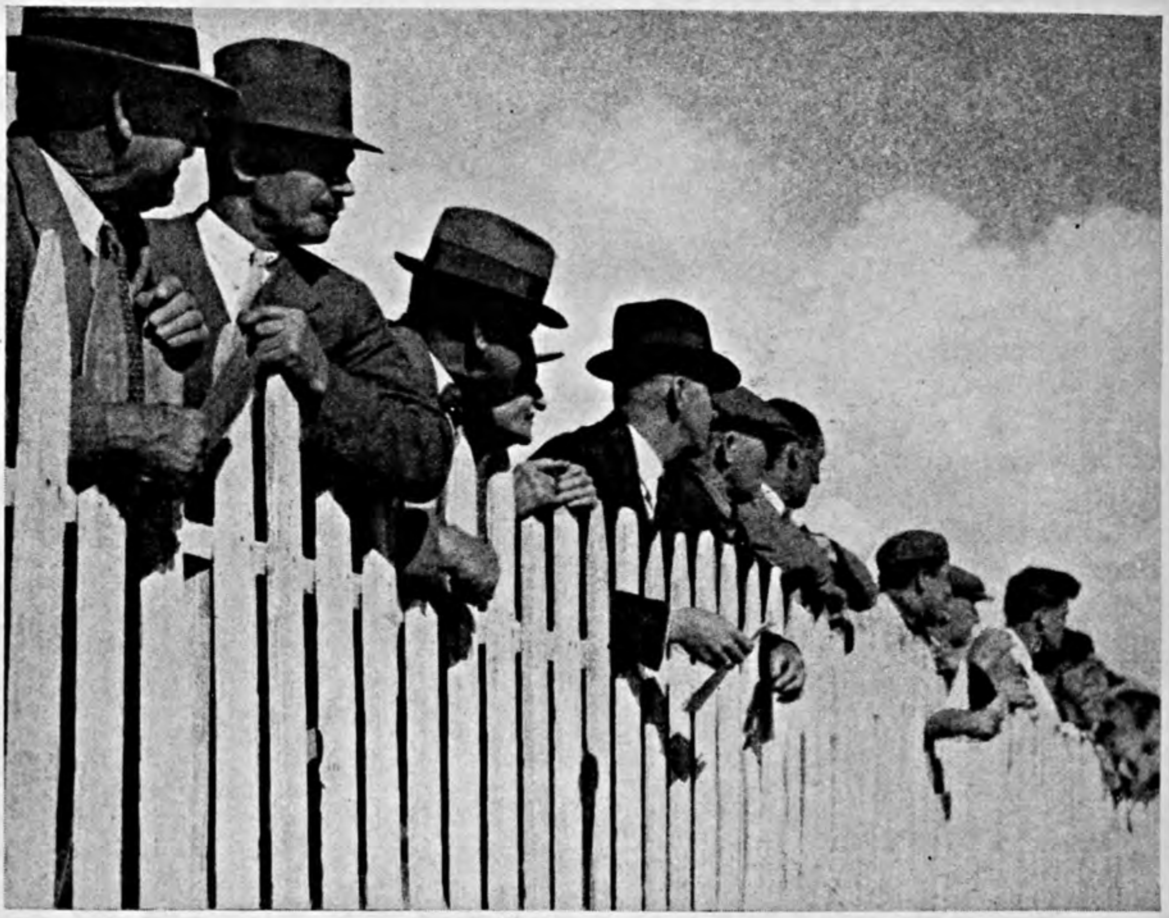
Treatment	Pct. wilt infection 1932 July	1932 Aug.	1932 Oct.	1933 July	1933 Aug.	1933 Oct.
Check no fertilizer	8.7	30.2	43.5	8.1	29.7	45.00
Nitrate of soda—200 lbs	6.9	30.7	45.0	5.9	24.1	34.67
Nitrate of soda—200 lbs. and muriate of potash—100 lbs.	2.0	6.9	11.0	2.4	7.3	11.33
Nitrate of soda—200 lbs. and muriate of potash—50 lbs.	3.5	13.3	18.3	2.9	10.1	15.00
Muriate of potash—50 lbs	3.4	11.7	17.0	3.4	13.2	17.33
Muriate of potash—100 lbs	3.0	10.3	13.3	3.4	14.9	20.33
Muriate of potash—200 lbs	2.1	6.6	9.0	3.0	14.4	21.00

TABLE II-a

Treatment	Pct. wilt infection 2-year av. July	Aug.	Oct.	Lbs. seed cotton per acre 1932	1933	2-year av.
Check no fertilizer	8.4	29.9	44.25	836	1,134	985
Nitrate of soda—200 lbs	6.4	27.4	39.83	739	1,369	1,054
Nitrate of soda—200 lbs. and muriate of potash—100 lbs	2.2	7.1	11.17	1,146	1,458	1,302
Nitrate of soda—200 lbs. and muriate of potash—50 lbs	3.2	11.7	16.67	1,106	1,406	1,256
Muriate of potash—50 lbs.	3.4	12.4	17.67	873	1,211	1,042
Muriate of potash—100 lbs.	3.2	12.6	16.81	1,012	1,114	1,063
Muriate of potash—200 lbs.	2.6	10.5	15.00	1,039	1,037	1,038

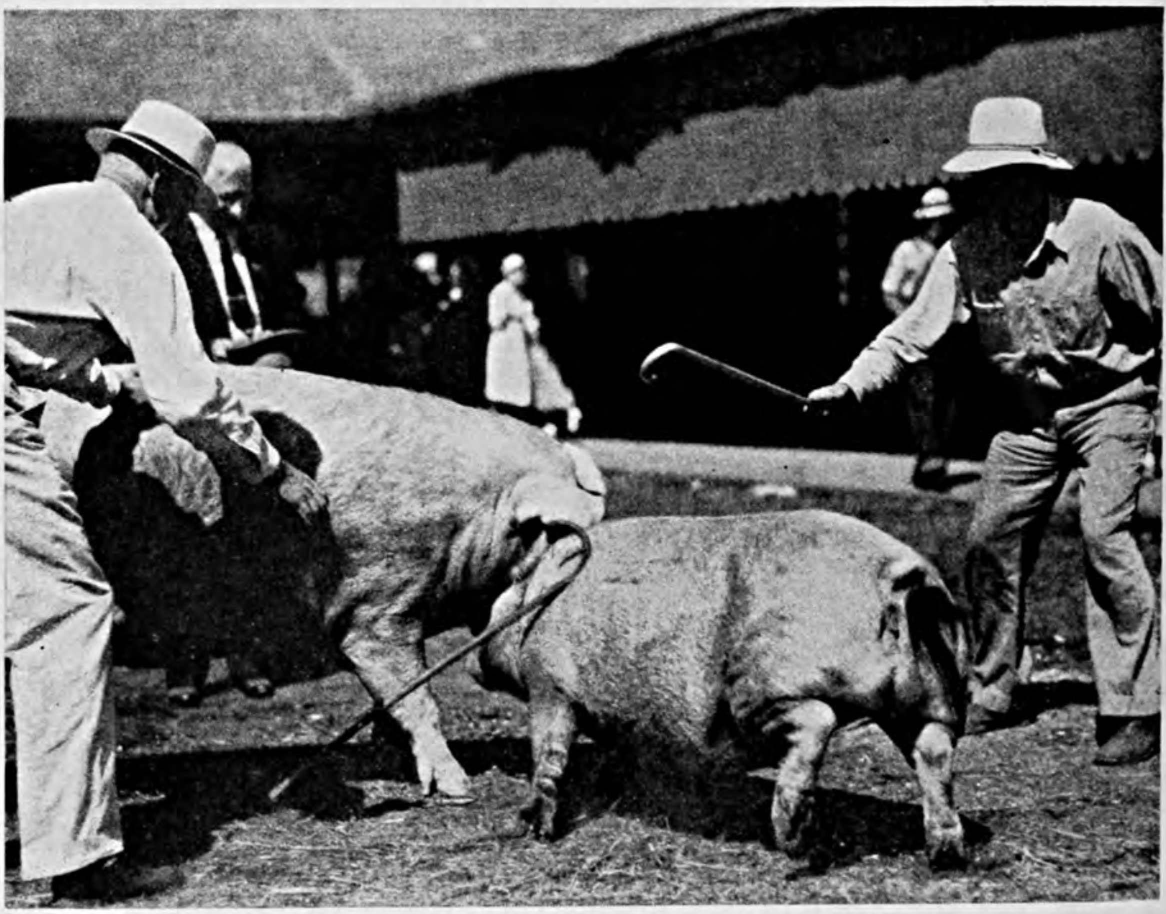
PICTORIAL

WHEN A MAN'S A MAN



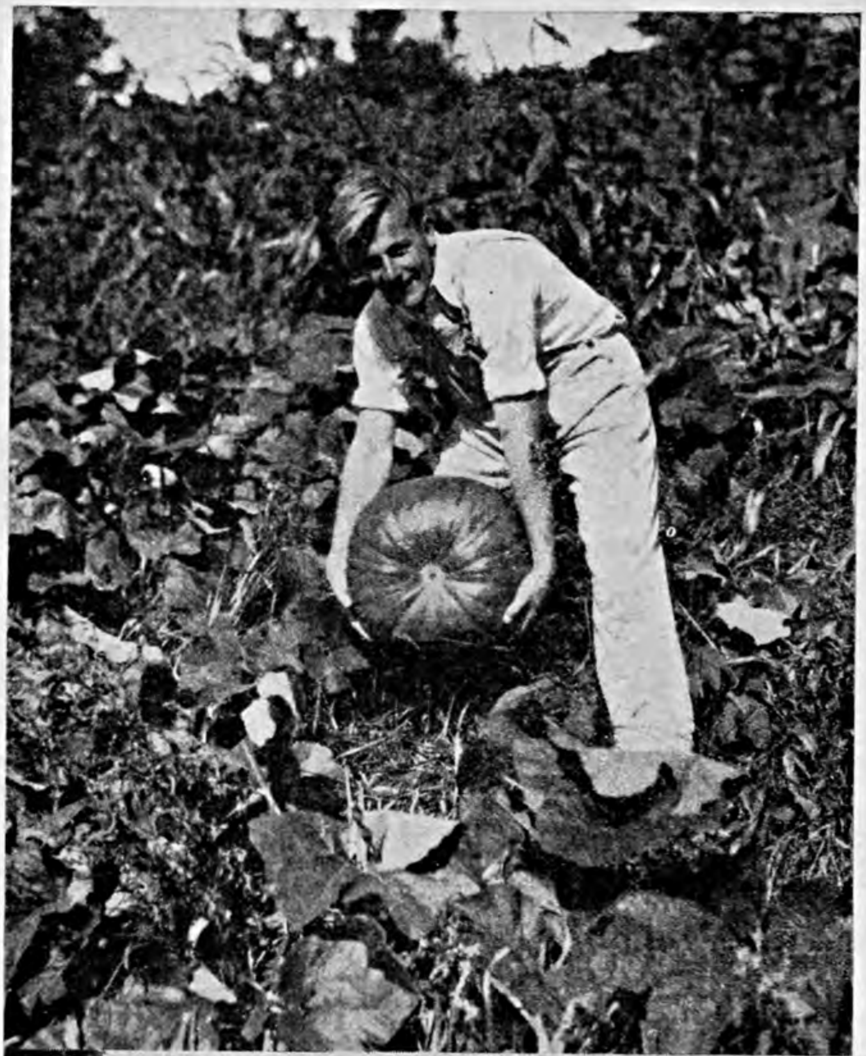
Above: Fall work is forgotten when "they are coming round the bend."

Below: Two prize-winners contest the judges' decision "out of court."



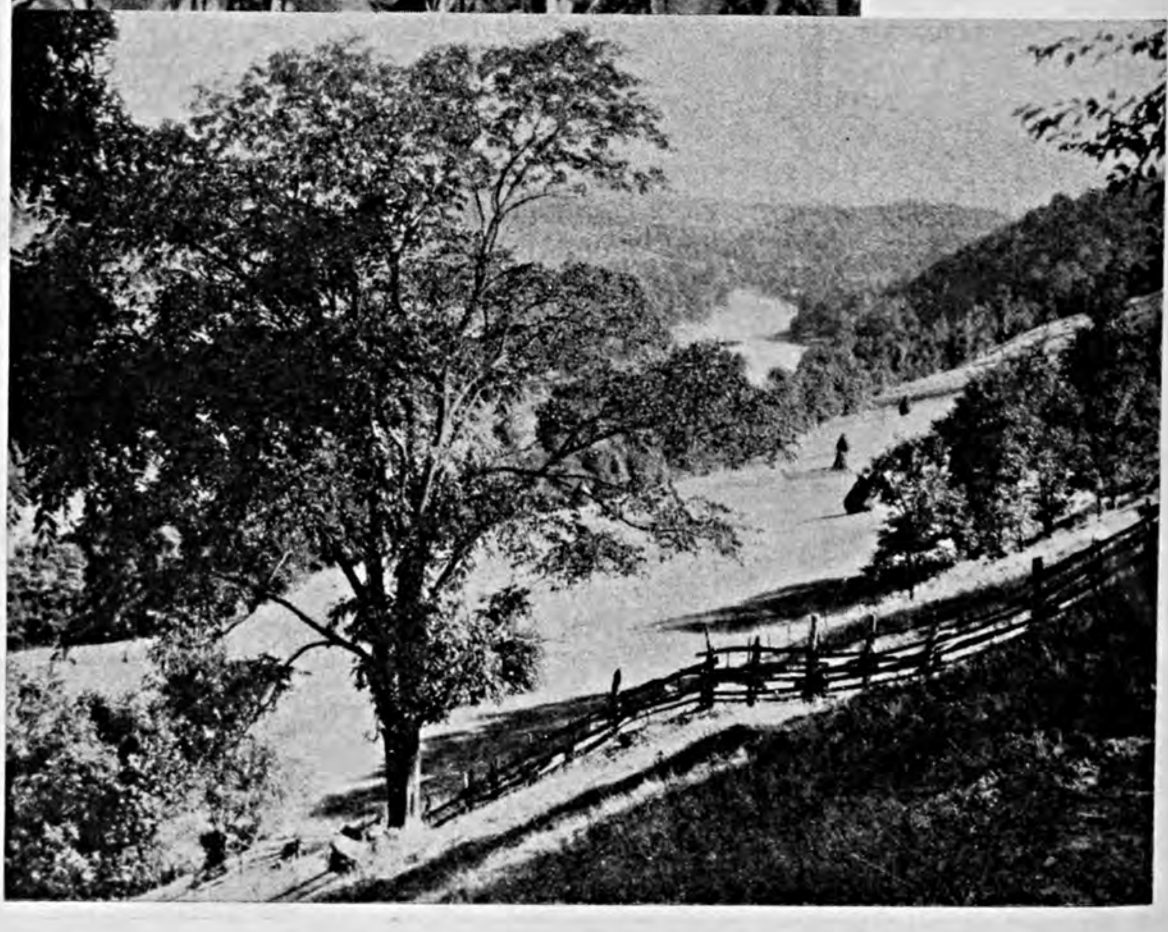
Above: Indian summer days rearrange and repaint rural landscapes.

Below: There are many days of unemployment for doctors represented here.



Left: The gold in "them thar hills" tempts a Halloween jokester.

Below: Where one might expect to see a full range of autumn coloring.



The Editors Talk

"As the Soil Goes, So Goes the Town"

There is a great deal more to this saying than the fun of saying it. Using it as a title for an editorial in a recent issue of *Farm and Ranch*, the editor has well pointed out the wide-spread significance of the "jingle."

"The large cities of the country, especially those in agricultural areas," he says, "must quickly awaken to the fact that their interests are not local if they are to continue to prosper. When the soil in the small town and small city trade area washes away, or becomes unproductive for any other reason, that town immediately feels the loss. Continued decline in the amount of wealth produced is reflected in the loss of business and a decline in population. Once prosperous towns quickly go to seed. When business in the small towns and cities slips, business in the larger cities can be maintained only through the widening of their trade territory, and there is a limit to that form of expansion. Therefore, it behooves the large cities to take an active interest in the development of industry in the towns and cities in their trade territory, and in the conservation of their natural resources."

The editor points out that in full realization of these principles, the Kessler Plan Association of Dallas, originally organized for the purpose of developing the city along logical lines, has extended its activities and is striving to create an interest among the citizens of Dallas in the welfare of the towns and cities in the surrounding sixty or more counties. The secretary of the Association has called attention to the fact that the census figures show that every one of these counties, except Dallas and Tarrant and the counties in which there are oil activities, have lost population, and that the county-seat cities, as well as other cities in these counties, have either slowed down or are just about holding their own, or have fewer citizens than they had ten and twenty years ago.

A survey of the situation showed that the trade territory of these towns has slipped in production; that the soils have become unproductive; that the original owners have moved away, and many of the farms are occupied by tenants who are not encouraged to conserve and build up the land. Some of the towns apparently have gone to seed due to the lack of civic pride and constructive plans of development. This has resulted in the migration of young men and women and many of the more enterprising citizens.

We need, on the part of urban people, a greater realization of the importance and problems of soil productivity. Farm advisers, so frequently called upon to address urban groups, could well afford to make it a theme and stress the personal interest of their audiences in the welfare of their farm neighbors.

As the Texan editor points out, "Chambers of commerce frequently seek the location of industry, and at this time there is considerable discussion on the subject of decentralization of industry. One of the prime considerations of industry, in seeking a new location, is the desirability of the town or city as a place to live. Oftentimes it proves to be the controlling factor in making a choice. Therefore, chambers of commerce should strive to develop their city in such a manner as to make it attractive as a place to live; and furthermore, they will find it profitable to lend their aid in the conservation of the natural resources of their trade territory. In this the large cities should give constructive cooperation, for as the farms give support to the small cities, the small cities support the larger ones."

Pasture Progress

When the ills of a crop cause a consultation of specialists, that crop is on its way to health and vigor. Such a consultation was held on pastures in New York City late in September when, at a Pasture and Hayland Conference, members of the agricultural press, the fertilizer industry, and state and Federal agricultural scientists met in the best interests of the crop.

The conference was called by the National Fertilizer Association, and there were in attendance 20 editors and representatives of farm journals, 26 agricultural workers, and 84 representatives of the fertilizer industry. The purpose of the conference was to provide an intelligent approach to pasture and hayland problems and develop cooperation among all interested agencies in providing farmers with the most practical information and materials for improving these forage crops.

Many important papers were given and were followed by discussions involving the practical angles of the points brought out. General agreement emphasized a few general facts:

1. Cheap roughage, including hay, pasture, and silage, is necessary in order to make money from the production of milk or meat.

2. Pasture is the cheapest of all feeds.

3. The production of good pasture requires liberal applications of plant food.

4. All of the speakers agreed that it is profitable to fertilize hay and pasture land, although there was, of course, some difference of opinion as to the kind of fertilizer to use. There was general agreement that lime, superphosphate, and potash should be the basis for any system of pasture improvement and that nitrogen is essential, but the manner in which it is most economically supplied varies with local conditions.

5. There was complete agreement as to the need for improving a very large acreage of pasture and hayland throughout the country, in the South and Midwest as well as in the Northeast.

Such meetings are to be highly commended. The betterment of American agriculture was sincerely at heart, and the "common ground" provided a means to formulate policies on how best to serve in its furtherance.

REVIEWS

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

Fertilizers

Research Bulletin 197, Iowa Agricultural Experiment Station, entitled "The Effects of Liming on the Liberation of Potassium in Some Iowa Soils," by Hartzell C. Dean, contains many outstanding conclusions following an extensive study of a number of Iowa soils. Analyses of 12 high-lime soils disclosed that all of the soils contained relatively large amounts of total potassium, carbonates, and total nitrogen. The investigation showed, however, that 11 of the 12 high-lime soils contained an insufficient amount of available potassium conducive to maximum plant growth, and that these soils were either in need of or would respond to potash fertilization. The author asserts that this low content of available potassium is correlated with the high carbonate content. It is also stated that soils containing 20 per cent or more of carbonate were deficient in available potassium, regardless of the total potassium they contained. Data obtained from these investigations indicate the depressive effect of calcium on the availability of potassium in soils may be partly due to the action of microorganisms. The results of this study concerning the replacement of potassium in the exchange complex by calcium confirm the findings of other investigators.

"Fertilizing Onions on Muck Soils" is the title of Cornell University Agricultural Experiment Station Bulletin 650 by J. E. Knott. A concise interpretation of the results secured from onion fertilizer experiments conducted for five years on muck soils of New York is interestingly discussed. Soils that had been cultivated for 3 years, 20 years, 30 years, and 56 years were employed in the experiments reported in this bulletin, these soils having been used to determine the optimum application of nitrogen, phosphoric acid, and potash for onions on muck soils differing in length of time they had been cropped. As a result of this work the author recommends certain fertilizer practices that should serve as a starting point from which a grower may adjust the quantity and the analysis to fit his particular conditions. Onions grown on recently cleared mucks should receive a ton of 0-10-10, or one-half ton of 0-20-20 fertilizer per acre. Some new mucks which support reeds and sedges instead of timber require nitrogen, for which 200 pounds nitrate of soda per acre are advised as a supplement to the 0-10-10 or 0-20-20 application, or 1,000 pounds of a 3-12-18 per acre may be used. A muck soil that has been fertilized well for 10 years or more and has not been flooded should have about 50 pounds of nitrogen and 80 pounds each of phosphoric acid and potash applied broadcast to meet the needs of the crop and maintain the reserve in the soil, or an application of from 1,000 to 1,200 pounds of a 5-8-7 per acre should be sufficient. It is best to use from 1,200 to 1,500 pounds of a 4-8-12 analysis for a few years on mucks that have been flooded to replace the fertility which may have been lost, the author suggests. It is also recommended that an application of 300 pounds of finely ground copper sulphate per acre should be applied to mucks that produce onions with thin, poorly colored scales, and on which the tops die prematurely.

"The Effect of Soil Treatment on the Mineral Composition of Exuded Maize Sap at Different Stages of Development," Agr. Exp. Sta., Experiment, Ga., Bul. 193, May 1936, M. W. Lowry, W. C. Huggins, and L. A. Forrest.

"Recommendations Made by the Louisiana Agricultural Experiment Station for the Fertilization of Field and Truck Crops in Louisiana," Agr. Exp. Sta., Baton Rouge, La., C. T. Dowell, Director.

"Synthetic Manure Production in Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 157, July 1936, L. M. Turk.

"A Review of the Experimental Work with Phosphate in Montana, 1928-1935," Agr. Exp. Sta., Bozeman, Mont., Cir. 148, Apr. 1936, Jesse R. Green.

"Recommendations with Reference to the Fertilization of Flue-cured, Sun-cured, and Shipping Tobacco Grown on Average Soils in Virginia, North Carolina, South Carolina, and Georgia for the Year 1937," Agr. Exp. Sta., Raleigh, N. C.

"Magnesium Deficiency. I. The Value of Magnesium Compounds in Vegetable Production in Virginia," Truck Exp. Sta., Norfolk, Va., Bul. 89, Oct. 1, 1935, R. L. Carolus and B. E. Brown.

"The Influence of Acid-neutral Fertilizers on Vegetable Crop Production in Eastern Virginia," Truck Exp. Sta., Norfolk, Va., Bul. 90, Jan. 1, 1936, Jackson B. Hester and Florence A. Shelton.

Soils

The earnest endeavor of our soil scientists to conserve the resources of the soil is evidenced by the excellent contributions which are appearing on this subject. Recent publications detailing valuable accomplishments rendered since cooperative agricultural agencies far and wide declared soil erosion a serious menace to all society include:

"Soil Erosion in Iowa," Special Report No. 2 of the Iowa Agricultural Experiment Station, by R. H. Walker and P. E. Brown, which reveals among other outstanding facts that about 30 billion tons of soil have been washed away from Iowa land since its cultivation was begun by man, representing a tremendous loss of plant nutrients valued at approximately $2,975 per acre of farm land.

"Cropping Systems in Relation to Erosion Control," Missouri Agricultural Experiment Station Bulletin 366, by M. F. Miller, which presents many significant recommendations in accord with the proper adjustment of cropping practices to control erosion.

"Soil and Rainfall Conservation in New Mexico," Bulletin 238 of the New Mexico Agricultural Experiment Station, by C. P. Wilson, P. E. Neale, K. W. Parker, and H. N. Watenpaugh. These authors portray the difficulties encountered in New Mexico in solving the problem of soil and rainfall conservation. Many striking illustrations depicting the results of improper range management, thus inviting soil blowing, gully forming and flood producing effects, are shown.

"A Soil Resources Program for Oklahoma," Circular 335 of General Series 106, issued by the Oklahoma Agricultural Extension division, outlines the work that needs to be done to show an improved "inventory" of Oklahoma's soil resources. "Protect, improve, and Prosper with the Soil" is the general theme of this progressive program. "Lost soil fertility is not the whole story in parts of Oklahoma. Some of the state's soils, in fact, never had abundant amounts of certain minerals necessary to produce crops most profitably. But those minerals can be put into the soil, and they can be restored where they have been lost by washing or used up by cropping." The circular declares that "a farmer is no richer than his soil."

"The Reaction of Zinc Sulfate with the Soil," Agr. Exp. Sta. Gainesville, Fla., Bul. 298, June 1936, H. W. Jones, O. E. Gall, and R. M. Barnette.

"Some Bacteriological and Chemical Effects of Calcium and Magnesium Limestones on Certain Acid Iowa Soils," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 196, Apr. 1936, Harold L. Dean and R. H. Walker.

"Liming the Soil," Univ. of Ky., Ext. Div., Lexington, Ky., Cir. 59 (5th Ed., Rev.), Feb. 1936, P. E. Karraker.

"Soil Testing, A Practical System of Soil Diagnosis," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 132 (Rev.), Oct. 1935, C. H. Spurway.

"Testing Soils for Acidity by the Modified Comber Method," Agr. Ext. Serv., Columbia, Mo., Cir. 339, Mar. 1936, M. F. Miller.

"Report on the Investigation of Phosphorus-deficient Soils, 1935," Agr. Exp. Sta., Bozeman, Mont., Bul. 316, Mar. 1936, Jesse R. Green and F. M. Harrington.

"Genesis and Composition of Peat Deposits," Cornell Univ., Agr. Exp. Sta., Ithaca, N. Y., Memoir 188, Apr. 1936, B. D. Wilson, A. J. Eames, and E. V. Staker.

"Soil Survey of Livingston Parish, Louisiana," U. S. D. A., Washington, D. C., Series 1931, No. 22, A. C. Anderson, E. B. Deeter, S. Rankin Bacon, W. H. Buckhannan, C. S. Simmons, K. V. Goodman, R. R. Finley, and B. H. Hendrickson.

"Soil Survey of Oscoda County, Michigan," U. S. D. A., Washington, D. C., Series 1931, No. 20, J. O. Veatch, L. R. Schoenmann, C. E. Millar, and A. E. Shearin.

"Soil Survey of Hubbard County, Minnesota," U. S. D. A., Washington, D. C., Series 1930, No. 38, P. R. McMiller, C. S. Simmons, G. A. Swenson, and W. J. Leighty.

"Soil Survey of Dillon County, South Carolina," U. S. D. A., Washington, D. C., Series 1931, No. 17, W. J. Geib, W. J. Latimer, F. R. Lesh, and A. E. Shearin.

Crops

E. H. Rawl is stressing the important considerations applicable to potato growers in South Carolina in establishing the production of this crop as a profitable enterprise. In South Carolina Agricultural Extension Service Circular 152, entitled "Sweet Potato Production," he gives specific information on such matters of production as selecting the best varieties, proper seed and treatment, growing plants and vines, soil types best suited, recommended fertilizers, and cultural practices. When plantings are made for the northern markets, the author states that the Porto Rico variety consisting of the copper-colored strain should be grown exclusively. Much care should be exercised in handling seed freed from all dirt; and all that show black spots, rotten ends, and bad bruises should be discarded. Seed potatoes to be treated for disease-producing organisms should be held for at least 8 and not more than 10 minutes in a solution of mercuric chloride. To produce sweet potatoes of the finest quality, the publication suggests that sandy loam soils are desirable, since stiff clays and the deep sands are poorly adapted. Based on experimental work and repeated demonstrations in South Carolina a fertilizer carrying 3 per cent ammonia, 8 per cent phosphoric acid, and 8 to 10 per cent potash, applied at the rate of 800 to 1,000 pounds per acre, is recommended for sweet potatoes in that state. A very helpful table showing suggested materials to use in mixing a fertilizer analyzing 3-8-10 (N-P-K) suitable for average soils is given.

"Forty-sixth Annual Report for the Year Ended June 30, 1936," Agr. Exp. Sta., Tucson, Ariz., P. S. Burgess, Director.

"Pasture Investigations, Eighth Report, Modifying the Seasonal Growth Habits of Grasses," Agr. Exp. Sta., Storrs, Conn., Bul. 209, Mar. 1936, B. A. Brown and R. I. Munsell.

"1935 Report Cooperative Extension Work in Agriculture and Home Economics," Agr. Ext. Serv., Gainesville, Fla., Wilmon Newell, Director.

"Pastures for Georgia," Agr. Ext. Serv., Athens, Ga., Bul. 457, Feb. 1936, E. D. Alexander.

"The Tung-oil Tree in Georgia," Agr. Exp. Sta., Experiment, Ga., Cir. 108, Apr. 1936, H. L. Cochran.

"Lespedeza in Georgia," Agr. Ext. Serv., Athens, Ga., Cir. 263, Feb. 1936, E. D. Alexander.

"Science Aids Idaho Farmers—Annual Report for the Year Ending December 31, 1935," Agr. Exp. Sta., Moscow, Idaho, Bul. 220, June 1936, E. J. Iddings, Director.

"Strawberry Culture in Illinois," Agr. Exp. Sta. and Ext. Serv., Urbana, Ill., Cir. 453, May 1936, A. S. Colby.

"Grape Culture," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 102 (3rd Rev. Ed.), Apr. 1936, Rev. by C. E. Baker.

"Summary Report of the North Louisiana Experiment Station, Calhoun, Louisiana, 1935," Agr. Exp. Sta., Calhoun, La., Sidney Stewart, Supt.

"Cotton Growing for 4-H Club Members," Agr. Ext. Serv., Baton Rouge, La., Ext. Cir. 160, Mar. 1936, R. A. Wasson.

"Ramie, A Critical Survey of Facts Concerning the Fiber Bearing Plant, 'Urtica Nivea'," Univ. Studies No. 26, La. State Univ. Press, Baton Rouge, La., G. L. Carter and Paul M. Horton.

"The Relation of Physical Properties and Chemical Composition of Red Clover Plants to Winterhardiness," Agr. Exp. Sta., College Park, Md., Bul. 391, Jan. 1936, Glenn A. Greathouse and Neil W. Stuart.

"The Bulbous Iris and Its Outdoor Culture

in Massachusetts," Agr. Exp. Sta., Amherst, Mass., Bul. 330, Apr. 1936, Frank A. Waugh.

"The Katahdin Potato in Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 271, June 1936, H. C. Moore and E. J. Wheeler.

"The Production of Cucumbers for Pickling Purposes," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 273, July 1936, H. L. Seaton, Ray Hutson, and J. H. Muncie.

"Factors Influencing the Yields of Montmorency Cherry Orchards in Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 275, July 1936, V. R. Gardner.

"Selection of Orchard Sites in Southern Michigan," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 155, Mar. 1936, N. L. Partridge and J. O. Veatch.

"Management of Bent Grass Lawns," Agr. Exp. Sta., East Lansing, Mich., Cir. Bul. 156, May 1936, James Tyson.

"Strawberry Growing in Minnesota," Agr. Ext. Div., Univ. of Minn., University Farm, St. Paul, Minn., Sp. Bul. 72, May 1936, Franc P. Daniels.

"Bush Fruit Growing in Minnesota," Agr. Ext. Div., Univ. of Minn., University Farm, St. Paul, Minn., Sp. Bul. 79, Rev. Mar. 1936, Franc P. Daniels.

"Forty-second Annual Report. July 1, 1934 to June 30, 1935," Agr. Exp. Sta., University Farm, St. Paul, Minn., W. C. Coffey, Director.

"Influence of Length of Day (Photoperiod) on Development of the Soybean Plant, var. Biloxi," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 242, July 1936, A. E. Murneek and E. T. Gomez.

"Lespedeza for Winter Pasture," Agr. Ext. Serv., Columbia, Mo., Leaf. 44, Mar. 1936, C. A. Helm.

"Johnson Grass," Agr. Ext. Serv., Columbia, Mo. Leaf. 45, Mar. 1936, C. A. Helm.

"Reshaping Montana's Agriculture—Forty-first Annual Report. July 1, 1933 to June 30, 1934," Agr. Exp. Sta., Bozeman, Mont., F. B. Linfield, Director.

"Agricultural Research in New Hampshire—Annual Report of Director of New Hampshire Agricultural Experiment Station for the Year 1935," Agr. Exp. Sta., Durham, N. H., Bul. 289, Mar. 1936, J. C. Kendall, Director.

"Extension Work in New Hampshire 1935—Annual Report of the Director of Extension Service," Agr. Ext. Serv., Durham, N. H., Ext. Bul. 49, Mar. 1936, J. C. Kendall, Director.

"The Home Vegetable Garden," Agr. Ext. Serv., New Brunswick, N. J., Ext. Bul. 177, Apr. 1936, Charles H. Nissley.

"4-H Potato Growing," Cornell Univ., Agr. Ext. Serv., Ithaca, N. Y., Bul. 56, Mar. 1936, Arthur J. Pratt.

"Meadow Improvement through Seeding, Fertilization and Management," Cornell Univ., Agr. Ext. Serv., Ithaca, N. Y., Bul. 181, June 1929 (Rev. Mar. 1936), A. F. Gustafson.

"The Residual Effects of Some Leguminous Crops," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 645, Mar. 1936, T. L. Lyon.

"Quality of Lettuce as It Affects the New York Lettuce Industry," Cornell Univ., Agr. Exp. Sta., Ithaca, N. Y., Bul. 651, June 1936, J. E. Knott.

"Seedlessness in Grapes," Agr. Exp. Sta., Geneva, N. Y., Tech. Bul. 238, Jan. 1936, A. B. Stout.

"Effects of Some Environmental Factors on Growth and Color of Carrots," Cornell Univ., Agr. Exp. Sta., Ithaca, N. Y., Memoir 186, Mar. 1936, W. C. Barnes.

"Effects of Light on Carotenoid Formation in Tomato Fruits," Cornell Univ., Agr. Exp. Sta., Ithaca, N. Y., Memoir 187, Mar. 1936, Ora Smith.

"Tensile Strength, Extensibility, and Other Characteristics of Wheat Roots in Relation to Winter Injury," Agr. Exp. Sta., Wooster, Ohio, Bul. 568, May 1936, C. A. Lamb.

"Experiments with Potatoes on Muck Soil," Agr. Exp. Sta., Wooster, Ohio, Bul. 570, June 1936, John Bushnell.

"Horticulture at the Ohio Agricultural Experiment Station," Wooster, Ohio, Sp. Cir. 48, June 1936.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXI, No. 181, July-August 1936.

"Potato Culture in Pennsylvania," Agr. Ext. Serv., State College, Pa., Cir. 167, Mar. 1936, J. B. R. Dickey.

"Annual Report for the Fiscal Year Ending June 30, 1935," Agr. Exp. Sta., Brookings, S. Dak., James W. Wilson, Director.

"All-year Pasturing with and without Concentrates for Dairy Cattle," Agr. Exp. Sta., Knoxville, Tenn., Cir. 58, Apr. 1936, Ben P. Hazelwood.

"Abstracts of Bulletins 503-522, Circulars 73-76, and Other Publications During 1935," Agr. Exp. Sta., College Station, Brazos County, Texas, Cir. 78, June 1936.

"Twenty-first Annual Report of Cooperative Extension Work in Agriculture and Home Economics, State of Vermont, for Year 1935," Agr. Ext. Serv., Burlington, Vt., J. E. Carrigan, Director.

"Further Studies of the Limits of Photosynthesis," Agr. Exp. Sta., Burlington, Vt., Bul. 402, Mar. 1936, G. Richard Burns.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 339, July 1936.

"Growing Peas for canning in Washington," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 150, Apr. 1936, C. L. Vincent.

"Today's Science for Tomorrow's Farming—Annual Report of the Director 1934-35," Agr. Exp. Sta., Madison, Wis., Bul. 435, Mar. 1936, Chris L. Christensen, Director.

"Security and Permanence for the Farm Home—Annual Report for 1935," Agr. Ext. Serv., Madison, Wis., Cir. 279, Mar. 1936, Chris L. Christensen, Director.

"Celery Growing," U. S. D. A., Washing-

ton, D. C., Farmers' Bul. 1269, *Rev. Mar.* 1936, *W. R. Beattie.*

"*Speeding up Flowering in the Daffodil and the Bulbous Iris,*" *U. S. D. A., Washington, D. C., Cir.* 367, *Jan.* 1936, *David Griffiths.*

"*New Sugar-beet Varieties for the Curly-top Area,*" *U. S. D. A., Washington, D. C., Cir.* 391, *Apr.* 1936.

"*Positions of Seeds and Motes in Locks and Lengths of Cotton Fibers from Bolls Borne at Different Positions on Plants at Greenville, Texas,*" *U. S. D. A., Washington, D. C., Tech. Bul.* 509, *Apr.* 1936, *Dow D. Porter.*

"*Agricultural Adjustment* 1933 *to* 1935," *U S. D. A., Washington, D. C., G-55, Agricultural Adjustment Administration.*

Economics

In a recent bulletin by K. T. Wright of the Farm Management Department, Michigan State College, entitled "Economics of Bean Production in Michigan," are presented some very interesting practical facts based on the experiences of practical farmers with problems of bean production in that state. Pea beans are one of the major cash crops of the Michigan farmer, and Michigan is the leading state in bean production. Due to the fact that the pea bean is by far the most important grown in the state, the results of the study are more applicable to this type of bean crop. Bean production has increased much faster than population. In the five years from 1930-1934 there were 40% more pea beans produced per capita than in 1890.

Unfortunately, the study was made during a period when bean prices were extremely low, and the weather conditions during the critical months for this crop averaged below normal. Thus the results of the study must be interpreted in light of these facts. The wide variation in yields for the different years indicate the wide variation in weather conditions. The highest yields obtained by any of the cooperators in 1929-30 were 25 bushels; in 1931, 34 bushels; in 1932 (when the rainfall was adequate) 42 bushels. The lowest yields average around five bushels.

It was found that yields were an important factor in profitable bean production. The low yield group, taking the state as a whole, lost $7.12 per acre on their bean crop, while the high yield group made a profit of $7.47 on their crop. As the yield went up, the cost per bushel went down. It was found that in general the growers obtaining the higher yields, grew the robust variety, plowed the ground in the spring, planted their beans comparatively early, planted them on well-drained land, efficiently utilized their barnyard manure and used more commercial fertilizer than those receiving the lower yields.

The records were analyzed on the basis of soil types, and it was found that the growers on Brookston soil had lower than the average charges for labor, power, and machinery, but the land charges were high making the total cost per acre $29.92. The yield for this group averaged 15.2 bushels per acre with an average cost of $3.19 a hundred, and the return per hour of labor averaged 29c. On the Miami soils the acre cost was $27.60, due to the lower charges for the land, but the average yield was only 10.4 bushels making the beans cost $4.25 per hundred, and the labor returns were only 9 cents an hour. On the sandy soils records were available for only three years, and the results are not fairly comparable. The cost per acre averaged about the same as on the Brookston soils. The yield per acre was only 7.2 bushels and the cost per 100 lbs. of beans was twice as much as on the Brookston soils. These farmers lost 9 cents an hour for the time they spent on their crop.

It is concluded that on the basis of present production and demand the possibility of profit in beans in the near future, when the yields are only about 10.7 bushels per acre, is very limited. However, the growers using good practices and efficient methods of production resulting in good yields can reasonably hope for a fair return for their management and labor.

"*Part-time Farming in New Castle County,* *Delaware," Agr. Exp. Sta., Newark, Del., Bul. 199, Apr. 1936, M. M. Daugherty.*

"Quarterly Bulletin," State Bd. of Agr., Dover, Del., Vol. 25, No. 4, Quarter Ending Dec. 31, 1935.

"Illinois Farm Economics," Agr. Exp. Sta., Urbana, Ill., No. 14, July 1936.

"Fertilizer Tonnage Sold in Illinois in 1935," Agr. Exp. Sta., Urbana, Ill., May 1936.

"Tonnage of Fertilizers Reported by Manufacturers as Shipped to Kansas," 1934 and 1935, State Bd. of Agr., Topeka, Kans., C. E. Buchanan, Dir. of Control Div.

"Public Produce Markets of Michigan," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 268, May 1936, Orion Ulrey.

"Changes in Standards of Consumption During a Depression," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 274, July 1936, Irma H. Gross and Julia Pond.

"Readjusting Montana's Agriculture. VII. *Montana's Dry-land Agriculture," Agr. Exp. Sta., Bozeman, Mont., Bul. 318, Apr. 1936, E. A. Starch.*

"Readjusting Montana's Agriculture. VIII. *Tax Delinquency and Mortgage Foreclosures," Agr. Exp. Sta., Bozeman, Mont., Bul. 319, May 1936, Roland R. Renne.*

"An Analysis of the Present Status of Agriculture on the Sun River Irrigation Projects," Agr. Exp. Sta., Bozeman, Mont., Bul. 321, May 1936, P. L. Slagsvold.

"Montana Land Ownership, An Analysis of the Ownership Pattern and Its Significance in Land Use Planning," Agr. Exp. Sta., Bozeman, Mont., Bul. 322, June 1936, Roland R. Renne.

"Factors Determining Type-of-farming Areas in Nebraska," Agr. Exp. Sta., Lincoln, Nebr., Bul. 299, May 1936, L. F. Garey.

"New Jersey Farm Prices and Their Index Numbers, 1931-1935," Dept. of Agr., Trenton, N. J., Cir. 255, Mar. 1936, William B. Duryee, Secretary.

"Commercial Fertilizers. Sixth Annual Report of the New Mexico Feed and Fertilizer Control Office for Fiscal Year Ending June 30, 1935," N. M. Feed and Fert. Control Office, State College, N. M., R. W. Ludwick and Lewis T. Elliott.

"Farm Economics," Cornell Univ., Col. of Agr., Ithaca, N. Y., No. 95, May 1936, and No. 96, June 1936.

"Part-time Farming in Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 340, June 1935, G. W. Kuhlman, T. J. Flippin, and E. J. Niederfrank.

"Apple Prices Received by Washington Growers," Agr. Exp. Sta., Pullman, Wash., Bul. 326, Feb. 1936, Chester C. Hampson.

"Indexes of Prices Received by Washington Farmers," Agr. Exp. Sta., Pullman, Wash., Bul. 328, July 1936, Chester C. Hampson.

"Development and Use of Standards for Grade, Color, and Character of American Cotton Linters," U. S. D. A., Washington, D. C., Misc. Pub. 242, May 1936, Guy S. Meloy.

"Carlot Shipments and Unloads of Nineteen Important Fruits and Vegetables," U. S. D. A., Washington, D. C., Stat. Bul. 53, May 1936.

Winter Corn and Cotton

Corn and cotton are hot-weather crops. A farmer, even in the South, cannot grow these crops in winter. But he can grow what is substantially the equivalent of corn or cotton as a winter crop, says the United States Department of Agriculture. A. D. McNair, of the Bureau of Agricultural Economics, and Roland McKee, of the Bureau of Plant Industry, tell how.

Plant a legume crop that will grow in fall and winter and plow it under in the spring. Then plant corn or cotton and the field will yield enough more grain or lint to make the equivalent of a winter cash crop. In farm management studies on farms in Georgia, Alabama, and the Carolinas, these men found that, on the average, corn which followed a winter legume in the South yielded 14 bushels an acre more than corn on similar land that stood bare. So the 14 bushels an acre could be regarded as the corn yield of the winter legume.

Cotton following a winter legume yielded on the average about 100 pounds more of lint than cotton on fallow fields. This 100 pounds is traceable to the legume. The farmer who plants legumes has other advantages. The winter legumes prevent erosion, improve the soil, make cultivation easier, and furnish some winter feed for livestock.

Well-fed Raspberries Stand Cold

Winter hardiness of some of the berries, particularly raspberries, is not entirely a matter of winter temperatures or snow cover, as many have supposed. It is the well-fed raspberry plant that endures cold winter weather. When the summer climate is favorable to development of anthracnose (gray bark) and leaf spot, the plants are defoliated and go into the winter weakened and with scant reserves of food, says George M. Darrow of the Bureau of Plant Industry. The result is winter injury. In Maryland, for example, where winter temperatures are relatively mild because it is near the southern border of the raspberry range, there has been much winter-killing among varieties that are known to be hardy even in Canada. To prevent winter injury, growers need to spray regularly in the summer for control of fungus diseases.

Mr. Nat Stafford Learns About Potash

(*From page* 17)

facts we were walking about in that corn field. Where the phosphate-potash mixture was used, the corn was beautiful. It had matured good ears on good stalks and would produce a profitable crop. Where he ran out of the mixture and had used only the phosphate, the corn had made practically no growth, had fallen ove. badly, and one could hardly find a decent ear in the whole area. But there was an island of good corn in this area, and that was where he had thrown the 10 quarts of muriate on the day he had run out of a job. At the end of the field where the manure had been added to the phosphate, the corn again was good, but not quite in the condition found where the phosphate-potash mixture had been used.

The island of good corn that got the 10 or 12 qts. of muriate of potash one day as a top-dresser. This was in the center of the area of poor corn and at the edge of the 25-acre field.

Mr. Stafford was so concerned over his unwitting demonstration that he went to Graham and urged County Agent Shiver to come out and see the field. Others have made similar trips. To them Mr. Stafford tells the story of what happened and how it happened. He voices no explanation except that the soil is the same throughout the field save for one narrow strip where an old hedgerow runs across it. He knows now that it would have paid him to have mixed potash with his phosphate in spite of his great hurry to get his corn seed in the ground. But it was dry in North Carolina this spring, and for a while it looked as if few of us would make any corn at all. Perhaps he is to be excused, therefore, for his haste to take advantage of the blessed moisture. Certainly he has gained in knowledge what he lost in corn yield.

Potassium Availability in Illinois Soils

(*From page* 15)

prevent replenishment of potash from the minerals. The plant, over a period of time, can overcome or at least not be affected significantly by factors which might at first hand be considered theoretically important; however, we did find that the soil test for replaceable potassium was affected by certain of these factors. We found that we had to have a very strong replacing solution under the soil-test conditions where only one equilibrium is established between soil and solution. As we reduced the replacing strength of the solution it took out less and less replaceable potassium, and this reduction in amount was not in proportion to the total amount present but was influenced mainly by the amount of replaceable calcium and magnesium present. With more dilute solutions, therefore, we obtained values having no relation to the total amount present; i. e., the amount of available potassium.

This work convinced us that it is not practical to try to measure the relative "availability" of the replaceable potassium by a chemical test, and that our best bet is to measure the total replaceable potassium present and let the crop establish the availability in terms of its own requirement; i. e., establish the level required. If the replacing solution is too weak to replace all the potassium in the lower testing soils and a large part of the replaceable potassium in the higher testing soils, even relative results are not possible.

In the above discussion I have not included some important exceptions to our general findings. It is only on the silt and clay loam soils that our general calibration is of value. Two fields on dune sand did not test high in potash and yet gave no decided responses. These sandy soils are very open and contain only a small amount of organic matter and clay. The base-exchange capacity is less than 3 M.E., or less than one-tenth that of the better soils. All of these factors help to make for a higher positional availability than on the silt and clay loams. We have no calibration of the test for these sandy soils. We know that a "high" test indicates sufficient potash, but we do not know at what point crop response occurs, because we do not have sufficient field experiments to effect a calibration. Fortunately, we have only a limited area of sand in our state. If it were an important type we could establish the necessary calibration by field and laboratory work.

The changes in the replaceable potassium level during the season and from year to year are interesting to watch, as are the changes in the distribution throughout the soil profile. These changes do not affect the potassium fertility of the soil until the level falls below the level required for best results. Some soils can maintain a luxury level; our Hartsburg and Minonk experiment fields are examples, with well over 200 pounds of replaceable potassium present. The Dixon field level has been steadily going down since 1929, and we expect all plots to respond to potash application in time. The chart accompanying this article (Figure 1) shows what happens when the replaceable potassium level is reduced seriously by cropping. This chart shows that over a period of only five years the Dixon field has been converted from a non-responsive to a potash responsive field, and the decrease in the replaceable potassium values reveals the reason for this. On the other hand, even soils which have never been farmed in southern Illinois are already low in replaceable potassium, since these soils have a naturally low rate of supply. The use of sufficient potash will maintain a good level of replaceable potassium, and the level in the subsurface will also be raised eventually, provided the amounts of potash fertilizer used exceed the amounts removed by the crops grown. On the other hand, in untreated, deficient soils the subsurface potash level is lower than that of the surface.

Alkali spots caused by snail shell accumulations under wet conditions are usually deficient in replaceable potassium, due to the weathering away of the mica form of potash which occurs in the very fine portion of the soil mass. The fact that the calcium bicarbonate formed from the snail shells acts as a replacing agent also helps to prevent the building up of a good level of replaceable potassium.

In general, our potassium deficiencies are related to the amount of the mica form of potassium and vary progressively with the change in the amount of this potassium mineral present in our loess soils. As a result of this regular variation we have been able to divide the state into areas corresponding to the relative rate of supply from the mineral forms. We are thus able to show the areas deficient in potash, the areas which will soon become deficient, and the areas where potassium deficiencies will not generally occur in the near future, although a few deficiencies have shown up in local areas. This map is shown in Figure 2.

Measure of Supply

One important question which has not been answered is how long the best soils will be able to continue to supply available potash in sufficient amounts. The Dixon field on one of our best soil types is already responsive to potash, although it can still produce on the RLP plot without added potash much higher crop yields than the county average. It is highly probable that the decrease in yield on the RLP plot resulting from this deficiency will slowly develop over quite a number of years, but that crop yields will not become as low as on our southern soils, during our lifetime at least. We have tried to measure this rate of supply of available potassium from the non-available form in the laboratory by acid digestion methods. Although we can get good relative results, they cannot be translated into terms of years.

In the above discussion I may have used the terms "low in available or replaceable potassium" and "deficient in potash" synonymously. As a matter of fact, a distinction should really be made between the two terms. We consider a soil low in replaceable (available) potassium when it contains less than 90 pounds per acre in 2,000,000 pounds of soil. We call this low because the common field crops of Illinois will respond to potash fertilization in a profitable way if not limited by other factors. We know, however, that the crop will not have a chance to respond satisfactorily if other "deficiencies" are not made up. In southern Illinois in particular we recognize two conditions. The soil containing less than 90 pounds per acre we call "low in available potassium" when other elements are still "deficient." If these other deficiencies have been made up, thus giving the plant a chance when potassium is added, we then call it a potash deficient soil. Most of the limed, phosphated, and legumed fields in central southern Illinois are "potash deficient," while most of the untreated soils are "low in available potassium," although "potentially deficient" under good treatment.

Proper Management

The 103 plot at the Dixon field which tested medium in potassium (113 pounds by the quantitative laboratory method) in 1931, would not be recognized as a deficient soil if farmed without the necessary soil treatment. It is only by increasing the productive capacity of a soil to a point where it can utilize more potash than is being supplied that a soil becomes truly potash deficient. I believe that most of the farmers on our best soils in northern Illinois are farming at too low a productive level to efficiently utilize all the potash becoming available. It is only through the use of a good system of soil management and treatment that productive levels which will effectively utilize the potash are reached. If the potential productive capacity is sufficiently higher, then purchased potash can be used at a profit. We hope that most of our better soils will be able to give their high yields under good treatment for a long time without having to supply potash fertilizer. This will probably be true of some of the best soils. However, even though potassium deficiencies develop, due to increased crop yields, the cause of the development must be kept in mind.

Any system which can raise the productive level of a soil from 35-40 bushels of corn (county average) to 63 bushels (RLP treatment, average of 11 northern fields) can well afford to include potash in the treatment when and if this becomes necessary to maintain the high level of productivity reached. Just as we undertake trying to do something too much for us to accomplish and finally realize our own personal deficiencies, so many of our soils will probably be shown to be not as potassium rich as we have considered them when we actually put them to the test. Thus it is that with our northern Illinois soils so high in potential productivity, any fertility treatments designed to actually attain their high potential capacity will probably eventually have to include potassium. We consider it far better to treat our soils in this manner, maintaining a good rotation, keeping the ground covered most of the time, and turning under large amounts of residue and green manures, than to run down the fertility and productiveness of our soils by a corn and oats rotation, thus exposing them to erosion.

In southern Illinois our lime, legume, and phosphate treatment system will work only up to the point where the yearly supply of available potassium is being effectively used for the rotation as a whole. This, however, is at a low productive level as compared with the full possibilities, for higher returns are obtained when potash is added to the fertilizer system. From the practical standpoint, however, credit must be given to the whole treatment, since all elements of the treatment are necessary to produce the effect. On our most deficient fields the competition between the crops in the rotation is at a maximum on the RLP plot, and corn, having the highest requirement, suffers the most.

At present we are trying to overcome the old viewpoint that a good soil treatment system including residues and green manures can practically bring about the liberation of the mineral potash and build up the available supply. We have many farmers in southern Illinois who have used lime, legumes, and phosphate, but do not yet understand that potash in addition is essential in order to get their money back from the lime and phosphate treatment. They do not know that these treated fields are potentially their richest fields. We are going to make it our business to let them know it and have already started with various news releases. Furthermore, we are going to tell the same story over and over, that is, that these soils are low in available potash, that they can never hope to liberate potash from the minerals at anywhere near a sufficient rate, and that potash must be returned to the land if they intend to attain the productive level possible.

Flower Symptoms Warn of Food Deficiency

(*From page* 10)

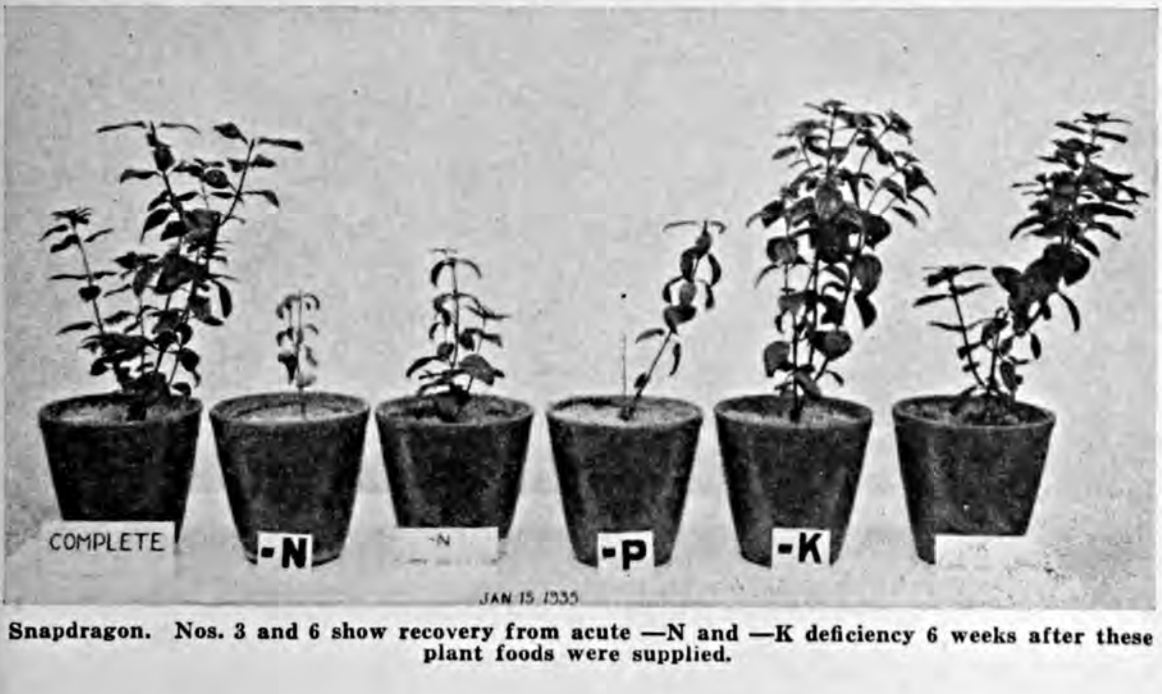
The young leaves were of a very dark-green color. The old leaves were bronzy-dark green in color and showed a definitely purple cast beneath, later shriveling and dying to a purplish-bronze color.

Without Potash—The plants were only slightly stunted in growth. The young leaves were yellowish green in color with dark-green veins and a reddish tinge along the margin. The older leaves turned purplish green in color on the upper surface but not purplish beneath like those in the treatment without phosphorus. These leaves began to die first along the margin and in spots over the entire leaf.

Sweet Pea

Complete—The plants were vigorous in growth and of a normal green color.

Without Nitrogen—The plants were very stunted in growth, and all of the leaves were very light yellow, almost white, in color. The old leaves died and dried to a grayish-white, papery color and remained on the plant quite a while before dropping.



Snapdragon. Nos. 3 and 6 show recovery from acute —N and —K deficiency 6 weeks after these plant foods were supplied.

Without Phosphorus— There was not a distinct symptom that could be attributed to a phosphorus deficiency in this treatment. The plants were almost normal in growth, showed only a slight yellowing of the old leaves, and no shedding of the leaves.

Without Potash—The plants were stunted in growth, and the older leaves showed a progressive yellowing from the margins to the center of the leaf. The veins of the yellowing leaves remained green until the entire leaf had turned yellow. The yellowing progressed upward until only the young leaves at the tip remained green. The dead leaves dropped from the plant early.

Several tests were run to determine whether plants showing symptoms of acute nutrient deficiencies would recover if the deficient nutrient was supplied.

Roses in the minus-nitrogen treatment that had ceased growing and had dropped all leaves produced new growth in 2 weeks after nitrate of soda was added to the nutrient solution.

Cinerarias without potash, showing whitish-yellow spots between the veins and whitish-yellow margins, regained their normal dark-green color, except for a very narrow yellow margin on the oldest leaves, in 6 weeks after potash was added to the nutrient solution.

The stunted and rusty-yellow Snapdragons that had ceased to grow without nitrogen, regained their normal green color and began to grow soon after nitrogen was added to the nutrient solution. Except for the dwarfing caused by the omission of nitrogen, the plants were as vigorous as those in the complete treatment. In the minus-potash treatment, the yellowish-green young leaves regained a normal green color in 6 weeks after potash was added to the nutrient solution. Even the oldest leaves, with the

Right: Nutrient deficiency symptoms exhibited by the Sweet Pea.

brown margins and spots over the entire leaf, regained a normal green color except for the brown areas.

Summary

In general, the visual deficiency symptoms for nitrogen (N), phosphorus (P), and potassium (K) for the plants studied may be summarized as follows:

1. **Nitrogen deficiency** produces a severe dwarfing of the plant and a uniform yellowing of all leaves. The young leaves begin to yellow very soon after the oldest leaves begin to turn. The affected leaves die slowly and remain attached to the plant for some time. The plant ceases to produce new growth soon after yellowing begins.

2. **Phosphorus deficiency** produces a severe dwarfing of the plant with most of the leaves remaining abnormally dark green. In severe cases, the oldest turn grayish-green or sometimes purplish-green and later begin to turn yellow. The yellowing usually begins at the margin and progresses toward the petiole, and the leaf usually drops before it becomes completely yellow. The plant ceases to produce new growth soon after yellowing begins.

3. **Potassium deficiency** usually produces only a slight dwarfing of the plant, and the leaves remain normal dark green in color until affected by the characteristic potassium deficiency injury. The injury usually appears first on the oldest leaves when the margin and area between the veins turn yellow and the veins remain green. Later the leaf begins to turn brown and dies along the margin and in spots over the leaf. The leaves die slowly and remain attached to the plant for some time after dying.

Potash for Cotton Wilt

(*From page* 22)

potash was relatively high but was much lower than on either of those which had had no potash. The October count showed merely a consistent increase in amount of wilt in all plats.

The average infection for the check and nitrate plats for the two years was 44.25% and 39.83%, respectively. The lowest wilt infection over the 2-year period was on the plat receiving 200 lbs. of nitrate of soda and 100 lbs. of muriate of potash, namely, 11.17%. This was a very material reduction over the infection on the check and nitrate plats. The highest yield also, 1,302 lbs. for the 2-year average, occurred on the same plat, as compared with 985 and 1,054 lbs. for the check and nitrate plats for the same period. The indications in this test, as in the one reported immediately preceding it, are that potash fertilizers, even when used in combination with other necessary elements, though beneficial in bringing about very marked reduction in wilt infection, cannot be depended upon to adequately control wilt if a very susceptible variety of cotton is used.

The same test was planted on the property of W. M. Simpson, Webb, Miss., in 1931 and 1932. The soil on which it was located was of quite a sandy character, entirely typical of the bulk of that characteristic of the Delta in general, which is of a much heavier and more alluvial nature. Such sandy spots are, however, not uncommon in certain parts of the Delta. The chief variation in the lay-out of the test consisted in the size of the plats. In this case they were only five rows wide instead of 10 as in the two tests previously reported. In 1931 the ground was prepared and the fertilizer weighed and applied by hand on March 22. Missdel No. 2 cotton was planted two weeks later. In 1932 the ground was prepared, the fertilizer applied, and the seed planted on April 9.

In both years wilt counts were made in July, August, and early October, the final one being after harvest was completed. These counts, together with other results secured, are presented in table III. The table shows that wilt infection progressed at the various dates very much in the same manner as in the two tests previously reported. The 2-year average presents a very satisfactory picture of conditions for each of the inspection dates, with the relative position of each of the plats remaining approximately the same with respect to infection. Wilt was heaviest in each case on the check plat which received no fertilizer. The nitrate plat ranked next in infection, the respective average infection for the two plats over the 2-year period being 45.15 and 37.15%.

All plats receiving potash showed a very materially reduced wilt count. The lowest percentage of infection occurred on the plat treated with 200 lbs. of potash alone (Fig. 1) namely, 8.9%, while the plat receiving 100 lbs. of potash alone ranked second lowest with 11.75%. The plat receiving 200 lbs. of nitrate of soda and 100 lbs. of muriate of potash showed 12.4% wilt and was followed in order by the two receiving 200 lbs. of soda and 50 lbs. of potash and 50 lbs. of potash alone, with wilt percentages of 16.6 and 19.39%, respectively.

Yield records over the 2-year period indicated that the most efficient application of fertilizer among those tested, as shown by decrease in wilt and increase in yield, was a combination of 200 lbs. of nitrate of soda and 100 lbs. of muriate of potash per acre. This plat gave an average yield of 1,568 lbs. of seed cotton, an increase of 814 lbs., or 107.97% over the check plat. The one receiving 200 lbs. of soda and 50 lbs. of potash yielded 1,393 lbs., an increase of 639 lbs., or 84.75%. The

TABLE III. WILT FERTILIZER TEST. PROPERTY OF W. M. SIMPSON, WEBB, MISS., 1931-1932

Treatment	Pct. wilt infection 1931 July	Aug.	Oct.	1932 July	Aug.	Oct.
Check no fertilizer	7.2	28.7	41.3	7.8	33.1	49.0
Nitrate of soda—200 lbs	4.1	27.1	39.6	6.3	24.9	34.7
Nitrate of soda—200 lbs. and muriate of potash—100 lbs.	.8	6.7	12.0	1.2	7.9	12.8
Nitrate of soda—200 lbs. and muriate of potash—50 lbs.	2.2	10.0	16.2	2.4	10.8	17.0
Muriate of potash—50 lbs	3.4	14.1	20.5	3.5	13.0	18.2
Muriate of potash—100 lbs	2.1	8.4	13.0	2.2	7.0	10.5
Muriate of potash—200 lbs	1.1	5.8	9.0	2.0	6.3	8.8

TABLE III-a

Treatment	Pct. wilt infection 2-year-Av. July	Aug.	Oct.	Lbs. seed cotton per acre 1931	1932	Av. 2-year Av.	Increase
Check no fertilizer	7.5	30.9	45.15	752	756	754	...
Nitrate of soda 200 lbs.	5.2	26.0	37.15	960	1,080	1,020	266
Nitrate of soda—200 lbs. and muriate of potash—100 lbs	1.0	7.3	12.40	1,588	1,548	1,568	814
Nitrate of soda—200 lbs. and muriate of potash—50 lbs	2.3	10.4	16.80	1,444	1,342	1,393	639
Muriate of potash—50 lbs	3.4	13.5	19.39	1,004	994	999	245
Muriate of potash—100 lbs	2.1	7.7	11.75	1,120	1,012	1,066	312
Muriate of potash—200 lbs	1.5	6.0	8.9	1,152	1,212	1,182	428

application of 200 lbs. of potash alone gave an average yield for the two years of 1,182 lbs., an increase of 428 lbs., 56.76%. This application was much more efficient in wilt control and much more profitable than was that of 200 lbs. of nitrate of soda alone, which was the fertilizer treatment that had been given to this plat of land by the grower in previous years. The average yield of the latter was 1,020 lbs., an increase of only 266 lbs. or 35.27% over the check. This was exceeded even by the plat treated with 100 lbs. of potash alone, which yielded 1,066 lbs., an increase of 312 lbs., or 41.37%. In 1931 the yield of the nitrate plat was exceeded even by the one receiving the meager application of 50 lbs. of potash alone.

This test indicated that on the type of soil represented and with the heavy infestation of wilt which occurred on it potash was more important and profitable on account of the degree of wilt control secured than was an equivalent amount of nitrate when the elements were applied separately. The most efficient fertilizer, however, was one which contained both elements combined in proper proportions and in adequate amounts.

In 1929 and 1930 another simple test was planned and conducted on the property of D. E. Denby, Charleston, Miss. This was on land at the eastern edge of the Delta, immediately adjacent to the bluffs which bound it at that point, very similar in character to that on which occurred the test on the property of Spencer J. Brown, Cascilla, Miss., which has been discussed previously. In fact, these two tests were but two or three miles distant from each other.

Three plats were laid out, the first being the check and receiving no fertilizer, the second receiving 100 lbs. per acre of nitrate of soda, which was the treatment that had been given the land in the past by this particular grower, and the third received the 100 lbs. of nitrate of soda and an additional 50 lbs. of muriate of potash per acre. All plats were replicated three times. They were planted with Delfos 6102 cotton, and wilt counts and yield records were taken at the end of the harvest season. The results are shown in table IV.

TABLE IV. WILT FERTILIZER TEST ON PROPERTY OF D. E. DENBY, CHARLESTON, MISS. 1929-30.

Treatment	% wilt infection			Lbs. seed cotton per acre			
	1929	1930	Ave.	1929	1930	Ave.	Ave. % increase
Check No fertilizer	44.3	47.6	45.95	763	714	738.5	.....
Nitrate of soda—100 lbs.	47.0	50.2	48.60	911	935	923.0	23.49
Nitrate of soda—100 lbs. and muriate of potash—50 lbs.	15.0	17.3	16.15	1,268	1,239	1,253.5	69.73

The results secured in the tests reported herein are sufficient indication that there are numerous fields and soil types located in various parts of the Delta on which cotton wilt and rust are problems of major importance. They show also that the use of potash on such soils is practicable and justified, in that it acts to reduce damage from these troubles and to assume profitable returns from such land. Practically all of the soils along the eastern edge of the Delta, bordering on the foothills and bluffs which limit it, are deficient in potash, and the cotton planted on them suffers from rust and wilt. In seasons such as the present one, 1936, one traveling along the highways in the Delta can readily observe fields in which rust and wilt are present and are causing great damage. It is in such fields as these, wherever located, that a deficiency of potash is indicated, and in which its use may be expected to render profitable returns.

Crop Insurance

(*From page 5*)

average recorded in the domesday book of statistics, half the required rice tax was remitted, and when the yield fell 70% below the normal, then the entire tax was remitted. The lowest class of non-landed gentry paid no tax of this kind, but the other five non-farm groups paid from five "to" to five koku. A "to" amounts to about two pecks, and look back to my estimate of a "koku," to estimate what the white collar bunch paid in.

As a systematic complement of the local or village rice stores, the Tang administration in 585, two years after they set up the village granaries, established district granaries. These were filled to the brim by a tax in kind. Citizens paid according to three distinct groups. The first or prosperous tillers paid one koku yearly, the next lower class paid seven "to" per annum, while the lower division were docked for only four "to" each season; and these reckoned in our terms mean about 4.96 bus., 3.46 bus., and 1.98 bus., respectively.

Rice was loaned out of these district storages, but it had to be repaid within a year. A third granary recess, or holy of holies as it were, was sealed up and only opened for public convenience when famines occurred throughout the land.

During Oriental famines mention is often made in historical notes: "the government opened its reserve rice granaries and doled out grain to the starving." In Japan the government granaries of this kind were filled only by tax-fee rice, whereas in China there was an extra tithe in kind during extra good years, above and beyond the normal rate. In 1871 the Japanese rice granaries were abandoned for the time being, and their contents sold to the value of about one and a half million "yen," said fund being turned over to the national treasury. At this time loans of rice were laid aside and money loans substituted. For a time they also relieved distress in times of climatic disaster or epidemics, allotting one sixth of one koku of rice for 15 days to a family of five. Bear in mind also that a carefully worked out plan of excusing or postponing the payment of local taxes was in vogue, rated according to the nature and extent of the crop loss suffered each season in relation to the amount of crop adopted in assessing the tax. It strikes me that we might question some of our yellow brethren when we start doping out a sound, farm distress law for America.

IT has been said in a general way by some sage insurance observers that the major risk in all-coverage crop policies must be stated as a mathematical formula. I shall not herein uncover my absolute vacuum in mathematics, but quoting one of the figure sharks aforesaid, this risk may be represented "by the fraction whose numerator is a variable income (based on prices and yield) and whose denominator is a fixed group of costs per acre, established by agreement when the document is written."

Only a few adventurous concerns have tried crop insurance, outside of the realm of hail and tornado. By a little digging I discovered that Minnesota, land of advanced farm ideas, floated the original company of this kind back in 1899. It was the Realty Revenue Guaranty Corporation, writing an optional-sale contract on grain. Upon payment of a 25-cent per-acre premium, this concern agreed to buy the whole crop covered by the policy at $5.00 an acre, if the insured acted on his option at least five days after harvest and threshing; barring all hazards occurring after September 15.

Still another company operated at a great loss in Montana in 1917 with a policy guaranteeing $7.00 an acre for all the area in grain. Fixed prices per bushel were set forth, and the company was liable for the difference between the actual yield times the fixed prices and the amount of stated insurance. In another instance a Pennsylvania company wrote similar insurance, and their agents were local bankers in the western states who wrote thousands of policies on the eve of a severe drought, so that they might get back some of the loans they made to farmers. Naturally it flopped.

Again in 1920 the Hartford Fire Insurance Company tried out a combined insurance against costs of production plus loss or damage to growing crops, and in testimony at a Senate hearing a few years ago the president said the losses cost his company $2,500,000. Thus, on the whole, we do not face a very eager bunch of profit-taking corporations when crop insurance is mentioned.

I agree that we indeed stand on shaky ground in this matter, sort of half way between rugged individualism and the dumping of all risks on the shoulders of paternal governments. The more we can leave dollars and cents out of our proposition the better off we stand, which makes us cater more to the payment-in-kind theory than to any complex arrangement insuring farmers completely or even partially on a cash settlement basis. Having spent a few minutes thinking it over, I am as well prepared as the average Congressman or magazine scribe to give you the "last word" and the compound conclusion.

As a self-appointed expert, I would limit crop insurance of a national kind to indemnities paid out under these conditions and circumstances: No. 1. When failure is due clearly to natural causes and the farmer is not to blame in the least, or when such damage is general and widespread so that whole counties and states suffer loss.

AS my old book-shelf friend Mayet inquires, "Shall nature bear all the guilt in every case?" Without a bevy of snoops bordering every corn field and cotton patch in our broad land, would it not be a ticklish job to determine how well the farmer fulfilled his obligations—under ordinary years of scattering crop reduction? Then, as we all know full well, group and sectional pressure is a horrible machine when it gets going with all bearings red-hot in a campaign year, intimidating would-be statesmen and causing them to deny that their own home county ever raised half a crop of anything except ballots. In confidence, I would hardly trust myself even, when the government bean bag is wide open. It's so easy to make a thirsty farmer look like a dry spell, and a hungry candidate resemble a national famine! If continued it might put the reverse English on all our agricultural policies in time and give the hill-billy a permanent premium over the chap who wears out a new plow and a pair of overalls between sunrise and sunset.

This brings me to my second great proposal, to wit and to wonder: No. 2. No indemnities unless the crop fizzle is a real one, and never unless the farmer himself bears some share of the risk. In this case I mean a sort of partial payment system, as for instance: In only a moderate loss, all to be borne by the farmer himself;

in a larger proportionate loss, half and half; and full indemnity paid only for a total loss or a very considerable one, considering always the circumstances.

I would divide the dangers into two broad classes—acute ones and chronic ones. Insects and diseases, flood, hail, tornado, and early frost are acute dangers; while protracted cold spells, exceedingly long droughts, and continuous wet spells are chronic hazards. Where intelligent and advance management might tend to lessen the rigors of any calamity, partial indemnities would govern, such as in losses due to insects and diseases, soil depletion, frosts, and mild droughts and short wet spells. With flood, hail, and tornadoes, widespread droughts and unseasonable cold, there would be some excuse for stretching the payments to the utmost, if not to the full extent of the policy. The one who would help the farmer must not lose sight of the fact that there are as many different kinds of farmers as there are divers kinds of preachers, or essay writers. It ill becomes the body politic to pile on its shoulders any system of crop insurance that is open to abuse from town heelers or tired tommies.

And again, we have been deeply immersed of late in drought psychology. It may cause us to forget that there is hardly a season when some group or locality does not experience a diminished harvest, and whoever tackles this job of sorting the sheep from the goats is bound to refuse to run for re-election. There wouldn't be any use anyhow. Nothing short of a dismal dictator would be able to stand the gaff.

Yet we must do something about this just the same. As long as farm distress was manifested outwardly by good yields and more surplus it was spoken of lightly as "relief," and the mortgages, high taxes, unfair exchange values, and low living standards were sort of remote economic complaints which did not bother the average consumer very much. The farmer got a heap of consolation for his financial woes out of a bumper harvest. It was a sedative which, added to the political soothing syrup he consumed, kept him asleep.

But when a flock of lean years arrived and there wasn't enough moisture on an acre to breed a mosquito from May to August throughout the bread basket of America, this waked up the city denizens. Here was a brand of distress which they shared themselves. They had to change shirts twice a day and keep the sprinkler running on the links all night. With the aid of a dramatic corps of reporters and grain-pit market dopesters, caught in the doldrums of a slow summer for scandal, the drought held first page for weeks, and even had the editorial scribes running to the library looking up unfamiliar farm terms.

WHEN butter and eggs begin climbing in price and the grocer scanned the shelf with dubious mien, they grew anxious. Some of the extreme urbanite customers said they could not see why ducks and cream had to be jacked up out of sight, as long as there were no reports of heat injury to quack grass or milk weeds! Anyhow, the searing effect of three out of five years of crop flops has developed a new and selfishly personal agricultural attitude on the part of our non-farm population.

Thus it's up to the farmers to get what they want before it rains again. Therefore, it's an ill wind (or a persistent "high") which bringeth no good usward. Which means that the legislators may go ahead on crop insurance plans for 1937 with just as much united public support as the general emergency of 1933 provided.

And let's not spoil it by mentioning the Supreme Court. We haven't got that far yet anyhow!

TRUE PATRIOT

"George Washington was a great man."

"He must have been," said Mr. Dustin Stax, "to transact so much big political business with so few brass bands."

Voice (over telephone)—"Are you the game warden?"

Game Warden—"Yes, ma'am."

Voice—"Well, I am so thankful I have the right person at last! Would you mind suggesting some games suitable for a children's party?"

O'Brien called downtown to see Mrs. O'Connor, to tell her that her husband was locked up for being drunk.

"Why didn't you bail him out, man?"

"Bail him out! Bedad, you couldn't pump him out!"

WHAT—AGAIN?

"What's the idea of all the crowd at church?"

"There's a traveling salesman down there confessing his sins."

A Yale player was teaching some cowboys how to play football. He explained the rules and ended as follows:

"Remember, fellows, if you can't kick the ball, kick a man on the other side. Now, let's get busy. Where's the ball?"

One of the cowboys shouted: "Fergit the ball! Let's start the game!"

BRITISH DIPLOMACY

A story of Winston S. Churchill—told by Gertrude Atherton:

"Shortly after he left the Conservation side of the House (of Commons) for the Liberal, he was taking a certain young woman down to dinner, when she looked up at him coquettishly, and remarked with the audacity of her kind:

" 'There are two things I don't like about you, Mr. Churchill.'

" 'And what are they?'

" 'Your new politics and mustache.'

" 'My dear madam,' he replied, suavely, 'pray do not disturb yourself. You are not likely to come in contact with either.' "

Doctor: "Is the night nurse giving you proper attention?"

Vic: "Not exactly, but I'm perfectly satisfied."

A NOVICE

Gert: "I think it's a shame to send those nice marines to China. What will they do there?"

Peg: "Good heavens, Gert! Ain't you ever been out with a marine?"

Father: "It's simply awful how close these young people sit in a rumble seat."

Wife (smiling): "Yes, I remember how you used to hate the old hammock because it had such a wicked way of pushing us so close together."