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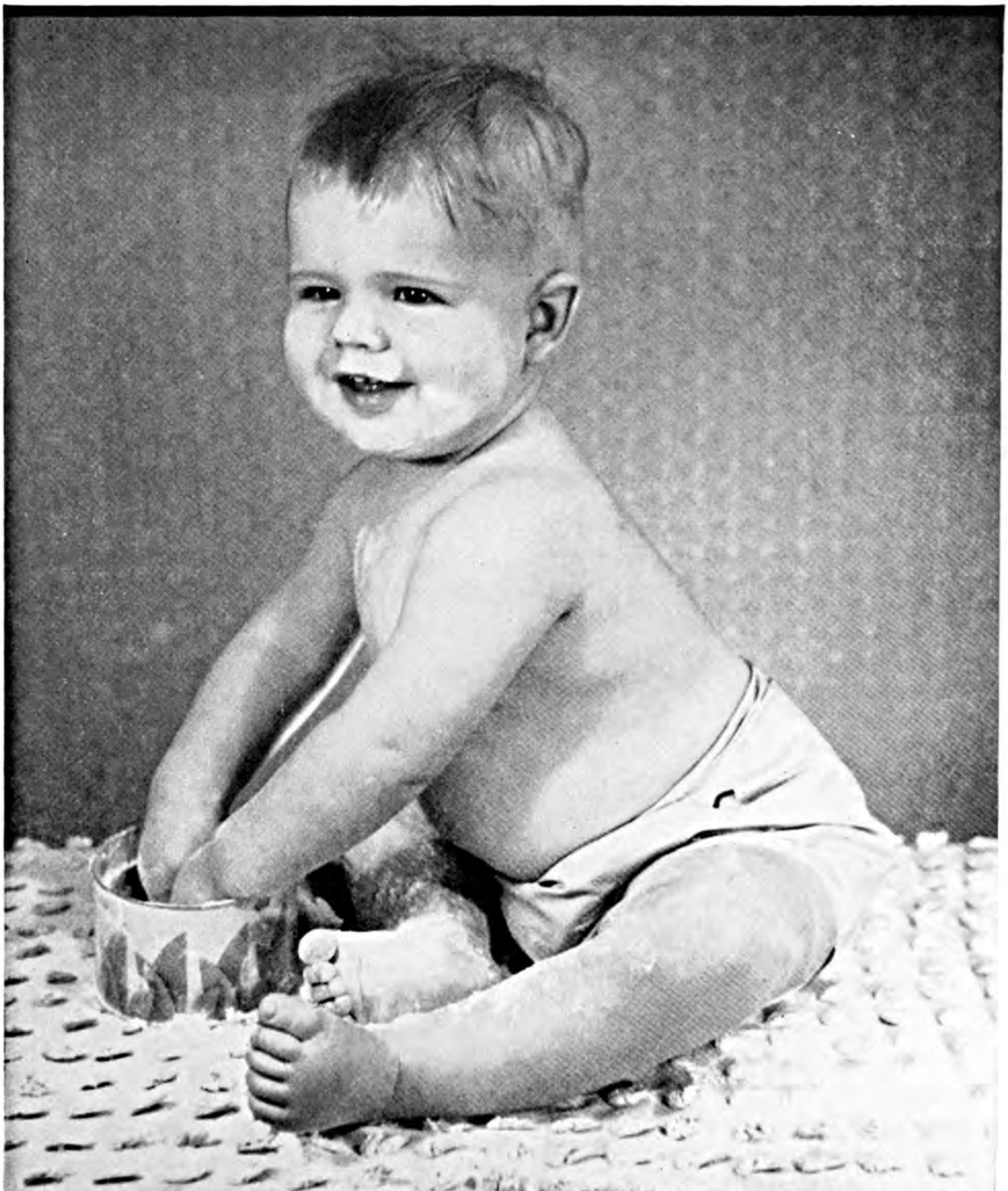

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

***Editorial Office:* 1155 16th Street, N. W., Washington 6, D. C.**

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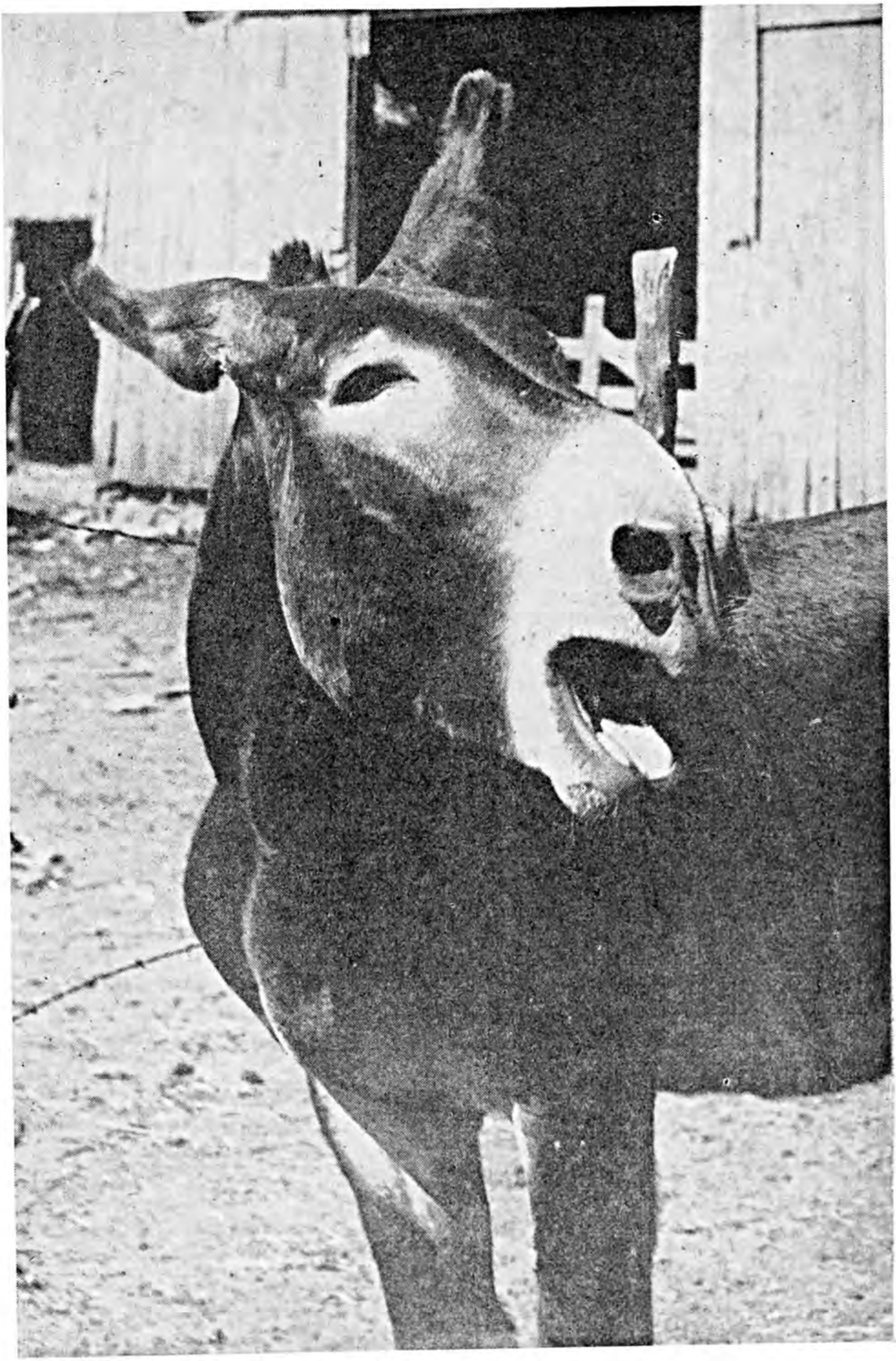

Lament!

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIV WASHINGTON, D. C., JANUARY 1950 No. 1

Halfway Thru . . .

The Old Century

Jeff McDermid

ALTHOUGH 1950 is the half-way year of the good old Twentieth Century, most of the inhabitants of the world were born in these last 50 years since Father Time pushed the Nineteenth Century and its rousing Victorian era aside to make room for all the frightful and fruitful things which five decades have brought us. It therefore devolves upon a scant percentage of us living mortals to draw upon living but imperfect memories to reinforce library references respecting the marvels and movements before and since the present middle-aged century opened.

During the passing away of 50 years we have gone from the steel age to the power age and through that to the electric age and the atomic age, which now confronts us. All this and more has happened to us without changing some of the elemental and primary things of life—like the need to eat when you're hungry, to rest when you're weary, and to depend on good friends and faithful companions when you're lonely and bereft.

And it hasn't changed one iota the other processes, such as birth and marriage and death—and taxes. Also, I regret to report, it finds us very little further along in securing a peaceful and brotherly universe, with just a few noteworthy and encouraging exceptions.

In our neighborhood in 1900 and 1901 we had at least two rather irrelevant and immaterial topics to take up our spare time around the parlor heater or at country-store opinion forums.

They were not so important for human welfare but they attracted attention far beyond their merit and caused old friends to break company and relatives to squabble.

FOREMOST was the debate arising over the exact January 1 when the new century was to be born and celebrated. Some hailed January 1, 1900, as the natal day, and perhaps a larger crowd poo-poohed that idea and fixed their welcome programs for January 1, 1901. Arguments would arise high over digits from 1 to 10 in efforts to simplify the problem, some saying that when you counted 10 that was 10, while others said that 10 was not fully accounted for until you got to 11. A few insisted that the 12 months between 1900 and 1901 were a sort of threshold period and belonged to neither the fresh nor the stale century, being just a transition; and that the real opening of the Twentieth Century had to wait until 1901 appeared. I expect you folks who live to bring in the Twenty-first Century will be apt to start all that useless battling over again.

Now the other question was whether to uphold or condemn the suggestion made by Vice-President Theodore Roosevelt to remove from our coins the motto, In God We Trust. It raged all that Winter, as near as I can remember, with some voicing the opinion that the base use to which money is put is an insult to the Creator, and the others adhering to the patriotic stand that America must never refuse to acknowledge Heaven's help and succor.

I recall that our home-folks stood as a unit on the 1900 entry date for the new century, and we also stood pat on keeping the theological motto on our money.

Father went to bed early on the night of December 31, 1899, and "Ma" and I ushered in the Twentieth Century together by the old sitting-room stove. We laid aside our card game of "authors" and she postponed darning my socks, so that we might clasp hands and welcome the fateful dawn of a New Era in proper style. The rest of the family were in other locations. When the whistles stopped and the church bells finished their clamor, Ma and I went to the kitchen and sampled some of the sweet cider and doughnuts.

She had been born about 50 years before, in just about the same spot in the past century that we now find ourselves occupying in this one. But she and her folks were of the original pioneers and broke the first trails and plowed the first furrows—all of which shows us how very youthful our country really is.

In the midst of old-time reflections like these—which usually do not inspire young folks very much—it's my privilege to point out that Ma and Pa and the rest of the elders back there did not try to advise us kids about all details for the future, even at such a momentous milestone as 1900. They didn't do it because they realized, as we do now, that young folks seldom take advice in any form, sugar-coated or bitter.

IN the long run I guess it's just as well they don't. Nobody alive can sense the future's forces and conditions enough to chart a course for a new life or be sure that decisions facing young people can be made entirely on the experience of the past. Sure, we can point out shoals or rapids and sharks, but all the steering and navigating is going to be handled by the person who wants to be captain of his own soul, the master of his own destiny.

In this I refer more to negative advice than positive truths. So that squares with our own experience, wherein many young leaders and discoverers paid no heed to elderly warnings that "nothing like that ever worked and never will—don't waste your time on it." If they had taken that sage philosophy to heart, we would be minus many of the achievements and facilities of this modern age.

Changes that time has wrought in the course of the present century, all within a span of 50 years, have altered many of the physical and material possessions and conveniences on the farm and in the home. It cannot be said that all of the credit for these advances belongs to the workers and inventors in this century, however, because the need was there and the seed was sown and the first steps were taken in the last 50 years of the century preceding this one.

In any consideration of so vast a theme and so revolutionary a period of change, it's interesting to get the opinion of one of the daring pioneers whose name will forever be linked with youth and its classic achievements. Colonel Charles Lindbergh, whose great flight alone across the Atlantic in May 1927 held millions breathless for 30 hours, has only recently pointed out in a talk on the ocasion of the Wright Brothers anniversary that we are now too much insulated by mechanics and luxuries from the basic experiences that make men spiritually great. He insists that we stand in need of more fundamental things than those science has supplied to save us from exertion and to save time. In other words, he thinks that we can be so hemmed in and circumscribed by gadgets that we lose sight of things more worth while for the soul's peace and welfare.

Much as we fret and argue over the implications of what has sometimes been called "the welfare state" we cannot but applaud countless changes which this century has seen in the lifting of many burdens and unfair conditions, together with the passage of many wise laws and voluntary customs of a high social value.

After all, I am sure that many of the best movements for relief and fair play among our citizens have come about through education and voluntary efforts, rather than from being imposed by any regimented system. One need only scan the commercial and industrial field to sense the great betterment in working conditions and retirement and sick benefits that have made dark spots brighter and more humane in the past five decades. Even with our material achievements which have boosted us forward in 50 years to a greater length than man could boast of in any previous 50 centuries, our hearts yet beat warmly and our sympathies and our sense of justice are fully awake and responsive.

Balanced achievement in a wide field of endeavor has been encouraged by many notable means, none of the least of which has been the Nobel annual award. It was in 1901 that the Swedish Academy of Science announced the first Alfred Nobel prizes, including awards to Wilhelm K. Röntgen for discovery of X-rays in 1895, to J. H. van't Hoff for work in chemical thermo-dynamics, and to E. A. von Behring for his antitoxin against diphtheria. Three other mighty discoveries which were made in the last four years of the Nineteenth century got later recognitions by the Nobel committee. These were to Max Planck for his revolutionary quantum theory, Pierre and Marie Curie for radium, and to J. J. Thompson and Henry Becquerel for discovery of the electron and radioactivity. In all, since this great incentive to progress has been in effect, there have been 124 prizes in

(*Turn to page* 49)

Fig. 1. Plant breeders attending first annual soft red winter wheat field day in Indiana at Schenk Farms, R. 5 Vincennes, Indiana, in 1947. Left to right: Dr. C. A. Lamb, Ohio State University; Dr. Wayne Bever, U. S. D. A.; Dr. John Washko, Penn State College; Dr. L. M. Josephson, University of Kenutcky; H. R. Lathrope, Purdue University, in charge of the field day; Charles Schenk, farmer cooperator; Dr. David Reid, University of Kentucky; Dr. O. T. Bonnett, University of Illinois; L. E. Compton, U. S. D. A.; and Dr. B. B. Bayles, U. S. D. A.

Wheat Improvement in Southwestern Indiana

By H. R. Lathrope

Extension Agronomist, Purdue University, Lafayette, Indiana

THE Southwestern Indiana Wheat Improvement Program is a demonstration in adult education. Eight counties, known as the "Pocket Area," are involved. More than 3,000 wheat producers have been growing soft red winter wheat in this area, primarily for cake and pastry flours, for nearly 100 years. The "campus" of Purdue University has been enlarged to include an intensive educational program in the Pocket Area.

The improvement of soft red winter wheat in southwestern Indiana (Pocket Area) was undertaken in 1930 by Purdue University in cooperation with Igleheart Brothers, Inc., Evansville, Indiana, which has been the sole and continuous sponsor for the past 19 years. The initial program was formulated by the "Three Johns," namely, John Hull, county agent, 1928-1940, Vanderburgh County; the late Dean John Skinner of Purdue; and the late John Igleheart of Igleheart Brothers. A directive and memorandum of understanding were signed May 24, 1930, by Purdue's president E. C. Elliott, Dean Skinner, A. T. Wiancko, and Mr. Igleheart. The memorandum stipulated for: (1) Surveys of the wheat situation in the eight counties later called the Pocket Area; (2) tests and demonstrations on varieties, and on fertilization and rotation practices; (3) demonstrations on control of smuts, other diseases, wild garlic, and weeds; (4) location of desirable sources of seed wheat and aid in their production and distribution; and (5) promotion of improved production practices, discovered by research and farm experience.

The Pocket Area is well adapted, with respect to soils, climate, and farm "know-how," to the production of soft red winter wheat suitable for the manufacture of the finest pastry flours. The program involves participation by about 3,000 producers who grow wheat annually on nearly a quarter of a million acres. These producers operate a total of approximately one million acres of which about 45 per cent is devoted to corn, 22 per cent to wheat, 21 per cent to soybeans, three per cent to oats, and ten per cent to hay and legumes. Only about three per cent of the land devoted to legumes is producing alfalfa or sweet clover. Producers have followed a cash-crop system of agriculture. Livestock consists mainly of hogs.

Average Yield Increased

In 1930 the average annual yield of wheat in the eight counties was 14.1 bushels per acre. After the improvement program had been operating for nine years, the yield had increased to 17.4 bushels per acre while the average annual yield in eight nearby counties having no intensive program was still 14.0 bushels per acre. If valued at $1 per bushel, this 3.3 bushel per acre increase on the 200,000 acres represents an added annual income since 1939 of more than $600,000 to the 3,000 producers.

Vigo, the first disease-resistant soft red winter wheat released from Purdue, was distributed to 12 producers in 20-bushel lots in the fall of 1946. Vigo, seeded on good soil and fertilized well, yielded double the average of the old varieties. More than 8,000 bushels of this new variety were seeded in the area in the fall of 1948. Because of its stiff straw and its resistance to loose smut and leaf rust, Vigo won the admiration of wheat producers, and more than 100,000 bushels of Vigo seed wheat were produced in 1948. It has been estimated that one-third of the entire area was seeded to Vigo in 1948. In 1949 Vigo was judged the best variety in each of the eight counties by 320 local judges who selected the best fields for the 10-acre contest. Vigo possesses high-yielding ability as well as eye-appeal.

Twenty-eight wheat producers were consulted in 1946 concerning the program for improvement. The following was adopted subject to revision at each annual planning conference:

1. Sow only seed which has been cleaned and treated for stinking smut, (bunt).

2. Sow only approved soft winter wheat varieties, which include Vigo,

Fig. 2. These soil-testing tubes (Hoffer's underground periscopes) are very useful in examining the soil tilth and aeration. The fine texture of the soil on the left is much more valuable to the owner than the tightly compacted soil on the right. Deep-tap-rooted legumes, such as sweet clover and alfalfa, are perhaps the best known methods of correcting the condition caused by continuous plowing and use of heavy equipment —tractors, corn pickers, lime spreaders, and combines.

Royal, Goens, Rudy, Fultz, Thorne, and Butler.

3. Sow on fields free from garlic, cockle, and cheat.

4. Correct soil acidity and follow a good rotation including deep-tap-rooted legumes.

5. Sow after fly-free date.

6. Fertilize with 400 to 500 pounds of 3-12-12 per acre or its equivalent. If in doubt concerning soil needs, submit soil samples to county extension agent.

7. Apply 80 to 125 pounds of nitrate material (20 to 25 pounds of nitrogen) per acre about March 1 as a top-dressing on light-colored soils or those low in organic matter.

8. Combine wheat only when moisture content is 14 per cent or less.

9. Store wheat in bins which have been thoroughly cleaned and sprayed with a five per cent solution of DDT.

10. Feed or destroy small lots of wheat. Never store new wheat with old wheat.

11. Wheat to be stored more than 30 days should be fumigated with an approved fumigant.

More than 350 wheat producers enter the 10-acre contest each year. Local committees select the championship field in each county, and three judges selected at Purdue visit all the championship fields, scoring each on uniformity, diseases, weeds and crop mixtures, soil management and culture. After the fields are scored for appearance, four samples are cut by each of the three judges in four places in each field—a sample being cut with a hand sickle from a section 30 inches wide and across one drill row. The wheat is later sacked, tagged, and threshed. Yields are computed for each field. During the past three years, nine different judges have used this method and have arrived very accurately at the yield of each field. Cutting 16 samples from each of the fields adds to the work but promotes stability and accuracy.

The wheat improvement work in southwestern Indiana is a demonstration in adult education. Sponsored by an industrialist for the betterment of all the people in the community, it is a brilliant example of cooperation among industry, research, and farm folks. Local people, when asked to place first things first among a list of six major problems ranked them as follows: (1) Fertilization, including lime, in addi-

Fig. 3. Joe Youcum, Vincennes, believes in applying nitrogen to his wheat fields around the first of March each year. Mr. Youcum is showing the drillability of the material which is applied at the rate of 20-25 lbs. of N. per acre.

Fig. 4. Check plot #2 in a field taken over by wild garlic. The balance of the field was sprayed with 2 lbs. 2,4-D, Amine, April 1, 1948; picture taken three weeks after spraying. Equipment furnished by Ken Standard Corporation, Evansville, Indiana, was a spray boom attached to a jeep.

tion to phosphate, potash, and nitrogen; (2) soil tilth and soil structure; (3) better varieties; (4) garlic control; (5) cleaning and treating of seed; and (6) control of stored-grain insects.

Soils in the Pocket Area are low in organic matter, phosphorus, and potash; many are strongly acid. Much of the soil in the area lacks good tilth and structure, suffers from lack of aeration, and has low water-holding capacity. Plow-sole hardpans prevent good vertical drainage and root penetration. Much evidence has been found to indicate that magnesium, manganese, and boron also are lacking. Getting good catches of legumes has been a problem for years. In 1949, however, producers secured good catches of legumes, including ladino, alfalfa, sweet clover, and red clover in high-yielding fields where 100 pounds of A.N.L. carrying 20.5 per cent N had been applied as a topdressing and where 50 to 60 pounds of P and K had been applied at seeding time.

Harold Pirtle of Sullivan County, winner of the area 10-acre contest, using 100 pounds A.N.L., secured an excellent stand of wheat, yielding 57 bushels per acre, and an excellent stand of legumes. Seven of the eight contestants in the county championship contest secured good stands of legumes and each used at least 400 pounds of 3-12-12 or its equivalent. In previous years producers using nitrogen as a topdressing sometimes blamed the nitrogen for the failure of legumes. But Herb Johnson with his 46-bushel yield of Vigo in 1947 and Carl Batteiger with his 45-bushel-yield in 1948 secured good stands of legumes on well-limed soils, using 20 to 25 pounds of N per acre as a topdressing and 400 to 500 pounds of complete fertilizer at seeding. Legumes such as alfalfa and sweet clover, topflight soilbuilders, are the lubricants in the soil production program. Charles Schenk, president of the Southwestern Indiana Wheat Improvement program, says: "We have to stop our machines for oil and grease, and I believe that it pays to stop production long enough to grow a deep-taprooted legume. Soil-improvement crops are necessary if we expect to continue to produce high yields."

Stinking smut has been kept out of the Pocket Area by the use of seed cleaning and treating machines. The wheat is not taken to the machines for cleaning; instead, portable machines are routed right to the farm, where from 50 to 2,000 bushels of seed per farm are cleaned and treated at the rate of 100 bushels per hour. Producers recover the cost of the entire cleaning and treating through the salvaged screenings—the cracked, broken, and damaged wheat which possesses only low germination value and which, if planted, would rot and decay in the soil. At the same time as the wheat is cleaned, it is treated for "bunt" or stinking smut with Ceresan M. County agents and county wheat committees route the machines and solicit producers who desire to have their wheat cleaned and treated. The Pocket Area is rapidly becoming an excellent source of high-yielding seed, free from smut and from cockle and other weeds. The portable cleaners are owned privately as well as by cooperative groups. More soft red winter seed wheat is cleaned and treated annually in the Pocket Area than in any other place in the Midwest.

In order to secure the best wheats from the area, 25 lines comprising the best wheats being produced at Columbus, Ohio; Urbana, Illinois; and Purdue University are seeded in replicated plots in each of the eight counties. Eight hundred plots were seeded in 1948. Last season all plots were harvested and threshed and yields were computed by July 15.

In addition, 156 drill-width plots, about 1/40th of an acre in size, were seeded at the Schenk farm. On this farm 30 wheats were seeded in four replications. A vacuum sweeper was used to clean the grain drill after the seeding of each plot, enabling the entire test area to be seeded in one day. Wheats were seeded on high- and low-fertility levels. All the high-fertility plots received 480 pounds of 3-12-12 at seeding time and were topdressed with 100 pounds of A.N.L. on March 1. On July 4 the entire layout, consisting of 156 drill-width rows, was combined with a push type machine. (See Table I.) The short early ripening wheats, which have captured the eye of every wheat grower and miller in the area, again outyielded all others.

Nowhere else in the Nation have

Fig. 5. Twenty pounds of dusting sulfur per acre were applied for the control of black stem rust. The applications were made in the early morning when the air was still and there was dew or moisture on the wheat. The sulfur remained until harvest time in areas where no heavy rains fell.

the most promising wheats of three great plant-breeding stations been tested under farm conditions in such large numbers. The old-fashioned wheats of yesteryear are far outclassed by the new "college-bred shorties," strains which possess winter hardiness, stiff straw, earliness, and yielding ability. Farm folks appreciate the opportunity to inspect these new wheats before they are released. Cooperators on whose farms they are grown enjoy the opportunity of seeing the new wheats first. Such cooperators respect their obligation and privilege to work with a great university in a modern wheat improvement program. These new wheats are as safe in the hands of the nine cooperators as they would be on any experiment station in the country.

Because soils in the area are lacking in nitrogen and organic matter, 1,000 tons of A.N.L. were secured for a test-demonstration program. Each producer was allotted one-half ton. Few men in the area had used nitrogen

TABLE I. WHEAT YIELDS—SCHENK PLOTS—KNOX COUNTY—1949

Variety	Fert. av. bu. per A.	Unfert. av. bu. per A.	Increased yield bu.	Profit from fertilized section after deducting growing and harvesting cost of $38 per acre. Wheat at $2.	Ht. inches 1st. rep.		Rank
					Fert.	Unfert.	
Royal	51.8	39.2	12.8	$65.60	45	40	13
Butler	50.1	37.7	12.4	62.20	46	42	17
Vigo	49.7	41.1	8.8	61.40	48	42	18
Thorne	48.6	38.3	10.3	59.20	45	41	19
Prairie	44.7	32.6	12.1	51.40	48	41	22
Goens	44.5	33.6	10.9	51.00	46	45	23
Rudy	42.6	31.9	10.7	47.20	46	39	24
Fairfield	41.8	30.9	10.9	45.60	46	44	25
Fultz*	40.2	30.2	10.0	42.40	45	39	26
Experimental							
414A9-2-3	65.0	51.9	13.1	98.00	44	38	1
414A29-4-1**	62.0	51.9	10.1	86.00	44	36	2
414A16-3-1-2	59.2	44.7	14.5	80.40	42	35	3
CI12557	56.2	44.4	11.8	74.40	47	38	4
C250	55.1	36.0	19.1	72.20	50	43	5
43-254	53.9	36.3	17.6	69.80	49	45	6
CI12651	53.7	44.6	9.1	69.40	46	36	7
CI12457	53.7	40.8	12.9	69.40	44	38	7
41-679	53.0	41.0	12.0	68.00	48	40	9
T. N. 1016-4	52.8	34.7	18.1	67.60	48	41	10
B40149A4-9-3-2	52.1	40.6	11.5	66.20	40	35	11
CI12650	52.0	40.6	11.4	66.00	47	36	12
CI12530	51.8	41.7	10.1	65.60	45	36	13
CI12400	51.8	41.7	10.1	65.60	47	39	13
C180	50.6	42.6	8.0	63.20	48	43	16
C247	47.0	37.6	9.4	56.00	50	46	20
C248	44.9	34.5	10.5	51.80	50	43	21
C263	38.8	32.1	6.7	39.60	52	45	27
C179	49.7	40.0					
45-501		45.6					
45-553		42.8					

*4 Replications
**2 Replications
Average number of bushels from fertilized plots, 50.7 bu. per A.
Average number of bushels from unfertilized plots, 39.0 bu. per A.
Average increased yield, 11.7 bu. per A.

Fig. 6. Harold Pirtle combined his championship wheat field on July 4, 1949; the yield was 57¼ bu. The contest drew 350 entrants from the eight counties in the Pocket Area.

material previously for topdressing wheat. Nearly 2,000 men called for and paid cash for 1,000 pounds of this "gunpowder" nitrogen material and applied it early in March. The 1,000 tons were enough to topdress only about 20,000 acres, or 10 per cent of the total wheat acreage. Those using the material applied it to their best acres where 300 to 500 pounds of 3-12-12 had been used at seeding. The average increased yield reported was about seven bushels per acre.

The 1,000 tons cost producers about $60,000 but increased the yield more

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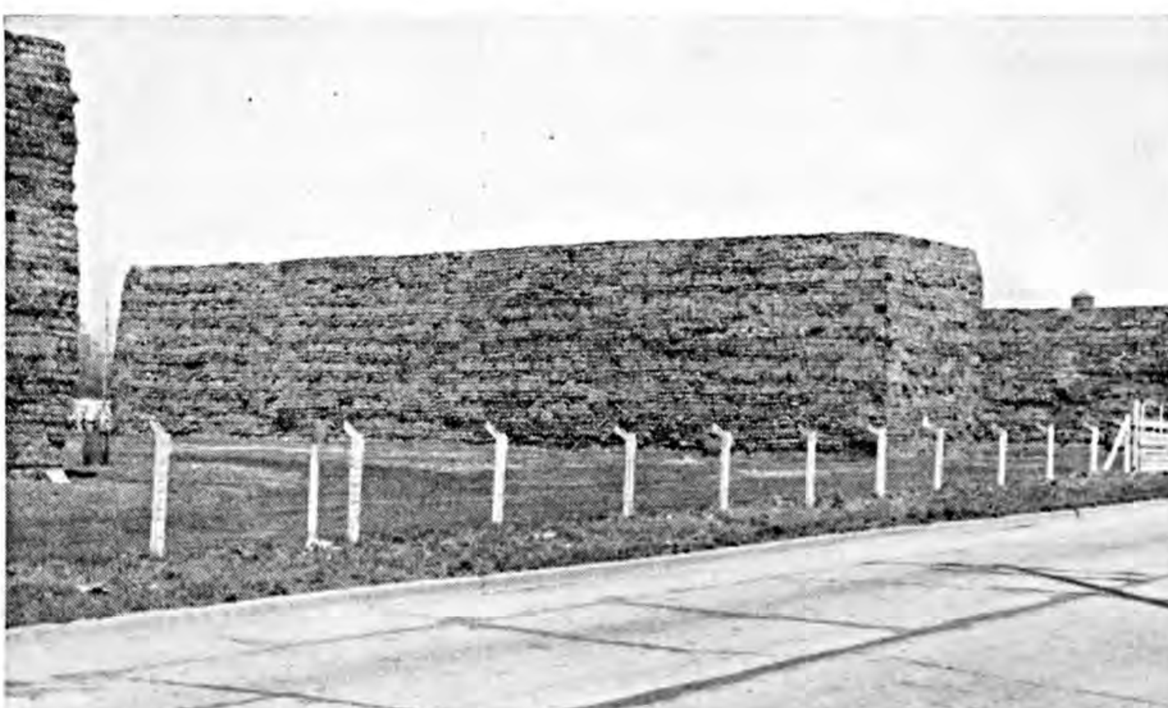


Fig. 7. This 400-ton rick of wheat straw taken from about 400 acres contains approximately 4,000 lbs. of nitrogen, 1,500 lbs. of phosphorus, and 6,000 lbs. of potash—equivalent to about 400 bags (100 lbs. each) of a fertilizer grade of about 10-3-15. When a farmer sells his wheat straw he should return the equivalent minerals in fertilizer.

More Corn from Fewer Acres

By Murry C. McJunkin

Coke Oven Ammonia Research Bureau, Columbus, Ohio

IN the late 30's before hybrids were generally grown in Pennsylvania, total annual production of corn was around 40 million bushels. Last year's crop was approximately 65 million bushels from about the same acreage. All of this increase can not be attributed to hybrid seed, nor can it be assumed that a limit in production has been reached. The concensus of the Pennsylvania Station Corn Team[1] is that 85 million-bushel annual crops for the State are entirely possible with no increase in acreages if present scientific knowledge is put to work.

In the June-July, 1949, issue of BETTER CROPS WITH PLANT FOOD, L. L. Huber, leader of the Corn Team, explained how "Heredity Plus Environment Equals a Corn Crop." Presumably an adapted corn hybrid has good heredity as far as the area in which it is to be grown is concerned, thus satisfying one of the factors in this equation. Environment, the other factor, includes seasonal temperatures, rainfall, soil type, soil fertility, and the associated features of any agronomic area. Environment not only exerts a major influence on yields but maintains rigid control over how strongly heredity is expressed.

Farmers can do nothing about the weather and very little about the various soil types which appear in their fields. However, the productivity level and moisture-holding capacity of a field may be improved through the growth of legumes, incorporation of barnyard manure and plant residues into the soil, and the liberal application of mineral fertilizers. This appears to be the key to further increases in corn yields.

Records taken by vo-ag students and veterans in training during 1947 and 1948 substantiate the predictions of the Corn Team. This was, as far as the writer knows, the first time that an attempt has been made to translate research findings in corn growing with little or no modification directly into farm practice.

In the 1947 trials, 186 vo-ag boys and veterans grew 2-acre test plots of corn in 27 counties of the State. The trials covered a wide variety of conditions; frost-free periods ranged from 125 to more than 200 days with com-

Fig. 1. Amos Pyle, Mercer county, produced the most grain per acre each year by following research practices.

[1] The members of the Pennsylvania Station Corn Team: L. L. Huber and B. L. Seem, corn breeders; J. E. Steckel, soils technologist; S. M. Raleigh, chemical weed control; C. C. Wernham, plant pathologist; B. F. Coon, entomologist; R. C. Miller, agricultural and biological chemist; and A. W. Clyde and R. E. Patterson, agricultural engineers. In 1947 and 1948 the writer was associated with this group in supervising the trials reported in this article.

parable variations in soil types and rainfall. The average yield of corn per acre for those who completed their records sufficiently well for analysis was 77 bushels in comparison with 66 for check plots on home farms and a 45-bushel State average.

In 1948, a total of 386 vo-ags and veteran trainees, including many who also engaged in the 1947 trials, grew corn in accordance with suggestions outlined by the Station Corn Team. The average yield of corn for those who completed their records was 97 bushels per acre. The average for the check plots was 87 bushels and for the State, 46.

Amos Pyle, Mercer county, grew the highest yielding plots both years. The first season his 2-acre plot averaged 164 bushels and the second year 170 bushels of shelled corn per acre.

Before engaging in these tests, few of the boys had made pre-planting applications of mineral fertilizer for corn. Most of them were accustomed only to the use of moderate applications with the planter. Insofar as was possible, 10-10-10 fertilizer was used in all trials both years.

In general, analyses of the data showed that those who followed the recommendations of the Corn Team closely attained the best results. Those young farmers who made pre-planting applications of 200 pounds of mineral fertilizer per acre in addition to regular fertilizing practices averaged more than eight bushels per acre gain in yield; those who made pre-planting applications of 400 pounds per acre averaged more than 11 bushels gain; and those who made pre-planting applications of 500 pounds per acre averaged slightly less than 10 bushels per acre gain in yield. Increases dropped off rapidly where greater pre-planting applications of mineral fertilizer than these were made. Best yields in general followed legume sods topdressed with manure, in addition to mineral fertilizer applied both before planting and with the planter.

The suggestions offered by the Corn Team and used by the students in conducting these trials are condensed here. The more important were:

A. A list of open-formula hybrids approved for each of the five adaptation areas of the State.

Fig. 2. After the planting rate was calculated, the vo-ag and veterans found careful adjustment of the planter a prime necessity.

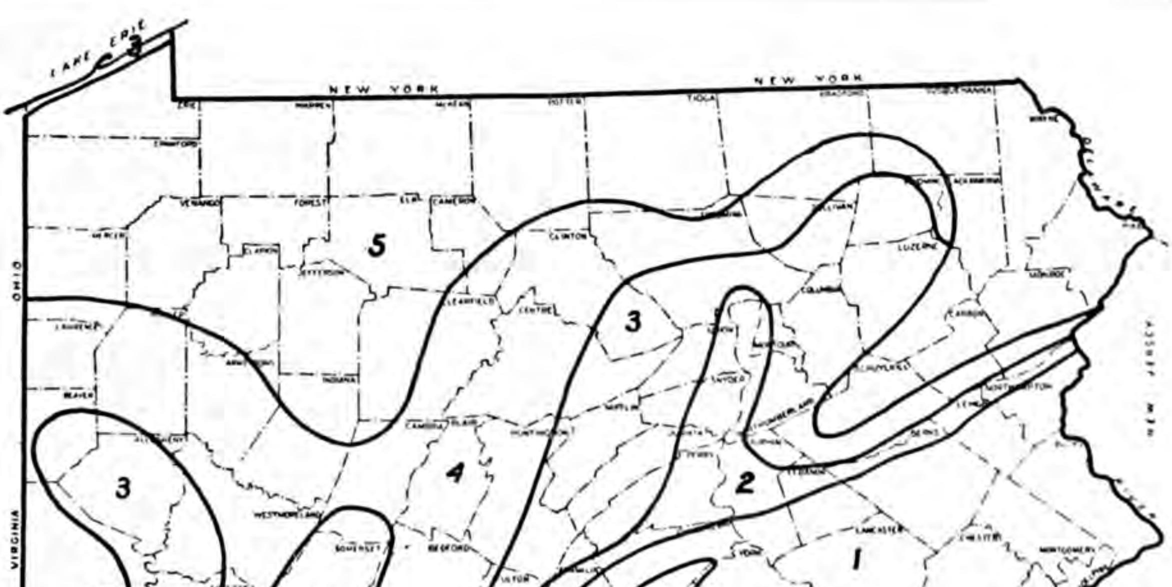
Many of the boys preferred closed-formula seed with which they were acquainted, but others chose hybrids in accordance with the accompanying Table I and map.

B. A suggested fertilizer program:

1. Lime the soil to pH 6. Don't guess—*test* soil for acidity.
2. Plant corn following a sod—a *legume* sod is much to be preferred.
3. Add at least 8 to 10 tons of manure. Each ton of manure should be treated with 50 pounds of 20 per cent superphosphate while in the stable.
4. On soils low in nitrogen, phosphorus, and potash, heavy supplemental applications of 10-10-10 have produced large, profitable increases in corn yields. The amount that should be applied will depend on the fertility level of your soil. (300 to 800 pounds of 10-10-10 gave profitable results last year.) Planting rates must be increased by 1,000 plants for every 100 pounds of 10-10-10 added. This seems to be a good general rule if the present planting rate is adjusted to the fertility of the soil in your field.

TABLE I.—SUGGESTED ADAPTED HYBRIDS.

	Quickest ripening		to		Slowest ripening
Area 1	Ia. 4059	Oh. C 88	Oh. C 12	U. S. 13	Oh. L 86
Area 2	Oh. K 24 Pa. 611 Pa. 612	Ia. 939	Ia. 4059	Oh. W 10	Oh. C 12 U. S. 13
Area 3	Oh. M 15	Pa. 5602	Pa. 612 Oh. K 24 Pa. 611	Ia. 939 Ia. 4059	Oh. W 10
Area 4	Wis. 335	Wis. 412	Oh. M 15	Pa. 5602	Oh. K 24 Pa. 611 Pa. 612
Area 5	Wis. 275		Wis. 335	Wis. 412	Oh. M 15



There are five main areas, determined on the basis of temperature, soil, and other factors that bear upon corn production. The hybrids listed are recommended for the areas indicated.

TABLE II.—PLANTING CHART.

Plants per acre	Pounds seed required per acre			Inches between rows	Inches between plants in rows
	Large rounds	Med. flats	Large flats		
8,000............	7¼	6¼	7¾	36 38 40 42	21.8 20.7 19.6 18.7
10,000............	9	8	9¾	36 38 40 42	17.4 16.5 15.7 14.9
12,000............	11	9¼	11½	36 38 40 42	14.5 13.8 13.1 12.4
14,000............	12¾	11	13½	36 38 40 42	12.4 11.8 11.2 10.7
16,000............	14½	12½	15½	36 38 40 42	10.9 10.3 9.8 9.3

SOIL FERTILITY-PLANT POPULATION BALANCE SHEET.

1. Plants per acre in 1948 corn field ....
2. Average weight of ears in 1948 crop (in tenths of a lb.) ....
3. Average weight of efficient ears (in tenths of a lb.) .6
4. Difference between my ear wt. and efficient wt. is ....
5. Multiply difference (from item 4) by 2,000 = 2,000 × = ...
6. How many *bags* of 10-10-10 are you plowing down? .... ×1,000 = ...
7. Adding the outside column gives the number of plants I should plant per acre this year.................. ....
8. My yield goal for 1949 = .6 70
   (ear wt.) × (plants /A.) ÷ (wt./bu.) = ...

How to calculate the lines in balance sheet

Line 1—Check your planter to see how far part it is dropping the seed. Look this up in the table under proper row width.
Line 2—Weigh several bushels of corn (run-of-the-crib) and figure their average weight. Better use a milk scale.
Line 6—Be sure to use hundreds of pounds and not pounds.
Line 8—Must be on 15.5 per cent moisture basis.

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5. Use 100 pounds of 10-10-10 or up to 300 pounds of low nitrogen fertilizer (3-12-6 or 3-12-12) in the planter when you plant the corn.

C. A plan for adjustment of plant population to fertility level.

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Fertilizer Trends in South Carolina

By B. D. Cloaninger

Department of Fertilizer Inspection and Analysis, Clemson Agricultural College, Clemson, South Carolina

CONSIDERABLE progress has been made in the manufacture and use of commercial fertilizers in South Carolina during the past 60 years. Farmers no longer sit at the cross-roads store and argue as to whether an old 2.5-8-1 mixture, containing 11½ units of plant food applied at the rate of 200 pounds per acre through a guano horn, is too strong for their land. They now talk in terms of 20 units or more of plant food applied broadcast or in bands at the rate of 1,200 to 2,000 pounds per acre.

Within the past 60 years our average analysis of complete fertilizers in South Carolina has increased from the equivalent of a 1.81-8.30-1.34 analysis in 1888-89 to a 3.88-9.69-6.50 analysis in 1948-49; the average total plant-food content has increased from 11.45 to 20.07 units for the periods just mentioned. As noted in Table I, the element potash has enjoyed the greatest increase of any in the complete fertilizer, with nitrogen next, followed by phosphoric acid.

Other than for the World War I period and the depression years, there has been a continued increase in analyses and total plant-food content. Farmers are rapidly learning that it is a better practice to use fewer pounds of a high-analysis mixture, thus reducing the cost of handling, bags, and

TABLE I. AVERAGE ANALYSIS AND TOTAL PLANT-FOOD CONTENT OF COMPLETE FERTILIZERS USED IN SOUTH CAROLINA FOR THE PERIODS SHOWN.

Years	Nitrogen	Phosphoric acid	Potash	Total plant-food content
1888–89...	1.81	8.30	1.34	11.45
1893–94...	2.08	9.27	1.79	13.14
1898–99...	2.24	9.32	2.21	13.77
1903–04...	2.46	9.12	2.90	14.48
1908–09...	2.49	9.16	3.08	14.73
1913–14...	2.83	8.79	3.75	15.37
1918–19...	2.43	8.82	2.23	13.48
1923–24...	2.97	9.06	3.52	15.55
1928–29...	3.27	9.29	4.03	16.59
1933–34...	2.92	8.75	3.76	15.43
1938–39...	3.10	8.36	4.57	16.03
1943–44...	3.62	9.55	5.70	18.87
1948–49...	3.88	9.69	6.50	20.07

Prior to August 1939, grades were stated as phosphoric acid, ammonia, and potash. All figures above represent nitrogen, phosphoric acid and potash.

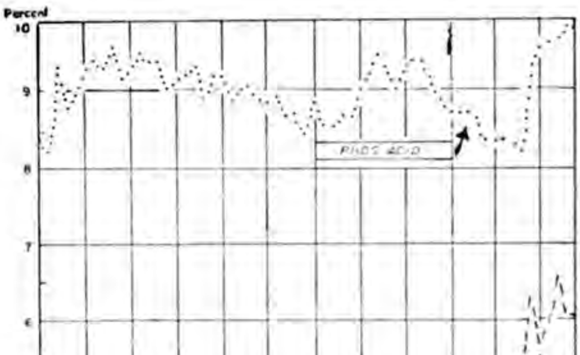

Fig. 1. Trends in the consumption of nitrogen, phosphoric acid, and potash in complete fertilizers in South Carolina, 1888-1948.

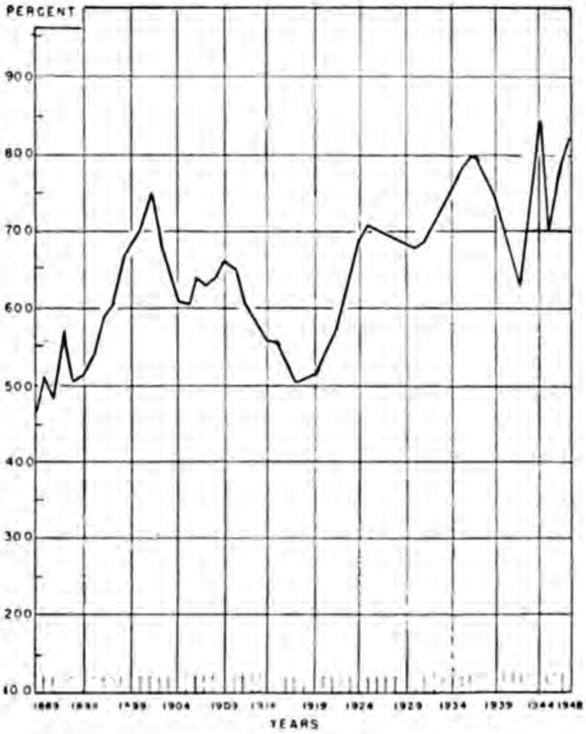

Fig. 2. Percentage of total consumption of complete fertilizers represented by four leading grades in South Carolina, 1888-1948.

freight on the "make-weight" or inert materials used to "balance out" a ton. Higher-analysis materials and better manufacturing facilities along with improved farm machinery for applying the fertilizer to the soil in a manner that will not injure seed germination have been factors of considerable help in making for a better and more economical fertilizer program in South Carolina.

Through the concerted efforts and close cooperation of all agricultural workers, the fertilizer industry, and the desire of farmers for a better product, the number of grades of fertilizer in South Carolina has been reduced from 200, plus 75,000 tons of Customers' Mixtures not reported, to 29 grades.

Four of the 29 grades sold represented 84.4 per cent of all sales, whereas six grades represented 95 per cent of all sales. Even though it is generally agreed that two grades will meet almost any farm need, certainly six or not over eight should meet the needs of all farmers of the State. It is reasonable to suppose that a fertilizer manufacturer can prepare several grades more economically than he can 40 or more.

As noted from Table III, during the period when low-analysis mixtures dominated, the ratios of nitrogen to phosphoric acid were rather wide. As the analysis increased the ratios of nitrogen, phosphoric acid, and potash in a complete fertilizer narrowed; in fact for 1948-49 it was 1:2.50:1.68.

The South Carolina fertilizer law gives the Board of Fertilizer Control, composed of members of the Board of Trustees of The Clemson Agricultural

TABLE II. THE NUMBER OF GRADES, THE FOUR LEADING GRADES, AND THE PER CENT TOTAL TONNAGE OF THE LEADING GRADES USED IN SOUTH CAROLINA FOR THE PERIODS SHOWN.

Years	Number grades	(1)	(2)	(3)	(4)	Per cent of total tonnage of leading grades
1888–89....	43	1.7–8–1	2.1–8–1	1.7–9–1.3	1.7–8–2	46.7
1893–94....	36	1.7–8–1	2.1–8–1	1.7–8–2	2.1–8–1.5	51.6
1898–99....	21	2.1–8–1	1.7–8.5–2	1.7–8–1	1.7–9–2	68.7
1903–04....	18	1.7–8.7–2	2.1–8–1	2.5–8–3	3.3–8–4	61.7
1908–09....	50	1.7–8.8–2	2.5–8–3	3.3–8–4	2.1–8–1	65.9
1913–14....	146	2.5–8–3	3.3–8–4	1.7–9.2–2	2.1–8–1	55.2
1918–19....	52	2.5–8–3	2.1–8–1	2.5–8–2	1.7–8–2	51.3
1923–24....	71	2.5–8–3	3.3–8–4	4.1–7–5	3.3–10–4	68.4
1928–29....	72	2.5–8–3	3.3–8–4	4.1–7–5	3.3–12–4	68.0
1933–34....	40	2.5–8–3	4.1–7–5	3.3–8–4	3.3–10–4	75.1
1938–39....	142	2.5–8–3	4.1–7–5	3.3–8–4	3.3–8–6	74.3
1943–44....	24	3–9–6	4–10–6	5–10–5	4–10–4	84.6
1948–49....	29	4–10–6	3–9–9	5–10–5	3–9–6	84.4

TABLE III. TRENDS IN THE RATIOS OF THE COMPLETE FERTILIZERS USED IN SOUTH CAROLINA FOR THE PERIODS SHOWN.*

Year	Nitrogen	Phosphoric acid	Potash
1888–89......	1	4.59	.74
1893–94......	1	4.45	.86
1898–99......	1	4.16	.98
1903–04......	1	3.71	1.18
1908–09......	1	3.68	1.24
1913–14......	1	3.11	1.33
1918–19......	1	3.63	.92
1923–24......	1	3.05	1.19
1928–29......	1	2.84	1.23
1933–34......	1	3.00	1.29
1938–39......	1	2.69	1.47
1943–44......	1	2.64	1.57
1948–49......	1	2.50	1.68

*Prior to August 1939, grade stated as phosphoric acid, ammonia, potash. All figures above represent nitrogen, phosphoric acid and potash.

College, authority to establish a maximum of 25 grade ratios. The most popular ratios in order of amount used during 1948-49 were as follows: 2-5-3 (48.3 per cent); 1-3-3 (14.7 per cent); 1-2-1 (11.2 per cent); 1-3-2 (10.2 per cent). Since there is a definite relationship to the amount of each plant nutrient absorbed or used by the plant, increased emphasis needs to be placed on the ratios of the nutrient included in the fertilizer mixtures. Strictly speaking, our fertilizer problems boil down to the ratio of the nutrients to each other and to pounds of plant food rather than the analysis and fraction of a ton of the mixture applied per acre. In speaking of ratios, one is reminded of the ignorant sharecropper, who when asked what kind of fertilizer he wanted, said, "I want a naught, double naught."

Only about one-fifth as much fertilizer was used in 1891-92 as in 1948-49. Not only has the tonnage increased but the plant-food content of the complete fertilizer has about doubled during the past 60 years. The amount of fertilizer and fertilizer materials used in South Carolina has increased constantly since 1891-92, the peak being reached for 1920, at which time the tonnage was 1,106,941. The tonnage for 1948-49 was the highest since 1920-21. A complete analysis shows there is a very close correlation between land prices, farm income, and fertilizer consumption. As the fertilizer tonnage has increased, crop yields and returns from pastures have likewise increased. See Table IV.

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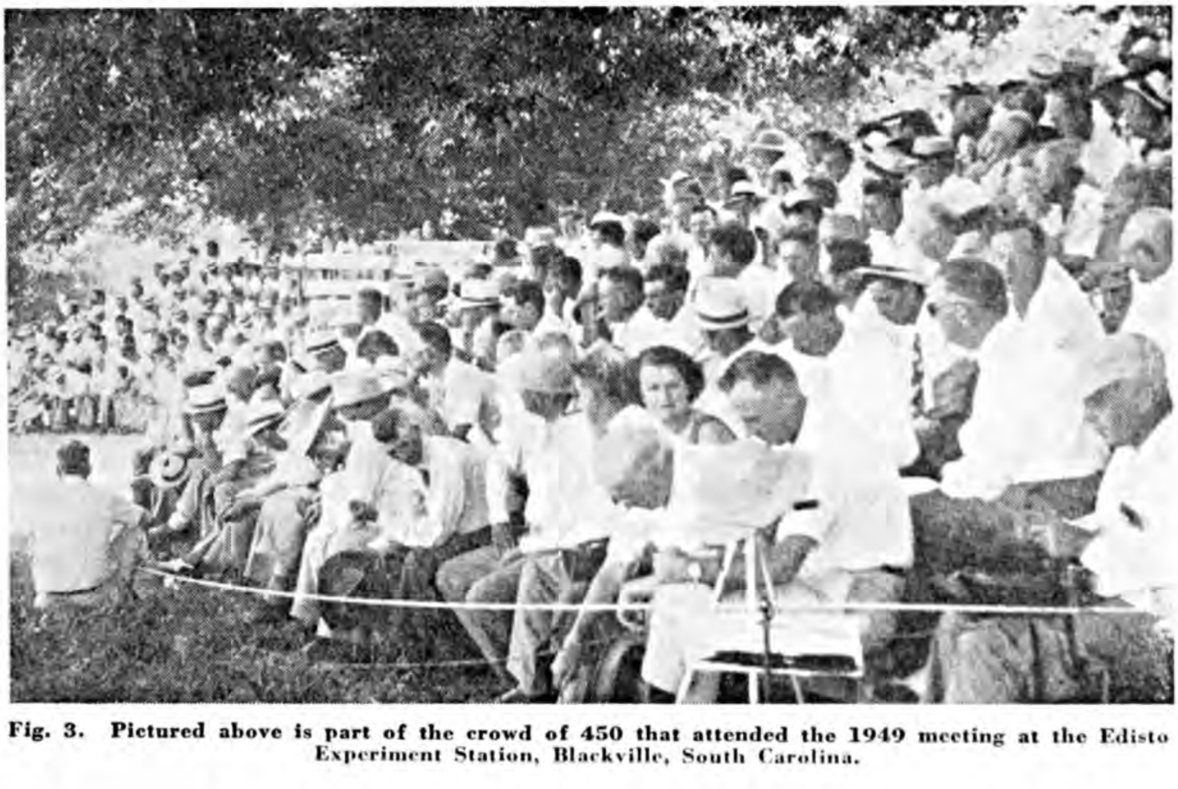

Fig. 3. Pictured above is part of the crowd of 450 that attended the 1949 meeting at the Edisto Experiment Station, Blackville, South Carolina.

Fig. 1. More than 16,000 stalks of corn per acre on Delanco sandy loam.

Know Your Soil*

I. Delanco Sandy Loam

By J. B. Hester, F. A. Shelton, and R. L. Isaacs, Jr.

Department of Agricultural Research, Campbell Soup Company, Riverton, New Jersey

A STUDY of the various soil reports reveals that there exists a very large number of different soils. Many of these soils have been classified under different series and different soil types. In fact, in New Jersey there are more than 50 different soil series classified and more than 190 different types of soil. One of the principal reasons for classifying these soils into different categories is to encourage a more efficient utilization.

*In January 1945 an article was published on the subject of "Know Your Soils." The primary purpose of this article was to point out the extreme differences in soils and what could be done to utilize efficiently the particular soils that a grower has on his farm.

During the summer of 1949 the climatic conditions at Cinnaminson, New Jersey, were extremely varied from average conditions, particularly in reference to rainfall. The mean rainfall is between 3 and 4.5 inches per month for the growing season. During May 1949 the rainfall was 5.44 inches, but during June it was 0.33 inches. August also was a dry, hot month. Furthermore, the rainfall in July was confined primarily to two hard rains. It, therefore, is obvious that the erratic conditions affected crop yield very much. In fact, certain crops on certain soils were a complete failure. This is why it is important to examine the soil concerned—Delanco sandy loam—located at Cinnaminson, N. J.

This particular field was divided into three approximately equal sections, one planted to corn, one to tomatoes, and the other to oats. In face of the erratic climatic conditions and without irrigation, the area planted to corn yielded 102 bushels per acre, tomatoes—15 tons, and oats—78 bushels per acre. Because of these above-average yields, an investigation of this soil was prompted.

Soil Profile

A hole approximately 5 x 5 x 5 feet was dug between the corn and tomato rows. A descriptive drawing of this soil is shown in Figure 1. The roots of the corn penetrated to and were about equally distributed throughout the first 46 inches. The roots of the tomatoes penetrated to a depth slightly greater than the corn, but avoided the gray, leached horizon at the 9-23-inch depth. All of the roots concentrated in the clay section of the soil particularly around the 34-inch depth. Below this clay horizon was concentrated a gray and red mottled compact clay. Root penetration practically stopped at this depth. The compact clay tended to prevent the movement of water and root penetration. Immediately under the A_p horizon was a plow sole which undoubtedly had been developed over a period of years due to a constant depth of plowing. While this layer was compact, it obviously had little or no influence on yield.

Soil Analyses

Data in Table I shows the results of the mechanical analysis of the soil. These results bear out the fact that there was a concentration of clay in the lower depths. It becomes obvious that this soil, to the ultimate depth, has the capacity for holding approximately 5 million pounds of water to the acre. According to most of the published figures, this is sufficient to produce 100 bushels of corn per acre if evaporation from the soil did not occur. The water at the maturity of the crops had been exhausted as far down as the B_1 horizon. Moisture still existed in the B_2 horizon to the extent of approximately 15 per cent.

The chemical analyses shown in Table II are very revealing. There was a concentration of readily available potash in the B_1 and B_2 horizons of the soil. This is shown by the sodium acetate extraction and the total replaceable. From the estimation of the organic matter and other available plant nutrients shown in Table II, it becomes

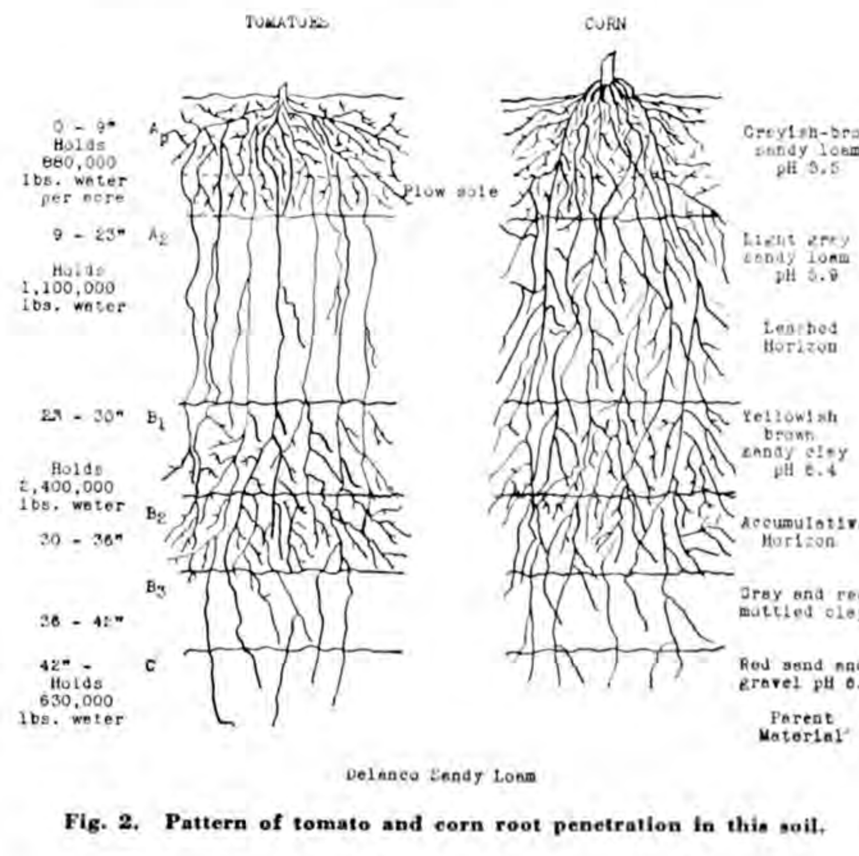

Fig. 2. Pattern of tomato and corn root penetration in this soil.

TABLE I—MECHANCAL ANALYSES OF SOIL.

Horizon	Per cent				
	Gravel	Sand	Silt	Clay	Water*
A_p....	3	79	10	8	4.0
A_2....	0	75	15	10	3.7
B_1.....	11	42	24	23	8.5
B_2.....	7	39	28	26	15.0
C.....	25	44	12	19	10.5

*110° C.

obvious that this was not a fertile soil. Consequently, the method of fertilization used in producing these yields becomes interesting.

Fertilization

The particular area of soil in question has been used for the growth of tomato seedlings for a number of years and has not been fertilized with commercial fertilizer since 1942. The whole area after spring plowing received a broadcast of 1,000 pounds of a 4-8-12 fertilizer carrying 20 pounds each of borax and manganese sulfate per ton of fertilizer. The oats were sown and no additional fertilizer applied. U. S. Hybrid 13 corn was planted on May 19 and 300 pounds of cyanamid per acre broadcast the day after planting the corn to supply nitrogen and effect some weed control. The corn perhaps was planted too thick. There were more than 16,000 stalks per acre and some stalks did not produce. The corn was cultivated only twice and very little grass appeared. At approximately the knee-high stage, 500 pounds of a 7-7-11 fertilizer and 200 pounds of ammonium nitrate per acre were applied as a sidedressing. From visual observation this corn did not suffer from a lack of moisture at any time during the growing period.

The tomatoes received, in addition to the 4-8-12 fertilizer, 500 pounds of a 7-7-11 fertilizer per acre as a sidedressing. This fertilizer contained 1 per cent borax, 3 per cent magnesium oxide, 2 per cent manganese sulfate, and traces of copper, zinc, and molybdenum. It is obvious from the treatment of this soil that an abnormal amount of fertilizer was not used. The nature of the soil was such that leaching was minimized and the total waterholding capacity was great. The study of the soil profile obviously reveals the reason for it being possible to grow these crops in the face of adverse weather conditions.

In order for any grower to rationally fertilize and cultivate his field, it is essential that a knowledge of the properties of the soil be known. It is for this reason that it is intended to study and present the facts about different soils. It is obvious that irrigation is not necessary for tomatoes and corn on the Delanco soil, whereas with other soils it may be profitable.

TABLE II—CHEMICAL ANALYSES OF SOIL.*

Horizon	Pounds per acre								% Organic matter
	pH	CaO	MgO	N as NO_3	P_2O_5	K_2O	Al	Mn	
A_p..........	5.45	330	33	6.8	60+	48	0.8	0.6	1.1
A_2..........	5.95	200	90	15.8	60+	50	0.6	0.8	0.4
B_1..........	6.35	1275	270	2.1	6	420	0.9	1.2	0.3
B_2..........	6.25	425	100	1.8	3	110	1.2	0.4	0.5
C..........	6.00	200	110	3.0	3	98	0.8	0.4	0.2

*Sodium acetate extract.

Fig. 1. Adequate fertilizer, added to ponds on favorable sites, is a must for higher production of fish.

More Fish and Game

By Verne E. Davison

Regional Biology Division, Soil Conservation Service, Spartanburg, South Carolina

MORE than 25 million Americans hunt or fish. Still more would enjoy hunting and fishing if they had a successful place to do so. Demand exceeds the supply almost everywhere; unfortunately the supply is spotty, inadequate, and poorly developed.

We have had a traditional belief that everyone is entitled to hunt and fish in our great states—across the fields and through the woods, and down the streams and around our lakes. All we once asked of ourselves was to buy a license, obey the laws, and limit our harvest to something less than a glutten would carry home. It is becoming evident, however, that an ever-increasing number of people can find little if any hunting and fishing available to themselves and their families.

Conservation is not enough. Conservation means only to save—to guard—to protect. We must turn now to production—agricultural production—if we want good hunting and fishing. We must grow five pounds of fish where nature supported but one, and grow fish where no water existed before. We must grow two coveys of quail, two squirrels, two rabbits, where only one is now able to live, and grow more where none have survived in recent years.

Anyone who owns land can improve it; can make it produce more game or fish or both. And (with a few ex-

Fig. 2. Every pond deserves protection against erosion and excessive run-off. Fine pasture is just one of the land treatments which favor wildlife indirectly in soil and water conservation farming.

ceptions) he can have more regardless of what his neighbors do with their lands. These lands and waters will continue to support only meager populations of fish and game unless the management of water and wildlife land is included as a part of everyday farming. The decision is not in the hands of sportsmen alone, as many have believed. It is a determination to be made individually by the man who owns or works the land. Encouragement by hunters and fishermen, and by agricultural and wildlife leaders, is needed. One should never forget that fish and game production is an elective to be employed or ignored as the landowner wishes.

How many have a place to hunt or fish where the sport is as good as it was 10 years ago? Not one in a hundred, in my experience. Almost invariably, the rare few who have better hunting or fishing have made it better by increasing the necessary food on their lands or in their ponds. Or they have a farmer friend who has done it.

This, then, may well become our traditional thought: The right to good hunting and good fishing must be EARNED by dependable effort to PRODUCE the game and fish we seek.

We glibly think of America as having been a paradise of fish and fowl and big game before white men came with their axes and plows and livestock and modern industries. It wasn't so! The whole country supported no cows or horses or sheep or any domestic stock. The Indians and the explorers starved to death for lack of food. It was a country where agriculture was practiced only in the most primitive way. It is agricultural development which has made it possible for America to support 150 million people at home and many others abroad, where less than a single million eked out a living 400 years ago. It will be agricultural development, largely, that builds the game and fish supply to provide more for the present and future demand.

There was an earlier time when all men lived entirely on wild fruits and roots, wild bird eggs, and what animal life they could catch. Man ate no wheat or rice or corn because these foods grew too sparsely for him to harvest. Then man discovered agriculture—learned that he can support more people and more livestock on any land, by choosing the plants he wants and excluding the ones useless to his needs for food, clothing, and shelter.

The productivity of land and waters for wildlife can be increased in the same ways. We are doing it with farm ponds for fish, with bicolor lespedeza for quail, with multiflora rose for rabbits, and in a general way for several kinds of wild creatures by the land-use improvements inherent with application of the best soil and water conservation measures.

Ten years ago the idea of increasing fish production by fertilizing pond waters was called "impractical, theoretical, ridiculous." But those who termed it so could not tell how to increase the average yield of fish from 10 or 15 pounds per acre annually to 100 or 200 pounds each year. Swingle and Smith, Alabama Agricultural Experiment Station, discovered the way to high production of fish in ponds. We have followed their methods successfully on thousands of farm ponds in soil conservation districts. Today every Soil Conservation Service technician can show the farmers in his work area where to build good ponds, and where not to build them, too. He can predict good yields with certainty to the pond owner who will follow simple instructions on (1) selecting the site, (2) dam and bank construction, (3) proper stocking, (4) high fertilization, and (5) consistently regular care. *An acre of water today can provide 10 times the fishing entertainment possible 10 years ago.*

By making every square foot of a one-eighth-acre plot produce a heavy crop of bicolor seed (40 or 50 pounds per patch) a covey of quail can be fed better than nature or man has ever fed them before. The Soil Conservation Service worked out this production technique in answer to a very large demand for permanent, economical means of bobwhite management. The same principle of "high yield of food on small areas" is equally important if one wants to grow corn, or annual lespedeza, or soybeans, or any other game food.

Southeastern lands, like all others, will not clothe and feed people sufficiently unless fertilizer, soil culture, and the right kinds of soil and water conservation measures are applied to over-

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Fig. 3. Fifty pounds of quail food can be grown on one-eighth-acre strips, if fertilizer is applied when needed. Birds increase with ample food.

A Simplified Field Test for Determining Potassium in Plant Tissue

By S. W. Melsted

Department of Agronomy, University of Illinois, Urbana, Illinois

THE use of rapid chemical tests to determine the presence or absence of ions in plant sap is an accepted technique in determining plant-nutrient deficiencies. These tissue tests vary considerably in their ease of operation and in the amount of equipment necessary for their use. The potassium test described here is the well-known dipicrylamine spot test modified and adapted for field use.

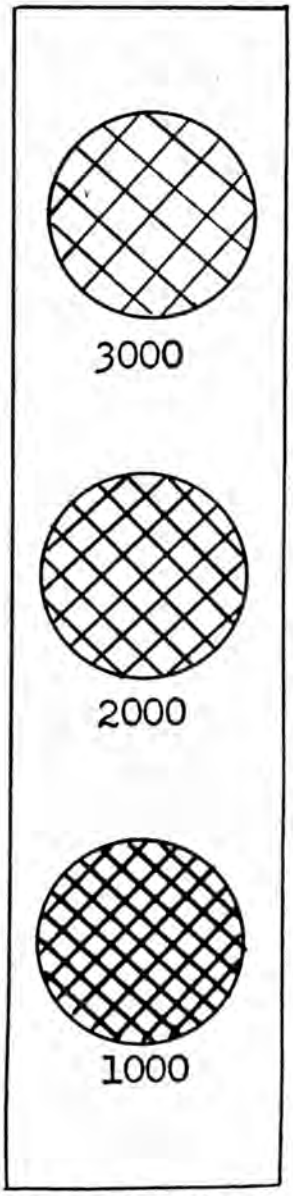

Fig. 1. Illustration of the general appearance of test papers.

One of the common techniques used in spot-test work is to place a drop of the test reagent on a strip of filter paper and allow it to dry. Then, when a test is to be made, a drop of the unknown solution is applied to the test-spot area on the filter paper and the color change noted. The use of such techniques as field tests has several advantages. The equipment is easily transported and the tests easily and rapidly performed, requiring little special skill. Their disadvantages are their lack of quantitative accuracy and their lack of a sufficient range of measurement required for satisfactory tissue-testing work. The technique suggested here for a field plant-tissue test for potassium is an attempted compromise between quantitative accuracy and ease of operation.

The test is essentially as described by Feigl (1). A drop of the test reagent is placed on a strip of filter paper and allowed to dry. Then a drop of the plant sap is squeezed onto the test spot, allowed to react for about 30 seconds, and then the paper is immersed in a solution of 0.5 normal hydrochloric acid for about 30 seconds. If a reddish-orange spot remains, potassium is present; otherwise the test spot turns a lemon-yellow color. By varying the concentration of the reagents used to make the spots, it is possible to prepare test papers that are sensitive to different levels of potassium in solution. Or, as is the case here, it is possible to prepare a filter paper strip impregnated with a series of test spots each of which is sensitive to a different level of potassium.

Preliminary work with corn, soybeans, and alfalfa has indicated that if the concentration of potassium in the expressed sap is below 2,000 ppm the plants are growing on soil that probably would have responded to potash fertilization. If the potassium concentration

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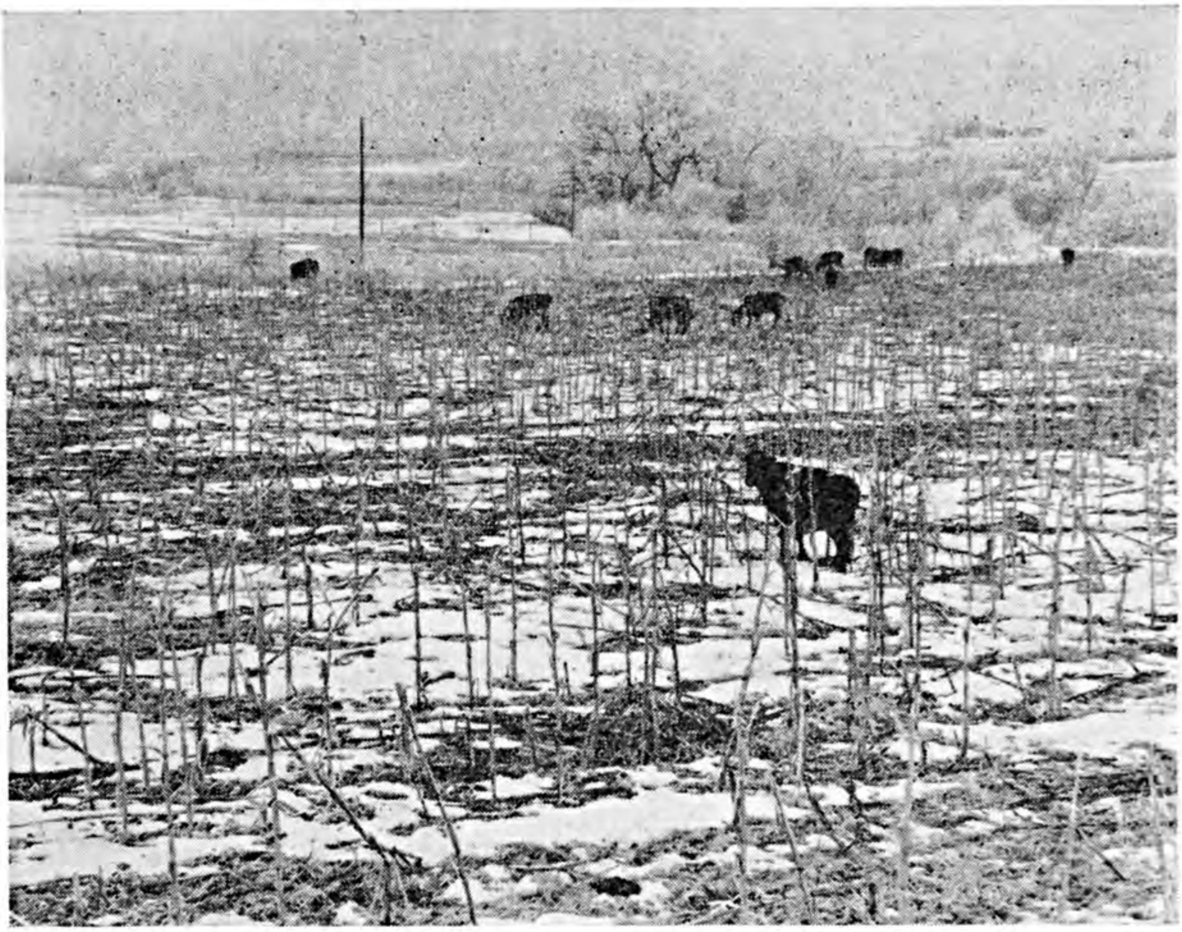
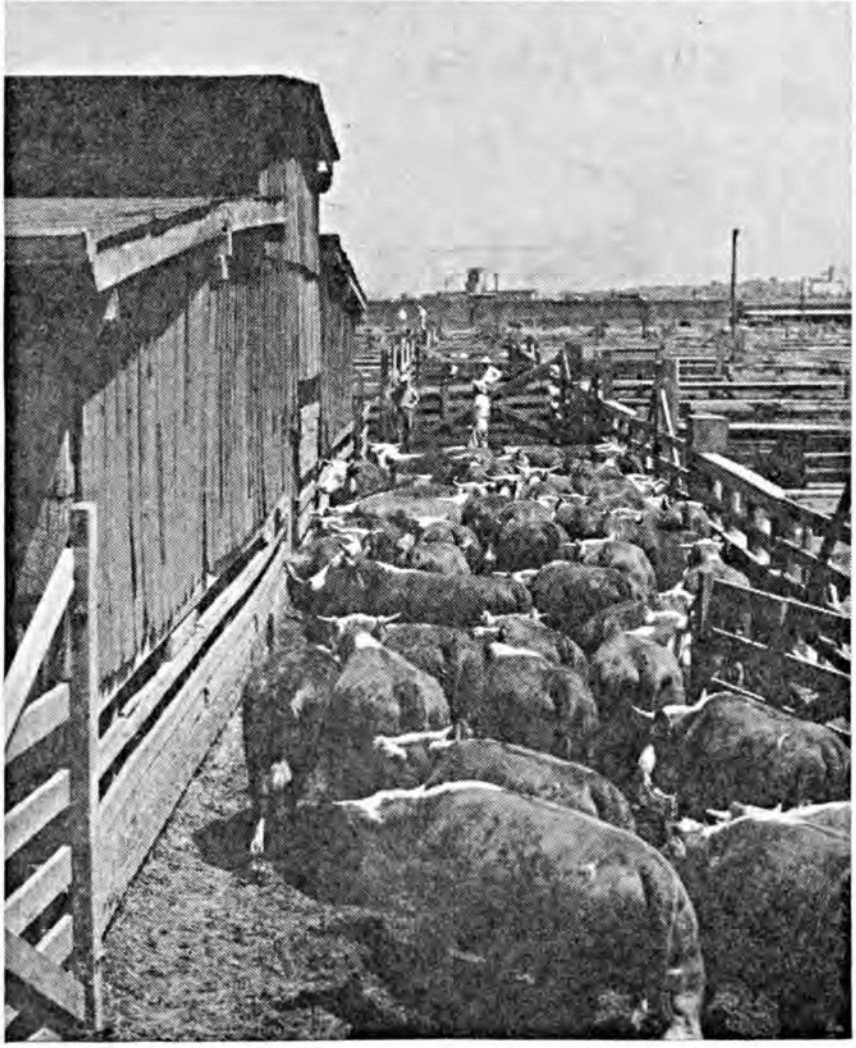
PICTORIAL

T. J. Bird, Jr., with a 3-day-old ram on the Bird Farm, Merkel, Texas.

Slow Going



Slim Pickin's



Above: The grand champion steer at the International Livestock Exposition, Chicago, was Judge Roy Bean, entered by the Pecos county, Texas, 4-H Club. He was purchased at a record price of $11.50 per pound by Dearborn Motors, Detroit. The club will use the money ($13,800) to take its members on an educational tour. Posing with the champion are: W. T. Posey, Pecos county extension agent; Morris Kreidel, Howard Morgan, Sim Reeves, Henry McIntyre, Albert Hallford, and Frank Baker, members of the club which owned the steer; W. R. Moody, club leader, who fed the animal; Will Slaten, another member of the 4-H Club who originally owned the steer and raised it from a calf, and David Meeker, director of education for Dearborn Motors, who made the record bid.

Left: These steers aren't champions but look as though they will be classified as "prime" beef.

The Editors Talk

Looking Ahead

The outlook for farmers in 1950 is for a year of high production, although they may not be called upon to produce as much as during the last two record-breaking years. According to the Bureau of Agricultural Economics, U. S. Department of Agriculture, the economic prospects for 1950 indicate that there will be another decline from the 1948 peak demand for farm products. Both business and consumers have been spending slightly less, apparently having satisfied their most urgent postwar demands. Total employment is somewhat smaller, resulting in lower incomes and smaller worker demand for farm products.

So far as the farm business itself is concerned the Bureau says that the downward trend of 1949 in prices and income will probably continue. Production will again be large if growing conditions are average. Increases in output of meat, milk, and eggs will almost offset declines in crop production. Cuts in crops are expected with acreage allotments already in sight for wheat, cotton, peanuts, tobacco, and some other major crops.

Although the volume of marketings may be almost as large, prices received by farmers in 1950 may average 10 per cent below this year, with a corresponding drop in cash receipts. This would be about the same as the decline from 1948 to 1949. Farmers' costs also will decline, probably more than in 1949, but again less than the decline in receipts. In 1949, gross farm income was down 10 per cent and net farm income 15 per cent from 1948. This pattern is likely to be repeated in 1950. If it is, net farm income still will be more than double prewar, but down nearly one-third from the 1947 peak.

With that picture in mind, how should the "business" farmer proceed? For farming is a business in every sense of the word and is subject to most of the factors which govern success in business.

First, he should take an inventory of his assets and review his gains or losses of the past year. It is not probable that a great many farmers make a practice of taking inventory despite the fact that such information, used with his records of sales and expenditures which must be kept for income tax purposes, provides him a means of checking on his investment in capital as well as in time and labor and discovering shifts to improve his financial status.

Next, the businessman looks into the capabilities of his production plant. In the case of a farmer this would be the fertility of his soil. H. H. Bennett, Chief of the Soil Conservation Service, has urged completion of detailed surveys to determine the capability and conservation needs of the nation's farms at the earliest possible date. Surveys already made have shown that now being cultivated are many millions of acres that should go out of cultivation into permanent pasture or into quick-growing trees. This is important to the individual farmer, Dr. Bennett believes, because it means efficiency in production and, in the long run, will mean a more stable income.

But the individual farmer does not have to wait for the soil survey. The ever-increasing soil-testing facilities make it possible for him to have samples of his fields tested for their plant-food content and to receive guidance on fertilization to produce the high yields and quality which result in lower per-unit costs. R. H. Bray, widely known soil scientist and a Professor of Soil Fertility, Illinois Agricultural Experiment Station, has this to say: "Soil tests tell when to use fertilizer and when not to use it, and guarantee a farmer a three- to five-fold profit from its use. Fertilizer use is climbing despite the end of the war and crop surpluses are accumulating. If crop prices were cut in half, fertilizer use would still be profitable where a soil-testing system is followed. Production is still going up as more and more acres are built up to maximum fertility."

Space does not permit outlining here other business practices which farmers should be considering in their planning for 1950. The two mentioned, however, are of prime importance and should be, as they *are* being, urged upon growers before the rush of the planting season begins.

Protecting Soils

Agricultural Science always constitutes a big and important "Section" when the American Association for the Advancement of Science convenes. In connection with the Association's last meeting, the University of Wisconsin, College of Agriculture, issued a press release which we believe will be of wide interest among our readers. It is quoted below in full:

New York, Dec. 30, 1949: Soil conservation would progress much faster if farmers and others worked more to increase soil fertility, Emil Truog, University of Wisconsin soil scientist, told the American Association for the Advancement of Science here today.

Measurements in billions of dollars will fail utterly to show the full loss to society of soil washed from farm land onto highways and into rivers, lakes, and other water supply sources, he warned.

You would think, Truog pointed out, that damage from soil loss is so great and so apparent that all would be interested in stopping it.

One reason he said that farmers seemed to lack interest was that terraces, waterways, and strip-cropping do not immediately increase crop yields.

If more emphasis were put on building up the soil fertility we would get soil conservation and increased production all at one time, he told the scientists. "Farmers would have an incentive to spend money on soil conservation."

Truog outlined five ways in which increased fertility would hasten the job of soil conservation.

1. Fertile soils produce a heavier plant growth that shields and protects the soil against washing.
2. Heavy plant growth would remove more water from the soil, allowing it to soak up more rainfall, cutting the amount that would run off.
3. Fertile soil is in better condition to soak up rainfall than poor soil is.
4. More fertile soils would increase yields, giving farmers a greater incentive to use soil conservation methods.
5. Fertile soils help provide farmers with the money needed to build terraces, waterways, and the like.

Truog called for closer coordination in the work of the extension service, the soil conservation service, and other agencies in protecting the soils of the country.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	.....
1924...........	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941...........	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942...........	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947...........	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948...........	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
January.....	29.27	42.9	166.0	236.0	125.0	202.0	19.80	65.70	....
February....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March.......	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April........	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May.........	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June........	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July.........	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August......	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September...	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October......	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November...	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....

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

1924...........	185	190	98	170	166	141	107	147	143
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	89	81	109	74	87	110
1938...........	69	196	80	79	76	64	57	97	88
1939...........	73	154	100	84	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	105	117	107	82	211	129
1942...........	153	369	168	134	143	124	91	202	163
1943...........	160	405	188	235	174	154	125	231	245
1944...........	167	420	214	216	170	160	139	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	178	248	212	209	141	319	204
1947...........	257	380	232	248	336	259	148	381	249
1948...........	250	387	220	249	212	232	160	301	238
1949									
January.....	236	429	238	269	195	229	169	291	282
February....	235	295	249	279	174	219	173	237	285
March.......	232	319	250	290	184	224	168	228	263
April........	241	247	260	314	190	226	160	223	236
May.........	242	325	260	312	190	226	149	224	213
June.........	243	315	251	301	188	210	138	207	175
July.........	243	565	222	323	195	206	132	166	185
August......	236	446	221	305	184	202	135	197	174
September...	240	487	198	263	181	212	137	193	205
October......	231	474	187	224	170	214	141	185	170
November...	224	434	192	216	159	215	141	188	226
December....	214	454	188	230	176	218	144	192	206

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	10.11	10.59	10.84	9.85
1949						
January	3.15	2.23	10.29	8.68	11.53	11.53
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94

Index Numbers (1910-14 = 100)

1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949						
January	118	78	294	246	342	328
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate, Balti-more, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	.472
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948	.764	4.27	6.60	.478	.681	14.14	.195
1949							
January	.770	4.61	6.60	.375	.720	14.50	.200
February	.770	4.61	6.60	.375	.720	14.50	.200
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	72
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949							
January	144	128	135	68	76	60	83
February	144	128	135	68	76	60	83
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924	143	152	143	103	97	125	94	79
1925	156	156	151	112	100	131	109	80
1926	146	155	146	119	94	135	112	86
1927	142	153	139	116	89	150	100	94
1928	151	155	141	121	87	177	108	97
1929	149	154	139	114	79	146	114	97
1930	128	146	126	105	72	131	101	99
1931	90	126	107	83	62	83	90	99
1932	68	108	95	71	46	48	85	99
1933	72	108	96	70	45	71	81	95
1934	90	122	109	72	47	90	91	72
1935	109	125	117	70	45	97	92	63
1936	114	124	118	73	47	107	89	69
1937	122	131	126	81	50	129	95	75
1938	97	123	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	124	131	127	86	56	130	102	77
1942	159	152	144	93	57	161	112	77
1943	192	167	151	94	57	160	117	77
1944	195	176	152	96	57	174	120	76
1945	202	180	154	97	57	175	121	76
1946	233	202	177	107	62	240	125	75
1947	278	246	222	130	74	362	139	72
1948	287	264	241	134	89	314	143	70
1949								
January	268	260	233	136	97	313	144	72
February	258	257	231	136	99	309	144	72
March	261	258	231	134	99	290	144	72
April	260	258	229	134	99	291	144	72
May	256	257	227	134	99	293	144	72
June	252	257	223	134	99	304	144	65
July	249	256	225	140	100	349	144	68
August	245	254	222	143	100	372	144	68
September	249	253	225	138	100	334	144	68
October	243	251	222	138	98	331	144	72
November	239	250	221	136	96	321	144	72
December	236	251	220	136	96	317	144	72

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

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"1949 Results of Boron Topdressing Demonstrations on Alfalfa," Soils Dept., Univ. of Wis., Madison, Wis., C. J. Chapman.

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Soils

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Crops

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"Practices, Costs, and Tuber Bruising in Digging Potatoes in Aroostook County, Maine," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 472, June 1949, W. E. Schrumpf.

"Corn Storage for '49," Ext. Serv., Univ. of Md., College Park, Md., Ext. Leaflet No. L7, Sept. 1949.

"Tung Culture in Southern Mississippi," (Revised), Agr. Exp. Sta., Miss. State College, State College, Miss., June 1949, Bul. 464, W. W. Kilby and G. F. Potter.

"Science Serves New Hampshire Agriculture," Agr. Exp. Sta., Univ. of N. H., Durham, N. H., Sta. Bul. 376, Dec. 1948, A. R. of the Director.

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"Why did Mahatma Gandhi leave college, Simon?"

"All of the girls wanted his pin."

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

Determine Cause of Alfalfa Ills Then Apply Cure

BEFORE you can cure yellowing or dying of alfalfa you must first know the cause, University of Tennessee Agricultural Extension Service agronomists advise farmers.

Discoloration, often laid to weather conditions, may be caused by mineral deficiencies in the soil, or by fungus diseases. It is sometimes difficult to determine the cause without a soil test or a study of the plant for signs of disease.

In periods of dry weather, potash and boron are less available to the plants, which may cause deficiency symptoms if the soil is low in either or both of these minerals. Where it is known that soil has been amply supplied with potash it is likely that yellowing is caused by a boron shortage.

A boron deficiency causes yellowing of the upper leaves of the plant and the short innernodes at the upper end of the main stems. While boron is usually applied in February or March, it may be applied after the first alfalfa cutting at the rate of 15 to 20 pounds per acre. Soil tests should indicate the amount of potash to add.

Sometimes after prolonged damp and warm spring weather, purple rhizoctonia, a fungus disease, attacks alfalfa. In this case the stems turn purple or brown, and the entire plant dries up. Early cutting, grazing, and crop rotation are methods of control.

Erosion Experiments Show Need For Sod

THAT Pennsylvania farmers should use longer rotations, strip cropping, and contour planting is reflected in results of a 6-year series of experiments conducted at the Pennsylvania State College. These erosion studies show the need for longer rotations involving more hay and grass crops, and either strip cropping or contour planting for grain and cultivated crops.

Both water and soil losses were studied in the cooperative project of the Pennsylvania Agricultural Experiment Station and the Soil Conservation Service. Soil losses for corn were found to be most critical during August and September, after the corn has completed its growth and cultivation has ceased. This indicates need of adequate cover crops. With oats, most soil was lost in the first month of growth.

Water losses were found to be high during midsummer when corn, oats, and wheat are grown, but the peak is reached in March of every year. This peak is caused largely by melting snow and ice in late winter and early spring.

Rainfall during spring and summer months is greater than in fall and winter. Crops, therefore, do not suffer so much from lack of rainfall as from the inability of the soil to catch and hold moisture. This was attributed to the more intense rains during the summer and to unfavorable physical condition of the soil.

In addition to measuring soil and water losses over the 6-year period, the studies also included soil rebuilding, strip cropping with typical Pennsylvania crops, tillage analysis, and contour cultivation.—*A. H. Imhof, Pennsylvania Agricultural Experiment Station.*

Uncultivated Orchards

By David S. Clarke

Work Unit Conservationist, Alexandria, Kentucky

"I'D give up orcharding if it was necessary to cultivate them."

That's a strong statement to be said by the son of an orchardist who believed in working the ground under his fruit trees, but Albert Kenneweg did not give up orcharding and he does not cultivate the steep land on which his orchards grow.

Standing on one of the high points of his farm overlooking his acres of apples and peaches, weighted down with a bountiful crop, Albert Kenneweg pointed to a hillside of apple trees, "My father plowed that field one year," he said, "and the rains came and the soil was washed off as deep as he had plowed. He cultivated it and lost more soil. This process was repeated from year to year, until that orchard was abandoned to brush and locust. My father died, and for awhile my brother and I together ran this farm. Later, I took over the field operation and have been in full charge since 1938. As you can see, my orchards are uncultivated. The soil under the trees is held in place by grass."

It was true, under all the trees where I could see, there was grass, orchard grass, bluegrass, alsike, Kentucky fescue, lespedeza, and even some sweet clover, which Kenneweg said was volunteer. I had to look a long time to find even a small area as large as my hat, bare of a blanket of grass.

Seeing the soil wrapped and covered in the green sod, it was hard for me to believe the story Kenneweg told of the farm's past history. "On that hillside, when I took over the operations of the farm," he said, "the orchard was overgrown with brush. A man from somewhere farther South helped me clean out the brush and thin the fruit trees which were twice as thick as they are now. Then I seeded grasses and clovers, using manure and fertilizer to get the grass to grow. Over there," he added, pointing to a young orchard on a smooth green hillside, "were gullies deep enough to bury a horse in. I plowed the gullies in and smoothed it, still more, with a bulldozer."

Kenneweg convinced me when he directed my attention to a hillside, green with alfalfa and said, "Do you remember that field?" I remembered. In 1946, he had taken me over that field which was then rough, gullied, and brushy, producing neither pasture nor crops. Now there are no gullies, no brush, no wasteland. Only a few spots where the alfalfa is not as luxuriant as the rest indicate a few of the former galled, eroded, or gullied areas. "I'm treating those areas with organic matter, barnyard manure, and fertilizer. Soon they will be growing grass as tall as the rest of the field," Kenneweg told me. "A man named John Herpst, who died last summer when he was over 90 years old, told me he could remember when he helped scythe timothy growing shoulder high from that field. I have not gotten it back to that state of fertility yet, but it has improved a lot since I started working on it in 1946.

"I have one sore spot left on this farm, I'd like you to see," so we walked to the back end of the 126-acre farm. There, hidden by surrounding apple orchards, was an acre or so of eroded overgrown wasteland; a mass of six-foot deep gullies, gouged into the earth.

"One of my next projects," announced Kenneweg, "is to bulldoze the brush from this area and build a pond here to supply water to use in spraying. The area will be inclosed by a multiflora rose fence for a haven for quail and other wildlife. After I have this in shape where you can see, I want you to use your level to lay out this pond like you did for the lake I built last year.

"John Herpst, the old man I mentioned to you, said this field was gullied as long as he could remember. He said that several times he helped fill them up but they formed again. This ground washes easily, that's why I plan to use it for a pond and protect it with vegetation which will hold the ground and furnish food for wildlife."

As we retraced our steps back through the orchards, Kenneweg revealed more reasons of his success in obtaining soil-holding grasses and bountiful fruit. "When I cleared and smoothed the alfalfa field," he said, "I saved the limestone rocks in it and had them crushed to spread on my fields. Each year I topdress parts of the orchard with 10-6-4 fertilizer which increases the fruit yield and furnishes some phosphate and potash to help the clover. The clover produces nitrogen cheaper than I can buy it, but not enough, so after the June drop, I topdress the peaches with additional nitrogen, with one or two pounds per tree. Sometimes I use as much as four pounds on thin areas. Where I fertilize early, the effect on the trees and fruit is noticeable the first year. I mow under the trees according to the need. This year I mowed twice, once before the fruit bent the limbs down in the path of the tractor. I leave what I mow on the ground to form a mulch which holds back the rainwater until it can soak into the ground. The grass and mulch cause more water to soak into the soil for the trees than the grass used, so by not cultivating my orchards I am saving not only soil but water also."

Having reached the farm buildings, Mr. Kenneweg exhibited his tractors and other machine-operated tools. "There isn't a horse on the place," he announced. "I do all my work with machinery." He proudly showed off his herd of high-grade Guernseys which he built up from a common herd by the use of good sires.

Then we went into his home, equipped with modern labor-saving devices, and met his family. His mother was using a new electric washing machine. His wife was putting the youngest of their three children to bed for an afternoon nap.

"There is another advantage of using grass in my orchards instead of cultivating them," said the pleased Kenneweg, looking at his youngest child. "Cultivating and plowing take a lot of time and I have no one to help me. The oldest of my two sons has not started to school. It will be a long time before they can help with the farm work, but even with their help, I'll give up orcharding on these steep hills if it becomes necessary to cultivate them."

Wheat Improvement in Southwestern Indiana

(*From page* 12)

than 140,000 bushels. At $2 per bushel this program netted farmers over $200,000 in cash and helped them gain experience and "know-how" for the future. Several carloads of other forms of nitrogen material were secured and applied. Producers report that early applications, about March 1, gave best results. The nitrogen was applied with grain drill, hand seeder, and fertilizer spreader, and by airplane. The cost of applying the material by "air express" was not out of line with the cost of other methods. Early applications of both nitrogen and legume seed by plane when fields were too wet and soggy for tractor and grain drill application more than paid, through increased yields, for the entire cost.

Agricultural research coupled with farm "know-how," plus better yielding wheats, disease-free and winter hardy, and possessing short stiff straw and satisfactory milling qualities, are bound to increase the average annual yield in the Pocket Area. With the help of 320 local committeemen, county agents, elevator operators, and plant scientists from Purdue University, the wheat improvement program will be effective, not only in increasing yields but also in improving soil conditions so that farm folks will have a happier and more satisfied life. Better homes are being built and more sons and daughters are getting a better education through "Vigo fellowships." In the next decade producers hope to raise the average annual yield of wheat from 17.4 bushels to 25 bushels per acre. Increased yields per acre put more profit dollars in the pockets of farm folks. Larger profits per acre mean more farm purchasing power and a better commonwealth.

Simplified Field Test for Determining Potassium

(*From page* 26)

is over 2,000 ppm the plants are growing on soil which probably has sufficient exchangeable potassium for normal growth. When the potassium concentration in the expressed sap falls to, or below, 1,000 ppm the plants will be showing definite potash-deficiency symptoms. Preliminary work with tomatoes has indicated that some response to potash fertilizer may be expected even though the expressed sap contains 2,000 ppm of potassium.

Preparation of Reagents

The reagents required for the preparation of the test papers are prepared as follows:

Solution A

Weigh 0.60 grams of dipicrylamine and 0.60 grams of Na_2CO_3 into a 100-ml. beaker. Add 15 to 17 ml. of distilled water, stir, and bring to a boil. Then cool and filter using a small (7 cm.) filter paper. Wash the residue on the filter paper with distilled water and make the volume up to 25 ml. (For convenience, filter and wash directly into a 25-ml. graduate.) This reagent, when used as a spot on a filter paper, is sensitive to concentrations of about 1,000 ppm (or more) of potassium in solution, but not to concentrations of less than 750 ppm.

Solution B

Transfer 8 ml. of *Solution A* into a 25-ml. graduate and dilute to 25 ml. with distilled water. This reagent, when used as a spot on a filter paper, is sensitive to concentrations of about 2,000 ppm (or more) of potassium in solution.

Solution C

Transfer 10 ml. of the *Solution B* into a 25-ml. graduate and dilute to 15 ml. with distilled water. This reagent, when used as a spot on a filter paper, is sensitive to concentrations of about 3,000 ppm (or more) of potassium in solution.

Preparation of the Test Papers

Cut Whatman No. 1 filter paper into strips approximately one-half inch wide and three inches long. At one extreme end place a small drop of *Solution A* on the filter paper to form a test spot. Then about one-half inch above this spot, place a small drop of *Solution B* on the filter paper strip. Finally, about one-half inch above the second spot place a small drop of *Solution C* on the filter paper strip. Allow the papers to dry, or place them in a drying oven for three to five minutes at 85° C. for drying. When dry the test spots should vary in color from a deep orange color for the first (Solution A) spot to a light orange color for the last (Solution C) spot. Once the spots or papers are dry they may be stored for future use. Although prepared papers have been kept and found usable after two years, the reagent ages and becomes sluggish in action with time. To insure good results it is not recommended that prepared papers be kept for more than a year. Figure 1 illustrates the general appearance of the prepared test papers.

Performing the Test

For corn, place the test paper along the midrib of the corn leaf. Using a pair of pliers, place one of the jaws on the test spot and the other underneath the midrib and gently squeeze until the plant sap moistens the test-spot area. This procedure is repeated on the same leaf and midrib for each of the three test-spot areas on the test paper. Allow the sap to react with the test paper for about 30 seconds, then dip the test paper into a vial of approximately 0.5 normal HCl solution for about 30 seconds. The test is positive if a reddish-orange or brownish color persists on the test-spot area. The test is negative if the spot turns a lemon-yellow color. Since the blanks or negative readings differ slightly in their depth of yellow color, an unused test paper should be dipped into the acid to get a true color of the blank. Finer readings may be secured by noting the relative intensity of the color developed in positive tests.

Interpretations

Preliminary work with corn indicates that if the plant sap contains over 3,000 ppm of potassium, i.e., when all three spots are positive, the soil is supplying plenty of potassium to the plant. If the center (2,000 ppm) spot is positive but the last (3,000 ppm) spot is negative, the plant is probably getting enough potassium from the soil. If the first (1,000 ppm) spot is positive but the other two are negative, the corn plant is probably growing on a soil that would have responded to potassium treatment. If all three spots are negative the plant will be showing definite potash-deficiency symptoms. This type of calibration may be illustrated by the data in Table I. These preliminary results were obtained during the 1949 season on the Toledo and Newton experimental fields which are extremely potash-deficient fields.

In reading the test it should be kept in mind that the test was developed to give a definite reading at the concentrations indicated. Therefore, as the concentration of potassium in solution approaches the indicated levels, smudges or weak tests will be obtained. These weak tests permit a somewhat greater range in interpretation of the test since a weak test indicates smaller amounts than actually needed for a positive test. Similarly, a good strong test indicates the presence of somewhat greater concentrations of potassium than actually needed for a positive test.

For comparative work, the same general portion of the plant must be sampled each time. Measurable differences in potassium concentrations in the plant sap may be found from top to bottom of the plant. This is especially true for soybeans, where the lower leaves have a higher potassium content than do the upper leaves. In the preliminary work on corn, the leaf at ear level was always tested, while for soybeans the enlarged base of the petiole on a leaf from the top of the plant was used for testing. For legumes the enlarged base from upper leaves was used.

General Discussion

In presenting this field plant-tissue test for potassium no claim is being made for the accuracy of the critical levels of potassium required in the plant sap for normal growth. The work so far is definitely of a preliminary nature and is subject to such changes as further data may dictate. However, indications are that the critical levels indicated are somewhat within the proper range, and that the tests can be used successfully to confirm indefinite potassium plant-deficiency symptoms, or to exclude the possibility of such deficiencies.

It should also be pointed out that test papers can be prepared to suit specialized conditions. The sensitivity of the test spots can be increased or decreased by increasing or decreasing the concentration of the reagents used to prepare the test spots. Similarly, the range or spread between the test spots can easily be altered by controlling the concentrations of the reagents used.

With succulent plants high in chlorophyl the green color of the expressed sap may shadow or mask the color of the test. This difficulty may be overcome to some extent by using a wider strip of filter paper folded lengthwise. The test spots are then placed on one-half of the strip of paper, and when the paper is used for testing, the untreated half is used as a filter to absorb the leaf color as the sap is squeezed through it on to the test-spot area. Such a technique is necessary when working with green grass leaves or leaves that have short petioles. Under some conditions the testing of the actual stem may be necessary.

Caution is advised in making, or trying to make, fertilizer recommendations on the basis of this test. It is felt that

TABLE I. DATA FOR A PRELIMINARY CORRELATION BETWEEN TISSUE-TEST VALUES FOR POTASSIUM AND RESPONSE TO SOIL TREATMENT AND SOIL TESTS

TOLEDO FIELD

Treatment	K Soil Test Lb/A	Corn				Soybeans			
		Yield* Bu./A.	Paper Test**			Yield Bu./A.	Paper Test		
			1,000	2,000	3,000		1,000	2,000	3,000
Check	40−	13	+	0	0	14	++	0	0
Manure	110	41				19	+++	+	0
Residues, Lime, Rock phosphate	40−	24	+	0	0	14	++	0	0
Residues, Lime, R. phos., Potash	100	62	+++	+	0	23	+++	++	0
Residues, Lime, R. phos., Potash, Potash	260	69	+++	+++	++	30	+++	+++	+

NEWTON FIELD

Treatment	K Soil Test Lb/A	Corn Yield* Bu./A.	Corn 1,000	Corn 2,000	Corn 3,000	Soybeans Yield Bu./A.	Soybeans 1,000	Soybeans 2,000	Soybeans 3,000
Check	60	11	++	0	0	9	+++	+	0
Manure	150	26	+++	0	0	16			
Residues, Lime, Rock phosphate	50	39	++	0	0	15	+++	++	0
Residues, Lime, R. phos., Potash	160	54	+++	++	0	20	+++	+++	+
Residues, Lime, R. phos., Potash, Potash	250	57	+++	+++	+	20	+++	+++	++

* Average yields 1945-1948

** 0 = Blank or negative test
+ = Slight test
++ = Fair test
+++ = Good or positive test

the test is not sensitive enough for reliable fertilizer recommendations. It does indicate and separate the extremes in potassium levels, but it does not indicate, and is not intended to indicate, small differences in the potassium levels in the soil. It is suggested that the test be used on several plants in any given area and a representative reading secured. If it is found that the majority of the plants are indicating a low level of potassium, a soil sample should be collected and tested. The soil-test values can then be used for an accurate fertilizer recommendation.

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More Fish and Game

(*From page* 25)

come the common deficiencies of natural climate, plant growth, and soil. The management of wildlife land and pond waters is an exact parallel. Our experience with failures and successes on the widest range of conditions is such that we can tell landowners how to make failures or successes of their efforts.

Failures come from two major causes:

First, unsound site selection—too much water or silt or both in ponds; land too wet or subject to grazing in the case of bicolor plantings.

Second, failure to fertilize the clear waters of ponds sufficiently; and failure to feed bicolor with the phosphate and potash which a vigorous growth requires to produce a heavy crop of seed.

Poor selection of sites can be avoided by making a complete farm plan through the facilities of soil conservation districts. They have the conservation survey maps and watershed surveys to determine the land's ability for production and safe management. Every district has a trained technician supplied by the Soil Conservation Service

Fig. 4. Wildlife production is often attained on old, eroded field borders, but may be considered also on any semi-idle lands.

to counsel with the landowners on these technical matters so vital to safe and sure production. That Soil Conservation Service technician is the "man of experience" in wise land use and the way to conserve land and the waters that fall upon it.

Disappointing failures—delayed yields—are equally unnecessary. A man should not plant bicolor or any kind of bird food unless he intends to give it the fertilizer to produce a good crop of seed. We have seen hundreds of plantings where fertility has been allowed to run down too much. Seed produced was too little to feed a covey of 12 or 15 birds twice a day, and the birds moved off as one would expect them to do.

Good ponds, properly stocked, have "gone to pot" just as readily when owners failed to understand the fertility requirements of high production. The first warning is given by clear water. If a bright tin object held 12 inches beneath the surface can be seen, there is need to fertilize the pond. If the water is not fertilized, the next symptom—water weeds such as coon tail beginning to grow under the surface from the bottom—will be observed. Fertile waters become dark enough to shade out submerged weeds. Infertile waters support relatively few pounds of fish and allow weeds to grow. The weeds protect little fish from the big ones until too many pounds of fish are smaller than usable size, too few are large enough to take home. Fishing isn't worth the effort under these conditions. The waters are unused, unproductive, unprofitable.

The new use of multiflora rose—incidentally, another in the science of modern land-management practices contributed by Soil Conservation Service "wildlife technicians"—has an indirect influence on farm game foods. The rose is used simply as a permanent "living-fence." It has direct value as cover but almost none as food for our resident wildlife. But it is an absolute necessity on livestock farms before you can protect wildlife foods from grazing, plowing, and mowing. Here we use a cover plant of high quality to protect food and grass cover alongside, reaching the goal to grow plenty of food and cover on a small amount of land devoted to wildlife production. More farm game can be grown with these at-

Fig. 5. The "living-fence" of multiflora rose designs the livestock farm to protect game food and cover.

tractive, dependable, growing-fences. This rose, incidentally, will not become a pest. We have grown it on farms in the South for 14 years, and have found beyond question that we can live with it happily.

In addition to the influence of farmer districts, Soil Conservation Service, and Extension Service, the State Game and Fish Divisions have very great opportunities to work on farm game developments. Federal aid funds appropriated to the states are being used and should be used in greater amounts to supply cooperating farmers with seed and plants of bicolor and multiflora rose. Similar aid is needed for fish management—removing rough fish and weed growth from farm ponds. The soil conservation districts need help from these sources and, happily, they are getting some, though not enough.

We need our sportsmen's clubs, game laws, and education nonetheless because of this new approach to wildlife restoration. We are simply adding an essential effort which has been lacking, an effort which would have prevented much loss of game and fish had it been employed earlier. But it is not too late. Game and fish will multiply readily, as fast as each pond and wildlife land-area is managed adequately and consistently for their support.

More than 25 million Americans can enjoy greater hunting and fishing than is available to them today. But they will have to encourage and support its production on the farms and ranches where they expect to find the fish and game. Otherwise less and less can be expected as we grow more livestock, build more highways, and expand our cities and industries. Restoration is the combined effort of good conservation and high production.

More Corn from Fewer Acres

(*From page* 16)

D. Advice in weed control:

Cultivate Properly

Any list of the enemies of corn should have *the man with the cultivator* at the head of the list. Cultivation, properly done, is a necessity to corn raising. Cultivation, improperly done, is one of the chief causes of reduced yields of corn.

The main purpose for cultivating is to control weeds, and cultivating should be done only as often as necessary to accomplish this. Use of the spike harrow or weeder while corn is too small to cultivate may save several cultivations later on and give better weed control throughout the season. Plant a little heavier if you intend to use a harrow. You will destroy some plants.

The first cultivation should be the

Fig. 3. The first step in adjusting the corn planting rate to the fertility of a farm is to calculate the average ear weight.

Fig. 4. The worst "enemy" of corn under present growing practices is man with power tillage tools. "Go slow" cannot be over-emphasized.

closest to the corn since that is the time when the feeder roots are not too long and are less likely to be cut off by the cultivator. If you use a tractor cultivator—go slow. Every stalk you tear out or cover up is another ear of corn lost.

The cultivator should be equipped with wide sweeps that do not penetrate deeply, but cut off the weeds very effectively just under the surface. Narrow shovels penetrate too deeply and cut off feeder roots of the corn. They also dodge around a lot of weeds and get only those on which they score a "direct hit."

Fig. 5. Vo-ag and veteran trainees watched their corn crops for signs of nutrient deficiency and disease.

Fertilizer Trends in South Carolina

(*From page* 19)

A meeting of all fertilizer manufacturers, dealers, and salesmen in South Carolina is held each year either at the Clemson Agricultural College or at one of the five branch experiment stations. Other than getting better acquainted, which helps solve problems of mutual interest, all in attendance are able to see at first hand plant-food deficiency symptoms, experiments with varying amount of different fertilizers, and experiments and demonstrations with all types of machinery for properly applying fertilizers. The groups are also interested in the general experiment station program, such as experiments with varieties, spacing of plants, plant breeding for disease resistance, and other features. The 732 fertilizer dealers, 96 fertilizer manufacturers located in the State, and 70 other fertilizer manufacturers located in 14 states who sell in South Carolina, along with the numerous salesmen, play an important role in molding the 42 million dollar fertilizer program in South Carolina.

TABLE IV. TOTAL ANNUAL FERTILIZER TONNAGE USED IN SOUTH CAROLINA FOR THE PERIODS SHOWN.

Years	Tons
1891–1892	213,143
1893–1894	200,996
1898–1899	261,977
1903–1904	395,638
1908–1909	688,939
1913–1914	961,794
1918–1919	1,028,597
1923–1924	693,040
1928–1929	793,337
1933–1934	547,460
1938–1939	666,853
1943–1944	802,579
1948–1949	998,512

The Old Century

(*From page* 5)

science given to 159 persons in 20 countries. Germany with 38, our country with 29 awards, Great Britain with 28, and France with 16 winners are among the leaders in the world's march to fundamental accomplishments.

Although they began their first work in the 1890's, the great magical names of Edison, Steinmetz, and DeForest shine just as brightly as any who have graced the galaxy of the Nobel lists representing the United States. And now those remote farm homes that we knew so well and think of so yearningly are able to have the good things of life, thanks to these marvelous mentalities, plus the equally effective science of mass distribution.

Agriculture also has partaken of the glories and the progress marking the Twentieth century. Just before it dawned we revered the past successes of such men as Edmund Ruffin in soil chemistry, John Deere and Cyrus McCormick in farm mechanics, Justin S. Morrill in education, S. M. Babcock in dairy science, Theobald Smith in eradication of cattle fever, and Harvey Wiley, the astute chemist and food crusader.

At the turn of the century men discovered the pure-line theory of breeding plants and rediscovered the forgotten Mendel law of heredity. This hastened the work of cereal improvement by selection to fix desirable characters.

Rapidly there came to the fore many brilliant plant breeders to unshackle the farmer from low yields and poverty. The list includes H. F. Roberts of Kansas, C. E. Saunders of Canada, W. J. Spillman, pioneer in wheat hybridization, H. K. Hayes of Minnesota, E. S. McFadden of Texas, Cyril G. Hopkins of Illinois, and turning to corn alone—more master minds. These included G. H. Shull of Carnegie Institution, E. M. East of Illinois and Connecticut, A. D. Shamel of the U. S. Department of Agriculture, and many more.

IT was back in 1917 that the first commercial hybrid corn that involved inbred lines appeared—a Burr-Leaming double cross, perfected at Connecticut Station. Then the next commercial hybrid to be produced and sold commercially was a cross between an inbred Leaming line from Connecticut and an inbred selection from the Bloody Butcher variety, known as Copper Cross. It was distributed by Henry A. Wallace of Iowa in 1924. Today open-pollinated corn and the old-fashioned methods of curing ears for planting are gone for good. Instead we have over 90 per cent of the crop in a majority of the largest corn states planted only in select hybrid seed. That this and the advent of the sturdy resistant wheats seem to have produced a headache in disposal of a frequent so-called surplus is a story that challenges us to take the next vital step. That step is in the realm of social and economic discovery—to find a foolproof way to live with and enjoy overwhelming abundance.

Even now men are arguing about that goal and how to get there. Each proponent of a plan is sure his is the real road to the Utopia of profitable plenty. But when it comes, he who discovers it and makes it work without subsidizing farmers and "pauperizing" consumers is bound to have a permanent niche carved out for him in the annals of agriculture.

Where is the wealthy concern or organized association that will now come forward and offer some tempting plum to a person or a group of people who can work out such a desirable achievement? It offers just as good a field for further encouragement to ambitious brains as the Nobel prize itself. I am sure that you who are left to celebrate the advent of the year 2000 will be able to name the one who finally found a practical plan to take the risk out of growing more and better crops and livestock so that two-thirds of the world's population need not go hungry in an era of multiplied production power.

It would be a lasting disgrace if all our potent plant and animal breeders and our scientific soil chemists and pesticide compounders find themselves frustrated and their efforts brought to a stalemate because of some economic laws and barriers. Where would we find again such men as M. A. Carleton of the Federal research staff, H. L. Bolley of resistant flax fame, or Sewell Wright and his coefficient of livestock breeding?

IN a similar way when it comes to choosing better diets and living on better balanced foods, we are often cornered and browbeaten by silly economic philosophies of long standing that have never been exploded. In this field we take pride in the work in vitamins of McCollum and Steenbock, Sherman and others—and yet it sounds foolish to ask everyone everywhere on all levels of income to abandon narrow menus and eat more fresh fruits and vegetables, dairy products and red meats, in search of abundant vitamins for young and old to prolong life and make it happier while it lasts. No, instead of nurturing the underfed and providing milk, cheese, and eggs for disadvantaged children, we rush to Washington for some support price project that puts the government into the storage and holding business and lifts the vitamins out of the reach of the jobless and the destitute. We do that because we haven't yet discovered the thing which we shall know and use smoothly and fairly before the turn of the next century rolls around. Our sense of justice and our thrift will force us into what will prove to be the biggest milestone of any in the present century—making abundance a boon to everybody.

LIKEWISE the soil has been the object of countless heroic and determined lives in this century. We have had men like Curtis F. Marbut, father of the pedacals and pedalfers, and who was right at home with the Russian men of science, learning from them and adapting what they had found to what he sought for a better system of farming based on the right tillage and fertilization. We have had soil-test discoverers also whose work did much to hasten the application of the right plant food to the soils needing it most. These men, like Truog of Wisconsin, Spurway of Michigan, Hoffer of Indiana, Morgan of Connecticut, Thornton of Indiana, and Bray of Illinois contributed much to this astounding period of enhanced food output, the like of which no century before this one has ever beheld—and will not behold again if we fail to get true satisfaction out of plenty.

I haven't the time to hunt through the files of the good old BAE to get the exact figures with which to make you bug-eyed about how much more one good farm hand can jerk up out of the earth compared to his granddaddy before him—provided he doesn't keep union hours or get discouraged over bumper crops and what often happens to them. Yet I really do have a few digits around handy to wind up this essay with, if you can take it like a man.

In short, what I can prove easily is that one of the queer farm situations that have arisen since 1900 is simply less folks making a living on the farm, but with a larger percentage of the total national land area of about 1.9 billion acres fenced off into farms and ranches than we started out with 50 years ago. That is, we have a wonderful production of farm goods per man engaged in agriculture and a larger total farm area in relation to the entire land area than before.

Just 100 years ago I presume U. S. farmers were proud of the fact that the census takers figured that we had 1,500,000 separate farms, occupying 15.6 per cent of the total national land area. The land and buildings had a going value then of about $3.2 billions.

Then coming to 1900, we are said to have had then about 5,740, farms, occupying 839 million acres, or about 44 per cent of the national land area. In that year our fathers and grandfathers harvested crops on 283 million acres and the value of land and buildings they possessed or rented was $16 billions. The farm population at the turn of the century was somewhere close to 35 million souls, against a national population of about 80 million.

At the latest official tally in 1945 the reported number of farms was 5,800,000, consisting of 1,142,000,000 acres, or 60 per cent of the total land area, and the harvest was taken from about 352 million acres. But the farm residents numbered only about 28 million, more or less, being just through with a big war, against a background of something like 145 million persons.

YOU and I know the tiptop job we did during the war in feeding domestic consumers and serving thousands overseas with the best the world afforded. Sure, they got paid for it, but meanwhile there was something missing in the soil and some pretty thin hides left on the older operators too.

So it hasn't all been rosy and one-sided in this game of feeding more people with the work of fewer trained farmers. But the record is there for all to read and be proud to acclaim. Let's hope and pray that those who round out the last of this potent century of achievement and bereavement will have their destiny in better control than we did and peace for all time to come.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What is the Matter with Your Soil?
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
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P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
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T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa — A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
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P-3-47 Year-round Grazing
T-4-47 Fertilizer Practices for Profitable Tobacco
AA-5-47 The Potassium Content of Farm Crops
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NN-11-48 Ladino Clover — Italian Gift to North Carolina Pastures
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N-3-49 Are You Shortchanging Your Corn Crop?
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EE-8-49 Why Use Potash on Pastures
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THE AMERICAN POTASH INSTITUTE
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FREE LOAN OF EDUCATIONAL FILMS

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

FILMS (ALL 16 MM. AND IN COLOR)

The Plant Speaks Thru Deficiency Symptoms (Sound, running time 25 min. on 800-ft. reel.)
The Plant Speaks, Soil Tests Tell Us Why (Sound, running time 10 min. on 400-ft. reel.)
The Plant Speaks Thru Tissue Tests (Sound, running time 14 min. on 400-ft. reel.)
The Plant Speaks Thru Leaf Analysis (Sound, running time 18 min. on 800-ft. reel.)
Save That Soil (Sound, running time 28 min. on 1200-ft. reel.)
Borax From Desert to Farm (Sound, running time 25 min. on 1200-ft. reel.)
Potash Production in America (Silent, running time 40 min. on 400-ft. reels.)
In the Clover (Sound, running time 25 min. on 800-ft. reel.)

OTHER 16 MM. COLOR FILMS AVAILABLE ONLY FOR TERRITORIES INDICATED

South: Potash in Southern Agriculture (Sound, running time 20 min. on 800-ft. reel.)
Midwest: New Soils From Old (Silent, 800-ft. edition running time 25 min.; 1200-ft. edition running time 45 min. on 400-ft. reels.)
West: Machine Placement of Fertilizers (Silent, running time 20 min. on 400-ft. reel.)
Ladino Clover Pastures (Silent, running time 25 min. on 400-ft. reels.)
Potash From Soil to Plant (Silent, running time 20 min. on 400-ft. reel.)
Potash Deficiency in Grapes and Prunes (Silent, running time 20 min. on 400-ft. reel.)
Bringing Citrus Quality to Market (Silent, running time 25 min. on 800-ft. reel.)
Canada: The Plant Speaks Thru Deficiency Symptoms
The Plant Speaks, Soil Tests Tell Us Why
The Plant Speaks Thru Tissue Tests
The Plant Speaks Thru Leaf Analysis
Borax From Desert to Farm

DISTRIBUTORS

Northeast: Educational Film Library, Syracuse University, Syracuse 10, N. Y.
Southeast: Vocational Film Library, Department of Agricultural Education, North Carolina State College, Raleigh, North Carolina.
Lower Mississippi Valley and Southwest: Bureau of Film Service, Department of Educational Extension, Oklahoma A & M College, Stillwater, Oklahoma.
Midwest: Visual Aid Service, University Extension, University of Illinois, Champaign, Illinois.
West: Department of Visual Education, University of California, Berkeley 4, California.
Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.
Department of Visual Instruction, Oregon State College, Corvallis, Oregon.
Bureau of Visual Teaching, State College of Washington, Pullman, Washington.
Canada: National Film Board, Guelph, Ontario, Canada.

IMPORTANT

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

Request bookings from your nearest distributor.

Three small boys were seated on the curb. One was playing with an airplane. One was playing with a fire engine. The other one was reading "Esquire."

A kindly old man approached and asked them what they wanted to be when they grew up. The first replied that he wanted to be a pilot on a B-29. The second wanted to be a fireman. The third looked up from his magazine and said, "Aw, I just want to grow up."

* * *

"Now, John," said the Judge, "tell us why you insulted this lady."

"Well, y'r Honor, I picked this lady up in me cab and took her to where she wanted to go, an' when she got out she gave me the exact change and no more, an' I sez under my breath: 'You stingy ol' hen,' and she heard me."

"Perhaps, John, you can tell us just what is your idea of a lady."

"Well, y'r Honor, I picked up a lady the other day an' took her to her destination, an' she gave me a five dollar bill, an' me bein' an honest man I reaches fur me change, but she sez: 'Aw, t'hell with the change, go buy yourself a shot o' gin.' Now, that's what I considers a lady."

* * *

A woman complained to an elderly man, who every evening walked his dog by her house, because the pup always paused by her new shrubs.

"I wouldn't worry," he said. "I always start around the block the long way, and by the time he reaches your bushes, it's only a gesture."

The conductor was perplexed. "Who on earth," he sputtered, "would want to steal a Pullman ladder?"

Just then, the curtains parted and a little old lady poked her head through cautiously. "Porter," she whispered, "you may use mine if you like. I won't need it until morning."

* * *

"I've made up my mind to go to Florida next winter so as to avoid the expense of fuel."

"Don't do it. The prices they charge for summer heat down there make our coal dealers seem like philanthropists."

* * *

A practical bridegroom was Sandy MacHughes.

He spent the first night trying on the old shoes.

* * *

In a restaurant, an elderly man had made several attempts to flirt with the pretty young waitress who was serving him. Finally, when she brought his dessert, he grew a little more bold. "My dear," he purred, "where have you been all my life?"

"Well," answered the girl quickly, "for the first forty years anyway, I probably wasn't born."

* * *

"I had to change my seat several times at the movies."

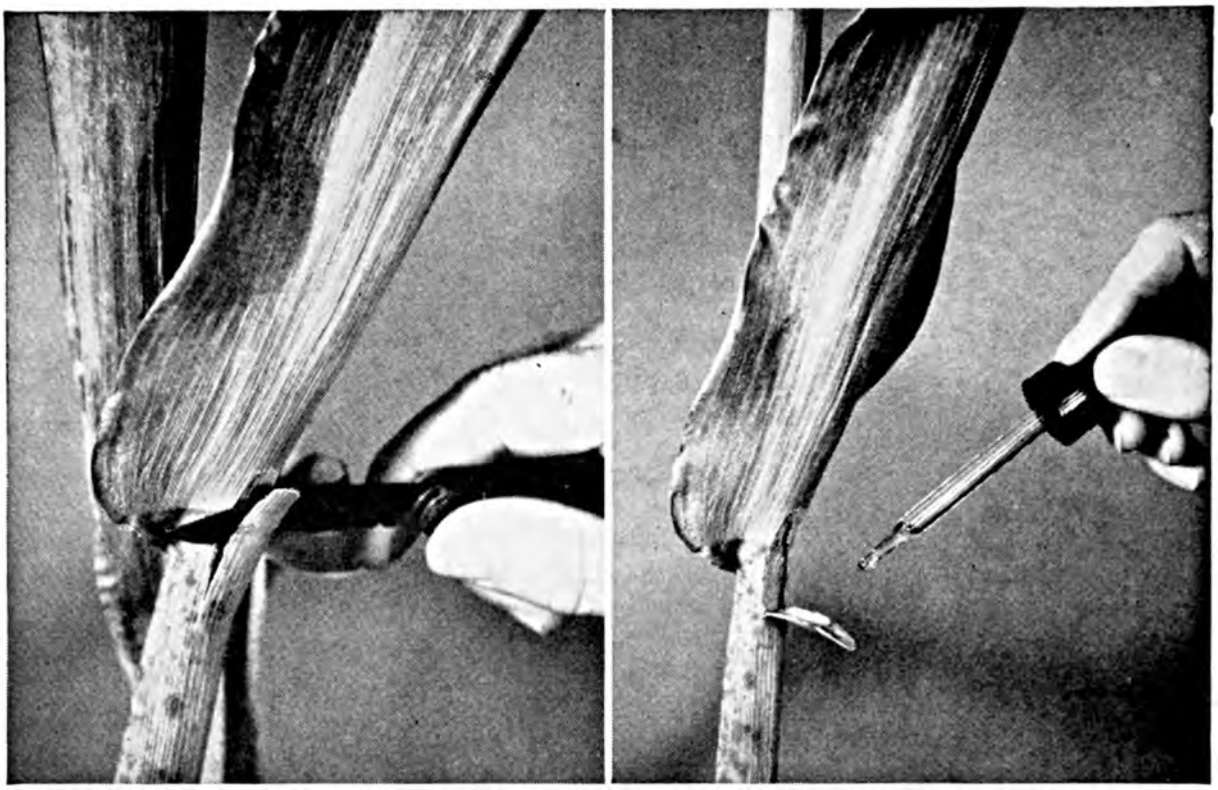
"Gracious, did a man get fresh?"

"Well, finally."

* * *

"Should a man propose to a girl on his knees?"

"Either that or she should get off."



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.

Equipment used in a well-developed laboratory for soil analyses.

Better Crops WITH PLANT FOOD

February 1950 10 Cents

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

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VOLUME XXXIV NO. 2

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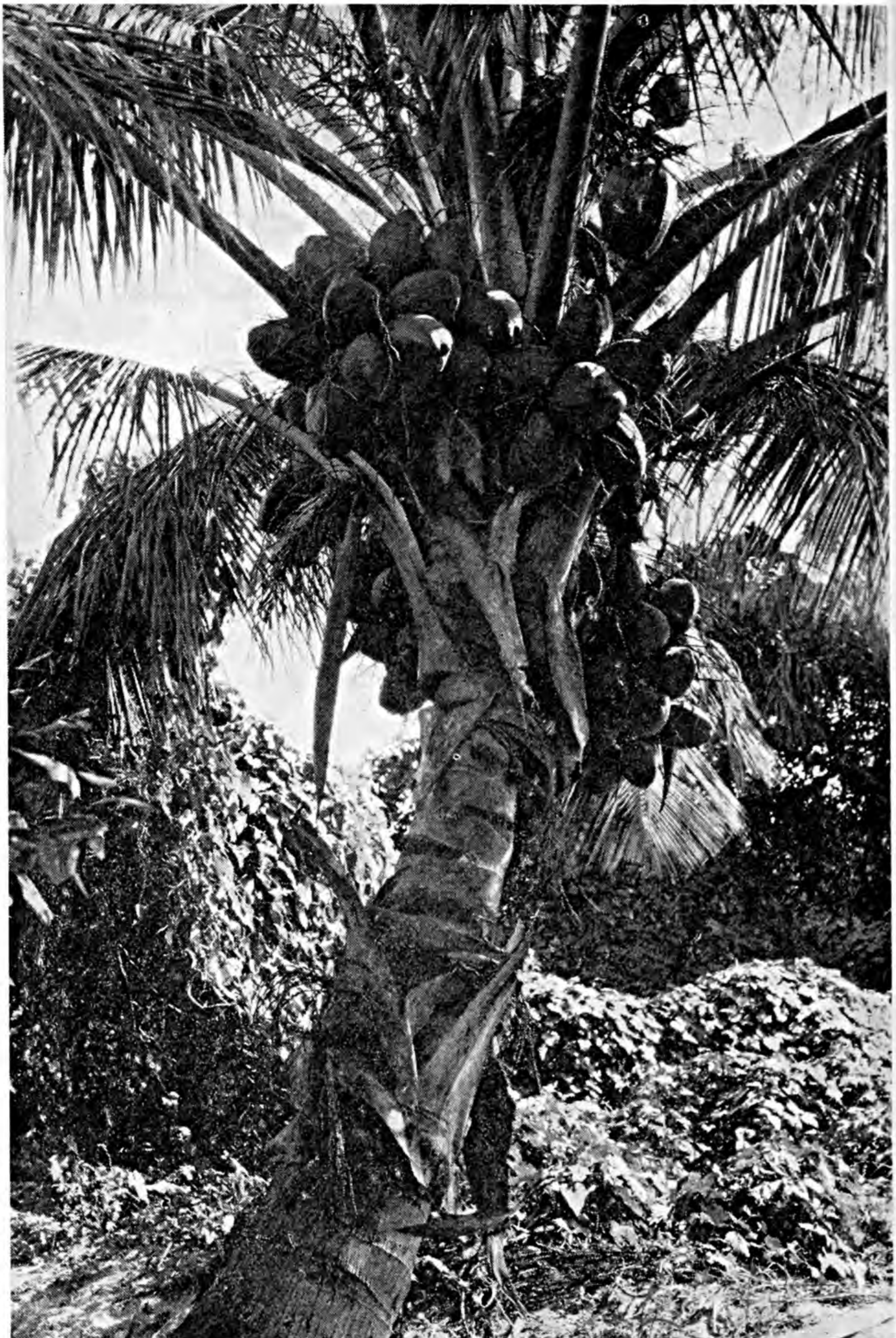

Ready to Drop?

Better Crops with Plant Food

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VOL. XXXIV WASHINGTON, D. C., FEBRUARY 1950 No. 2

Europe's Dilemma . . .

Splintered Acres

Jeff McDermid

"LET'S help 'em get the women and girls and the cows and oxen out of the farm-power business, and then consolidate some of those little scattered plots of land into wide fields for tractors, manure spreaders, gang plows, and combines." That neighborly cry of sympathy to French and German brethren of the soil was voiced repeatedly by American farmers touring abroad last summer. It will be the war cry again in 1950 as legions of land operators from here sail or fly to the older farm sections of the world. This plea has been the invariable remedy for farm recovery in foreign lands, where yield per acre is often higher than it is here, although purchased at an enormous waste of labor and a consequent low output per worker on farms.

While declaring stoutly for mechanized agriculture, the visitors will usually admit that the soil on many of these small strips is fairly productive, sometimes highly so. They will often remark that conservation of crop residues and animal manures and wide use of commercial fertilizers have advanced faster over there than they have in many parts of our own country.

In general, then, we have to recognize that our farming system is better on top of the land than theirs, while maybe their method is a trifle advantageous underneath the surface, compared with ours. That is, what we do to the land with motive power is superior, while their intense zest for conserving tilth and fertility shames our extensive, hasty, prodigal, and neglectful soil mismanagement.

Some facts basic to consideration of possible adjustment of splintered acres into workable fields and the extent of the problem involved were secured last summer by the writer from sources in France and Germany. Our authority in France is Denis R. Borgman, economist with the Ministry of Agriculture, and in Germany our points come from Paul Taggart and his associates in agricultural extension for the U. S. Military Government's food division.

The small average size of French farms is the main drawback to better layouts. More than one million of the estimated two and one-half million farm units in France are under 25 acres. The second cause that harms layout is the clustering of farmsteads around compact villages, most common in northeastern France, brought about by economic and social influences, scarcity of land in relation to people, and rigid community rules as to rotations and grazing. The final cause lies in the ending of primogeniture late in the eighteenth century, making more heirs to a given tract and hence more splitting.

IT is stated that the average-size land parcel in France is about 0.35 hectares or just under one acre. This is shown on the existing cadastral maps, but there may be cadastral boundaries even where there are no changes of owners, so a good estimate is that the actual average size of the pieces belonging to each owner is at least two or two and one-half acres. Where one whole commune is operated by one farmer or where cash tenants farm on land that belongs to several absent owners, boundaries can be adjusted and layouts improved for machine use.

Then there are the legal and organization sides to it, both worth passing notice. The French Planning Board has the so-called Monnet plan to suggest as a goal. The plan calls for rectangular fields, with their sides not less than 325 feet wide by 975 feet long, with a minimum of about eight acres, and to be located not more than two miles from the farmstead. This was a target to shoot at, but signs of progress being made to reach it are not numerous.

BACK in 1918 after some bitter strife, the Chauveau Act was passed. This provided that in a given area it would be compulsory to regroup land tracts along certain lines if requests for this move were filed by more than two-thirds of the owners of over half the area, or more than one-half the owners of over two-thirds of the area. This resembles the local option deal so long in vogue here for livestock disease control, such as the area test.

The law provided that safeguards against unfair separation and distribution of the land would be granted. Hence every owner ended up with the same acreage he put into the pool, and with just as good soil as a rule. Results were pretty slow, however, except in the badly eroded and broken battlefield areas of France, where less opposition and delay were met in completing the regrouping.

From 1919 through 1941, or through all the era of peace between the two world wars, only 615 communes with about 700,000 acres were regrouped. It is not hard to tell why faster headway was not made. There was no aggressive educational and extension work done to show the advantages of such shifts and adjustments in land patterns. The Ministry of Agriculture was ready with engineers to service the farm villages on request, and the government promised to stand part of the expense of surveying the tracts. Inertia and family tradition and devotion to certain specific plots of soil slowed down the movement and almost halted it for awhile.

Yet it isn't dead. The idea takes on new life since the Ministry of Agriculture is in league with ECA and other wise and hustling foreigners, including corps of U. S. extension teachers and mechanical experts. France now has more available farm machines and a growing number of tractors, with the usual crew of active fieldmen who all take part more or less in propaganda for real progress.

Besides the extra voices raised in behalf of larger tracts, a newly amended federal law has been in force for a year or two. It simplifies the procedure

which was required under the old law and cuts out the "one-half and two-thirds" jinx. The new law says that a communal board living in any rural village may hire a surveyor to draft up a regrouping plan. Then when the plan has been finished and the board has conned it all over very carefully, a public hearing is announced. Here the farmers who live in the commune, and work the scattered plots around about, are free to speak up. Thereupon the board decides what to do. Usually they adopt the survey plan and then it becomes compulsory. Each owner must wind up with all of his land in one piece—a much more direct and drastic provision than the other law provided.

Probably this new and stronger law actually reflects the new and different attitude toward consolidations. It has been brought about largely by so many more tractors—France having nearly 125,000 of them last year. Inflated costs of fuel and oil for the operation of power farm machinery remain a terrific drawback, yet 500,000 acres were involved in regrouping plans in one year alone, or about as much land as received this adjustment during the whole 1919-40 peacetime period.

The French treasury pays 80 per cent of the survey and office overhead expenses. Appropriations fail to keep up with actual rising costs. On the average these costs have risen from about $2.50 per acre in 1947 to $3.75 per acre late in 1948.

SOME areas outside of the French northeastern zone have diversified plantings of vines and fruit trees lying along the hillsides, especially in the famous champagne region near Rheims and Epernay. Other zones are at such high altitudes that field boundaries are fixed by topography and are not easy to relocate in justice to all concerned. Under both these conditions it has been more difficult to settle these adjustments on the same pattern that would fit the more level and general farming sections.

One force that has taken a big part in the gradual change in terrain and which has knitted small pieces into larger tracts is the rapid emergence of the French machinery cooperatives. None of them existed before the war, except for doing threshing jobs. The latest data on them estimate their number at 8,500. They are officially called Cooperatives d'Utilization de Materiel Agricole. In our usual terms, their alphabetical title is CUMA. Our Economic Cooperation Administration workers have dealt with them and the U. S. makers of agricultural implements know them very well, as do the fast expanding domestic farm machinery plant managers and their active field salesmen. Indeed this commercial and government encouragement of their work is responsible for much of their growth.

By recent guess made to me at Paris, the co-ops are said to own about one-fourth of all the farm tractors in France. Many of the co-ops have only one tractor and a few implements, but

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Fig. 1. Broadcasting fertilizer on asparagus in early spring.

Fertilizer Placement for Vegetable Crops

By Alvan C. Thompson

Production Manager, King Farms Co., Morrisville, Pennsylvania

FERTILIZER is usually the largest single cost item in vegetable crop production. It often amounts to more than the combined cost of lime, seed, and spray materials.

Large amounts of fertilizer are generally necessary for heavy yields and high quality vegetables. However, if improperly used, fertilizer may cause injury to sprouting seeds or plant roots. Another angle to consider is the loss of plant food in fertilizer that is applied too far in advance of crop needs. This loss occurs by leaching of soluble materials or fixation into relatively unavailable forms.

Perhaps the methods of fertilizer placement and reasons for certain practices can be brought out best by talking about how it is done at the King Farms Co. Many people know our location at Morrisville, Pa., directly across the Delaware River from Trenton, N. J. The total area consists of about 7,000 acres, with about 3,000 used for vegetable production. The present list of crops grown includes asparagus, rhubarb, spinach, beans, broccoli, cabbage, cucumbers, carrots, beets, parsnips, turnips, tomatoes, parsley, and onion sets. In past years other crops have been grown, such as lima beans, sweet corn, cantaloupes, lettuce, peppers and eggplant. Having a list not too large simplifies the growing and handling of the crops.

The soil we farm is of glacial origin. In places gravel outcrops at the surface are so heavy that some fields are unfit for farming. But over much of the area there is four or five feet of fine moulding sand under the topsoil. The topsoil varies in depth from about 6″ to 10″. The soil composition is variable in different fields, but most all of it is of an open porous nature having good drainage. The physical makeup runs high in sand content, some having gravel, with a low percentage of clay and silt particles, making it possible to get on it quickly after rains in the crop-growing season. We have found that this soil is responsive to good treatment, but also unproductive under bad treatment. It has a low retentive capacity, making it subject to quick change. Ordinarily, the pH will drop back about .5 of a point due to leaching, crop removal, and natural soil processes during each year. The soil survey by the U. S. Department of Agriculture classifies our soil as Sassafras loam, Tioga silt loam, Tioga loamy fine sand, Chonango gravelly loamy sand, and two or three others.

When the land was first taken over about 20 years ago, much of it was in a run-down condition. This made it necessary to apply large amounts of lime, commercial fertilizer, some manure, and lots of cover crops to build up the organic matter. Usually whenever cover crops or crop remains were turned under, cyanamid was added to hasten decomposition and improve fertility.

Plant-food Requirement of Vegetable Crops

Most vegetable crops in the early stages of growth require only a small part of the total plant food necessary to grow the crop. In Bulletin 1 published in January 1939 by the Campbell Soup Company, Hester and Shelton show that the tomato crop uses only 3 per cent of the total plant food the first month, 27 per cent the second month, and 70 per cent after the end of two months. In a book just published by the American Potash Institute a table shows that a crop of garden peas uses 5 per cent of the nitrogen, phosphorus, and potash the first 30 days, 55 per cent the next 30 days, and 40 per cent in the next 14 days. In the case

Fig. 2. Planting four rows of beans at a time and applying a band of fertilizer at each side of the row.

of carrots they say the crop uses only 4 per cent of the potash in the first 70 days, 27 per cent in the next 30 days, and 69 per cent in the next 30 days.

Twenty years ago most vegetable growers were still farming with horses. We found it necessary to adapt horse-drawn equipment to tractors, since multiple row seeders and fertilizer side-dressing equipment were not on the market at that time. One of the machines we assembled was a four-row bean planter, which we still use today. It places a band of fertilizer at each side of the row. Previous to having this machine, we were using 1,500 lbs. of fertilizer broadcast for a crop of beans. This machine cut the amount down to 700 lbs. placed in bands.

Another thing which saved a lot of fertilizer for us was the making of side-dressing fertilizer equipment to hang on tractors. Instead of applying all the fertilizer for crops like cabbage and tomatoes before or at the time of planting, we were able to put a smaller amount on at the start and later side-dress during the growing period.

Methods Used to Fertilize Several Other Vegetable Crops

1. *Broccoli* usually has about 1,500 lbs. of fertilizer plowed down and two side-dressings of 500 lbs. each. *Cabbage* usually has 1,000 to 1,500 lbs. plowed down and one side-dressing of 500 lbs. Plant starter is not used because there is very little response on our soil due to the large accumulation of phosphorus.

2. *Cucumbers* and cantaloupes are rather sensitive to fertilizer, and usually have 1,000 lbs. or less plowed in wide bands 3″ to 4″ from the row. For additional fertilizer, it may be plowed down, or extra nitrogen applied through irrigation water.

3. *Tomatoes.* 500 to 750 lbs. of 5-10-10 fertilizer were plowed down, 500 lbs. 5-10-10 side-dressed 30 days after set, and 500 lbs. 7-7-7 at last cultivation. Plant starter was used at setting.

4. *Spinach.* We have been using from 1,200 to 2,000 lbs. of 5-10-10, 5-10-5, and 7-7-7 based on fertility test of the soil. Additional nitrogen is usually obtained by plowing down cyanamid or applying nitrate of soda pellets as a topdressing or in the irrigation water. Under our conditions we have been applying all of the mixed fertilizer broadcast to the surface and discing in before planting (except for fertilizer residue from previous crops).

5. *Parsley* takes about the same fertilizer as spinach except that the crop lasts longer and may require extra nitro-

Fig. 3. Applying nitrate of soda topdressing to spinach.

Fig. 4. Applying 300 pounds granular cyanamid per acre for plowing under.

gen. One-half of the fertilizer should be plowed under.

6. *Beets.* Usually about 1,200 to 1,500 lbs. of 5-10-10, 7-7-7, or 4-12-8 are used, depending upon soil test and time of year. Usually a mixture carrying higher nitrogen is used for early spring. All is commonly broadcast and harrowed into the soil before planting.

7. *Carrots* and *Parsnips* require about the same fertilizer, usually high in potash, such as 5-10-10 or 4-12-8 at about 1,800 to 2,000 lbs. per acre. Two-thirds to three-fourths of this should be plowed under and about 500 lbs. broadcast on the surface and harrowed in before planting.

8. *Turnips* usually require very little fertilizer and will often make a good crop on the residue left in the ground from a previous crop. There is some danger of over-fertilizing and growing big tops. If soil test is not up, about 500 lbs. of 5-10-10 broadcast and harrowed in the surface should grow a good crop.

9. *Asparagus.* Effective results from fertilizer are dependent to some extent on the liberal use of lime on asparagus. Lime not only liberates plant food in the soil, but makes fertilizer act more effectively and supplies calcium and magnesium. A common practice among growers is to apply about one ton of fertilizer per acre broadcast, splitting the application so that half goes on in early spring and half at the end of the cutting season at the end of June. However, the asparagus crop is produced largely from food stored in the roots the previous year, so in recent years we have been applying 300 lbs. of cyanamid in the spring and one ton of mixed fertilizer at the end of the cutting season. This can be a 5-10-10 or 7-7-7. In the asparagus seedbed we have used a 4-16-10, and then usually a 4-12-8 for the first year or two after set out. After the bed gets into cutting we like to feed liberally with about a 1-1-1 ratio and use lots of lime. Cyanamid is an excellent source of nitrogen, and if applied to the ridges about 3 or 4 weeks after cutting begins in spring at the rate of 900 lbs. per acre on the area covered, it will control weeds as well as supply 50 to 60 lbs. of nitrogen per acre. When asparagus roots are first set out, 1,000 lbs. per acre of superphosphate applied in two bands about eight inches apart down in the bottom of the trench will last for quite a while with-

out much loss from fixation, and the extra phosphorus will develop strong root systems. We made up the tractor to do this by extending the tubes down into the trench, in our regular two-row side-dresser, and by using dual wheels on the tractor, both front and rear, to straddle the ridges.

10. *Rhubarb.* This is a perennial crop, also, and produces its crop from growth made the previous season. Rhubarb is a rather heavy feeder and requires about one ton of 5-10-5 or 7-7-7. The plants are checked in 4-ft. hills, and the fertilizer is applied in bands in two applications about a month apart at the time of cultivation, the first being made in early spring.

11. *Sweet Corn.* From 500 to 1,000 lbs. of 5-10-10 fertilizer may be applied in bands 2″ to 3″ from the row at the time of planting. Growers often side-dress with 150 to 200 lbs. of ammonium nitrate or sodium nitrate when the corn is knee high.

12. *Potatoes.* The usual application is about one ton of 5-10-10 or 4-12-8 acid goods applied in two bands placed about 2″ each side of the row and 2″ below the seed piece. The application of 150 lbs. ammonium nitrate as a side-dressing at the last cultivation has been known to increase the yield of potatoes 100 bu. per acre. Fertilizing the fall cover crop is another practice used for several years in central New Jersey and has increased yields from 50 to 100 bu. per acre. Usually 800 to 1,000 lbs. 7-7-7 fertilizer or 300 lbs. cyanamid are broadcast and disced in before seeding the cover crop, since the grain and fertilizer cannot be sown together because of the danger of burning. This method of fertilizing the cover crop and plowing it down in spring changes inorganic material over into organic material, giving the potato crop an extra reserve of plant food to draw on and produce a bigger crop.

Applying Fertilizer Through Irrigation Water

Dry fertilizer is of little value, since plant food must be in soluble form before it can be absorbed by the roots. Water from rain or irrigation dissolves the fertilizer salts, which have been carried upward toward the surface during dry periods, and again carries them downward within reach of the plant roots. For this reason thorough water-

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Fig. 5. Applying fertilizer in irrigation water.

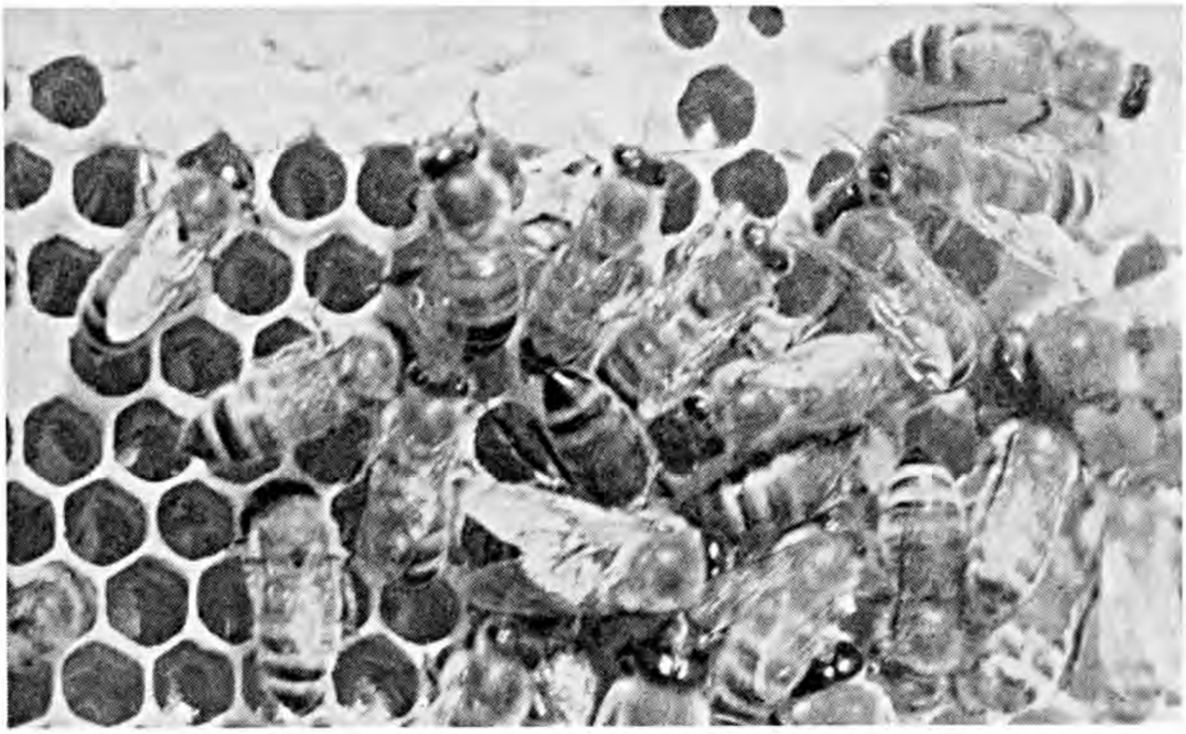

Fig. 1. Bees are efficient pollinators for legumes and carry the nectar home.

Put the Bee on Southern Agriculture

By G. B. Killinger and John D. Haynie

Florida Agricultural Experiment Station and Extension Service, Gainsville, Florida

IT has long been realized that for a successful agriculture in the Southland legumes must be utilized in the farm programs. To be successful in the culture of legumes bees are necessary. This necessity stems from the fact that many legumes require bees or other insects for tripping in flower fertilization or for cross pollination when individual flowers are self sterile.

Growing More Legumes

Experiment Stations, Extension Services, and Federal Agencies have played an important part in increasing legume plantings throughout the South. Most of this increased planting has come about within the last 15 years. AAA and more recently PMA payments have greatly stimulated this phase of the agriculture program.

Dixie crimson clover, ladino clover, Southern white clover, lupines, hairy indigo, several strains of red clovers, lespedeza, trefoils, and various other legumes have greatly increased in acreage during the past few years. New strains of some of these carrying disease resistance and legumes producing hard seed which allows for natural reseeding or volunteering have stimulated farmers into giving them a trial.

Pasture legumes should either be perennial by nature or produce suffi-

Fig. 2. Honeybees are very active on Hubam sweet clover bloom.

cient seed each season under normal grazing practices for a natural reseeding. Until recent years the legumes grown in Florida were limited by their inability to perpetuate themselves. Improved fertilization practices with new strains and varieties of old legumes and new legumes have materially changed the outlook for their culture.

At present most legumes grown on the acid soils of Florida require the soil to be treated with from one to two tons of limestone per acre every four or five years and annual applications of 500 to 800 pounds per acre of an 0-14-10 or 0-10-10 fertilizer. On certain soils minor elements have been needed, particularly copper and in some cases manganese and zinc, to successfully produce the legumes. Borax has given a response at several locations, as evidenced by seed production and leaf appearance on sweet and black medic clovers.

Bees Depend on Pollen

Beekeeping is a profession with some men and they are dependent upon the sale of honey and bees for their livelihood. The honeybee and the bumblebee rely on nectar-producing flowers for their existence. In Florida, perhaps most of the honey production comes from the citrus, tupelo (black gum), and gallberry blossoms. A great many other domesticated and wild flowering plants also contribute to honey production. Apiculturists have noted for some years that nectar production was highest in regions of limited rainfall and where soils are nearly neutral or high in calcium. It is thought that soil calcium supply and content of plants may have a direct bearing on nectar secretion.

Nearly every type of legume flower is worked by bees or other insects either intensively or to a limited extent. If no nectar is present, bees may work the blossom for pollen. Bees are dependent upon pollen as their protein supply for rearing the young brood in the colony. No measure of honey production from sweet clover grown under Florida conditions has been made, although bees are very active on this plant. Many acres of this annual sweet clover are grown in the State; however, most of the acreage is widely distributed along railroad embankments and highways where soils are nearly neutral and well supplied with calcium.

Bees do not work white clover blossoms nearly as vigorously as the sweet clovers. Usually on a clear warm spring day many honeybees and bumble bees can be found in a freely blooming white clover pasture.

Increased Seed Crop

In the fall of 1943 a number of small fertility plots were seeded to a mixture of mildew-resistant strains of red clover. These plots have satisfactorily reseeded for the past six seasons, although usually only a few seed can be found in any one seed head. Some years ago it was thought that only bumblebees could pollinate this particular plant. In more recent years it has been found that the honeybee can do the job very well.

In the spring of 1949 a colony of bees was transported to this red clover area to determine their effect on seed production. Two cages six feet square covered with cheesecloth were placed on the area and all blossoms showing were plucked off. One of the cages was opened so that bees from the colony could either enter the cage or the outside but other bees and insects could

TABLE I.—EFFECT OF HONEYBEES AND INSECTS ON RED CLOVER (TRIFOLIUM PRATENSE) SEED PRODUCTION

Treatment of 36-sq.-ft. plots	Av. from 20 seed heads		Yield calculated from 36-sq.-ft. of harvested plot
	No. of pods per seed head	% of pods with seed	Pounds of seed per acre
Caged—no bees	91.6	0	11.2
Caged—with bees	74.6	53.0	57.9
Not caged—all bees and insects	83.6	81.1	83.5

not enter the cage. The second cage was completely covered and no bees or other insects were allowed to enter.

In May when the clover seed were mature, random samples of 20 seed heads were taken from each caged area and a like number from a six-square-foot plot area which had not been caged. The entire plot (36 square feet) for each of the three treatments was then harvested. Legumes or pods per seed head, percentage of seed per pod, and pounds of seed per acre are given in Table I.

No seed were found in any of the seed pods from the 20 seed heads picked at random from the caged area which excluded bees, yet some seed were set, as noted in the yield column. The yield of 11.2 pounds of seed per acre from the 36-square-foot caged area was small but indicated some fertilization which may be attributed to natural causes or other very small insects which may have penetrated the cheesecloth or hatched out under the cover.

The caged area which allowed bees to come and go but excluded bumblebees, wild bees, and other insects produced clover seed in 53 per cent of the pods and yielded 57.9 pounds of seed per acre.

The area not caged and to which all bees and insects had access had seed in 81.1 per cent of the pods and yielded

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Fig. 3. Honeybees caged on freely blooming red clover increase seed crop.

Food for Thought About Food[1]

By Firman E. Bear[2]

ALICE, in Wonderland, was running hand-in-hand with the Queen, and just as fast as she could. But she was surprised to find that she wasn't getting anywhere. The Queen said, "What did you expect?" "Well," panted Alice, "in our country you would generally get to somewhere else." "That's a slow sort of country," said the Queen. "Now *here,* you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that."

We older agronomists have to run as fast as we can just to keep pace with the rapid developments that are taking place in food and fiber production. We depend on the younger men "to get somewhere else." They are not handicapped by having learned so many things that are no longer so.

All of us see the need for abundant supplies of food and fiber—enough to meet the requirements of all our people all the time. We recognize the importance of having substantial surpluses for export. We think it essential to have reasonably large quantities in storage to carry us safely through in time of drought. Finally, we are impressed with the necessity of having dependable reserves of productive capacity that can be called into play in the event of war or other world catastrophe.

". . . The most accurate population estimates for the United States appear to be those of Raymond Pearl, who, 25 years ago, predicted a population of 149 million people for 1950. Pearl's estimate for the year 2000 is 186 million. To be on the safe side . . . it is believed that plans should be developed for 200 million."

Planning for 200 Million People

Recently, the 150-year-old Malthusian principle has been revived. Malthus asserted that population tends to increase up to the limit set by the food supply. His concepts fell into disrepute, however, with the rapid agricultural development of the New World during the nineteenth century. But much is now again being said about this subject by a great variety of people, many of whom have no first-hand knowledge of agriculture. It seems important, therefore, that some of us who deal directly with farming carefully consider the matter. Accordingly, I propose to outline the potentialities for food and fiber production in the United States of America in relation to our future needs.

[1] Presidential address, 1949 annual dinner, American Society of Agronomy, Milwaukee, Wisconsin, October 26, 1949.

[2] Research specialist in soils, Rutgers University, New Brunswick, N. J.; Past-president, American Society of Agronomy.

Population growth provides a good starting point. When the first settlers arrived some 350 years ago, the 1,905 million acres that now constitute the United States of America was an Indian Paradise, with about 800,000 people in it. During the first 200 years after the white man arrived, the population increased only to about 4 million people. But by 1850 it had grown to 23 million, by 1900 it had reached 76 million, and by 1950 the total number of people in the United States is expected to be 150 million.

This vast new country had tremendous natural resources. Its population grew rapidly because the people prospered. A large percentage of them lived out in the open country where children had economic value. In 1820, over 80% of our people were farmers. Now, 130 years later, over 80% of them live in cities. In the city, children tend to be economic liabilities, knowledge of contraceptives is sought and applied, the capacity to reproduce is lowered, and the rate of increase declines.

The tendency toward a declining birth-rate is being compensated for temporarily by a marked increase in longevity. This is credited to improvements in sanitation, growth in medical knowledge and facilities, and development of new drugs. By the year 2000, it is believed that some 13% of our population will have passed the 65-year mark.

The curve of population growth in any new country is sigmoid. It rises slowly at first, then more rapidly, later it flattens out, and finally it falls. The most accurate population estimates for the United States appear to be those of Raymond Pearl, who, 25 years ago, predicted a population of 149 million people for 1950. Pearl's estimate for the year 2000 is 186 million. Most experts in this field doubt that the population of the United States will reach that number before it begins to decline. To be on the safe side, however, it is believed that plans should be developed for 200 million people.

The Food and Agriculture Organization of the United Nations has set the *optimum* daily energy requirements of man at 3,000 calories. The distribution of these calories among the carbohydrates, fats, and proteins is important. The vitamin, amino acid, and mineral content of the food must also be kept in mind. But the average diet in the United States exceeds the calorific and all the other requirements set by the FAO by very liberal margins. If the whole world ate in accordance with our standards, not over one-third of its $2\frac{1}{4}$ billion people could be fed at present world-production levels. In comparison with the average diet of all the other people on earth, this more-than-optimum diet of ours is nothing less than extravagant.

Acreage of Farm Land Can Be Increased

About 300 million acres of our best cropland would produce the food our people are now consuming, at present crop yields and living standards, and leave a reasonable quantity for export. If we substituted the "moderate-cost" diet suggested by the National Research Council, these cropland needs could be reduced approximately 20%. This

". . . There are many ways by which additional land can be made available. . . . If the time comes that we have to resort to such enterprises on a large scale, we have the know-how to do it."

would necessitate a 14% reduction in the consumption of animal and poultry products and the use of more potatoes and vegetables. As of today, however, a little over 400 million acres of land are being cropped. Additional acreage can be put to work if conditions warrant.

Approximately 19 million acres of arid and semi-arid land are now under irrigation. The Bureau of Reclamation estimates that 23 million more acres could be irrigated with the water at hand. The National Resources Board raises this to 31½ million acres. Between 5 and 10 million of this is expected to be brought into production within 25 years.

Economies are being effected in the use of water, and this expands the acreage. More ditches are being lined with concrete or other impervious materials to reduce seepage losses. Shorter irrigation runs aid further in water conservation. Multiple-purpose projects, serving the interests of irrigation, power, and city development, keep the problem constantly in the foreground. One company reports that, by taking advantage of the desert sunshine, it can produce distilled water from the ocean at a cost of 5 cents per thousand gallons.

In 1939, some 26 million acres of land were included in organized drainage projects in the humid areas of the United States. There are nearly 100 million additional acres of wet, swamp, and overflow land, of which about 18 million can be drained at a reasonable cost. The remainder can be brought under production if the need develops.

Drainage costs run from $20 to $30 an acre. To drain the land area requiring it in the 38 states east of the 100th meridian would cost about $500 million. Crop increases from drainage of farmed land run from 40 to more than 100%. In times of national prosperity, or in the event of great need, it should not be difficult, by state and federal aid, to drain large areas of this wet land for productive agriculture.

There are many other ways by which additional land can be made available. For example, the Dutch reclaimed some 400,000 acres from the Zuider Zee at a cost of $500 million. There are similar possibilities for reclaiming large acreages of land from the ocean along the lengthy shores of the United States. In many parts of this country, virtually waste land is now being rapidly reconditioned for agricultural use by the aid of bulldozers. Irrigation is being applied to some half million acres of land in the humid regions. By the use of soluble fertilizers, this practice can be greatly expanded to cover many acres of waste sand in what would constitute, in effect, a soilless-culture system. If the time comes that we have to resort to such enterprises on a large scale, we have the know-how to do it.

Great improvements are being effected in the management of some 40 million acres of summer-fallow land in areas of 10 to 20 inches of rainfall. Farmers are now keeping the surface rough, growing their crops on the contour, employing strip-cropping procedures, and using stubble-mulches. Steep land is being permanently planted to grass.

More than 1 billion acres of land are being used for grazing. Three quarters of this area consists of rangeland in the arid and semi-arid West. The productivity of this land is closely related to the rainfall. If this is not over 5 inches, up to 200 acres are required for each animal. At 20 to 25 inches rainfall, 12 to 35 acres are needed. The aim is to control grazing at the point where the animals increase weight at a rate of not less than 1 pound a day.

Mesquite, prickly pear, and sage brush tend to develop with overgrazing. Some 33 million acres of Texas rangeland are badly infested with mesquite, and 20 million more are seeded with it. But weed-killing chemicals offer great promise in the control of these and other types of undesired growth. Range owners are now railing-off sagebrush, using off-center disc-pit plows, applying seed-containing hay, and dropping pelletized seed from airplanes. Some 80 million acres need reseeding, and this is rapidly being effected by modern techniques.

Large numbers of springs are being opened up and many ponds are being built as a means of preventing livestock from walking-off their gains while searching for water. Some 150,000 spring developments, 250,000 water reservoirs, and 150,000 wells are planned, as well as 100,000 miles of fences and 20,000 miles of trails. These and other improvements in the management of rangeland are raising beef yields over vast areas at a rate that more than keeps pace with the enlarging needs of our growing population.

Acre Yields Are Being Raised to Higher Levels

New types of plants are being bred to meet specific needs, old ones are being adjusted to a wider range of environment, and selection is being employed against undue loss from drouth, disease, and insect damage. In one generation, hybrid corn spread across the continent with an estimated 20% increase in yield. The same principle is being applied to grain sorghum to step-up yields, cut the stalks down to combine size, and shove this highly important crop farther into the desert. Both physical and chemical methods are now being employed in speeding-up changes in genes and in chromosome number and structure in a great variety of crop plants.

Chemistry is playing an ever more important part in getting plants off to a quicker start, speeding them on their way, protecting them against parasites, and improving the quality of product that finally finds its way to market. Mineral fertilizers pioneered the way. Now, wide-scale use is being made of DDT (dichlorodiphenyl-trichlorethane) and its analogues and isomers to control some 200 insects; BHC (benzene hexachloride) for wire-worms; TEPP (tetraethyl pyrophosphate) for aphids, thrips, and mites; DNTP (o-o-diethyl-p-nitrophenyl thiophosphate), which is 5 to 10 times as toxic as DDT, for a wider range of insects; DMTC (dimethyldithiocarbamate) for fungus diseases; 2,4-D (2,4-dichlorophenoxyacetic acid) for weeds, and ANTU (alphanaphthyl thiourea) for rats. There is reason to believe that nematodes and similar parasites, including the giant snail, will be brought under control by such chemicals. Antibiotics, like penicillin and streptomycin, will undoubtedly find important places in the control of diseases of both crops and livestock.

Crop acreages and areas are being adjusted to changing economic conditions, altered demands, more effective machinery, and better land-use programs. The possibilities in this connection are so great that it is difficult to present an adequate picture of them.

Cotton provides a striking example. Since 1925, the area devoted to this crop has been reduced from 44 to around 23 million acres, or nearly 50%. Yet the number of bales of cotton harvested has fallen only about 5%.

Part of the improvement in acre yields was due to the use of better seed and more fertilizer. But a much larger part of it is accounted for by movement of the acreage into Texas and California, where large-scale modernized operations were put into effect. The

". . . Tremendous strides have been made in awakening national interest in soil conservation. . . . The health of our people has improved in proportion to the increased use of chemicals on the soil."

160 man-hours required to produce a bale of cotton by the one-man, one-mule, hand-picking system has been reduced to about 28 man-hours by use of four-row tractors, flame cultivators, and mechanical pickers.

The need for land to grow cotton has been greatly lessened as a result of the production of synthetic fibers from wood pulp. Continued lowering of costs is being effected in the manufacture of non-cellulose fibers from coal, resins, and glass, and synthetic protein fibers are possible competitors of wool.

By 1950, less than half the cloth fiber used in the United States will come from cotton. Trees grow very rapidly in the humid south. Loblolly pines produce cellulose at the rate of about 650 pounds an acre annually without plowing, cultivating, or fertilizing. Nearly two and one-half times as many industrial research workers are devoting their time to wood fibers, from which rayon is made, as to cotton. If rayon is improved as much as is expected, it is predicted that less than 1 million bales of cotton will be used at 25 cents a pound, and not over 7 million bales at 12 cents.

Considerably less land is being required for growing corn. The area harvested fell from 110 to 85 million acres during the last 16 years, yet total production increased 25%. The improvement in yield was due to the use of hybrids, more seed per acre, heavier applications of fertilizer, and better machinery. No doubt the weather had a great deal to do with the record 3,650 million-bushel yield of 1948. But the 25 million acres of land retired from corn production were those that were least suited to this crop. In other words, better land-use programs came into operation.

Similar adjustments are being made with wheat. The area planted to this crop during the last 30 years has fluctuated between about 60 and 70 million acres. But the production of grain has risen nearly 50%. For the last 3 years it has averaged better than 1¼ billion bushels annually.

Many innovations are in store in farm mechanization by which acre yields will be further increased, harvesting losses lowered, and the need for labor lessened. The goal of the agricultural engineer in preparing the land and planting it to crops is a bladed machine that operates on a not-too-rapid rotary-tiller basis, incorporates trash and liming materials, applies high-pressure steam to kill weed seeds, disease organisms, and insect pests, firms the seedbed, and plants and fertilizes the seed, all in one operation. Recent engineering achievements include high-velocity low gallonage sprayers, dielectric hay driers, suction devices for picking up fallen seed and leaves, and combines for harvesting sugar beets and sweet potatoes. It is expected that the tractor will be transformed from a puller to a pusher type. This will permit a more rapid hitch and release and a better view of what is being accomplished.

The farm motor now milks the cows, cools the milk, pumps the water, cleans the stables, refrigerates the food, and heats the house in winter and cools it in summer. Artificial light gets the hens up earlier in the morning, rouses the pigs for a midnight snack, and illuminates the fields so the tractor can be kept going 24 hours a day. Having an air-conditioned house, the night operator can then sleep during the day.

Few persons realize the tremendous potentialities for food production in the United States. As the selling price of farm produce went up 2½ times during World War II, the consumption of fertilizer climbed in almost direct proportion. Many more tractors and other mechanical devices were put into operation. From 1940 to 1945, the investment in farm machinery was increased $2 billion. This permitted further replacement of horses and mules, with resulting saving of the feed they would have consumed. Some 7 million fewer laborers were required to do the work. The output per laborer was increased 50%. The net effect of

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Boron for Alfalfa*

By K. C. Berger and E. Truog

Department of Soils, University of Wisconsin, Madison, Wisconsin

DURING the past few years it has become increasingly evident that many soils in Wisconsin are lacking in available boron for good growth of alfalfa. In the summer of 1946 approximately 60 per cent of the second crop of alfalfa in southern Wisconsin showed symptoms of boron deficiency, causing yields in some cases to be reduced by one-half. In 1948, a survey of nearly 900 alfalfa fields in 39 counties showed that 56.7 per cent of the fields were deficient in available boron for the normal growth of alfalfa. In one experiment in Green Lake county, the yield of second crop alfalfa hay was increased from 1,000 pounds to over 3,000 pounds by the application of boron.

Because of exhaustive cropping, boron has been removed from many soils faster than it is being made available. Soil analyses show that many of the acid light-colored soils and alkaline soils in general in Wisconsin are too low in available boron for normal growth of alfalfa. Soils should contain about 1.5 pounds, or more, per acre plow-layer of available boron for normal growth of alfalfa. These surveys and tests show that fertilization with boron is needed in many cases in Wisconsin for the satisfactory growth of alfalfa.

What Is Boron and How Supplied?

Boron is a chemical element that is needed by all crops for normal growth. Although the amount of boron required is small (a ton of alfalfa hay containing only about one-half ounce) plants cannot make growth without it. Boron is now commonly supplied in the form of a gray, granular powder called fertilizer borate, and a white powder called borax.

Fig. 1. (Left) Boron-deficient plant; (Right) Healthy alfalfa plant.

How Tell When Alfalfa Lacks Boron?

Symptoms of boron deficiency in alfalfa occur more often in the second crop than in the first. The most specific symptom is a stunting of the growing tip or uppermost part of the plant causing a telescoping together of the upper branches on each main stalk and an umbrella-like top growth. Flowering is checked or prevented. Since boron is required at the growing points, a

*Reprint of "Boron for Alfalfa," Extension Stencil Circular 296, July 1949, University of Wisconsin, Extension Service, College of Agriculture, Madison, Wisconsin.

lack prevents growth and elongation of these points and thus causes the umbrella-like appearance. A yellowing or reddening of the upper leaves and a sickly and stunted appearance of the plant also develop, but these conditions can also be caused by a deficiency of other elements, insect injury, and certain diseases, and hence, none of these is a positive symptom as is the one first described—the telescoped or umbrella-like top.

In Figure 1, a boron-deficient alfalfa plant is compared with a healthy one. It will be noted that the lower parts of both plants appear much the same as regards distance between the branches. The tops, however, are quite different. A lack of boron has produced the umbrella-like top by preventing growth and elongation of the upper tip.

A lack of boron can also be told by analyzing the soil. If the test shows that a soil contains less than 1.5 pounds per acre plow-layer of available (hot water soluble) boron, then it is quite certain that boron fertilization of this soil will benefit alfalfa. These tests are made in the State Soils Laboratory, University of Wisconsin, at a cost of $0.50 per sample.

Still another way of determining a lack of boron is to analyze the plant. If the dry tissue of alfalfa plants contains less than 10 pounds of boron in a million pounds of the tissue, a lack of boron is indicated. The labor and cost of making this test is the same as for the soil test.

General Appearance of Boron-deficient Alfalfa Fields

The more severe the boron deficiency, the greater will be the proportion of plants that are stunted, have umbrella-like tops, turn yellow or reddish, and fail to bloom. When the deficiency is mild, these symptoms show up in single plants or in spots; when severe, nearly all of the plants may exhibit some or all of these symptoms. Alfalfa affected in this way will not produce seed because the growing point cannot grow and flower. It is highly important to clearly distinguish leaf hopper injury and disease from boron deficiency symptoms.

Yellowing from boron deficiency occurs largely in the upper parts of the plants, and often only on scattered plants throughout the field. On the other hand, yellowing from leaf hopper injury occurs on the lower leaves as well as on the upper, and in the second crop generally starts at the edge of the field where the alfalfa was cut first. Boron deficiency may occur on any part of the field, and plants affected always exhibit umbrella-like tops.

Correcting Boron Deficiencies

Boron deficiencies in soils are corrected by adding a borate, such as borax, or fertilizer borate. The borate may be applied to established alfalfa fields any time from spring till late fall. It is of course best to apply it as soon as feasible after a deficiency is noted. If the borate is applied well in advance of the needs of the alfalfa, it will have time to dissolve in the rain water and be carried into the root feeding zone of the alfalfa so that it can be utilized when the need develops. For alfalfa, the borate is applied at the rate of 20 to 40 pounds per acre. It may be applied with a grass seeder, or it can be mixed and applied with other fertilizer.

Often fertilizer containing phosphate and potash is needed for alfalfa. This may be applied just prior to or at the time of seeding the alfalfa, or if need shows up later, on the established alfalfa as a topdressing. If boron also is needed, it is most conveniently applied as a fertilizer mixture containing borax. A good mixture for this purpose is an 0-9-27 grade containing 150 pounds of borate per ton. This should usually be applied at the rate of 300 to 600 pounds per acre.

Avoid Injury to Grain

Although boron is required for growth by all plants, it does not take much of it in the form of a borate to be very toxic to some plants, such as peas, beans, and the small grains. When a

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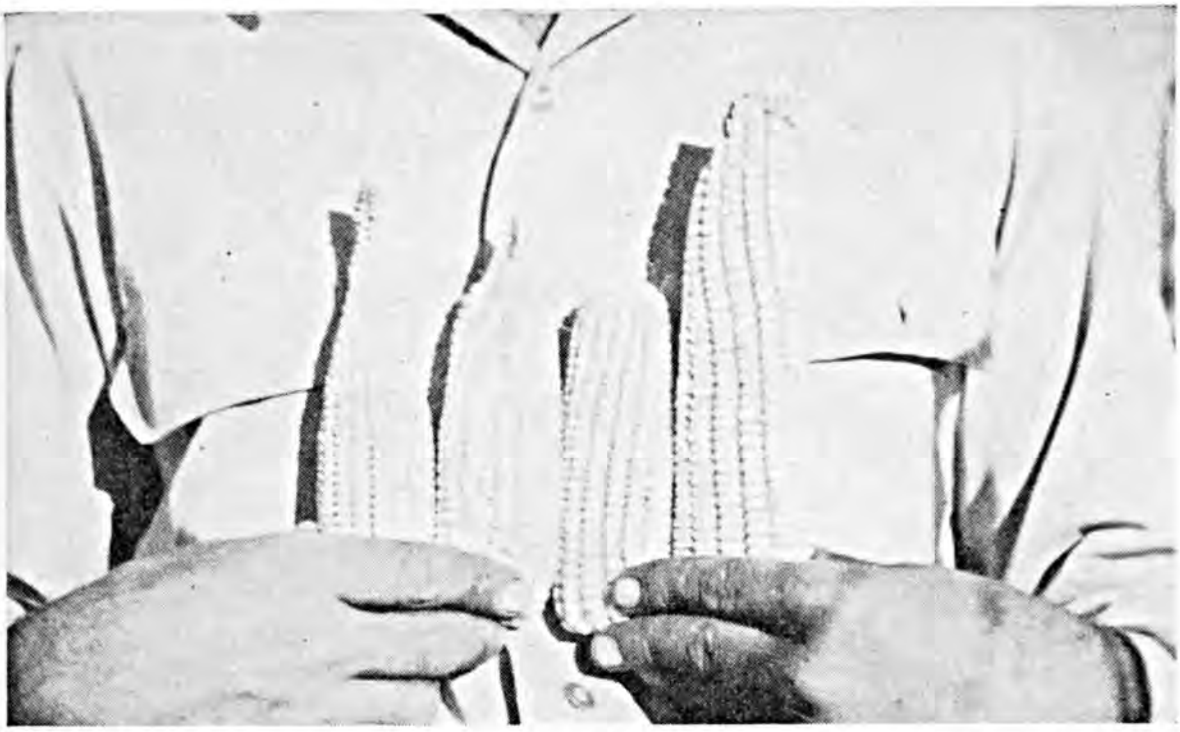

Fig. 1. These differences are due to plant-food deficiencies caused by variance in date of planting which affected plant-food and moisture intake.

All Factors Are Important

By Roy H. Anderson

Agronomist, North Texas Supply Co., Paris, Texas

PICTURED are four ears of Texas Hybrid 18 with definite nutrient deficiencies of, from left to right, potassium with its pinched tip of chaffy grain, phosphorus with its short incomplete rows, and nitrogen with its small blunt ear. On the right is a normal ear. Observation without explanation would lead one to believe that these ears show the results of some kind of experiment. They certainly show all these major element deficiencies.

That is not the case, however. The three ears of the left were grown in the same row and within 25 feet of the ear on the right, with no soil variation between them. All received the same amount of fertilizer, the only difference being in the planting date. The corn on the left was planted one month later than the corn on the right, which caused it to silk during the hot dry month of July with a limited moisture supply.

At silking time all deficiency symptoms shown in the abnormal ear development were clearly seen in the leaves. First a purplish color developed in some leaves showing definite phosphate deficiencies. Then a little later the leaves showed a nitrogen deficiency with a dead tip and a yellow streak running up the midrib. About the same time a potash deficiency showed up characterized by the leaves turning

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Fig. 1. Strip cropping on an Ohio farm, using a 4-year rotation of corn, oats, and two years of meadow to reduce soil and water losses and to provide a given acreage of all crops each year.

Use Crop Rotations to Improve Crop Yields and Income

By Harry H. Gardner

Soil Conservation Service, Milwaukee, Wisconsin

THE use of crop rotations affects the management of soils, the farm enterprise, and the income of the farmer. When selected to fit the capability of the land, rotations (1) provide a systematic use of cropland, (2) increase the productivitity of the soil, (3) decrease soil and water losses, (4) diversity the production of crops and the farm income, and (5) help determine the type and size of the livestock enterprise of the farm. With these and other advantages in mind, it is difficult to understand why all farmers do not follow adapted crop rotations. Some of the reasons most commonly heard are (1) the difficulty to maintain the crop sequence, especially when meadow seedings fail, (2) the urge to grow corn and small grain crops when the market values are high or to feed livestock, and (3) the lack of understanding of crop rotations and how to arrange or rearrange fields to start a rotation.

A crop rotation is simply the growing of different crops in recurring succession on the same land. It is an orderly method of crop production—no continuous cropping to corn, to cotton, or to any other crop, and no haphazard change of crops from one year to another due to a lack of a definite plan.

Rotations usually consist of a combination of row or cultivated crops, small grain crops, and grass-legume meadow crops. They may be of any length, usually from 2 to 6 years. Under ordinary farming conditions it is practically impossible to maintain yields of row or grain crops in continuous culture; but when these crops are properly combined with grass-legume meadow crops to form a well-balanced crop rotation, the soil is improved and crop yields are increased. The highest yields are attained by the use of proper rotations and the replacement of the needed plant nutrients in the form of commercial fertilizer.

A rotation must include at least two crops and is usually understood to require the same number of years as there are crops in the rotation. However, in Missouri, a winter wheat and lespedeza rotation is used which includes two crops but requires only one year to complete the rotation. The land is prepared in the fall and seeded to winter wheat. Lespedeza is seeded early the following spring. The wheat is harvested for grain and the lespedeza provides pasture or hay the same year. Once the rotation is started, it is necessary only to disk the land in the fall and seed the wheat because the lespedeza volunteers. This rotation has been followed for 10 years or more on the same land with good results as far as the crop yields are concerned. However, it is questionable whether a desirable physical condition of the soil (tilth) can be maintained indefinitely under this system.

Two-year Rotation Popular

The 2-year rotation, corn followed by small grain with sweetclover as a catch crop, is very popular with farmers in the Corn Belt. It provides for the production of corn on half of the land and requires no haying equipment or roughage-consuming livestock. The sweetclover in this rotation provides some nitrogen; but without the use of a grass-legume sod, soil organic matter can hardly be maintained. The damage done to the sweetclover crop by the sweetclover weevil in the last few years reduces the dependability of the nitrogen supplied by this crop. The rotation ranks very low in its ability to resist erosion. For these reasons it cannot be classified as a soil-building rotation.

On heavy flat land, such as overflow river bottoms, a corn-soybean rotation is used. Floods often occur so late on this land that not even soybeans can be planted. This rotation is more soil-depleting than the corn-grain rotation just described because of the low nitrogen fixation by soybeans as compared to sweetclover, the lack of a deep-rooted legume to improve tilth, and the destruction of organic matter by two cultivated crops. It includes nothing to contribute to soil maintenance or improvement.

Corn-Meadow Rotation

Another 2-year rotation, corn-meadow, has considerable merit but is not commonly in use because of the hazard of establishing a meadow crop in corn at the last cultivation. This rotation does permit a large acreage of corn. In a strip-cropping system, it provides alternating strips of meadow and corn, and is, therefore, more erosion-resisting than the 2-year rotations already mentioned. Sweetclover and ryegrass are probably the best species to be used in the meadow. Sweetclover used for seed production can be a profitable cash crop, at the same time providing nitrogen, raw organic matter, and the soil-improving effects of a deep-rooted legume. Combined with a fibrous-rooted grass like ryegrass, it provides excellent resistance to erosion.

A 3-year rotation of corn-small grain-meadow (C-G-M)[1] is in more common use than any other rotation. It is simple, easy to establish, and provides a high percentage of corn and small grain crops. If such a rotation had been used on the prairie soils of the

[1] C means corn or any other cultivated crop; G, any small grain crop; and M, a grass-legume meadow.

Corn Belt continuously since they were first plowed, it is very probable that the productivity of the soils would be much higher than it is at present. However, it is doubtful that soils that are in poor tilth due to misuse can be improved significantly by the use of a 3-year rotation. The Morrow Plots in Illinois provide good evidence. In the 3-year rotation of corn-oats-clover, the nitrogen and organic matter have been reduced and the corn yields have hardly been maintained even with the use of hybrid corn. On the plots where manure, lime, and phosphate have been applied, organic matter has been maintained and crop yields have been increased. But, more manure is used in these experiments than is available under general farming conditions. Therefore, the results on the Morrow Plots are better than a farmer could expect. This rotation cannot be considered a soil-building rotation, although it meets more of the requirements than the C-G (sw.cl.) rotation because of the 1-year (stand-over legume) meadow crop.

Four-year Rotation

A 4-year rotation permits a greater selection and a more flexible arrangement of crops. It can be C-G-M-M, C-C-G-M, C-SB-G-M, C-G-G-M, G-G-M-M, and G-M-M-M. Of these, the C-G-M-M rotation is adapted to a wide range of conditions. It is not used uniformly throughout the Corn Belt, possibly because of the relatively small amount of corn, 25%, and the large percentage of meadow, 50%. More will be said of this 4-year rotation later.

The 5-year rotation is even more flexible than the 4-year rotation. It includes such combinations as C-G-M-M-M, C-C-G-M-M, C-SB-G-M-M, C-G-G-M-M, C-C-G-G-M, C-C-SB-G-M, G-G-M-M-M, G-M-M-M-M, and perhaps others. Only the first and the last two rotations mentioned, C-G-M-M-M, G-G-M-M-M, and G-M-M-M-M, can be arranged in satisfactory strip-cropping systems, that is, where a meadow strip separates corn and grain strips. The C-G-M-M-M rotation is popular in the dairy sections; the C-C-G-M-M and the C-SB-G-M-M rotations are somewhat popular in the Corn Belt. The C-G-G-M-M rotation is popular where winter wheat is grown. Unfortunately, a 5-year crop sequence resembling C-C-SB-G-M has been too widely used.

The 6-year rotation is still more flexible than the 5-year rotation. It can include rotations such as C-G-M-M-M-M, C-C-G-M-M-M, C-C-G-G-M-M, and several other combinations of crops. Any 6-year rotation that contains 3 or 4 years of meadow can be arranged in strip-cropping systems. Small grain and meadow rotations are used in grassland farming.

Longer Rotations

Longer and more intensive rotations can be made by combining two short rotations such as C-C-O-M-M-C-C-O (sw.cl.). This 8-year rotation has the advantages of a 4-year rotation, since it can be arranged in four fields so as to have two fields in corn, one in oats, and one in meadow each year. However, it is too intensive (50% corn), except perhaps for the most productive soils.

So far little has been said about the selection of the rotation. Too often the farmer uses a haphazard change in crops, influenced by the market price of corn, instead of a crop rotation. Market prices must be considered, but there are other factors that are more important, such as (1) increasing the productivity of the soil, (2) reducing erosion, (3) improving soil tilth, and (4) providing a profitable farm enterprise.

It would seem, from all of this, that the selection of the proper rotation for a farm is rather complicated. It is, to a certain extent, although after considering all of the soil-management factors, namely, replacing nitrogen and mineral plant nutrients, increasing organic matter, reducing erosion, and improving soil tilth, a 4-year rotation of C-G-M-M with appropriate soil conservation practices will usually meet the

Fig. 2. A 4-year rotation of corn, oats, and two years of meadow arranged in a strip-cropping system in Minnesota. It provides a systematic use of cropland and diversifies the production of crops and farm income.

soil requirements. Experimental work in Iowa on the size and stability of soil aggregates indicates that two consecutive years of grass-legume meadow are necessary to maintain soil tilth. The work on the Paulding soils in Ohio provides yield data that confirm the Iowa work. A 4-year rotation including two meadow crops can be used with any soil conservation measure, like contour tillage, strip cropping, and terracing. With the ordinary use of crops and crop residues, such a system can provide sufficient nitrogen and organic matter. And, contrary to popular opinion, it is a profitable rotation.

Taking the actual yield data from the rotations used in the Ohio Agricultural Experiment Station for three 4-year rotations and using the 10-year average (1934-43) farm prices from AGRICULTURAL STATISTICS, the average annual value per acre for a corn-wheat-alfalfa-alfalfa rotation is $45.46; for the corn-soybean-wheat-clover rotation, $32.53; and for the corn-oats-wheat-clover rotation, $32.08. These values are based on the sale of crops. Part of this reduction in value is due to decreased yields of grain following a 1-year meadow. Where the crops are fed to livestock on the farm, greater incomes could be realized. If it is desirable to measure the crops of the

TABLE I.—LEGUME MEADOWS INCREASE THE VALUE OF ROTATIONS.

Rotation [1]	Average annual value per acre [2]	Average annual total protein per acre [3]	Average annual TDN per acre [3]
C–W–A–A [4]	$45.46	511 lbs.	3,180 lbs.
C–SB–W–Cl	32.53	307 "	2,110 "
C–O–W–Cl	32.08	250 "	2,050 "

[1] Using actual yield data from Ohio Agricultural Experiment Station.
[2] Using 10-year average (1934-43) price of farm products from AGRICULTURAL STATISTICS.
[3] Computed by the Ohio Agricultural Experiment Station.
[4] W = wheat; A = alfalfa; SB = soybeans; O = oats; Cl = clover.

rotation by their feeding value, the average annual digestible protein is 511, 307, and 250 pounds per acre, respectively; and the average annual total digestible nutrients is 3,181, 2,110, and 2,050 pounds per acre according to the computations made by the Ohio Agricultural Experiment Station.

Using the yield data for three 5-year rotations from the Ohio Agricultural Experiment Station, namely, corn-wheat-3 years of alfalfa, corn-corn-wheat-2 years of alfalfa, and corn-corn-corn-wheat-alfalfa, and using the same prices for farm products from AGRICULTURAL STATISTICS, the average annual values of crops produced are $50, $45.17, and $38.21 per acre, respectively. Likewise, the amount of digestible protein and the total digestible nutrients in the crops grown are reduced as the amount of corn in the rotation is increased and the alfalfa decreased. This is strong evidence against the argument that a large acreage of corn must be grown in order to pay off the mortgage.

From this, then, it might be concluded that the 4-year rotation C-G-M-M is well balanced and applicable to a wide range of farm conditions. Where it is desirable to use a more intensive rotation, because of the high quality of the soil and the needs of the farmer, a year of corn may be added. This makes a 5-year rotation, C-C-G-M-M, and raises the acreage of corn from 25% in the 4-year rotation to 40% in the 5-year rotation. By adding the 2-year rotation, C-G (sw.cl.), to the C-G-M-M rotation, a 6-year rotation C-G-M-M-C-G (sw.cl.) is obtained. The acreage of corn is raised from 25% in the 4-year rotation to 33⅓% in the 6-year rotation, thus providing for the same acreage of each crop as a 3-year rotation. But, two consecutive years of meadow (plus a sweetclover catch crop) have greater value from a soil-management viewpoint than two 1-year meadow crops in the same period of time. This rotation could be expected to give higher yield.

A less intensive rotation can be formed from the basic 4-year rotation by substituting grain for corn, making a G-G-M-M rotation; meadow for corn, making a G-M-M-M rotation; or by adding small grain and a sweetclover catch crop, making a C-G-M-M-G (sw. cl.) rotation.

TABLE II.—NITROGEN CHANGES DUE TO CROP UTILIZATION.[1]

(Average Annual Pounds Per Acre)

Rotations [2]	Fed[3]	Sold[4]	Pastured[5]	Plowed[6]
C–W–A......	8	−40	2.7	16.0
C–W–A–A....	35	−36	11.0	25.0
C–W–A–A–A.	42	−34	4.6	16.0
C–C–W–A–A.	24	−39	−.4	11.4
C–C–C–W–A.	−4	−40	−15.5	−7.6
C–SB–W–Cl..	8	−36	−12.4	−4.8
C–O–W–Cl...	−7	−46	−20.0	−15.0

[1] Using factor reports in "Planning the Farm Business," Univ. of Ill.
[2] Using rotations and actual yields from Ohio Agricultural Experiment Station.
[3] All crops fed and manure returned to the soil.
[4] All crops sold and nothing returned to the soil except crop residues.
[5] All crops sold except one year of meadow is pastured (the last year when there is more than one year of meadow).
[6] All crops sold except one year of meadow is plowed under as a soil-improving crop.

The data in column two above show that where the crops are all fed on the farm and the manures returned to the soil, it is only the very intensive rotations that show a loss of nitrogen, such as a loss of four pounds for the C-C-C-W-A rotation and seven pounds for the C-O-W-Cl rotation. But if all the crops are sold (column three) and nothing returned to the soil, all of these rotations show a heavy average annual loss of nitrogen. Where all the grain and hay is sold but the last year of the meadow is pastured (column four), one, two, and three years of alfalfa meadow produce a gain in nitrogen provided there is only one year of corn in the rotation. If the last year of meadow is plowed under as a soil-improving crop (column five), the gains in nitrogen are much greater.

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PICTORIAL

Chores! . . . Damn 'em! ! !

Above: Nectar from the trees.

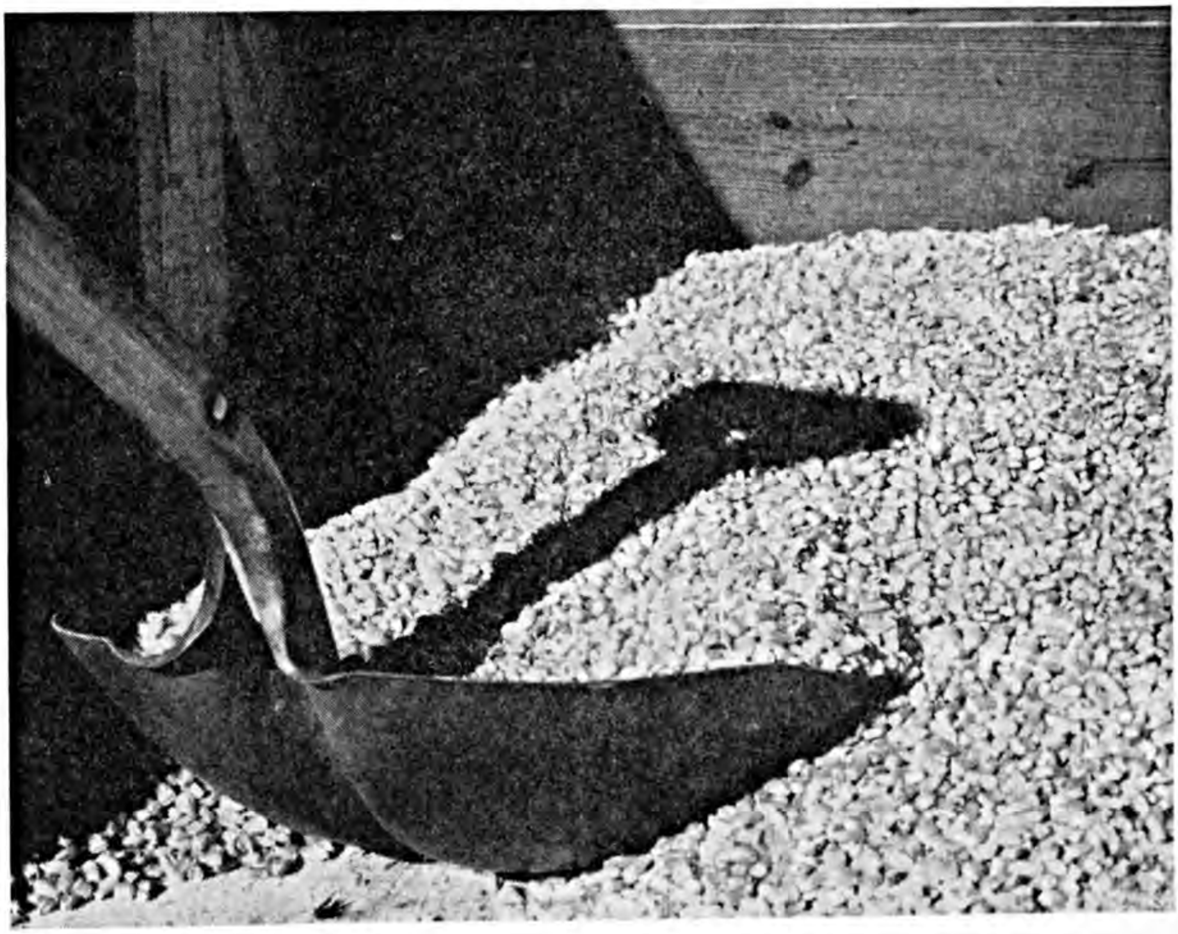
Below: Feeding spring seeding.

Above: Flooded farm land.

Below: Gully-wash damage.

Above: Corn on the cob.

Below: Corn—no cob.



The Editors Talk

The South Reviews Its Agriculture

Coming together to hear discussions built around the general theme, "The South's Agriculture Is on the March—Let's Tell More About It," some 1,500 Southern Agricultural Workers held the 47th Annual Convention of their Association in Biloxi, Mississippi, February 9-11. Sunny skies lent an added optimism to the pride over what has been accomplished and the determination to solve the problems ahead. The convention, largest of its kind in the country, attracted research workers and extension people in the fields of agricultural economics and rural sociology, engineering, agronomy, animal production, dairy science, forestry, horticulture, marketing, phytopathology, plant physiology, poultry, and soil conservation. In addition, the home economists held several sessions and the agricultural editors reviewed their means of disseminating the wealth of information which is coming from the progress in the New South's agriculture.

There was no settling back on "laurels won." Rather, did the greatest attention center on the problems ahead. For instance, Dr. R. Q. Parks, Soil Scientist of the U. S. Department of Agriculture, told a large group of crops and soils men that in a look ahead at research needed to solve soil-management problems in the humid South, the maintenance of fertility and better use of water are the chief concerns. He listed five broad problems which call for study, as follows:

1. The favorable levels of available soil phosphorus for different crops and soils. Southern farmers apply an average of 3½ times as much phosphorus in fertilizers as is removed in crops. If favorable levels were known, it might be more economical to apply the phosphorus all at one time rather than in small amounts over a period of 25 to 125 years.

2. The extent to which deep-rooted legumes such as sericea and kudzu can be used to improve the soils.

3. The rates at which native potash is released and how this release can be modified by management practices.

4. Much more information on the availability of minor elements in soils and the effect of modern management practices on their release.

5. The possibility of using a wide range of liming rates together with greatly increased applications of the minor elements and potash, magnesium, and phosphorus to increase and maintain soil fertility.

Turning to water conservation in soil management, Dr. Parks said in some areas Southern farmers can do a great deal to supplement rainfall but those on far larger acreage must give attention to getting more efficient use of the rain that falls on the land. The use of supplemental irrigation has increased in the South as the result more of farmer interest than of agronomic recommendations. If irrigation is to be used efficiently in the humid South, research is needed to find detailed answers to the following questions:

1. What are the potential sources of water supply of surface water and the quality and potential volume of supply of underground water within economic reach for pumping?

2. What are the agricultural potentialities of supplemental irrigation in areas near good water supplies?

3. What state laws have been passed relating to the appropriation of surface and underground water resources for supplemental irrigation? Should model legislation be developed to define and protect such water rights?

A major question in developing more efficient use of the rainwater that falls on the land, Dr. Parks feels, is how much a combination of good management practices—use of improved varieties and high fertilization—can decrease erosion. Another question that needs to be answered is what depth can available soil water be stored on different soil types and to what depth can it be removed by plant roots. A crop that roots to a depth of three feet has available a soil-moisture reservoir three times as large as a crop that roots to only twelve inches. Most Southern soils have potential root-zone depths that are not being utilized.

Numerous papers were devoted to pasture and their management, a subject of great importance and significance in view of the necessity for finding use for many acres of land being taken out of cotton and other row crops. Joint meetings and symposia were held on methods for determining the nutrient requirements of crops, fertilizer needs of soils, fertilizer formulation and use, and farm mechanization.

The South is to be congratulated on having this Association of Agricultural Workers. It is in such meetings as their conventions that problems on an area-wide basis can best be discussed. It is in such discussions that the true interdependence of each phase of agricultural research with the others is best realized. From such realization and a working together comes the real March of Progress.

Food for Thought About Food

In this issue of this magazine we are pleased to begin the reprinting of Dr. Firman E. Bear's widely acclaimed presidential address before the American Society of Agronomy in Milwaukee, Wisconsin, last October. His subject, "Food for Thought About Food," was just that and with it, citing what already has been accomplished by agricultural science and what will be accomplished, he dispelled any fear that our future generations with their increasing populations will go hungry.

Dr. Bear prefaced his address with the Malthusian principle, the growth of population, and the agricultural development in the New World which refuted the concepts of Malthus. From there he speculated on the increased population which will have to be fed and clothed in coming centuries and the potentialities in food and fiber production with which to meet these needs. He outlined the acreages which can still be put to work with proper technology, the possibilities of increasing acre yields, the solving of soil problems, and the control of diseases and pests. In closing he dwelt upon the synthetic production of food, when and if the need ever arises.

We believe that all of our readers who did not have the privilege of hearing the talk or seeing it in print elsewhere will thoroughly appreciate our printing of it and find in it much "food for thought."

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941...........	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942...........	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947...........	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948...........	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
February....	29.14	29.5	172.0	244.0	112.0	194.0	20.50	53.40	....
March.......	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April........	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May.........	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June.........	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July.........	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August.......	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September...	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October......	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November...	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January......	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	89	81	109	74	87	110
1938...........	69	196	80	79	76	64	57	97	88
1939...........	73	154	100	84	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	105	117	107	82	211	129
1942...........	153	369	168	134	143	124	91	202	163
1943...........	160	405	188	235	174	154	125	231	245
1944...........	167	420	214	216	170	160	139	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	178	248	212	209	141	319	204
1947...........	257	380	232	248	336	259	148	381	249
1948...........	250	387	220	249	212	232	160	301	238
1949									
February....	235	295	249	279	174	219	173	237	285
March.......	232	319	250	290	184	224	168	228	263
April........	241	247	260	314	190	226	160	223	236
May.........	242	325	260	312	190	226	149	224	213
June.........	243	315	251	301	188	210	138	207	175
July.........	243	565	222	323	195	206	132	166	185
August.......	236	446	221	305	184	202	135	197	174
September...	240	487	198	263	181	212	137	193	205
October......	231	474	187	224	170	214	141	185	170
November...	224	434	192	216	159	215	141	188	213
December....	214	454	188	230	176	218	144	192	196
1950									
January.....	213	397	195	245	179	217	144	193	261

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	10.11	10.59	10.84	9.85
1949						
February	3.19	2.27	9.44	12.36	10.78	10.70
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949						
February	119	80	270	350	320	304
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate, Balti-more, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14.........	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925............	.600	2.44	6.16	.584	.860	23.72	.483
1926............	.598	3.20	5.57	.596	.854	23.58	.537
1927............	.525	3.09	5.50	.646	.924	25.55	.586
1928............	.580	3.12	5.50	.669	.957	26.46	.607
1929............	.609	3.18	5.50	.672	.962	26.59	.610
1930............	.542	3.18	5.50	.681	.973	26.92	.618
1931............	.485	3.18	5.50	.681	.973	26.92	.618
1932............	.458	3.18	5.50	.681	.963	26.90	.618
1933............	.434	3.11	5.50	.662	.864	25.10	.601
1934............	.487	3.14	5.67	.486	.751	22.49	.483
1935............	.492	3.30	5.69	.415	.684	21.44	.444
1936............	.476	1.85	5.50	.464	.708	22.94	.505
1937............	.510	1.85	5.50	.508	.757	24.70	.556
1938............	.492	1.85	5.50	.523	.774	15.17	.572
1939............	.478	1.90	5.50	.521	.751	24.52	.570
1940............	.516	1.90	5.50	.517	.730	24.75	.573
1941............	.547	1.94	5.64	.522	.780	25.55	.367
1942............	.600	2.13	6.29	.522	.810	25.74	.205
1943............	.631	2.00	5.93	.522	.786	25.35	.195
1944............	.645	2.10	6.10	.522	.777	25.35	.195
1945............	.650	2.20	6.23	.522	.777	25.35	.195
1946............	.671	2.41	6.50	.508	.769	24.70	.190
1947............	.746	3.05	6.60	.498	.706	18.93	.195
1948............	.764	4.27	6.60	.478	.681	14.14	.195
1949							
February.....	.770	4.61	6.60	.375	.720	14.50	.200
March.........	.770	3.85	7.06	.375	.720	14.50	.200
April..........	.770	3.85	7.06	.375	.720	14.50	.200
May...........	.770	3.85	7.06	.375	.720	14.50	.200
June..........	.770	3.66	7.06	.330	.634	12.76	.176
July...........	.770	3.60	5.87	.353	.679	13.63	.188
August........	.770	3.60	5.47	.353	.679	13.63	.188
September....	.770	3.65	5.47	.353	.679	13.63	.188
October.......	.770	3.75	5.47	.375	.720	14.50	.200
November....	.770	3.76	5.47	.375	.720	14.50	.200
December.....	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January.......	.762	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

	Super-phosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1925............	110	68	126	82	90	98	74
1926............	112	88	114	83	90	98	82
1927............	100	86	113	90	97	106	89
1928............	108	86	113	94	100	109	92
1929............	114	88	113	94	101	110	93
1930............	101	88	113	95	102	111	94
1931............	90	88	113	95	102	111	94
1932............	85	88	113	95	101	111	94
1933............	81	86	113	93	91	104	91
1934............	91	87	110	68	79	93	74
1935............	92	91	117	58	72	89	68
1936............	89	51	113	65	74	95	77
1937............	95	51	113	71	79	102	85
1938............	92	51	113	73	81	104	87
1939............	89	53	113	73	79	101	87
1940............	96	53	113	72	77	102	87
1941............	102	54	110	73	82	106	87
1942............	112	59	129	73	85	106	84
1943............	117	55	121	73	82	105	83
1944............	120	58	125	73	82	105	83
1945............	121	61	128	73	82	105	83
1946............	125	67	133	71	81	102	82
1947............	139	84	135	70	74	78	83
1948............	143	118	135	67	72	58	83
1949							
February.....	144	128	135	68	76	60	83
March.........	144	107	145	68	76	60	83
April..........	144	107	145	68	76	60	83
May...........	144	107	145	68	76	60	83
June..........	144	101	145	62	67	53	80
July...........	144	100	120	65	71	56	82
August........	144	100	112	65	71	56	82
September....	144	101	112	65	71	56	82
October.......	144	104	112	68	76	60	83
November....	144	104	112	68	76	60	83
December.....	144	104	112	68	76	60	83
1950							
January.......	142	104	112	68	76	60	83

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
February	255	242	231	136	99	309	144	72
March	258	245	231	134	99	290	144	72
April	256	244	229	134	99	291	144	72
May	253	244	227	134	99	293	144	72
June	249	242	223	134	99	304	144	65
July	246	240	225	140	100	349	144	68
August	244	238	222	143	100	372	144	68
September	247	238	225	138	100	334	144	68
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	220	135	96	316	142	72

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

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

Fertilizers

"Inspection of Commercial Fertilizers and Agricultural Lime Products," Fert. Control Serv., Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Control Series Bul. No. 142, July 1949.

"Fertilizer Experiments on Grasslands in the Northeastern Region," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 518, Sept. 1949, R. R. Robinson and R. J. Garber.

"Commercial Fertilizers in 1948–49," Agr. Exp. Sta., Texas A & M College, College Station, Texas, Bul. 714, Sept. 1949, J. F. Fudge and T. L. Ogier.

"Vegetable Fertilizer Studies in the Walla Walla Area," Agr. Exp. Stations, State College of Wash., Pullman, Wash., Bul. No. 508, Aug. 1949, W. J. Clore and C. L. Vincent.

"Available Phosphorus and Potassium of Washington Soils According to the Neubauer Rye Seedling Test," Agr. Exp. Stations, State College of Wash., Pullman, Wash., Sta. Cir. No. 78, June 1949, H. E. Dregne, Errett Deck, Jr., and S. C. Vandecaveye.

"What Fertilizer Should I Use?" Ext. Serv., Univ. of Wis., Madison, Wis., Special Cir. 13, Oct. 1949, Emil Truog, C. J. Chapman, and K. C. Berger.

Soils

"The Chemical Composition of Representative Arizona Waters," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 225, Nov. 1949.

"Growth and Nutrition of Plants as Affected by Degree of Base Saturation of Different Types of Clay Minerals," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Tech. Bul. 214, June 1949, T. S. Chu and L. M. Turk.

"Irrigation Farmers Reach Out Into the Dry Land," Agr. Exp. Sta., Montana State College, Bozeman, Mont., Bul. 464, Sept. 1949, R. E. Ward and M. M. Kelso.

"How to Build a Farm Pond," U.S.D.A., Washington, D. C., Leaflet 259, Sept. 1949, W. S. Atkinson.

Crops

"Twenty-ninth Biennial Report—from July 1, 1944, to June 30, 1946," State Dept. of Agr., Tallahassee, Fla.

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Science Explores Root Zone

BACTERIA and other microorganisms had been helping plant roots etch the ancient buried marbles of Greece and Rome for centuries before men learned anything about the biological forces within the soil and their effects on the nutrition of plants. Now experts on the microflora of the root zone have an active part in present widespread efforts toward a better understanding of the whole so-called soil complex. Dr. Francis E. Clark, microbiologist of the U. S. Department of Agriculture's Bureau of Plant Industry, Soils, and Agricultural Engineering, sees a "rebirth of interest in the biology of the soil" and thinks it is likely due in large measure to the parts these organisms play in the production of crops.

Writing in the American Journal of Agronomy, Clark throws light into this dark economy by explaining some of the collective accomplishments of the microorganisms. He describes them as: Providing plants with nutrients in more available form (they are processors); conserving and protecting nutrients for the later use of plants (storehouse watchmen); in some cases competing with plants for nutrients (like sparrows in the chicken yard); sometimes forming substances that improve tilth (same as in a compost pile); sometimes guarding plants against parasites (sheepdog work); and (as may surprise many) promoting the ability of plant roots to absorb nutrients.

According to Clark, products of microbial action have a dissolving effect on minerals in the soil—both those minerals found in organic combinations (vegetable and animal matter) and those inorganic ones (such as the mineral fertilizers). Then he shows how these dissolving substances from the microorganisms work. He says many microbiologists now believe that while these organisms are making the nutrients more suitable for absorption by the roots, they also are making the walls of the roots more permeable. As the substances the organisms produce etched the ancient marbles and tend to dissolve minerals in the soil today, so they erode the surfaces of the rootlets on which they swarm. There is evidence, he says that they even encase the rootlets so that the plants are not actually in contact with the soil particles at all but get everything through what we might well call micromiddlemen.

Use Crop Rotations to Improve . . .

(*From page 26*)

If the rotation contains three years of corn, small grain, and one year of meadow, there is a heavy average annual loss of nitrogen regardless of how the crops are utilized.

Besides the cash and feeding values of the crops grown, rotations should be soil-building in order to fill the needs of the farmer. Too often no consideration is given to this phase. If the crops in the rotation are profitable to grow or if they satisfy the feed requirements of the livestock enterprise, the farmer may forget that the needs of the soil are also a reason for using rotations. The way he uses the crops he grows has a great deal to do with the selection of the rotation that will maintain the soil. For example, a crop rotation that is soil-building when all of the crops are fed to livestock on the farm may be soil-deteriorating when the crops are sold.

There is always a loss of phosphate and potash from the soil no matter how the crops in a rotation are used. These must be replaced by using commercial fertilizer in order to keep the soil fertile. The supply of nitrogen and organic matter can be changed materially by the use that is made of the crops.

It has taken a lot of experimental

work on the various phases of soil management and a lot of experience in farm planning over a wide range of soil conditions to take the guesswork out of crop rotations and put them on a technical and practical basis. The old method of adjusting the crops to be grown to the feed requirements of the livestock enterprise has changed to one of adjusting the livestock enterprise to the amount and kinds of feeds the soil is capable of producing. The old measure of market supply and demand does not determine the selection of the crops in the rotation. Instead, the needs of the soil to keep it productive and in good physical condition indefinitely are the determining factors. Help in planning and establishing proper rotations, and information on proper land use, soil productivity, and erosion are available.

Fertilizer Placement for Vegetable Crops

(*From page 10*)

ing when irrigating is important. When irrigation water is applied at the surface it should not be so rapid as to cause fertilizer loss by surface runoff and it should continue until the moisture meets with the moisture down below.

Peikert and Cook in an article in Michigan Agricultural Experiment Station Quarterly Bulletin, May 1948, say, "Carolus has reported that potatoes, at the Virginia Truck Experiment Station, required only 7 lbs. of nitrogen an acre during the first 7 weeks of their growth period, but during the next 5 weeks the crop used 53 lbs. an acre. The logical time then to apply nitrogen for such a crop is during that period of rapid growth when the need for nitrogen is great."

The article states that only soluble salts such as ammonium sulfate, ammonium nitrate, and sodium nitrate can be effectively applied through irrigation water, and 40 to 80 lbs. of nitrogen per acre should be sufficient to take care of the rapid growth period of most vegetable crops which takes place several weeks after planting.

It is further stated that potash salts are largely soluble in water and yet do not leach readily from the soil nor form unavailable compounds in the soil. Therefore, all the potash may be applied at the time of planting or before. However, if tests show that the crop needs more potash it can be added through the irrigation water.

In the case of phosphorus, it is stated that tests show this element to be most effective when applied in bands. When phosphorus is broadcast and mixed with the soil, a large part of it is changed over into relatively unavailable compounds. The same thing happens when put into irrigation water. However, most of the phosphorus used in mixed fertilizer does not dissolve readily in water, and soluble forms of phosphorus are too expensive to use. So it is not practical to try to put phosphorus on through the irrigation water.

On our farm when we apply fertilizer through the irrigation system we dissolve it in a barrel and pass it through the centrifugal pump on the suction side. Where turbine pumps are used, the solution must be forced into the discharge line at a pressure higher than that of the pump.

Some Other Methods of Applying Fertilizer

1. Fertilizer attachments have been made to fit the plow and apply bands of fertilizer and lime in the bottom of furrows, but this is expensive and slows up the job of plowing. It is much faster to broadcast on the surface and plow under.

2. Band fertilizing can be done at the time of setting plants, but here

again it is apt to slow up the planting and can probably wait, especially if starter solution is used in the planter water.

3. Ordinarily fertilizer cannot be mixed directly with vegetable seeds without danger of burning. However, superphosphate can be safely mixed with grain crops.

4. Whenever fertilizer is used directly under or over the row, there is danger of burning the plants because of the movement of soluble materials upward and downward. Ordinarily there is not much movement sideways.

5. Recently anhydrous ammonia and other solutions have been used in irrigation water in the West, or for direct application by machine to the soil, and good results are claimed.

6. Minor element deficiencies have been corrected by use in the fertilizer and by direct application to the foliage of plants in the form of a spray. Manganese, zinc, copper, and several other elements can be absorbed from sprays directly on the leaves. For several years now we have had from 5 to 15 lbs. of borax and 25 lbs. of manganese sulfate mixed with our fertilizer.

Good Judgment Needed in Fertilizer Placement

1. *The nature of crops grown.* A knowledge of the extent of the root system of crops and the feeding habits in regard to plant-food requirement is essential. Fertilizer should be placed within the reach of plant roots, but still not close enough to cause root injury. In the case of asparagus the bulk of the fertilizer should be applied after the crop is harvested.

2. *The kind and amount of fertilizer used.* Phosphorus fertilizers become fixed in the soil if mixed with it. They do not shift their position in the soil and should usually be placed deeply in bands where they will do the most good. Crop roots may be burned with heavy applications of soluble inorganic nitrogen or potash salts.

3. *Timing the application.* Most crops require only small amounts of plant food in the early stages of growth. If all the fertilizer is applied at the start, and none later, on a long season crop, it may suffer from lack of plant food because of leaching and fixation.

The following is taken from page 5 of a special bulletin on "Methods of Applying Fertilizer," published in November 1948 by the National Joint Committee on Fertilizer Application, under the heading "Principles Involved in Fertilizer Use:"

"Topdressing and side-dressing with nitrogen, and sometimes with potash, are useful in minimizing the concentration of salts when heavy total applications are made, in providing nutrients at a critical or opportune stage of crop development, and in replacing plant food when losses result from leaching or other causes. Nutrients applied as side-dressings are of most immediate benefit to the plant when placed in moist soil in the root zone; but in making the application, excessive mechanical destruction of the root system must be avoided."

4. *Physical nature of the soil.* On sandy soils we have faster leaching, and more frequent applications are necessary. Sandy soils also have less buffer action and retentive capacity than heavier soils.

5. *Drainage.* Good drainage is necessary to provide aeration for the development of soil organisms which break down and release plant food.

6. *The pH level.* Phosphates are made more available in soils near neutral. A slightly acid soil favors the maximum release of plant food.

7. *The organic matter content.* Organic matter acts as a sponge to hold water and plant food and reduces the danger from fertilizer burning. It also acts as a buffer to prevent injury from heavy doses of fertilizer.

8. *Spacing of rows.* Generally band fertilizing has been done on wide row crops and not so much on close row crops, probably partly because of the difficulty in getting machines to do the

job and also because there is less danger of burning by broadcasting large amounts.

9. *Cover crops and crop residues.* Both add considerably to the organic matter in the soil. Cover crops can be used as a means of predigesting fertilizers applied to them for gradual release to future growing crops.

10. *Animal manures.* These are still as valuable as ever when obtained at a reasonable price, but the quantity is limited. They are usually deficient in phosphorus.

11. *Equipment available.* There seems to be machinery available for banding fertilizer on wide rows, but for close rows there seems to be a need for machines to place fertilizer in bands and for side-dressing multiple rows.

12. In conclusion, no one fertilizer placement is best for all soils and all crops. To get the most value and best crops from fertilizer requires proper placement. This, however, usually means a combination of several methods of application and a consideration of a number of factors affecting crop needs, the release of plant food, and absorption into the roots of plants.

All Factors Are Important

(*From page 21*)

brown and dying along the outer edge.

In the adjacent plot of early planted Texas 18, green color persisted and normal two-ear development was observed against the late planted corn with only one ear to each stalk. This and ear size accounted for a 25-bushel-per-acre difference in yield.

A limited moisture supply at the critical silking time restricted maximum plant-food utilization and these deficiencies developed. This situation frequently becomes possible under average farm conditions in Texas when moisture becomes the limiting factor of production. Under conditions of low rainfall which prevail over a wide area, it is very important to have more than a minimum requirement of the various plant-food elements in the soil.

Quite a large acreage in Lamar county is of a claypan type soil that develops a moisture shortage due to the inability of the soil to absorb water into the impervious subsoil. Subsoiling is becoming a practice by some of the farmers to store up the late winter and early spring rains. Then organic matter incorporated into the soil increases the capacity of the soil to take up and retain this moisture for later use. The use of more fertilizer also decreases the amount of water necessary for dry matter production. All go together for maximum yields.

Our farmers are doing something about this. Our cover crops for organic matter in the county increased from 14,000 in 1948 to 20,000 acres last year. One fertilizer dealer reported an 800 per cent increase in fertilizer sales this last March over the previous March, and the tractor dealers note an increased interest in subsoil plows.

We have reported yields of 118 bushels per acre upland corn and 132 bushels Red River bottom corn. These yields are unusual when compared to our average Texas yield of 16 bushels per acre and have received quite a lot of attention. This year the local Junior Chamber of Commerce has a corn contest planned and expects to see quite a few acres grow 100 bushels. We feel that we have been a little behind on fertilizer and cultural practices in the past but look to do some fast catching up.

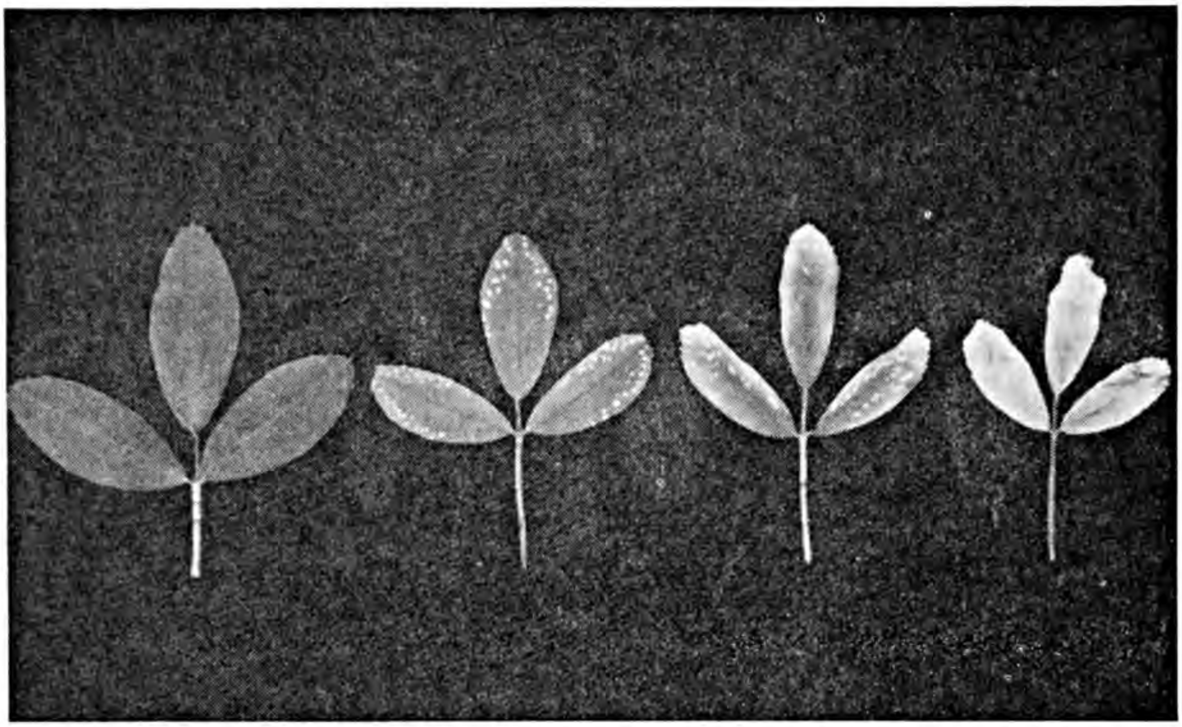


Fig. 2. Potassium deficiency symptoms in alfalfa: (Left) Normal or healthy leaves; (Second from left) First stage of potassium deficiency indicated by white spots near margin of leaves; (Third from left) Second stage of potassium deficiency. The white spots have extended so as to entirely cover the margin, causing them to become whitish, yellow, and finally brown and dry; (Right) Advanced stage of potassium deficiency. Leaves have lost all chlorophyll and finally dry up.

Boron for Alfalfa

(*From page 20*)

borate alone or in a mixture with other fertilizer materials is applied near the time of seeding alfalfa with a grain nurse crop, it should be broadcast and worked into the soil a week or two before seeding to avoid injury to the grain. Borates alone or in a mixture should never be applied directly in contact with the seed of grains, peas, beans, and seeds in general because even relatively low rates will seriously retard or entirely prevent germination. This danger of injury does not exist when borates are applied on established alfalfa in the amounts and manner previously indicated.

Need for Potassium Often Accompanies That for Boron

Many alfalfa fields that show a need for boron also lack an adequate supply of available potassium. Fortunately, a deficiency of potassium in alfalfa is marked by definite and unmistakable symptoms. These are illustrated in Figure 2.

The spots which indicate a deficiency of potassium are always whitish and appear first on the margins, usually on the older leaves. They should not be confused with yellow or brown spots which appear any place on the leaves and are caused by insects and diseases. In nearly every alfalfa field, occasional leaves that exhibit these potassium deficiency symptoms may be found. It is only when a considerable portion of the plants exhibit these symptoms that the condition is serious enough to warrant application of potash fertilizer.

Summary

Much of the alfalfa in Wisconsin suffers from a lack of available boron in the soil. Because of this, yields are often low, seed production is greatly reduced, and winterkilling is more severe than need be.

When alfalfa suffers from a lack of boron, the plants exhibit definite deficiency symptoms in the form of stunting of the growing tip of the plants which results in the formation of an umbrella-like top growth of a yellow or reddish color. A lack of available boron may also be detected by soil and plant analysis.

The remedy for a lack of boron is application of a borate at the rate of 20 to 40 pounds per acre, either alone or in a fertilizer mixture. The application may be made as a topdressing on established alfalfa fields, or just prior to seeding.

Alfalfa frequently suffers from a lack of lime, phosphorus, and potassium, and when one or more of these are also lacking (soil tests will tell), suitable correction must be made in order to obtain satisfactory results.

Put the Bee on Southern Agriculture

(*From page 13*)

83.5 pounds of seed per acre. No similar red clover was available a sufficient distance from the colony for a check on fertilization by only wild bees, bumblebees, and insects; however, previous observations indicated only 2 to 10 per cent of red clover pods contained seed in the absence of honeybee colonies.

This is the first time that a study of the relationship of honeybees to pollination and seeding of legumes has been made on red clover grown in Florida. A similar experiment was conducted on ladino clover, but due to an almost total lack of blossom, no data are available. Indications are that a longer length of day is needed to force the blooming of ladino clover.

Fig. 4. Pasture of Louisiana white clover and carpet grass averaged over 600 pounds of beef per acre per year for four years.

Food for Thought About Food

(*From page 18*)

this stepped-up activity was a 30% increase in production. In 1947-48, we not only exported nearly 19½ million tons of food products, but we ate about 10% more at home than before the war.

The number of acres of cropland remained nearly constant during the war. Much additional land that, with some improvement, could have been used for growing crops was not farmed for lack of labor. The only thing needed to bring such land into production, and to further raise yield levels of that already being farmed, is a suitable incentive, in terms of a reasonable selling price for farm produce over a period of years, and an adequate supply of labor and machinery.

Serious Soil Problems Being Solved

There are, of course, some serious soil problems that must be solved. The Soil Conservation Service has effectively dramatized the tremendous soil losses from the cultivated lands of this country. Widespread fears have been aroused, notably among city folks, that the nation's land resources will soon have been destroyed.

Within limits, these fears are well founded. Our European ancestors were unacquainted with the corn, tobacco, potatoes, peanuts, and tomatoes that we inherited from the Indians, and few of them had ever had any experience with cotton. Nearly 140 million acres of our finest land were being turned with the plow and planted to these clean-cultivated row crops, year after year, before anyone realized what disastrous effects their production was having on the staying powers of the soil.

The introduction of the tractor and its rapid growth in number from a mere 2,000, in 1909, to 2½ million much faster and more effective models by the end of World War II resulted in rapid acceleration of loss of soil by erosion. Some 50 million acres of hay and pasture land for mules and horses was released to the plow. Thousands of miles of fences were torn out for convenience in operating the tractor. The net effect was an ever-longer sweep of wind and water over an ever-larger acreage of cultivated land.

Erosion ruins the contour of the land and necessitates farming in patches. It may remove soil down to bare rock that cannot be farmed. One of the nation's foremost geologists has set the rate at which soil is formed from rock at not over 1 foot in 10,000 years. This is less than 400 pounds per acre per year. Multiply this estimated rate of renewal by 10, and still it is far from being fast enough to replace soil losses in many cases.

But tremendous strides have been made in awakening national interest in soil conservation and in bringing erosion under control. Millions of acres of land are now being farmed on the contour. Contour strip-cropping is being practiced on an ever-enlarging scale. Moldboard plows have been widely replaced by tillage implements that leave soil-protecting crop-refuse on the surface. Many livestock farmers have reduced their acreage of cultivated crops and are growing hay and grass instead.

Land-use planning programs are being developed by the Soil Conservation Service as rapidly as funds permit. The purpose is to provide a detailed map for every farmer as a guide in deciding which part of his land can be safely cultivated, and with what precautions, and which part must be put down to grass and trees. Hopefully, every agricultural county will soon have a full-time conservation specialist whose energies will be entirely devoted to this purpose.

Another serious result of soil erosion is the sedimentation in the bottoms of water-storage reservoirs. Some 2,000 of the nation's smaller reservoirs have already been filled with soil. The average life of these reservoirs is less than 50 years. At the current rate of sedimentation, one-fifth of our 9,000 large reservoirs, on which we depend for power, drinking water, industrial use, and irrigation, will be filled with soil by the end of this century.

Reforestation One Answer

One of the best answers to this problem in the humid regions lies in reforestation of the surrounding watersheds. Fortunately, in meeting this need, we give support to the forest resources program. Over 40% of our land area, or about 820 million acres, was originally covered with forests. Some 200 million acres of the best of this have been cleared. Much of the remainder is being cared for on a very haphazard basis. As a result, our annual timber harvest is not replaced, large areas of land are subjected to unnecessary erosion, flood waters pile up to dangerous proportions, and water supplies are polluted.

It is highly unfortunate that we have fallen so far short of the possibilities of transforming waste land into productive forests. One encouraging feature is the extent to which counties, townships, communities, and municipalities are undertaking forest enterprises. Some 10 million acres of land are now in community forests. These are designed for the protection of local water supplies, for sport and recreation, and for the protection of wild life. Some of them are self-supporting. Moderate charges are made for hunting, fishing, and camping, and incomes of $2 to $3 an acre are obtained annually from the sale of timber.

Our virgin forests contained about 8,000 billion board feet, but current reserves are only one-fifth that amount. The goal set by the U. S. Forest Service is an annual growth of 20 million cubic feet. This calls for 100 million more acres of our present forest land in intensive production and a fourfold increase in well-managed extensive stands. It requires that fires be brought under better control. In addition there is need for more advisory service to small owners of woodland, for improved planting and cutting management, for cooperative control of diseases and insects, and for wide-spread recognition of the fact that forests are long-time enterprises to be passed on intact from one generation to the next.

It now seems probable that marginal farming areas can be developed into joint livestock-farming and forestry enterprises. They need to be brought together in large enough units to provide 500 to 1,000 acres of farming land, which would permit of economy in the use of labor and machinery. The additional rougher acreage could then be devoted to trees for Christmas greenery and for poles, pulpwood, and saw timber. Such an operation is already under way on a highly profitable basis in northern Pennsylvania.

Trees have special value in that they constitute important reserves of food and fiber that can be used in time of necessity. Wood is readily hydrolyzed to sugar that can be used either directly as food or feed or indirectly in the manufacture of edible proteins and fats.

There is great need for protecting farms and cities that lie in the larger river valleys of this country. It was not until 1917 that officials of the federal government were sufficiently impressed with this problem to enact laws by which flood control could be effected on a large scale. Since then plans have been prepared for virtually all the critical areas, and they are being put into effect as rapidly as funds permit. Those for the Missouri River basin provide a good example. They call for the construction of 100 new reservoirs with storage capacity of 63 million acre feet of water. This would provide irrigation for nearly 5 million acres of land. It would also permit of the construction of 22 hydroelectric plants that would yield more power than is now being used in the area.

About 25% of our water supply comes from underground sources. In some areas such water is being removed faster than it is being replaced. Notable instances of this occur in the Texas Panhandle; in Marcopa County, Ariz.; in the San Joaquin Valley, Calif.; and in Louisville, Ky. Another example is found in Philadelphia, where salt water is now being drawn into the city system. All of these argue for cutting down runoff, for improving the rate of water intake of soils, and for increasing their capacity to store water.

Soil Organic Matter Center of Interest

Physical deterioration of some of our farmed land is a troublesome fact. Most of the virgin soil from forest, prairie, and plain was in a good physical state when first put to the plow. In some areas the land had to be drained and in others it was underlain with impervious layers. By and large, however, bad physical state in any of our best land is chargeable to bad farming practices. It is associated with excessive cultivation, loss of organic matter, working the soil while it is too wet, running over the land with heavy machinery, permitting rain to beat down on bare soil, and allowing actual loss of soil by erosion.

The natural renovating agents are plant roots, organic matter accumulations, earthworms, frost, and desiccation. As full advantage as the type of agriculture permits must be taken of these natural processes. This calls for keeping the land completely covered as much of the time as possible, growing deep-rooted legumes as a regular rotation procedure, making use of manure, cover crops, and hauled-in organic matter, and applying such chemical amendments as will guarantee good growth of crops with large root systems.

Chemical agents are being directly employed for improving the physical properties of soils. Liming materials have long been used for this purpose in humid areas and gypsum in irrigated arid areas. More recently great interest has been aroused in the use of gypsum, either alone or in association with liming materials, in humid areas. In 1948, some 1,300 tons of gypsum were applied at rates of about 2 tons per acre in clearing up wet spots on New Jersey farms, and 5,000 tons are expected to be so used in 1949.

But there are those who believe that the chemical method of dealing with soil unproductivity is fundamentally wrong and that the only safe procedure is by way of organic manures. A worldwide organic-farming cult has been formed to support this concept. The members of this group claim that the answer lies in the production of composts on a very large scale. They say that compost-treated soils produce plants that have much greater resistance to disease than those obtained by the use of chemicals and that they pass this disease-resistance on to animals and man. The seed of such plants are said to yield new generations of plants with continued high virility, whereas seed from fertilized plants "run out."

These organic-farming enthusiasts are seriously concerned about the very large waste that occurs by way of our sanitary sewers. They point to China, where farming has been going on for 40 centuries without the use of fertilizers. In view of the number of serious famines of the past in China and the conditions that obtain there at the present, one might well hesitate to follow the example of that country.

Our sewage systems are designed to be effective in terms of both economy and sanitation. They constitute one of the niceties of modern civilization. Investments in sewage-disposal plants in the United States are of the order of $10 billion. The wastes of half the population are carried through these systems. The effluent, containing the soluble nutrients, is poured into the rivers and oceans. Much of the sludge, collected separately, is barged out to sea, incinerated, or used for fill. Probably less than 25% of the human waste is returned to the land. Our annual loss in this material is equivalent to possibly 4 million tons nitrate of soda, 2 million tons superphosphate, and ½ million tons muriate of potash.

In a few cities, activated sludge, the result of forced aerobic decomposition, is produced for fertilizer purposes. The best example of this is in Milwaukee, where some 50,000 tons of Milorganite are produced annually. The revenue from the sale of this product is about $1½ million, which covers about half the cost of the operation.

Elaborate schemes have been proposed for the utilization of the sewage from New York City on the million or more acres of sand around Atlantic City. A study of the possibility of using the effluent from Philadelphia on land within a 40-mile radius on the New Jersey side of the city indicated that the installation cost would be $200 an acre and upkeep $15 to $20 an acre annually thereafter.

But in any such scheme the problem of sanitation is serious. There is danger both for those who work the soil and those who eat its produce. Much of the sewage from industrial centers carries substances that are highly toxic to plants. Furthermore, the costs of reclaiming and using both sludge and effluent are so high as to be a serious deterrent, and would require heavy federal subsidies.

Chemical Soil Amendments Play Important Part

A great many very intelligent men have studied the problems that are involved in maintaining and increasing the productivity of land. Most of them have come to the conclusion that development of the lime and fertilizer industries constitutes the most important advance ever made in the direction of providing plenty of good food. So effective are these chemicals that they are now being used in the United States alone at the rate of over 46 million tons annually. This is enough to fill four solid lines of 40-ton freight cars extending from New York to San Francisco. Instead of being a gigantic fraud, as the organic-farming enthusiasts would have us believe, they stand between us and any possible deficiency of food for centuries to come.

Only a few points in support of the use of chemicals as soil amendments can be presented in this statement. Both art and science played important parts in their development. The Romans knew, 2,000 years ago, that lime and wood ashes were effective in increasing soil productivity. Bones became an important article of commerce over 100 years ago. The natural nitrate of Chile became a popular soil amendment early in the nineteenth century. These materials found highly important places as supplements to animal manures, bird guanos, and human wastes. but all of them put together failed to meet the ever-growing needs of our rapidly increasing populations.

Fortunately, chemists and geologists came to our rescue. Chemists analyzed plants and calculated their nitrogen and mineral needs. Geologists set about the task of locating stores of these elements for replacement purposes. Abundant supplies of limestone, phosphate rock, and potash salts were found in ancient seas that are now dry land. Work was begun immediately to prepare these materials for use on the soil. Methods were developed for capturing nitrogen from the air. These fertilizer products are as *natural* as any other products on earth.

The health of our people has improved in almost direct proportion to the increased use of chemicals on the soil. Ours is one of the most healthful countries on earth. Life expectancy at birth has increased from 40 years, a century ago, to 67 years at present. So far as can be determined by this or any other known test, there is nothing fundamentally wrong with the chemical method of supplementing the organic manures that are being used on the land.

(To be concluded)

Splintered Acres

(*From page* 5)

others own several tractors of different power ratings so as to handle the varied tasks on member farms. Some of them do heavy plowing for farmers with crawler type machines, and then the farmers do the easier field tasks with horses and light tractors.

In diversified peasant-farming areas practically 100 per cent of the few combines which have been in use for the past three years are run by cooperatives. Similarly, co-op spraying equipment is used. One of these local units north of Paris has even begun to dust crops with a helicopter.

THESE local operating cooperatives belong in turn to larger regional set-ups, and they finally fit into a national union. The unions provide repair and heavy duty maintenance services for the local farmers everywhere. The one near Moselle is operating such service and procuring spare parts as well as new machinery. It keeps accounts for the locals and tends to the insurance details. It even runs a foundry for replacement of used plow points.

Few financial worries fret the French machinery co-ops. Probably two-thirds of their capital comes from loans granted by the national farm credit union, called Caisses de Credit Agricole. The factor of depreciation of equipment bothers some of the co-ops because members do not exactly grasp its true meaning.

ONLY a few of the older farmers find it hard to adjust to the new ways brought to them in the machine age. They often voice the fear that machines will deprive them of active jobs. The high price of oil and gas hovers like a threat over some of them, as they recall the occupation period in wartime when they could only run their tractors one day each month and had to resort to animal power again. They hope this won't happen now, but it halts the move to replace draft animals with machinery. Cows in many areas of France and Germany have their valuations ranked in terms of power, then meat, manure and finally milk. This must be changed to a greater emphasis on products from livestock.

One reason for success of these machinery units lies in the desire to maintain family-sized farms. This is because they place within the reach of the small farmer many advantages hitherto restricted to the large and wealthy operators.

TURNING to Wurttemberg-Baden in southern Germany, more notes on land use were obtained from Joseph B. Keim, extension leader with the food, agriculture, and fisheries division of the U. S. military government. Mr. Keim hails from Pennsylvania and is on leave to help set up practical extension work in that province, which is the second greatest food deficit zone of Germany.

The need for land consolidation to speed up mechanization is widely recognized and forms a major plank in a diversified extension plan now getting well started, with German youth aiding. The trouble is that the Nazis tackled this job and failed, and only through painstaking local demonstrations in the village land centers will any progress be possible.

THE usual approach has been through what the Germans called "flurboreinigung," or cleansing or adjustment of the fields. Its main positive results have been to straighten out the edges of the small strips and to eliminate a few cart roads. In spite of much expenditure of time and funds, the fields have been splintered apart faster than they could be cemented. Some of this arises from using the bureaucratic method, a sort of "perfectionistic" approach. German leaders, now sure that their agriculture faces bankruptcy under world competition and old costly systems, are happily joining the U. S. forces to reach farmers via conferences, meetings, educational material, and radio.

With 60 farmers I visited the village of Raunberg in the Heidelberg Kries. This area, centering in the stone cottage hamlet, has 229 operators of land totaling 1,150 acres. Friedrich Wilhelm Fischer, a leading farmer there, has 15 acres of land divided into 52 separate strips. He has six cattle, including two milk cows, eight hogs and eight pigs, and one horse. His cows averaged 8,150 pounds of milk a year, 3.7 per cent butterfat.

Fischer uses a seeder, a hay rake and mower, a motor sprayer, and a cider press and grape press. His regular daily labor force comprises himself and wife, a daughter, and a hired man. Three times weekly he employs one extra man and his wife. The map of his farm in relation to the entire commune was furnished by Mr. Keim. It shows the usual hopeless scattering of the tracts and the distance traveled to and fro and round about.

AS elsewhere in central Europe, the yields per acre are good. In fact, for the whole province itself the main crops give higher average yields than do those of Pennsylvania—but at a cost in wasted effort that seems pitiful to modern farmers. It all depends on the point of view.

A German law has been drafted to provide a short-cut land consolidation method, as well as a complicated standard plan something like the original used in France. Best present hope lies in the active extension demonstrations with machinery that help the farmers to take the first steps toward improvement. These are proceeding fairly well but are limited by lack of funds. Machinery dealers follow the demonstrations and often get orders for hand tools and a few larger machines. In any event, the volunteer, democratic way of influencing farmers through teaching and example is the only logical process—a great relief to those so used to being regimented.

There's hardly any need to say how much the American farm tourists in Europe observed these evidences of the real need for modern motive power in farming, and how stoutly they insisted on immediate "reform." In a way, it's funny business. You see, our cash-crop farmers are in a surplus dilemma for the time being, and they want to see every legitimate export avenue used to sell excess wheat, cotton, and tobacco abroad. Meanwhile all steps taken with good results in getting the European farmers to produce faster and easier aim a direct blow at the European market for surplus farm crops grown in this country. However, there may be another and a brighter side to it. In a long-time outlook the general prosperity of Europe and the raising of their standards of living will be felt indirectly over here.

AT any rate, few of the men I visited with in Europe had the slightest reluctance to boost for bigger production and more power machinery over there. I guess it traces back to a sort of international fraternal feeling between men of the land. They do not hold back secrets from each other as far as knowledge of greater production and mechanical short cuts. Unlike industrial schemers and inventors, new facts and new methods are not kept under lock and key for a few monopolists. Yet the competition is often really fierce and keen between farmers, despite their open way of doing business.

So we find the tradition repeating itself as far as our attitude toward European agriculture. Our farmers are zealous missionaries, vocal supporters, and strong endorsers of all the good ways of work and the achievements of life. They want to pass them on to brethren across the ocean—whose misfortunes have been magnified by war's alarms and the prejudice of ancient customs.

A tobacco farmer was asked why he refused to allow his daughter to enroll at college.

"Wal," he replied, "I started gittin' mad when they told her to go to the Registrar's Office to matriculate, but by cracky, I shore put my foot down when they said she had to use the same curriculum as the men!"

* * *

POKER FACES

The dining car waiter had taken the customer's three 1-dollar bills in payment for a $2.40 dinner. Presently, the waiter returned the change—a 50-cent piece, and a dime. The customer, a dour man, looked first at the change, then at the waiter's immobile face. He rose from the table, puffed on his cigar, picked up the half dollar, glanced again at the waiter—with a cool eye.

"It's all right, boss," and the waiter grinned from ear to ear. "I wins mo' times than I loses."

* * *

"Why did you strike the telegraph operator?" asked the patrol officer of the gob who was summoned for assault.

"Well, sir, I gives him a telegram to send to my wife, an' he starts reading it. So, of course, I ups and gives him one."

* * *

A bus repairman was filling out a report on a highway accident. When he came to a question, "Disposition of Passengers?" he candidly wrote: "Mad as Hell."

"Well, Dinah, what does the doctor say is the matter with you?"

"Why he tells me dat I'm sufferin' from hardenin' of de artillery, an' lan' sakes, I ain't even been neah no ahmy camp."

* * *

ASK FATHER!

Mother was absent from the dinner table; so Dorothy, aged seven, sat in her chair and pretended to take her place.

Father was watching the child's solemn assumption of matronly airs with ill-concealed glee, when her brother challenged her position with the remark: "So you're mother to-night? Well, if you're mother, tell me —how much is six times nine?"

Calmly and without hestitation, Dorothy retorted, "I'm busy—ask your father!"

* * *

When the teacher asked Johnny what George Washington was noted for, he surprised her by replying, "His memory." "Why do you think his memory was so great?" she inquired. Replied Johnny: "Because they erected a monument to it!"

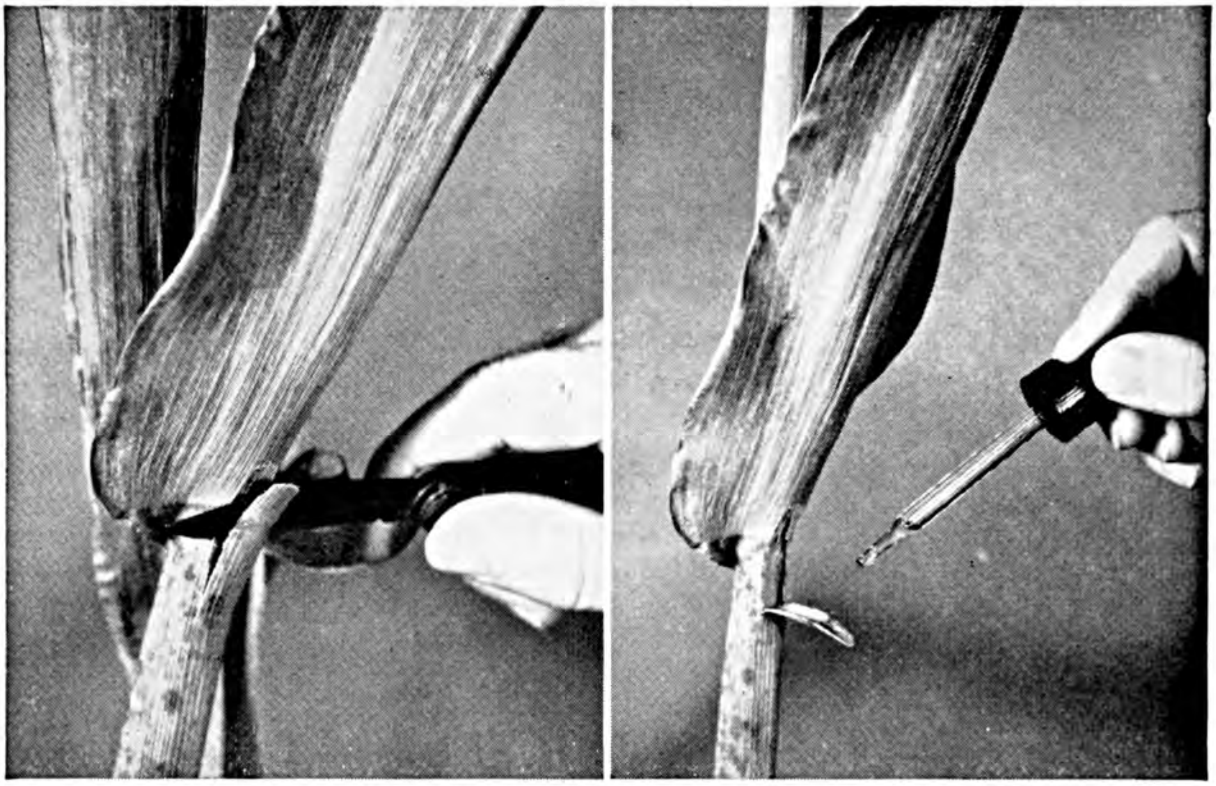
* * *

Asked for a good definition of home, a traveling man replied, "A place where a man can scratch any place that he itches."

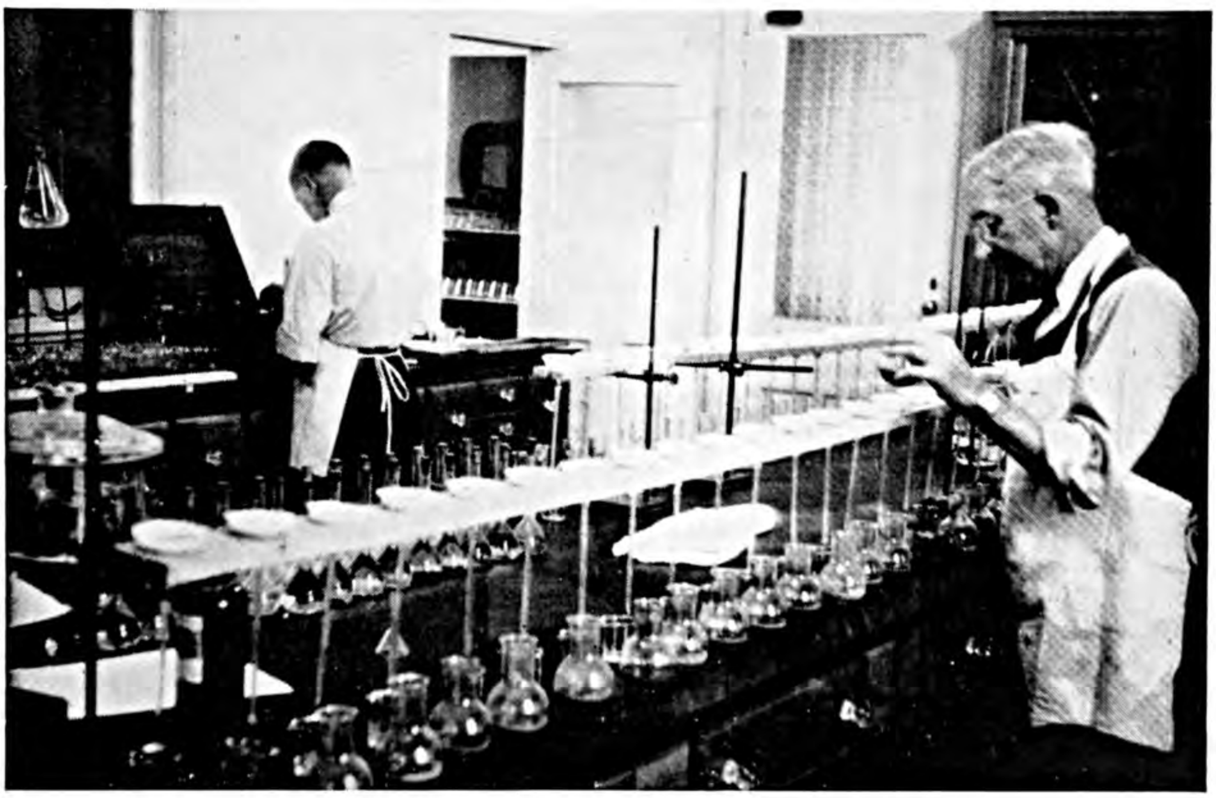
* * *

"Are you really ill?"

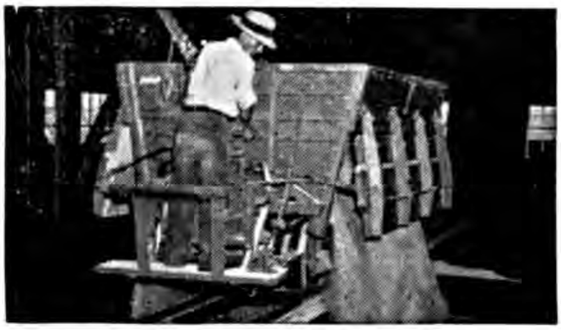
"Say, I'm so full of pills the doctors can't operate—I keep rolling off the table!"



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.



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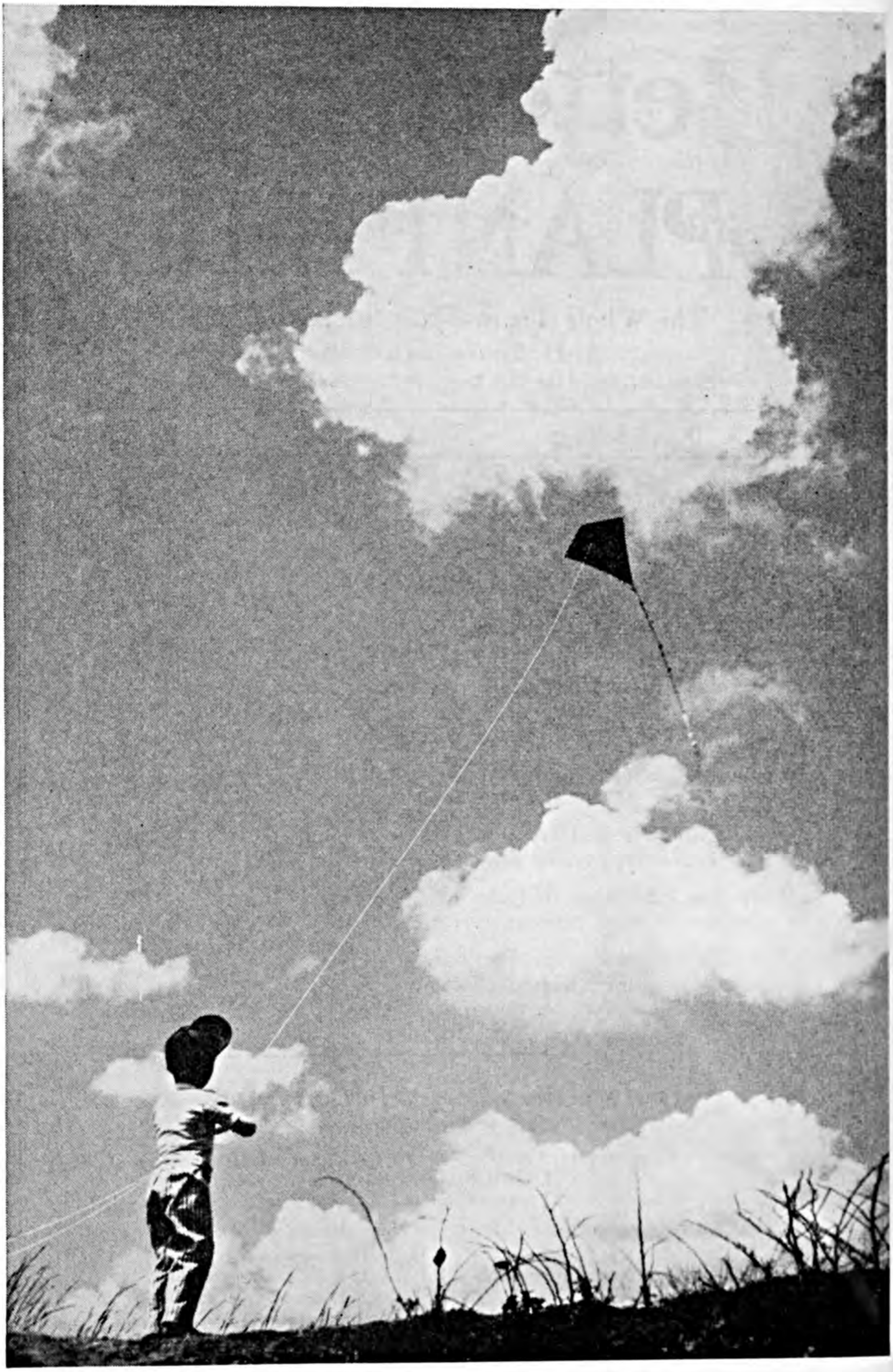

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VOL. XXXIV WASHINGTON, D. C., MARCH 1950 No. 3

Dutch Farmers Say . . .

Here Overstecken!

Jeff McDermid

WHEN you're in Holland you do as they do in the Low Countries—you obey the signs at street crossings and bridgeheads that say: "Here Overstecken," (Step Across Here). The doughty Hollanders are always "overstecking" their canals. Some canals curve and meander through ancient city streets that remind you of the craftsmen of the Hanseatic League, buildings with high peaked roofs and neat and weatherworn half-timbered gables having sturdy projecting beams for elevating heavy loads to upper floors. These urban canals are alive with chugging boat traffic—even brilliant flower barges. Their side-walls are well buttressed, while the stone pavements slope down to the watercourses, as a rule without any barriers to stop a headlong plunge. (Probably these Dutchmen never get dizzy.)

These weaving city canals often boast arched bridges and also an occasional set of locks. But the canals out in the level, verdant open countryside are usually straight as a ruler, with grazing cows, a few goats, and the fast diminishing windmills to make the tourist remember the blue designs on his delftware. Here, as in the cloistered towns that reflect the Middle Ages but live very much in the present, there are always the bridges and the tiny single catwalks thrown across the rural waterways.

I regard this happy phrase I have chosen at random—Here Overstecken—as a real symbol of the purposeful attitude and the devotion and courage of the Netherlands. Despite all injustice and the war's grievous blunders and ruination, and in the face of setbacks and disconcerting events, the Holland spirit steps over and across them all to a fresher and a better opportunity—even if it has to start all over again. No matter what comes, the Dutchman will always "overstecken," and keep his feet dry besides.

I dare say that Holland grows good field and forage crops and milks cows on types of "sunken" land that would not be considered a safe risk for most American drainage experts. I know that they grow excellent crops on other soil types of silt and sand that are above the water line, yet still would not be regarded with much favor by knowing farmers of our land.

I also know by observation that they diversify and develop and engineer things with a baffling skill and sturdy spirit of cooperation which make for rapid recovery from a series of disasters that our own country has, fortunately, thus far escaped.

I likewise know from personal touch that too little of the real Holland is known in America, where our ideas have been taken from old prints and old stories—some of them of doubtful truth. For example, I tried very hard to locate some genial Dutch informer who would verify the legend oft told me in my classrooms about Hans, the heroic boy in wide breeches and wooden shoes, who found a treacherous break in the dyke one evening, and who stuck his finger in the hole and kept it there all night long—finally saving the town from washing away and thereby becoming the toast and the boast of the era. One and all, they shook their sage heads and smiled. "Never heard of it."

But for every disappointment at the loss of a legend, we gain genuine admiration for the things which are true —and Holland is indeed a nation of builders and dreamers who make the most of everything and never think of depending on others as long as their own will to do and the materials at hand can turn the trick.

Just within the few days we spent in the picturesque rural areas of the peninsula north of Haarlem and Amsterdam, we easily proved the old truism that fact is stranger than fiction. First off, we went to the largest flower auction market in Europe, located at Aalsmeer. Barges loaded with gorgeous bloom ply the ancient canals and newer waterways, all moving to Aalsmeer's cooperative salesrooms, and there are joined by countless overland trucks heaped with the roses, carnations, dahlias, and mums, to be taken before the buyers in the amphitheater.

From there we left with regret to study the farming practices on one of the older reclaimed areas of Holland, called Haarlem meer polder, where we clustered around P. K. Kistemaker in a storage shed to hear him relate the early trials of those who did the first farming and soil improving there. Afterwards we went to learn a little more about the quality of the cattle and the methods of keeping records on them, taking Ruiter Bros. ranch near Oosterblokker adjacent to Hoorn as an example.

AT the midday interval we all sat around long tables in the hotel at Middenmeer, where we partook of a delicious luncheon with ample portions of that mild looking potage with a wallop in it, sometimes call schnapps. We wondered if Rip Van Winkle derived his twenty years rest from copious draughts of a similar Dutch liqueur. The display of crops and forages raised on the polder of Wieringermeer engaged our immediate attention while we heard the remarkable story of the way in which this war-flooded zone of 50,000 acres had been restored to agriculture within a year after the ravaging tide of silt-laden debris had been drained off again.

To reclaim the Zuider Zee in the name of agriculture is a far different method of "claiming" new empires than existed when men sailed to distant lands and planted flags on lonely beaches. In many ways, the Dutch method of creating new land out of the floor of the ocean itself is a more creditable performance than that of Cortez or Columbus perhaps. It would at any rate be a fine subject for one of those educational debates which

we often engaged in back in our high-school days.

To turn the great watery areas of the mammoth Zuider Zee into new acres for man's subsistence required modern engineering applied to jobs that began away back in the 12th and 13th centuries—when the Hollanders of that distant era began to reclaim northwestern estuaries. First, to stop the encroachment and the pressure of the ocean itself, they built a huge enclosing dam of concrete and steel running from the North Holland coast at the westward, via Wieringen Island, out eastward to the Friesian coast. We stood on top of that mighty rampart, erected not to defend against guns and bombs, but to protect the land to be drained and fertilized so that mankind might partake more generously of the food that nature provides. I was far more thrilled with this great stretch of masonry mileage than I was at seeing some pillboxes on the old Siegfried line.

Having shut off the wildest waves and set up valves to control them and to let water in and out at will, the planners fell to with a vim and plotted out the Wieringermeer polder and three other ones in that area, the last of which is being finished with Marshall Plan aid. The entire project will when completed add 543,000 acres to the productive power of this ancient, aquatic land. Temporarily the most of the wheat, oats, barley, hay, and truck crops raised thereon are under Government account but many population centers are growing fast and farms are being leased to qualified operators—with all buildings erected under official supervision. Cattle are not relatively numerous thus far in the reclaimed zone, although the lighter sandy areas seem to have more of them than the heavy loams and clays suited best to staple food crop production.

Within the present century the population of Holland has almost doubled. No wonder they hunt for more food in peaceful fashion by making the most of the least, or as our 4-H clubbers say, by "making the best better." During this interval of 50 years, in which the consumers grew from 5 million to 10 million, the productive food area of the country increased but 11 per cent. Even with the newly created farm land in the Zuider Zee polders, it leaves the nation with less than 6½ million acres suited for the plow. Hence each hungry mouth in Holland has less than three-fourths of one acre to support its needs. And by all the best authorities we consulted over there, the limit to further expansion has been nearly reached.

YET with a population so crowded that there are 700 persons to the square mile, the Netherlands has maintained its outstanding record for high quality agricultural goods and a very intensified and successful farm-management system. Moreover, this situation has been the reason for a high degree of specialization—experts in seeds, nurs-

(*Turn to page* 48)

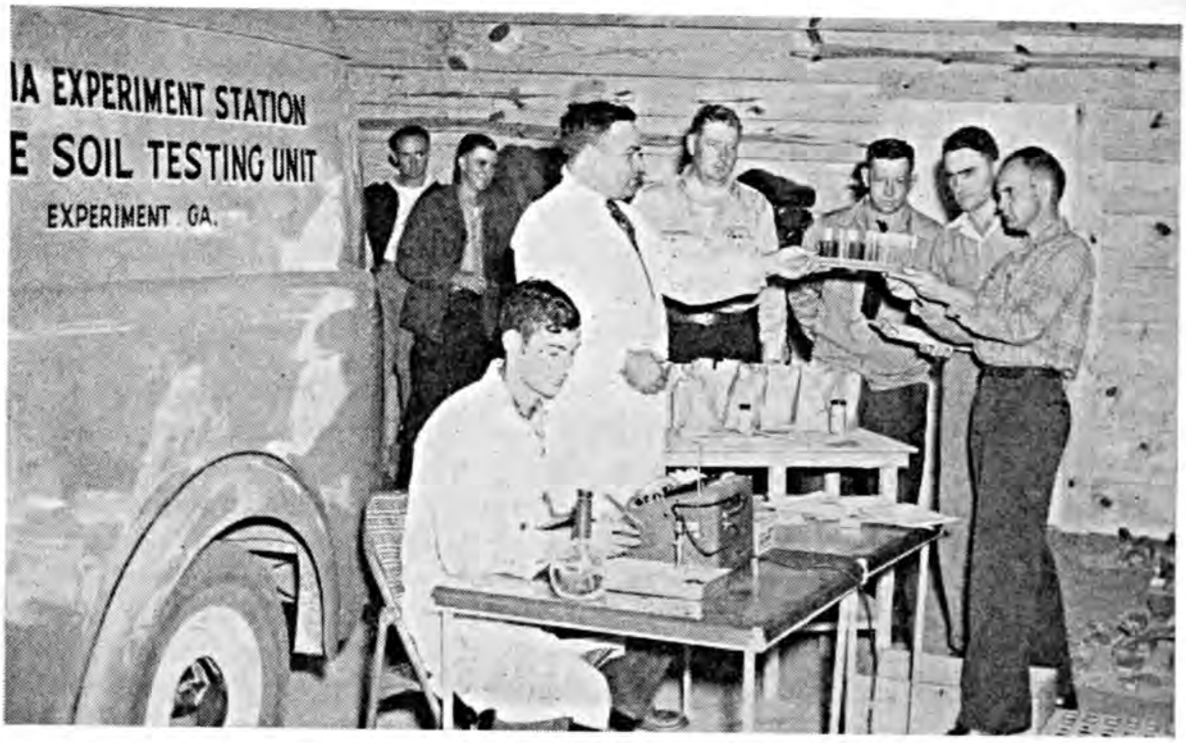


Fig. 1. The author and his assistant testing soil for a group of farmers in Madison, Georgia.

Soil Testing in Georgia Is Rolling Onward

By L. C. Olson

Soil Chemist, Georgia Experiment Station, Experiment, Georgia

SINCE the soil-testing program was begun at the Georgia Experiment Station in 1938, its popularity has grown rapidly. During the early years of this service only a few hundred samples were analyzed annually for fertilizer and lime requirement, but during the last few years 15,000 to 20,000 samples are tested each year. This work is done in two laboratories, one at the Experiment Station at Experiment, and the other at the College of Agriculture in Athens.

There are several reasons for the increased demand for this service by the farmers and growers of the State. Without the use of reliable methods of analysis and accurate interpretations of the results based upon a large number of field experiments, this program doubtlessly would have been a failure. In changing over from crops such as cotton and corn with which they were familiar to pasture and truck crops, growers have had to rely on soil tests and other information to determine the fertilizer and lime needs of these new crops. A general educational program in Georgia as well as in surrounding states has further pointed out the importance of soil testing to the farmer.

For the most part the soil-testing program in Georgia is similar to that being carried on in other states in the Southeast. Tests are made without cost to residents of the State for acidity, nitrogen, phosphorus, potassium, calcium, magnesium, manganese, and aluminum. A large percentage of the samples are collected by county agricultural agents, Soil Conservation Service personnel, teachers of agriculture, and other trained agriculturalists, although more and more farmers are becoming interested in collecting their own samples. Schools and short courses for the purpose of instruction in collecting soil samples are conducted in various parts of the State periodically.

Results of the chemical analysis together with an interpretation of the results and recommendations for the specific crop to be grown are sent out for each sample submitted. In the laboratory, the data for each sample are recorded on cards which are filed according to county. From these cards valuable information regarding the fertility status of the soils in various sections of the State has been obtained.

A recent innovation in soil testing in Georgia has been the introduction of a Mobile soil-testing unit. This unit, which is housed in a standard commercial panel truck, was put into operation on October 17 of last year. Since that date, 25 counties have been visited and several thousand samples analyzed in the unit. This laboratory is equipped with standard laboratory soil-testing equipment and the same tests are made on the truck as are made in the laboratory. One technician and one agronomist have been analyzing from 75 to 100 samples daily in this truck, and sufficient chemicals and supplies are carried for one week's operation.

Mobile Unit a Time-saver

One of the chief advantages of the Mobile soil-testing unit is that of saving from one to two weeks' time in getting the results of the analysis back to the farmer. The truck is located at a central point in the county and farmers bring their samples to the truck. While they wait, their samples are analyzed and the results and recommendations given to them. The educational value of this procedure is important. Many farmers have been convinced of the value of soil analysis by seeing their samples tested. Another advantage of this method of soil test-

(*Turn to page* 45)

Fig. 2. L. C. Olson giving recommendations for fertilizing pastures to C. E. (Tiny) Williams, Griffin, Georgia, well-known Angus breeder.

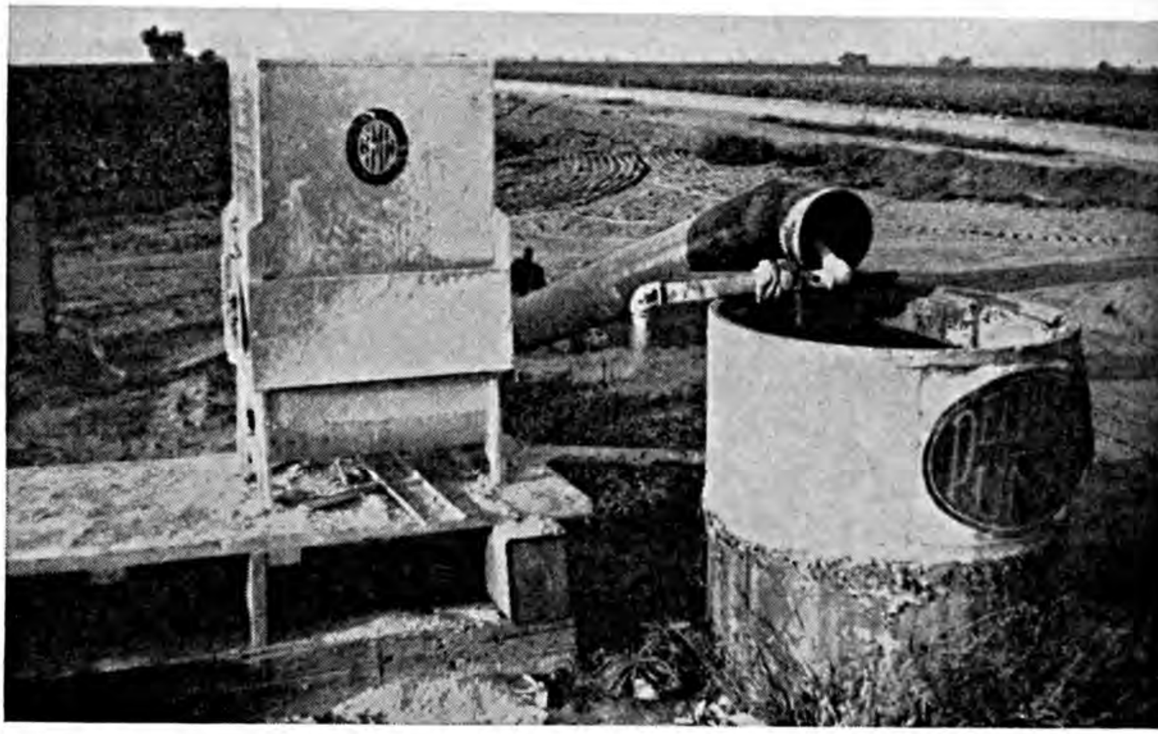


Fig. 1. Prizer Gypsum and Fertilizer Applicator set up to meter dry materials by water power alone.

Metering Dry Fertilizers and Soil Amendments into Irrigation Systems

By F. S. Fullmer

Corona Del Mar, California

THE application of dry fertilizer and soil-amendment materials through the irrigation system has increased rapidly in many sections of the West during the last few years. Although the first applicator capable of metering measured amounts of dry fertilizer materials into the irrigation stream was developed and patented 20 years ago, many of the advantages of this type of machine were not recognized until recently. During this early period the interest was mainly confined to the use of dry nitrogen materials. Even then, however, the use of anhydrous ammonia overshadowed this practice.

A number of factors have contributed to the recent development and use of machines designed to meter known amounts of dry fertilizer and soil-amendment materials into irrigation water. One is the marked increase in the use of nitrogen solutions, liquid phosphoric acid, liquid mixed fertilizers, and liquid soil amendments, in California, during the past few years (Table 1). The cost of equivalent amounts of nitrogen in the form of anhydrous ammonia and nitrogen solutions is approximately the same as that derived from dry nitrogen materials. However, in most cases, the water-soluble dry carriers of phosphate and potash can be applied at a much lower cost than the comparable liquid forms.

Within the last five years the Agricultural Extension Service of Kern County, California, working with the Department of Irrigation, University of California, found that under certain conditions adverse water and soil characteristics could be most effectively remedied by the application of gypsum to the irrigation water. As a result of this work, more than 500 gypsum applicators have been built and are now in use in Kern County. Irrigation water in this section is pumped from deep wells and most of the applicators are set up as a permanent installation, although there are a number of portable machines, that service a number of wells, now in use. Soluble dry fertilizer materials can be easily applied to the irrigation water through these same machines, and many growers are using the applicators for this dual purpose. The corrosive action of fertilizers, however, requires that the machines be thoroughly washed out after each use.

All chemical nitrogen and potash fertilizers can be satisfactorily applied through irrigation water, but the water-soluble phosphate materials are limited to ammonium phosphate (11-48-0) and ammonium phosphate-sulphate (16-20-0). The lack of adequate supplies of these soluble phosphates, during the past few years, has restricted the manufacture and use of water-soluble dry mixed fertilizers, but it appears that they will be more available in the future. Single and triple superphosphates have been used in open ditches, but the advisability of the application of these materials through closed irrigation systems is questionable.

There are two main types of machines available for the water application of dry fertilizers and soil amendments. The first type can, under many conditions, be operated entirely by water; while the second type is partially, or wholly, dependent upon power from other sources.

The Prizer Fertilizer and Gypsum Applicator (Fig. 1), manufactured by the Hooper Machine Works, Inc., Bakersfield, California, is an improved version of the original machine patented almost 20 years ago. A 2-inch intake pipe, with a control valve, conveys the water to one side of a double trough mounted on a pivot, which allows the trough to swing when one side is filled, bringing the other side into position for filling. The oscillations of the trough are communicated to a "shaker" at the base of the hopper which sifts a thin layer of fertilizer or gypsum into a basin below the double trough. The material is then washed, by the water from the dippers, into the discharge pipe. The rate of application is controlled both by the size of the slit above the "shaker" and the

TABLE 1.—TONNAGE OF LIQUID FERTILIZERS AND SOIL AMENDMENTS SOLD IN CALIFORNIA, 1943-1948, AS REPORTED BY THE BUREAU OF CHEMISTRY—CALIFORNIA DEPARTMENT OF AGRICULTURE

Year	Liquid Phosphoric Acid	Nitrogen Solutions	Liquid Mixed Fertilizers	Lime Sulphur	Sulphuric Acid
1943	1,101	....	967	....	....
1944	1,532	422	2,170	....	....
1945	2,552	1,722	4,310	....	....
1946	3,574	3,978	5,200	....	....
1947	5,174	8,883	7,744	....	....
1948	3,233	11,977	10,732	3,783	10,593

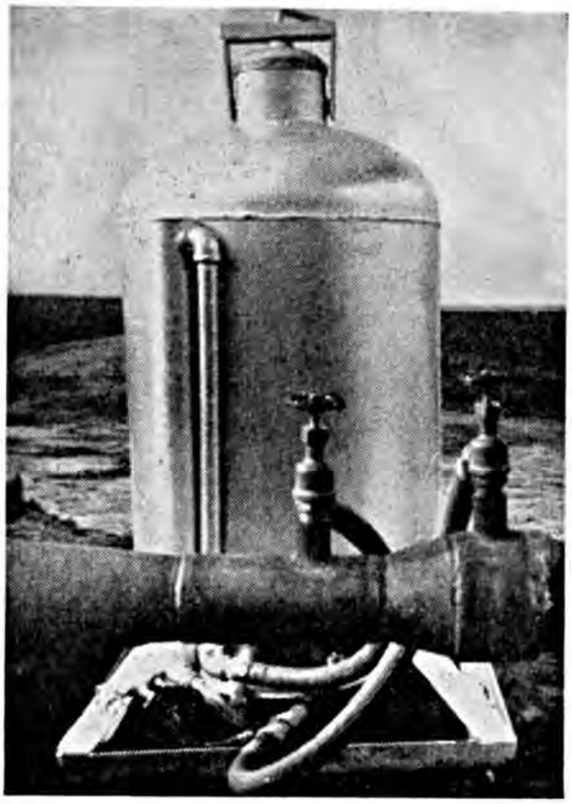


Fig. 2. Prizer "600" Pressure Type Applicator operating on 5-inch pressure line.

number of oscillations per minute of the trough, which is determined by the amount of water entering the intake pipe.

There are two sizes of the Prizer Applicator now being manufactured, and both are made from aluminum with monel bearings on the trough. The smaller model, which weighs 58 pounds, will hold approximately 650 pounds of gypsum, and with 11 complete oscillations of the double trough per minute, will apply a maximum of 400 pounds per hour. A larger model that weighs 120 pounds, and will hold 1,200 pounds of gypsum, will apply a maximum of 600 pounds per hour. By decreasing the amount of water entering the intake pipe, the machines will deliver as low as 20 pounds of material per hour.

The distance from the intake to the discharge pipe is 12 inches on the Prizer Gypsum and Fertilizer Applicator. Thus, this machine will operate on water power alone, under conditions where a 12-inch fall in water is obtained. In areas irrigated by gravity water, it is often necessary to draw water from the ditch by connecting a small centrifugal pump to the intake pipe. This machine is especially useful in fertilizing small acreages and is readily adapted to almost any type of irrigation system.

The Prizer Pressure Type Applicator capable of introducing solutions or suspensions of dry materials into irrigation water against high pressure, by utilizing the differential pressure developed by the flow of water through a venturi tube, is a development of special interest to users of sprinkler type irrigation systems. These applicators, ranging in capacity from 50 to 600 pounds, have been successfully connected to pressure lines varying from 2 to 6 inches in diameter. A typical installation consists of a venturi tube with two main valves connected on a 5-inch line just ahead of the booster pump (Fig. 2). The flow of water from the high to the low pressure valve passes through a sealed tank with a control valve. The rate of application of the dry or liquid material in the tank can be accurately regulated by the set of the control valve. If water is shut

Fig. 3. Dry-Flo Fertilizer Co. Applicator set up over irrigation ditch, prior to turning on water.

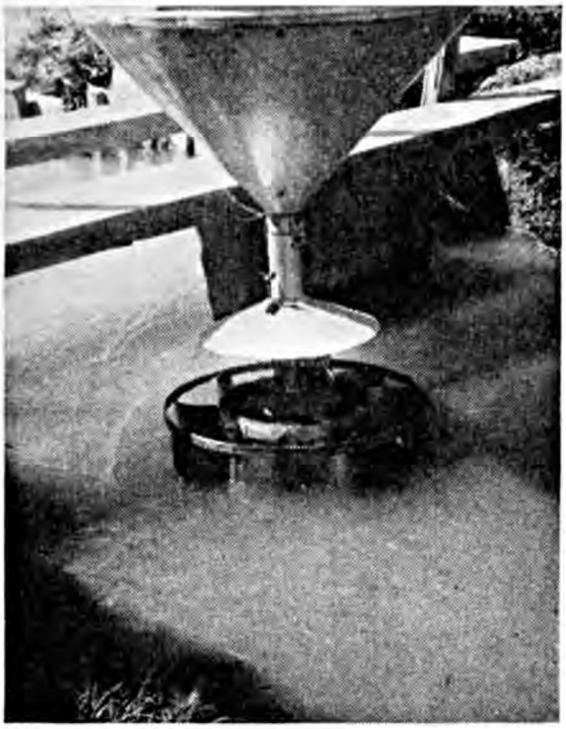


Fig. 4. Dry-Flo Applicator showing water operation of "squirrel cage" metering device.

off in the field, action stops as there is no longer a differential pressure between the high and low pressure valves of the venturi. The applicator is equipped with a translucent hose on the effluent side, making the flow of material into the line visible. It is possible to meter through this machine a large amount of fertilizer into the irrigation line in a short period. Thus, all of the fertilizer can be applied early in the irrigation period, allowing plenty of time to wash out the pipe lines and sprinklers.

Another Prizer Fertilizer applicator now used by the Dry Flo Fertilizer Company, Monrovia, California, was developed for areas irrigated by gravity water (Fig. 3). The machine is suspended over the main ditch, on a metal tripod, with the finned "squirrel cage" partially immersed in the water (Fig. 4). Fertilizer from the hopper passes through a 2-inch tube onto a plate, and as the "cage" rotates, the fertilizer is scraped into the water. The distance from the plate to the bottom of the delivery tube and the speed of the water in the ditch determine the rate of application.

Under most conditions, fertilizer is sold by the Dry Flo Company on an applied basis, although machines are also available to growers on a weekly, monthly, or acreage rental basis. The applicators are light in weight, easily set up and adjusted, will operate without the need of outside power, and serve a definite purpose in areas where frequent light applications of readily soluble fertilizers throughout the irrigation season are desired.

The Hydrator Fertilizer Side Dress Service Company, Goodyear, Arizona, also applies dry fertilizers through the irrigation water on a custom basis, at a fixed charge per acre. This company now has 25 machines operating in the Salt River Valley of Arizona and the Imperial Valley of California, and since February of 1946, more than 60,000 acres have been fertilized. A conveyor chain with a maximum of 37 buckets, each delivering approximately 50 pounds per hour, passes through the fertilizer hopper and drops the material into the mixing tank (Fig. 5). Water from the irrigation ditch is forced through the mixing tank at the rate of 50 gallons per minute by the use of a Briggs and Stratton engine and a Mallow centrif-

Fig. 5. View of hopper, mixing tank, suction and discharge lines of the Hydrator Fertilizer Side Dress Service Co. machine.

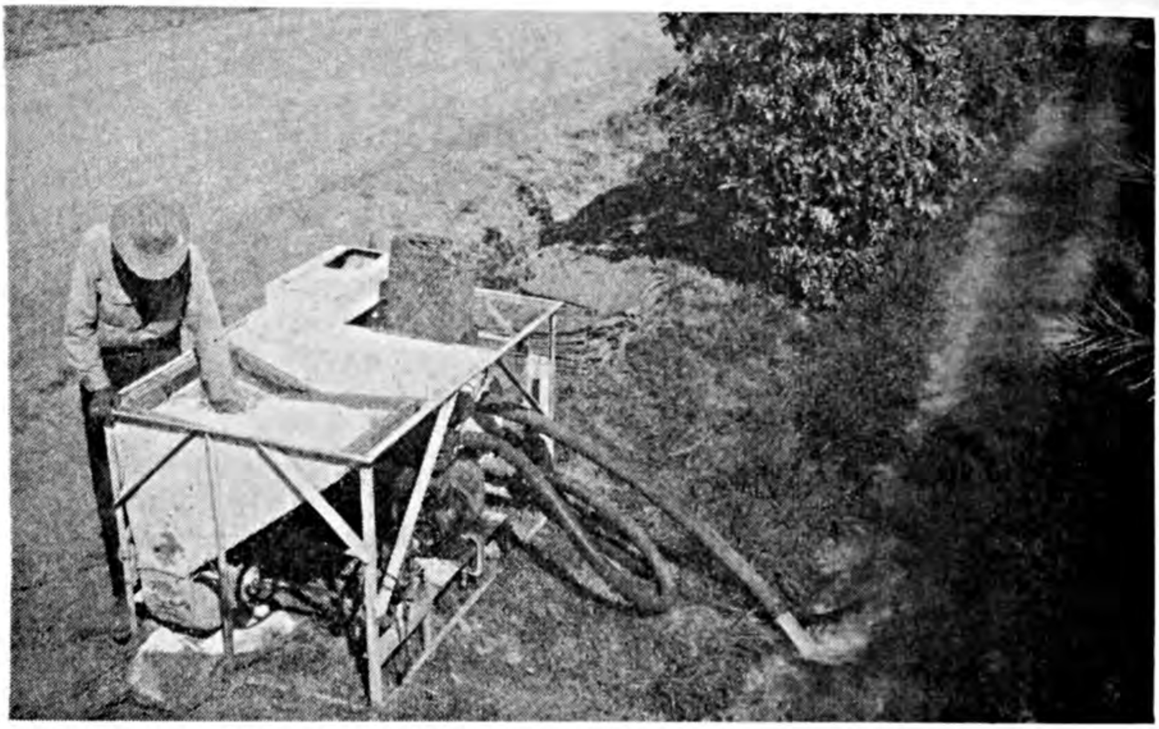


Fig. 6. General view of a Hydrator Applicator in operation.

ugal pump (Fig. 6). The buckets on the conveyor chain are removable, and the rate of application can be varied from 50 to 1,850 pounds per hour. By manually dropping fertilizer directly into the mixing tank, amounts up to 3,500 pounds per hour have been run through this machine.

Irrigation water in Kern County, California, is obtained from deep wells, and most of the gypsum applicators have been designed to fit into this type of irrigation system. The discharge line from the pump is tapped and a small pipe with control valve, connecting the line to the mixing tank on the

Fig. 7. Installation of E. L. Mitchell Gypsum Applicator at pump house, showing intake line and discharge line into irrigation stand pipe.

Fig. 8. Permanent installation of gypsum applicator manufactured by the Delano Engineering Co.

applicator, is installed. In most cases the gypsum suspension is pumped from the mixing tank, by means of a gas or an electric powered centrifugal pump, into high stand pipes or directly back into the irrigation line. With slight modifications, these machines can, and are, being used in areas irrigated by gravity flow water.

The E. L. Mitchell, Inc., Gypsum Applicator, manufactured at Arvin, California, consists of a hopper with nearly vertical sides to prevent "bridging" (Fig. 7). The entire load of the gypsum rests on an endless belt at the bottom of the hopper. A control gate at the discharge end of the belt may be adjusted to apply only a few pounds per hour, or as much as several hundred pounds per hour. The belt powered by a one-twelfth horse power motor and moving at a speed of 4 inches per minute, will deliver a maximum of 800 pounds of gypsum per hour. Under most conditions, it is necessary to pump the suspension from the mixing tank in to stand pipes. The most popular model has a small centrifugal pump operated by a one-third horse power electric motor attached to the discharge pipe of the mixing tank. A few machines with 1.5 H. P. air-cooled motors, that operate both the endless belt and the discharge pump, are also in use.

The Delano Engineering Company, Delano, California, is producing a stationary type of gypsum applicator (Fig. 8) and also a portable model mounted on wheels. The bottom plate of the hopper is rotated by means of a cam-operated ratchet against teeth cut on the outside of the plate. As the bottom plate rotates, the gypsum is measured into a stationary box by means of an adjustable gate, and is then carried to the mixing tank by

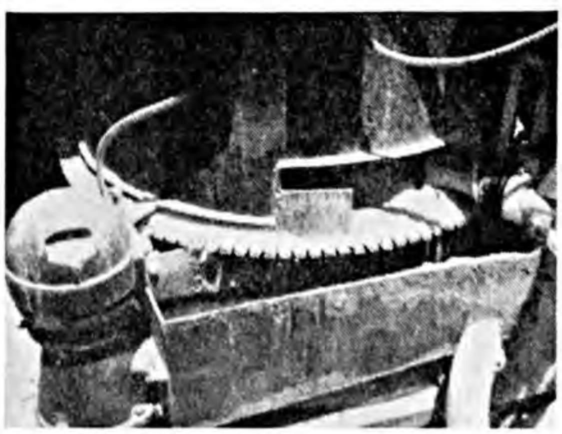


Fig. 9. Dry material being metered by means of rotating bottom plate and worm gear into mixing tank of Delano Engineering Co. machine.

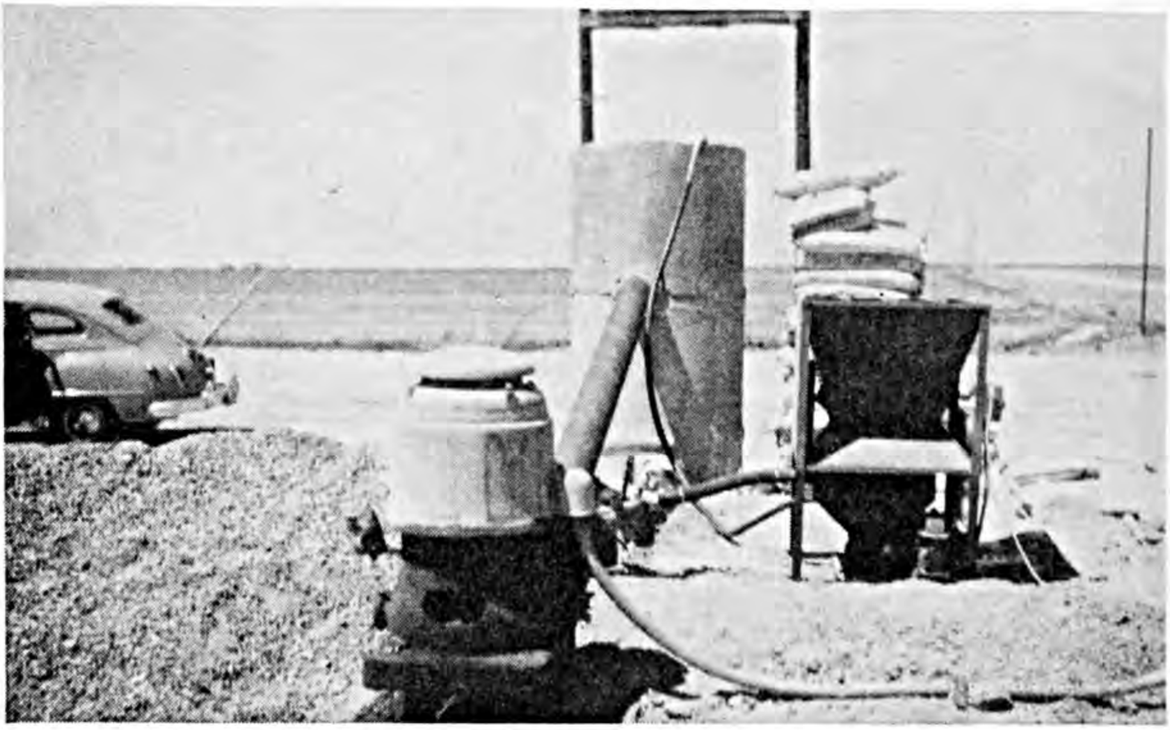


Fig. 10. Vanderlei Gypsum Applicator showing intake and discharge lines.

means of a worm gear (Fig. 9). The applicator holds 1,100 pounds of gypsum, and at a plate speed of 7 inches per minute will deliver a minimum of 5 pounds and a maximum of 1,000 pounds of gypsum per hour. The discharge pump, which does not need priming and is powered by a one-half H. P. motor, will deliver 55 gallons per minute, with a 15-foot lift. The intake from the well pump line is regulated by a valve that maintains a constant level in the mixing tank. The latest models of both the electric and the gas powered machines are direct drive operated, by means of gear reduction boxes, which eliminates the need for belts or chains.

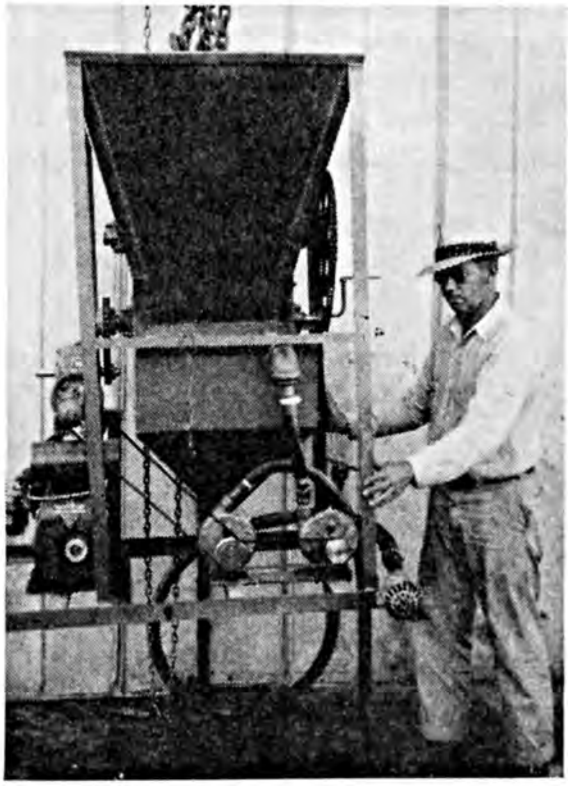


Fig. 11. Portable model of Vanderlei Applicator, showing details of construction.

Gypsum is metered into the mixing tank of the Vanderlei Gypsum Applicator, manufactured at Bakersfield, California, by the action of a worm gear directly over a series of adjustable holes in the bottom of the hopper. An agitator above the worm gear prevents "bridging." The present model delivers a maximum of 400 pounds of gypsum per hour, but this rate could be considerably increased if necessary (Fig. 10). The agitator, worm gear, and a discharge pump capable of delivering 30 gallons of water per minute with a 15-foot lift, can all be driven with a one H.P. electric motor or a 1.5 H.P. gas motor. The portable model (Fig. 11) has been equipped

(*Turn to page* 40)

Food for Thought About Food[1]

By Firman E. Bear[2]

(Conclusion)

SOILS in humid regions, as a result of long-continued leaching by heavy rainfall, tend to become hydrogen soils. The corrective is limestone, which is prepared for use either by pulverizing or by burning. The point toward which we strive in the soils of humid regions is a pH value between about 6.0 and 6.5, except for certain acid-soil plants that do best at somewhat lower levels. Some 30 million tons of liming materials are being used annually in the United States, and much larger tonnages could be applied to advantage.

In the irrigated arid areas, sodium soils tend to be dominant. The corrective for this condition is gypsum, together with the use of enough extra irrigation water to provide drainage. It has been suggested that irrigated saline soils should receive 1 ton of gypsum per acre annually and black alkali soils 2 tons, and that a 200-pound-per-acre application be made to all other irrigated soils of arid areas as a preventive measure. On this basis, some 10 million tons of gypsum might well be used annually to advantage.

A profitable agriculture requires the production of higher acre yields than are possible if one depends on Nature. The need for more nitrogen is of special interest in this connection. About 5 million tons of this element are being removed annually in the harvested crops in this country. Farmers in the Central West assume that, by plowing under an occasional crop of clover, they can replace the nitrogen they sell and that which escapes in the drainage water. They fail to realize that the remarkable increases in acre yields of corn resulting from the use of hybrid seed were obtained largely by raising the starch and lowering the protein content of the grain. Recently the need for

". . . Recently the need for more nitrogen has been re-emphasized by the phenomenal increases in corn yields that are being obtained in the South by stepping up applications of fertilizer nitrogen . . ."

[1] Presidential address, 1949 annual dinner, American Society of Agronomy, Milwaukee, Wisconsin, October 26, 1949.

[2] Research specialist in soils, Rutgers University, New Brunswick, N. J.; Past-president, American Society of Agronomy.

more nitrogen has been re-emphasized by the phenomenal increases in corn yields that are being obtained in the South by stepping up applications of fertilizer nitrogen to as much as 100 pounds of the element per acre.

There is plenty of evidence that the nitrogen content of the soils of the great corn, wheat, and cattle lands of this country is steadily decreasing. And there is equally abundant evidence that applications of fertilizer nitrogen over this entire area would work wonders in increasing crop yields. In fact, the estimated annual present need for commercial nitrogen, in terms of recognized deficiencies of the element, has been set at 1,160,000 tons by one of our governmental agencies. This is 50% more than our present consumption. But we have the techniques for getting this nitrogen out of the inexhaustible supplies in the air, and they are being ever more efficiently applied.

The plow depth of the average acre of soil contains only about 1,000 pounds of phosphorus. Deficiencies of this element are so widespread that it has become the key element in fertilizers. Fortunately about 50% of the world's known phosphate deposits are in continental United States. These contain an estimated 13 billion tons of phosphate rock. By reason of its good effects, we have been pouring superphosphate on the soil as though the deposits of phosphate rock from which it is made would last forever. Early in the century, consumption of phosphate was speeded up greatly under the slogan of higher-analysis fertilizers, merely by replacing filler with superphosphate. Now a similar movement has been started to report fertilizer constituents in terms of percentages of the element, which would give phosphorus a further boost.

Large amounts of phosphate are being wasted by excessive applications in the more intensive farming areas and by its indiscriminate use on other land that is subject to serious erosion. But large areas of our crop-land that are badly in need of phosphate have yet to receive their first application. The estimated current need for phosphorus is about 1¾ million tons of the element, which is about twice the present consumption. At the present rate of use, our phosphate reserves would last about 3,000 years. Unlike nitrogen, there is no inexhaustible supply of this element in the atmosphere.

The potassium problem is much simpler than that of either nitrogen or phosphorus. The average plowed acre contains 30,000 pounds of potassium. This is 10 times the soil's supply of nitrogen and 30 times that of its phosphorus. The potassium content of soil tends to increase with depth, whereas the nitrogen and phosphorus contents decrease. Thus the soil itself is practically an inexhaustible source of this element. Whatever difficulty plants may have in extracting as much potassium from the soil as they need, the fact remains that the element is there and something could be done toward increasing its availability in case of necessity. But, in most cases, this would be a very costly procedure.

Fortunately, there are enormous reserves of potassium in water-soluble form on which we draw. At our present rate of consumption, totaling about 800,000 tons of the element annually, the known deposits in the United States, amounting to about 1 billion tons, are enough to last about 1,250 years. Our present consumption is only about half the estimated need. But every cubic mile of ocean water contains about 1¾ million tons of potassium. If the price of potash salts should rise to about twice their present level, sea-water potash will enter the picture.

Some Soils Deficient in Minor Elements

Early in the twentieth century it became apparent that additional minor elements were required. At first these were limited to manganese and boron, but later it was shown that zinc, copper, and molybdenum also are essential to plants, and iodine and cobalt to animals and man.

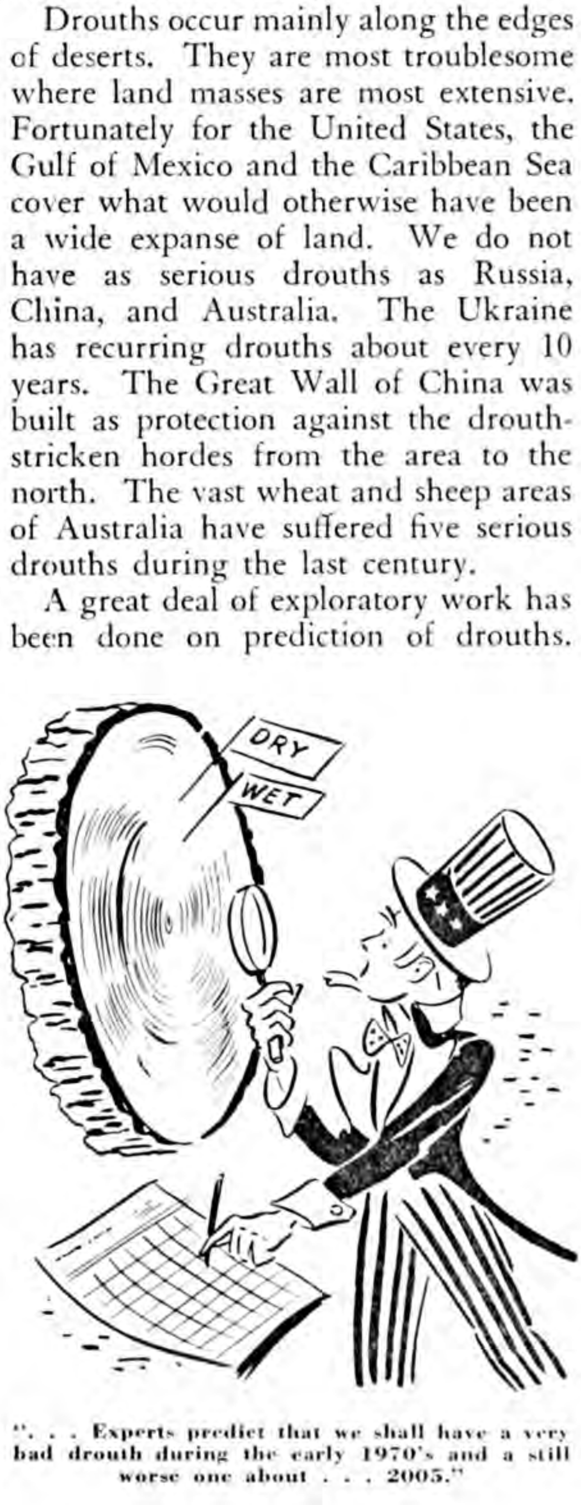
Our best example of the importance of minor elements is found in Florida. In the early days, the citrus industry was located largely in the northern part of the State. Then it was found that oranges would grow well on rough lemon stock. This allowed expansion of the industry southward on the more sandy soils, where freedom from frost was greater. About the time these new plantings came into bearing, a period of declining prices developed. This caused grove owners to switch from guano, animal tankage, and similar organic materials to the much less costly inorganic forms of nitrogen. Meanwhile, potash fertilizers had been greatly refined and bone had virtually disappeared from the market. This combination of sandy soils and inorganic fertilizers of an ever-higher degree of purity quickly began to have disastrous effects. Fortunately, our agricultural research agencies soon discovered that deficiencies of boron, copper, zinc, manganese, and magnesium were responsible for the trouble. Now these elements are regular constituents of most Florida fertilizers.

The need for minor elements is augmented with each year of increase in the agricultural age of the soil, with each step-up in acre yield, and with each move toward further purification of fertilizer salts. The supply of minor elements is limited, and economy in their use is essential. Fortunately, manures, sod crops, and cover crops serve both as sources of these elements and as agents for their solubilization in the soil. Waste is being reduced by applying the scarcest of these elements in spray form, either alone or in conjunction with insecticides and fungicides. In the event of exhaustion of the land supply of these elements, they can be obtained, in conjunction with potash salts, from the inexhaustible reserves in seawater.

The United States has experienced three serious drouths. They occurred in 1860, 1893-95, and 1930-38. During the 1893-95 drouth, about 90% of the settlers in the Great Plains area abandoned their farms. During the latest drouth, wheat production in Minnesota, Iowa, North Dakota, South Dakota, Montana, Nebraska, Kansas, Oklahoma, and Texas was cut in half and corn production was only one-third the pre-drouth average. Drouths favor grasshoppers, and the loss from these insects for the 1934-38 period was estimated at more than $315 million.

Drouths occur mainly along the edges of deserts. They are most troublesome where land masses are most extensive. Fortunately for the United States, the Gulf of Mexico and the Caribbean Sea cover what would otherwise have been a wide expanse of land. We do not have as serious drouths as Russia, China, and Australia. The Ukraine has recurring drouths about every 10 years. The Great Wall of China was built as protection against the drouth-stricken hordes from the area to the north. The vast wheat and sheep areas of Australia have suffered five serious drouths during the last century.

A great deal of exploratory work has been done on prediction of drouths.



". . . Experts predict that we shall have a very bad drouth during the early 1970's and a still worse one about . . . 2005."

Studies have been made of tree rings, silt deposits, and advances and retreats of glaciers. There is considerable evidence of a 35-year cycle, during which the climate varies from a period of cool wet years to one of warm dry years, and back again. This is known as the Brückner cycle, from its author, who predicts that we shall have a very bad drouth during the early 70's and a still worse one about the year 2005.

There are possibilities for the prevention of undue loss from drouth through the development of soil-management systems that are designed to increase the water-intake of soils. Much additional storage is being provided by contour furrows, contour listing, dam listing, lakes, and ponds. Shelterbelts slow down the wind, reduce evaporation, and hold the snow. Considerable protection is afforded to leeward of such plantings for a distance that is 20 to 30 times the height of the trees. Recently cloud seeding with dry ice has come in for a great deal of attention. But rainclouds are as scarce in humid regions in time of drouths as they usually are in the desert.

New Controls Being Developed for Diseases and Insects

Every crop is affected by one or more diseases. Some 75 diseases of wheat are known, over 100 of apples, and more than 70 of potatoes. These diseases are recognized under such names as *blights, wilts, leafspots, leaf curls, rots, scabs, russettings,* and *damping-offs.* Increasing difficulty is being experienced with viruses, about which relatively little is known.

Some disease organisms are so aggressive that they seriously reduce crop yields. Estimates for 1939 placed the loss from disease of our most important food crops at 5 to 25%. Occasionally, a disease organism gets so badly out of control as to ruin the entire crop. Notable examples are the late blight that destroyed the 1846 potato crop in Ireland, with resulting widespread famine, and the blight that eliminated the native chestnut from the United States.

In some cases, disease is controlled by crop rotation. In others, dependence is placed on selection and breeding for disease resistance. Often the most effective procedure is to use preventive sprays and dusts that kill the invading parasites before they can obtain a foothold. Some 80 million pounds of copper and 75 million pounds of sulfur are sold annually in the United States for this purpose. A wide variety of organic fungicides have recently come into use, and there are highly important possibilities for further advances in this field.

Plant diseases are being controlled ever more effectively, but they will never be eliminated. The important reason for this is that the infecting organisms reproduce so rapidly that mutations of great virulence continue to develop. Thus continuously effective control of plant diseases can be accomplished only as constant watchfulness is maintained and ever-better preventives are developed.

Insects Are Costly

The toll paid to insects in this country has been estimated at more than $1½ billion annually. The problem of their control is essentially the same as that for disease organisms. Under natural conditions, insects come to a state of dynamic equilibrium with one another, and with the other parasites that prey upon them. Various bacterial, fungus, and virus diseases serve as controls. Rain, wind, heat, and cold come to our rescue. Many of our standard agricultural practices are built around the need for insect control. Thus the corn borer is destroyed by plowing the stalks under. Clean cultivation is effective in the control of over 100 troublesome insects. Crop rotation and delayed seeding are often useful.

None of these natural controls can be depended upon to do all that must be done. As our population grows, so also does the intensity of our agriculture. The same crop is grown more frequently on the land, and this permits the multiplication of the insects that affect it. Risks from insects increase and the need for their control becomes more imperative.

In the early days, the primary insecticides were the salts of the heavy metals, notably of arsenic and lead. As time went on, natural plant poisons were brought into play in such products as rotenone and pyrethrum. Later a great deal of thought went into the breeding of parasitic insects and into inoculating with disease-producing bacteria, fungi, and viruses. More recently the synthetic organic chemicals of the DDT and BHC types have come into the forefront.

Four Problems

Four problems are presented by the use of insecticides. One is the development of insects that are highly resistant to a given poison and that reproduce themselves to become extremely hardy races. A second is the accumulation in the soil of poisonous residues, both mineral and organic, to the point that they are toxic to plants. A third is the problem of poisonous spray and dust residues on plant parts that are used directly as food or feed. The fourth is the destruction of honeybees and other useful types of insects.

But rapid progress is being made in the solution of these problems. One of the most important developments is the continuous discovery and use of new organic insecticides that are highly selective for insects and have no effect whatever on man. Similarly, the newer of these materials do not accumulate in the soil, but are decomposed by soil microorganisms like any other form of organic matter.

Recently, British scientists have developed a chemical control for the tsetse fly, the carrier of sleeping sickness. This probably means that a vast waste region in Central Africa, greater than the entire land area of the United States, can now be brought into agricultural production. Similar controls for other insects hold great hope for use in our hot and humid South.

It is highly important to the welfare of this nation that every effort be made to maintain consumption of animal products at a high level. Much of our land is of little use except in livestock production. Meat, milk, and eggs have great value as protective foods, and they add much to the joy of living.

A livestock economy permits of great flexibility between the production of meat and that of grain, as conditions require. Level grazing land can be put to the plow and returned to pasture with the ebb and flow of the need for grain, as determined by war, drouth, or other national emergency. Living animals constitute highly important reserves of concentrated food that can be totally consumed in case of necessity. Finally, pasture lands have tremendous potentialities in terms of storage of soil fertility that can readily be released by cultivation.

Dairying constitutes another important type of grassland agriculture that needs to be encouraged as much as possible. Milk is one of our most important foods. We are consuming a little over one pint a person daily. Our national consumption is over 120 billion pounds annually. This is the produce of 23 million cows. Dairy cows excel all other livestock in their economy in converting roughage to human food. They yield about 18 pounds of edible

". . . One of the most important developments is the discovery of new organic insecticides that are highly selective for insects and have no effect on man."

products for each 100 pounds dry weight of feed, as compared to 15.6 pounds in pork, 5.4 pounds in eggs, and 2.8 pounds in beef.

For reasons of health, a 20% increase in milk consumption is highly desirable. On this basis, and in view of the one-third larger population for which plans are being laid, our milk requirements would be increased more than 50%. This would call for the production of over 180 billion pounds of milk and an increase in the number of cows to 36 million, at present levels of production. Milk production per cow now averages about 5,000 pounds. But the average for all cows in the dairy herd improvement associations is over 8,600 pounds. One New Jersey herd of 78 cows has averaged nearly 15,000 pounds of milk annually per cow for 16 consecutive years of official test.

Continuous increase in milk production per acre is being effected not only by growing more and better feed, but by breeding more efficient cows. Artificial insemination, by which the service of a bull of superior lineage can be increased 20 times or more, is one of the most important of the newer developments. Much effort is being put into prolonging the cow's life well beyond the present three calvings through better feed and care. Use is being made of hormones to stimulate conception, mammary development, and milk secretion. A new technique of transplanting ova is being tried, for the purpose of obtaining more daughters from the better cows.

". . . Engines for converting the sun's rays into . . . energy are in their infancy, but effective ones are not impossible."

As a result of improved methods of pasteurization and refrigeration of milk, shipment in stainless steel containers, and use of better detergents and chemical germicides, the dairy industry is gradually shifting southward, where the longer grazing period makes possible more economic production. It is believed that milk production in the United States can be raised to the desired levels without materially increasing the acreage of land devoted to the production of grain feed for dairy cows.

Grains Consumed as Such in Case of Emergency

However important meat and milk may seem to many of us, they are not essential to our existence. Nearly two-thirds of the people of the world live on diets that are made up of 80 to 90% cereals and potatoes, in comparison with an estimated 27.5% in this country. By careful use of supplemental protective foods, including fruits, vegetables, eggs, sugar, and oils, these high-cereal diets can be made to meet the recommended food allowances.

About six of every seven calories are lost from grains by feeding them first to livestock and then consuming the animals or their products. A 3,000-calorie diet becomes, in effect, a 21,000-calorie diet, when eaten in the form of meat, eggs, and milk. At present, we are consuming more than five times as many grain calories as would be required if we lived on grain alone.

In this connection, it is important to consider the potentialities of such legume seeds as soybeans and peanuts. A given area of land will produce four times as much protein if planted to soy-

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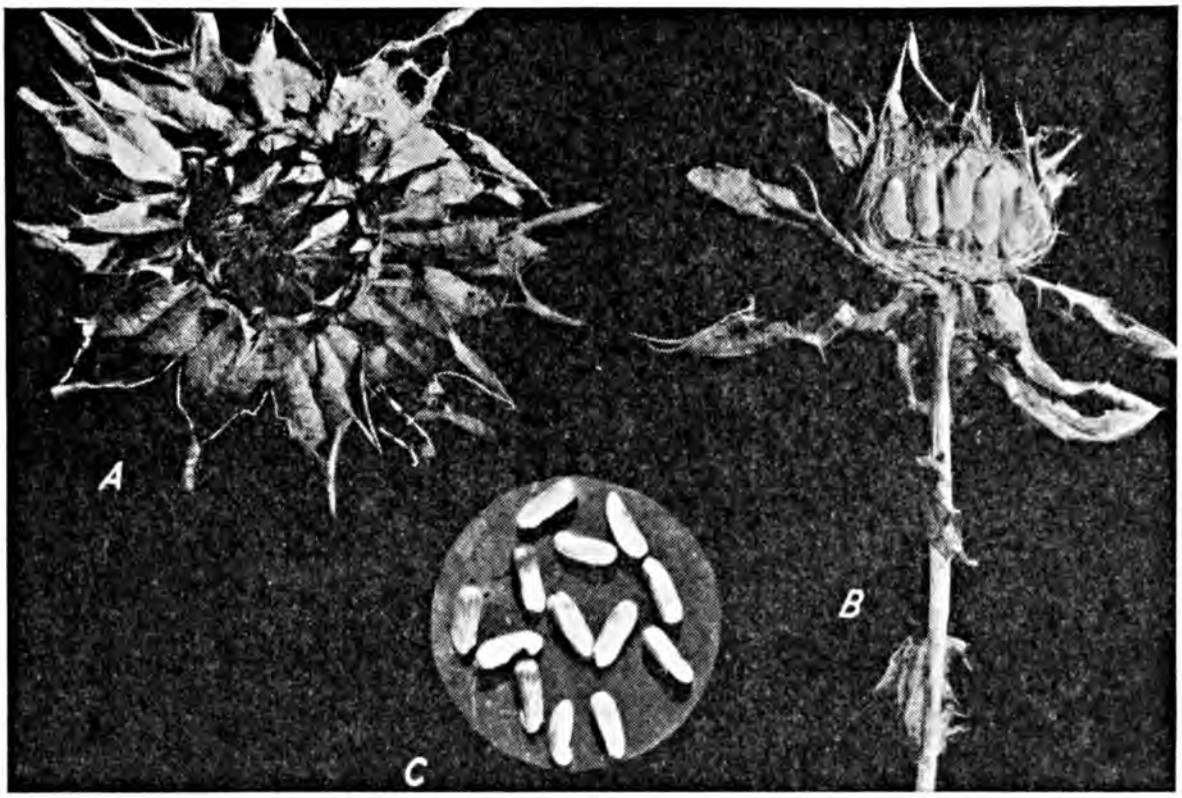

Fig. 1. Close-up view of new variety of Safflower; (A) Bloom, (B) Cross section of seed head, (C) Seeds.

Better Safflower Is Here

By C. B. Sherman

Information Specialist, U. S. Department of Agriculture, Washington, D. C.

SAFFLOWER is hailed as a new oilseed crop. New varieties that yield a larger crop of seed with a higher oil content have made it new. The development of better extraction methods, the establishment of plants for processing the seed, and successful experimental work with the resulting oil, cake, and meal have strengthened the impression that we have a promising newcomer in agriculture.

Actually safflower has been grown in this country, experimentally at least, for more than 20 years. Moreover, it was a crop of antiquity for we are told that its seed was found in tombs of the Pharaohs and we know it has long been grown in North Africa and the Middle East, where crude methods of growing, harvesting, and extracting, practiced on rudimentary plants, promised little for the future.

Certified N-852, on the other hand, is a variety developed by the University of Nebraska that has an average oil content of 32 per cent, and varieties of higher yield are nearly ready for release.

In dry-land farming, yields on non-

(*Turn to page* 41)

Fig. 1. The State Soils Laboratory, created by an Act of the Wisconsin Legislature in 1912, has turned out hundreds of thousands of soil tests during the past 37 years. In 1949 over 36,000 soil samples were tested in this laboratory. Soil tests are the basis now for practically 100 per cent of the fertilizer and lime recommendations to farmers.

Extension Education in Soils in Wisconsin

By C. J. Chapman

Soils Extension Specialist, University of Wisconsin, Madison, Wisconsin

WISCONSIN'S program of extension education in soils has been an important factor in the adoption of soil-building practices by our farmers. The increased use of lime and fertilizers has made possible the tremendous increases in the yields of the new and improved varieties of hybrid corn, small grain, and other feed and food crops being grown. This program of education in soils has been carried out by means of several major activities.

Soil-testing Program

The Wisconsin program of soil testing was initiated in 1912 as the result of an Act of our Wisconsin Legislature which created the State Soils Laboratory. This law, in part, reads as follows:

"It shall be the purpose and duty of the State Soils Laboratory to make field examinations and laboratory analyses of the soil of any land in this State and to certify to the results of such examinations and analyses upon the request of the owner or the occupant of the land and the payment by him of the fee or fees hereinafter prescribed."

The services rendered under this law include a detailed examination of the farm, sampling of the various fields, the testing of these soil samples, and finally, a comprehensive report in which a soil and crop management program is outlined based on information secured at the time of examining the farm, combined with the information gained from the soil tests. Where a group of farmers in a given community request this service, it has been customary to hold follow-up meetings, at which time the results of the tests are further explained and a general program of soil and crop management outlined to farmers who attend. The charge for this complete service for many years amounted to an average of about seven dollars per farm. In 1947 fees were doubled.

Over six thousand farms have been examined through the medium of this State Soils Laboratory during the past 37 years. This service has had a powerful influence in getting farmers started in the use of lime and fertilizers and improved cropping practices. After a farmer has his soil tested he feels that he has a very dependable guide in the use of lime and fertilizer. "Why," he'll tell his neighbors, "I've had my soil tested, and the test calls for three tons of lime on that north field, four tons on the south field, and in addition to lime these fields need an application of 300 pounds of 0-20-20 fertilizer per acre when seeded down to small grain and alfalfa."

For the most part, the recommendations in these reports have been followed religiously. The reports include a program of crop management, and usually special recommendations for the establishment of alfalfa are made. A program of pasture improvement is always outlined.

At present this individual farm-testing service has been greatly expanded and enlarged. In fact, a considerable number of counties are now set up in cooperation with the PMA which assumes the responsibility for and cost of collecting the soil samples. The farmer in turn pays 25 cents per sample for having his soils tested. Last year (1949) 54 Wisconsin counties cooperated with the PMA and availed themselves of this testing service.

In addition to this more complete farm soil survey service provided for by law, we have had for many years a free soil-testing service where farmers

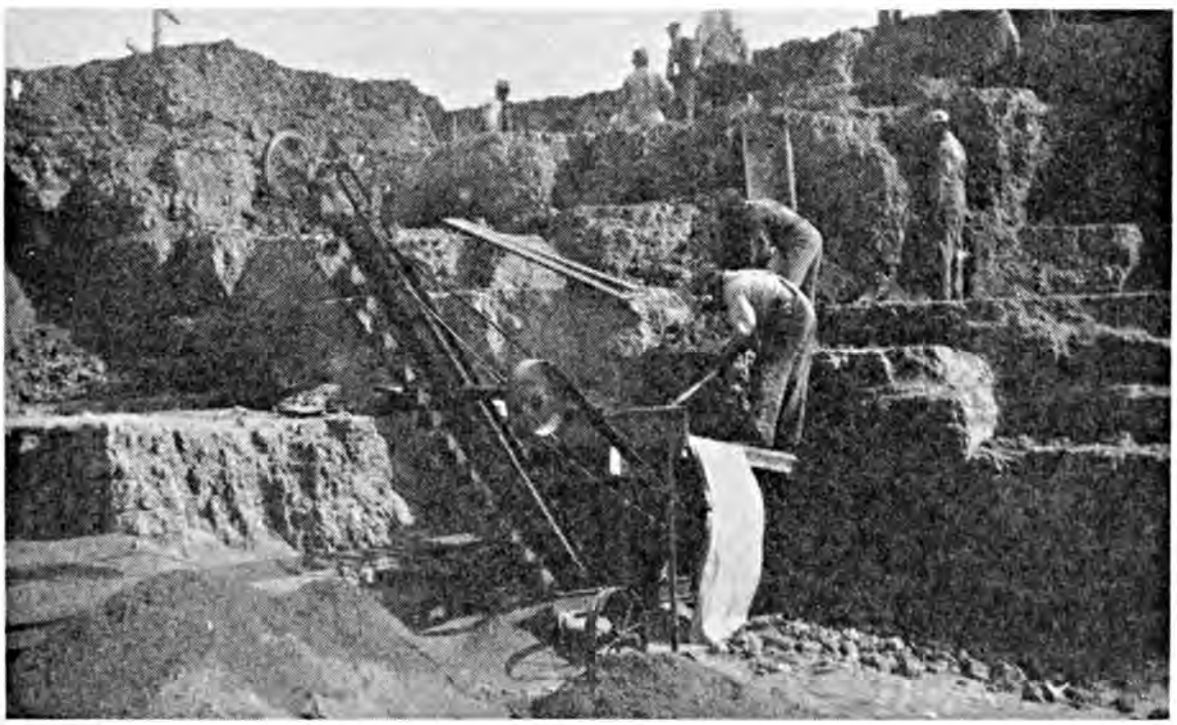

Fig. 2. Agricultural lime production was given a tremendous impetus during the period 1934 to 1941, when hundreds of work relief lime-grinding and marl-digging projects were set up. Since July 1934, a total of over 19 million tons of agricultural lime has been produced and applied to Wisconsin's acid soils.

have sent in hundreds of thousands of samples of soil which were tested for acidity, available phosphorus, and available potassium. In 1938 a State-wide WPA soil-testing project was set up and some 55 county laboratories were established. This WPA program was carried out over a period of four years. Later, some of these county laboratories were merged into district laboratories, while others are still functioning under the direct supervision of county agents.

In 1947 it was decided to charge 25 cents per sample for all samples of soil tested in our State Soils Laboratory. We felt that soil testing had passed the stage where we could justify the cost of it simply as a part of our educational program. The volume of soil samples coming into our laboratory was increasing every year by the thousands. Furthermore, we felt that this small charge would hold down the number of samples farmers and others might send in and especially it would cut down the number of the "flower pot" type of sample. Too, we felt that if farmers paid a small fee for this testing service, they would be more likely to follow through on the recommendations made as to lime and fertilizer treatments based on the tests.

In 1949 we tested 36,363 samples of soil in our State Soils Laboratory, with some 50 county laboratories testing better than 250,000 samples.

Some rather interesting information is coming out of all of this work. We are finding, for instance, that the increased use of lime has cut down the percentage of soil showing a strong degree of acidity (pH 4.8 to 5.2) and, of course, the percentage of soil samples actually showing acidity is on the decrease. Most certainly the 19 million tons of lime which have been spread on Wisconsin farms during the past 15 years have reduced the acidity of our soils. Lime is usually recommended on fields where the pH drops under 6.5. The average for the 36,363 samples tested in 1949 showed that about 52 per cent were acid and in need of lime, whereas 15 years ago better than 85 per cent of all samples tested in our laboratory were acid. Included, of course, in this 52 per cent of acid soil

Fig. 3. Result demonstration meeting held in the field gives farmers who attend opportunity to see as well as hear. This picture of a "Plow-sole Fertilizer Demonstration" on corn was taken on Earl Olson's farm, Spring Green, Wis., in 1949. Yields: 150# of 3-12-12 in hill = 48.5 bu. per acre; 150# of 3-12-12 in hill plus 800# of 8-8-8 plow-sole = 104.6 bu. per acre.

Fig. 4. The thousands of demonstrations carried out over the past 25 years on small grain and seedings of clover and alfalfa have had a powerful influence in selling farmers as well as county agents and other educational leaders on the use of fertilizers. Here, on Clair Bennett's farm, Endeavor, Wis., is the amazing response of Clinton oats to treatment with fertilizer. Yields: No fertilizer = 39.5 bu. per acre; 500# of 0-20-20 plus 100# ammonium nitrate = 79.8 bu. per acre.

samples were hundreds of samples representing thousands and thousands of acres which had been limed once and where the acidity had been reduced from strong to medium or slight degree.

The application of the millions of tons of lime in the past 15 years has further tended to loosen up phosphorus in our soils, and this factor combined with the cumulative effect of the repeated application of fertilizer rich in phosphate has cut down the percentage of samples showing a deficiency in this element. In averaging the results of tests for available phosphorus on the 36,363 samples tested in 1949, we found that 63 per cent were deficient in available phosphorus. Fifteen years ago over 80 per cent of the soils tested in Wisconsin were low in available phosphorus.

But the story for potash is just the opposite. In 1949, 93 per cent of all samples tested dropped under the optimum level for available potassium, whereas 15 years ago only 55 per cent of all samples tested in the State were low in available potassium.

Work Relief Lime Production Program

The Work Relief Lime-grinding and Marl-digging Project started in 1934 as a part of the FERA Work Relief Program and later set up as a work project under WPA gave tremendous impetus to the production and use of agricultural lime in Wisconsin. This program of lime production, sponsored by the Extension Service of the College of Agriculture, has made possible the doubling and the trebling of our acreage of alfalfa. And not only has there been this great increase in the acreage and production of alfalfa, but clover on Wisconsin farms has become a more dependable crop. In the wake of a larger acreage of legumes and the consequent fixation of more nitrogen, have come increases in the yields of corn, small grain, and other crops.

A law enacted in 1935 legalized the production of agricultural lime by county boards. During the period from July 1934 and for eight years following, WPA lime production projects

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Can We Afford Enough Fertilizer to Insure Maximum Yields?

By L. G. Zinn

Instructor, Institutional-on-Farm Training, Phillipi, West Virginia

AFTER writing the above title, I have decided that it is stated wrong and that it should have been, "Can we afford not to use enough fertilizer to insure the maximum yields?" And I believe that I can prove that we cannot.

Our old idea has been not to feed the crop with an application of plant food sufficient to insure a good yield. It has been more like the doctor that gives his patient a shot in the arm as a stimulant to enable him to recover enough to take more nourishment. But the trouble with us as farmers is that we have forgotten to provide that nourishment after the first shot. Rather, we have left the patient to shift for himself with very poor pickings, when we realize that we have been taking the plant food from the soil for 100 years or more and in many cases returning none.

Ever since I have been farming I have always felt that we should put back into the soil in some way as much actual plant food as we expected the crop to take out. There is just so much in our soils, and no magic that I know of will enable the soils to manufacture more from nothing.

I had never had the chance to test out this belief until we began high-yield tests in our class of Veteran Farm Trainees, and I am convinced now that the two past years have proved my theory. The first year I thought that it might have been mere chance that five farmers in different parts of the county under five different types of soil and different methods of planting could produce over 100 bushels of shelled corn per acre in a county that had an average of around 40 bushels. But this year when eight men did the same thing in a year that was not a good corn year I was convinced that it was not "chance."

I know that the experiment stations and few farmers have reached these and even higher yields. However, if you read the accounts of their plots, everything was in their favor. With our men it was different. They planted their corn on all kinds of land, steep and level, high-producing, and on land that did not produce enough wild hay to see where you went when mowing. There also was sandy to clay soil, some of which did not have a topsoil of over four inches.

Could they afford to apply enough plant food to produce this yield? We have been told by a lot of folks that they could not afford it and even a fertilizer expert had his doubts. But the saying that figures don't lie still holds good, and here are the figures to prove that they cannot afford *not* to use enough if they are to stay in the farming game. (See Table).

Now let's look at these figures. This is shelled corn, and the price was figured on what corn was selling for at the time of harvest. We have not allowed anything for the rent of the land nor taxes and other incidental expenses that go along with farming. However, suppose we say that Beryl Hardin would allow $44 for all those things which I am sure would more than cover the cost. Then that leaves him $100 labor income on an acre of corn. Beryl had the best chance for

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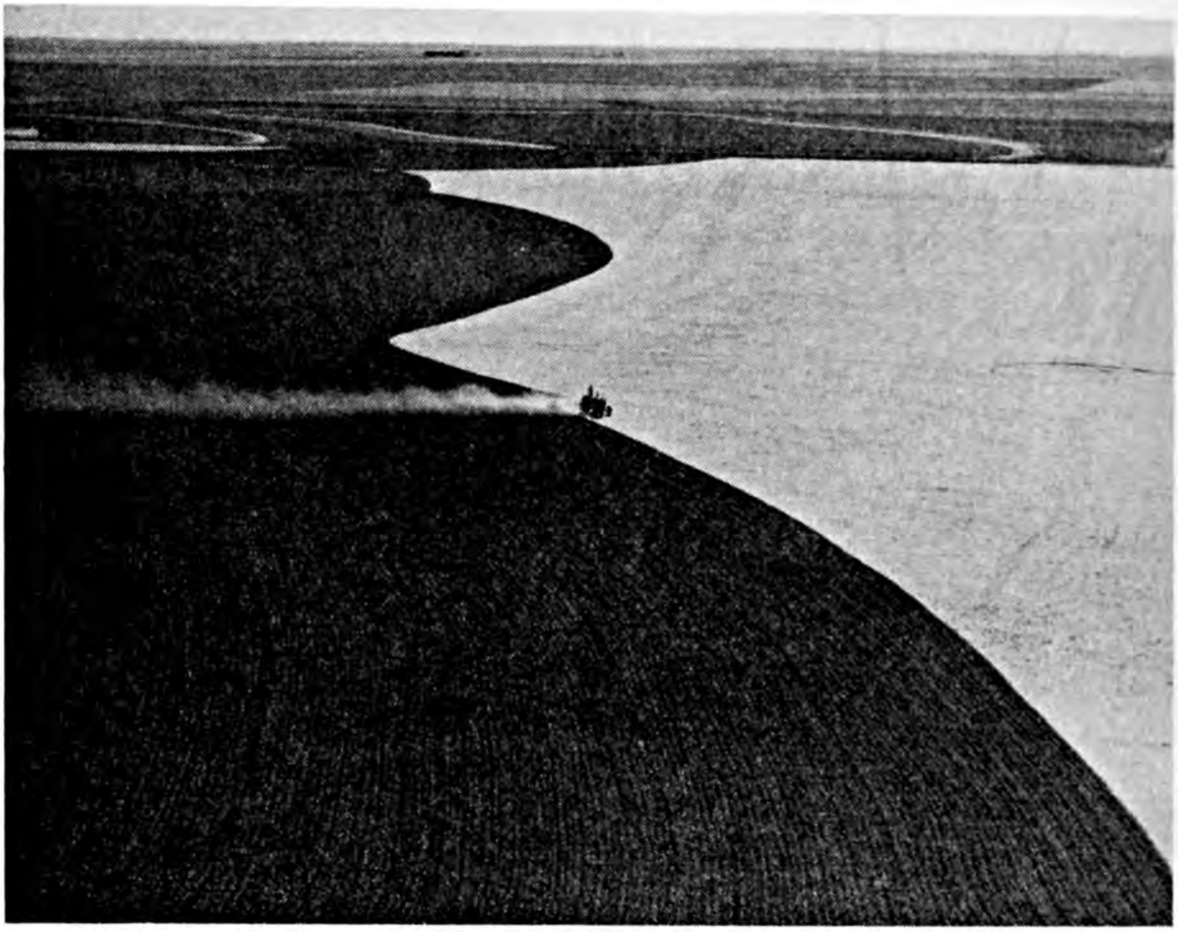
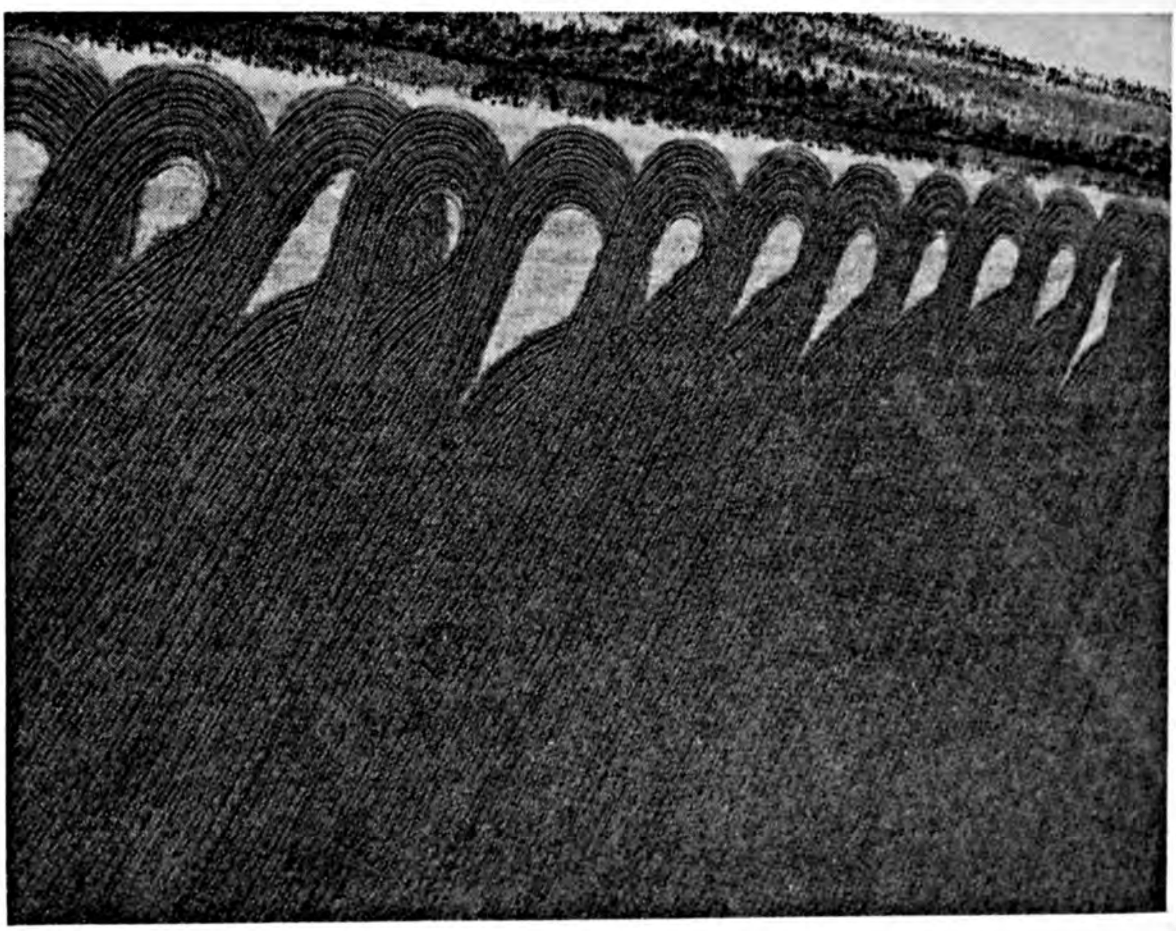
PICTORIAL

Getting Ready For Easter!



Spring Patterns on the Prairie



Recess Time from Spring Work

Farm Youngsters

The Editors Talk

Greener Pastures in 1950

The grass on the other side of many fences is going to look a lot greener this year if the interest in celebrating 1950 as pasture year continues to spread as rapidly as it has to date. Not only the agricultural press but State officials and leaders of groups throughout the country are endorsing a plan to stress the importance of more and better pastures in the Nation's agriculture. Governor Elbert N. Carvel of Delaware, after issuing a proclamation making 1950 Pasture Year in that State, wrote to the 47 other governors urging them to do likewise.

What can be and is being accomplished by a movement of this kind has been proved by the New England Green Pasture Contest now in its third year. Such outstanding results have been obtained and so much publicity given the contest that a green pasture program is being inaugurated in several other States, including North Carolina, Kentucky, Alabama, Mississippi, Wisconsin, Virginia, and Washington.

In Kentucky, long famous for her fine pastures, the objectives of the program are listed as follows:

1. To establish high-producing grasses and legumes on all land adapted to pasture production.
2. To encourage the more widespread use of cover crops for grazing.
3. To demonstrate how to secure maximum financial returns from pastures.
   a. By having pastures of high quality through all seasons.
   b. By providing sufficient soil nutrients and proper soil conditions for high pasture production.
   c. By full utilization of grasses and legumes in crop rotations.
   d. By employing appropriate mechanical practices.
   e. By effective utilization with livestock.
4. To recognize outstanding progress of individual farmers, and to use their achievements as demonstrations of what can be accomplished.

In carrying out the purposes of the program, awards will be given to farmers for outstanding achievements; recognition to 4-H, F.F.A., and G.I. enrollees; recognition to the county achieving the best program in the State. There will be district livestock-pasture meetings and some sort of recognition will be available to all persons participating in the program. Definite rules for eligibility and procedure for those competing for awards have been drawn up.

Undoubtedly similar set-ups will be adopted in other States inaugurating a pasture program on a State-wide basis. This is all highly commendable and should prove a most valuable means of disseminating the information available for pasture improvement. But in the absence of such stimulus, it behooves every livestock farmer to become interested in his own green pasture program, if he wishes to cut his costs of milk and meat production. Many farms do not have enough pasture. On others, there is too much and these old pastures have been grazed for years with no replacement of the mineral plant foods except in the scattered droppings. Such rundown pastures cannot produce the high-protein forage which is such a big factor in livestock profits.

A pertinent point in this connection was noted in the New England Dairyman, December 1949 issue: "New England's Green Pasture Program will, in 1950, become a year-around program; in other words, production of quality roughage for winter as well as abundant feed from early spring until late fall. This announcement comes from Louis A. Zehner of the Federal Reserve Bank, Chairman of the New England Green Pastures Committee."

A Record in Records

Despite all the good advice and urging, too many farmers are still neglecting the keeping of accurate records. This fact undoubtedly is brought home to them, as to a great many of the rest of us who are not actual farm producers, come income tax time. But like the rest of us, once the "headache" is over, they get back into the habit of "remembering it later."

It was heartening, therefore, to note in the U.S.D.A. Farm Paper Letter issued weekly by E. R. McIntyre of the Press Service, U. S. Department of Agriculture, what may well be a record in records. To quote the item in full:

"Here's a treasured letter received lately from Everett Martin, to whom the farm paper I edited in Wisconsin presented a Master Farmer degree back in 1929 when Mr. Martin was only 70 years young. Now at 90 years he takes his pen in hand, and a firm one too:

" 'It is with great pleasure that I learn that you have not forgotten me. Among my possessions the one most highly prized is the medal you saw fit to bestow on me. The Master Farmers of southern Wisconsin came on my 90th birthday to help me celebrate—a great surprise as I knew nothing of their intentions until they came.

" 'I have not for a moment regretted choosing agriculture for my life work. I can look back a greater distance than the majority of mankind; and can see I have made mistakes, but did the best I knew with the light I had at the time. I have tried to set an example that, if others followed it, they would not disgrace themselves at least.

" 'I feel that I am close to the end of the row. I felt badly when I found that I had to take a stand at one side and let the hired help and my son take the lead. I have given over the management of my farm to my son. I think he will continue along the lines that I have laid down. I sometimes think he might have had a better teacher.

" 'My grandson (he is now 15) seems to look with respect on the dairy cow. So I will leave this earth quite satisfied. Sometimes I am a little proud of my milk records. On January 1, 1950, it will be 53 years that I have weighed each cow's milk separately and have the records of the same on file. I am told there is not another farm in the United States that can show this equal in dairy records. I close with kind regards for your happiness and prosperity.' Everett Martin, Mukwonago, Wisconsin."

Just how much this accurate and detailed record-keeping has contributed to Mr. Martin's long and satisfying span of farming activity is a matter of speculation. It is a safe gamble, however, that it was one of the keynotes of his success and we do not blame him for taking pride in it.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
March	28.74	31.9	174.0	254.0	118.0	198.0	20.00	51.40	....
April	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	89	81	109	74	87	110
1938	69	196	80	79	76	64	57	97	88
1939	73	154	100	84	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	105	117	107	82	211	129
1942	153	369	168	134	143	124	91	202	163
1943	160	405	188	235	174	154	125	231	245
1944	167	420	214	216	170	160	139	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	178	248	212	209	141	319	204
1947	257	380	232	248	336	259	148	381	249
1948	250	387	220	249	212	232	160	301	238
1949									
March	232	319	250	290	184	224	168	228	263
April	241	247	260	314	190	226	160	223	236
May	242	325	260	312	190	226	149	224	213
June	243	315	251	301	188	210	138	207	175
July	243	565	222	323	195	206	132	166	185
August	236	446	221	305	184	202	135	197	174
September	240	487	198	263	181	212	137	193	205
October	231	474	187	224	170	214	141	185	170
November	224	434	192	216	159	215	141	188	213
December	214	454	188	230	176	218	144	192	196
1950									
January	213	397	195	245	179	217	144	193	261
February	222	341	191	252	181	218	141	193	203

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4 40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	10.11	10.59	10.84	9.85
1949						
March	3.19	2.27	9.27	12.36	9.64	9.71
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3 00	2.32	10 27	13 79	10 26	10 08
February	3.00	2.32	9.37	13.45	8.96	8.96

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949						
March	119	80	265	350	286	276
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	288
February	112	81	268	381	266	255

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948	.764	4.27	6.60	.478	.681	14.14	.195
1949							
March	.770	3.85	7.06	.375	.720	14.50	.200
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949							
March	144	107	145	68	76	60	83
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	91
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
March	258	245	231	134	99	290	144	72
April	256	244	229	134	99	291	144	72
May	253	244	227	134	99	293	144	72
June	249	242	223	134	99	304	144	65
July	246	240	225	140	100	349	144	68
August	244	238	222	143	100	372	144	68
September	247	238	225	138	100	334	144	68
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	93	316	142	72
February	237	237	223	132	93	233	142	72

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Fertilizer Analyses and Registrations, 1949," State Dept. of Agr., St. Paul Minn., H. A. Halvorson.

"County Fertilizer Data, January 1 through June 30, 1949," Ofc. State Chem., Texas Agr. Exp. Sta., College Station, Texas.

"Fertilizers For 1950," c/o CNR Agr. Dept., Maritime Fertilizer Council, Moncton, N. B., Canada, J. E. McIntyre.

"The Fertilizer Trade, July 1, 1948–June 30, 1949," Dept. of Trade & Comm., Dom. Bur. of Stat., Ottawa, Ont., Canada, C. D. Howe.

"The Fertilizer Manufacturing Industry, 1948," Dom. Bur. of Stat., Ind. & Mdsg. Div., Ottawa, Ont., Canada, Ann. Ind. Rpt. No. A50–50, C. D. Howe.

Soils

"Livingston County Soils," Agr. Exp. Sta., Univ. of Ill., Soil Rpt. 72, Urbana, Ill., Aug., 1949, H. L. Wascher, R. S. Smith, and R. T. Odell.

"Farm Ponds, September, 1949," Cornell Univ., Ithaca, N. Y., Ext. Bul. 771, A. D. Pistilli.

"Physical and Chemical Characteristics of Slick-Spot Soils, September, 1949," Okla. Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Manus. Rpt. Abstract No. 1, W. L. Blizzard and L. E. Hawkins.

"Liming Western Oregon Soils, September 1949," Agr. Exp. Sta., Oreg. State College, Corvallis, Ore., Sta. Cir. 180, Sept. 1949, R. E. Stephenson and W. L. Powers.

"Report of the Chief of The Soil Conservation Service, 1949," SCS, USDA, H. H. Bennett.

"Use The Land And Save The Soil," SCS, USDA, PA-71, Sept. 1949, R. H. Musser.

Crops

"Arizona Agriculture 1950," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 226, Jan. 1950, G. W. Barr.

"Arizona Home Gardening," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Ext. Cir. 130, H. F. Tate.

"Breeding and Testing Strawberry Varieties," Calif. Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 714, Oct. 1949, R. E. Baker and Victor Voth.

"Sweet Corn Trials, Mt. Carmel and Windsor, Connecticut, 1949," Conn. Agr. Exp. Sta., New Haven, Conn., Prog. Rpt. 49G1, W. C. Galinat.

"Thirteenth Biennial Report of the Department of Agriculture, State of Florida, from July 1, 1946 to June 30, 1948," Dept. of Agr., Tallahassee, Fla., Nathan Mayo.

"Corn Performance Tests, 1949," Ga. Exp. Sta., Experiment, Ga., Cir. 163, Jan. 1950, G. A. Lebedeff, O. L. Brooks, and M. B. Parker.

"How to Grow Tobacco Plants," Ga. Agr. Ext. Serv., Athens, Ga., Cir. 302, Rev. June 1949, E. C. Westbrook.

"Growing Lima Beans," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Press Bul. 618, Jan. 16, 1950, B. O. Fry.

"The Callaway and Coastal Blueberries," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 67, Jan. 1950.

"Kansas Corn Tests, 1948," Agr. Exp. Sta., Dept. of Agron., Kansas State College, Manhattan, Kans., Bul. 340, Feb. 1949, A. L. Clapp and L. A. Tatum.

"Vegetable Planting Guide for Louisiana," Div. of Agr. Ext., La. State Univ., Baton Rouge, La., Ext. Pub. 1019, (Formerly Leaflet No. 22, Rev. March, 1949), Oct. 1949, J. A. Cox, Joseph Montelaro, A. C. Moreau, and D. H. Spurlock.

"Louisiana Dallis Grass," La. State Univ., Baton Rouge, La., Ext. Pamph. 1001, July 1949, R. A. Wasson and W. E. Monroe.

"Research For Maine Farmers, Sixty-Fifth Annual Report of Progress, Year Ending June 30, 1949," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 473, June 1949, Fred Griffee.

"Green Manure Crops and Rotations for Maine Potato Soils," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 474, July, 1949, G. L. Terman.

"Varieties of Vegetables Recommended for Maryland in 1950," Hort. Mimeo. 38, Feb. 1950, E. K. Bender.

"The Nutritional Status of Maryland Orchards In Terms of Mineral Content of Leaves

and Occurrence of Deficiency Symptoms," Agr. Exp. Sta., Dept. of Hort., Univ. of Md., College Park, Md., Sci. Publ. No. A234, A. L. Schrader, L. E. Scott, and C. O. Dunbar.

"Annual Report For the Fiscal Year Ending June 30, 1949, Massachusetts Agricultural Experiment Station," Bul. No. 453, Aug. 1949, Univ. of Mass., Amherst, Mass.

"Fruit Varieties for Northern Michigan Areas Where Hardiness is a Factor," Mich. State College, Coop. Ext. Serv., East Lansing, Mich., Ext. Folder F-128, April 1949.

"Pollination and Fruit Set of Orchard Fruits," Mich. State College, Coop. Ext. Serv., East Lansing, Mich., Ext. Folder F-129, April 1949.

"Top Working Fruit Trees," Mich. State College, Coop. Ext. Serv., East Lansing, Mich., Ext. Folder F-131, April, 1949.

"Tips on Asparagus Growing," Mich. State College, Ext. Serv., East Lansing, Mich., Ext. Folder F-132, April 1949.

"Blackberries and Dewberries," Mich. State College, Coop. Ext. Serv., East Lansing, Mich., Ext. Folder F-133, April, 1949.

"Dwarf Fruit Trees," Mich. State College, Coop. Ext. Serv., East Lansing, Mich., Ext. Folder F-136, June 1949.

"Production Costs on Selected Dryland Grain Farms," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Mimeo. Cir. 52, Sept. 1949, R. E. Huffman.

"62nd Annual Report," Agr. Exp. Sta., Univ. of Neb., College of Agr., Lincoln, Neb., May 1949, W. V. Lambert and M. L. Baker.

"Annual Report of the Board of Control for the Fiscal Year Ending June 30, 1948," Agr. Exp. Sta., Univ. of Nev., Reno, Nev., 1949, Jack McCarthy.

"Field Crop Recommendations 1950," Ext. Serv., Rutgers Univ., New Brunswick, N. J., Leaf. 37, Nov. 1949, J. E. Baylor and R. A. Briggs.

"Growing Geraniums as House Plants," N. J. Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 530, Sept. 1949, H. M. Biekart.

"Making a New Lawn," N. J. Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Cir. 531, Oct. 1949, R. E. Engel and G. L. Ahlgren.

"Sixty-First Annual Report of the College of Agriculture at Cornell University and of The Cornell University Agricultural Experiment Station, 1948," Cornell Univ., Ithaca, N. Y., E. E. Day, A. W. Bigson, W. I. Myers, L. R. Simons, C. E. F. Gutterman, and Catherine Personius.

"The Planting and Care of Shrubs and Trees," Cornell Univ., Ithaca, N. Y., Ext. Bul. 185, Sept. 1929 (Rptd. Sept. 1949), D. J. Bushey.

"Hybrid Corn Field Trials, 1949," Agr. Exp. Sta. and Ext. Serv. Coop., N. D. Agr. College, Fargo, N. D., Mimeo. Cir. 82, Jan. 1950, Wm. Wiidakas, R. B. Widdifield and L. W. Briggle.

"Cotton Varieties for Oklahoma," Okla. Agr. Exp. Sta., Okla. A & M College, Stillwater, Bul. No. B-343, Jan. 1950, I. M. Parrott, N. M. Gober, Jr., and J. M. Green.

"Sprinkler Irrigation Costs for Vegetable Crops in the Willamette Valley, Oregon," Agr. Exp. Sta., Ore. Sta. College, Corvallis, Oreg., Sta. Bul. 463, June 1949, M. H. Becker and D. C. Mumford.

"Cost of Producing Sweet Corn in the Willamette Valley, Oregon," Agr. Exp. Sta., Ore. State College, Corvallis, Ore., Sta. Bul. 465, Aug. 1949, G. B. Davis and D. C. Mumford.

"Cost of Producing Table Beets in the Willamette Valley, Oregon," Agr. Exp. Sta., Ore. State College, Corvallis, Oreg., Sta. Bul. 465, Aug. 1949, G. B. Davis and D. C. Mumford.

"Cost of Producing Carrots in the Willamette Valley, Oregon," Agr. Exp. Sta., Ore. State College, Corvallis, Oreg., Sta. Bul. 467, Aug. 1949, G. B. Davis and D. C. Mumford.

"Quality Loss in Marketing Oregon Early-Crop Potatoes," Agr. Exp. Sta., Ore. State College, Corvallis, Oreg., Sta. Bul. 468, Oct. 1949, G. B. Davis.

"Cost of Producing Strawberries for Processing in the Willamette Valley, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 469, Oct. 1949, G. W. Kuhlman and D. C. Mumford.

"Boysenberries and Loganberries for Processing in the Willamette Valley, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 470, Nov. 1949, G. W. Kuhlman and D. C. Mumford.

"Cost of Producing Red Raspberries for Processing in the Willamette Valley, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 472, Dec. 1949, G. W. Kuhlman and D. C. Mumford.

"Cost of Producing Black Raspberries for Processing in the Willamette Valley, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 473, Dec. 1949, G. W. Kuhlman and D. C. Mumford.

"Cost of Producing Perennial (English) Rye Grass Seed, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. Sta. College, Corvallis, Oreg., Sta. Info. Cir. No. 461, Aug. 1949, E. A. Hyer, M. H. Becker and D. C. Mumford.

"Cost of Producing Alta Fescue Grass Seed, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Info. Cir. No. 462, Aug. 1949, E. A. Hyer, M. H. Becker, and D. C. Mumford.

"Cost of Producing Chewings Fescue Grass Seed, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Info. Cir. No. 463, Aug. 1949, E. A. Hyer, M. H. Becker and D. C. Mumford.

"Cost of Producing Highland Bentgrass Seed, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Info. Cir. No. 464, Aug. 1949, E. A. Hyer, M. H. Becker and D. C. Mumford.

"Comparison of the Cost of Producing Various Grass Seeds by Soil Classes, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg.

State College, Corvallis, Oreg., Sta. Info. Cir. No. 465, Aug. 1949, E. A. Hyer, M. H. Becker and D. C. Mumford.

"Cost of Producing Italian (Common) Rye Grass Seed, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Info. Cir. No. 466, Aug. 1949, E. A. Hyer, M. H. Becker and D. C. Mumford.

"Harvesting Pasture and Forage Crops with Turkeys," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Info. Cir. No. 467, Sept. 1949, D. H. Sherwood, C. A. Larson and J. A. Harper.

"Science for the Farmer," Agr. Exp. Sta., Pa. Sta. College, School of Agr., Supplmt. 1 to Bul. 515 (62nd Annual Rept.), Jan. 1950.

"Patterns of Fruit and Vegetable Production in Pennsylvania," Agr. Exp. Sta., Pa. State College, School of Agr., State College, Pa., Bul. 520, Jan. 1950, W. T. Butz and W. A. Lee.

"Buttonclover (Medicago Orbicularis)," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Cir. No. 104, Sept. 1949, J. A. Ewing.

"Cotton Varieties and Related Studies 1936 through 1948," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., Bul. No. 211, June 1949, N. I. Hancock.

"Grazing Studies On the Amarillo Conservation Experiment Station 1943-49," Texas A. & M. College System, Bul. 717, Dec. 1949, C. J. Whitfield, J. H. Jones and J. P. Baker.

"Results of the 1948 Cotton Defoliation Tests at Lubbock," Texas Agr. Exp. Sta., Texas A & M. College, College Station, Texas, PR 1182, Aug. 26, 1949, E. L. Thaxton, Jr. and D. L. Jones.

"Trees and Shrubs at the Big Spring Field Station," Texas Agr. Exp. Sta., Texas A & M College System, College Station, Texas, PR 1185, Aug. 30, 1949, F. E. Keating.

"Fruits For Home Planting At The Big Spring Field Station," Texas Agr. Exp. Sta., Texas A & M College System, College Station, Texas, PR 1186, Aug. 31, 1949, F. E. Keating.

"Cabbage Variety Trials In The Lower Rio Grande Valley of Texas," Texas Agr. Exp. Sta., Texas A & M College System, College Station, Texas, PR 1187, August 31, 1949, J. S. Morris and G. R. Williams, N. P. Maxwell, C. C. Edwards, R. Cintron and W. R. Cowley.

"Efficiency Studies of Utah Dairy Pastures," Ext. Serv., Utah State Agr. College, Logan, Utah, Ext. Bul. 188, L. H. Rich, A. F. Bracken, Wm. H. Bennett and G. T. Baird.

"Recommendations for Range Seeding in Utah," Utah State Agr. College, Logan, Utah, Ext. Bul. 193, L. A. Stoddart, Wayne Cook, H. J. Burbank, Joseph Libbie, George Stewart and R. L. Wrigley.

"Report of the Chief of the Office of Experiment Stations, Agricultural Research Administration, 1949," USDA, Wash., D. C., 860449—49, R. W. Trullinger.

"Growing Grapes for Home Use in Eastern Canada," Exp. Farm Serv., Div. of Hort., Dept. of Agr., Ottawa, Ont., Canada, Pub. 564, (Rev.) Cir. 147, Dec. 1949, F. S. Browne.

"Report of the Minister of Agriculture for the Dominion of Canada for the Year Ended March 31, 1949," J. G. Gardiner.

"Dominion Experimental Station, Lacombe, Alberta, Progress Report 1937-1946," Dept. of Agr. Exp. Farms Serv., Canada, G. E. Delong.

Economics

"Connecticut Vegetable Acreages, 1947–1948–1949," Dept. of Farms & Mkts., State Ofc. Bldg., Hartford, Conn., Bul. No. 107, 1949, Comm. John Christensen.

"Looking Ahead with Delaware Farmers and Homemakers," Ext. Serv., Univ. of Del., Newark, Del., Ext. Folder No. 17, Jan. 1950, Miss Louise R. Whitcomb and W. T. McAllister.

"Thirteenth Annual Report, Area 2, Farm Record Summary, 1948," Agr. Ext. Serv., Farm Mgmt., Iowa State College, Ames, Iowa, FM 1058, Aug. 1949.

"Twelfth Annual Report, Area 4, Farm Record Summary, 1948," Agr. Ext. Serv., Farm Mgmt., Iowa State College, Ames, Iowa, FM 1060, Aug. 1949.

"Eleventh Annual Report, Area 5, Farm Record Summary, 1948," Agr. Ext. Serv., Farm Mgmt., Iowa State College, Ames, Iowa, FM 1061, Aug. 1949.

"Farm Record Summary, Area 6, Southern Iowa, 1948," Agr. Ext. Serv., Farm Mgmt., Iowa State College, Ames, Iowa, FM 1062, May 1949.

"Farm Labor, Louisiana and the United States," Agr. Exp. Sta., La. State Univ., Mimeo. Cir. No. 95, June 1949, W. L. Bruner, Jr. and F. D. Barlow, Jr.

"Hogging-Off Corn and Soybeans In The Delta Cotton Areas of Louisiana," Dept. of Agr. Econ., Agr. Exp. Sta., La. State Univ., D.A.E. Mimeo Cir. No. 103, Aug. 1949, W. L. Bruner, Jr.

"Mechanical Harvesting of Corn in Louisiana," Dept. of Agr. Econ., La. State Univ., D.A.E. Mimeo. Cir. No. 104, Aug. 1949, W. L. Bruner, Jr.

"Reducing Sugar Beet Costs," Agr. Exp. Sta., Sec. of Ag. Econ., Mich. State College, East Lansing, Mich., Cir. Bul. 215, June 1949, C. E. Johnson and K. T. Wright.

"Mechanical Cotton Picker Operation In The Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 465, July 1949, G. B. Crowe.

"Prices of New Mexico Farm and Ranch Products," Agr. Exp. Sta., N. Mex. A & M College, State College, N. Mex., Bul. 348, July 1949, P. W. Cockerill, Fred Daniels, and R. R. Christeson.

"Economic Facts For Young Farmers," Agri. Econ., Agri. Ext. Service, Ithaca, N. Y., No. 40, Nov. 29, 1949, C. A. Bratton.

"Land Values and the Land Market in North

Dakota," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 353, June 1949, Rainer Schickele and Reuben Engel King.

"Texas Farm and Ranch Land Prices, 1948," Texas Agr. Exp. Sta., College Sta., Texas, P. R. 1181, J. H. Southern and W. C. Rohrer.

"Keeping Up On The Farm Outlook," Ext. Serv., Wash. State College, Pullman, Wash., Ext. Cir. No. 145, Jan. 30, 1950, Karl Hobson.

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Fertilizers in Small Lots

ALTHOUGH the total non-farm fertilizers used in this country, such as those bought by home gardeners for use on lawns and vegetable or flower gardens, amounts to only 2 per cent of all farm fertilizers, their manufacture and distribution are of importance.

Many large fertilizer manufacturers depend on these side-line products for part of their income, and numerous specialty producers make these products almost their exclusive business. This industry provides the home gardener and housewife means of obtaining small quantities of the fertilizers they need.

Fertilizer specialists of the U. S. Department of Agriculture have surveyed the field and have estimated the "non-farm use" of fertilizers. This included not only lawns and gardens but maintenance of golf courses, cemeteries, and city parks. When all these are added to the home garden use, they total roughly a third of a million tons. This is made up of 138,000 tons of mixed fertilizers and about 200,000 tons of fertilizer materials bought separately. This figures out that for every ton of mixed fertilizers sold in small lots to non-farm buyers, the industry sold 99 tons to farmer customers. For every 4 tons of separate materials sold for non-farm purposes, the farm buyers took 96 tons.

Metering Dry Fertilizers . . . into Irrigation Systems

(From page 14)

with a suction pump, in addition to the discharge pump, for use in areas under gravity flow water conditions. In the latter machines, a float is attached to the intake pump, which maintains a constant water level in the mixing tank.

The same possibilities of uneven distribution of fertilizer exist when applying dry fertilizers through the irrigation water, as with the use of liquid or gaseous materials, and various means are used to insure even application. In sandy soils and in heavier soils where long runs are encountered, the irrigation period is allowed to proceed for various lengths of time before introducing the fertilizer materials. Another means of accomplishing even distribution is the rapid flushing of the entire fertilizer application onto the field, using a large head of water. For example, in some cases where a 16-hour irrigation set is necessary, the fertilizer is flushed through the field in the first two hours, followed by a 14-hour run using a low head of water.

The present interest in the application of both liquid and dry materials in solution through the irrigation system would appear to make necessary further studies on the following: (1) Development of better methods of application under various soil conditions; (2) depth of penetration of "liquid" phosphates and potash, under field conditions; (3) the corrosive effect of fertilizer and soil-amendment salts on the metal parts of the machines now in use; (4) the action of these salts on concrete and metal pipe lines.

Better Safflower Is Here

(From page 21)

fallowed land usually range between 350 and 750 pounds per acre. Yields on fallow range from 750 to 1,200 pounds. On land of average fertility, when irrigated two or three times, yields of 1,750 to 2,750 pounds per acre are obtainable.

Safflower, an erect and spiny plant, is suitable for use in the general area of the Northern Great Plains. It does well on a sandy or clay loam soil and needs about as much moisture as flax. It likes a dry atmosphere from date of flowering to maturity. It is more resistant to frost than flax. It has to some extent its diseases and pests, and their control is yet to be studied. But the best cultural and harvesting methods are now pretty well established. It can be cultivated and harvested with the usual farm equipment, and the planting and harvesting dates do not conflict with those for wheat. It grows from 18 to 40 inches high depending upon conditions.

Welcome Alternative

Farmers in that region are looking for a crop that will fit into their rotations now that wheat acreage allotments are back again and long-time outlook reports are indicating the probable need for further reductions of wheat. Experimenters are now agreed that safflower can replace a small-grain crop under certain conditions. The Nebraska Agricultural Experiment Station, which has done much work on safflower, says it fits into the rotation systems of that State in the same way as any other full-season, spring-planted crop. A farmer in Nebraska says that his field of safflower, after being accidently overrun by cattle, proceeded to weather a hailstorm and a 4-inch snow, and yet yielded him 350 pounds of seed an acre.

An investigator got a somewhat different response, by the way, when he questioned one observer at a western institution. The best use of safflower, he affirmed, would be to plant in triple rows, using heavily spined varieties, around your watermelon patch.

Safflower is indeed a thistle-like plant but it will not become a weed, say the experimenters, because the seeds do not lie dormant in the ground. Its blossoms open early in the morning and vary from lemon and orange to burnt umber. The plant was once used as an ornamental in some gardens and earlier than that a dye was made from its flowers.

Among the agencies that have worked to develop and understand the crop are the University of Nebraska which has been at it the longest, the Northern and Southern Regional Research Laboratories, and the U. S. Department of Agriculture. The work has not been overlapping—each agency has studied a different phase or adaptation. Several commercial firms have done experimental work in production, extraction, and utilization.

Much of the present acreage is contracted to certain oil companies that are definitely interested in the potentialities. The 1950 acreage is expected to double last year's. Markets are not yet well established, and so arrangements for disposal should be made before any farmer begins to grow the crop. Several processing plants are planning to expand their operations, and one or two additional plants are projected. Several companies are looking for additional acreage to keep their establishments running at capacity.

Safflower-seed oil is judged by the technologists to be equal to linseed oil for many purposes and better than linseed for others. It is especially good as a drying agent. Paint in which it is used has been found to be free from yellowing and checking.

Other commercial possibilities of the safflower output are known or are under study. The oil cake and meal provide protein feeds in an area where such supplements are needed. The edible quality of the oils and their possible uses in foods are being studied by Nebraska and one of the regional research laboratories. The hulls are coarse and heavy. If the seed are decorticated there will be a problem of disposal. Use as fuel is the only method of disposal yet proposed. Furfural has been mentioned but this use has not been investigated.

Farmers in western Nebraska and Colorado grew most of the commercial crop last year. Farmers in Washington, Oregon, and Idaho have had satisfactory yields, but the present processing plants are so distant that the growers' profits are cut by the transportation charges. Some California growers are going in for production on a commercial scale this year, using certified or proved seed.

It was expected that more than eight million pounds of oil would be extracted from the entire 1949 crop of safflower. The yields of the crop to be grown this year and the final output will be watched by many thoughtful farmers.

Food for Thought About Food

(From page 20)

beans or peanuts as by growing beef cattle on it. Some 15 million acres are now being planted to soybeans and peanuts for direct harvesting. Soybeans normally contain about 17% oil and 37% protein, and peanuts about 47% oil and 30% protein. Both are finding their way to market as substitutes for butter and meat. Butter consumption fell from about 17 pounds to 10 pounds between 1935-39 and 1948, and the consumption of margarine and other vegetable fats was correspondingly increased.

The legume-seed crops are soil-exhausting crops. It is doubtful whether the farmer breaks even on intake and outgo of nitrogen in his soil by growing them. Important corrective measures have been found for the peanut crop in the development of a 1-year rotation with blue lupines, the latter crop being used as a winter cover. Plantings of lupines have multiplied tenfold during the last 8 years and now stand at about 500,000 acres in Georgia alone. Sweet clover and alfalfa are probably the best soil-improving crops to grow in rotation with soybeans in the Corn Belt.

Yeasts Important as Possible Protein Producers

Protein production by yeasts offers highly important possibilties. The distribution of the essential amino acids in vegetable proteins leaves much to be desired. Wheat is low in the vitally important lysine. But the proteins of yeasts are surprisingly similar to those of meat, and this makes them especially useful as supplements to cereals.

The best known yeast for commercial exploitation is *Torulopsis utiles*. This can be grown in large masses on cheap carbohydrate materials, such as molasses, vegetable wastes, potatoes, wood, and sulfite-waste liquor from the wood-pulping industry. Other yeasts are being used in the beer and whiskey industries. Still others have been developed for fat production. It has been estimated that 1 acre of concrete-enclosed pond filled with algae and yeast could produce fat equivalent to that yielded by 25 acres of a vegetable-oil crop. The prospects are bright for the hybridization of superior yeasts for the production of protein foods.

Yeasts can be produced in quantity within a few hours or days. Their efficiency in protein production from a given quantity of carbohydrate is about 65%, in comparison with about 20% for pork, 15% for milk, 5% for poultry, and 4% for beef. The produce of an acre of land can be transformed into 10 times as much industrial yeast protein as meat protein.

The basic materials for yeast production are carbohydrates and nitrogen. In addition, use must be made of mineral salts carrying phosphorus, potassium, magnesium, and sulfur. By continuous-flow aeration processes, large-scale production can readily be put into operation. Large tonnages of yeast proteins are already being produced to fortify breads, soups, gravies, and candies and as vitamin supplements. Highly important potentialities in their production lie ahead. Their use will be limited by economic factors rather than by any difficulties in technical development of the yeast industry.

Other Methods of Food Production Being Explored

Plants are relatively inefficient utilizers of the sun's energy. A 100-bushel corn crop uses only about 0.3% of the solar radiation that falls on the acre of land that produces it. The commercial goal is to make more efficient use of this energy by synthetic production of carbohydrates without the use of plants. This calls for unlocking the secrets of chlorophyll, which is credited with fixing 100 billion tons of carbon annually. Large-scale research programs are now under way to this end.

About 90% of the earth's photosynthesis is carried on in water, which covers about 2½ times as much surface as the land. Ocean water is a highly favorable medium for plant and animal life, because it occurs in dependable abundance, its temperature is uniform, it is well aerated, and it contains all the necessary mineral nutrients. Zooplankton, consisting of animals from 1 to 10 mm in length, can be made into a very tasty dish. They have a yield potential greater than the world's total meat supply.

Over 2½ million tons of fish are being harvested annually from the fresh waters of our 48 states and Alaska. About two-thirds of this is used for food. It is believed that the catch could be increased 50%. Some 25,000 fish ponds have been constructed in the United States during the last 15 years. Their 200-pound-per-acre yield could be tripled by proper management, including the use of fertilizer.

The agrobiologic school believes that the primary limitation to yield, other than the ability of plant protoplasm to do work, lies in the nitrogen content of the soil and of the crop that grows on it. The nitrogen content of plants varies between about 0.3 and 3%. If, whatever the crop, the same amount of nitrogen is removed from the soil, then the acre yield of one that contains only 0.3% nitrogen could be 10 times that of another that requires 3% nitrogen.

On this basis, if population pressure increased to a point that made it necessary, a gradual change could be effected toward the production of plants of the lowest nitrogen and highest carbon contents. Forest trees and sugar cane would qualify for this purpose. To overcome the low-protein disadvantage, the wood and cane, together with the necessary mineral nitrogen, could be fed to yeast with the resulting production of meat substitutes.

Final Answer Found in Energy Resources

The answer to the problem of producing still larger supplies of food will be found in the use of much greater amounts of the vast supplies of energy that surround us. At the moment, we are depending primarily on stored energy that had its origin in the sun. These energy resources consist mostly of coal, petroleum, natural gas, oil shales, and tar sands. About 98½% of the world's original known coal supply, 95% of its natural gas, and 90% of its petroleum are still available for use. The oil-shale and tar-sand resources remain to be explored. The exhaustion of these natural resources lies so far in the future as not to cause undue concern.

Large amounts of water power are going to waste. Little has been done toward harnessing the winds and the tides. The potentialities of atomic energy are being explored. But the primary source of energy is the sun. Its yearly output exceeds all the stored energy on earth. A 15-day period of sunshine provides energy equal to that contained in the world's entire coal deposits. A field of corn could be grown to maturity in a few hours if all the sun's energy that falls on it could be utilized.

Engines for converting the sun's rays into mechanical energy are in their infancy, but highly effective ones are not impossible. In due time the known principles of photochemistry and photoelectricity are quite likely to be put into operation in the capture and transmission of the vast quantities of the sun's energy that are now being wasted on the Great American Desert.

Given adequate energy resources, which seem assured for the not too distant future, gullied land can be leveled, and that in the shallower parts of the sea can be reclaimed from the sea. Even the ocean water can be distilled for use in making the desert bloom. Taking all the known facts into careful consideration, we need have no fear whatever of any lack of capacity to feed ourselves permanently in accordance with our desires. All we need to do is to make intelligent use of the abundant resources at our command.

Can We Afford Enough Fertilizer . . .

(From page 26)

the highest yield with one exception, and that was Stout. Beryl turned down an alfalfa sod and if he had side-dressed his corn with nitrogen at the last working I am satisfied he would have had at least 10 more bushels. Stout used more fertilizer and had bottom land with alfalfa sod but got a very poor stand and planted a hybrid that will not make extra high yields.

The second highest yield was Albert Post and his corn was planted on a hill that had had the grass taken off for 30 years and nothing put back. He had a slope of from 10 to 15 per cent, had to strip crop, and the soil was not over six inches at the deepest place and was underlaid with a soap-stone shale. His land never had been limed, but he did apply nearly the amounts of the three elements that the chemists tell us 100 bushels of corn will take from the soil. In other words, he put in the soil just about the amount that he expected to take out and he got what he expected.

These figures do not tell the whole story, only about half. For instance in Post's case, suppose that he had planted in the usual way with the average amount of fertilizer. In order to grow the same amount of corn which was needed in his feeding program, he would have had to plow nearly three acres of that steep hill instead of one. That would have increased his labor

Name	Yield Bu.	Value $1.50 per Bu.	Fer-ti-lizer cost	Profit
Beryl Hardin	125	$188	$44	$144
Albert Post	118	177	38	139
Carl Knotts	115	172	46	126
Henry Vincent	108	162	28	134
Jack Lucas	104	156	31	125
Raymond Stout	100	150	49	101
James Kerns	97	146	23	123
Satterfield	77	116	32	84
Average for county	43	65	*7	58

* We had no way of finding the exact amount of fertilizer the average farmer uses on corn, but from the experience of the class in talking with their neighbors, this figure was arrived at. If it is two small, the average profit is less.

costs more than three times, to say nothing of the risk of erosion in plowing so much hill land.

How much plant food did these men use? No two of them used the same amount, but the ones that made the greatest profit above the fertilizer cost applied about an average 140 pounds of nitrogen, 80 pounds of phosphorus, and 120 pounds of potash.

How did they apply it? No two of them applied it in the same way. Some turned it all down; some turned down part and worked in part; some put part in the row; and nearly all used a sidedressing of nitrogen at last working. Which method is best we have not determined but believe from observation that to plow down the phosphorus and potash and use the nitrogen in the row and as a sidedressing will give the best results.

All of them used a hybrid corn; five of the highest yields planted West Virginia B 17, and the seed was locally grown. Two planted Ohio W 17 which was also locally grown.

Look at these figures. If you are going to grow corn in the hill country where we must plow our lands just as little as possible, do you think you can afford to use less than the maximum amount of fertilizer, to say nothing of the impoverishment of your soil if you don't?

I do not claim that we will have to buy all this plant food in the form of commercial fertilizer, for we can grow a lot of the nitrogen with the use of legumes. However, we are going to have to put it in there if we expect to take it out in the form of crops that we can feed our livestock or eat.

Soil Testing in Georgia Is Rolling Onward

(From page 7)

ing is that gained by the man-to-man conversation which is obviously much better than correspondence that is often confusing, time-consuming, and expensive.

In addition to the routine testing of soils for fertilizer and lime requirement, the Mobile unit will be used for trouble-shooting in areas of the State where farmers are having difficulty, for demonstration, plant-tissue testing, and for locating fields suitable for experimental plots.

The outlook for mobile soil testing in Georgia is bright. Already another unit, a route van, has been obtained. This second unit will be in operation before July of this year. Each unit is capable of analyzing from 10,000 to 15,000 samples annually at a cost comparable to that when the analysis is made in a central laboratory. It is believed that six such units could take care of the needs for the entire State. The advantages of this type of soil testing, such as more rapid results, a greater educational value, and more accurate recommendations due to a better knowledge of local conditions, cannot be overlooked. The only disadvantage at the present is that the demand for "soil testing on the spot" far exceeds present facilities for doing it.

Extension Education in Soils in Wisconsin

(From page 25)

were set up in all counties in Wisconsin where sources of liming materials were available. In counties where limestone was available, this project afforded employment for hundreds of men in the quarrying of the rock and the lime-grinding operations. A total of better than seven million tons of lime was produced and spread on Wisconsin farms as a direct result of this program.

The impetus given to lime production through the setting up of several hundreds of these work relief lime-grinding and marl-digging projects has been reflected in our present large-scale agricultural lime production operations in Wisconsin. Better than two million tons a year are now being produced and spread on Wisconsin farms. The application of lime has always been one of the chief soil-building practices by which Wisconsin farmers earned their AAA payments. Records show that a total of over 19 million tons of agricultural lime has been produced and spread on Wisconsin farms since the inauguration of the work relief program of lime production projects starting in 1934. This program of lime production as a part of the federal work relief agencies was administered by county agents and their county boards and supervised by the extension specialist in soils.

Fertilizer Demonstrations—A Powerful Force

But perhaps the most outstanding program of education in soil improvement as viewed from the standpoint of getting farmers started in use of fertilizers has been our extension project of fertilizer demonstrations carried out in cooperation with county agricultural agents. This extensive program of fertilizer demonstrations has been made possible through generous contributions of the fertilizer industry and affiliated educational agencies. The American Potash Institute, the Middle West Soil Improvement Committee, and certain of the manufacturers of nitrogen fertilizer have been the chief contributors. For many years these agencies have supplied between $3,000 and $5,000 worth of fertilizer for these demonstrations and have further supported our work with leaflets, reprints, and circulars.

In addition to this type of work has been our whole-farm demonstration type of extension project, set up in co-operation with the Tennessee Valley Authority. This work was inaugurated in 1940 and is still functioning in about 45 Wisconsin counties.

In the early period of this program of large-scale demonstrations, the manufacturers of fertilizer distributing machinery supplied a considerable number of fertilizer-grain drills which were hauled on trailers by county agents over their counties in the setting up of these acre-scale demonstrations on small grain and seedings of legumes.

The yield data secured from these fertilizer plots, on small grain as well as on the hay crop the following year, have always been tabulated in all-state reports. For many years, 5,000 or more copies of these mimeographed reports were distributed among the fertilizer manufacturers and their dealers in Wisconsin. The reports were also sent out to Smith-Hughes teachers of vocational agriculture and to other educational leaders, including the AAA state and county committeemen.

The most valuable part of the demonstration in the early days was to sell the county agent, the Smith-Hughes teacher, and the county AAA committeemen on the use of fertilizer. Even at the present time, the county agent can best keep himself informed on new practices in fertilizer usage by cooperating in the setting up and carrying out of demonstrations on the use of nitrogen, potash, and phosphate.

Fertilizer Tonnage Increases in Spite of Shortages

The continuous teaching and preaching of fertilizer usage at winter meetings and via farm press, radio, and the actual demonstration of fertilizers even during the war and immediate postwar period, when there was never enough fertilizer to supply demand, did result in arousing a tremendous interest in the use of fertilizers; and in spite of shortages, there were large annual increases in tonnage consumption in Wisconsin. In 1939 a total of 42,623 tons of fertilizer was used by Wisconsin farmers, in 1948 a total of 404,121 tons.

This tremendous demand for fertilizer over the period of the past 10 years has resulted in the building of six new fertilizer factories in Wisconsin and four additional factories just across the Mississippi River on the Iowa-Minnesota side. These 10 new factories represent an investment of several million dollars, with capacity for the annual production of over 500,000 tons of fertilizer.

All of this increase in the use of fertilizers and capacity for the production of fertilizers in Wisconsin has come about in spite of adverse criticism during the war years that our extension program in soils was futile and that to urge farmers to use more commercial fertilizer was a waste of time, since there was not enough being manufactured to supply demand. We were told we might as well forget about our program of field demonstrations and even radio and platform presentation of the story of fertilizer usage, because farmers couldn't get it anyway. But my argument in rebuttal has always been that if we create a demand for fertilizers, somehow or other farmers will eventually have their demands satisfied. And this has proven to be the case. Actual capacity for the production of fertilizer in Wisconsin has been increased tenfold during the past five years.

Summary

1. Soil tests have given and are giving county agents and other educational leaders an intelligent basis for their recommendations of lime and fertilizers.

2. The psychology of the soil test is a most important factor in getting farmers started in the use of lime and fertilizers.

3. Even though soil tests are not a 100 per cent accurate guide in predetermining the need for lime and fertilizers, yet when backed up with information as regards previous crop and field treatment history, they are a real help in the diagnosing of crop ills and soil deficiencies.

4. Field demonstrations with fertilizer give a more positive answer as to what a farmer can expect in the way of crop response from its use. Seasonal conditions, however, greatly influence the response which crops show to fertilizer treatment, and for that reason the county agent or specialist must rationalize the results in the light of the seasonal factors.

The best evidence that extension work in soils has paid off in terms of crop improvement are the following facts:

Over 19 million tons of lime have been produced and applied on Wisconsin's farms in the past 15 years.

Over 2¾ million tons of commercial fertilizers have been used on Wisconsin farms in the past 15 years, with a present annual consumption of about 400,000 tons.

Alfalfa for the past 10 years in Wisconsin has averaged over a million acres, and in 1949 totaled 1,653,000 acres.

Wisconsin's corn crop, totaling nearly 125,000,000 bushels in 1949, was the best in the State's history (due in part to a most favorable season). Average yields, however, for the past 10 years have steadily increased, and even though a major factor in the increases in yield has been the contribution of the higher-yielding varieties of hybrid strains, yet the influence of the millions of tons of lime and fertilizer and the reflected effect on more nitrogen fixation by legumes have played their part.

Higher average yields of grain over the past 15 years are mute testimony to factors of improvement in varieties and soil fertility. Tremendous contributions have been made by the Department of Agronomy and associated Departments of Genetics and Plant Pathology in the breeding and selection of these new high-yielding strains of disease-resistant varieties of oats, barley, and wheat. It can be truthfully said that soil-fertility improvement has made possible the achievement of larger acre yields of hybrid corn and new grain varieties. Education in soil conservation and soil-fertility improvement has been implemented by the Federal action programs of the AAA and the Soil Conservation Service.

But there is still much to be done, much to be said, and much to be demonstrated in the field of soil-improvement practices in years to come.

Here Overstecken!

(From page 5)

ery stock, flowers, fruits, vegetables, pork and bacon, bulb raising, cheese making, and egg production par excellence.

The longest-lived and most historical of these famous Dutch specialities in farming are found in truck growing. Vegetables from Holland found favor with kings and lordly castle-owners back in the Middle Ages, and the selected plants and potted flowers grown in the low country were basic supplies for the courts of western Europe. Today the vegetable seeds, corms, and bulbs, as well as the certified seed potatoes, which Holland boasts about with perfect right, are valued export commodities at a time when export trade is widely sought. That some of the population draws the belly belts tighter so that some of the most delicious food may be sent out to earn exchange is probably just as creditable now as having to get along with a few skimpy meals during the war.

Unlike the case in our country with its vast land areas open to selfish exploitation, Holland has had its back to the wall, as it were, and to their farmers soil conservation meant more than a catchy slogan. Hence to maintain the kick and the comeback in fertile soils was a prime objective through the years for Holland farmers, making their country the leading user of commercial plant food. Belgium, Luxembourg, and Germany are the next highest fertilizer users.

Home manufacture of commercial fertilizers has been a thrifty necessity for Holland, and this has probably induced the heavy per-acre application. In pounds to the acre the Netherlands uses 55 pounds of nitrogen, about 90 pounds of phosphorus, and 88 pounds of potash, or 15 to 20 times the average rate for the United States as a whole. The world average runs somewhere between three and five pounds to the acre of agricultural land. Thousands of extra tons of plant-food supplies were imported by Holland farmers in the post-war period when domestic manufacture was slowed down. Grassland production has been especially helped by fertilizer imports, but the nitrogen used mostly in that regard is now being produced entirely by home factories with Marshall Plan assistance.

Grass combined with mineral plant food makes for a more lasting soil and a better balanced agriculture on the livestock pattern. So in Holland with its emphasis on dairying and grazing, the heavy fertilizer usage comes in good stead for cheap pasture promotion. Yet increased pasture is not the only aim. In addition to grazing the green meadows and cutting the hay for stacking and curing, a great impetus to artificial and mechanical grass-drying has developed. We saw much of that enterprise.

There are nearly 115 grass-drying plants available to farmers, mostly cooperative in character. South Holland and Friesland each have more than 25 of these dryers. Forage dehydration and the steaming of potatoes for hog rations are two group enterprises which might well be adapted in America, and more explanatory discussion is deserved than space permits.

Farm reliance upon good livestock and the proper improvement of the species as well as the domestic use and wide exports of livestock products are basic points in the husbandry of Holland. Our touring farmers rejoiced at the green meadows filled with cattle of real capacity—most of them the familiar black-and-whites known as Friesians, the solid black-bodied kind with white heads and bellies, called Groningens, and the blocky cows resembling our Shorthorns, but with red-and-white markings, similar to those in Germany, parts of France, and Switzerland—the Meuse-Rhine-Yssel cattle. These latter are the main draft animals in middle Europe.

AS for hogs, Holland raises just two regular breeds. One is for lean meat and bacon—the Landrace, often used for crossbred experiments under contract in this country; and the improved large white hogs, heavyweight fat stock. Of less frequent appearance in the rural scene are the Texel sheep, making up 70 per cent of the flocks, being a mutton-wool breed, white-faced, with long wool of average fineness, hardy and needing no shelter except in the very coldest of winters.

Used as cash income from mixed farming, Holland's poultry and ducks are under regular and systematic improvement work. The main chicken breeds are White Leghorns, Rhode Island Reds, and Barnevelders. A big increase in flocks occurred after the war and especially under the ECA aid program which brought tons of concentrates into Holland. Not only did this build up the poultry industry again, but it made possible a big jump in livestock products exports—from 550 tons of butter and 15,000 tons of cheese in 1947 to 24,000 tons and 22,000 tons respectively in 1948. Likewise, this available feed supply to eke out what home-grown grain and pastures provided enabled officials to remove milk, butter, and eggs from the domestic ration list, soon to be followed by meat and cheese.

MOST of us taking in the wonders of Holland last summer were struck by at least two significant factors that have contributed greatly to the advances these land-starved burghers have made in quality and quantity of farm production. One point is that the stockmen and their government are allied together in practically all regulatory methods designed to protect and increase the efficiency of domestic animals. The other is that a more progressive system of agricultural information and field education has sprung from the scientific and technical institutions and filtered down to the dirt farmer than seems to be the rule in any other European country visited.

This somewhat narrows the field in which our country and its best extension workers can expect to introduce educational subject matter that is really new to Dutch farmers. Perhaps our best bet in this case is to help them refine and redirect and reorganize some of the already well-established, and widely accepted and used, extension courses. I am of the firm belief that Holland—and maybe Switzerland—could send us "missions" too, teaching us some very vital things in conservation, thrift, and neatness. To be frank about it, the sharp contrast in good appearance and orderly care seen so commonly in Holland against the more ragged, unkempt, and sometimes slovenly and wasteful signs, all too evident in our own rural midst, calls for a dose of humility on our part, rather than so much "superior advice." We have had so much to do with, while they have had so little—that's the economic reason often heard. But don't forget that a sense of order, thrift, and pride in craftsmanship is something that we used to have in greater abundance than we enjoy today—maybe because our new immigrant citizens brought it along with them, and their offspring have since lost or mislaid it, under the pressure of our American age.

We won't have to pay duty on any imports of that kind we bring in and it will strengthen our courage and our self respect to get them.

Agricultural education and research are linked up with extension information to a surprising extent in Holland, compared with the situation found in adjacent countries that often possess as much know-how and about as advanced science but where no signal attempt to spread the knowledge to farmers has ever been successfully made.

AWAY back in 1890 when the State Agricultural College of Wageningen was founded there was money allotted to pay for agricultural teachers. The provinces of Friesland and South Holland at that early date had advisers already at work. This advisory service in 1948 was existing in agriculture with 22 advisers, in horticulture with 18, in dairying with 10, in livestock husbandry with 11, in poultry culture with 9, and even in beekeeping with 2 advisers.

The advisers form a link between the government and the farmers and between science and practice. They lecture, write, demonstrate, and organize. Manurial, plant-breeding, and cultivation tests and trials are major activities. Although this excellent start proved helpful and inspiring to Dutch farmers, the main trouble with it at first lay in the fact that aid and advice were open only to farmers who asked for them in a formal way. This left the ones most in need of assistance out in the cold, inasmuch as the lively, alert, and ambitious ones always had enough questions and requests on file to take up all the spare time left to the advisers. To some extent, even in our own country, the progressive seekers after new knowledge are apt to get first call from the extension agents. It all stems back to school usage, where the keen and responsive pupil attracts the chief attention of the teacher.

HOLLAND simply expanded its advisory system a few years ago and installed 450 agricultural and about 230 horticultural adviser-assistants, and on top of that the government established pilot farms here and there, choosing farmers with advanced technique to operate them. This effort is directed to the need of small landholders—the 15- and 20-acre people, and the red tape of asking for advice has been largely eliminated.

In the past 50 years a system of agricultural and horticultural education has become firmly set up. There is a network of more than 1,000 courses and evening classes. Low tuition fees and book charges are the rule, and study allowance grants are often used to overcome financial obstacles. Young people attend winter secondary schools as well, taking an entrance examination and receiving a system of follow-up instruction and farm visits during the summer months where they are employed. These same teachers who make the rounds checking up on their winter students are also used widely in management of the demonstration plots and experiments.

In cooperation and farm organization fields I doubt if we can do very much to instruct the Dutchman. To begin with, there are three general farm societies, the Royal Agricultural Commission, the Catholic Farmers and Growers Union, and the Christian Farmers and Growers Union. There are also three workers' associations—each one a parallel unit like the ones just noted—general agriculture and the Catholic and the Protestant farm employees. These six bodies in turn cooperate with the Agricultural Foundation at the Hague. This central unit is trying to evolve a series of regulations that will make legal certain binding duties and responsibilities for all farm producers in the interest of group welfare and efficiency.

In addition, Holland has 1,300 farm credit banks and literally hundreds of purchasing, marketing, and manufacturing cooperatives run by farmers. In the latter zone of operation, not only butter and cheese, but beet sugar, potato farina, strawboard for export, phosphate for fertilizer, and dried grass are made in large amounts.

IN short, in almost any complex and vital field of agricultural advancement—even in studying production in the colonial tropics—you'll be happy to find that the positive, pink-cheeked Dutchman has slowly but surely crossed off mistakes and marched forward.

An authority who confirms my enthusiasm about Holland is Dean Arthur Deering of the University of Maine, who has spent a few months in that country on one of the many U. S. special missions abroad. He writes home that "the Dutch people and their Nation are among the finest in the world." He praises their ambition, their fairness, and their whole philosophy of life. Their officials encourage farmers to be self-reliant and to avoid excessive debts and loans. Although the people do not have much money according to American standards, they appear well and happy, the Dean states. Like many others who look into the agricultural education plan in Holland, Dean Deering believes that no country has a better integrated system of research, teaching, and extension.

Yes, indeed, it's not just passing over his canals that the Dutchman says "Here Overstecken." He steps out on many fronts—firm, wide, and handsome.

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

Request bookings from your nearest distributor.

A young man, newly married, was filling in his Income Tax form. In the space for allowance claimed in respect of wife he joyfully wrote the amount. Then he came to the section marked "Allowance claimed in respect of children." He paused, pondered, and then with a flash of inspiration wrote: "Watch this space."

* * *

He appeared before the company officer, charged with using insulting language to his sergeant.

"Please sir," he protested, "I was only answering a question."

"What question?" snapped the officer.

"Well, sir, the sergeant said, 'What do you think I am?' and I told him."

* * *

An old colored employee was driving a truck along one of the New Jersey highways at a good clip one day, a good bit over the speed limit. A traffic patrolman picked him up, and when he had pulled over to the side, said:

"What's the matter, do you realize you were going 55 miles an hour?"

"No, suh," said the colored man, "Ah didn't know dat!"

"Well, haven't you got a governor on that truck?"

"No, suh, de governor's in Trenton—dat's fertilizer you smells."

* * *

The customer beckoned to the new waitress. Looking rather embarrassed, he said, "Could you tell me where the smoking room is?" "Oh," the waitress replied, "you can smoke right here at the table."

One girl asked another how to make love. "You can't really describe it," the friend replied. "You just stand still and defend yourself."

* * *

The three little Scouts who had been sent out from the meeting to do their good deed or else returned to report. "I did my good deed, sir," the first reported to the Scoutmaster. "I helped an old lady across the street."

"I helped her across, too," said the second Scout.

"Me too!", said the third.

"Do you mean," the Scoutmaster demanded, "that it took three of you to help one old lady across the street?"

"Oh, yes sir," the scouts agreed. "You see, sir, the old lady didn't want to cross the street."

* * *

The shapely chorine addressed the doctor: "I want you to vaccinate me where it won't show."

Doctor: "Okay, my fee is ten bucks in advance."

Chorine: "Why in advance?"

Doctor: "Because I often weaken and don't charge anything."

* * *

Reporter: "And what would you say has been the chief source of your strength and health?"

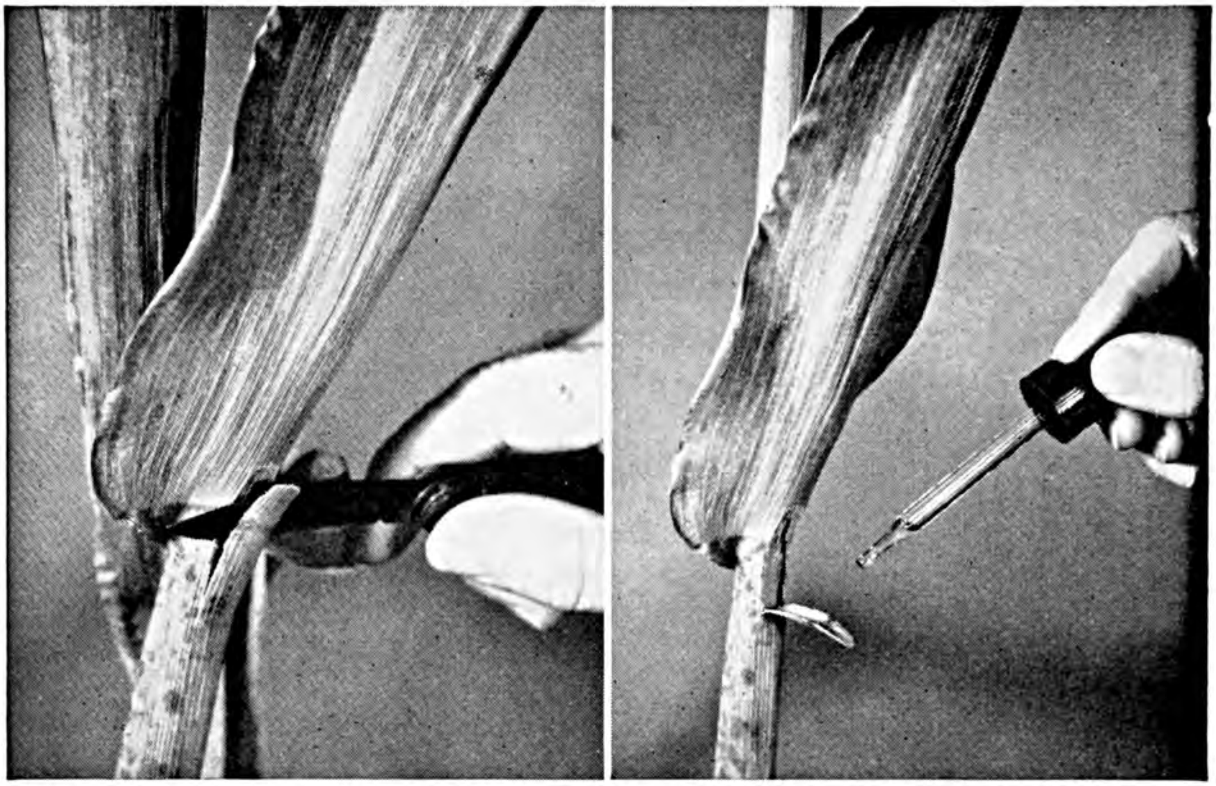
100-Year-Old: "Vittles."

* * *

He: "C'mon, give me a kiss."

She: "No, I've got scruples."

He: "That's all right. I had 'em twice."



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.

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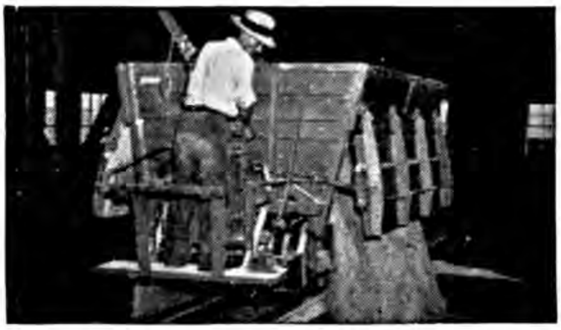

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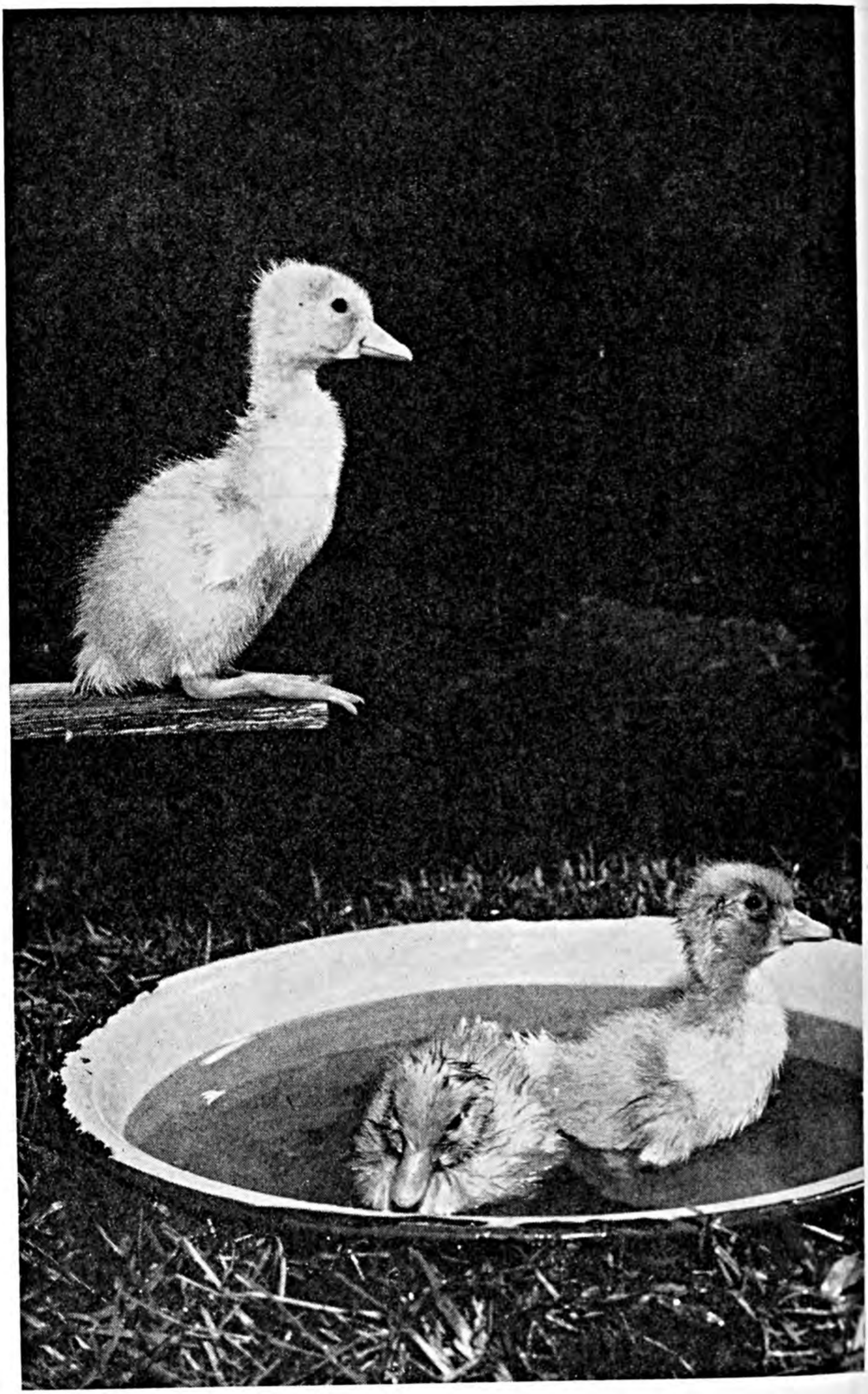

The Daredevil!

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VOL. XXXIV WASHINGTON, D. C., APRIL 1950 No. 4

We can learn from . . .

Buoyant Belgium

Jeff McDermid

MARTIAL music in the cobbled, winding streets and the dull boom of explosives in the orchard bordering the fields of Flanders on one bright September day of 1949 did not cause the despair and alarm so common around Ellezelles, Belgium, during two world wars.

This time no tanks and mopping-up squads rumbled into the little village, but a glance at the "officieel programma" within the covers of a yellow catalog told us that the national exposition of agriculture and horticulture was to be opened that morning with pomp and pleasantry by his honor, the Herr Minister of Landbouw, and the local gentry led proudly by Jean Vinois, Burgemeester of Ellezelles, aided by his gracious excellency, the Gouveneur of the Province of Henegouwen.

It all looked faintly familiar, a distant echo of many county fair gala days back home in the States—especially the robust and zealous farm implement demonstrators for manufacturers and dealers. Their array of bright steel and painted iron devices was assembled in the town square—a gently sloping stone-paved yard between the ancient square-towered church and the stores and refreshment cafes at the lower edge where the main street crossed the exhibit areas.

Here the "machines agricoles," the "tracteurs," motorculturen, the potato diggers, the wine casks and presses, the combines, the grain seeders, the insect sprayers and dusters, the cream separators, the portable electric milking machines, the grass mowers, and the less pretentious hand tools were being inspected after the fashion of discriminating farmers in every land where their craft is paramount. And it's paramount in Belgium, to be sure, because of the teeming urban population whose birth rate is gaining on the capacity of agriculture—even at its modernized best. Each 200 persons of Belgium's total population of over eight million people has about 100 acres of farm land to rely upon for food. Because folks and more folks are so plentiful and land is so scarce and valuable, the general desire is to attain a high crop and livestock output per acre, regardless of how relatively low such a total volume may be when figured on the basis of farm employment. That is, yield per worker is not nearly as practical a goal to them as yield per acre—which by the way, is often surprisingly high even measured on the American terms.

HOWEVER, at this fair in Flanders the children were running everywhere peering and pointing, and their mammas stood on the clean stoops beside the heavy old doorways in the brick and stone houses, watching the goings and the doings on this best and most zestful of Ellezelles times. Farmers and their families in holiday dress trudged up the middle of the streets, many of them having arrived on foot and others coming by team and motor cars, to witness all these wonders, to gossip and trade, and learn how to keep up with the fast European recovery pace—if weather and good fortune and silent prayers could make it come true.

Many authorities said that few of these curious farmers knew very much about the United States financial aid program or what counterpart funds were and what they are doing in furnishing equipment in more than normal supply. But others retorted convincingly that neither did these peasant citizens know much about the sun or the rain or the science of the soil—or even of the facts of theology—but these missing details never stopped them from sowing and weeding and reaping or kept them from attendance at church or wayside shrine. It's what they perform and produce that counts, and the cause will be credited when the effect is realized.

OUR American farm tourists stepped stiffly down from the two big Brussels buses to join the country crowd. They grinned and shook hands and otherwise tried to make it clear in facial rather than Flemish language how tickled they were to be on hand for this farm exposition. They wanted the Belgians to know that they were also landsmen, and hence well equipped at all times with the password of the "corn plant at the waterford" and could advance the horny palm grip of furrow fellowship. In short, the Americans gave notice that they were truly worthy of being accepted into the inner crafts of any exposition "agricole, horticole et pomologique."

Yes, and a few of these Yankee farmers were able to grasp a native hand and say, "I remember this country of yours in the smoke of 30 long years ago—all the way from here to Ypres. Thanks all the same for tending those graves of my buddies out there on Flanders fields where poppies grow." So in a way it seemed to be a double reunion—that of the passing generation for the losses and the blunders past repair, and for the hopeful ones who look again to a future when guns will cease and rural meadows be free of marching men. It may sound ivory towerish, but they have high hopes that agricultural understanding and unity may finally cement broken ties and misunderstandings all over the world. Most of us merely smile at this wishfulness and mutter "So mote it be!"

Thus in everyday fashion devoid

of dreams and visions, we pushed our way through the Belgian throngs, trying to be realistic and not fatalistic, trying to make ourselves believe that seeing is proving and that there is just as great potential power in the small farmers of raddled old Europe as there was in America after the dilemmas of the depression had been faced and overcome. One point we could tell for sure—these rural men and women enjoyed the fair in all its phases taking keenest delight in learning the newer and the better ways.

We lacked the time to enroll in any of the conferences "educative," but we all elbowed our way into the several grand divisions into which the fair was divided. There were the Section de l'Agriculture, Section de l'Horticulture, Section de l'Arboriculture Fruitiere, Section de la Floriculture, Section Materiel Agricole, Section Pepinieres, (or ornamentals, shrubs, and espaliers). Electricity on the farm, a hall of cereals and potatoes, and kindred main crop systems featured the agricultural section. Tree and vine fruits and medicinal plants were seen in profusion in the horticulture rooms. Most of our visiting group were buying great, luscious bunches of grapes and nibbling at huge, solid, tempting pears, as they meandered through the crowds and tried to find out what kind of special skill and training it required to produce the quality of vegetables and fruits which the show displayed. I doubt if they ever did find out the answer, yet they all recalled a previous day we had spent in the section south of Brussels in the region of famed Waterloo, noted for the greatest concentration of grape houses in the world.

This hot-house grape business was a real surprise for even such technical vine experts as our New York and California delegates. Commercial grape culture under glass in Belgium began in our Civil War times. Holland has a small area with similar equipment. Since 1900 the industry has centered at Overijsche and Hoeilaart, and if all the 33,000 "greenhouses" were put in one cluster they would cover 1,250 acres. Growers told us that Belgium's average yearly output exceeds 25 million pounds. You never saw such grapes. On second thought, maybe you have seen them, for sale on some super-markets and served at fancy restaurants that import these black and white globes. The black varieties brought to juicy perfection under coal and sun heat combined are the Royal, Colmar, Hambro, and Leopold III, while two white varieties predominate—the Muscat and the Canon Hall.

MOST of the grapes under this hot-house system are raised by small farmers as a family enterprise, each owner having 10 to 20 glass enclosures. Here and there are "muscat magnates" who run perhaps as many as two or three hundred greenhouses. Each house has a narrow central aisle, where, as you walk, the thick vine arbor arches and bends above your head. The roots of the vine are located well back toward the outer glass walls and the branches twine upward and forward, heavy with grapes of all shades from the unripe green to the pulpy purplish black and clear white of the mature fruit. Visitors are cautioned not to rub or touch the vines and clusters, so all a hopeful devotee can do is to keep his mouth open and hope that a windfall may drop into it. Of course,

(*Turn to page* 47)

Birdsfoot Trefoil— A Promising Forage Plant[1]

By A. R. Midgley

Chairman, Agronomy Department, University of Vermont, Burlington, Vermont

BIRDSFOOT trefoil is an old legume with new life. It was recognized in Europe over 300 years ago and was actually introduced and tried out by some agricultural experiment stations in this country over 50 years ago. However, it was given only a limited amount of attention until about 1934 when it was found in several New York counties during a pasture survey in that state. Farmers recognized it as a good pasture plant and as having been present in these areas for at least 20 to 25 years.

There are many current theories regarding its initial introduction. The most logical one is its spread from ballast dumps along the Atlantic Coast and Hudson River. Its spread through forage and hay loft sweepings and other material, accompanying the importation of livestock from Europe, is equally logical. The plant is common in the vicinity of railroad yards, such as in Albany, N. Y., and a very old pasture stand of the narrow leaf variety was recently found along Lake Champlain in Shoreham, Vt., in the vicinity of "Panton Meadows," a prominent settlement in the days of Ethan Allen. It seems that birdsfoot trefoil also was introduced at an early period near Portland, Oregon, which is an important seaport.

Birdsfoot trefoil is a long-lived legume. There are two important but different types: (1) Narrow leaf (variety tenuifolius) which has narrow, slender leaves, weak stems, and a rather fibrous root system; (2) Broadleaf (Lotus corniculatus, variety vulgaris) which has broader leaves, more erect stems, and a more pronounced taproot. The narrow leaf variety has 6 chromosomes; the broadleaf 12. Therefore they do not cross or mix. In addition to the above, there is a European broad leaf type which has even larger leaves than the ordinary broadleaf. It has large leaves, is more erect, starts quicker from seed, and recovers sooner after cutting than the American strain. Selections of this plant are being made, but at present it is extremely variable, and frequently is not as winterhardy and does not stand close grazing as well as the New York broadleaf called Empire. Most of the present European stocks come from Italy.

At first glance the leaves of broadleaf trefoil appear to be similar to alfalfa, but they are lighter in color. They are grouped in three's (meaning trefoil), but they also have two smaller leaflets at the base of the leaf branch, actually making five in all. These extra leaflets, or wings, are an important distinguishing characteristic when the plant is young.

The flowers are in groups of two to eight, each like a tiny orange-yellow sweet pea about one-half inch long. The seed pods, of course, are the most outstanding character and give the name birdsfoot. They are about 1½ inches long and radiate out from the stalk like toes of a bird's foot. Each pod contains about 10 seeds. When ripe and dry it snaps open and scatters

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[1] Printed by permission of the Vermont Agricultural Experiment Station; Journal series, paper No. 13.

the seed a distance of several feet. This makes seed growing very hazardous. The seeds of this plant are somewhat smaller than red clover and alfalfa and range in color from olive green to dark brown.

The root system of birdsfoot trefoil is intermediate between alfalfa and red clover. It is more shallow than alfalfa but deeper than red clover and more branched. The broadleaf variety with its long taproot frequently goes down four to six feet, which makes it rather drought resistant. The narrow leaf has a more fibrous root system which seems to make it better suited to poorly drained heavy clay soils than the broadleaf. The narrow leaf variety does not "heave out" of clay soils very readily during the winter.

This is truly a triple purpose forage plant—pasture, silage and hay. As a pasture plant it is slower in starting growth in the spring than ladino or white clover, but it frequently produces better midsummer feed when they are dormant due to hot dry weather. Of course on good ladino-clover land, ladino produces much more feed than trefoil, but usually does not live as long. Birdsfoot trefoil can withstand overgrazing as well as close fall grazing better than most other legumes. This is important when fall feed is scarce and meadows are grazed. There has never been a case of "bloat" with grazing animals, which is always a risk when alfalfa, ladino, red, alsike, or sweet clover is grazed.

For silage, birdsfoot can hardly be beat. It is very palatable and good-smelling because it produces a minimum amount of odor. For a hay crop, trefoil is superior to ladino clover. It is more erect and easier to harvest and cure for hay. It can also be cut very late in the summer, if necessary, and still make better hay than alfalfa or the clovers. The reason for this is that birdsfoot trefoil continues to grow and send out new leaves from the terminal branches. Furthermore, the stem is fine and palatable regardless of age. Even though birdsfoot trefoil is not cut until late August or early September, it will still be in a vegetative state, having new green leaves, flowers, and seed pods on the same plant.

The feeding value of birdsfoot trefoil hay is comparable to other good leg-

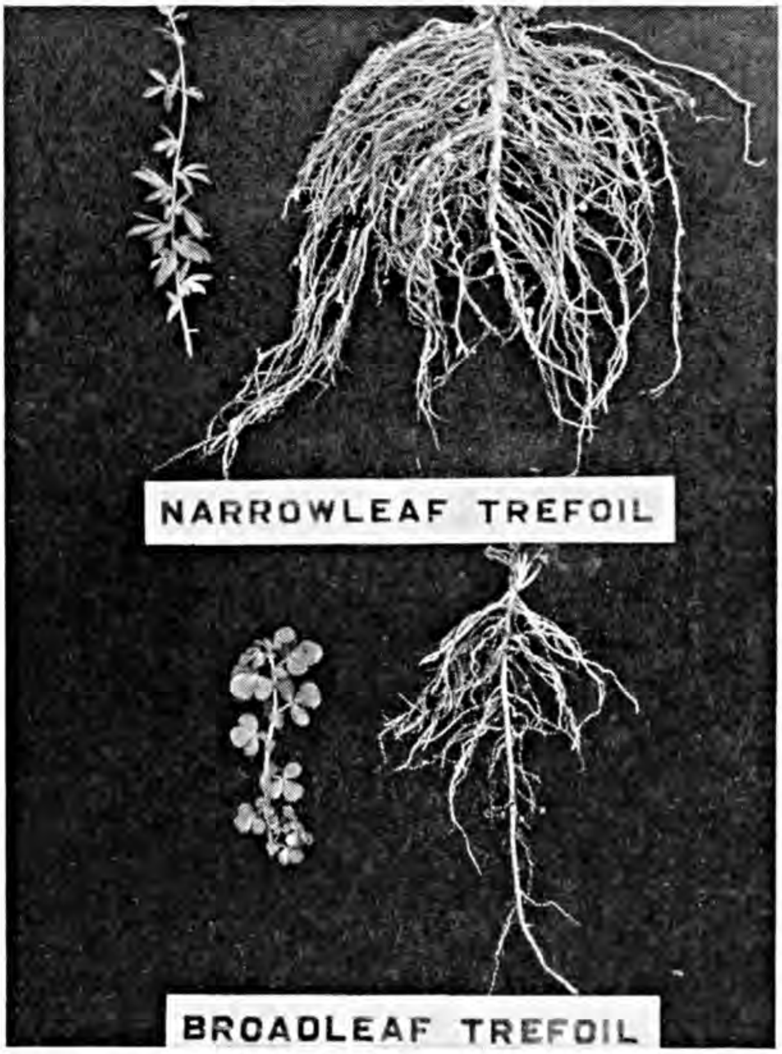

Fig. 1. Narrowleaf trefoil has small narrow leaves and a more extensive and fibrous root system than the broadleaf variety. It will grow on wetter soils, but for most purposes, particularly hay, it is inferior to broadleaf. Size and shape of leaves are the main distinguishing characteristics.

TABLE I.—YIELD AND PROTEIN CONTENT PER ACRE OF TREFOIL WHEN CUT AS PASTURE, EARLY HAY, AND VERY LATE HAY ON A HEAVY CLAY SOIL.

Cutting treatment	1947 lbs.	1948 lbs.	1949 lbs.	Average lbs.	Protein	
					%	lbs.
Pasture	3,636	3,611	1,477	2,908	18.95	551
Early hay	3,277	6,312	4,236	4,608	15.07	694
Very late hay	4,802	5,802	2,249	4,284	11.30	484

ume hay. The proportion of leaves to stems is similar to alfalfa, but both stems and leaves are finer. Full bloom is the best time to cut, and it frequently produces from two to three tons per acre. It must be handled carefully to preserve the leaves because they break off more readily than alfalfa or red clover. The second cutting is usually small but it does produce good aftermath for grazing.

The yield and protein content of birdsfoot trefoil when cut frequently to simulate grazing and when cut in the early as well as the very late stage are shown in Table I.

Highest yields and total protein were produced when cut at early hay stage. Over 2¼ tons of hay and 694 pounds of protein were produced per acre. In spite of the fact the very late hay stage was cut about September 8, over two tons of good hay and 484 pounds of protein were produced. There are very few if any other hay plants that can be cut so late and still produce such good quality, high protein feed.

The relative value of birdsfoot trefoil and timothy, compared to ladino clover and timothy, on a clay loam that was quite well suited to both plants is shown in Table II.

These seedings were made in 1942. During the first three years, ladino clover produced more feed than the trefoil, but from then on the latter was much better and averaged 1,000 pounds more hay per acre, per year, during the seven-year period. Much of the ladino clover died out after the third year, but by natural reseeding a relatively good stand was reestablished. The stand of birdsfoot, on the other hand, tended to improve each year, although in 1949, yields of both plants were poor because of dry conditions. In general, birdsfoot trefoil is adapted only to long rotations because it is slow in becoming established.

Soil Adaptation

Birdsfoot trefoil is frequently called a poor-land crop. Of course, it will "exist" on land that is acid and low in minerals, but yields are low under these conditions. Its ability to grow under poor soil conditions is the main reason it was discovered. In New York it was

TABLE II.—COMPARISON OF LADINO CLOVER WITH TIMOTHY VS. TREFOIL WITH TIMOTHY, GROWN IN FIELD PLOTS ADJACENT TO EACH OTHER.

Seeding	Pounds of early-cut hay per acre							
	1943	1944	1945	1946	1947	1948	1949	Av.
Ladino & timothy	3,670	2,240	4,558	4,759	6,560	6,013	2,590	4,341
Trefoil & timothy	3,130	2,000	7,392	7,777	7,069	7,434	3,593	5,485

found on poor, wet, stony land where little plowing was done and where there was little competition with other plants.

Birdsfoot trefoil is adapted to an extremely wide range of soil conditions. It has been found growing well on gravel ridges that are much too droughty for ladino clover, and it does much better than alfalfa on heavy clay soils that are wet. In fact, it will grow on wetter soils than practically any other legume. In Vermont some 75 plantings were made throughout the State in 1941. In practically all cases the best stands were obtained on the clay soils. It seems that the reason it does not grow better on sandy soils is lack of fertility. Clay soils are usually high in potash and lime.

Birdsfoot trefoil, like most other legumes, grows best on soils well supplied with lime. The optimum pH in the plow layer is about 6.5. On the clay soils in the Champlain Valley good stands have been obtained where the soil is more acid than this, but growth is usually slow until the deep roots reach the high lime subsoil, which is frequently at a depth of 18 inches. Soils that are not favored with this lime-bearing subsoil require higher lime additions. Birdsfoot trefoil, like alfalfa, feeds deeply in the subsoil and prefers good fertility in that area. Most sandy soils are at a disadvantage in this respect.

The old saying, "It takes money to make money," applies here because it takes good fertility to produce good forage feed. It is false economy to starve any plant even though it will grow with low fertility. In general, birdsfoot trefoil should be fertilized the same as for red clover. However, there is a marked exception. Manure should not be used the first year because of extra weed seed introduced and the tendency for excessive growth and competition from the faster growing plants. Nitrogen is not recommended because of the same tendency to produce excessive competition.

A number of fertility tests with birdsfoot trefoil have been conducted on both heavy clays and sandy soils. The results on a heavy soil (Panton Clay) are shown in Table III.

These results show that the greatest responses were obtained from use of superphosphate, but even on this soil with its rather high potash content, an

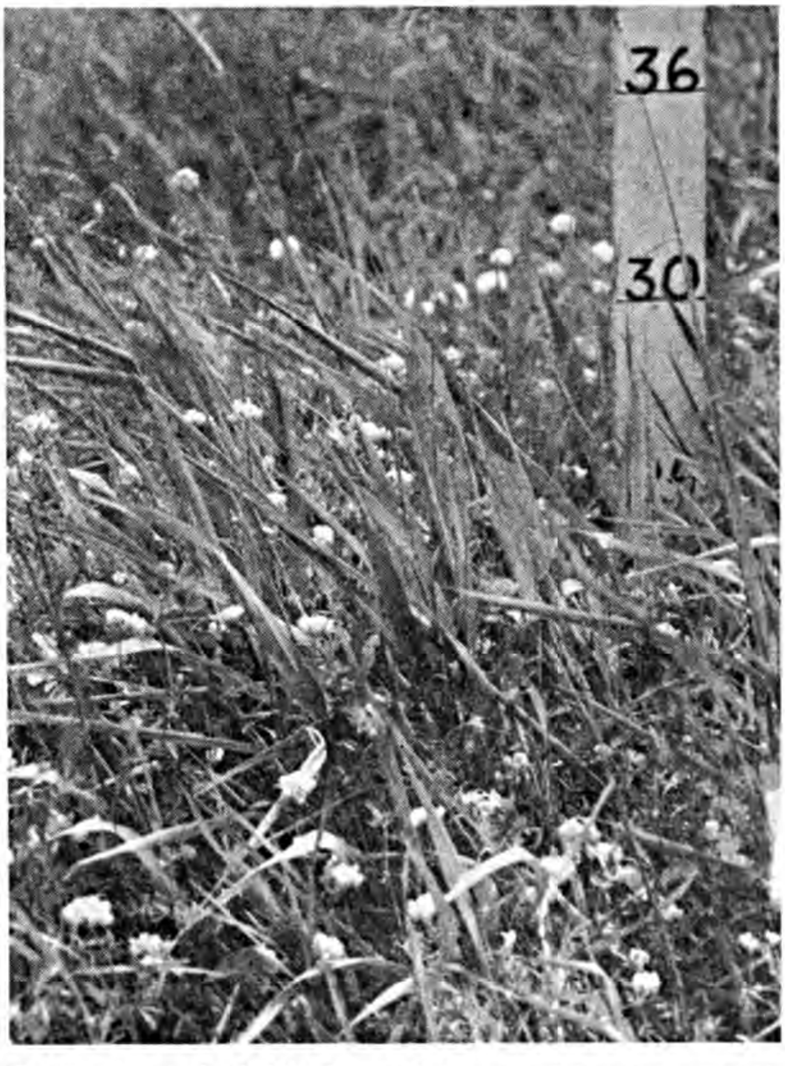

Fig. 2. On wet land, birdsfoot trefoil and reed canary grass have grown well together. If the grass becomes too vigorous, it should be pastured or cut for silage to reduce excessive grass competition.

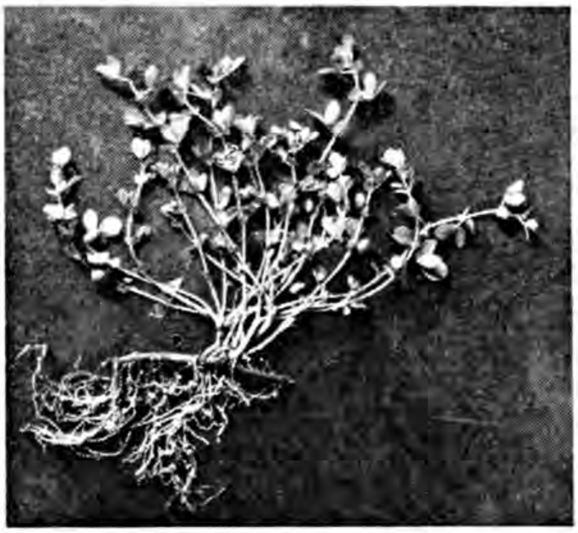

Fig. 3. Birdsfoot trefoil is one of the few legumes that will produce a new plant from a section of root. Breaking of roots by "heaving" or disking may actually help to thicken the stand, but it cannot be relied upon to do this.

annual application of 60 pounds of P_2O_5 and 15 pounds of K_2O produced nearly 1½ tons of extra hay per acre. The addition of nitrogen to the minerals actually caused a decrease in yield, primarily because of excessive grass growth. Data are not presented here but on a lighter soil, which was naturally more deficient in potash, even greater responses were obtained with this element. Borax also has been beneficial especially where large amounts of lime have been used. About 50 pounds of borax per acre in conjunction with manure after the second year of seeding have been very beneficial.

Since birdsfoot trefoil is a legume, it depends upon suitable organisms for nodule production and nitrogen-gathering properties. When properly inoculated, bacterial nodules are produced on the roots near the crown when the plants are very young. Later on most of the branching roots at greater depths develop clusters of these beneficial bacteria. Most soils do not contain this special type of organism, therefore it must be added to the seed at time of planting. Frequently seed dealers supply a can of inoculin with the seed, if not, it must be purchased separately. The inoculating material used for alfalfa, clover, beans etc. is not satisfactory because trefoil requires a special type.

Proper inoculation for this plant is so important that extra attention is worth while. Most inoculation material comes as a black, moist powder. Trefoil seed are so smooth that frequently the powder and organisms do not stick to the seed well enough to give good results. One very good method to overcome this is to add a handful of powdered clay, or other similar material, to the water before it is used to moisten the seed and inoculin. In this way all seed become coated with a thin layer of clay which sticks and holds the organisms to the seed.

Another and even better way is to add the powdered inoculin to pulverized sheep or old decayed dairy manure which has been dried and screened.

TABLE III.—FERTILIZER TRIAL ON BIRDSFOOT TREFOIL GROWN ON A HEAVY CLAY SOIL.

Fertilizer, lbs., per acre, per year $N-P_2O_5-K_2O$	Pounds of hay per acre			
	1947	1948	1949	Average
Check*	2,776	5,528	3,191	3,832
0–45– 0	3,986	6,364	4,545	4,965
0–45–15	4,941	6,790	4,628	5,453
0–60–15	5,822	8,871	5,299	6,664
15–45–15	4,542	6,812	3,811	5,055

* All plots, including check, received a basic treatment of lime and 300 pounds of superphosphate (60# P_2O_5) per acre when planted in 1946.

The manure-inoculin mixture should then be moistened for a better mixture of the two materials. This method has proven to be so successful it is thought that the manure acts as a "home" for the organisms and supplies food and protects them against excessive drying and sunshine after seeding. Some experimental evidence showed that the number of these desirable organisms increased greatly in this organic medium. Dried sheep manure or other material pulverized to the same size drills very well with the trefoil seed and therefore acts as an excellent material to dilute the seed for better planting. Equal volumes of seed and pulverized manure are recommended.

Seeding Methods

A good firm seedbed is important for trefoil. The seed are small and must not be covered deeply. They usually do best when covered with only ¼ to ½ inch of soil. A corrugated roller or cultipacker with small seed attachment is quite ideal. Grain drills are satisfactory but the small seed spouts should extend behind the regular grain and fertilizer spouts or disks, so that the seed will not be covered too deeply. A small amount of mineral fertilizer, especially superphosphate, can be drilled directly with the seed by running them through the same spout without burning or injury to the seed. Care must be used to see that the disks or shoes make only a very shallow furrow. The seed are then covered with chains following the drill or subsequent use of a cultipacker or roller.

We have obtained best results with trefoil when seeded as early as possible in the spring. This is advisable because trefoil starts slowly and it should be given a good start to survive the winter and frequent summer droughts. For the same reason, a so-called "nurse" or companion crop of oats should be used sparingly if at all. Either brome grass or timothy makes a good grass association. This type of grass is quite necessary to hold the trefoil plant up for easier cutting in hay production. Usually six to eight pounds of grass seed to five pounds of trefoil per acre are necessary for good stands. Clover or alfalfa should not be added to the above mixture because of their rapid growth during the first year or two.

Management

Trefoil must be managed (cut or grazed) properly the first year to reduce excessive competition by weeds, clovers, and other plants. Because it grows slowly the first year, competition by fast growing plants frequently crowds or smothers it out. Annual weeds and even red clover must be controlled by frequent clipping or occasional grazing and clipping. Grazing or the mower should be used the first year whenever the vegetation exceeds six to eight inches in height. If cut at this time it can be mowed rather closely because trefoil sends out new stems near the base of the plant. Close, early cutting when all vegetation is young actually damages most weeds more than it does the trefoil. Occasional grazing, or rather frequent clipping, is one of the most important factors in successful establishment of trefoil. Of course, this lessens the income of the land for one year, but with this long-lived legume, this loss is justifiable.

Seed Production

Birdsfoot trefoil usually produces a good crop of seed. The Vermont Station has produced from 300 to 400 pounds per acre. Harvesting, however, is very tricky and difficult. Frequently all the seed are lost, and 50 to 100 pounds of harvested seed per acre is considered a good yield. The plant blooms and sets new seed pods over a period of several weeks. Thus there are mature and green pods as well as flowers on the same plant. One must guess when most seed are ready because the mature pods split and expel the seed as soon as dry. Because of this diffi-

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Potash Production—
A Progress Report

By J. W. Turrentine

Washington, D. C.

THE accompanying chart, "Potash Deliveries, Agricultural and Chemical, North America," tells the story of the production increase by the American potash industry from 283,000 tons K_2O in 1938, the last normal prewar year, to 1,110,00 tons K_2O in the calendar year 1949. Of this total 1,039,000 tons K_2O were for agricultural, and 67,000 tons for chemical use. Of the 1,039,000 agricultural K_2O, some 955,000 tons were consigned to 45 states and the D. C., 42,000 tons to Canada, 5,000 to Cuba, 14,000 to Puerto Rico, and 12,000 to Hawaii. In addition, some 11,000 tons K_2O were exported to several other countries, principally of Central and South America. Imports into the United States and Canada shown on the chart amounted to 40,000 tons K_2O. In 1938, North American imports amounted to 225,000 tons K_2O.

The data on which this chart is based are briefly summarized in the following tabulation.

TABLE I.—POTASH (K_2O) DELIVERIES, AGRICULTURE AND CHEMICAL, NORTH AMERICA (UNITED STATES, PUERTO RICO, HAWAII, CANADA, & CUBA)

	1938 Tons	1943 Tons	1949 Tons
Domestic	283,000	730,000	1,110,000
Agricultural	268,000	646,000	1,039,000
Chemical	15,000	84,000	67,000
Imports	225,000	000	40,000

While use is made of the term *production*, it should be explained that the data being used here relate to *deliveries*, not necessarily synonymous but approximately so, since orderly shipments from refineries are now largely successfully organized. These delivery data are reported under confidential cover to the American Potash Institute by producers and importers to be totaled and released quarterly to the interested public. On this basis total deliveries in 1949 amounted to 1,146,000 tons K_2O, a decrease of 2.4% below that of 1948 due to a strike in the Carlsbad Potash Industries, thus interrupting for the first time an unbroken record of ever-increasing American production.

These reports of deliveries are received from the five major potash producers which are, alphabetically listed:

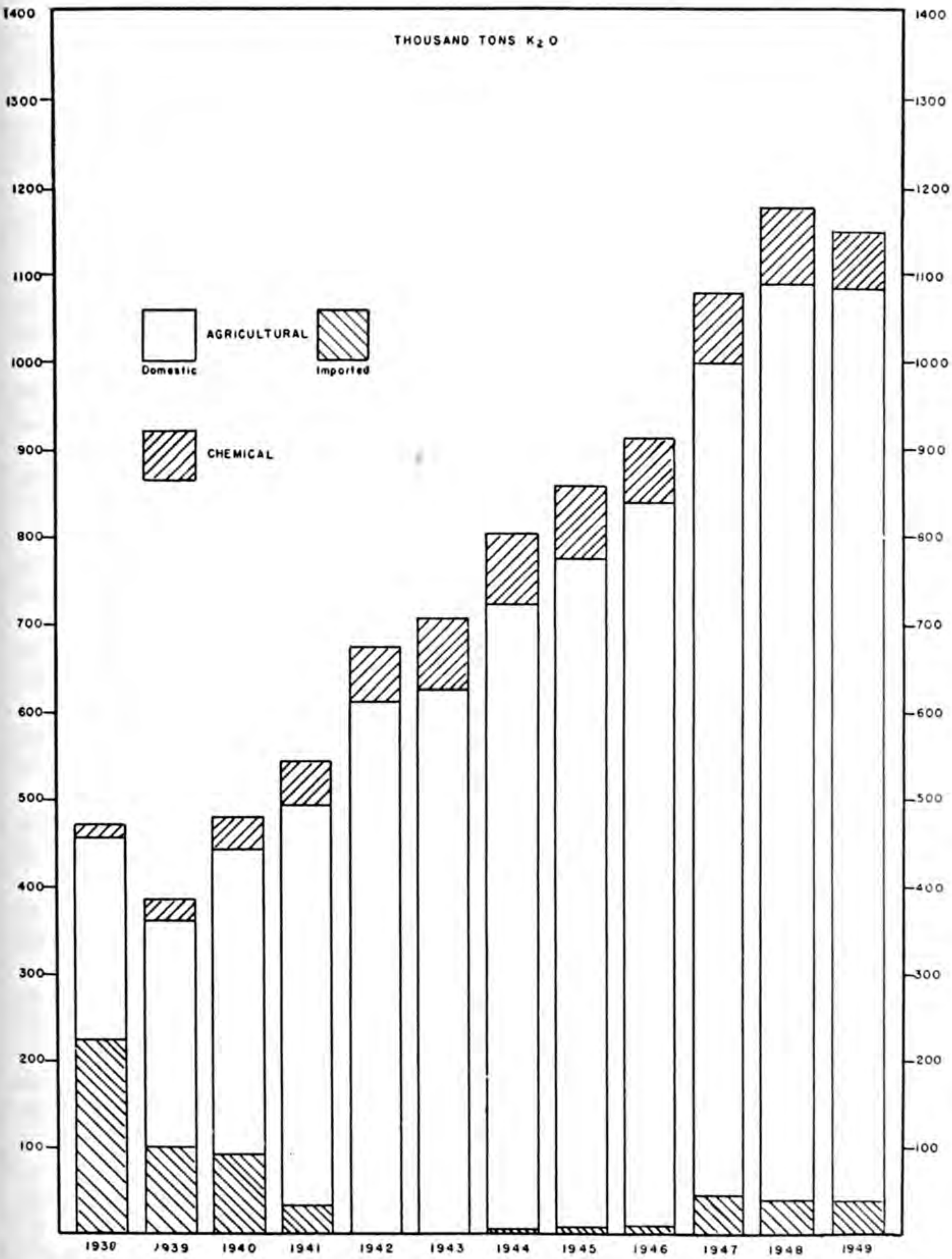
The American Potash and Chemical Corporation whose refinery is located at Trona in the Mohave Desert of California and whose raw material is the highly complex brine of Searles Lake.

Bonneville Limited situated on the salt flats of western Utah, whose raw material is the brine impregnating the muds underlying that salt crust.

International Minerals and Chemical Corporation, Potash Company of America, and the United States Potash Company whose mines and refineries are located in the Carlsbad area of southeast New Mexico and whose raw materials are the subterranean deposits of potash salts underlying that area.

Smaller tonnages of potash salts are produced by the Dow Chemical Company as a by-product from their processing of the natural brines of Michigan.

POTASH DELIVERIES – AGRICULTURAL & CHEMICAL
NORTH AMERICA



The total 1949 delivery of 1,146,000 tons K_2O was contained in 2,105,000 tons of potash salts, made up of the 60 and 50 per cent muriates of different crystal sizes, and the run-of-mine or "manure salts" as known in the fertilizer trade, the sulfate and the double sulfate of potash-magnesia. Of this tonnage the highly refined 98 per cent potassium chloride (60% muriate) amounted to 936,520 tons K_2O, representing 81 per cent of the total.

High-grade Muriate

The question might be asked, Why carry the refining process to the extreme of 98 per cent purity only to have the product diluted back to the 5 or 10 per cent K_2O fertilizer grades for retailing to the farmer and further diluted by him when he mixes 100 pounds, let us say, with 2 million pounds of soil constituting the top six inches of an acre of ground? The answer is *freight*—and the degree to which potash salts are being refined, increasingly so on the basis of the total output to further decrease freight charges, represents an outstanding achievement of the potash industry on which progress is still being made.

For example, concurrently with an increase of 400 per cent in production since 1938 there has taken place a 325 per cent increase in the production of the 98 per cent KCl grade, and with the added refining capacities now in full production or under construction this proportion will be progressively increased.

The relationship between concentration and freight per unit is a matter of importance to the man who pays the freight. With an average primary freight charge of $13 per ton of potash salts from the New Mexico refineries to widely scattered fertilizer mixing plants. the charge per unit K_2O in the case of the 60 per cent K_2O grade is $.22 as compared to $.26 for the 50 per cent grades and to $.52 for the 25 per cent grades. Here is a reduction in cost to the consumer of $.30 per unit K_2O resulting from the elaborate refining operations of the potash producers. Applied to the 937,000 tons of K_2O so refined, the saving in freight charges amounted to $28 million in 1949.

As stated, the expansions in refining capacities in operation during 1949 are designed to further increase this overall saving. Thus we may expect a decrease in deliveries of low-grade "manure salts" below the total of 46,100 tons K_2O (4 per cent of the agricultural salts) delivered in 1949 unless further increases in agricultural demands impel their shipment in the unrefined state as has been the case in recent years, their marketing at the behest of the buyers being prompted solely by potash demands beyond previously existing refining capacities.

New Developments

Progress is being continued in respect to both increased production capacity and average concentration of the marketed product, a statement applicable in varying degree to all the major producers. Still adhering to the alphabetical order, the five major producers will be considered briefly in the following paragraphs:

The American Potash and Chemical Corporation of Trona, California, has registered progress in various directions in increasing production with added efficiencies. From its raw material, the highly complex brine of Searles Lake, a long list of chemicals, it is recalled, are being produced. These include high-grade muriate of both agricultural and chemical grades and of different crystal sizes, potassium sulphate, borax (hydrated and dehydrated), boric acid, salt cake, soda ash, bromine and bromides and lithium concentrates. To maintain such a list of major and side products in balance with increasing potash output and market demands represents problems that call for frequent technological improvements in plant operations. Enlarged research and pilot plant laboratories have been built and equipped to provide for the ever-expanding research program.

Bonneville Limited, near Wendover, Utah, situated in the vast salt flats of the western part of that State has improved its refining facilities during the past year whereby the output of muriate of potash has been increased. This unique enterprise in the past has relied upon an extensive system of ditches as its source of dilute brine which is pumped therefrom into a series of large solar evaporation ponds. To augment the supply of brine, several deep wells have been bored. In addition an electrical power plant has been installed and sources of fresh water from deep wells have been developed.

Since the Carlsbad, New Mexico, producing center provides most of the potash currently supplied, what transpires in that area naturally may be of major interest to the fertilizer chemist.

The International Minerals and Chemical Corporation, producers of potassium chloride from the mineral sylvinite and of potassium sulphate and the double sulphate of potash-magnesia from the mineral langbeinite, has expanded its muriate production and has revamped its sulphate production facilities to improve the percentage recovery and the quality of its agricultural sulphate. In addition it has installed facilities for the production of the specially refined potassium chloride designed for the chemical industries. At the same time it has revamped some of its mining operations to improve both efficiency and output.

The Potash Company of America, whose principal product has been the high-grade muriate with some potassium sulphate produced through collaborative arrangements by salt cake manufacturers, has brought to completion its $4 million expansion program to increase its muriate capacity by 25 per cent including a 50 per cent increase in capacity for its chemical grade of potassium chloride. This comprehensive expansion program has involved both mining and refining facilities—an increase in hoisting capacity of some 65 per cent and added flotation units with collateral equipment, such as thickeners, filters, conveyors, and dryers.

The United States Potash Company is enlarging its refinery capacity with improved efficiency to provide a substantial increase in its output of high-grade muriate. Included is the installation of a nine-section forced draft Morley cooling tower for cooling the water used on its crystallization equipment as likewise that to be passed through steam turbine condensers. This is of particular benefit during hot summer months, preventing the let-down in production due to inadequate cooling during that period and thus providing a more uniform year-round production level. This increased refining capacity means the diversion of run-of-mine salts formerly marketed as such to the refinery for conversion into high-grade muriate.

All three companies in the Carlsbad area have continued research in every branch of their operations, from mining to refining. This has resulted in improved practices including drilling, blasting, haulage of the raw salts both below and above ground, mining machinery, hoisting, flotation, leaching, thickening, crystallization, filtering, and drying. Situated in a desert area, water supply is of major concern, a problem solved by piping in water from remote sources. Ever-increasing economies are essential if current low prices are to be maintained with wages at the highest levels paid in any comparable industry.

Speaking of prices and progress—progress may be claimed as continuing in the ability of the potash producers still to sell at prices virtually at the prewar levels against an ever-mounting rise in the cost of labor, materials, and services in general. Certainly this applies to high-grade muriate, 81 per cent of the total of domestic potash production, the only one of the three major plant foods that has not increased in price. Thus potash prices within the United States are lower than those prevailing in international commerce—connoting progress still being maintained in resisting the enticements of the export market in consideration of the requirements of the American farmer.

Exploration

The Carlsbad area continues to attract the interest of prospective new potash producers. Conspicuous among these is the Duval Texas Sulphur Company of Houston, Texas, which at the end of the year announced in the press its plans for entering the potash mining and refining industry under the name of the Duval Sulphur and Potash Company, following two years of intensive exploratory work on Federal and State lands in the Carlsbad area of New Mexico. Resulting from some 60 core tests at a stated expenditure of $450,000, potash ore bodies were located. These were of sufficient dimensions and richness to warrant the drawing up of plans, as announced, for the development of a mine and the construction of a refinery at an estimated cost of $7,500,000 to be expended over the period of the next two years.

The acreages covered by the Federal permits to this new entrant into the potash-producing field are close to those held by the other three producers in this area. It is estimated that one of these permits granted the Duval Company overlies a minimum of 14,000,000 short tons of potash ore currently available by present mining practices, which means without pillar robbing.

Thus, in due season, there is the prospect of four mines and refineries operating in the Carlsbad potash producing center. In addition, 22 leases and 177 permits have been issued by the Land Office of the U. S. Department of the Interior for further prospecting for potash on public lands in New Mexico, California, Utah, and Colorado.

Changes in Distribution

Returning to distribution, definite progress has been registered in recent years with respect thereto, both geographically and agronomically. To the fertilizer chemist familiar with the fertilizer distribution pattern of past years, it is well known that the consumption of plant food in mixtures was more widespread in the Southern States. While these mixtures were low grade by present standards, carrying but a few units of potash, the aggregate mixed goods tonnage sold in that area was of sufficient dimensions still to effect the retail distribution of the major part of the potash used in American agriculture. To illustrate, in the State of North Carolina, the leader in the tonnage consumption of mixed goods with considerably over one million tons per annum, 15 years ago some 45 per cent of the tonnage was in the form of the 3-8-3 mixture. In 1948, by contrast, 71 per cent of the total contained 6 units, and 15 per cent contained in excess of 6 units K_2O. In point of potash consumption the South still leads, but that progress is being made toward a more uniform geographical distribution is illustrated by the following figures:

Comparing delivery figures of the calendar years of 1940 and 1948 we find that in the 10 Southern States including Virginia and Tennessee on the north and Texas on the southwest, 152,000 tons K_2O or 50 per cent of the U. S. total were delivered in the earlier year as compared to 446,000 tons K_2O or 46.5 per cent of the total in the latter year.

In the seven Midwestern States including Ohio on the east to Iowa on the west, 1940 deliveries of 64,000 tons K_2O were 21 per cent of the total compared to 285,000 tons K_2O which were some 30 per cent of the total of U. S. deliveries in 1948. While in the 10 Southern States there was a 293 per cent increase in deliveries during this nine-year period, in the seven Midwestern States there was a 445 per cent increase. These data are summarized in Table II.

TABLE II.—CHANGES IN POTASH (K_2O) DELIVERIES BY SECTIONS.

Ten Southern States	*Seven Midwestern States*
1940—152,000 tons	64,000 tons
U. S. Total, 50%	21%
1948—446,000 tons	285,000 tons
U. S. Total 46.5%	30%
Increase—293%	445%

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Economic Agriculture, A Reality at Last?

By Ivan E. Miles

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I AM an optimist by nature and sincerely hope always to be able to see the better side of life. I am also a realist and at times I want to shut myself away from the world for the specific purpose of looking at myself and doing some thinking. I do not believe that I am terribly dumb or very brilliant. I am neither very young nor very old. Life has been very good to me and so I should not be, nor do I think I am, sour on the world. I have lived outside my native state long enough to properly appreciate it and have come home to settle down. It has been my privilege to see something of agriculture in every state in the Union and in a number of places outside. The things that I shall point out in my native state are true in varying degrees everywhere I have been.

It is my opinion that Mississippi has promise of making as much or more progress in the next 10 years as any state in the Union. I think there has never been a time anywhere when the people were so genuinely ready to do something as the farmers of Mississippi are today. But help me face my responsibilities as Extension Agronomist in a state where 75 per cent of the agricultural income is from crops included within my sphere of responsibility. Perchance, you will have a fleeting moment from time to time to take a back-handed sort of glance at yourself.

We certainly will not have time to exhaust the field but let's look at me, as a paid agricultural worker, and then let us think of just a few phases of agriculture.

Corn

The corn production average for 1949 was 23 bushels per acre, which is about 50 per cent above the 1939-1944 average. Even at 23 bushels, however, if prevailing local prices are paid for labor for man and mule, for rent, seed,

Figs. 1, 2. We can easily double our State average yield of corn.

depreciation of tools, fertilizer, and everything and the corn were sold for the current local price of $1.20 per bushel, the farmer would lose $6.10 per acre, not on one acre but on the state average, covering approximately 2¼ million acres of corn. That is to say, if the farmer is paid a living wage for his time he loses $6.10 per acre on the corn grown.

This would be sad indeed if nothing could be done about it. Luckily, however, such is not the case at all. Through the corn-breeding program under the able supervision of R. C. Eckhardt [1] and others, high-producing adapted varieties for most areas of the state are readily available. By using these adapted varieties, Howard Jordan [2] has very capably shown that with proper fertilization, stand, and other improved practices, excellent yields can be obtained. If Mississippi farmers would take this information secured by these men and apply it, the state average could easily be 50 bushels instead of 23. This could be done by following seven simple steps: 1. Grow on land adapted to corn; 2. prepare seedbed well; 3. select recommended variety or hybrid; 4. fertilize properly; 5. plant thick; 6. control weeds; 7. protect from pests.

Instead of losing $6.10 per acre as true for 23 bushels, 50 bushels would net a profit of $12.65 per acre above labor and all other costs, or to state it another way, corn cost $1.42 per bushel when only 23 bushels per acre are produced against a cost of $.95 per bushel on 50 bushels per acre. This is not guesswork, but is based upon many experiments and thousands of actual field trials. Actually when the farmer uses all his corn and has to buy, it will cost him considerably more than allowed in these calculations. Furthermore, the only way to make money growing corn is to sell it through livestock.

Figs. 3, 4. Where approved practices are followed good cotton can be grown.

Cotton

Perhaps a better job is being done in growing cotton than any other crop, but a recent survey has been made, and based on present price structures this survey showed that if all known facts in producing, harvesting, and marketing cotton were used there would be an average net profit of $75 more per acre than at present. On two million acres [3] this would amount to $150,000,000 or almost $500 for every farmer in the state. This means $500 more than he now gets. This information also lends itself to seven easy steps: 1. Plant on land adapted to cotton; 2. fertilize properly; 3. use adapted varieties (One-

[1] Agronomist, Division of Cereal Crops and Diseases, U. S. Department of Agriculture.

[2] Soil Scientist, Division of Soil Management and Irrigation, U. S. Department of Agriculture.

[3] In 1949 there were 2,800,000 acres in Mississippi.

Variety Community); 4. use labor effectively; 5. control insects and diseases; 6. pick and gin for high-grade cotton; 7. sell on grade, staple, and variety value.

Every one of these steps is important and should be provided. For instance, everything can be done correctly except controlling weevils and yet certain years the weevil infestation will be so serious as to destroy completely the crop regardless of whatever else is done.

Today, successful farming depends upon a completely unitized and coordinated program covering every phase of the crop from the selection of the seed and the land upon which those seed will be planted all the way through the marketing of that crop. If we will apply the information contained in the 7-step program, we can average a bale of cotton to the acre instead of the one-half bale secured in 1949.

Pasture

Pasture building has grown phenomenally during the last three or four years, but 2,250,000 acres of pasture are only a good beginning and many of these are not fully developed. We can take the information available and easily double the carrying capacity of our pastures and extend the grazing period from the average of 6 months to 12 months per year.

Fertilizer

In this warm climate and with an abundant rainfall, organic matter content in the soil is kept at a relatively low status and much plant food is lost by erosion and leaching. Consequently, our soils are comparatively low in productivity. Therefore, large amounts of fertilizer are an absolute essential in successful farming. If other approved practices are followed and the proper kind and amount of fertilizer are used on the major crops of Mississippi, every dollar spent on fertilizer will yield a net profit of a minimum of $3. That is a pretty good investment in anybody's language. Yet, far and large, the average farmer knows little about fertilizers. Generally speaking, he understands very little about the function, behavior, and action of plant foods and therefore is at a very distinct disadvantage to know what kind and how much to supply and how to secure proper balance between the various plant foods on a given soil for the crop to be grown.

While thinking of efficiency in the use of fertilizer, and perhaps lime should also be added, it might be well to raise the questions, "How does the farmer decide whether he needs lime and if so how much? How does he decide on what fertilizer to use and how much?" They are often purchased on the basis of hearsay or on brand

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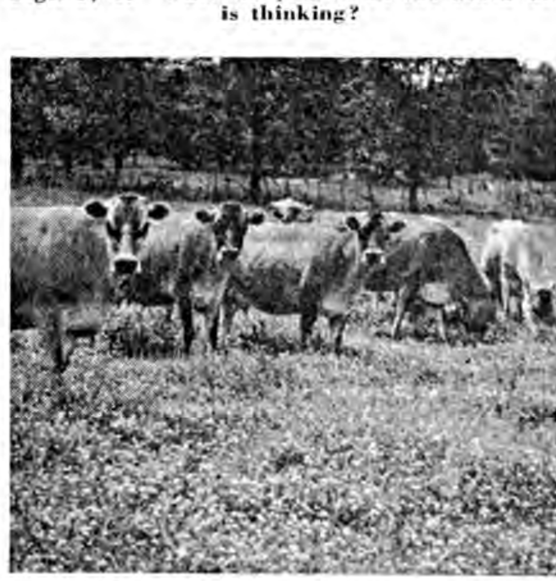
Figs. 5, 6. What do you think the black cow is thinking?



Know Your Soil

II. Evesboro Loamy Fine Sand

III. Sassafras Sand

By J. B. Hester, F. A. Shelton, and R. L. Isaacs, Jr.

Department of Agricultural Research, Campbell Soup Co., Riverton, New Jersey

THE climatic conditions that existed at Cinnaminson, N. J., in 1949 and the resulting differences in yield of tomatoes treated similarly prompted a study of the three soil profiles located within one mile of each other to ascertain information about the relative soil conditions that made possible the differences in yield. The Delanco soil, the first one described in the series, produced 102 bushels of corn, 15 tons of tomatoes, and 78 bushels of oats per acre. The Evesboro loamy fine sand produced 11.48 tons of tomatoes and the Sassafras sand only 3.97 tons per acre. Excavations similar to that made in the Delanco were made in these soils, and the root systems were studied.

Soil samples were taken at each depth of soil and analyzed. The clay depth in the Evesboro occurred much below that of the Delanco, i. e., the clay became prominent at the 23- to 42-inch depth in the Delanco and between the 53- and 60-inch depth in the Evesboro and was not found at the 60-inch depth in the Sassafras sand.

Using the conventional methods for determining the water-holding capacity, the Evesboro had the capacity of holding only 80 per cent of the amount held by the Delanco, and less than one-third of that amount was held by the Sassafras sand and at a much lower depth.

The characteristics of the Evesboro loamy fine sand, as shown in Table I,

TABLE I.—CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE EVESBORO LOAMY FINE SAND.

Horizon*	Depth inches	pH	Pounds per acre							% Organic matter	Water-holding capacity pounds	Per cent		
			CaO	MgO	Al	Nitrate nitrogen	P_2O_5	K_2O	Mn			Sand	Silt	Clay
A_p	0–7	6.9	2,800	90	1.7	1.4	60	194	T	1.5	571,200	89	4	7
A_{ps}	7–10	5.8	125	35	5.9	3.4	31	150	T	0.8	290,800	90	4	6
A_2	10–24	5.0	86	14	10.8	7.8	0.5	115	T	0.2	1,154,400	91	3	6
B_1	24–32	5.4	99	21	13.2	5.8	0.3	126	T	0.2	591,200	91	3	6
B_2	32–39	5.5	140	50	8.6	8.6	1	129	T	0.1	578,400	92	2	6
B_3	39–53	5.1	30	23	15.6	5.0	0.3	123	T	0.1	1,269,200	90	5	5
C	53–60	4.7	18	50	14.8	4.4	0.3	95	T	0.2	728,400	45	31	24

*A_p Brownish gray loamy fine sand; A_{ps} Light yellowish gray loamy fine sand; A_2 Brownish yellow loamy fine sand; B_1 Grayish yellow to yellow sand; B_2 Mottled light gray and reddish brown sand; B_3 Mottled grayish white and reddish brown sand; C Light brown and brownish yellow mottled sandy clay.

indicate a soil well supplied in calcium and magnesium in the top layer, but poorly supplied below. It was also very acid in the lower depths, which undoubtedly contributed very much to the unfavorable conditions for root growth. Available potash was fairly uniform throughout all depths, but the organic matter was low. Available potash was probably not being utilized in the lower depths of soil because of the unfavorable conditions for root growth. A plow sole had been developed between the 7- and 10-inch depth, but apparently was affecting the yield less than the extremely acid condition and the lack of water-holding capacity. Figure 1 shows the profile, the development of the plow sole, and the formation of the clay subsoil.

The leaching of nitrate nitrogen from this soil is extremely important as is shown by the tile drain in Figure 2. All during the months of June and July, six of these tile drains from the field were pouring out nitrate nitrogen at the rate of 47 to 60 parts per million and potassium at the rate of 15 to 18 parts per million. This makes nitrogen and potash fertilization on this soil important. A study of these facts points out the potential crop-producing power of this soil. Undoubtedly irrigation would be worthwhile under some conditions. On the other hand, care should be exercised in applying fertilizer so as not to lose it by leaching.

Sassafras Sand

It was difficult to excavate the Sassafras sand to get satisfactory studies because of the caving nature of the soil. While this soil is low in organic matter and without a satisfactory pH value and nutrient supply, it is perfectly obvious that the water-holding capacity in comparison with the formerly discussed soils is extremely low. The data in Table II characterize the nutritional status of the soil.

(*Turn to page* 43)

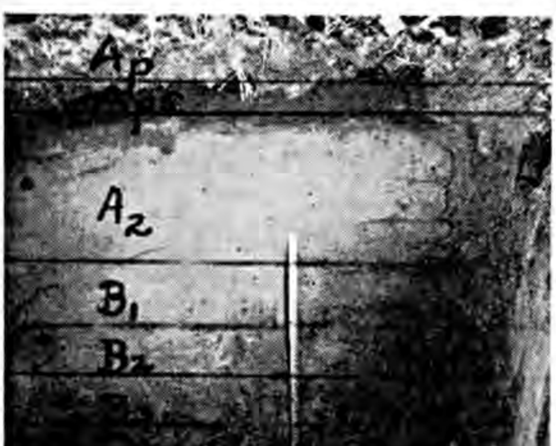


Fig. 1. Evesboro profile.

Fig. 2. Leaching from Evesboro soil.

TABLE II.—CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE SASSAFRAS SAND.

Horizon*	Depth inches	pH	Pounds per acre					% Organic matter	Water-holding capacity pounds	Per cent		
			CaO	MgO	Al	P_2O_5	K_2O			Sand	Silt	Clay
A_p	0–10	5.5	136	12	T	33	86	0.5	477,000	88	6	6
A_2	10–33	5.7	125	11	N	7	24	0.2	581,000	93	2	5
B	33–60	5.9	100	9	N	3	44	0.1	696,000	94	2	4
C	60–	6.0	100	15	N	5	24	0.1	232,000	94	2	4

*A_p Grayish brown loamy sand; A_2 Yellowish brown sand; B Reddish yellow sand; C Yellowish red sand.

Fig. 1. Crimson clover was seeded on this field of sericea in the fall of 1948 on the farm of A. T. Harrison, Munford, Ala., and was in bloom when photographed, April 25, 1949. See Fig. 2.

Year-round Green

By R. Y. Bailey

Regional Agronomist, Soil Conservation Service, Spartanburg, South Carolina

FARMERS in the South are learning to keep land green in summer and winter. To do this, they are using perennial summer legumes and grasses in combinations with annual reseeding winter legumes and grasses. This double cropping system keeps the land fully protected and gives a long season of grazing for livestock.

Sericea, kudzu, Johnson grass, Coastal Bermuda grass, and the narrowleaf Bahia grasses (Pensacola and Wilmington) are the most widely used perennials. Tall fescue has been seeded on several sericea fields and has shown much promise. Reseeding crimson clover, wild winter (also called Caley and Singletary) peas, grandiflora vetch, manganese bur clover, Italian ryegrass, and rescue grass are winter annuals that have shown most consistent ability to volunteer in thick stands when grown in combination with a perennial grass or legume.

Sericea and reseeding crimson clover have made excellent ground cover and furnished a long season of grazing at several experiment stations and on a large number of farms. This combination has grown well on soils ranging

Fig. 2. Sericea came back in a vigorous stand after the crimson clover shown in Fig. 1 matured seed. Another thick stand of crimson clover came in after frost killed the sericea in the fall of 1949. Field photographed July 26, 1949.

from heavy clays to deep, loamy sands.

Best results have followed where sericea was seeded a year or two before crimson clover was planted. Medium late dates of seeding, about October 15 in the middle South, have given better stands of clover than very early planting. Inoculated clover seed has been sown on sericea stubble following mowing or grazing. Seed was covered lightly by a section harrow or similar implement. Good stands also have come from seeding on the surface without any covering.

Farmers who have used sericea and reseeding crimson clover on the same land like this mixture for pasture. H. Owen Murfee, Jr., Prattville, Ala., is one of several farmers in that locality each of whom has several hundred acres of upland planted to this mixture. He reported 340 days grazing per year from this mixture, which is a very long season for an upland pasture to furnish feed. An increasing number of farmers in several Southeastern States are planting a high percentage of their upland pasture land to sericea and are sowing crimson clover the following fall or in the fall of the second year.

Like all new mixtures, this one requires some special management. Several farmers already have found that where this double cropping with legumes was practiced, the accumulation of nitrogen stimulated summer weed growth. Owen Murfee is trying rescue grass, tall fescue, and Harding grass in mixtures with reseeding crimson clover on sericea. He believes these grasses will use the extra nitrogen and reduce weed growth the next summer.

Results in the Land Utilization Project of the Soil Conservation Service at Dalton, Ga., at the State Hospital farm, Goldsboro, N. C., and on a number of farms in several different states have indicated that rescue grass will volunteer fairly consistently in such mixtures without the land being disked.

Italian ryegrass grows vigorously and

produces a large amount of good winter pasture when grown in mixture with reseeding crimson clover. It usually volunteers best where the surface of the soil is disked in late summer. Annual disking of sericea land is not a good practice because the disks injure the sericea plants and thin the stand.

Uses of Tall Fescue

Tall fescue has been sown on land after a stand of sericea was one or more years old and has made satisfactory growth wherever the grass seed was drilled an inch or a little less into the soil in the fall while there was a good supply of soil moisture. A few cases have been observed where sericea and fescue were sown together early in the spring and good stands of both developed. It is usually better, however, to seed the fescue on land where sericea has grown one or more years and built up organic matter and nitrogen in the soil. Fescue plants have developed somewhat more slowly on sericea than on other areas where a good seedbed was prepared and liberal amounts of nitrogen fertilizer were applied. Fescue on sericea has made exceptionally good growth the second year, after its roots were well developed.

Fescue plants usually have failed to survive the first summer drought where sericea was neither grazed nor mowed. For this reason, it is advisable to confine fescue seedings on sericea to areas that are to be pastured or mowed for hay. It does not fit well in a system where sericea is grown primarily for seed. A few plantings have been observed where tall fescue and a reseeding legume like crimson clover or wild winter peas both were sown on sericea land. The mixture has looked promising to date, but more time will be needed to get any final answers on such combinations.

Wild winter peas have been seeded on several established stands of sericea, and this legume has added to the density of the ground cover in winter and furnished good pasture in late winter and spring. Press Adams, Anniston, Alabama, pastures dairy cows on a combination of wild peas and sericea on part of his land and on another part he uses reseeding crimson clover and sericea. He gets good results from both reseeding winter legumes.

Good results with wild peas and sericea have been observed at several places in Mississippi. The commissioners of the Newton County Soil Conservation District bought a small, eroded hill farm and planted the cropland fields to different mixtures. Wild winter peas and sericea were used in one field for spring and summer hay. Peas were harvested for hay early in the spring and sericea in the summer. Observations there and elsewhere have shown that wild peas bedded down in the spring and did considerable damage to the stand of sericea if neither grazing nor mowing was practiced. The kind of mowing is important. Very close mowing prevented peas from making seed. Where the cutter bar was set to leave stubble about five inches high, enough short vines were left to make plenty of seed for reseeding.

Other Grass-legume Combinations

Another combination that is being tried under nursery conditions is a summer mixture of sericea and Pensacola Bahia grass and a winter cover of either reseeding crimson clover or wild winter peas. Sericea and Bahia grass have grown well in mixtures on small areas of the Soil Conservation Service nursery at Americus, Ga. Both reseeding crimson clover and wild winter peas have grown well as winter covers on Bahia grass. Combinations of these plants may give us green cover and a long season of grazing on sandy uplands. Such combinations are mentioned here only as possibilities that as yet have not been fully tested in our observational nursery program. A few observational seedings of sericea and Wilmington Bahia grass also have been made on farms.

Grazing management is an important

Fig. 3. Reseeding crimson clover was sown on a sod of Coastal Bermuda grass at the SCS nursery, Thorsby, Ala., in the fall of 1948. This good growth was photographed May 3, 1949. A volunteer stand of clover came up after Bermuda grass was killed by frost in the fall of 1949.

part of these double-cropping systems with sericea and other plants. Best volunteer stands have come in the fall where sericea was mowed for hay or grazed fairly closely in late summer. Where very dense sericea was left uncut, volunteer stands of the winter plants often were late and thin. Likewise, sericea needs protection in the spring. As pointed out in connection with wild winter peas, very dense growth of one of the reseeding legumes that is neither grazed nor mowed for hay sometimes tends to mat down and smother sericea plants.

Where reseeding annuals are pastured in the winter and spring, it is necessary to regulate the rate of stocking so that these plants will make seed. In mixtures that include wild winter peas, stock should be taken off before the seed pods begin to fill. The seed of this legume contains an alkaloid that is toxic to livestock. Animals that were left in the fields where peas were making seed sometimes became stiff in their hindquarters. These animals usually recovered when moved to other pasture.

Proper grazing management of sericea also is important. Several fields where good stands of sericea were weakened and thinned by continuous close grazing have been observed. Sericea is like other plants in that both roots and tops are necessary for normal growth. Excessive grazing, therefore, reduces the amount of feed produced, in addition to weakening the stand of sericea.

Another combination that keeps the land covered with green plants and makes good pasture is Johnson grass and wild winter peas. Sometimes farmers use the peas for winter and spring pasture and harvest the Johnson grass for hay in the summer. Press Adams at Anniston, Ala., has this combination and his spring grazing and summer hay show that this is a highly productive combination. Nitrogen from

(*Turn to page* 44)

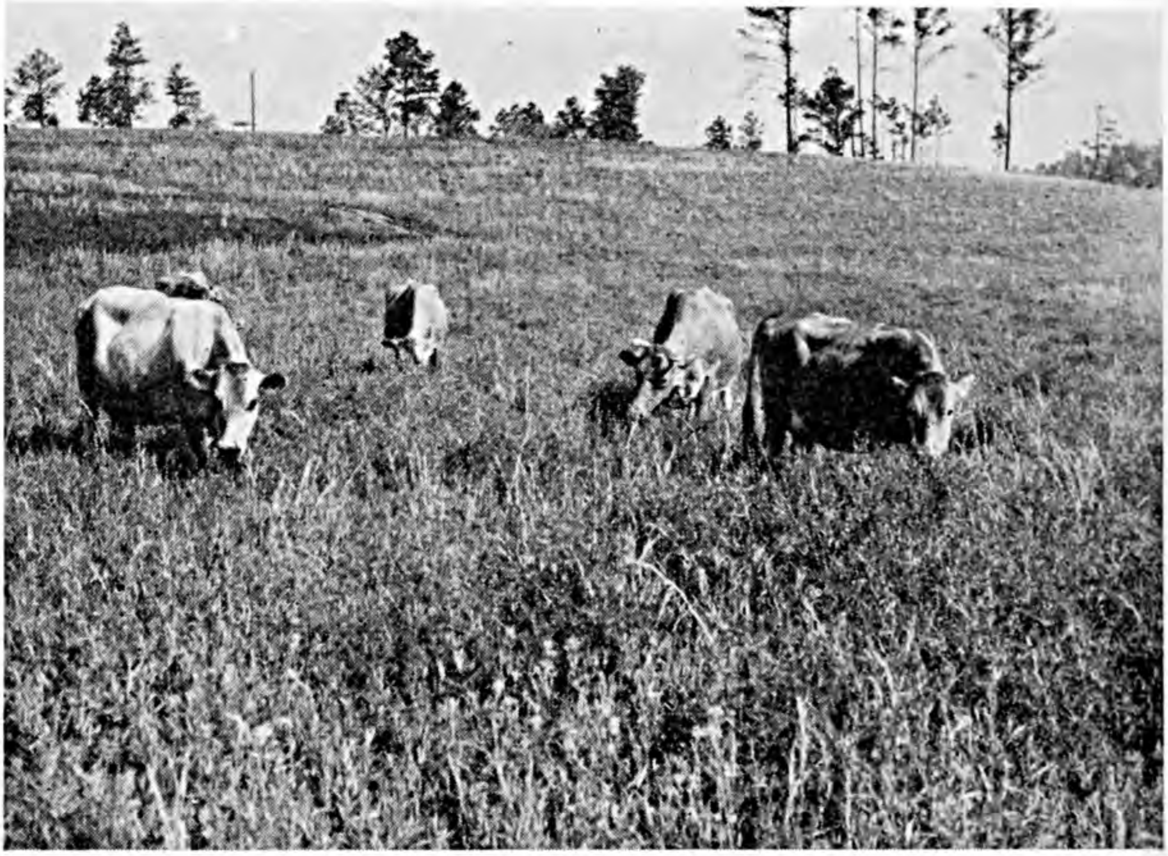


Fig. 4. Dairy cows grazing a mixture of Caley peas and vetch on a sericea field on Press Adams' farm, Anniston, Ala. Photographed April 26, 1949.

Fig. 5. Sericea made good summer growth after the winter legumes shown above matured seed. Photographed July 26, 1949.

Fig. 6. Caley peas made good late winter and spring grazing on a Johnson grass field on Press Adams' farm, Anniston, Ala. Photographed April 26, 1949.

Fig. 7. This dense growth of Johnson grass followed the Caley peas shown above in Figure 6. Photographed July 26, 1949.

Fig. 8. Caley peas sown on Coastal Bermuda grass at the SCS nursery, Thorsby, Ala. Photographed May 3, 1949. A thick stand of peas came up on this area in the fall of 1949.

Fig. 9. A volunteer stand of reseeding crimson clover on kudzu at the SCS nursery, Thorsby, Ala. Photographed May 3, 1949. Another volunteer stand came up in the fall of 1949.

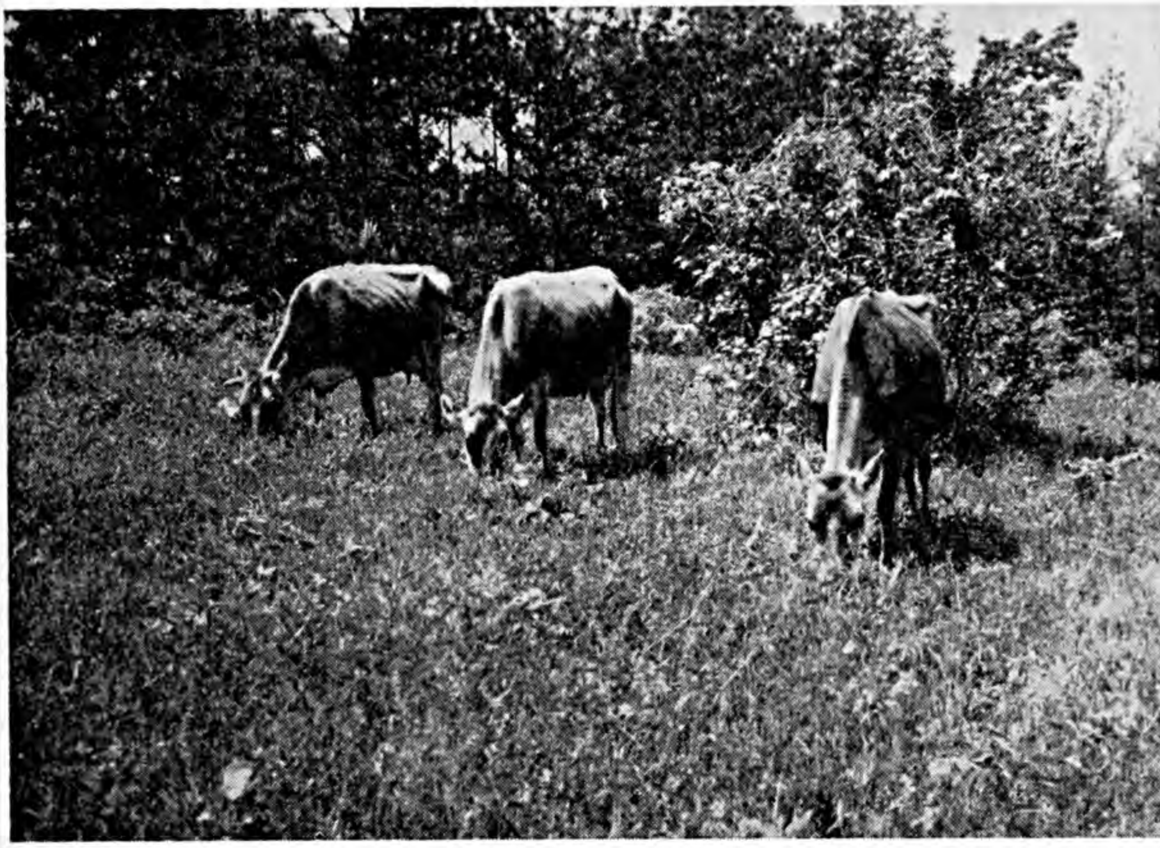


Fig. 10. Caley peas were sown on kudzu on F. E. Williams' farm, Columbiana, Ala., in the fall of 1941 and have volunteered each fall since. Photographed April 26, 1949.

Fig. 11. Growth of kudzu that will make good fall pasture on same field shown above. Photographed July 26, 1949. Kudzu was followed by another stand of peas.

Fig. 12. Caley peas on a kudzu field furnished excellent late winter and spring pasture on W. J. Bailey's farm, Montevallo, Ala. Photographed April 26, 1949.

Fig. 13. Kudzu, on the field above, made enough growth to produce over a ton of hay per acre after the peas matured seed. Hay was being cut when photographed July 26, 1949.

The Editors Talk

Elastic Fertility

Some plant nutrients, principally nitrogen and water, are mobile and will find their way to the plant roots. Other nutrients, chiefly phosphorus and potassium, except in very sandy soils are largely immobile and tend to stay where they are put. To be used, they must be found by the plant roots. It is on these facts, together with knowledge of rooting habits of the different crops, that all of the research on fertilizer placement has been based.

According to Roger H. Bray, Professor of Soil Fertility, Illinois Agricultural Experiment Station, in the book DIAGNOSTIC TECHNIQUES FOR SOILS AND CROPS, fertile soils are soils which, except for nitrogen and water, have a large reserve of nutrients already present in available forms—forms which can be used by the plant roots when the roots reach them. It is these reserves, accumulated in the past as a result of previous treatments or natural processes, that are responsible for fertility in soils. The yearly release of nutrients from unavailable forms has, except for nitrogen, only a minor effect on the immediate crop, although it can have a major effect on maintenance of fertility over a long period.

Because these nutrients are relatively immobile, their availability to plants is limited by the nature of the plant, particularly the density and extensiveness of the rooting system. The roots must go out and forage for the immobile nutrients, continually sending out new roots as the older ones exhaust the effective feeding zone.

Dr. Bray states that an "elastic" availability of the immobile forms is made possible by the large amounts present. Even in a deficient soil the amounts are several times larger than can be used by a single crop. But the immobile forms have a very indefinite availability to plants. Favorable seasons, favorable physical soil conditions, and good varieties all help produce higher yields, which require the uptake of larger amounts of nutrients. It is the larger, denser, and more efficient root system produced by these more favorable conditions that makes it possible for the plant to forage for the large amounts of nutrients needed. Although varying amounts of a nutrient can be absorbed from any level of supply, maximum yields are impossible if that supply is low, since the deficiency cannot be overcome by making the other conditions more favorable. This is because the plant is influenced by all factors determining its growth. If for example, potassium is only 80 per cent sufficient for a given crop it will restrict yields by about 20 per cent over a wide range of fertility. The higher yields take out more potash but will still be 20 per cent lower than what could have been produced with adequate potash. In the face of an added deficiency, say only enough phosphorus for a 60 per cent maximum yield, the 80 per cent supply of potassium would bring the yield down to 80 per cent of 60 per cent or 48 per cent of a full crop.

This illustrates, according to Dr. Bray, what is meant by elastic availability of the immobile nutrients, which enables them to work with a similar percentage of effectiveness at different productivity levels. It could only work where the total immobile supplies of the available forms are, even in deficient soils, in excess of the needs of any one crop. This seeming anomaly is due to the fact that no one crop during a single season could remove the total supplies of immobile but "available" nutrients. In a way this is nature's method of preventing the total depletion of a soil.

In this is the explanation of why there may be little or no response from an application of a plant-food element when there is a deficiency of one or more of the others. It argues well for a more universal use of soil tests. Dr. Bray has estimated that in Illinois alone $5,000,000 worth of fertilizer has been wasted by farmers who didn't test their soils and put on something that wasn't needed. On the other hand, the ones who have tested have saved about $4,000,000 by using the kind of fertilizer they needed, in the amounts needed, and where it was needed.

The Value of a Good Farm Wife

With spring "busting out" all over, garden soils are being turned and the air is full of the cheeping of young poultry. Perhaps at no time of the year does a busy farmer appreciate more the services of a good farm wife. Between her housecleaning and hundreds of other household chores, she manages to save him countless steps and laborious details which are so time-consuming in the rush of spring work.

What is the value of a good farm wife? There was a time back in the colonial period between the years 1619 and 1621 when a farmer could secure a wife for about $36. This came about through the importing by governing officials of "young and uncorrupt" maidens as mates for the settlers. The charge to the settler after he had chosen his maiden was 120 pounds of tobacco to pay for her transportation across the sea.

We have come a long way from colonial values and it is not surprising to learn that a good farm wife is now considered to be worth $60,000. M. L. Mosher, Extension Farm Management Specialist at the Illinois College of Agriculture, has figures to show that the average farm wife is worth that amount in extra income to her husband and family during their married life.

He gets the figure from a study of farm earnings on 240 north-central Illinois farms for the 10 years, 1936-45. A few of the operators were bachelors. They earned on the average $2,400 less in net earnings each year than the married farm operators. Yet both groups operated the same general size and type of farm. This $2,400 difference capitalized at four per cent amounts to $60,000. If you multiply the $2,400 difference each year by 35 years of married life, the figure would jump to $84,000. Mr. Mosher, however, does not assure bachelors that marriage will automatically guarantee successful farming and $60,000 more income. But he believes that having a wife does help.

And so—hats off to the farm ladies. We all know many whose worth could not be measured in dollars. Their inspiration to home and community life are intangibles upon which it would be difficult to put a value and which have contributed so greatly in making American agriculture the basis of this nation's prosperity and well-being.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941...........	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942...........	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947...........	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
April........	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May.........	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June........	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July.........	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August......	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September...	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October......	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November...	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January.....	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February....	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March.......	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay[1]	Cottonseed	Truck Crops
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	89	81	109	74	87	110
1938...........	69	196	80	79	76	64	57	97	88
1939...........	73	154	100	84	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	105	117	107	82	211	129
1942...........	153	369	168	134	143	124	91	202	163
1943...........	160	405	188	235	174	154	125	231	245
1944...........	167	420	214	216	170	160	139	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	178	248	212	209	141	319	204
1947...........	257	380	232	248	336	259	148	381	249
1948...........	250	387	220	249	212	232	160	301	238
1949									
April........	241	247	260	314	190	226	160	223	236
May.........	242	325	260	312	190	226	149	224	213
June........	243	315	251	301	188	210	138	207	175
July.........	243	565	222	323	195	206	132	166	185
August......	236	446	221	305	184	202	135	197	174
September...	240	487	198	263	181	212	137	193	205
October......	231	474	187	224	170	214	141	185	170
November...	224	434	192	216	159	215	141	188	213
December....	214	454	188	230	176	218	144	192	196
1950									
January	213	397	195	245	179	217	144	193	261
February....	222	341	191	252	181	218	141	193	203
March.......	226	320	189	253	185	224	139	191	168

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	10.11	10.59	10.84	9.85
1949						
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34

Index Numbers (1910-14 = 100)

1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949						
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948	.764	4.27	6.60	.478	.681	14.14	.195
1949							
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949							
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
April	256	244	229	134	99	291	144	72
May	253	244	227	134	99	293	144	72
June	249	242	223	134	99	304	144	65
July	246	240	225	140	100	349	144	68
August	244	238	222	143	100	372	144	68
September	247	238	225	138	100	334	144	68
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	222	134	96	305	142	72

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Commercial Fertilizers, Report for 1949," Agr. Exp. Sta., New Haven, Conn., Bul. 534, Dec. 1949, H. J. Fisher.

"Fertilizer Analyses—Fall 1949," Kansas State Board of Agr., Control Div., Topeka, Kansas.

"Louisiana Fertilizer Report, 1948-1949, Fertilizer Consumption, Fertilizer Recommendations, Fertilizer Analyses," La. Dept. of Agr., Baton Rouge, La., E. A. Epps, Jr.

"1950 Fertilizer Recommendations of the Louisiana Experiment Station," Agr. Ext. Serv., Baton Rouge, La., M. B. Sturgis and R. A. Wasson.

"Maryland Fertilizer Facts for 1949," Inspection and Regulatory Service, College Park, Md., L. E. Bopst.

"Know Your Fertilizers," Ext. Serv., Miss. Sta. College, State College, Miss., I. E. Miles.

"More Efficient Use of Fertilizer," Agr. Exp. Sta., Univ. of Mo., College of Agr., Columbia, Mo., Bul. 531, Dec. 1949.

"New York Fertilizer Recommendations," Ext. Serv., College of Agr., Cornell Univ., Ithaca, N. Y., Cornell Ext. Bul. 780, L. R. Simons.

"Better Fertilizer Means Better Tobacco," Ext. Serv., Va. Polytechnic Institute and USDA Cooperating: Cir. 489, Jan. 1950, L. B. Dietrick.

"Fertilizers for Western Washington," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 386, Feb. 1950, S. C. Vandecaveye, H. E. Dregne, Karl Baur, C. D. Schwartze, D. F. Allmendinger, and D. J. Crowley.

Soils

"Studies on the Forms and Availability of Soil Organic Phosphorus," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Research Bul. 362, Aug. 1949, C. A. Bower.

"Terracing to Save Soil," Agr. Ext. Div., College of Agr. and Home Econ., Univ. of Ky., Lexington, Ky., Cir. 473, J. L. McKitrick.

"Taking Soil Samples," Ext. Serv., Okla. A. & M. College, Stillwater, Okla., Cir. 513, R. O. Woodward.

"The Conservation of Calcium and Magnesium from Inputs of Burnt Lime, Limestone, Dolomite, and Dicalcium Silicate, As Influenced by Rate and Frequency of Liming and by Zone of Incorporation," Agr. Exp. Sta., Va. Poly. Inst., Blacksburg, Virginia, Tech. Bul. 112, July 1949, W. W. Shaw, W. H. MacIntire, and H. H. Hill.

"Release of Non-exchangeable Potassium in Hawaiian Sugar Cane Soils," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, Tech. Bul. 9, Dec. 1949, A. S. Ayres.

Crops

"58th and 59th Annual Reports, Jan. 1, 1947-Dec. 31, 1948," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Jan. 1950, M. J. Funchess.

"Let's Make More and Better Peanuts," Ext. Serv., Ala. Poly. Inst., Auburn, Ala., Cir. 372, Jan. 1950, J. C. Lowery.

"Field Corn Report, Mt. Carmel and Windsor, Connecticut, 1949," Conn. Agr. Exp. Sta., New Haven 4, Conn., Rpt. of Prog. 49G2, Feb. 1950, D. F. Jones and H. L. Everett.

"Progress Report of Studies Concerned with Quality Cottonseed Production in the Coastal Plain Area," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Tech. Mimeo. Paper No. 2, Nov. 1949, J. H. Turner, Jr.

"Profitable Cotton Production," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Cir. 359, Jan. 1950, E. C. Westbrook, J. R. Pressley, and J. F. Forehand.

"Coastal Bermuda for Grazing and Hay," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Cir. 355, Jan. 1949, E. D. Alexander, J. B. Preston, and J. R. Johnson.

"Plans and Plantings for Georgia Homes," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 402, June 1949, H. W. Harvey.

"The Use of Hotbeds in Early Sweet Potato Plant Production," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 69, Jan. 1950.

"High Protein Wheat with Conservation Farming," Ext. Div., Univ. of Idaho, College of Agr., Moscow, Idaho, Ext. Bul. 181, July 1949, H. C. McKay and W. A. Moss.

"Better Farming with a Legume-Grass Program," Agr. Ext. Serv., College of Agr., Univ. of Ill., Urbana, Ill., Cir. 649, Oct. 1949, R. P. Rusk.

"The Extent and Causes of Variability in Clinton Oats," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Research Bul. 363, Aug. 1949, D. D. Morey.

"Lespedeza in Kansas," Agr. Exp. Sta., Kansas State College, Manhattan, Kan., Cir. 251, June 1949, K. L. Anderson

"Some Items of Interest to Kentucky Nurserymen for the Year Ended June 30, 1949," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 75, Sept. 1949, W. A. Price and H. G. Tilson.

"Pasture Renovation," Univ. of Md., College Park, Md., Mimeo. 16, Jan. 6, 1950, T. B. Symons.

"Pointers on Pickle Growing," Mich. Sta. College, Coop. Ext. Serv., East Lansing, Mich., Ext. Folder F-127.

"The Story of Mississippi Extension Service in 1948," Ext. Serv., Miss. Sta. College, State College, Miss., Bul. 150 (1500), May 1949, L. I. Jones.

"Missouri's Sixtieth Year of Agricultural Research," (Annual Report of the Mo. Exp. Station, 1947-1948) Agr. Exp. Sta., Univ. of Mo. College of Agr., Columbia, Mo., Bul. 528, Sept. 1949, E. A. Trowbridge and J. E. Crosby, Jr.

"Alfalfa, Its Mineral Requirements and Chemical Composition," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 748, Jan. 1950, F. E. Bear and A. Wallace.

"Plantations of Northern Hardwoods," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 853, Nov. 1949, E. F. Wallihan.

"Growing Pumpkins and Squashes," College of Agr., Cornell Univ., Ithaca, N. Y., Cornell Ext. Bul. 776, Sept. 1949, E. V. Hardenburg, C. Chupp, and R. W. Leiby.

"North Dakota's Agricultural Progress Through Research, Annual Report of the N. D. Agricultural Experiment Station," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Sta. Bul. 356, Jan. 1950, H. L. Walster.

"The Influence of Several Factors on the Sprouting Quality of Oklahoma-grown Mung beans, Phaseolus aureus Roxb.," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Manus. Rpt. Abst. 5, Mar. 1950, L. L. Ligon and J. B. Cox.

"Oklahoma Cotton Variety Texts, 1944 to 1948," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Tech. Bul. T-37, Feb. 1950, I. M. Parrott, N. M. Gober, Jr., and J. M. Green.

"Cotton Growing in Eastern Oklahoma, A Comparison of Present Methods and Recommended Practices," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. No. B-345, Feb. 1950, W. F. Lagrone.

"Controlling Damping-off in Vegetable Seedlings," Agr. Exp. Sta., Oreg. State College, Corvallis, Oregon, Cir. of Inf. No. 447, (Rev. of S.C.I. No. 305) Jan. 1949, E. K. Vaughan.

"Grape Culture in Pennsylvania," Agr. Ext. Serv., Pa. Sta. College, State College, Pa., Cir. 353, Jan. 1950.

"Progress Report on Spoil Bank Planting—Fall, 1949," Agr. Exp. Sta., Pa. State College, State College, Pa., Prog. Rpt. No. 24, Mar. 1950, W. C. Bramble and R. H. Ashley.

"Fertilizing Vegetable Crops in Pennsylvania," Agr. Exp. Serv., Pa. State College, State College, Pa., Cir. 324, Jan. 1949, J. H. Boyd and J. O. Dutt.

"The 1949 Cotton Contest for Better Quality and Higher Yields," Ext. Serv., Clemson Agr. College, Clemson, S. Car., Cir. 348, Jan. 1950, H. G. Boylston.

"Rye Grass and Crimson Clover for Winter Pasture," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. Car., Bul. 380, Jan. 1950, J. P. LaMaster, W. A. King, and J. H. Mitchell.

"Tall Fescue," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 345, Dec. 1949, H. A. Woodle and E. C. Turner.

"Cotton Variety Tests in the Lower Rio Grande Valley, 1949," Agr. Exp. Sta., Texas A. & M. College System, Weslaco, Texas, Prog. Rpt. 1195, Nov. 15, 1949, J. S. Morris and W. R. Cowley.

"Plant Diseases in Texas and Their Control," Agr. Exp. Sta., Texas A. & M. College System, College Station, Texas, Cir. 124, Dec. 1949, A. A. Dunlap.

"More Profit from Your Cotton," Ext. Serv., Va. Poly. Inst., Blacksburg, Va., Cir. 491, Jan. 1950, L. B. Dietrick.

"Feeding the Trees on the Lawn," Va. Agr. Ext. Serv., Blacksburg, Va., A. G. Smith, Jr. and A. S. Beecher.

"Lawns," Ext. Serv., Va. Poly. Inst., Blacksburg, Va., Cir. 479, March 1949, A. G. Smith, Jr.

"Agricultural Research, Report for the Period July 1, 1947-June 30, 1949," Va. Agr. Exp. Sta., Blacksburg, Va., Oct. 1949.

"Your Home Garden," Agr. Ext. Serv., W. Va. Univ., Morgantown, W. Va., Cir. 353, Dec. 1949, C. R. Kemper and J. D. Downes, Jr.

"Turn to Grassland Farming Now . . ." Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Stencil Bul. 4, (Rev. Aug. 1949), Feb. 1948.

"Tobaco Culture," USDA, Wash., D. C., Farmers' Bulletin No. 571, Nov. 1949, J. E. McMurtrey, Jr.

"Report of the Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, 1949," USDA, Wash., D. C.

Economics

"New Wealth from Soils," Ext. Serv., Ala. Poly. Inst., Auburn, Ala., Cir. 380, June 1949, D. R. Harbor, J. C. Lowery, F. H. Orr, and R. M. Reaves.

"Dry Edible Beans: Situation In California, 1949," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 394, Oct. 1949, W. D. Fisher and W. F. Williams.

"Connecticut Crop, Livestock and Marketing Review for 1948," Dept. of Farms and Mkts., Sta. Ofc. Bldg., Hartford, Conn., Bul. 105, Dec. 1949, Div. of Mkts.

"Conservation Field Days," Agr. Ext. Serv., Univ. of Ill., Agr. and Home Econ., Urbana, Illinois, AEng603, May 1949.

"Oklahoma Farm Production Prospects For 1950," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-188, Oct. 1949, W. L. Blizzard and L. E. Hawkins.

"A Progress Report on Factors Affecting Farm Earnings on 81 Farms Raising Grass Seed or Having Improved Pastures, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. Sta. College, Corvallis, Oregon, Cir. of Inf. 459, Aug. 1949, M. H. Becker, E. A. Hyer, and D. C. Mumford.

"Economic Land Classification of Goochland County," Agr. Exp. Sta., Blacksburg, Va., Bul. 421, July 1949, G. W. Patteson and A. J. Harris.

"Economic Land Classification of Wythe County," Agr. Exp. Sta., Blacksburg, Va., Bul. 422, Aug. 1949, G. W. Patteson and Z. M. K. Fulton, Jr.

"Keeping Up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 147, Feb. 28, 1950, K. Hobson.

"Annual Report on Tobacco Statistics, 1949," USDA Prod. & Mkt. Adm., Wash., D. C., CS-39, Dec. 1949.

"Changes in American Farming," Bur. of Agr. Econ., USDA, Wash., D. C., Misc. Pub. 707, Dec. 1949, S. E. Johnson.

"Report of the Secretary of Agriculture, 1949," USDA, Wash., D. C., Nov. 30, 1949.

"Progress Report Dominion Experimental Station, Morden, Man., 1938-1946," 12919—10M—11:49, J. G. Gardiner, Ottawa, CANADA.

Potash Helps Keeping Quality of Cabbages and Tomatoes

By Clyde Beale

Associate Extension Editor, Gainesville, Florida

THAT potash fertilization has a significant bearing on the storage quality of cabbage and handling and shipping quality of tomatoes has been indicated in research by Dr. Raymond A. Dennison, Florida Agricultural Experiment Station Horticulturist, and Dr. Byron E. Janes, former Florida Station Horticulturist now with the Connecticut Experiment Station.

Drs. Dennison and Janes also found that muriate of potash was better than sulphate of potash or nitrate of potash for cabbage, while sulphate of potash proved superior to muriate or nitrate of potash for tomatoes.

In their investigations with cabbage, they applied fertilizer at the rate of one ton per acre, but varied the amounts and kinds of potash for different plots. To one plot they applied a 5-7-5 mixture, with the potash in the form of muriate; to another they applied a 5-7-10 mixture, also using muriate of potash; to a third and fourth plot, they applied mixtures of the same percentages, using nitrate of potash; and they followed the same procedure with two more plots, applying 5-7-5 to one and 5-7-10 to the other, using sulphate of potash. To a check plot they applied a no-potash fertilizer, 5-7-0, at the rate of one ton per acre.

There were only small differences in yields from all the plots, but the cabbage harvested from the plantings which received the fertilizer containing muriate of potash stood up better in storage of 47° Fahrenheit over a period of two months than the crops from the plot which received no potash and the plots receiving nitrate and sulphate of potash. Heads from the plots which received muriate of potash were firmer and were of all-round higher quality than those from the other plantings, and heads from the plot which received the mixture containing 10 per cent muriate of potash were superior to those from the plot receiving 5 per cent.

In their tests with tomatoes, Drs. Dennison and Janes applied fertilizer at the rate of 2,500 pounds per acre to their plantings and followed the same procedure as they did with their cabbage—no potash (5-7-0) and 5-7-5 and 5-7-10. The sources of potash they used were the same—muriate, nitrate, and sulphate of potash—and the variations in kind and percentage of potash in fertilizers they used were the same.

With tomatoes, sulphate of potash proved superior. The plants which received no potash produced an average of 341 bushels per acre, while those which received potash produced 452 bushels per acre. Yields from the plantings receiving the various kinds of potash at 5 and 10 per cent levels did not vary to any appreciable extent.

After testing on a laboratory machine which simulates commercial handling and shipping conditions, however, tomatoes from the planting which received the mixture containing 10 per cent sulphate of potash (5-7-10) were markedly superior in quality to those from the other plantings, which also were tested.

The crop from the plot which received the 10 per cent sulphate of potash mixture was 71.4 per cent marketable, while that from the no-potash plot was only 47.1 per cent marketable, and the marketable portions of the crops from the plantings which received 5 to 10 per cent muriate of potash were only 51.6 per cent and 53.8 per cent, respectively. All crops were tested on the machine, and the general all-round quality of the tomatoes from the planting which received 10 per cent sulphate of potash was superior to those from the other plots.

Good Farmers Make Good Soils

"SOMEHOW the notion gets around," says Dr. Charles E. Kellogg of the U. S. Department of Agriculture, "that originally our farm soils were highly productive; that is, productive when first plowed. Many of them were like the black lands in our Middle West and in central Eurasia, for example, and in some of the great deltas and alluvial valleys. But most soils are not. It is through liming and fertilization, drainage, irrigation, the introduction of legumes, and a host of other practices, that farmers have made their soils productive," explains Dr. Kellogg who is Chief of the Division of Soil Survey in the Bureau of Plant Industry, Soils and Agricultural Engineering.

"After all," he continues, "this is the important thing; not the productivity when first plowed; but the response of soils to management systems. There is no more reason for saying that large areas in the tropics are without an agricultural future than there is for saying that large areas in the eastern United States and Western Europe are without an agricultural future, simply because one gets low yields in the absence of management practices that depend upon science and industry. Science and industry are within man's control."

Potash Production—A Progress Report

(*From page* 16)

This change in the distribution pattern is highlighted by what has happened in certain states. For example, during this nine-year period Ohio deliveries increased from 28,000 to 89,000 tons K_2O thus crowding Georgia for first place in point of deliveries. Illinois showed an increase from 15,000 to 83,000; Indiana from 14,000 to 54,000; Wisconsin from 1,600 to 22,000 and Iowa from 330 to 13,400 tons K_2O.

These data are tabulated as follows:

Table III.—Changes in Potash (K_2O) Deliveries in Five Midwestern States.

	1940 Tons	1948 Tons
Ohio	28,000	89,000
Illinois	15,000	83,000
Indiana	14,000	54,000
Wisconsin	1,600	22,000
Iowa	330	13,400

Reflected in these figures showing increased deliveries is the progress being made agronomically in the wider and more diversified use of potash. With 95 per cent of the agricultural potash being retailed to the farmer as a constituent of mixed goods, its usage naturally follows that of mixed goods and that in turn, we have been taught, rises and falls with the farmer's gross income. Of the 12 million tons of mixed goods used during the year ended June 30, 1948, 66 per cent contained 6 units or less K_2O. This certainly reflects wide-spread distribution, but distribution after the ancient pattern of low potash mixtures. Included in the total tonnages, however, were 23 per cent of grades containing more than 6 units of K_2O with 9 per cent containing 12 units K_2O or more. The corresponding figures for 1947 are 18.6 per cent containing more than 6 units K_2O and 5 per cent containing 12 units or more.

Such grades and higher are to be found on the lists of recommendations by state agronomists in increasing numbers—recommendations based on research and demonstration in the improved fertilization of a long list of crops. Included conspicuously are the legumes, such as alfalfa, ladino clover, soybeans, and the grass-legume pastures, now so widely being adapted particularly in the South. There the economic importance of this development can scarcely be over-estimated as the foundation of a livestock industry based on 10 to 12 months grazing and frequently closely associated with soil conservation. This program is based essentially on lime, phosphate, and potash in adequate amounts. The farmer can buy his lime and phosphate as materials, but as a source of potash he cannot get by with 6 per cent K_2O mixtures. The agronomist insists that what he must have are grades such as 0-10-20, 0-9-27, or 50-60% muriate.

Of special importance is the new technique of corn production calling for radically increased, but still profitable, fertilizer applications, predominately nitrogen but with the essential balance of phosphate and potash. The economic importance of this new development to the South is easily visualized when it is recalled that corn acreage predominates there with a former average yield of some 16 bushels per acre now susceptible to being raised four-fold.

Education

In the past, reference was frequently made to the "time lag" between agricultural education and practice, spoken of as something that couldn't be helped and as an implied reflection on the farmer's intelligence. It would seem from a study of the agricultural literature, revealing rapid progress in farmer adoption of so many new practices, that this time lag has been greatly shortened and that the reason is two-fold—improved education and farm income sufficient to permit the farmer to adopt the practices taught by the educator.

As to farm income, that is a matter of statistics, as likewise is the farmer's willingness to spend dollars to buy plant foods in terms of his gross income even when his net income is shrinking. As to improved education there can be no question—more students studying agriculture, better research, a vastly expanded demonstrational program by State and Federal agencies,—experiment stations, the extension and the soil conservation services, vocational agricultural schools, and veterans agricultural training programs.

In the field of education, the potash industry as represented by the three Member Companies of the American Potash Institute continues its contributions on an expanded scale through its endowment of research and its wide dissemination of educational material in various forms—books, the agronomic magazine, *Better Crops With Plant Food,* news letters, colored plant-food deficiency charts, motion pictures, etc. —totaling some 1,200,000 items issued during the past 12 months.

In summarizing this report on the American potash industry, progress is claimed in respect to expanded plant facilities and improved economies resulting in increased potash production and in the potash content of the tonnage produced. This increased refinement results progressively in the decrease in freight charges to be paid by the consumer—the farmer. With rising production costs there has been no rise in the price of the major product, 60 per cent muriate. Prospecting and exploration by new companies have expanded. Geographically, wider distribution of potash salts is being accomplished; and agronomically, as the result of education, potash use is being diversified and more scientific rates of application are being utilized.

Economic Agriculture . . .

(*From page* 19)

name or price basis without reference to plant-food content or balance or what is needed for the crop and soil concerned. Often there is a distinct prejudice against new and high analysis fertilizers, regardless of their value.

Then there are those 5,000,000 acres of idle land. They are doing little or nothing for anyone except growing broomsedge. This is a disgrace to me as an agricultural leader. We have no waste land in Mississippi. All of it, almost every acre, can be utilized so as to conserve and improve the soil and at the same time yield some income. After all of the other crop needs have been supplied, the remainder of the land can be planted to trees. Well-managed forest projects can be quite profitable in Mississippi.

Problem

What have we proposed? Every acre to the crop to which it is best adapted and much greater efficiency in the production of every major crop. Won't this put us into over-production? Not in any sense of the word! Reduce the acreage planted to corn by 50 per cent and double the yield per acre, maintaining the same total production as the present. This means over a million acres—hazardous acres—acres which have failed often because of poor drainage, overflow, excessively sandy or steep eroded shallow hillside soils—to come out of corn and be planted to forage crops, pastures, or trees. This million acres will cease to be a liability and loss but instead will start on the road to soil-building and finally become a real source of income. The same principles will hold on all acres taken from other crops.

Please keep all the above facts in mind and look again at the farmer. On the average his income is miserably low and his family larger than yours. The conveniences at home are not too good either for him or his family. His school, his roads, his hospital, his church, his community, in fact, just about everything could stand some improvement, but what can he do about it on his income? Yet his income could easily be doubled if he would use the information available to him as suggested above. Do you see what I am trying to say?

The man needs that money very badly, and I know how he can make more of it. He loves his family and thinks he is doing everything he can for it. I MUST get him to stop and think, to take inventory like any other business man. What does he have? Where does he want to go? Let us help him make plans to get there. Let us show him his land and crop adaptations, how to use all the research data pertinent to problems on his place, how to use soil testing and other experimental data as a basis for liming and fertilization.

Let us show him that money invested in lime where needed and in the proper amount and kind of fertilizer is not a waste but a very good investment. Let us help him plan his program well in advance, realizing that farming is a 12-month job; let us show him that there is work to do every day the same as the merchant, the postman, the banker has every day. Let us get him to take a short vacation and get away from the place and get some new ideas. It is my job to lead this farmer to do these things. He is paying me for that purpose. It is my job along with other specialists and 20 paid local agricultural workers in the average Mississippi county.

Before you go let us take a quick look at your situation. Are your farmers operating as efficiently as they could and should? If not, why aren't they? Do you see what I mean?

Know Your Soil . . .

(*From page* 21)

Figure 3 shows the root penetration of this soil undoubtedly making an extreme effort to obtain sufficient water. Another characteristic of this soil is the weakness for becoming magnesium deficient in years when leaching is a factor. Figure 4 shows extreme magnesium deficiency in corn produced on this soil when adequately fertilized with nitrogen, phosphorus, and potash.

The Sassafras sand is a good, early truck-crop soil if carefully managed, if irrigation is available, and if short-seasoned crops are grown.

Considerable interest is being displayed by the farmers in New Jersey in digging holes in their soil to determine some of the limiting factors. It is believed that without this information the best use of soil amendments, irrigation, and cropping practices cannot be made.

Fig. 3. Plant-root penetration in Sassafras sand.

Fig. 4. Magnesium deficiency frequently prevalent on sandy soils.

Year-round Green

(*From page 25*)

the peas has greatly increased the growth of his Johnson grass the following summer.

Johnson grass is seldom planted in the South because it is a weed pest on cropland. There are, however, many thousands of acres on which there is a thick stand of Johnson grass. The addition of wild winter peas greatly increases the pasture and hay from such land.

Coastal Bermuda grass and either reseeding crimson clover or wild winter peas make a combination that furnishes excellent pasture from about the first of December until frost kills the grass the following fall. The date that winter grazing begins depends largely on fall rainfall. When there is plenty of rain in September to get crimson clover started and then enough in October to keep the plants growing, grazing sometimes can be started as early as the first of November. When fall rain is lacking, clover often furnishes little grazing until after Christmas. Wild winter peas start a little more slowly than crimson clover and usually give little grazing until after Christmas.

Manganese bur clover has made excellent growth in combinations with Coastal Bermuda grass in the Coastal Plain of Georgia. Bur clover starts to grow early in the fall and makes early winter and spring grazing. It also beds down in a rather heavy mat if it is not grazed in late spring. This tends to smother the Bermuda grass and sometimes thins the stand.

Kudzu makes pasturage of good quality and is very useful during periods of dry weather in the summer and fall. It also grows well on rough, steep land. Kudzu gives almost complete protection against erosion and greatly increases the percentage of rainfall that is taken into the soil. It tends to suppress brush and certain weeds. This makes kudzu particularly desirable for land that is too rough for convenient mowing.

Kudzu usually is pastured only during dry summer and fall periods, and its grazing season is rather short. A winter crop that would volunteer each fall, keep the land green in the winter, and give a longer season of grazing would add much to the value of kudzu land. Several farmers have seeded wild winter peas on their kudzu land and have been pleased with the amount of late winter and spring pasture it has given.

F. E. Williams of Columbiana, Ala., planted kudzu on five acres of Montevallo shale in 1941. He seeded wild winter peas on this land in the fall of 1943 and peas have volunteered each fall since. He pastures dairy cows on his kudzu and peas from about October 1 each fall until late March or early April. Mr. Williams estimates that this combination has furnished pasture for at least two cows per acre over a period of 5½ months during each of the past five years. In discussing it, he said, "I figure that I get more grazing at less cost per acre from the kudzu-Caley pea combination than from any other grazing crop on my farm. And, this is from land that was practically waste land when the kudzu was planted." Montevallo shale is one of the poorer soils in the South, which makes the grazing Mr. Williams gets from these five acres all the more remarkable.

W. J. Bailey, Montevallo, Ala., has a 15-acre field of good cropland that he planted to kudzu in 1939. He began mowing the kudzu for hay in 1942. In raking kudzu hay, wild winter peas were dragged along by the rake and scattered from a small patch where they had been planted the year before kudzu was planted. Peas are now over the entire 15 acres and come up in thick stands in the fall. Mr. Bailey uses his kudzu for hay or pasture, whichever he needs most. In 1948, he pastured 40 beef cows on the 15 acres from the first of August until frost on a basis of two weeks on kudzu and two weeks off. On February 15, 1949, he turned 40 cows in this field and left them until May 10. On July 24, he harvested a little more than a ton of kudzu hay per acre from the field and had enough new growth by the end of September for a considerable amount of fall grazing.

Mr. Bailey is a polled Hereford breeder and appreciates the value of good pasture. In commenting on his experience with this combination of grazing crops, he said, "I believe Caley peas and kudzu are the best combination of grazing crops that the hill land farmer can grow. These crops have produced the most feed at least cost per acre of any grazing crops we have. Cows relish Caley peas just as much as they do white clover. In fact, I have seen my cows walk out of white Dutch clover voluntarily and start grazing Caley peas."

Reseeding crimson clover and grandiflora vetch are volunteering in thick stands on kudzu at the Soil Conservation Service nursery at Thorsby, Ala. Grandiflora vetch appears to be particularly well adapted for some of the sandier soils where spring drought sometimes seriously limits the growth and seed production of wild winter peas.

An unfortunate misunderstanding about kudzu and sericea has been the idea that these are *poor-land* crops. It is true that both of these deep-rooted perennials have grown on some poor soils, sometimes with little fertilizer. In all too many cases, however, stands have been weakened by overgrazing or mowing and underfeeding. The result has been a few years of hay or pasture and then back to broomsedge.

All of the forage and grazing crops mentioned in this article must be fertilized properly if they are to grow, either alone or in combinations with other crops. All of the winter legumes mentioned here respond to liming, on soils that need lime. Where it is not convenient to get a laboratory test to find how much lime is needed, a ton or two of ground limestone per acre usually is a safe amount. A ton of finely ground limestone per acre on sandy soils and two tons on the heavier-textured soils may be applied early in the spring before reseeding crimson clover or wild winter peas is to be seeded in the fall. If this liming is repeated about once every five years, the needs of the winter legumes usually will be met.

All of the legumes require phosphate and potash fertilizer. About 500 pounds per acre of 0-14-10 or 0-12-12 fertilizer each year will keep both the summer and the winter legumes in vigorous condition. On the sandier soils where crimson clover is grown, about 10 pounds of borax per acre usually are beneficial. Combinations of plants that give long-season pasture on eroded uplands will pay good returns for regular applications of fertilizer.

One of the more interesting observations of these combinations of plants has been the effect the build-up of soil fertility has on the growth of the annual legumes. As an example, crimson clover and Italian ryegrass were seeded on a field in the Land Utilization Project of the Soil Conservation Service at Ackerman, Miss., in the fall of 1948.

All of the land in this project was purchased because it was considered too poor to be farmed economically. On a portion of this particular field where kudzu was planted several years ago, ryegrass and crimson clover made excellent growth in the spring of 1949. On a portion of the field where there was no kudzu, clover and ryegrass did not make enough growth to cover the ground. Fertilizer treatment was alike over the entire field. This serves to illustrate the importance of planting the perennial legumes first and following with the annual legumes and the grasses after the land has been manured and improved by the perennial.

The wide variety of warm-season and cool-season plants that we have in the South gives us combinations to fit many different soil conditions. These conditions range all the way from the heavy clays of the Black Belt to sandy loams and even deep, loamy sands of the Coastal Plains. By making use of adapted combinations, we can put a great many acres of idle land to productive use.

Birdsfoot Trefoil . . .

(*From page* 11)

culty the field should be cut on the early side when most of the pods are commencing to change color and turn brown. The difficulty of obtaining the seed and their resultant high cost are the major obstacles in the increased use of trefoil.

Some seed growers are having most success by cutting with a windrow attachment on the mower and then combining after sufficient curing in the windrow.

It is frequently advisable to graze or cut the seed field up until the last of May. This reduces the bulk of material for threshing and tends to make the time of ripening more uniform. During dry years, however, there is frequently insufficient later growth to produce good seed. Whether the first crop is cut or grazed, it should never be done later than June 1 in Vermont.

Honeybees are important for good seed production because the plant is cross-pollinated The plant is practically self sterile and depends upon insects for pollination. It is an excellent honey plant, producing large quantities of high quality honey which commands a premium price.

Birdsfoot trefoil produces a large number of "hard" seed. These seed do not absorb water and many of them remain dormant for several years. This may be a "blessing in disguise" for it is nature's way of having some germinate and grow the second year if conditions are poor the first. This "hard" seed problem is another reason why better stands are not produced the first year and why rather heavy seeding rates are needed. Better methods of scarifying or scratching the seed coat, for uptake of water and better germination the first year, should be advisable provided all other conditions are right during the seeding year. In case of drought or winterkilling, however, the "hard" seed insurance has proved helpful on many fields.

Summary

Birdsfoot trefoil is a long-lived legume which is superior to alfalfa on the poorer drained clay soils. It is better than ladino clover on the drier lands, because of its deep root system. It withstands more abuse, particularly close grazing, than alfalfa or most clovers. It is less exacting in soil fertility or moisture requirements than other legumes, but under proper conditions it produces excellent hay, pasture, or silage. It grows on a wide range of soil conditions but does best on clays and clay loams. Up to the present time at least, it is subject to attack by fewer insects or diseases than most other legumes.

It also has some disadvantages. The plant is rather slow in getting started and frequently it is difficult to get good stands. Since it has rather thin weak stems it requires some grass to keep it upright. When properly inoculated it supplies its own nitrogen and some for associated grasses, but its nitrogen-gathering properties are less than those of alfalfa or ladino clover. After first cutting for hay, it recovers slowly, but makes good aftermath or midsummer grazing. Production of seed is difficult and seed costs are high on a pound basis. However, its long life and the fact it does not need to be seeded frequently make the actual cost not excessive.

The following procedure should insure a good stand of birdsfoot trefoil if carefully followed:

1. Thoroughly prepare the soil and make a good firm seedbed.

2. Lime and mineralize the soil to a red clover level of fertility. Do not use manure the first year. Adequate lime and minerals in the subsoil are helpful for this deep-rooted plant.

3. Inoculate the seed with a special birdsfoot trefoil inoculin. Adding this first to a clay suspension or pulverized manure is advisable.

4. Plant only grass with trefoil. Brome grass or timothy is usually best. Do not seed clover or alfalfa with trefoil because they grow too fast and offer too much competition. If oats is used, it must be grazed or cut early when not over 8 to 10 inches high.

5. Plant on a firm seedbed and cover lightly with not more than ¼ to ½ inch of soil. The seed are small and have insufficient food to come through much soil.

6. Drilling a small amount of superphosphate directly with the seed frequently stimulates them to a good start, but cover lightly.

7. Prevent excessive competition by weeds and grasses the first year by frequent mowing or occasional grazing and mowing.

8. After establishment, allowing the plant to reseed occasionally is advisable.

9. Birdsfoot trefoil does best in long rotations. Since it starts slowly do not be discouraged the first year. It thickens up each year.

10. If you have some clay soil where alfalfa does poorly, it should be the first choice for a trefoil trial.

Buoyant Belgium

(*From page* 5)

they use plenty of mixed plant food under direction of specialists and experienced growers. Bunches weighing several pounds are not uncommon, and the home demand is keen, to say nothing of the excellent trade maintained in distant Paris, Geneva, and London.

In the specialized vegetable section we saw our old friend of a former rural ramble near Louvain—witloof chicory. This is the best fresh winter delicacy in its field. Growing chicory began away back in 1845 on the outskirts of Brussels. Just before World War II witloof chicory flourished on about 18,000 acres. It's a small farming industry. French cuisine delights in serving the brittle, white salad and has become Belgium's chief customer for chicory—taking 42,000 tons of the vegetable just prior to the recent hostilities. All adjacent countries use it freely and some even gets shipped over here by air and vessel.

Witloof chicory is a winter vegetation, grown in frost and snow. The roots are taken up in the late fall months and laid down in heated earth-mounded, metal-covered silos. The white sprouts burst forth out of the buried crowns and when all is ready for harvesting, all members of the family cut, clean, and sort the sleek, smooth white delicacy. Looking like snow-white ears of sweet corn, the product is layered into crates and packing boxes for the waiting connoisseurs.

Should any reader unfamiliar with

the quality of these two Belgian specials wish to learn more about the methods of culture involved, the best place to write is to National Des Debouches Agricoles et Horticulture, at No. 4, Quai de Willebroeck, Brussels. One of the members of the honorary committee at our Ellezelles exposition was a representative of this institution—Directeur C. Vandendaele. And by all means, don't forget to ask them all about those rare Belgian pears—which we lack either space or suitable voluble vocabulary to extoll as they deserve. Their aromatic taste will remain with us far longer than many another memory gained abroad. And if you have a little wall or other nook that needs beauty and utility combined, get their advice on training espaliers—those dwarfed, twisted, wire-supported tree fruits turned into vines. To our eyes they are strange, but to Belgians they are an old, established form of fruit culture. You can see a few of them at Mount Vernon, a relic of Washington's era when such quaint conceits were all the rage.

Belgian farmers are transformers of imported raw materials into finished food products—many of them delicacies. Before the last outrage, Belgium was almost self-supporting with most of the livestock products, raising roots, forage, and coarse fodder for animals, but not growing at any time enough coarse grains and millfeeds to go around. The farmers are trying hard now to get back where they left off in animal husbandry, yet not enough cereals will ever be grown in Belgium to feed out the livestock properly.

ABOUT 325,000 Belgium farmers work full time on their small holdings of a few acres. There are not more than 2,500 farms in the country which can point to as much as 125 acres under cultivation.

There is a distinct social class which is half industrial and half agricultural, these people working a couple of acres apiece. For the country as a whole, tenants occupy about half of the acreage in farms. Some of the owners are residents of the zone, and others live in the large cities. For every 100 acres of farm land in the country there are 13 persons engaged in agriculture—and as noted before, consumers of all kinds have a ratio of 200 persons to each 100 acres. So you have a rural-urban ratio of 13 to 187 for every 100 acres devoted to land tillage. No wonder their farm pattern is geared to high concentrated returns per acre instead of otherwise. But wise planners can see a real need to multiply the production power of this actual farm minority so as to more nearly meet the needs of the non-farm consuming majority. That's why the machinery section at Ellezelles was always such a busy, intriguing place. That's why European implement designers are studying ways to make their models more useful for all-purpose farm work, in imitation of the tractors which have made this country of ours the leading food source in the world.

YET make no mistake about it, Belgium is also a livestock paradise. We all know of its stout, proud, brown and dappled draft horses with the long names and manes, which we have seen plowing long furrows or stepping out to get a judge's ribbon at the state fairs—the breed that bears the nation's hall-mark. Our folks went to one of those fine old Belgian horse stud farms near Lembeek, and saw its gabled roofs, decorative brick homes, wide cobbled court and exercise yards, stone walls, and poplar trees. But the best horses were gone, and what were left were doing humble tasks, because of the ruinous war and the swift decline of horseflesh to do Britain's and America's farming.

We trod the same breeding ground and talked to the same draft horse leaders who not so long ago dealt in big figures with the ambitious farm horsemen of Iowa and Illinois—just a memory of a vanished power economy.

Even if this big slice of livestock exports and dollar-earning capacity is gone forever, Belgium still has about three-fourths of its farm land in crops for animal sustenance. To raise these plants vigorously on a limited available area next to crowded cities, the farmers there use as much, maybe more, organic matter and artificial fertilizers to each unit of surface as any other farmers in Europe. The Ministry of Agriculture served plenty of fertility figures at the big exposition in the little town. Per acre of all farm land in Belgium in the crop year of 1948, the country used 42.8 pounds of nitrogen, 46.7 pounds of phosphates, and almost 66 pounds of potash. The total over-all ratio of commercial plant food utilized, according to the accredited report, stands at 1 for nitrogen, 1.05 for phosphates and 1.49 for potash. This translates in tonnages to 79,500 metric tons of nitrogen, 86,600 metric tons of phosphates, and 121,100 metric tons of potassium, which was the estimated usage in 1948. Compared with our rates per unit of land it is large, but on the entire tonnage basis it is lower.

NATURALLY, with such a generous dosage of plant nutrients, the harvests respond nobly in Belgium—often ranking among the best in any modern agricultural country. These yields made eyebrows lift among the visitors last fall, but we are not skeptical in the least. For instance, winter wheat in 1948 averaged 37 bushels, rye went to 33 bushels, winter barley made 46 bushels, oats in a bad season hit 56 bushels, dried beans averaged 22 bushels, flaxseed reached about 8 bushels, mid-season potatoes yielded 398 bushels, and alfalfa hay reached over two tons an acre.

Well-fed on fertilized meadows and hay and beets, dairy cows averaged about 8,000 pounds of 3.2 per cent butterfat milk a year. The reported annual average egg production was 130 eggs per hen.

Chief agricultural exports by Belgian farmers tend toward the semi-luxury goods in general. In the top listings in the 1948 exports from farms we noted 32,000 tons of apples, 15,000 tons of that chicory-endive delicacy, 3,200 tons of pears, 5,500 tons of cut flowers and nearly 2,000 tons of hothouse grapes.

Belgium has not quite five million acres of its land in farms. That seems very small and inconsequential in contrast to the 350 million acres or more that U. S. farmers put into all crop uses last year. Yet to them it is just as serious a matter to get the most from the least and to make the best better in all forms of farm endeavor. Maybe with all our huge empire of soil to perform upon we do not appreciate some of the little things that enter into a true balance in conservation and lasting land values. It is for this reason that I believe many of our exchange youth who are going over this season to live and learn on European farms will be able to bring back just as much fundamental knowledge as they will take over there.

FOR they will get a lot more benefit than appears on the surface of sight and sound, field lesson, and livestock precept and practice. They may not understand all that's told them like they do in the corner trading post here at home, but he who has eyes, let him see, and he with an open mind will quickly learn. This Belgium is an old and ancient domain, its customs and its methods and traditions of life and work are fixed and hard to change—and sometimes we wonder if it would be a net gain in all ways if we *did* change them.

For no man with breadth of vision and some history stored away in his mind can travel any of these storied lands abroad and see only as moderns see. Patient farmers and craftsmen in Belgium stem back for six centuries to the cathedral-building times and the era when artisians formed self-directing and self-correcting leagues and unions—all pledged to complete as near a perfect task as man's feeble abilities would permit.

Talented sculptors and architects spent as much skill and put as much soul and toil into creating some image or decoration up on some high spire or pillar beyond the normal view of passersby as they devoted to an illumination on a prayer book page. They did not sign their names or take personal glory as their due. They were dedicated to skillful achievement, whether for religion, or art, or trade.

HENCE no youth—or elder too—who visits these so-called "backward" agricultural lands should fail to dig deeper than the surface of the soil to get his perspective. Moreover, he should not limit his "researches" to things in farm or feed lot, but he should travel around a little to trace some of these craft associates of olden times for whom the peasants of the Middle Ages provided food. The marvelous shrines, paintings, and halls of Belgium and adjacent lands have existed alongside the little divided farms for centuries, and you cannot clearly grasp the true meaning of one without studying and appreciating the other.

Call it cultural and educational, if you choose. Yet it's all that and much more—and it's something stirring within us that really makes all the work of man come finally to a common center to reach a common end. This is the doctrine of our own 4-H clubs and the bulwark of our best rural life. I think you sense this relationship of all crafts and our universal need of "recovery" or a new renaissance when you see old Europe struggling to restore itself. Maybe in aiding her a little in the right way we won't need to count it entirely as a one-way benefit. If Europe can't teach us much in farming, perhaps they can help us renew the stock of virtues we started out with.

A Few Whinnies

A woman got on a bus and took the only empty seat, next to a harmless-looking reveller. Soon she opened a map of Manchuria and began to study it.

The reveller gazed at the map for a while and finally addressed the woman in an interested tone: "Sure you're on the right bus?" he asked.

* * *

"Sometimes, when I think of what you've meant to me all the years we've been married," the taciturn old Vermonter said to his spouse, "danged if it ain't more'n I can stand not to tell ye!"

* * *

Mose: "Ah called to see how my fren' Joe Brown was gettin' along."

Nurse: "Why he's getting along fine; he's convalescing now."

Mose: "That's O.K. I'll just sit down and wait till he's through."

* * *

"Pappy, ain't you gonna shoot that city slicker who didn't do right by me yistiddy?"

"Sure, datter—but don't be so tarnation hurrified; fust give me a chanct to shoot the one who didn't do right by you day before yistiddy."

* * *

Eunice: "Would you refuse to go out with a man who had made just one mistake?"

Clara: "Sure, who wants a man with as little experience as that."

"What a change has come over your husband, Zeke, since we persuaded him to join the church," exulted a preacher in the hill-billy country. "Have you noticed it?"

"Sure have," agreed Zeke's wife. "Before, when he went visitin' on Sundays he carried his jug o' corn whiskey on his shoulders. Now he hides it under his coat."

* * *

"Now, Mrs. Spreadbottom," said the doctor, "you'll have to go on a diet. All you can eat is some lettuce, carrots, green onions and green stuff."

"I don't understand," said the woman. "Do I take this before or after meals?"

* * *

"Gawdge," another equally unbleached gentleman inquired, "who is dat pouter pigeon gal yonder whut carries herse'f so pertuberant?"

"Why, dat's Miss Iodine Johnsing, fum Memfuss."

"Doggone! She sho' do put on a wonderful front, don't she?"

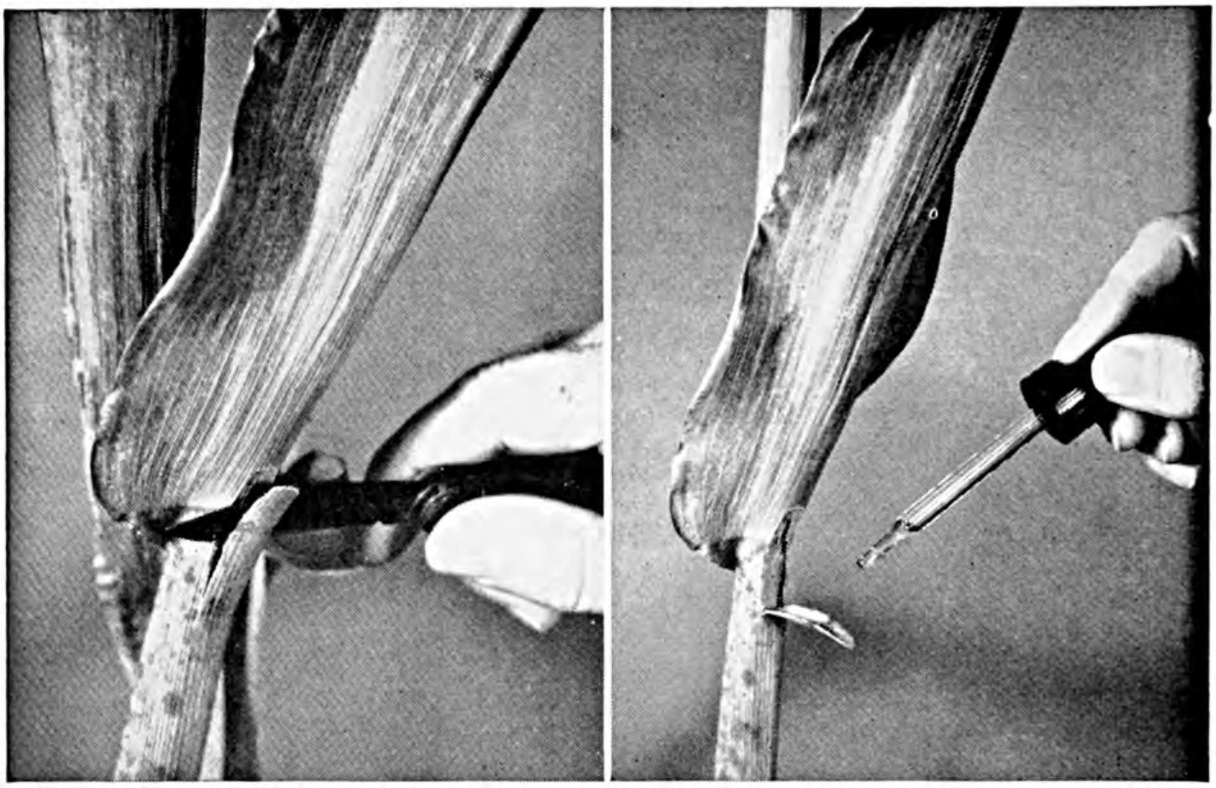
"Hush yo' mouf, nigger," was the reply. "Dat ain't put on."

* * *

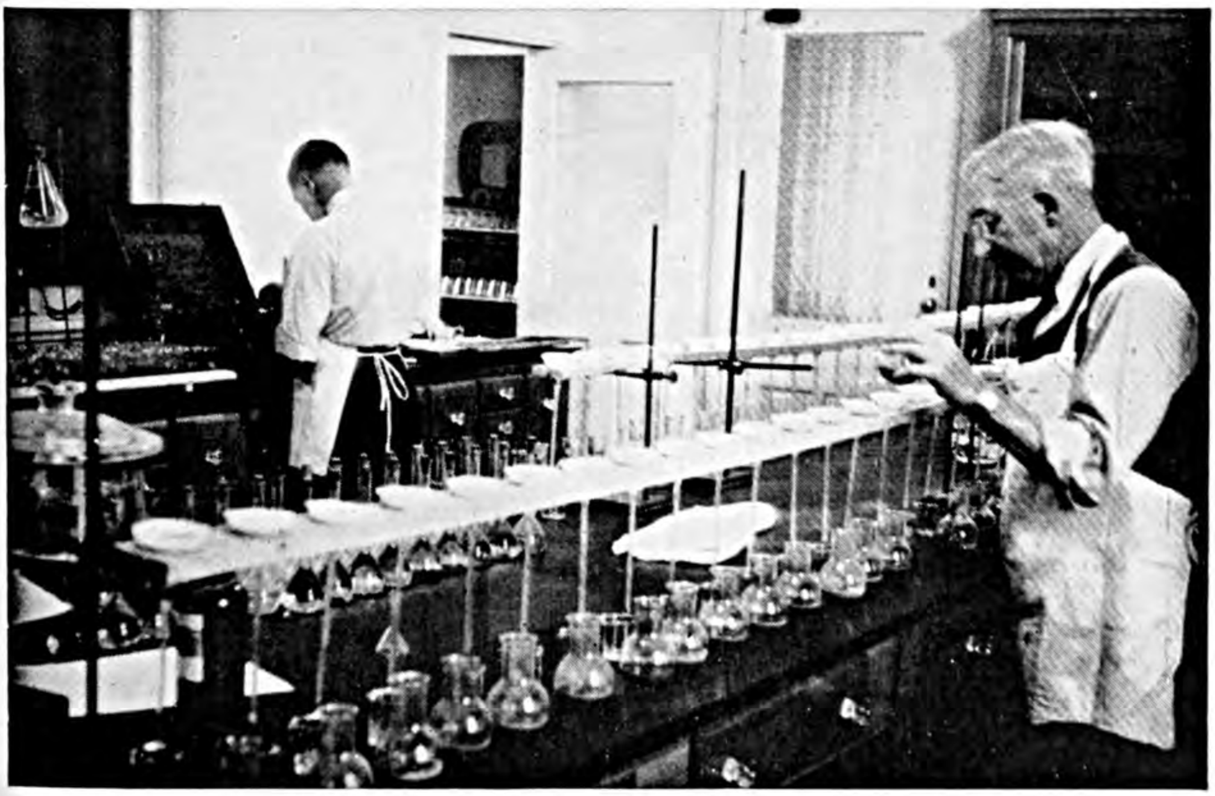
Two men were discussing a mutual acquaintance.

"Nice fellow," said one, "but have you noticed how he always lets his friends pick up the dinner bill?"

"Yes," replied the other. "He has a terrible impediment in his reach."



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

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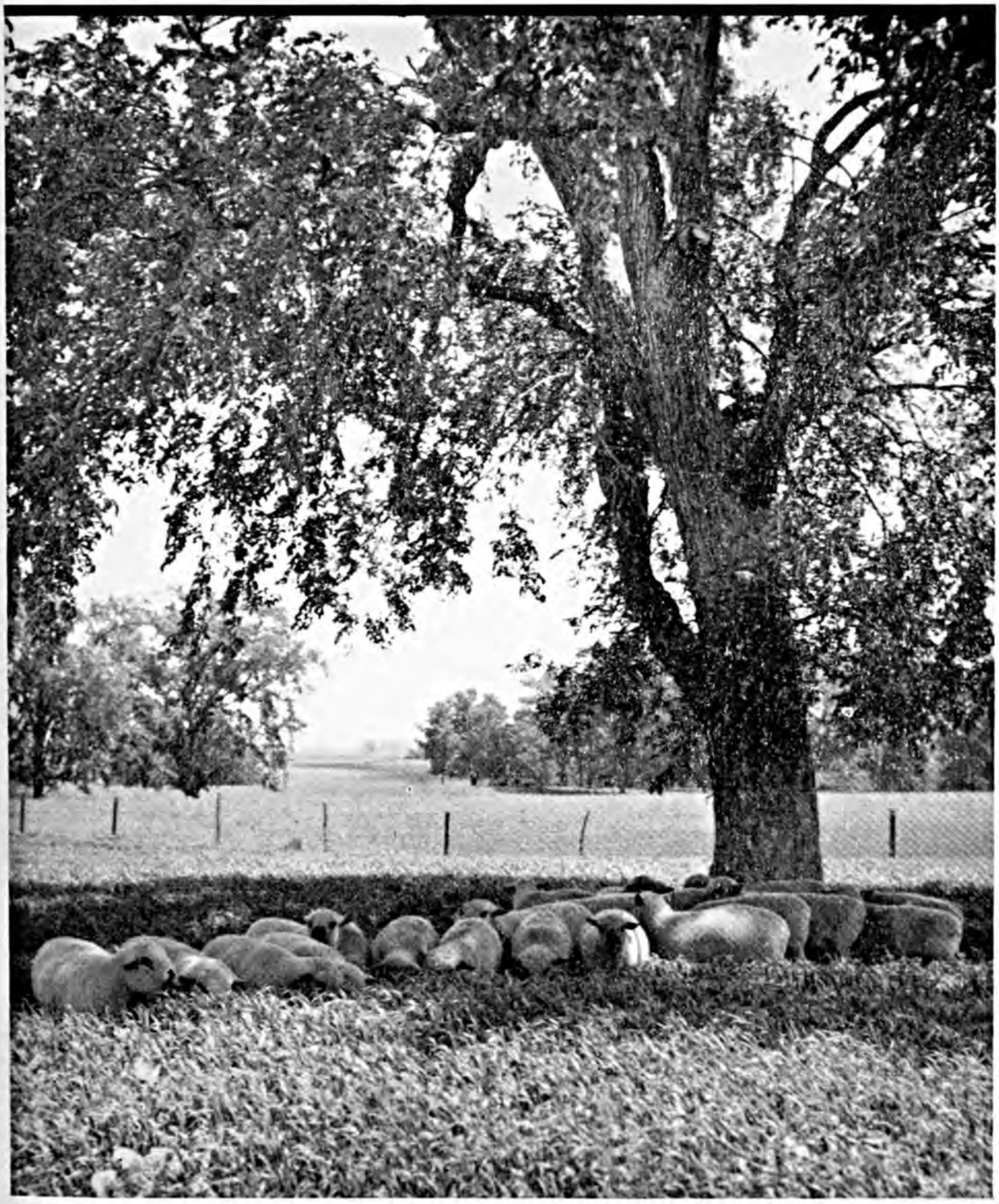

The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth
R. H. Stinchfield, *Editor*
Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIV NO. 5

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The American Potash Institute, Inc.
1155 16th Street, N. W., Washington 6, D. C.

Member Companies: American Potash & Chemical Corporation
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Better Crops with PLANT FOOD

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VOL. XXXIV | WASHINGTON, D. C., MAY 1950 | No. 5

Memories of . . .

Gumbo and Gumption

Jeff McDermid

MY Mother and I first saw the clapboard shack on the west Dakota prairie in the late afternoon of a bright day in the fall of 1907—the domicile that sheltered us from strong winds and driving rain and snow for a year and a half of homesteading. Dad had been our forerunner and advance provider, and the reason why he went out there like John the Baptist into the "wilderness" on a mission of his own creating is a separate, but necessary, incident to make the sequel clear. Our coming was a natural result, as there were only two of us left in the immediate family to follow his leadership and honor his hunches.

This time his hunch was an unfulfilled wish to accommodate himself a little financially through recourse to the existing homestead rights and privileges belonging to veterans of former wars. They were not called "GI" benefits in those remote days, nor were their variety and value as generous and tempting as the rewards that are provided for the ex-members of the armed forces today. Moreover, none of the gentler sex were listed among the beneficiaries.

For several years, over his pipe and cider mug, he was wont to relate to us his war experiences and privations; and wind up with a vow to make good some day on his inherent right to acquire a parcel of government land for the small cost of residing on same and plowing a few rods inside the new barb-wire fences. He never expected to stay through the whole five-year, proving-up period required, but he decided that by staying on the claim for a couple of years they would permit him to obtain full title to a quarter section at the nominal cost of $1.25 per acre.

At his age—66 years—he did not feel like gambling an extra three years to get a deed for nothing. We used to think that all those yearnings and vague proposals were as evanescent and unstable as the blue smudge arising from his bowl of black standard tobacco. But he surprised us the year before I graduated from high school by announcing that he had seen a successful homesteader down at the G. A. R. Post hall lately, and had been "sold" again with a vim to the idea of being an Argonaut to the western Eldorado. This comrade of his was a convincing talker.

So we invited the gent with the data to come out for dinner, and we listened in mingled ardor and gloom to his recital of claim life in Pennington county across the winding Teton river. (Dad's was the ardor, and the gloom and foreboding were from mother and me.) Yet so intriguing and stirring was the narrative of the other enthused war hero that we finally became slightly imbued ourselves with a dash of the infection for adventure that animated Dad.

TRUE, it was quite some radical departure, in more ways than one, for a family used to the tree-clad, rolling hills and alternate marshlands and inlets of flowing rivers, dotted on many sides with clear, blue lakes and olive-green willow colors in spring and ruddy variegated hues in autumn. Our own country was as dear to us as it had been to our grandparents and their close neighbors, the Winnebago Injuns, who "saw God in clouds and heard him on the winds." Like them, we saw no pressing need to traipse out west into the dun-colored vastness of waving grass, haunt of the once-proud buffalo and the fiercer tribes of Oglalla Sioux.

But, still and all, it was something to ponder over during the school recess and to look forward to as a chance to prove the truth of those dog-eared dime novels alive with cowboys and callow tenderfeet. Besides, I was young enough to make up for the combined age of my parents, and my eyesight and my endurance must meet the test.

THERE would not, of course, be any great change in temperature extremes by our migration due westward on the same parallel, but the high and dry plateaus and uplands, minus frequent natural waterways, bounded on the top by the clouds and the stars, and fringed on all sides with vibrating mirages and brown endless, treeless distances, would be indeed a change of scene. The drier atmosphere was guaranteed by our informer to banish colds and seeping sinuses and impart a leather-toned and shiny complexion to any outdoor sojourner in that realm.

Little explanatory comment was made by our mentor about the slightly inconvenient and dismal disadvantages of existence on a claim in a makeshift shack, frequented by field mice and prey to other night vermin that penetrated the mattresses. Nor was it said that our rude shack would be exposed to the brilliant sun, whose rays scorched and bent the tar-paper roofing. The small detail of good well-water was glossed over too, a point I paid for later by lugging sploshing pailfuls a mile or more from the nearest neighbor's claim, on a neck-yoke device, while the voracious mosquitoes bedeviled my face and hands as I stumbled through the bunchgrass. These mosquitoes were likewise unexpected in a region almost without any visible breeding pools of stagnant water. They, like the occasional horned toad and the frequent prairie-dog town and owl habitation, seemed to defy all rules for sustenance.

But nevertheless, we went. Dad preceded us by several months. My first duty in the interval was to finish high school and arrange for someone to stay in our eastern home while we endured the western fever. I had planned to leave my dog, Major, with them too; but he broke away the night Mother and I left with our trunks and boxes, and appeared at the depot platform about fifteen minutes before the old "pioneer limited" was due to pick us up. So I had a friend in the baggage car to look after and feed and exercise at junction stops and transfer points. As a matter of fact, Major gave me less worry and anxiety than my Mother,

whose none-too-robust health was in a dither and a stew as we rode all those weary miles by day coach and overland Concord stage, eating the somewhat crumbly and greasy lunch that good friends provided as a fond farewell. Major's only mishap was a fall from the side of the open baggage doorway at one station stop, where he hung by the leather collar until rescued by the attendant. Otherwise he enjoyed the change of scenery and proved to be a consoling companion on many prairie hikes, where he flushed up gray larks and snuffed at gopher holes.

Our journey by rail through Fort Pierre westward included a river ferry across the Missouri and more rattling travel out to the Northwestern's current terminal at Philip, where we stayed over night in a hostelry that was a reminder of old Virginia City days—all bunks full of construction crews. The next day we boarded a six-horse stage to jump the gap to Wasta, from whence the line of rails extended to Rapid City through the little town in the cottonwood "draw" that was our trading-post and post-office.

This lumbering Deadwood type of coach and its laconic driver thrilled me no end. Only two summers before I had seen the dramatic stage coach robbery enacted by Sioux Indians at William F. Cody's own side-walled circus and historic pageant, where the famous Annie Oakley shot on the wing from a prancing broncho. The coach we rode in was exactly like it, and no tenderfoot ever had a worse case of tension and elation than myself, perched beside the driver up front, with Mother, Major, and the trunk and pine boxes careening along behind in the baggage "boot"—across virgin prairies and over steep fords where the chances for quicksand in the Bad river's bed was pointed out luridly by the driver.

Nothing serious happened to the baggage, except that at one stop I hastened to the rear to look things over and found that a fork had jabbed through a crack in the box board. I pulled it on out and stuck it in my vest pocket—a handy weapon to have if we were ambushed by Sioux and had to resist scalping.

I KNOW that my green exterior and my graduate-class suit and stiff "derby" hat, layered with alkali dust, must have been a great temptation to our jehu to josh me and initiate me to the ways of the West. He was not very communicative, but all his brief answers were tuned to the occasion, including the hint that homesteaders were interlopers who had stacks of hostility awaiting them from the old-time ranchmen and cow-punchers, who hated furrows and fences because they wrecked the range.

Loyal as I remained to my Dad's devoted ideal, this slant on the expedition gave me some inner misgivings. Yet the vastness of the grassy seas we were traversing emboldened me to reply that there appeared to be ample room out there for more beef and wheat than the country could easily consume. This sage forecast was made long before any government price supports and acreage allotments were in the cards.

But he was a standpatter. Perhaps

(*Turn to page* 48)

Physical Soil Factors Governing Crop Growth

By R. Earl Storie[1] *and Walter W. Weir*[2]

California Agricultural Experiment Station, Berkeley, California

PLANTS differ greatly in their growing and rooting habits. Some will extend their roots deeply into the soil when they are given the opportunity; others not so deeply. In general, annual crops are more shallow-rooted than perennials, and there is a definite correlation between the size of the plant and the extent of its root system. In general, if a plant has sufficient depth and volume of soil in which to extend its roots to the full extent of its habitual traits, it will be a better plant than if the root system is restricted in any way.

The productive capacity of a soil and the physical features which are conducive to maximum yields should be judged by their ability to produce a wide variety of useful plants rather than a single crop which because of environmental conditions may make it highly desirable and profitable. There are certain physical characteristics of an all-purpose, highly productive soil that make it distinctive.

[1] Soil Technologist.
[2] Drainage Engineer.

Fig. 1. Shallow upland soil. Profile-Group VIII. Plant growth is limited by volume of soil.

Soil Depth and Permeability

No single physical characteristic of a soil is quite so important or is reflected so prominently in both quantity and quality of plant growth as depth. In other words, the amount or volume of permeable soil that a plant has to grow in to a large extent determines its size and quality. Alluvial soils which have been deposited so recently that they have undergone no significant changes in profile development will be found to be the most conducive to plant growth. The shallow depth of many upland or primary soils or the imperviousness of many of the older terrace soils greatly restricts the amount of soil that a plant may explore for moisture and nutrients. (Figs. 1. 2). The lack of soil volume can in a measure be overcome by improving the growing conditions through the application of moisture, fertilizer, and the best management, but the same effort placed on a deep, permeable soil would be even more productive of results.

Deep, permeable alluvial soils are inherently more fertile and more productive than claypan and hardpan soils for the reason that the natural processes of weathering which have de-

Fig. 2. Shallow soil. This land should be utilized for grazing as there is insufficient depth of soil for orchard. Profile-Group VIII.

veloped these subsoil conditions have leached the soil of much of its plant nutrients at the same time that they reduced the depth or quantity of soil available to plants.

Soils may be classified on the basis of their profile development or, if you please, of their depth and permeability. This is exactly what has been done in Storie's profile-groups.[1], [2] The first five of these profile-groups contain secondary soils which progressively become shallower and more dense and impervious in the subsoil. This is always accompanied by conditions less favorable to plant growth.

Profile-group I. Soils on recent alluvial fans, floodplains or other secondary deposits having undeveloped profiles underlain by unconsolidated material. These profiles show no accumulation of clay in the subsoil resulting from the downward movement of particles from the surface horizon.

Profile-group II. Soils on young alluvial fans, floodplains or other secondary deposits having slightly developed profiles underlain by unconsolidated material. These profiles show slight compaction or slight accumulation of clay as the result of leaching from the surface horizon.

Profile-group III. Soils on older alluvial fans, alluvial plains or terraces having moderately developed profiles underlain by unconsolidated material. These profiles have moderate accumulation of clay in the subsoil as the result of the continued movement of particles from the surface horizon.

Profile-group IV. Soils on older plains or terraces having strong accumulations of clay in the subsoil underlain by unconsolidated material (Fig. 3). These are claypan soils in which the pans are relatively near the surface and very slowly permeable to the downward movement of water.

Profile-group V. Soils on older plains and terraces having hardpan subsoil layers, usually underlain by unconsolidated material. These rock-like hardpan horizons may be lime, lime-iron, or iron cemented and do not soften or disintegrate in water (Fig. 4). They are the result of the downward move-

[1] Storie, R. Earl. Index for rating the agricultural value of soils. Bul. 556, California Experiment Station, Revised 1937.

[2] Storie, R. Earl, and Walter W. Weir. Manual for identifying and classifying California Soil Series. Associated Students' Store, Berkeley, 1948.

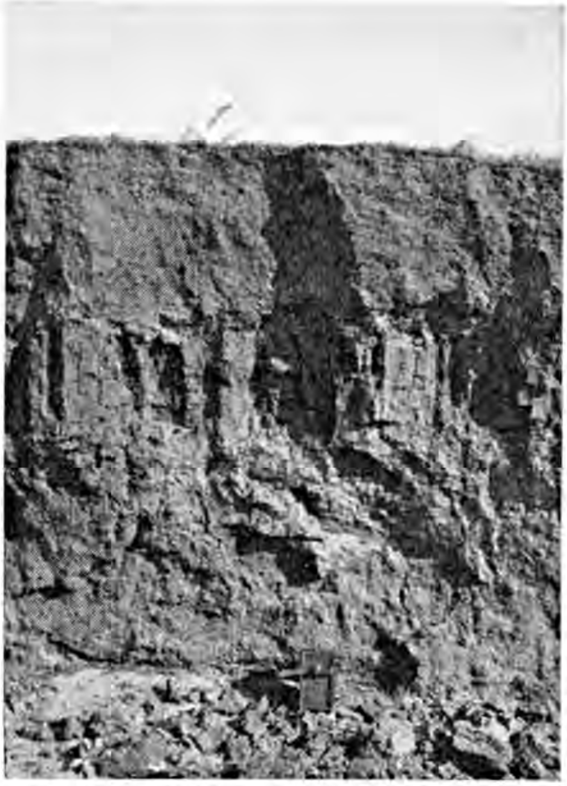

Fig. 3. Soil having very dense claypan in subsoil which is very slowly permeable to water movement. Profile-Group IV. Roots do not easily penetrate this claypan.

ment of the cementing materials from the surface horizon.

Profile-group VI. In addition to the five groups of secondary soils, there are a few older terrace and upland soils having dense clay subsoils resting on moderately consolidated, usually unrelated materials. From a physical standpoint these soils are the least desirable for plant growth.

There are also three groups of upland or primary soils, as follows:

Profile-group VII. Soils on upland areas developed in place by the weathering of hard, acid, or basic igneous rocks.

Profile-group VIII. Soils on upland areas developed in place by the weathering of hard consolidated sedimentary rocks (Fig. 1).

Profile-group IX. Soils on upland areas developed in place by the weathering of softly consolidated sedimentary rocks.

The primary soils usually occupy rolling to steep topography and may vary in depth as the result of erosion or other soil-forming factors.

It may be readily seen that permeability of secondary soils is closely related to the depth of material available for root development and plant growth. The more impermeable a soil is to the movement of water, the more restricted becomes the area into which roots will penetrate.

Soil Texture and Structure

Soil texture probably is the next most important physical characteristic of soil in its effect on plant growth. By texture is meant the fineness or coarseness of the individual soil grains and the proportion of each that makes up the soil mass. Clays have the smallest sized grains and sands the largest. The most ideal texture is a mixture of all sized particles such as occur in loams.

Structure is a term expressing the arrangement of the individual soil grains and aggregates such as crumby, cloddy, columnar, granular, etc.

Heavy or fine-textured soils in which a large proportion of the grains is clay size are dense and less permeable to moisture, air, and roots, but have a high moisture-holding capacity. Because these soils take up moisture slowly, they also give it up slowly and they remain wet for a long time. As they dry out they become hard and seldom make what is considered a desirable seedbed. Clay soils may, however, be fertile and contain relatively high amounts of plant nutrients because as the soil particles break down and release these elements, they are not easily leached out of the soil.

Clay soils may be improved and made more friable by the addition of large amounts of organic material. The structure of clay soils can be changed by the application of lime, which promotes the accumulation of the individual soil grains into granules. Granular structure improves the permeability of the soil to take moisture and roots. Excessive quantities of lime should not be placed on soils which are expected to produce crops which prefer a neutral or acid condition.

Light or coarse-textured soils contain a large proportion of the sand sized grains. These are readily permeable to water and plant roots, but their moisture-holding capacity is low and they give up their moisture rapidly and soon dry-out. Plant nutrients are usually lower in sands than in clays because as these elements are released through weatherng they are more readily leached out of the soil mass.

Sandy soils may also be improved by the addition of organic matter such as barnyard manure and cover crops. Soils thus treated are improved in water-holding capacity, and they retain inorganic fertilizers longer before they are leached out by excessive drainage.

Medium textured soils—loams, silt loams, fine sandy loams, etc.—make the most desirable medium for plant growth. They are permeable enough so that plant roots have little difficulty in penetrating; moisture and air can enter in sufficient quantity and rapidly enough for plant requirements, and leaching is not excessive.

The depth and texture of a soil are permanent soil characteristics that are not changed by the addition of organic matter, lime, and other amendments or fertilizers. Such additions, to a limited degree, alter the structure; and to a somewhat greater degree, overcome some of the limitations imposed by lack of depth and extremes in texture.

Fig. 4. Shallow hardpan soil. Profile-Group V. Adapted only to growth of shallow-rooted plants.

Soil Factors That May be Modified by Management

There are several other soil characteristics which have their influence on crop growth; and although under some particular circumstance, anyone of them may dominate the entire pro-

Fig. 5. The coastal plain claypan soils of California (Profile-Group VI) constitute some of the most erosive soils of the State. This land should be protected from erosion because it causes damage to the valuable valley land in the foreground made up of Profile-Group I soils.

ductivity picture, they are subject to modification by soil-management practices. These factors may include slope and erosion, drainage, alkali, low nutrient levels, micro-relief, and acidity.

Slope and erosion. Soils may be too steep to be farmed by methods usually employed in this country, or erosion may become a serious problem on soils of only moderate slopes. Under virgin conditions sloping soils are protected from excessive erosion by their native vegetation, but when the cover is removed through cultivation or grazing, erosion may be accelerated.

Steep slopes usually occur on primary and upland soils of shallow depth where runoff is excessive and the volume of soil is not adequate to produce a large or vigorous plant. Erosion may be excessive on claypan terrace soils where the volume of soil is limited by the nearness of the pan to the surface and the soil has neither the water-holding capacity nor the space for root development that is necessary for quantity production (Fig. 5).

Drainage. Soils which contain free water, that is, water in excess of that which they will normally hold against the force of gravity, are said to be poorly drained or to have restricted drainage. There may be a number of causes for this condition. Slope is important in drainage. If a soil lies on a flat or level position, so that excess water will not flow away or there is some strata in the subsoil that restricts the downward movement of water, it may become poorly drained. Plants do not grow satisfactorily in a saturated soil. High water table restricts the area of soil with the most suitable moisture condition for root development and has the same general effect of reducing the depth of soil.

In soils having a high water table, air movement through the soil is reduced and plant growth restricted on this account. For the best growth conditions, a soil should be moist but not saturated. Upland or primary soils lie on slopes of sufficient steepness to permit rapid surface runoff of excess water and therefore these soils seldom become waterlogged. In many soils the installation of drains to carry off the excess moisture will prove to be profitable.

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Fig. 6. This is a deep, permeable soil of Profile-Group I that rates 100% by the Storie-Index and is highly productive for orchards and many truck and field crops. Every effort should be made to maintain the high fertility of this soil.

Fig. 1. Lespedeza sericea and Autauga reseeding crimson clover in an Alabama pecan grove. Left to right: Ralph Johnston, chairman of out-of-state tours of Houston, Texas, Chamber of Commerce; H. Owen Murfee, Jr., secretary-treasurer, Autauga Reseeding Crimson Clover Association; C. L. Breedlove, Autauga county agent; and Gen. R. C. Kuldell, chairman, agriculture committee, Houston Chamber of Commerce.

Reseeding Crimson Clover Adds New Income for the South

By James A. Naftel

Agronomist, Pacific Coast Borax Co., Auburn, Alabama

RESEEDING crimson clover is expected to be a key crop in the changing pattern of Southern agriculture. This new crop fits into the year-round grazing program which offers great hope for raising the farm income through better balanced crop-livestock farming.

The search for a thoroughly dependable and satisfactory annual winter clover for the South has been under way for many years. An ideal clover should be easily established, make good vegetative growth, and produce ample seed. Crimson clover has been grown in certain sections of the South for some time and has produced large yields of forage and seed. In much of the South, especially on the less fertile and sandy type soils, it was difficult to obtain good stands and growth of crimson clover. Tennessee formerly grew about 35,000 to 40,000 acres and produced two-thirds of the entire seed crop in the United States. Autauga county, Alabama, alone expects to have 35,000 acres of reseeding crimson clover next year.

Farmers are familiar with the germination of shattered crimson clover seed after each rain in the summer. Periods of drouth in summer and early fall generally caused a complete loss of the seedlings. There was little possibility

Fig. 2. Reseeding crimson clover on Cahaba sand on the farm of Wadsworth Brothers, Prattsville, Alabama.

of volunteer stands of crimson clover living through these hot dry periods. This difficulty could be overcome by developing hard-seeded strains which would not germinate as early in the summer as the ordinary crimson clover.

Thanks to agronomists of the Agricultural Experiment Stations in Alabama, Georgia, North Carolina, and the U. S. Department of Agriculture, superior strains of crimson clover have been developed with sufficient hard seed to be dependable for reseeding. These improved strains are Auburn and Dixie, and after several years' trial they have continued to prove their reseeding ability. Several observant farmers, seeing the future possibilities of reseeding crimson clover, have located and developed other superior strains, namely Allen, Hardy, and Thornton in Georgia, and Autauga and Watson strains in Alabama. These hard-seeded selections have made it much more certain to obtain good stands even with adverse weather. Farmers are finding them thoroughly dependable year after year in establishing volunteer stands.

Reseeding crimson clover may contribute to farm income in three ways: (1) As a winter-grazing crop, (2) as a seed crop, and (3) as a soil-building crop. All of these features fit into the changing pattern of Southern farming. Combinations of crimson clover with small grains, grasses, and summer legumes such as lespedeza sericea are proving highly successful for livestock grazing. Cash returns from the seed crop of Auburn, Autauga, and Dixie have amounted to more than $100 per acre during the last few years. Demands for certified and known origin reseeding crimson have increased greatly. The soil-building quality of the crop results not only in a protecting cover for the soil when rainfall is high in the South but also in adding organic matter and nitrogen to the soil.

Adaptation of reseeding crimson clover is probably more widespread than was that of the ordinary strain, since the hard seed insure stands in areas such as the sandy coastal plains of the Southeast, formerly regarded as unsuitable for this crop. The older established crimson clover areas were the Piedmont section of northeast Alabama, Georgia, the Carolinas, and Virginia, together with considerable areas

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Alfalfa—Its Mineral Requirements and Chemical Composition*

By Firman E. Bear and Arthur Wallace[1]

Soils Department, Agricultural Experiment Station, New Brunswick, New Jersey

ALFALFA has long been recognized as an outstanding hay plant, in terms of both yield and feeding value. It is high in digestible protein, minerals, and vitamins (Table I). Because of its long life, it can be economically produced. It is of exceptional value in maintaining soil fertility. It helps control erosion, improves the physical condition of the soil, and accumulates large amounts of nitrogen (N)[2].

Acreage Moving East and South

Forty years ago, 88 per cent of the alfalfa in the United States was being grown in Kansas, Nebraska, and the states from Colorado westward (Fig. 1). In 1919, 78 per cent of the acreage was in that region; in 1927, 64 per cent; and in 1944, only 44 per cent. In contrast, only 5 per cent of the nation's 1909 alfalfa acreage was in Ohio, Iowa, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Missouri, North Dakota, and South Dakota. But in 1919, these states contained 14 per cent of the acreage; in 1927, 28 per cent; and in 1944, 41 per cent. Likewise, the areas devoted to alfalfa in the eastern and southern states have greatly increased. About 3 per cent of all cultivated land in the United States is now devoted to this crop.

New Jersey grew 1,400 acres of alfalfa in 1909, 26,000 in 1929, and 74,000 in 1945 (Fig. 2). The area now devoted to this crop constitutes about 25 per cent of the hay acreage in the state. Alfalfa should be better adapted to the soils of the northern part of the state than to those in the southern part. Some of the soils of the northern area have been derived from limestone and have natural pH values that approach neutrality.

But, because of the difficulty of keeping a stand for more than a year or two, many New Jersey farmers are no longer attempting to grow alfalfa. A survey of 31 well-distributed fields of the crop showed that the soils in many of them were not fertile enough for alfalfa, they did not contain enough available potassium (K), and they had not been adequately limed.

Alfalfa Has Very High Mineral Requirement

Although alfalfa, like all other plants, is made up mostly of carbon (C), hydrogen (H), and oxygen (O), it requires large amounts of mineral nutrients. A good crop removes calcium (Ca) equivalent to 400 pounds

TABLE I.—SOME FEEDING VALUES OF ALFALFA, RED CLOVER, AND TIMOTHY.

	Protein*	Carotene*	Calcium†	Phosphorus†
	per cent	*ppm.*	*per cent*	*per cent*
Alfalfa	18	50	1.44	0.24
Red clover	15	30	1.20	0.18
Timothy	10	24	0.28	0.15

* Standards for excellent hay.
† Average values.

* This is a reprint of New Jersey Agricultural Experiment Station Bulletin 748, January 1950.

[1] The authors wish to thank S. D. Gray, Northeast Manager of the American Potash Institute, for many helpful suggestions during the course of this study, and the Institute for partly financing the work.

[2] The first time an element or compound is mentioned, both the name and the symbol or formula may be given. In subsequent cases, only the symbol or formula may be shown.

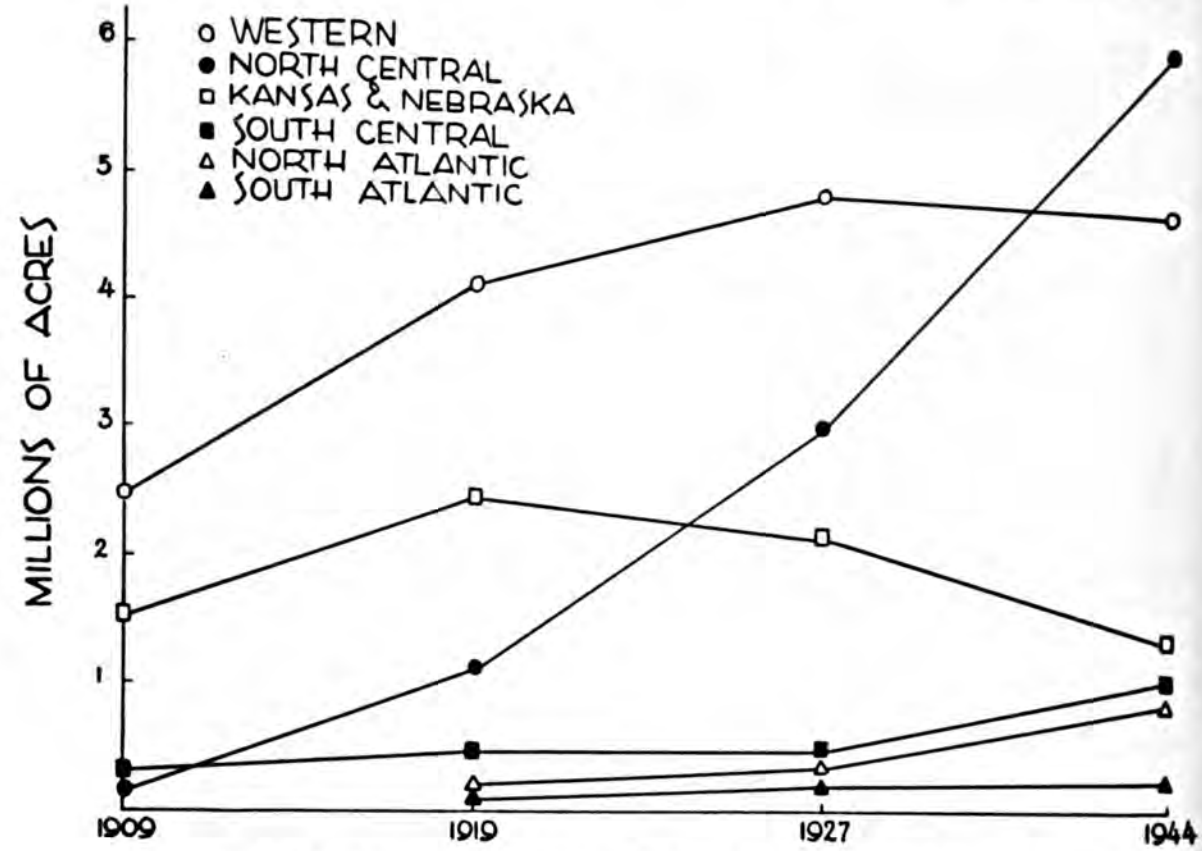

Fig. 1. Alfalfa acreage is increasing in humid regions of United States.

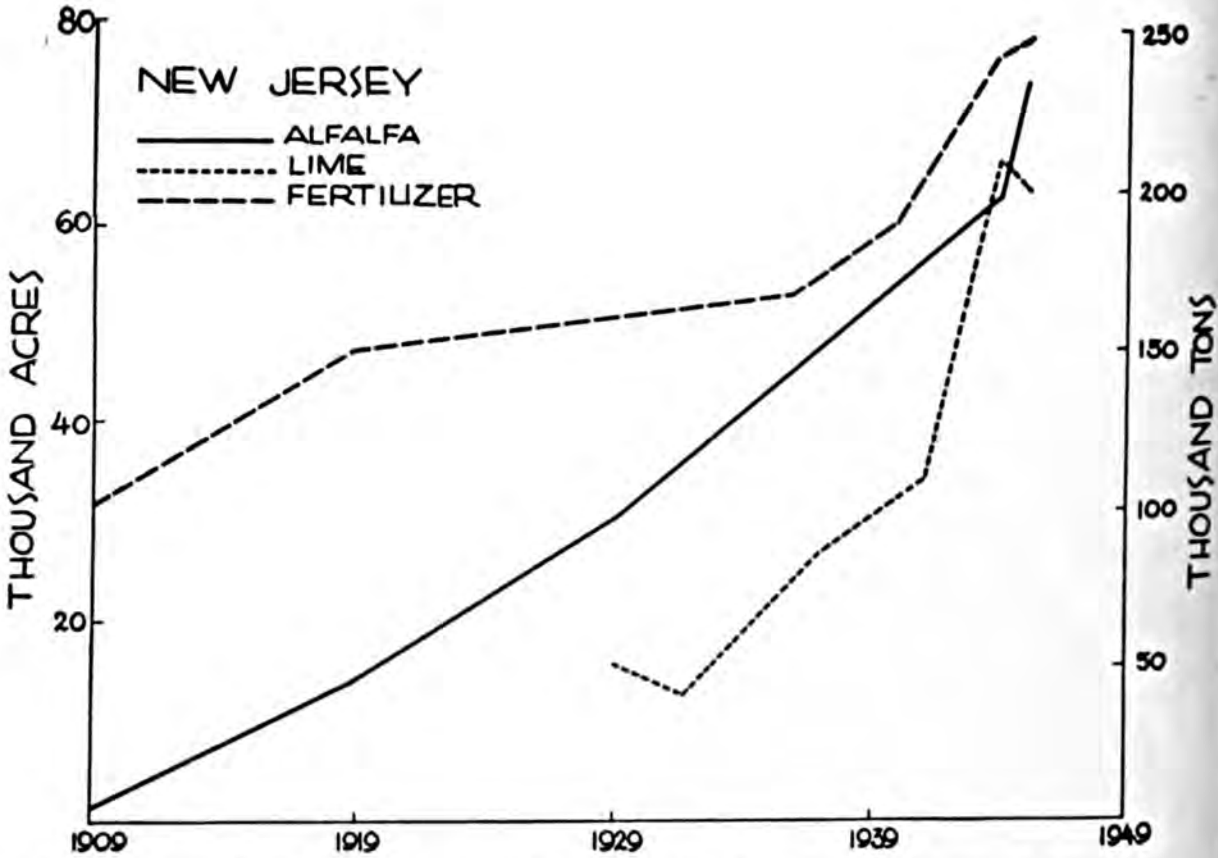

Fig. 2. Alfalfa acreage in New Jersey has grown in almost direct ratio to increased use of lime and fertilizer.

pure limestone ($CaCO_3$) an acre annually from the soil, and an equal amount may be lost by leaching. It frequently contains more than 2 per cent K, on the dry-weight basis (Fig. 3). More K is removed from the soil by a good crop of alfalfa than is usually returned to it, even when liberal use is made of fertilizers. Large amounts of phosphorus (P), magnesium (Mg), and sulfur (S), and appreciable quantities of such minor elements as boron (B), manganese (Mn), zinc (Zn), and molybdenum (Mo) are taken out of the soil by this crop. Alfalfa also requires iron (Fe) and normally contains aluminum (Al), sodium (Na), chlorine (Cl), and silicon (Si). Success with alfalfa in the humid areas of the United States is determined largely by the natural fertility of the soil and the extent to which supplemental liming materials and fertilizers and the necessary minor elements are applied in preparation for seeding and during the period of growth.

The natural habitat of alfalfa is a semiarid, alkaline, calcareous soil. Early attempts to grow this crop in New Jersey failed because the fundamental importance of lime was not understood. Wing says that alfalfa roots "seem to actually like to touch calcium carbonate." Good results with this crop in humid areas are most likely to be attained if the soil has been raised to a high level of fertility by good soil management and if liming materials have been used regularly for a number of years preceding the date at which it is seeded.

Field Study of Plant's Needs Undertaken

Because of the importance of alfalfa to the dairy industry, combined field, greenhouse, and laboratory studies were inaugurated to evaluate the several soil-

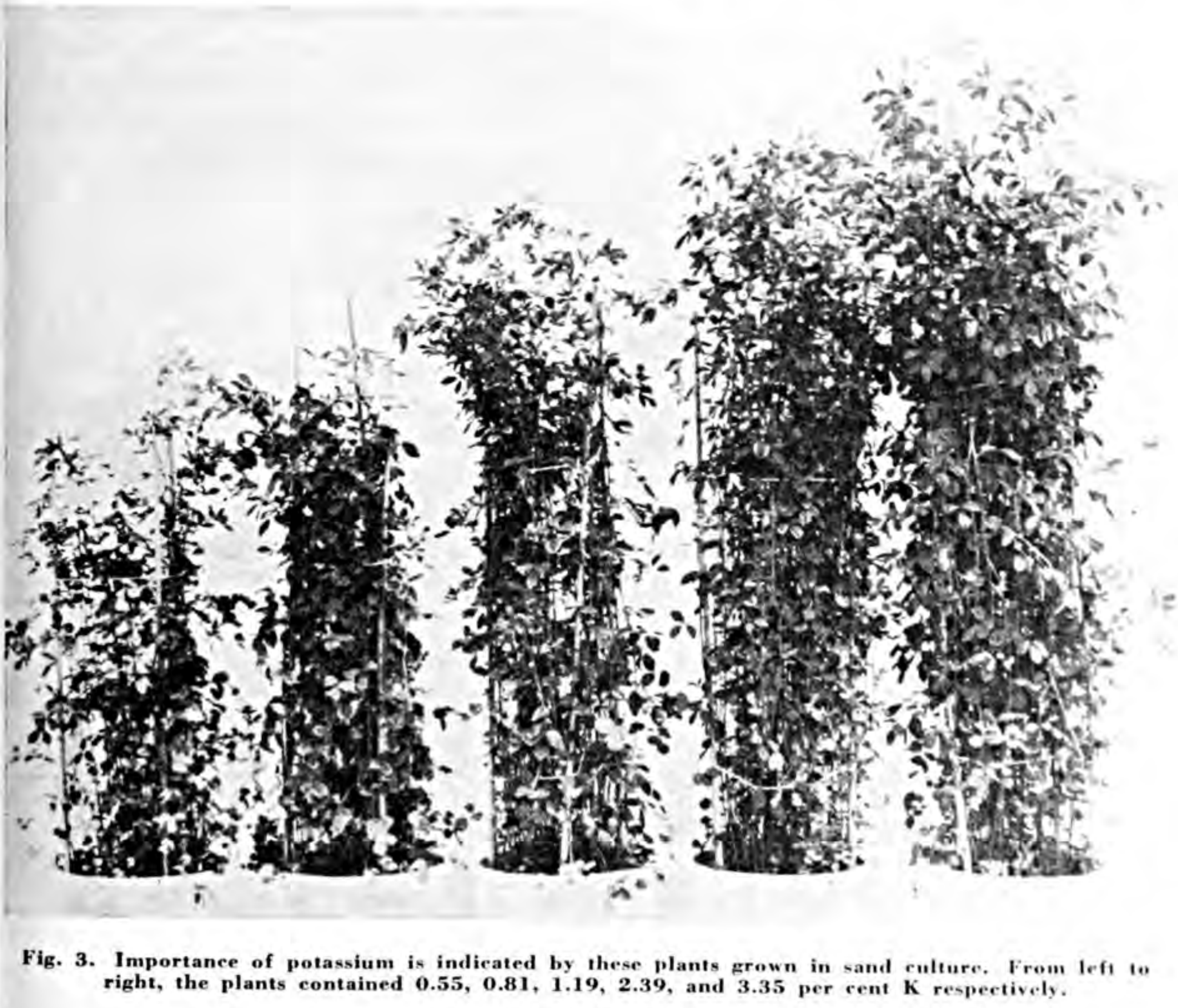

Fig. 3. Importance of potassium is indicated by these plants grown in sand culture. From left to right, the plants contained 0.55, 0.81, 1.19, 2.39, and 3.35 per cent K respectively.

plant factors involved in successful production of this crop.

The field area under experiment was 600 feet long and 64 feet wide, and contained about ⅞ acre. It was sown to clover and timothy in the spring of 1941 and remained in these crops until the summer of 1944, when it was plowed, prepared, and seeded to alfalfa. As the drouth of that summer prevented a successful stand, the area was plowed again in the spring of 1945, kept free of weeds during early summer, and reseeded in early August.

Pulverized calcitic limestone was applied to the entire area at the rate of 1½ tons an acre before the 1944 plowing. An additional 2 tons of the same kind of limestone were used before the 1945 spring plowing. A 5-10-10 fertilizer was broadcast with a grain-fertilizer drill over the entire area at the rate of 600 pounds an acre after the soil had been prepared for seeding in 1944. In preparation for reseeding, in August 1945, an application of 600 pounds 5-10-10 was made, after which the area was sown to Ranger alfalfa. A good stand was obtained.

The soil on which this experiment was located is Nixon loam, which is akin to Sassafras loam but overlies red shale. The area is level and well drained. In the summer of 1946, a composite sample containing 30 borings of the Ap horizon was collected and analyzed (Tables II and III).

At seeding time, the entire area was treated uniformly, except for two sets of triplicated plots. One of these sets of plots received an extra 240 pounds each of potash (K_2O) and phosphoric acid (P_2O_5) an acre. The other set was seeded to timothy, at the rate of 3 pounds an acre, at the time the alfalfa was sown.

TABLE II.—CHEMICAL COMPOSITION OF NIXON LOAM ON EXPERIMENTAL PLOTS.

Constituent	Per Cent	Constituent	Per Cent
SiO_2	83.4	K_2O	0.88
Al_2O_3	4.8	Na_2O	0.40
Fe_2O_3	2.6	CaO	0.36
O.M.*	3.2	MgO	0.23
N	1.2	P_2O_5	0.11

* Organic matter.

The annual rainfall in New Jersey is about 45 inches. This is distributed fairly uniformly throughout the year, except for short periods during autumn (Fig. 4). The mean annual temperature is about 52.7° F. The climate is characterized by some hot, dry periods, which, in combination with high humidity, sometimes result in leaf scorch (Fig. 5). The late summers of 1948 and 1949 were abnormally hot and dry at New Brunswick.

Plots Harvested Three Times Annually

The plots were harvested at one-tenth to one-half bloom stage on June 6, July 18, and September 15, 1946; June 11, July 23, and August 25, 1947; June

TABLE III.—pH VALUES AND CATION-EXCHANGE CAPACITY OF AND EXCHANGE CATIONS IN THE SOIL ON WHICH ALFALFA WAS GROWN.

Depth	pH	Exchange Capacity	Exchangeable Cations*				
			H	K	Ca	Mg	Na
in.		*me.*	*me.*	*me.*	*me.*	*me.*	*me.*
0–6	6.56	7.50	0.76	0.14	5.80	0.78	0.02
6–12	6.40	9.55	0.49	0.21	7.45	1.31	0.09
12–18	7.05	8.60	0.01	0.18	7.11	1.21	0.09

* me. per 100 gm. soil. See footnote 4 for factors to translate me. values into percentages.

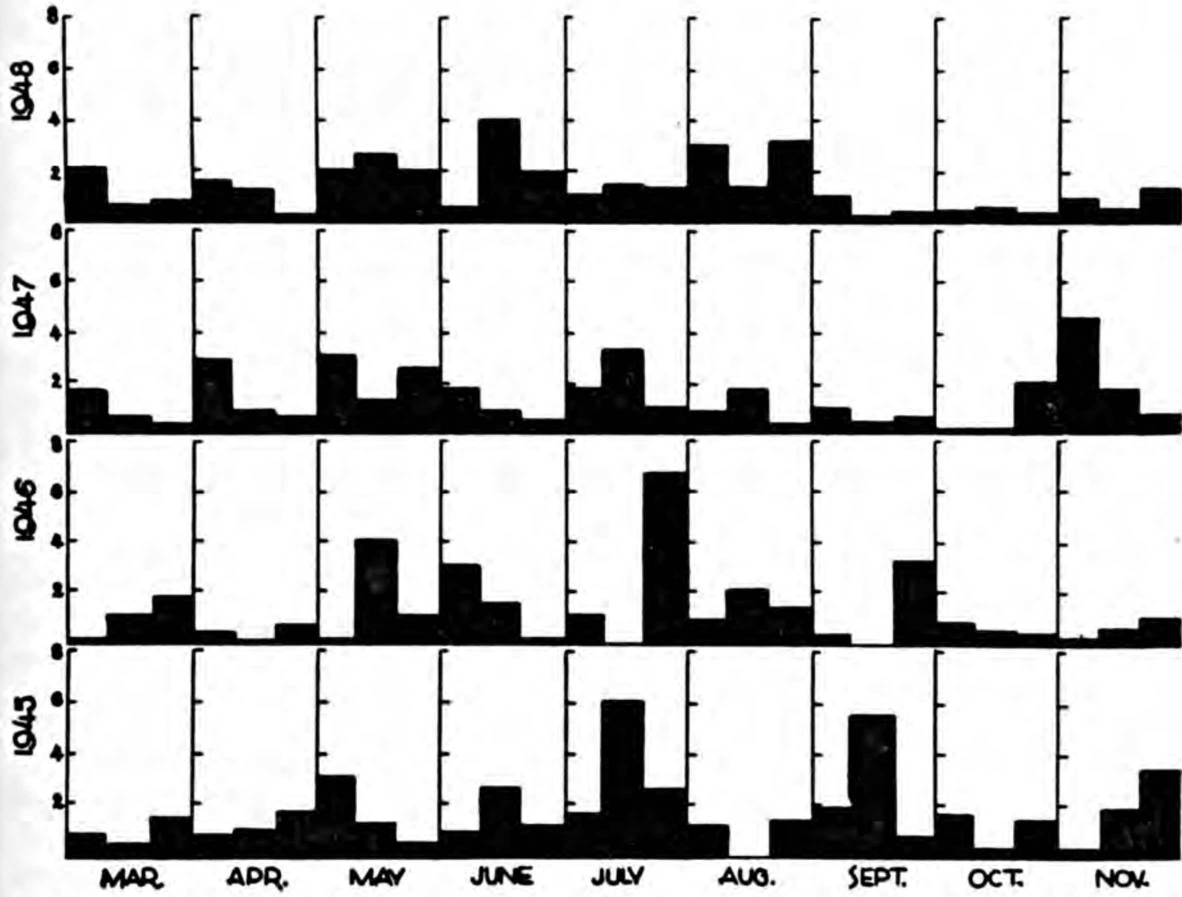

Fig. 4. Distribution of rainfall in inches by 10-day periods throughout the growing season in New Brunswick.

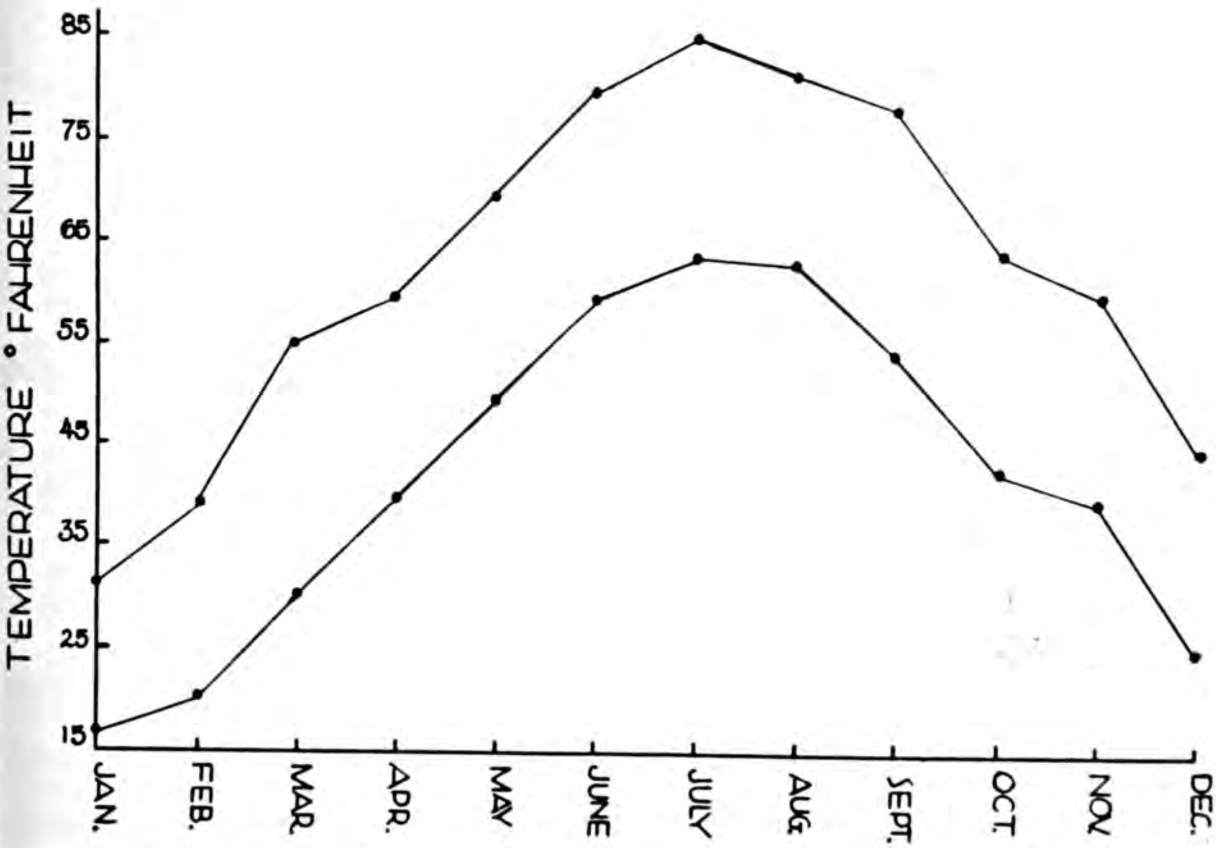

Fig. 5. Mean monthly minimum and maximum temperatures for New Brunswick.

10, July 16, and August 30, 1948; June 6, August 5, and September 10, 1949. The harvested-for-record portions were 5 feet by 43.56 feet, an area of 0.005 acre. The swath was weighed on a portable platform-scale in the field. A sample for moisture was taken simultaneously, weighed on a Toledo scale, and dried in a forced-draft gas oven.

The entire area was finally mowed and the mowings were removed from the plots so that no leachings of plant nutrients from the alfalfa went back on the soil. Fertilizer topdressings, as indicated by the outline (Table IV), were made in early spring, or as soon as possible after the first or second crop[3] had been harvested. Except for plot 5, these topdressings were not begun until the spring of 1947. The yields obtained are reported in terms of pounds oven-dry matter an acre. As air-dried hay normally contains about 10 per cent moisture, that percentage would have to be added to the weights recorded to make them comparable to ordinary field results.

Samples of alfalfa for chemical analyses were obtained the day before harvesting. One stalk from each of 20 plants was selected at random throughout the center portion of each plot. Leaves were removed from stems, and the two portions were weighed separately. The samples were dried at 70° C. in a forced-draft oven and then ground. They were analyzed for N, K, Ca, Mg, Na, P, S, Si, Fe, Mn, B, Cl, and Mo by standard laboratory procedures. All other minor elements were determined by spectrographic procedures.

The K, Ca, Mg, and Na contents of the plant material were calculated to milliequivalents per 100 gm. dry tissue. The N, P, S, Cl, and Si contents were similarly calculated from the milliequivalent weights of the nitrate (NO_3), phosphate (H_2PO_4), sulfate (SO_4), chloride (Cl), and silicate (SiO_3) ions.[4]

Liberal Fertilization at Seeding Gave Good Results

The use of 500 to 1,000 pounds of 5-10-10 fertilizer at seeding time has given good results with alfalfa in New Jersey. Application of such large amounts of K has been criticized because it may result in luxury consumption at the expense of Ca and Mg. But large enough applications must be made to ensure a good start for the plants before winter begins.

In this experiment, plots receiving 2,500 pounds of 0-12-12 fertilizer an acre at seeding time in 1945 produced 760 pounds more hay an acre in 1946 than those to which only the standard 500 pounds of 0-12-12 had been applied. At the time of the second and third cuttings of the first year, the alfalfa in these heavily fertilized plots was several inches taller than that on the rest of the field. Late in fall, this alfalfa was growing much more vigorously than that on the rest of the field. In 1947, the yield of these heavily fertilized plots was much higher than that of any other set of plots, although the others had received fertilizer topdressings during that crop season.

During 1948, the stand of alfalfa on these heavily fertilized plots was maintained in good condition without additional fertilizer, even though the plants showed signs of K deficiency. The yields on these plots would probably have been much larger that year if they had received supplemental K prior to 1948. But soil tests revealed that not all of the K that was applied at seeding had been removed from the soil by the end of 1947.

Lack of K was the most serious limiting factor on yield in this experiment (Table V). Although 120 pounds K_2O an acre were applied to the soil during a period of a little more than

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[3] At the beginning of the experiment, it was assumed that only two crops would be harvested annually, but it was found possible to remove three crops every season.

[4] These values can be converted to percentages by multiplying the me. K by 0.039, Ca by 0.020, Mg by 0.012, Na by 0.023, N by 0.014, P by 0.031, S by 0.016, Cl by 0.0355, and Si by 0.014.

Potassium Cures Cherry Curl Leaf

By A. R. Albert

Soils Department, University of Wisconsin, Madison, Wisconsin

RECENT trials in Door County, Wisconsin, have shown that potassium, when supplied to sick cherry trees, either in a fresh straw mulch or in commercial fertilizers, will cure sour cherry curl leaf. Since straw is usually scarce and relatively expensive, high-potash fertilizers undoubtedly will be more generally used in the prevention and cure of this malady of fruit trees in Door County's "Cherryland."

Soil on Wisconsin's "thumb" is of limestone origin. Some of it is as little as six inches deep over the Niagara bedrock. This is not enough soil to grow general farm crops dependably, because such thin soils are "pumped dry" too rapidly. Besides that, during some four-score years of cropping, many such soils, and deeper ones as well, have been quite thoroughly impoverished. Although such shallow soils are not the best of orchard land either, it seems that cherries are the best crop yet discovered for them.

The underlying bedrock is more or less fissured and cherry tree roots have more time than field crop roots to seek and find these cracks and make use of the moist soil in them. However, if no fissures occur near enough to where some trees were set, those trees are doomed at middle age, and earlier if severe drouth overtakes them, regardless of the fertility level of such thin soils.

First symptoms of cherry curl leaf are an upward curling of leaf edges accompanied by bronzing which later develops into scorch or necrosis that progresses inward from the leaf edges. Terminal twig growth is greatly reduced; in severe cases, none is made. Defoliation of the upper branches of larger trees is common in mid-summer. These conditions are readily mistaken for effects of drouth. After a few seasons of struggle to maintain themselves, trees begin to die—some without ever bearing any fruit. Curl leaf is aggravated by dry soil conditions and seems more prevalent in cultivated than in sodded orchards. It is estimated that about 75 per cent of the cherry trees show curl leaf and about one-third of these are severely afflicted.

One cherry orchard at North Bay (near Ephraim) had been set out in 1942 on one-time farm land in shallow Miami loam soil. Five years later it had produced little fruit, some trees already had been replaced, and many more were slowly dying. Most of them had severe curl leaf, and the owners had become resigned to abandoning the orchard.

They consulted Dr. J. D. Moore, who in turn conferred with the writer. Moore had been unable to attribute curl leaf to any disease organism or insect pest, but had observed that a good straw mulch prevented curl leaf development on young trees and believed that potash in the straw might have helped these trees. However, mulch does several things:

1. It prevents cultivation under the trees and consequent injury to surface feeding roots.
2. Soil is kept cooler and moister in summer and warmer in winter.
3. Fresh straw supplies plant nutrients, especially potassium.
4. Under mulch the soil comes alive with biological activity.

Which of these was most responsible for the observed reduction of curl leaf?

To answer this question for practical application by cherry growers, a fertilizer trial was indicated. Ten treatments, each on 27 trees and in 3 replications, were applied during the fall of 1947. Fertilizer treatments were broadcast over the whole soil area covered by 9-tree plots at 1,000 lbs. per acre, but more heavily around the trees. Fertilizers were cultivated in lightly and then straw mulch treatments were applied on some plots at about 50 to 60 lbs. per tree and 6 to 8 inches deep. In spring, 1948, a ladino clover cover crop was sown all over and all cultivation stopped thereafter. Nitrogen treatments were continued every spring on all trees at conventional rates after 1947, just as previously.

The first season after treatment was exceedingly dry, and all mulched trees showed considerably more improvement in health than trees which were only fertilized. Untreated trees continued their struggle to live. Some trees died, even on treated plots, because they had become too weak to recover under the dry soil conditions of 1947-48.

Rainfall during the second 12-month period after treatment was nearly normal, and marked improvement resulted from several fertilizer treatments. Mulched treatments had gained a start and held those gains. Value of the several treatments was determined in July, 1949, from three independent workers' ratings of all trees, one by one, into one of four classes according to remaining degree of affliction with curl

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Fig. 1. No treatment.

Fig. 2. Fertilized with 1000#/A of 0-9-27.

Fig. 3. Mulched.

Fig. 4. Mulched plus 1000#/A of 0-9-27.

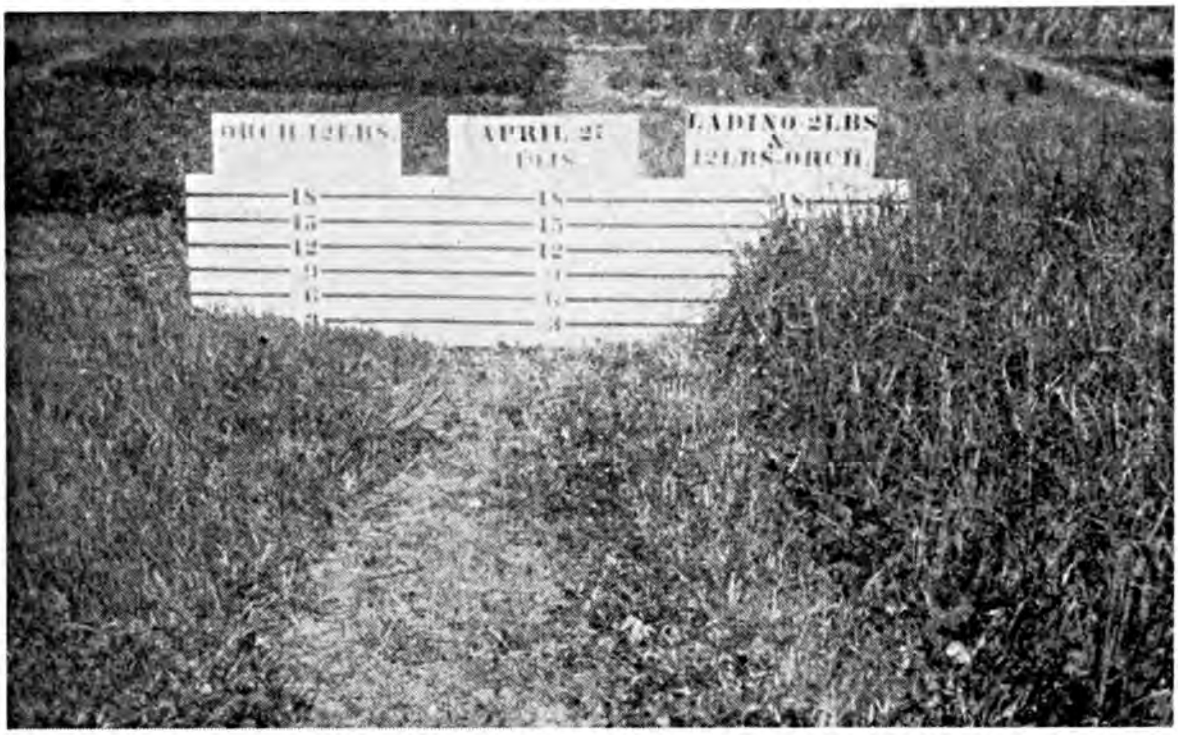

Fig. 1. Orchard grass alone (left) and orchard grass with ladino clover (right) are compared. Both plots were fertilized, maintained, and mowed in the same manner.

The Production and Utilization of Perennial Forage in North Georgia

By Orien L. Brooks

Mountain Experiment Station, Blairsville, Georgia

THE yield records that have been obtained with pasture and forage plants in north Georgia can be more fully appreciated with a brief review of the area as background. This is especially true of the high production obtained with perennial plants such as ladino clover and tall fescue.

Elevation averaging around 2,000 feet, normal rainfall of nearly 60 inches, and a mean temperature in the mid-fifties all encourage better production as it relates to grassland agriculture in the Mountain area of Georgia and the Southeast. As a rule, however, many of the soils, when unfertilized, are deficient in phosphate to the extent that this element is very often a limiting factor. Lowland soils are more commonly deficient in potash but often show combined deficiencies of phosphate and potash. Liming, in all cases when soils have not been previously treated, is a practice that is highly economical with the major crops in the area. Good response is usually obtained from the use of nitrogen on all of the grass crops on most any soil type.

Species study on legumes ranging from alfalfa, trefoils, red clovers and

Fig. 2. Winter grazing on a pure stand of alta fescue.

white clovers and grasses, including bluegrass, herds, orchard, and tall fescue, have been conducted. Ladino clover and tall fescue have given best results, as a legume-grass mixture, of all the species and varieties tested. Alfalfa here, as in other sections of the country, is rather expensive and difficult to maintain. Ladino clover and orchard grass when used as hay will give yields comparable both in amount and protein content to alfalfa, and this mixture is much easier to maintain. An average of three years' yields has shown that from early spring to early fall ladino will very nearly furnish the nitrogen required to keep the grass producing at a high level.

Results with trefoil, both the birdsfoot and major lotus or big trefoil varieties, have been very promising as to yield and protein production. However, Rhizoctonia has made it very difficult to manitain a stand. Results with red clovers have been disappointing, too, due to diseases.

Ladino clover is the superior variety of white clover and has been the most persistent legume to give high yields of maximum quality.

Ladino clover is an excellent legume for hay or grazing mixtures. It will withstand many days of 20° temperature, but one day as low as 15° terminates grazing from this clover until the weather is warm enough for growth recovery. About the same is true of orchard grass, making a mixture of these two plants very desirable for hay production, but they offer very little for winter grazing during colder periods. The quick recovery made by ladino after mowing, grazing, and cold injury does make it the most desirable perennial legume. This clover increases both yield and protein of tall fescue.

The yields from Alta and Kentucky 31 fescue have shown very little practical difference either in test plots or

TABLE 1. YIELD RESULTS OF WHITE CLOVERS, 3-YEAR AVERAGE

Variety	Seeding rate per acre	Yield per acre	Protein content*
	pounds	*pounds*	*per cent*
White Dutch..	4	2,718	26.6
Dixie White...	4	4,223	25.6
Ladino.......	2	5,815	26.6

* Analyses by K. T. Holley, Chemist, Georgia Experiment Station.

TABLE 2. COMPARISON OF TALL FESCUE VARIETIES AND ORCHARD GRASS FORAGE PRODUCTION, EARLY SPRING TO EARLY FALL, 3-YEAR AVERAGE

Plant	Seeding rate per acre	Yield per acre	Protein content*	Total protein produced per acre
	pounds	*pounds*	*per cent*	*pounds*
Alta fescue	12	2,437	16.7	409.9
Kentucky 31 fescue	12	2,286	15.9	363.4
Orchard grass	12	2,487	17.3	430.2

* Analyses by K. T. Holley; seasonal average by cuttings.

under grazing. Both varieties are susceptible to Helminthosporium net blotch and Rhizoctonia and respond equally to fertilization. Both are drought and cold resistant and produce seed and forage at practically the same rate.

It is very interesting to note the excellent increase in forage that is obtained when ladino is mixed with the above three grasses.

It is imperative that production of orchard and ladino or fescue and ladino be utilized either by mowing or grazing as the forage is produced in hot, rainy periods. One of the quickest ways to eliminate ladino from a mixture is to allow the grass to mat down on the clover during the summer. Cross-fencing or division of larger areas into paddocks is one of the best ways to assure continued high production of a fescue and ladino mixture. Even then, with the practice of rotational grazing, hay should be mowed during lush periods of growth. All of the above figures represent production from early spring to early fall. By allowing growth to accumulate during early fall, it can be held in reserve for the coldest periods of winter. It should be utilized by February 1, however, to allow new growth. Ladino affords high carrying capacity until the temperature goes below 15°F. Fescue will remain in good grazing condition through temperatures below 0°.

The expense of establishing a pasture of fescue and ladino is no more per acre on soil of average fertility than is annually seeded small grain, crimson clover, and ryegrass. This mixture offers hay, grazing, and seed production

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TABLE 3. COMPARISON OF TALL FESCUE VARIETIES AND ORCHARD GRASS WHEN GROWN IN MIXTURE WITH LADINO CLOVER. FORAGE PRODUCTION, 3-YEAR AVERAGE

Mixture	Seeding rate per acre	Yield per acre	Protein content*	Total protein produced per acre
	pounds	*pounds*	*per cent*	*pounds*
Ladino clover &	2			
Alta fescue	12	9,093	21.2	1,927
Ladino clover &	2			
Ky. 31 fescue	12	8,775	21.1	1,842
Ladino clover &	2			
Orchard grass	12	7,927	18.7	1,482

* Analyses by K. T. Holley; seasonal average by cuttings.

Fertilizers Help Make Humus

By R. E. Stephenson

Soils Department, Oregon State College, Corvallis, Oregon

SOILS are put under cultivation to obtain economic returns from crop harvests and not primarily to improve the fertility. Not only does tillage operate to speed the decomposition of organic matter and loss of fertility that has accumulated over the ages past, but nutrients are removed in the harvested crops.

The situation is not helped by the too often completely bare fields left to leach and sometimes to erode through the long winters. A lifetime of such practices may seriously impoverish the soil and sometimes results in complete destruction. Prevention is much easier, quicker, and less expensive than to effect a cure for the trouble after the damage is done.

In proportion, as the destructive processes are allowed to go on, yields drop, sometimes to 50 per cent or less of the virgin capacity of the soil to produce. Sooner or later the farmer finds it necessary to use commercial fertilizers and to adopt other good practices, the response from which depends, among other things, upon how well he provides for humus renewal at the same time.

The tendency in developing a fertilizer program is to apply fertilizer to the cash crop, which is good, and to neglect to fertilize the soil-improving crop, which is bad. This seems to indicate that soil conservation and improvement are frequently inadequately evaluated. There is no other explanation for the much waste land and land of low productivity which now exist.

Humus renewal, so important to maintaining the soil at a high production level, usually receives verbal approval, but too often nothing is done about it. The unused straw some of which is burned, the rotting heaps of manure wasting their fertility for lack of someone to spread the material on the soil, the bare fields sometimes cut with gullies, all are evidences of unwarranted neglect. No plant material should ever be destroyed or wasted when it can be returned to help save and enrich the soil.

Humus contains those materials that were present in plants. The bulk of all plant material is organic, built up principally from those elements (carbon, oxygen, and hydrogen) coming from air and water. Only a small portion, 5 to 10 per cent, comes from the minerals of the soil. These relationships in no wise minimize the importance of the soil in its capacity to support plants and provide them with the necessary 11 or 12 elements that help to make good harvests.

When humus is taken apart to get an insight into its make-up and to learn why it functions as it does, some pertinent disclosures are brought to light. The material designated as lignin, present in varying amounts in the plant materials that go into the soil, makes up an important part of the humus complex, perhaps 40 per cent of the total. Protein material, found in all plants and in the cell tissue of the organisms of the soil, is also an important constituent of humus. There are some celluloses, hemicelluloses, fats, resins, waxes, and other things, all of which are found in plants.

Since all these things are organic, they are all subject to decomposition and will ultimately disappear from the soil unless there is regular renewal. Lignin and protein, which Waksman believes enter into a semi-stable combination as the "humus-nucleus," persist longest. The amount of humus in the soil, therefore, is considerably influenced by both the kind and the amount of plant materials which regularly return to the soil.

The materials for humus renewal may be placed in three groups. The most important humus materials are the residues of whatever plants are grown. These include root systems, stubble, leaves, vines, stalks—whatever portion of the plant is unharvested and is allowed to return to the soil. The residue of organic matter left from some crops is large, from others small, sometimes nearly negligible. The sod crops with profuse root development and the legumes with large, deeply penetrating roots contribute most to humus renewal.

The cover crop to be used as a green manure is another means of humus renewal important in some types of farming, particularly orcharding. The contribution from green manures includes both roots and tops, and the amount of growth is quite variable depending upon soil fertility, type of plant, and general management practices. Two tons of top and one of root system are not impossible, but the production is more often under this amount. Such material, because of its easy decomposability, is especially important in contributing to the active humus.

Not infrequently, there is a voluminous growth of volunteer weeds, just as valuable for humus renewal as the more commonly accepted cover crops. In spite of the usual effort to keep weeds under control, the soil is full of weed seeds ready to germinate and grow profusely at the first opportunity. They are not entirely a nuisance, and on rare occasion may be seeded purposely for providing a cover crop. Mustard provides an excellent cover crop and green manure and sometimes is purposely seeded.

Stable manure, though frequently not sufficiently abundant to cover much area, is both a fertilizer and a means of humus renewal of excellent quality. A prominent farmer recently remodeling his system of farming to include a dairy business gave as his major reason the desire to improve his soil. For soil improvement, dairying is a sound business, scarcely equalled by any other type of farming that can be followed. Soil-improving sod crops and legumes are needed and there is abundance of manure made from good feed, some of it purchased, to bring fertility onto the land.

With all these good practices there is an important place for commercial fertilizers. The organic gardeners do not so much overvalue humus renewal as they unjustly undervalue and villainize the use of mineral fertilizers. The elements which mineral fertilizers supply are exactly the same kind as those already in the soil and the same as those in the organic materials. They function in the same way in the nutrition of both plants and animals. They are no more poison than those elements which nature placed originally in the soil. They simply come in a convenient form to be bagged and transported to the field and introduced into the soil as needed to make better plant growth and more profitable harvests. There is no other way to place something in the soil not already there but to bring it in from some convenient outside source—as in a fertilizer bag.

Fertilizers are effectively used to grow soil-improving crops for humus renewal. The plant knows no difference in the nitrogen, phosphorus, potassium, or other element provided by the fertilizer and that provided by the soil or by some form of organic material. The elements are used in the same way by the plant and thus become a part of the organic matter whatever their source. The important thing is to provide whatever is needed by the plant to make good growth.

Bulk growth is necessarily of prime importance in humus renewal. Few things will contribute as much to bulk growth as properly chosen and wisely used commercial fertilizers. On an orchard cover crop of barley and vetch in Oregon, where the unfertilized yield was three-quarters of a ton or less per acre of dry material, the yield was brought to one and one-half to two tons and sometimes more an acre with commercial fertilizer. For increasing the growth of cover crop, nitrogen stood first in importance, phosphorus second, and potassium third, and some source of sulfur is important on legumes. How much better to have two tons rather than one ton or less returning to the soil for humus renewal.

A nice feature of the use of fertilizers on soil-improving crops—a cover crop or an established sod—is that the fertilizer is converted into organic combinations by the growing plants, thus preventing loss of fertility. When the growth is returned to the soil to make humus, the slow rotting process provides a gradual liberation and continuous flow of available nutrient for the root system of the crop that is produced for an economic return. Fertilizing the orchard by the cover crop route is an accepted practice and it gives good returns.

Fertilizers cause no harmful effects when rightly used on the soil. Among the inexperienced in the use of fertilizers the question is sometimes asked, "Does commercial fertilizer poison the soil?" "No!" is the definite answer to the question.

Essentially the same question, differently formulated, sometimes appears, "Isn't the use of commercial fertilizer like a shot in the arm, a substitute for sound practices of soil management—a stimulant, the effect of which soon wears off and which must always be repeated in ever increasingly large doses to be effective?" Again the answer is "No." Only in the same way in which the animal must be regularly fed in order to get results. The use of fertilizer is a practical and effective means of feeding plants and must be practiced whenever plants are produced and according to the specific need of the plant under the conditions existing where the plant is grown. This is not forgetting the importance of adequate moisture to enable the plant to utilize the fertilizer that is applied.

To depend upon fertilizers alone would be as inadequate as to depend upon humus alone for maintaining soils. Fertilizers provide essential nutrients, but a good soil must have physical properties that permit the plant to develop a root system that functions to withdraw water and nutrients through surface contacts between root and soil. The nutrients and water must be passed on and distributed throughout the plant. Poor crop yields are not infrequently caused by lack of root systems and lack of functioning of the roots to withdraw the needed water and nutrients from the soil. Back of the lack of functioning roots is a soil with physical properties that are unsuited.

Before roots function properly, the soil structure must be such that waterlogging does not occur easily and air as well as moisture must circulate and become available to the root system. A favorable porous, granular structure permits rapid removal of carbon dioxide given off in the soil and just as rapid renewal of the oxygen supply. To develop and maintain this kind of structure, renewal of the humus with soil-improving crops including deep-rooted legumes is the most effective treatment that can be given. The best aeration that a porous structure can afford, and that is consistent with a good moisture supply, is most favorable to plant growth and most helpful in making the use of fertilizers effective in feeding the crop.

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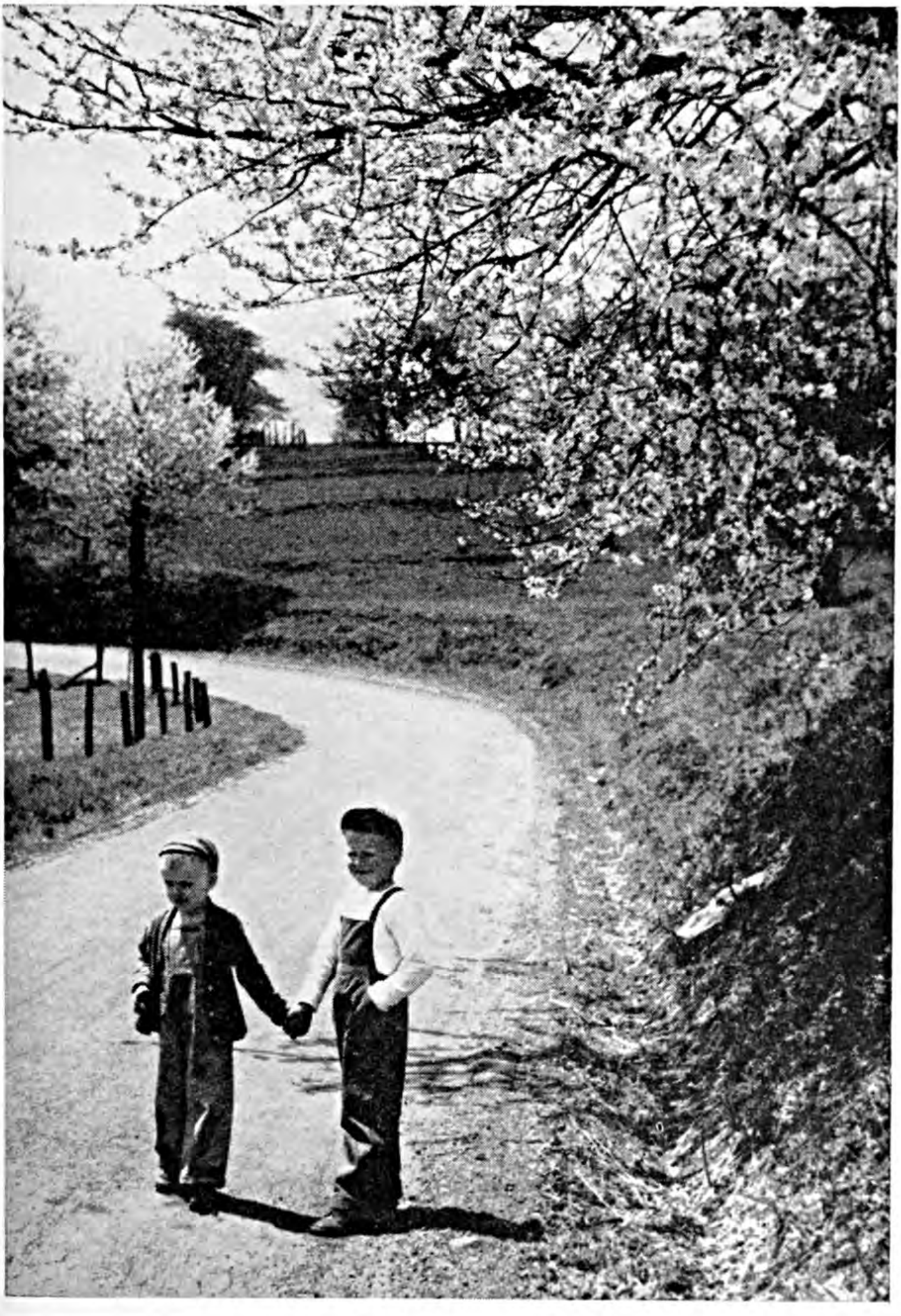
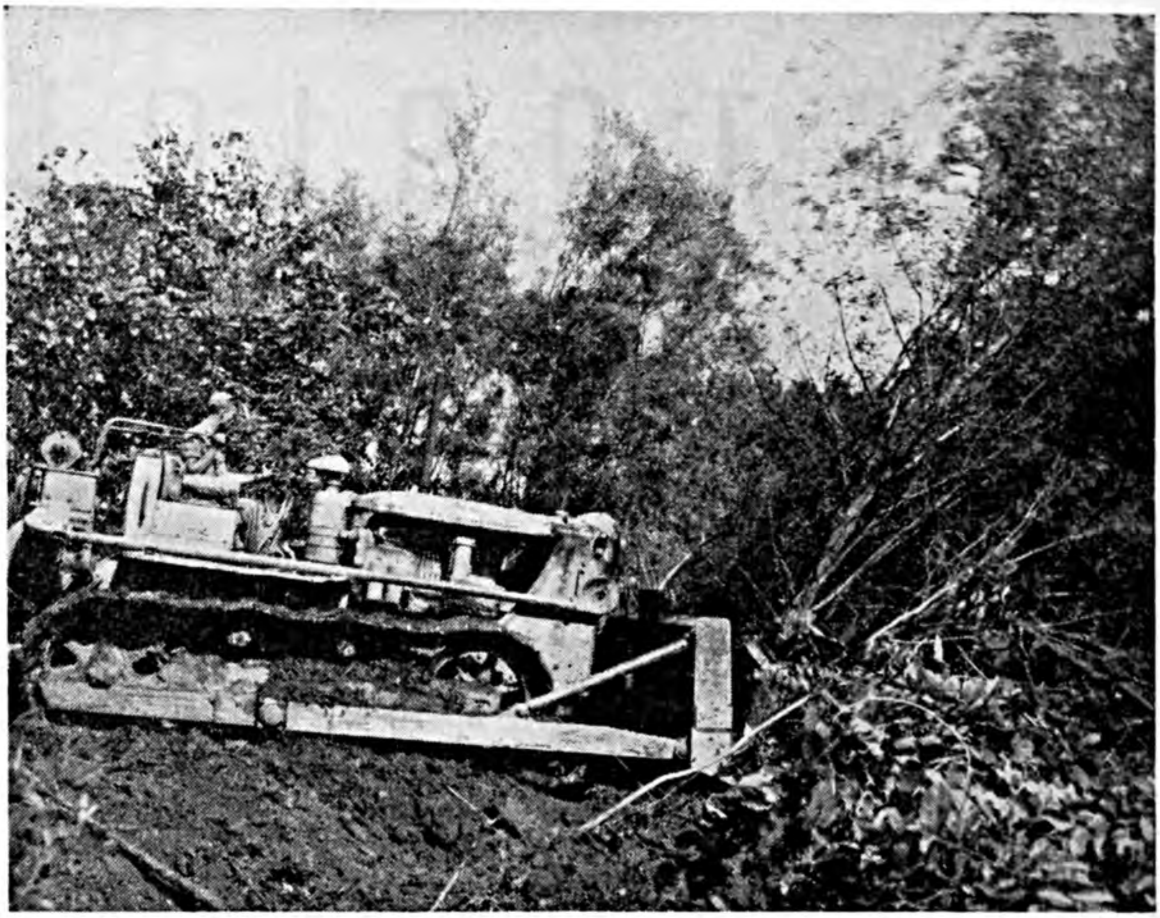
PICTORIAL



The Next Car Must Stop!



Above: A "push-over" for good crops.

Below: Turning brush into pasture.

Above: Let-er-fly—plant-food gained.

Below: Dust in motion—fertility lost.

Above: Competent help.

Below: A pile of pigs.

The Editors Talk

Youthful Ambassadors of American Agriculture

Early in June, some 40 healthy and alert American farm boys and girls will leave to spend 4½ months living and working with farm families in Europe. These delegates have been nominated by directors of agricultural extension or the officials of an adult organization, are between the ages of 18 and 25 years, high-school graduates, and have a background of farm work and farm living, experience in rural organizations, and knowledge of educational activities. Their expenses are underwritten by individuals, groups, and organizations interested in rural youth, and no Federal or State government funds are expended for this purpose.

Each delegate will have devoted considerable time and energy to an intensive advance orientation course in geography, history, culture, and agriculture of both the United States and the country to be visited. He will live on assigned farms to which he has been invited in the country to which he is sent, sharing in the daily work and social life of the family, doing his part in a program intended to contribute toward a better understanding by his hosts and himself of the customs, life, and culture of the other's country. On returning to the United States, he is expected to remain out of school or college during the fall and devote considerable time to speaking and extending to others the benefits of his experience.

This is our part of an International Farm Youth Exchange Project which began in 1948 when 17 delegates went to Denmark, France, Great Britain, Italy, Netherlands, Norway, and Sweden. In 1949 there were 31 delegates representing 22 States. In return, farm families in this country have been hosts to 39 delegates from European countries.

The objectives of the project are aid in the development of an informed junior farm leadership and help to young people in understanding something of international relationships and the problems of world peace. In these times of unsettled world conditions paramount in everyone's mind, and particularly in the minds of youth facing the future, this exchange is most praiseworthy. Our delegates during the past two years have done much to spread the doctrines of American agricul'ural efficiency and this year's "ambassadors" will ably extend the good will already engendered.

Alfalfa

Alfalfa is one of the most universally grown crops in the United States. It is estimated that about three per cent of all the cultivated land is now devoted to alfalfa, a percentage which undoubtedly will increase as more acres are released from the production of the staple crops and more is learned about the requirements for success with this outstanding hay and pasture plant

Known for centuries, its origin is attributed to Persia. Coming westward with civilization, it still was to be found chiefly in semi-arid regions where the soil was rich in mineral nutrients. On this continent it first became established in Mexico and southern California. But now, in the words of Joseph E. Wing, "It fits on every farm, once the soil is made right. It is a permanent thing. It is a mine of riches, a magazine of rich provender, a source of fertility where-with to build animals and to build soils."

Yet thousands of dollars are wasted every year on alfalfa seed by farmers who know the value of the crop but do not know enough about its plant-food requirements and management. Recently published by the New Jersey Agricultural Experiment Station, Bulletin 748 "Alfalfa—Its Mineral Requirements and Chemical Composition" is one of the best treatises on the subject which has come to hand. The authors, Firman E. Bear and Arthur Wallace have been exhaustive in their research and inclusive in their presentation of practical information for success in obtaining good stands and maintaining high yields.

With the purpose of adding to the dissemination of their findings, and through the courtesy of the New Jersey Agricultural Experiment Station, we are beginning in this issue the reprinting of this bulletin. It will be continued in two forthcoming issues, after which we shall have reprints available.

Surplus Acres

"The long-expected adjustments from the wartime pattern of agricultural production are on in earnest in 1950. Problems of adjustment will, in one way or another, affect practically every farmer in the country in coming years." Thus, does Carl P. Heisig of the Bureau of Agricultural Economics, U. S. Department of Agriculture, express what everyone seriously looking into the future of American agriculture knows.

To many of these serious-minded, the almost "stock" adjustment solution—"Turn to Grass"—may have become a poser. What will we do with all the grass after we get it? True, it holds the soil in place and helps maintain its fertility. But for profit, it should be utilized by livestock and what are we going to do with all the livestock needed to utilize all of the grass?

After considering factors of higher consumption of food per person, rapidly expanding population, and demands for food for export, it is interesting to note that Mr. Heisig and his associates in the Division of Farm Management and Costs still feel that for the bulk of the 30 to 35 million surplus acres in prospect, the answer seems to be largely more hay and pasture to produce milk and beef.

Contemplating what effect such a shift would have on the prices of milk and beef, these economists say that if per capita consumption of meats, especially beef, could be increased by only 10 pounds from the 145 pounds consumed in 1949 back to the 155 pounds consumed in 1947, and if fluid milk consumption could be increased from the 380 pounds per capita of 1949 to the 432 pounds actually consumed in 1945, we would have a ready market for the forage from about 35 million acres. These estimates are on the basis of present population. If it is assumed that 5 or 6 years will be required for such a shift, population will have increased 8 to 10 million.

The major unknowns, they say, seem to be whether consumer incomes will remain high, how much of a decline in prices of milk and meat would be necessary to induce increased consumption, and what progress farmers can make in reducing costs so as to make increased production profitable even at lower prices to consumers. Ways and means of reducing costs by better farm planning, through farm reorganization, or through adoption of improved practices, techniques, and machinery will be particularly important.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
May	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	89	81	109	74	87	110
1938	69	196	80	79	76	64	57	97	88
1939	73	154	100	84	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	105	117	107	82	211	129
1942	153	369	168	134	143	124	91	202	163
1943	160	405	188	235	174	154	125	231	245
1944	167	420	214	216	170	160	139	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	178	248	212	209	141	319	204
1947	257	380	232	248	336	259	148	381	249
1948	250	387	220	249	212	232	160	301	238
1949									
May	242	325	260	312	190	226	149	224	213
June	243	315	251	301	188	210	138	207	175
July	243	565	222	323	195	206	132	166	185
August	236	446	221	305	184	202	135	197	174
September	240	487	198	263	181	212	137	193	205
October	231	474	187	224	170	214	141	185	170
November	224	434	192	216	159	215	141	188	213
December	214	454	188	230	176	218	144	192	196
1950									
January	213	397	195	245	179	217	144	193	261
February	222	341	191	252	181	218	141	193	203
March	226	320	189	253	185	224	139	191	168
April	232	...	192	260	196	227	140	221	205

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19

Index Numbers (1910-14 = 100)

1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910-14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200
April	.760	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83
April	142	104	112	68	76	60	83

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
May	253	244	227	134	99	293	144	72
June	249	242	223	134	99	304	144	65
July	246	240	225	140	100	349	144	68
August	244	238	222	143	100	372	144	68
September	247	238	225	138	100	334	144	68
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	222	135	96	313	142	72

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Twelfth Annual Report Of The Arizona Fertilizer Control Office—Fertilizers and Agricultural Minerals, Year Ending December 31, 1949," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Spec. Bul., Feb. 1950.

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended December 31, 1949," Bur. of Chem., Dept. of Agr., Sacramento, Cal., No. FM-194, Feb. 20, 1950, A. B. Lemmon.

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Physical Soil Factors . . .

(*From page* 10)

Alkali. In arid regions many of the soils contain soluble salts which may be grouped under the general term "alkali." When these salts accumulate on the surface or within the root zone, they may be detrimental to plant growth. This condition is usually closely associated with either present or past conditions of poor drainage. Here again, as in most factors which limit plant growth, it is associated with some adverse condition in the depth, permeability, and texture of the soil. The installation of drains may greatly improve alkali soils.

Slick spots are areas of very slowly permeable soils in which a defloculation of the soil particles has been brought about largely by excess sodium. These spots may be improved by any method which will cause water to penetrate more freely, such as the application of organic matter, soil amendments, irrigation, or fertilizer.

Low nutrient level. A few soils are inherently low in plant nutrients, probably because the parent material from which they are derived is deficient in these nutrients. Acid or leached soils, as well as a large percentage of the claypan and hardpan soils, may also be inherently low in nutrients. All of these soils respond to fertilization. Of course, any inherently fertile soil will lose its productiveness if cropped for a long period of time and eventually will need fertilization.

Micro-relief. The term micro-relief is used to describe a surface irregularity not necessarily associated with major topographic features such as slope. Small drifting sand dunes in areas subject to wind action, hog-wallows, or small mounds are characteristic of many of the hardpan and some claypan soils; and stream-channeled areas lying adjacent to major streams which have overflowed and left the surface irregular are examples of micro-relief which affect plant growth. These conditions can, to a considerable extent, be remedied by leveling and farm-management practices.

Acidity. In areas of high rainfall, soils tend to become acid in reaction. Many plants prefer a neutral or slightly basic soil for highest production. An acid condition may be remedied by the application of lime.

None of these conditions, including poor drainage and excessive slopes, normally occur on soils having deep, permeable profiles of medium texture. Most unsatisfactory conditions leading to poor plant growth are in some way associated with an inferior condition in one or more of the basic qualities—depth, permeability, and texture.

Lack of sufficient moisture during the growing season may be a controlling factor in arid and semi-arid areas, or low temperatures may limit production to certain crops or seasons, but these are both essentially climatic rather than soil factors.

There are many soils on which production may be increased by fertilization, drainage, liming, leveling, irrigation, and other management practices. Some soils may even be raised from an unproductive capacity to a productive capacity by man-applied means, but it should be fully recognized that regardless of the improvement in an otherwise handicapped soil, the same amount of effort or expenditure in fertilization, irrigation, leveling, etc., on a deep, permeable, medium-textured soil will pay even greater dividends in increased yields. Nothing that man can do to a soil can entirely compensate for shallow depth, slow permeability, and undesirable texture.

Nothing that has been said about the advantage of a deep, permeable, medium-textured soil should be construed to mean that such soils do not need periodic fertilization and the best of management to keep them productive. Any soil will lose its productiveness if cropped for a long time with no replenishment of plant nutrients. In fact, much greater response to fertilization and proper management can be expected from good soils than from poor soils (Fig. 6). It is more profitable to maintain the productiveness of a soil which will produce 50 bushels or more per acre than to double the yield on a soil which will produce only 10 bushels.

Good progressive farmers are rarely

found on poor soils, and conversely, poor and careless farmers seldom have good soils. The exceptions to this are when a good farmer discovers some land which has the potentialities of a productive tract but which is at present unproductive because of poor drainage, alkali, or high water table, and he believes that through his efforts the inhibiting factors may be overcome. Some farmers, of course, produce only specialty crops and will be found where these crops can best be produced and where the over-all productive capacity of the soil may be a secondary consideration.

Fertilizers Help Make Humus

(*From page* 26)

Fertilizer use is essential for promoting fundamental processes carried on in the soil by many organisms. The processes associated with humification which results in the liberation of nutrients from the organic and mineral portions of the soil to support plant growth are carried on by a multitude of participating organisms that obtain what is essential for their own nutrition from the materials which they decompose and from the soil. What the bacteria, fungi, and other organisms are able to obtain and what is left over for the crop depend in part upon the composition of the material introduced into the soil for their decomposition.

When straw of relatively low nutrient content is returned to the soil, there likely will be at least a temporary shortage of nutrients needed to support the organisms that decompose the straw, particularly a shortage of nitrogen. Straw may contain as low as half of one per cent of nitrogen or less. About two per cent is more favorable to decomposition. The number of organisms is limited by their food supply. They must have nitrogen for formation of the proteins for the protoplasm of their cells. The number of organisms cannot increase beyond the supply of nitrogen to meet their needs. Straw which is relatively rich in cellulose and other carbohydrates has an excess of energy material over protein material.

This condition is easily corrected by using a nitrogen fertilizer to provide the organisms with this necessary nutrient element. Then straw will be decomposed more rapidly and at the same time more humus will be produced from it for improving the soil. Experimental work has shown that when straw is added to the soil and supplemented with commercial fertilizer to bring the composition of the straw up to that of farm manure, the results in increased crop yields are as good where straw is used as where the manure is used.

Humus for soil improvement can be made out of nearly any kind of organic matter if properly supplemented with commercial fertilizers. Sawdust, which is principally cellulose and lignin with little nitrogen or other nutrient elements needed by plants, will make humus and improve the soil if properly supplemented with fertilizer including nitrogen, phosphorus, potassium and, in Oregon, frequently sulfur. Any reasonable amount of sawdust can be applied to the soil at one time with no harmful effects to a crop if the necessary fertilizer is also used. Soon the sawdust-treated soil will take on a superior tilth and the growth of plants will be greater than where no sawdust was used. Usually, however, better organic materials than sawdust can be made available for renewing the humus.

Organic materials and fertilizers therefore effectively supplement each other for soil improvement. Some types of organic materials can be advantageously combined—the low nitrogen with the high nitrogen, the green, immature, and succulent with the ripened and woody growth, to obtain more effective use of the materials for making humus. A young growth of weeds in a mature grain stubble provides such a combination, as does also the dead leaves in the orchard with the green cover crop.

There are considerable tonnages of straw, corn stalks, leaves, and other litter frequently destroyed by fire that could much better be returned to the soil and supplemented with fertilizers to help bring about their decomposition. When there is sufficient recognition of the importance of both organic materials and commercial fertilizers for improving and conserving the soil while at the same time producing profitable harvests, fewer matches will be allowed in the field and more fertilizer bags will be brought to the farm.

. . . Perennial Forage in North Georgia

(*From page* 23)

possibilities, with good management, during the time that annual seeded areas are idle.

In an exploratory test to evaluate grazing, four cows have been placed on four acres of ladino and tall fescue that have been cross-fenced into paddocks of one and one-third acres each. By rotating areas, the four cows grazed 61 days on the paddock that was allowed to accumulate during fall. The cows have been allowed no grain and have had no hay except a portion of that harvested from the four acres during the previous summer.

Fig. 3. Hogs on fescue and ladino clover, November 1949.

The production of ladino clover and tall fescue apparently can increase forage production more in north Georgia than good practices have increased corn production. With equal expense, acre for acre of corn versus forage, the advantages of soil holding and building and higher economic returns per acre from grassland agriculture make it very inviting. Once established, annual maintenance of 4-12-12 at 500 pounds per acre and 100 pounds of ammonium nitrate, all applied in the fall, costing about $16 per acre, with livestock doing their own harvesting, makes this type of land use much more economical than high corn production on the same area. This is particularly true unless good producing animals are available to convert the corn to cash or the producer is interested in reducing his corn acreage to make room for more acres of highly productive, easily maintained areas of perennial clover and grass that bring a higher economic return. By proper fertilization and using adapted plants and varieties, practically any desired percentage of the total acreage in this area can be made to produce year round grazing.

Potassium Cures Cherry Curl Leaf

(From page 20)

leaf. Ratings were consolidated into curl leaf indices, and these are given in Table I.

TABLE I. CURL LEAF INDICES OF SOUR CHERRY TREES TWO YEARS AFTER TREATMENT

Trees set, 1942. Treated, 1947. Observations, 1949. Indices calculated from means of three persons' ratings of three replications with 27 trees under each treatment.

Treatment No.	1947 Treatment— lbs. per acre over all	1949 Curl leaf index
8	1,000 lbs. 0–9–0	100
1	None	97
10	None in 1947—1,000 lbs. 0–9–27 in 1948	79
7	1,000 lbs. 0–9–27 and 200 minor element mixture	76
2	1,000 lbs. 0–9–27	59
6	1,000 lbs. 0–9–27 and 200 manganese sulfate	57
3	1,000 lbs. 0–9–27 with potassium as sulfate	57
9	1,000 lbs. 0–0–27	51
5	8" straw mulch around trees	41
4	8" straw mulch and 1,000 lbs. 0–9–27	33

MSD = 17. O = No curl leaf. 100 = Severe curl leaf.
Annual nitrogen treatments were made on the entire orchard.
1947 soil tests: pH—6.0-7.5; Av. P—20-30 lbs.; Av. K—80-90 lbs.

Time and soil moisture were and remain important factors in tree recovery. Trees can suffer nutrient deficiency for several years and still live. But also, correction of the deficiency may not result in immediate recovery, especially with insufficient moisture. Mulch had a multiple effect, including addition of potassium. Because of drouth, mulched trees got a lead on fertilized trees and are holding this lead. Where 0-9-27 was applied a year earlier in treatment No. 9 than on treatment 10, a lead was likewise established.

Superphosphate alone caused no improvement, but potash alone effected about a 50 per cent recovery. Potassium as sulfate or as muriate showed no significant differences between them (treatment 2 and 3). Since the index for the minor element mixture with 0-9-27 was above that for 0-9-27 alone, it shows that minor element deficiency was not responsible for curl leaf.

Cherry growers in Door County will be using potash or 0-9-27 fertilizer along with their regular nitrogen applications. They realize that by the time trees indicate potassium deficiency through curl leaf, they already will have done much less than their best for several years, and that prevention pays even better than cure. Many orchards, especially the younger ones with severe curl leaf, will be mulched as well as fertilized in order to assure earlier recovery even in drouthy seasons.

Whether mulches which supply little or no potassium would be of real value was not determined. Insofar as they would encourage root feeding in more of the limited surface soil volume, such mulches should give trees a temporary respite but at the expense of the small amount of remaining available soil potassium. Stoppage of cultivation doubtless had a similar though lesser contributing beneficial effect. Since evidence points so conclusively to inadequate potassium uptake as the cause of cherry curl leaf, any practice which fails to restore the diminished soil supply of available potash should be regarded as a stopgap, even though the practices themselves are sound and beneficial.

For small cherry trees with curl leaf in sodded or cultivated orchards, one may apply 3 to 6 lbs. of 0-9-27 or similar fertilizer per tree under and somewhat beyond the tips of branches and also a mulch. This should carry trees into production; but if no mulch can be provided, it may be desirable to repeat the fertilizer application in about two years.

For larger producing trees with curl leaf, mulches would also be excellent but are not usually practical. From 5 to 20 lbs. of 0-9-27 per tree can be applied under and somewhat beyond the branches. Tree size, severity of curl leaf, and density of cover crop growth will govern how much to use per tree.

Doubtless many orchards are on the verge of curl leaf development and to ward it off and keep trees thrifty, a maintenance treatment of 3 to 8 lbs. of 0-9-27 (or similar fertilizer) per tree every year or two may be made. Exactly what rate per tree is best will probably be hard to establish. Therefore, after 5 to 10 years of using this or any other regular maintenance treatment, a phosphorus and potassium inventory should be made by soil testing. Available phosphorus probably need not exceed 60-80 lbs. per acre eight inches deep and available potassium 250 to 300 lbs. When past treatments have built up either the available phosphorus or potassium to these levels, (1) the formula should be modified, (2) clear phosphates or clear potash may be applied, or (3) rate of treatment may be reduced.

In sodded orchards phosphate and potash fertilizers may be broadcast on open soil at any convenient time. The rate per tree should be somewhat high because the trees must feed at the "second table" after the needs of the cover crop has been appeased. In cultivated orchards fertilizers should be applied shortly before they can be cultivated in. If fertilizer is left on a bare soil surface, heavy rains may wash it away.

Nitrogen treatments, as required by size and age of trees, should be made in spring. If both nitrogen and phosphate and potash are to be spring-applied, a complete high-nitrogen, high-potash fertilizer may be used.

Reseeding Crimson Clover . . .

(*From page* 12)

in North Alabama, Tennessee, Kentucky, and Oregon. Fairly heavy type, well-drained soils were generally regarded as necessary. However, with proper plant foods, the reseeding type crimson clover will grow on well-drained soils wherever the climate is favorable.

Land preparation is important, especially for establishing the first stands. Summer fallowed land is preferred and may be conveniently arranged after harvesting small grain. Stands can also be established on lespedeza sericea and Johnson and Bermuda grasses by scarifying the sods slightly before sowing the crimson clover. Inoculation of the seed with the proper culture is very important on new land.

Reseeding crimson clover responds well to moderate liming and may be classed in the group requiring a medium lime content. Liberal amounts of phosphate and potash should be applied for this crop where the soil is known to be low in these plant foods. Experience in Alabama, Georgia, and Tennessee has shown beneficial results from the use of 15 pounds of borax per acre both in an improved inoculation of the clover and in seed yields. Recommendations for fertilizer in addition to lime are as follows: The use of 400-500 pounds per acre of 0-14-10, 0-12-12, or 0-14-7, with borax. On light sandy soils or soils of low fertility, it would be desirable to add two to three per cent nitrogen in the above fertilizers to assist in getting the first crop established.

From 15 to 20 pounds of certified or known high quality seed per acre should be sown, preferably with a grass seed attachment on a cultipacker or grain drill. The date of planting should be about one month to six weeks ahead of the average date of first frost. For much of the South this is during last of September through October. A good rule is to plant after a good rain on a firm seedbed and cover lightly with a cultipacker, weeder, or drag.

Crimson clover seed germinates quickly and with adequate moisture and plant foods will make rapid growth. On soils of low fertility and low organic matter content, it makes a very poor growth until spring when warm weather enables the nodules to supply the needed nitrogen for rapid growth.

With proper management reseeding crimson clover will prove a highly prized crop in the South. As an example, Autauga county, Alabama, has increased its acreage from a few acres on a few farms to 8,000 acres on more than 100 farms within the last three years. This acreage will be increased four-fold next year. The large increase in acreage was due to the value of this crop in additional farm income through winter grazing, seed sales, and soil building. Other adapted areas of the South should grow reseeding crimson clover to improve their farming enterprise.

Alfalfa—Its Mineral Requirements . . .

(*From page* 18)

a year preceding the test, typical K-deficiency symptoms were apparent early in the spring of 1947 (Fig. 6). Many of the plants never recovered from this early deficiency. Total yields undoubtedly would have been considerably higher if no lack of K had ever been allowed to develop.

The highest yield was obtained for the heaviest rate of K application (Table VI). Plants on plots receiving 180 pounds K_2O an acre were the only ones that did not show deficiency symptoms in the third cutting. A 60-pound application produced maximum yields for only one cutting following its

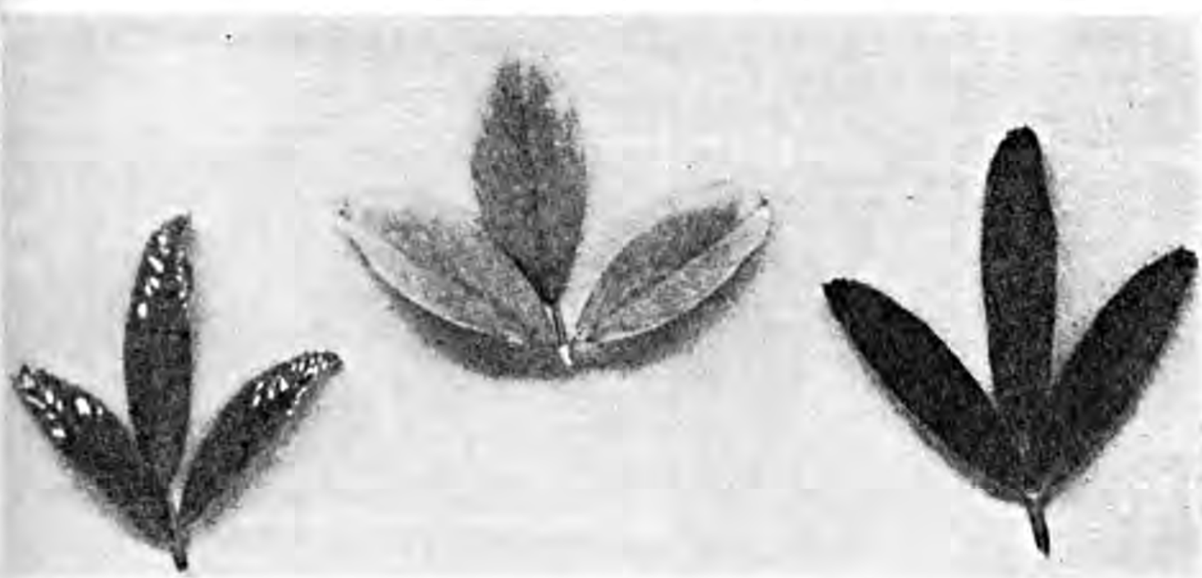


Fig. 6. White spots early in the year and yellow discoloration later indicate potassium deficiency. Normal leaf at right.

TABLE IV.—FOUR-YEAR YIELDS RANGER ALFALFA AS INFLUENCED BY KIND, AMOUNT, AND DATE OF APPLICATION OF FERTILIZER TOPDRESSINGS. IN POUNDS DRY MATTER PER ACRE—MEAN OF THREE REPLICATIONS.

Plot	Treatment*	1946				1947				1948				1949				4-Yr. Total
		June 6	July 18	Sept. 5	Total	June 11	July 23	Aug. 25	Total	June 10	July 16	Aug. 30	Total	June 6	Aug. 5	Sept. 10	Total	
1	K+B	5100	2950	2230	10,280	2930	2730	1460	7120	2740	2290	1750	6780	2650	1380	790	4820	29,070
2	P+B	5160	2990	2210	10,360	3090	2780	1290	7160	2180	1730	1020	4930	930	770	690	2390	24,830
3	K+P+B	5150	3040	2210	10,400	3730	2890	1540	8160	3420	2530	1580	7530	3170	1880	900	5950	32,040
4	K+P+B	5120	3040	2200	10,360	3200	2990	1560	7750	2850	2500	1730	7080	2370	1670	930	4970	29,150
5	K+P+B	5190	3220	2170	10,580	3980	2890	1770	8640	3070	2400	1850	7320	2790	2180	920	5890	32,430
6	K+P+B	5250	3100	2190	10,540	2960	3030	1670	7660	2910	2600	1680	7190	2340	1340	880	4560	29,940
7	2K+P+B	5130	3090	2160	10,380	3080	3110	1660	7850	3210	2640	2040	7890	3130	2060	1100	6290	32,410
8	3K+P+B	5170	3110	2080	10,360	2890	2960	1570	7420	3620	2810	2140	8570	3550	2690	1220	7460	33,800
9	K+P+B+Na	5390	3140	1960	10,490	2720	2950	1630	7300	2830	2450	1810	7090	2550	1430	960	4940	28,820
10	K+P+B+N	5180	3190	2130	10,500	2540	3020	1650	7210	3560	2370	1650	7580	2630	1360	850	4840	30,130
11	K+P+B+N	5120	3010	2090	10,220	2650	3260	1540	7450	2820	2730	1760	7310	2350	1330	1120	4800	29,770
12	K+P+B+N	5190	3030	2030	10,250	2710	2530	1570	6810	3220	2190	2350	7760	2290	1410	1280	4980	29,800
13	2K+P+B+N	5290	3140	1980	10,410	2750	3290	1730	7770	3110	2900	1890	7900	3120	1820	1310	6250	32,320
14	K+P+B+N+Na	5320	2980	1930	10,230	2850	3290	1600	7740	2660	2590	1780	7030	2770	1760	1320	5850	30,850
15	2K+2P+B	4900	2990	1950	9,840	2640	2850	1590	7080	2990	2490	1940	7420	3010	2160	1300	6470	30,800
16	2K+2P+B+Mg	4920	3090	1980	9,990	2590	2940	1610	7140	3130	2810	1820	7760	3030	1900	1230	6160	31,040
17	2K+2P+B+2Mg	5040	3250	1990	10,280	2570	3150	1580	7300	3360	2610	2000	7970	3280	1980	1200	6460	32,000
18	K+P+B+2Mg	5150	3270	2010	10,430	2630	3200	1660	7490	2940	2420	1600	6960	2260	1450	990	4700	29,580
19	2K+2P+B+Ca	5410	3010	2100	10,520	2810	2980	1650	7440	3560	2740	2050	8350	3120	2290	1260	6670	32,980
20	2K+2P+B+Mo	5110	3160	2090	10,360	2830	3050	1660	7540	3230	2520	2040	7790	3120	2220	1330	6670	32,350
21	2K+2P	4980	3210	2070	10,260	2660	2840	1690	7190	3070	2630	1850	7550	2910	2250	1090	6250	31,240
22	K+P	4980	3170	2060	10,210	2730	2850	1590	7170	2930	2450	1470	6850	2540	1310	910	4760	29,080
23	———	5150	3000	2180	10,330	2700	2670	1330	6700	2070	1470	920	4460	900	470	410	1780	23,270
24	5K+5P	5330	3300	2440	11,070	4250	3080	1550	8860	3190	2230	1390	6810	1630	1160	790	3520	30,260
25	2K+2P+B	6250	2740	2050	11,040	3620	3040	1640	8300	3450	2470	1850	7770	3090	1990	1340	6420	33,450
	Mean				10,390				7530				7260				5366	30,456

* Per acre—K = 60 lb. K_2O, P = 60 lb. P_2O_5, N = 60 lb. N, B = 20 lb. borax, Na = NaCl equivalent to K, Ca = 1,000 lbs. $CaCO_3$, Mg = 160 lb. MgO as $MgSO_4 \cdot 7H_2O$, Mo = 5 lb. sodium molybdate. All treatments applied after first cutting except plots 3 and 10—early spring plots; 5 and 12—after second cutting; plot 24—seeding time only; plot 6—P and B in early spring.

† During 1946, the alfalfa was entirely dependent on the fertilizer used in advance of seeding. Plot 5 received its topdressing September 9, 1946, but all other topdressings were first applied in 1947.

‡ Mixed seeding of alfalfa and timothy.

1949 was an abnormally dry year, the June rainfall being only 0.02 inch and that for June, July, and August being 6.73 inches below the average.

TABLE V.—EFFECT OF P, K, AND P + K TOPDRESSINGS ON ACRE YIELD OF ALFALFA AND ON ALFALFA AND WEED POPULATIONS AFTER 3 YEARS.

	Plot 23 No Fertilizer	Plot 2 P Fertilizer	Plot 1 K Fertilizer	Plot 4 P+K Fertilizer
1947 Acre yield . . . . *lb.*	6,700	7,160	7,120	7,750
1948 Acre yield . . . . *lb.*	4,460	4,930	6,780	7,080
1949 Acre yield . . . . *lb.*	1,780	2,390	4,820	4,970
Total Acre yield . . . . *lb.*	12,940	14,480	18,720	19,800
Alfalfa plants per A.* . . . *thousands*	87	122	174	201
Weeds . . . . *per cent**	87	75	39	35

* At time of first cutting in 1949.

use. Severe K-deficiency symptoms were always apparent in the third cutting following the annual use of that amount of K_2O, whether it was applied in early spring or after the first or second crop had been harvested. A 120-pound annual rate of application of K_2O was not excessive for such yields of alfalfa hay as this soil is capable of producing.

Annual P_2O_5 applications were much less effective than those of K_2O. This suggests the desirability, in topdressing, of using fertilizer grades that contain considerably higher percentages of K_2O than of P_2O_5. These experimental results indicate a need for a topdressing of about 500 pounds of an 0-12-24 grade of fertilizer.

(*To be Continued*)

TABLE VI.—EFFECT OF INCREASING INCREMENTS OF K AND TIME OF APPLICATION OF P + K AS TOPDRESSINGS ON YIELD OF ALFALFA OVER A 3-YEAR PERIOD.

Plot	Treatment*	Time*	Acre Yield 1947	1948	1949	Total
			lb.	*lb.*	*lb.*	*lb.*
Increasing increments of K as topdressings						
4	P+K	AFC	7,750	7,080	4,970	19,800
7	P+2K	AFC	7,850	7,890	6,290	22,030
8	P+3K	AFC	7,420	8,570	7,460	23,450
Time of application of P+K topdressings						
3	P+K	ES	8,160	7,530	5,950	21,640
4	P+K	AFC	7,750	7,080	4,970	19,800
5	P+K	ASC	8,640†	7,320	5,890	21,850
6‡	P+K	ES–AFC	7,660	7,190	4,560	19,410

* All plots received standard applications of borax. P = 60 lb. P_2O_5; K = 60 lb. K_2O; ES = early spring; AFC = after first cutting; ASC = after second cutting.

† Received first topdressing September 9, 1946. None of the other plots were topdressed until 1947.

‡ P in early spring, K after first cutting.

Gumbo and Gumption

(*From page* 5)

he saw a long ways ahead through the prairie dust, to the days when radicals of progress would shift all his native scenery and customs for him—when the homesteaders would be raising rust- and drought-resistant grain and thronging the local towns for movies and gadgets; and the Black Hills country would be full of gas stations, hotels, and garages to accommodate eastern motorists, whose high-powered cars would no longer ford the winding Teton, or be halted and detoured by the gorges, pinnacles, and desolate colored realm of the north wall of the Badlands. Maybe he thought that there was a real permanence to such items as Bill Hickok, Calamity Jane, Corbin Morse and his fabulous ranch, Bat Masterson, and their nomad neighbors, Sitting Bull and Red Cloud—*Pashuta Luta.* But he didn't reckon with the great stone faces on Rushmore mountain or the road-building kind of highwaymen.

Well, in due time our lurching conveyance brought us up lumbering through the sage to the eastern end of the track from Rapid City, at the tiny but ambitious town of Wasta. I learned later on while clerking for an Indian trader at Pine Ridge agency that Wasta in the Sioux language means Good. But taken casually from that angle, it did not seem to fit. However, we soon unloaded and reloaded our heavy personal luggage and took the train for the last few miles to Owanka —the "place to camp" along the meandering Box Elder Creek.

I HAVEN'T been out there to Owanka since the summer of 1911. An old chum of my prairie years has told me that the big main highway runs far northward of the site where the traders and the postal boys built the rude wooden stores with false fronts and pony racks, and where the red sectionhouse and box depot stood away back when.

About a half mile north of the broad valley where Owanka was nestled there was a steep and difficult hill in those days of the first claim squatters. Dad met us at the depot with a wagon and a team he had borrowed from another homesteader, and we piled in with stiff joints and started off with our baggage and the dog—heaving up that gravelly, hill road to the prairie upland. Here a narrow, aimless trail between a few wire fences led away for three miles to the quarter-section near the Beam schoolhouse—a dull, squatty, district school that had served the sparse population of youngsters since the original ranchers took over the Indian country in the seventies.

IT might be well to pause right now and declare fervently that ranch families like the Ike Beams and their friends never once molested or belittled us, contrary to the premonitions of the sallow driver on the stage. They even invited us to their round-ups and their anniversary parties, and advised us on building cave cellars and digging wells. For the record it should be known, that most of the mistrust and ill-will could be traced to the attitudes of the newcomers rather than to the grudge of the men who believed in beef and the open range.

Isn't it queer — all the little things we remember and the big ones we forget? For the life of me, I cannot tell the names of our township officers, the detailed nature of the ranch operations around us, the type of the soil we had, or the cost of barb-wire and groceries in the far-off claim era at the turn of the century.

But I recall many odd instances and random memories, mental cloud shadows, and passing incidents, here and there without rhyme or reason, but all serving as accents to a kind of life that none of us shall ever live again. (Not while the productive surge of farming runs so high without requiring new developments.)

THAT first arrival at the yellow frame shack stands out. It was hardly a haven for the weary, especially a weary woman. Mother surely was "played out" and in no mood to look on life with candid hope and vivid reality, even had the lonely spot been bedecked with prairie flowers for her advent—which it was not. She had to climb down and drag her tired feet through the little doorway, where a mail-order stove was waiting for somebody's home economics; where a sleazey cotton curtain on wire loops separated the maternal and paternal couch from the single bed whereon my patchwork quilt was spread. Then between the sleeping side and the living and cooking and eating section was suspended a second curtain strung up at right angles to the other wire. The whole space was floored with unmatched lumber and the ceiling was just lean-to rafters.

Over-all dimensions of the claim abode were sixteen feet east and west by fourteen feet north and south. The "high side" of the shack faced south. It had a little step-like platform at the door and a wood and kindling storehouse to the west. On the east end was the necessary outhouse with a two-holer accommodation, and adjacent to the shack on the sunrise end was the customary food storage cave, banked over with a mound of gravelly clay gumbo. Tar paper covered the slanting roof, and the walls were sort of "insulated" with one air space between siding and sheathing boards.

We found out that life could change, all right. Every-day things and ordinary privileges of the eastern country were luxuries in the claim business. Whoever built our well had not done well. The casings were not soundly inserted, the platform was weak and wobbly, and hence certain wild creatures of various kinds had tumbled into the well and drowned. The taste of the fluid warned us and we boiled it regularly. Finally we had another well dug, properly lined, and safeguarded.

Our first night at the claim found us too tired to mind external disturbances. But on the second night we retired as usual before ten o'clock and shortly bedlam broke loose on the windswept prairies. At first the tumult sounded like the chorus made by young folks on a sleigh ride, but Dad assured us it was not a band of savages seeking revenge for our land stealing, but merely a couple of stray coyotes out on the prowl. I dug my head under the quilts and thought of the school-room chromo showing a lone wolf on the brow of a moonlit hill overlooking a lonely town. Then I felt a flutter in my hair. Thinking maybe my hair was standing up in fright, I clutched at a moving lock and grabbed a field mouse in my fist. Him I threw across the dark room, and made a mental vow to buy a few spring traps when I next traded at Owanka.

YES, this too was living in the rude and the raw. Not all the tall tales could be found in the state historical collections. Daniel Boone, Kit Carson and his kindred, Father DeSmet, and Buffalo Bill were being reincarnated by an unprepared and unwilling novice from the Class of 1907. Yet at sundry subsequent moments I have rejoiced indeed that in my short experience with pioneering a link was forged for me to give me fresh admiration for adventurous ancestors. And moreover, the sameness, the monotony, and the absence of many vital incentives train a fellow to be patient and serene. To be satisfied with a reasonable limit in things and to know that the best comes to him who waits and trusts help one to form a good philosophy.

Of course, it wasn't all just abiding with the "old folks" at home in the shack. The community had its quota of bright young bloods and jolly companions. I'd like to see a few of them again, such as Rolla Wilson, the Cottier boys, (and by all means, their sister), Chuck Brady, and Forest Peck. Sure, they're older now, maybe a bit forgetful of what we did at parties in the claim homes, at the battered schoolhouse, and at picnics on the Box Elder bottoms. What big stories we imagined, what hopes we nursed, and how pulsatingly young we felt—out there beyond the Missouri valley in the shadow of *Paha Sapa,* or the Black Hills to you.

WE went up to Deadwood sometimes on rare occasions. Spearfish Canyon and Buffalo Gap were household words. Harney's peak loomed above us westward while we broke the sod and made our arms numb in the chucking down of hand planters filled with seed corn, placed for the first time since creation under the surface of the prairie. Oats grew fairly well except in the whitish alkali spots, but never did agricultural seed thrive like the buffalo grass and the sage—for commercial fertilizers were not customary equipment for the Iowans and Nebraskans who made up the bulk of the Pennington county settlers. The remnants of the scattered cattle and buffalo chips were dry and useless for plant food, and nobody had enough livestock to make a respectable manure pile.

Finally, after long sojourn in that remote habitation within distant view of the shimmering Badlands, Dad got his belly full of pioneering. We had a husky neighbor on the north, proving up on the next quarter, who had enough of a working crew in his family to undertake more risks and duties. So a sale was consummated to Brother Fuller at a fair price per acre, and it left Dad a small margin after cash preemption was over. Then with a series of hearty good-byes and come-back-won't-you farewells, we three closed the door, boarded the eastbound rattler, and vanished from Dakota forever as residents. One return journey was made five years afterward, just so I might renew acquaintances and see what changes time had wrought.

Let nobody speak up and declare that Dad and others of his ilk were gamblers and exploiters, instead of founders of farm prosperity. If we study the methods of the suit-case farmers and land lessors today who plunge and plunder fertility from topsoil subject to erosion and wind destruction, and who chase the high dollar regardless of conservation principles—then any primitive effort at settlement and colonization such as our associates indulged in forty years ago is pure and undefiled. It we say that the men who went out there and lived in humble shacks and sold for a few dollars an acre gain were exploiters, then those who settled there before them and pastured the public domain and made snug fortunes on a free and open range might also be blamed equally for greed.

BUT now we know otherwise. I am sure we can go to any county agent in Dakota and visit any laboratory experts in college work on the plains and find that agriculture today is producing more abundantly and its devotees are wealthier, man for man, than any layers of civilization who preceded them into the sunset land.

Certainly, therefore, I have no remorse or regrets or drawbacks to blur my retrospective memories of days gone in Dakota. My only real regret is that I am not ever going to ride a Deadwood stage again, or listen to the coyotes by night, or watch them brand a maverick in a dusty corral—from a safe seat on the fence. And if I ever see those great rock faces on Rushmore cliff, I'll be looking far beyond them to certain filmy faces of the past who peopled the prairie for me in my youth. They never realized what mighty farm forces they engendered.

A Few Whinnies

A middle-aged Negro woman sat crying on the steps of the county court house.

"Why, aunty, what's the matter?" asked a passing white man.

Between sobs and sniffles she spoke. "Mistuh, my ol' man's done divo'ced me. An' dat ain't all—de jedge done give him all three children. An' dat ain't all—weren't none of 'em his chillun, anyhow."

* * *

A farmer posted a sign on the entrance of his premises which read: "No huntin, no fishin, no nothin."

* * *

Lecturer: "Can anyone give the derivation of the word 'Auditorium'?"

Listener: "Yes, from the word AUDO—to hear, and TARIUS—bull. A place where you. . . ."

Lecturer: "That will do."

* * *

He: "Do you smoke?"
She: "No, I don't smoke."
He: "Do you drink?"
She: "No, I don't drink?"
He: "Do you neck?"
She: "No, I don't neck."
He: "Well, then what do you do?"
She: "I tell lies."

* * *

Little Louise: "Mother dear, what does dehydrate mean?"

Mother: "It means getting all the water out of anything. Why?"

Little Louise: "Well, my puppy just dehydrated in the living room."

When the teacher asked little Johnnie how he enjoyed Easter Sunday, he came across with the following tale: "Pop and Mom painted some real pretty Easter eggs for Sis and me, and then hid them in the hen house so we couldn't find them. About that time, Joe, our rooster, came along and took one look, dashed over the fence into the next yard and kicked the heck out of the peacock over there."

* * *

Rastus: "Where are ya goin', boy?"

Sambo: "I's goin' down to git myself some tuberculosis stamps."

Rastus: "What is dey? I ain't never heard tell of em."

Sambo: "Every year I gits myself fifty cents worth of dem tuberculosis stamps an' stick dem on mah chest an' I ain't neber had tuberculosis yet."

* * *

Visitor: "Where's your daddy, Sonya?"

Sonya (age 4): "He's out in a gawage, fitsin' the dam car."

* * *

Man to his wife at the zoo: "Where are the monkeys?"

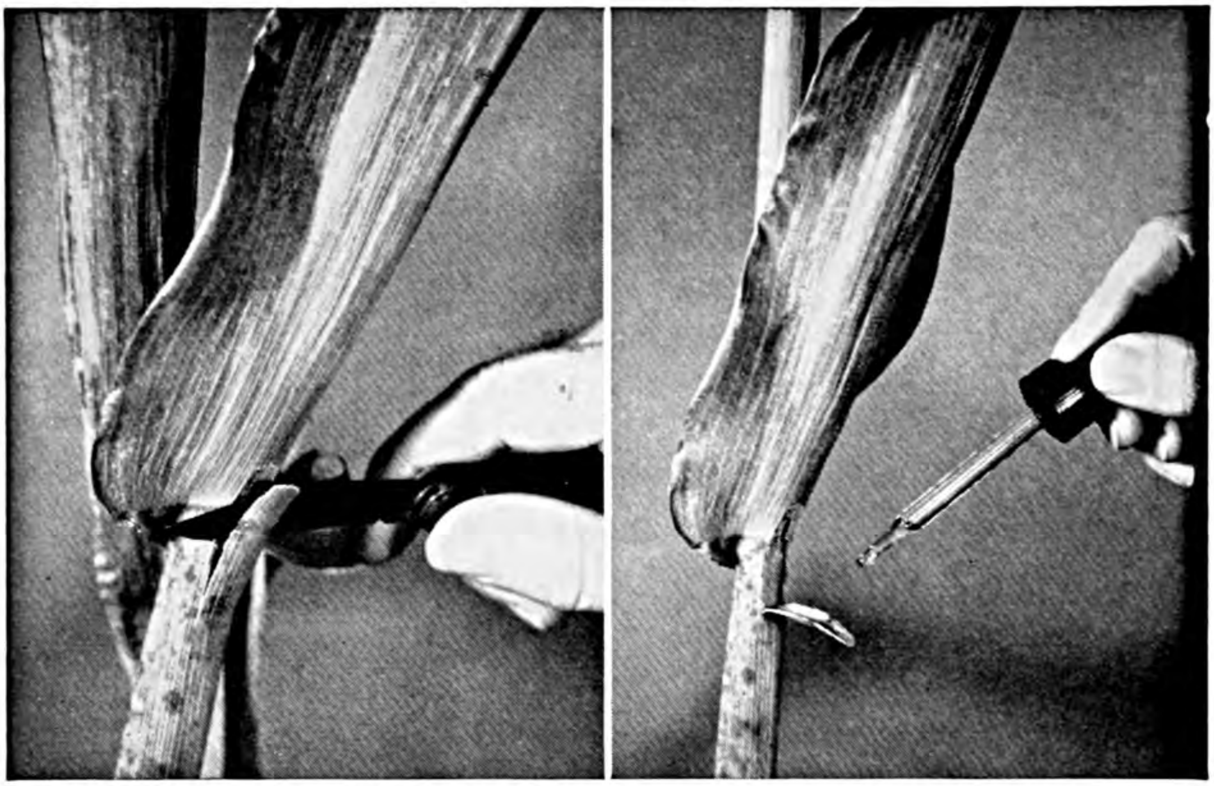
Wife: "Probably inside making love."

Man: "Would they come out for peanuts?"

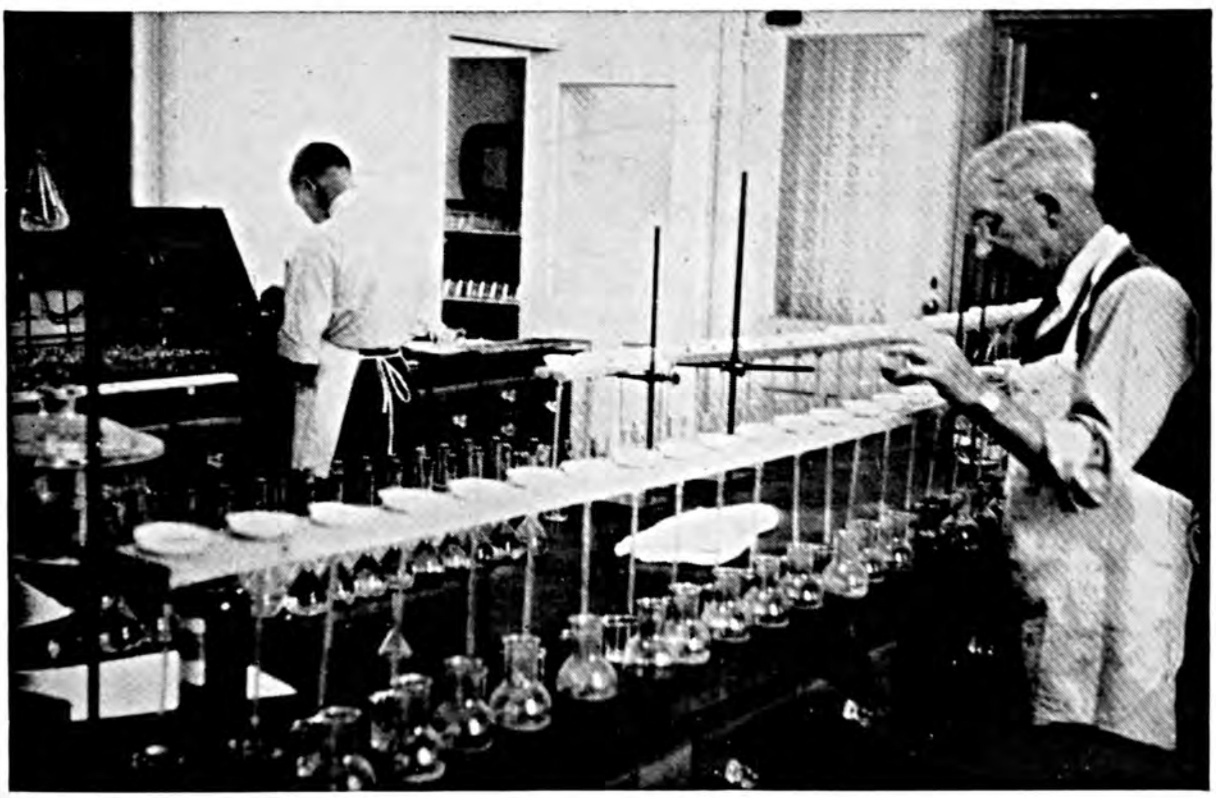
Wife: "Would you?"

* * *

Two old ladies were discussing their physical ailments. Said one: "So your trouble is constipation. What do you take?" Said the other: "I just take my knitting."



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



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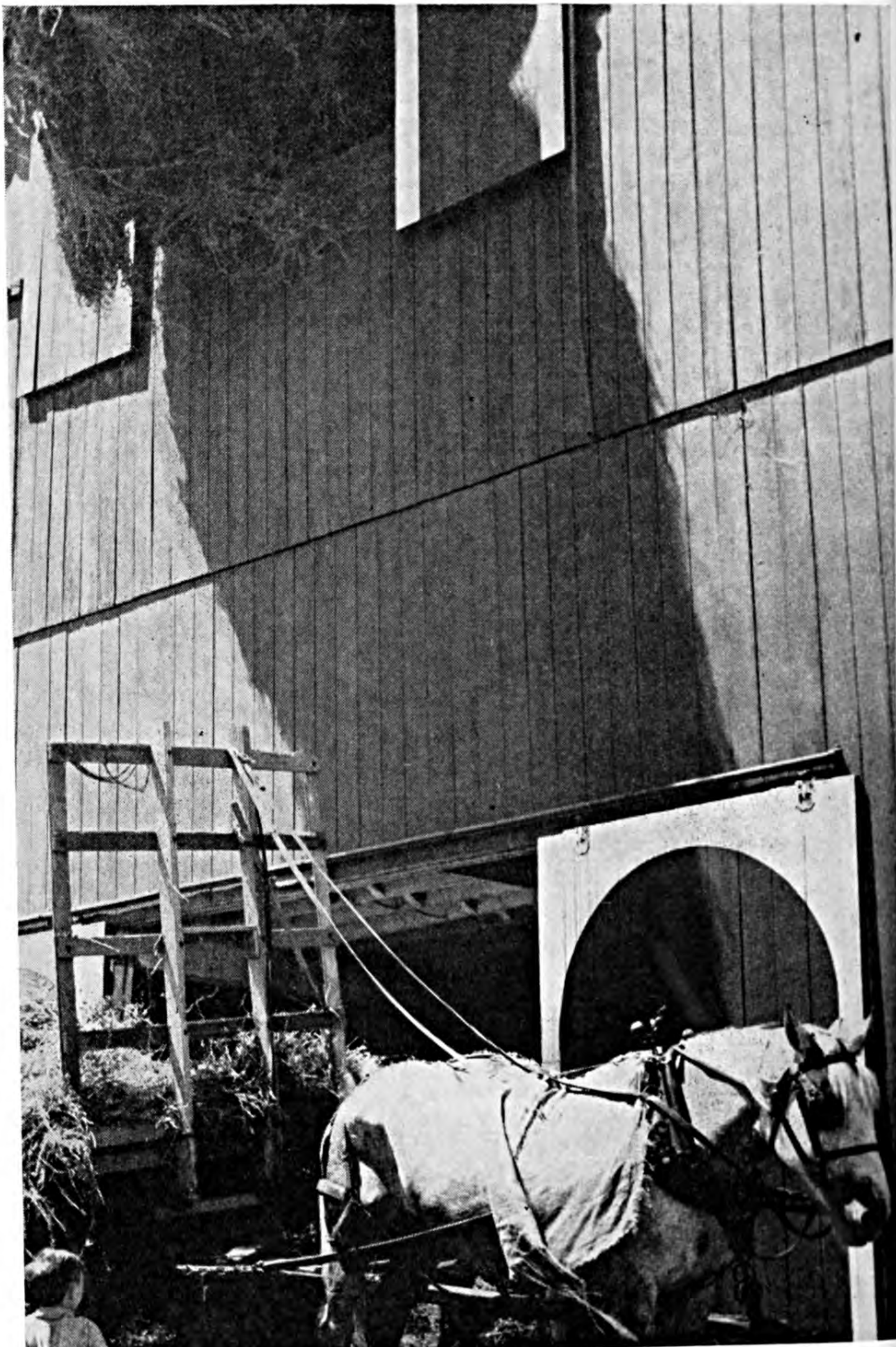

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VOL. XXXIV WASHINGTON, D. C., JUNE–JULY 1950 No. 6

On Thinking Back . . .

Those Were the Days

Jeff McDermid

AS a memory test, or an exercise to bring relaxation and slumber, have you ever tried to recall the names and faces of the boys and girls with whom you graduated from the home-town high school away back, let us say, more than 40 years ago? My recent attempts to catalog those once familiar faces and list those Jims, Janes, and Johnnies whose studious achievements and recess antics figured as the main theme of my life in the late "teens" so long departed have indicated that memory is a flighty thing and old associations too quickly fade.

In all frankness, I was able to remember and jot down the names of only three-fourths of the class roll whose youth and hope were so much in evidence a few years after the turn of the twentieth century. Racking my noodle as best I can has failed to revive the faces and characters of at least five juniors of the early 1900's who marched up the aisle with me to receive those white rolls tied in blue ribbon and bearing the seal and the signatures of the principal and the members of the board of education—a hardware dealer, a plumber, a lawyer, and a traveling salesman. In retaliation, *they* have no doubt long since forgotten *me,* what with life's triumphs and responsibilities and the more pressing and important urge—to work for the future, in this world and the realm to come. To forget each other after years of intervening time is not so vital, after all, as for us to remember the youth we had and the dreams we shared for making the places we lived in a little better because of ourselves and the children we raised. So, regardless of memory's tricks and failures, we can all join in one acceptable belief—that despite much we have since beheld, those were the "grandest days."

THAT was the grandest age because America itself had just come of age. We juniors, preparing to graduate at that calm period, had for our elders and companions the veterans of the Civil War, which put the cement in our foundations, and the younger fellows whom we saw march off to rescue Cuba and put the U. S. on the world map as a mighty power. To be sure we were roosting on a powder keg in those years from 1900 to 1914. Yet the Germans we knew and played with on the school grounds were all "gemütlich" people of apparent good will and loyalty, mainly the sons and grandsons of sturdy, peaceful, honest citizens who broke away from European goose-stepping to build what was—and is—among our finest national traditions.

They say there has never been a completely warless period in the history of the world, and during those formative times of domestic tranquility through which we studied ancient history and geography the newspapers reported troubles enough between British and Boers and Japs and Russians, and no doubt overlooked many colonial invasions and injustices by the leading countries of wealth and imperialism.

That all these secret deals and schemes of expansion would some day wind up in two bitter wars and find our country trying to salvage what was left of decency and honor beyond our borders—at an investment far exceeding all it took to finance the U. S. and its political subdivisions in our high-school days—we were happily unaware. Moreover, we had not as a whole reached the point when anybody not quite to our liking might be termed a "communist." I know that the bitter-ender Republicans who ruled our state called the Democrats worse names than that, but it lasted only a few weeks in campaign time. We did have grave doubts and no love for Emma Goldman and the crazy "anarchists" and wanted them deported pronto, but we had little of that philosophy to accuse our neighbors with—using our prejudice instead to mutter and grumble at what was called the "A. P. A." So our scene was domestic and world relations were remote.

Turning back to the class again, my own recollection is sharpest for the "junior year" in high school. Then I could sit back and watch the solemn (?) seniors tramp to and fro to the little side classrooms, just "ferninst" the large assembly hall where we had plaster casts of the winged Mercury, the discus thrower, and the Victory of Samothrace on wall pedestals. I thought of those days last summer when walking up the stairs to see the wonderful stone carving of the "Victory" in the Louvre.

IN addition to this watchful waiting for coming honors and final release during the third-year high-school semesters, it was my lot to be cast as the awkward orator to write and deliver what was then regarded as a prominent plum—the Junior Response. I wrote it on old scratch pads and five-cent tablets up in my small bedroom, and memorized it after it was "cleared" with the teachers to improve its syntax and delete its insults.

To this day I can't imagine why the kids selected me for that representative post. I shunned the weekly declamation demonstrations and got weak-kneed every time my turn came to stand up there and quote the classics. But through some self-mesmerism and a resolve not to let them down, I finally spoke my speech to the senior class and got a nice bouquet of carnations sent up from the juniors huddled in an alcove where we had the school library and the picture of George Washington.

I may add that I was not chosen for any such honor when we graduated, not even for the valedictory won by mere grubbing and book learning. Once was enough for all of us. Yet somehow that youthful triumph over self, and its reactions on my outlook, have remained with me as one of the nicest successes it has been my privilege to enjoy. Everybody else has long for-

gotten it, but all the others have some similar personal achievement of their own to brighten and smooth the way.

For graduation finery, the girls of our class wore nice white dresses and blouses, had their hair all in pompadour with little "rats" to roll it back upon, and for outside headgear they wore straw sailor hats. The boys had blue suits; some of them wore white duck trousers and blue coats. I remember our class motto—Incomplete, but Striving—but the colors I "disrecollect." I recall how the Baptist minister in his sermon to us graduates praised our choice of a motto because it carried with it Christian humility and high fortitude. The majority of us who are left out of that handful of graduates probably still feel that the old motto fits them yet.

We had some parties, too, during the festive week and just before. One was held in the high school, and the other was a "progressive" affair with five girls as hostesses in turn at their homes. At the last place we were supposed to wind up with delicious ice cream and layer cake. We got the cake all right, but someone—we suspected the juniors—stole the can of ice cream off the back porch in the midst of our merriment. I have seen but two of those five fine girls in the past 30 years. I miss them more than we missed the dessert, believe it or not.

Those of us who had either stage presence or good looks or good memories were put on the cast for the annual class play. The coach and director chose a flamboyant drama from some current list of those suited to amateurs and picked us kids to fit the parts—my part being the almost speechless one of a butler. My only vocal interpretation of character was in a short dialogue with the housemaid. During the rest of the show I just moved around with cakes and ale. All I had to do was remember my entrance cue and not stumble. The dashing athletic boys had the large parts to portray and, of course, the prettiest girls were the heroines and the luminaries.

SO instantly popular was our drama before the home audience that we were besought to repeat it in town one week later on. Then, to add some income to our high-school social funds, it was decided to take the play "to the provinces." By this I merely mean a one-night stand fifteen miles distant in a country trading post. Thither we "bent our steps" in a big carriage that the livery stable was wont to reserve for funerals, having the local theatrical ticket-man and manager as the driver and second-fiddle chaperon. The determined and efficient coach on the faculty acted as prompter.

But June in our country was a time of sudden thunderstorms and violent winds. That happened to us with a vengeance. We took our lunches along, ate en route, and went direct to the "theater"—a hall that seated 300 persons over a hardware store. It did not seat over 100 that night, owing to the threatening clouds to the west. I think they shelled out 50 cents apiece. Anyhow, I recall that the lightning and the tempest struck hard in the first

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Alfalfa—Its Mineral Requirements and Chemical Composition*

By Firman E. Bear and Arthur Wallace

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If alfalfa fields are to be maintained for a number of years, topdressing is essential both for yields and for stand. Originally it had been thought that the weathering processes during winter would release sufficient K to carry the crop through the first cutting of each season. Consequently, most of the topdressings in the test were made after the first crop had been harvested. But K deficiency was so marked on these plots in the early spring of 1947 as to demonstrate that the soil K was not being released rapidly enough to meet the requirements.

For 4½ months, samples of the soil were subjected to continuous artificial weathering, such as would have occurred during the winter, and the amounts of K and P released were measured. The results indicated that the rate of release of K from this soil during winter was not rapid enough to meet the needs of the early spring crop. The amounts of P dissolved were adequate. For this soil, topdressing in early spring appears to be more effective than topdressing after the first crop has been harvested (Table VI). This may apply to other soils as well, since the first cutting is the largest for the year and full advantage should be taken of the better growing conditions at that season. The evidence on plot 5 suggests that a late fall topdressing would be as effective as an early spring application.

As previously indicated, alfalfa has a marked capacity to absorb much larger quantities of K than are necessary for maximum growth. This is objectionable because most of the available soil K may be removed in the first few cuttings after seeding. This difficulty can be overcome by supplying K in increments rather than in large individual doses.

Neither the 60-pound nor the 120-pound annual rate of use of K_2O supplied sufficient K when applied all at one time, and the 180-pound rate involved considerable loss by leaching (Table VII). Since no one cutting appeared to need more than 60 pounds K_2O, an application of that amount after each cutting possibly would produce better results than one single large application each spring or fall, and the danger of luxury consumption would be reduced.

Soils Vary Greatly in Potassium-supplying Powers

As was pointed out, the Nixon soil, on which the field test was conducted, did not supply sufficient K for the first cutting of alfalfa following the winter rest period. The rate of removal of the K supply during the winter months is of vital importance. If one is to know the time as well as the rate of application of fertilizer, he must have an intimate knowledge of the soil in question. If K-deficiency symptoms tend to develop in the first cutting, the alfalfa should be fertilized in late fall or early spring. If not, it may be better to wait until after the first crop has been harvested.

Sandy soils may require more frequent applications of K than heavier soils. The heavier soils are able to store much more K, and they have higher

* The second installment of a reprint of New Jersey Agricultural Experiment Station Bulletin 748, January 1950.

supplying powers for this element. Studies on the K-supplying capacities of 20 important New Jersey soils resulted in classification of the soils in this respect (Table VIII). Rates of application of K can be estimated from this classification and from the expected crop yields. A ton of good alfalfa contains approximately 40 pounds K_2O. Soils having low K-supplying powers may need as much K_2O as the alfalfa takes off the land, whereas those with large supplying powers, such as the Collington, may need relatively little.

Some Soils Have Very High Phosphorus Requirements

Alfalfa is relatively high in P and usually shows marked response to applications of this element. Its effect as a topdressing in this experiment was small but definite. The results indicate that the P content of the crop should not be allowed to fall below 0.27 per cent.

Studies of the 20 New Jersey soils previously referred to (Table VIII) permitted their grouping according to P requirements for alfalfa. Large increases in yield from applications of P were obtained on 14 of the 20 soils, the most notable being that of Penn silt loam. The P content of the alfalfa grown on the 14 was materially increased by the use of this element.

In an over-state field survey of alfalfa, most of the samples that were low in P were obtained from fields in which the pH value of the soil was less than 6.0. Large amounts of P are often needed on acid soils to inactivate the excessive amounts of Al and Mn that become available under such conditions. For alfalfa, a better practice is to make liberal use of liming materials well in advance of the application of P. By this procedure there is less loss of availability of the applied P and more of the soil's natural supply of the element is released for crop use. Relatively heavy applications of P in advance of seeding are believed to be desirable.

Lack of Boron Often a Seriously Limiting Factor

Eight of the 20 New Jersey soils previously referred to (Table VIII) contained less than 0.35 ppm. water-soluble B, a critical value for growth of alfalfa. The water-soluble B content of the soil in the field experiment, however, was about 0.9 ppm., which is considerably more than is required. Accordingly, little or no response was obtained from applications of borax. The B content of the alfalfa on the borax-treated plots increased during the experiment.

Applications of borax are highly important in the production of alfalfa on soils that are deficient in B. Most of the fertilizer sold in New Jersey contains 5 pounds borax a ton. Larger

TABLE VII.—EFFECT OF VARYING ACRE RATE OF APPLICATION* OF K_2O ON 12-MONTH YIELD OF ALFALFA AND K_2O CONTENT OF CROP, AND ON K_2O RECOVERY AND PERCENTAGE K IN CROP.

K_2O Applied	Yield† 3 Crops	K_2O in Hay	K_2O Recovery	K in Three Cuttings		
				1st	2nd	3rd
lb.	*lb.*	*lb.*	*per cent*	*per cent*	*per cent*	*per cent*
0	6,250	56	....	0.82	1.00	0.50
60	7,400	103	78	1.53	1.20	0.70
120	7,980	131	62	1.58	1.47	0.97
180	8,150	149	52	1.65	2.03	1.38

* K_2O applied after first cutting.
† Yield for the three cuttings that were made within the succeeding 12 months.

TABLE VIII.—RELATIVE NEEDS OF 20 IMPORTANT NEW JERSEY SOILS FOR K, P, MG, AND B AS MEASURED BY RESPONSE OF ALFALFA TO THEIR USE ON THESE SOILS.

Soils*	K	P	Mg	B†
Collington loam	20	20	14	17
Penn silt loam	19	1	8	3
Dover loam	18	9	18	20
Bermudian silt loam	17	17	16	13
Dutchess shale loam	16	18	15	19
Washington loam	15	8	11	5
Chester loam	14	6	12	4
Hoosic loam	13	10	20	9
Sassafras loam	12	12	4	2
Lansdale silt loam	11	3	19	14
Fox gravelly loam	10	15	9	10
Colts Neck sandy loam	9	7	10	16
Merrimac silt loam	8	16	5	12
Hagerstown loam	7	11	7	18
Sassafras loamy sand	6	14	3	6
Papakating stony loam	5	5	13	15
Gloucester loam	4	19	6	7
Sassafras sand	3	13	2	1
Whippany silty clay loam	2	2	17	8
Lakewood sand	1	4	1	11

* The most marked response of alfalfa to the use of the element on these soils is designated by 1 and the least marked or no response by 20.
† The need for B was measured by hot-water extraction rather than by the response of alfalfa to the use of the element.

amounts, up to 25 or 30 pounds borax an acre, should be applied each year to alfalfa on soils suspected of being low in B. Soils of the Sassafras and related series are notably deficient in this element (Table IX). Those of the Collington series are not. Marked response to the use of borax on alfalfa has been observed on many soils about the state. At least 12 per cent of the soil in New Jersey contains less available B than is required for maximum crop yields.

Nitrogen Fertilizers Favor Grass and Weeds

It has been demonstrated that N is of considerable value in establishing a new seeding of alfalfa. When it was used as a topdressing on established stands, however, its effect was not marked, although significant increases in yield were noted. Cow manure, each ton of which carries about 10 pounds of N, is known to be valuable for topdressing alfalfa. But this may be due to the

TABLE IX.—EFFECT OF BORAX ON ACRE YIELD OF ALFALFA HAY ON SOILS OF SASSAFRAS SERIES.

Borax per Acre	Acre Yield of Alfalfa Hay	
	Sandy loams*	Loamy sands†
lb.	*lb.*	*lb.*
0	5,205	3,274
10	5,754	.....
20	6,454	5,029
40	7,052	.....

* Mean of three cuttings on each of two farms.
† Mean of two cuttings on each of two farms.

equally high K content of the manure, which may offset the disadvantages of the N it supplies. It may be worthwhile to topdress some fields with N, but this promotes the growth of weeds and grasses more than that of alfalfa (Table X).

The response of chickweed and crabgrass to N in this field experiment was an illustration of the operation of this principle (Table X). Part of the response was the result of K depletion. On one of the low-K plots, alfalfa contained only 0.8 per cent K, in contrast to 2.0 per cent in timothy. If the timothy had been stimulated with extra N, it would have competed even more seriously with the alfalfa for the available soil K. Alfalfa did well in association with timothy when topdressings at the rate of 120 pounds K_2O, 120 pounds P_2O_5, and 20 pounds borax an acre were applied annually to a mixed stand of these plants.

Lime Effective as Topdressing

The plot that received 1,000 pounds $CaCO_3$ as an annual topdressing showed a definite yield increase. By 1948, the pH value of the unlimed soil of this experiment had dropped to around 6, which is probably too low for best results with alfalfa. As the soil acidity increases, the nodule bacteria probably fail to function properly.

When lime is applied as a topdressing, the rate of movement downward in the soil has been reported to be 1 to 2 inches a year. But in the plot that was topdressed with $CaCO_3$, the pH values of the soil of both the plow depth and that below it were higher than those of the corresponding depths of soil of the neighboring plots.

Adequate liming presents a difficult problem on the sandier soils of south Jersey. These soils tend to become acid more rapidly than the heavier soils farther north. Consequently it is common for the southern soils to develop too much acidity for alfalfa within a year or two after the crop has become established. Under such circumstances, topdressing with some readily available form of lime has important possibilities.

Growth of alfalfa may be depressed following the use of unduly large amounts of liming materials on such soils. A field in Burlington County, on Collington sandy loam, showed evidence of such injury. Examination revealed that the soil had a pH value above 7. One result of liming to such high pH values is the loss in availability of some of the minor elements, notably Mn. When manganese sulfate ($MnSO_4$) was dusted on the alfalfa, the plants recovered quickly. It is believed that the coarser grades of limestone may be of special value on sandy soils in maintaining the pH value at suitable levels over longer periods and with less damage of overliming.

TABLE X.—EFFECT OF K AND N TOPDRESSINGS ON ALFALFA VS. WEEDS.

Plot	Treatment	Cutting Date	Alfalfa	Weeds
	lb./A.	1948	*per cent*	*per cent*
23	0	June	69	31
8	180 K_2O	June	94	6
23	0	August	15	85
12	60 K_2O +60 N	August	23	77
3	60 K_2O	August	73	27
8	180 K_2O	August	88	12
		1949		
23	0	June	13	87
4	60 K_2O	June	65	35
21	120 K_2O	June	91	9
8	180 K_2O	June	99	1

Mg deficiency has been observed on a wide variety of New Jersey crop plants. The three plots in this experiment that received soluble Mg did not produce significantly higher yields than comparable plots to which it was not applied. But many New Jersey soils are deficient in this element. Lack of Mg tends to become a limiting factor in alfalfa production when the content falls below 0.24 per cent of the dry weight. Marked response to applications of soluble Mg was obtained with alfalfa on 7 of the 20 soils previously mentioned (Table VIII), notably on those of the Lakewood and Sassafras series.

Since Mo is known to be an essential element for the nodule bacteria of legume plants, sodium molybdate ($Na_2MoO_4 \cdot 2H_2O$) was applied at the rate of 5 pounds an acre annually as an extra topdressing on triplicate plots of the field experiment. This raised the Mo content of the plants from 0.8 to 3.4 ppm. and that of the roots from 0.3 to 9.5 ppm. The yield increase from the use of Mo was of doubtful significance. The N content for alfalfa receiving Mo was 3.08 per cent, however, compared with 2.90 per cent for that not receiving it. This was a significant difference.

Lime increases the availability of soil Mo, and this may be one of the very important reasons for its special usefulness on alfalfa. Since the amount of Mo required is only a few ounces an acre, the best procedure in supplying it might be to dust the oxide or the Na salt of the element over the seed. Continued application of unduly large amounts of Mo could result in alfalfa that contained more than 10 ppm. of the element, a level that might well be toxic to livestock, especially if the plant was eaten in the green state.

Other Elements Sometimes Missing

Alfalfa requires about as much S as P, but lack of S is not believed to be a limiting factor in New Jersey. Considerable amounts of S are added to the soil in the rain water. Large additional amounts are supplied in the form of superphosphate. As previously indicated, lack of Mn may be a limiting factor on some soils, notably those that have been overlimed. Fe, Zn, and Cu are also needed by alfalfa. Little is known about the status of these elements in the soils of the state, but studies of them are now under way. There is reason to believe that some New Jersey soils are low in cobalt (Co), but this does not limit crop yields, since, so far as is known, this element is not required by plants. It is, however, essential to animals.

Sodium Has Value When Potassium Is Low

Alfalfa does not accumulate large quantities of Na, but it is improved by an application of salt (NaCl) when K is low. The Na content of alfalfa plants receiving no NaCl was very low, generally about 0.02 per cent, when sufficient supplies of K were available. Applications of NaCl resulted in increasing this content threefold or fourfold. The Na content of the roots appeared to be greater than the K content.

The results in Table IV reveal that topdressings of NaCl, in addition to those of K, materially increased yields. In proportion as lower quantities of K fertilizers are applied, the benefit from the use of NaCl would no doubt be increased. This does not mean, however, that NaCl is, as yet, recommended as a material for use in fertilizers for topdressing this crop.

Chlorides Reduce Nitrogen Content of Crop

The K in the field experiment was applied as KCl, and the Cl percentage in the alfalfa increased with increasing applications. As the Cl increased, the N decreased, so that the milliequivalent sum of the Cl+N anions was virtually constant. The Cl had no influence on the content of P and S in the alfalfa. The larger part of the decrease in the N percentage, however, was due to the

Fig. 7. Top—In absence of adequate amounts of potassium, weeds tend to crowd out alfalfa.

Bottom—When the soil is kept well supplied with potassium, a good stand of alfalfa can commonly be maintained for 5 or more years.

greater growth of stems. Thus the alfalfa grew more luxuriantly following the use of K, and there was a smaller ratio of leaves to stems on the K-fertilized plants than on those that received no K.

The range of Cl in alfalfa was between 0.04 and 0.48 per cent. Dock and dandelion contained more than 1 per cent Cl, and broadleaf plantain as much as 1.92 per cent. There was sufficient carry-over from a 300-pound application of KCl in 1947 for alfalfa to contain 0.20 per cent Cl and dandelion 0.64 per cent in the early spring of 1948.

Weeds Compete with Crop for Potassium

Weeds were important factors in determining the total yields of alfalfa in the field tests. Where the available soil K was low, crabgrass and other weeds were able to grow vigorously (Table X). In the third cutting of 1948, 85 per cent of the dry matter from the plots not receiving any fertilizer since seeding consisted of crabgrass. In another plot, where more but still insufficient K was applied, crabgrass and other weeds comprised 27 per cent of the forage. In the plot that received the highest amount of K, it was only 12 per cent. Dandelion, broadleaf plantain, dock, and shepherd's purse were very abundant in the K-deficient plots (Fig. 7).

The weeds contained much larger percentages K than the alfalfa that was growing on the same plots, whether the soils were deficient in K or not (Table XI). The amounts of K in these plants were related inversely to their Ca content. As a rule, plants that were low in Ca were able to obtain considerable amounts of K from K-deficient soils, whereas those like alfalfa that were high in Ca suffered from a lack of K. Afalfa has poor competing power with other plants, unless it has plenty of K at its disposal.

Plants compete with one another for water, light, and minerals. The competitive weapons are height, size and spread of leaf, depth of root, quickness of germination and growth, and resistance to drought, frost, or winter-injury. Weeds have initial advantages over alfalfa but, unless they are perennial, alfalfa takes over during the second year. Later the weeds return, unless the fertilizer and liming program is such as to continue to favor the alfalfa. Alfalfa-grass mixtures, as permanent crops, are in opposition to

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TABLE XI.—RELATIVE K AND CA CONTENT OF 1948 ALFALFA AND WEEDS IN ME.* PER 100 GM. DRY MATTER.

Plant	No K Applied		K Applied	
	K Content	Ca Content	K Content	Ca Content
	me.	*me.*	*me.*	*me.*
Spring, 1948				
Alfalfa	15	108	35	85
Dandelion	36	39	83	41
Shepherd's purse	42	44	74	45
Fall, 1948				
Alfalfa	12	105	30	77
Broadleaf plantain	14	173	53	165
Crabgrass	32	24	72	21
Dock	40	53	90	75

* See footnote 4 for factors to translate me. values into percentages.

Further Photographic Hints for Agricultural Workers

By Ross E. Hutchins

Agricultural Experiment Station, State College, Mississippi

IN a previous article in this magazine, consideration was given to some of the general photographic problems that confront the agricultural worker. In this article it is proposed to go into some of the more technical aspects of the subject.

The subject of lenses is one about which the average camera owner knows very little, yet this round piece of glass is the heart of the camera, as well as the most expensive part, and determines the quality of the pictures. You may have all sorts of gadgets on your camera but if the lens is poor your pictures will be poor. You can test your lens very easily. Focus your camera upon a newspaper or other large printed surface brought as close to the camera as your focusing adjustment will permit. Take a picture and study the result. Note especially the corners of the test shot. Are they as sharp as the center? Do all the letters stand out sharp and clear? If not, your lens is poor. It is also poor if your negatives won't stand at least four diameters enlargement without blurring sharp lines.

Before leaving the subject of lenses, the question of "coating" should be mentioned. Most of the new cameras are equipped with coated lenses. This coating consists of a layer of fluorine atoms that is placed upon the lens surfaces electrically and which cuts down reflection. You can tell if your lens is coated if you examine it by reflected light. A coated lens will show purple or blue reflections. There is no other one thing that will aid you in getting sharper and clearer pictures than to have your lens coated by

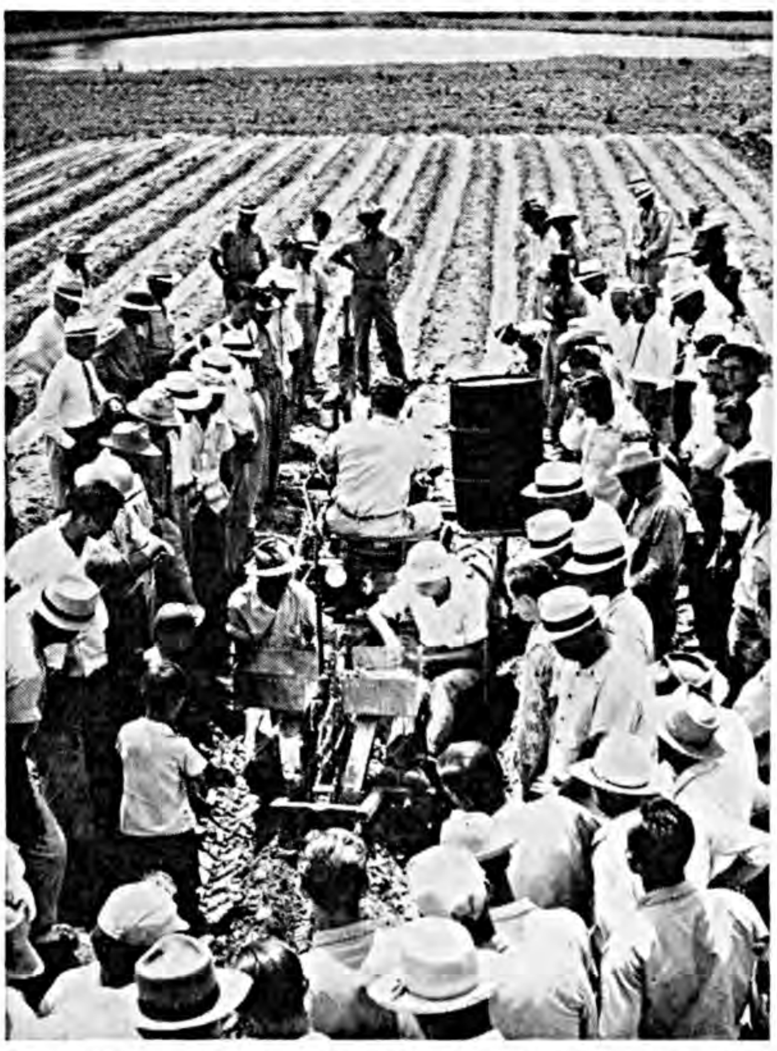

Fig. 1. This is a "high angle" shot. It is often an advantage to mount the camera on top of a high truck or ladder to obtain such shots.

a reliable firm. If your lens is not already coated, you can have it done for from $15 to $20 and you will find it well worth the money. Reliable firms will usually repolish and recement your lens in addition to coating it. Small scratches on the front of the lens are not too important, but scratches on the back element will harm picture sharpness. Small bubbles in the glass of a lens do no harm. In fact they are a mark of quality. Do not clean your lens with the first piece of rag that comes handy; use regular lens tissue or "Kleenex."

In purchasing a camera the subject of lens focal length often comes up and may cause some doubt. Focal length of a lens is the distance back of the lens at which the light rays that form the image converge. Now, if you are buying a press type camera, for example, the focal length of the lens will make a great deal of difference. The focal length of the lens you buy depends upon the use to which you expect to put your camera. If you expect to photograph livestock mostly, you will want one with long focus so that you can obtain a large image and not have to be too close to the subject. This is often important. The writer recalls a long session of hiding in a truck with P. H. Sanders of the Mississippi Experiment Station, waiting for some wild cattle to approach close enough for a color shot through a knot-hole in the truck body.

If many of your pictures are to be made of interiors where quarters are often cramped, then you will want a camera with a short focus lens to give you wider angle. Fair exhibits are hard to photograph because in most cases it is difficult to get back far enough to include all of the average exhibit. Probably the best solution to the problem is to have your camera equipped with a moderately long focus lens and then obtain a slip-on, wide-angle lens that is slipped on over the regular lens, thus increasing the angle. This will change the focus, however, and you will then have to use a tripod and focus by means of the ground glass. This is usually best anyway.

Color Filters

Whether or not to use color filters is a question that is often pondered over

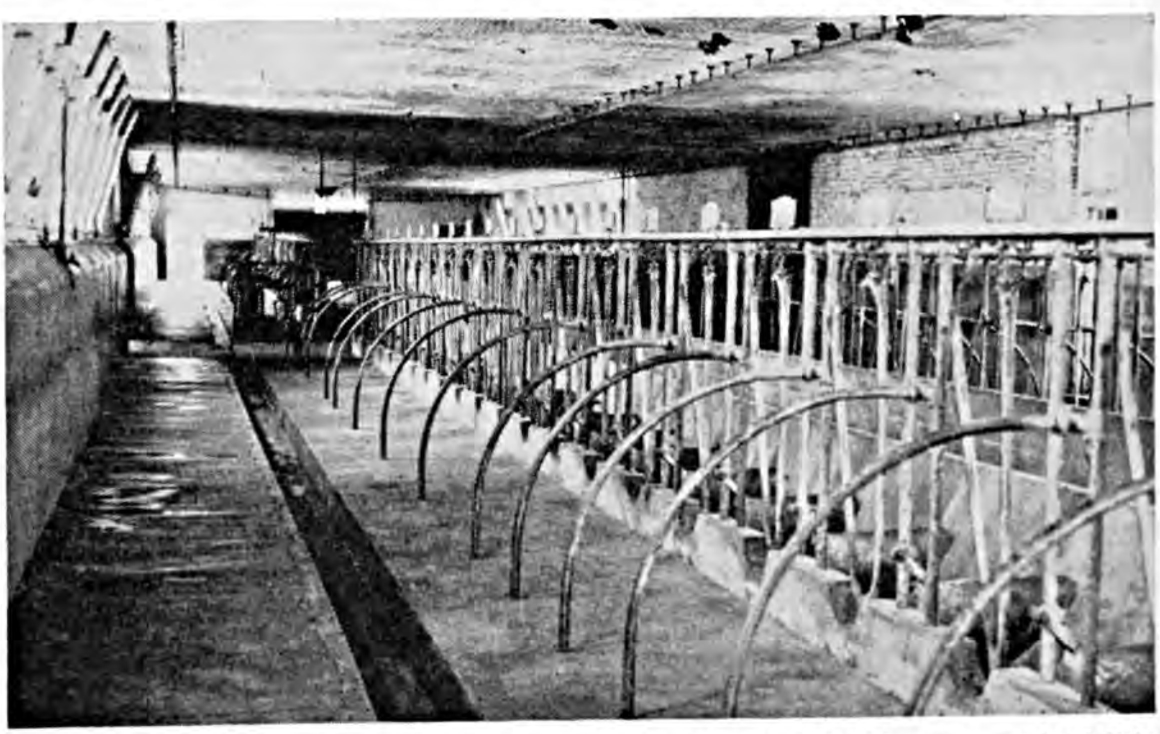

Fig. 2. Well-lighted interiors such as this may often be photographed without any artificial light. In this case the camera was placed on a tripod and a long exposure used. Also, since great depth of field was needed, the diaphragm was closed down to f.22.

Fig. 3. This picture illustrates what can be done with a roll film camera. This photo, taken on 620 roll film, will not stand the enlargement possible with larger negatives, but in other ways it compares favorably with the big cameras.

by agricultural workers. This question can hardly be answered by yes or no. It all depends upon the subject. If you are photographing a flock of chickens in a barnyard or a close-up of a prize bull, there is no advantage in using a color filter. Probably the only instance where the average worker can improve his pictures by filters is in field scenes having nice cloud effects overhead. Usually such clouds will not show unless a filter is used, and they often will dress-up an otherwise dull picture. Color filters are colored pieces

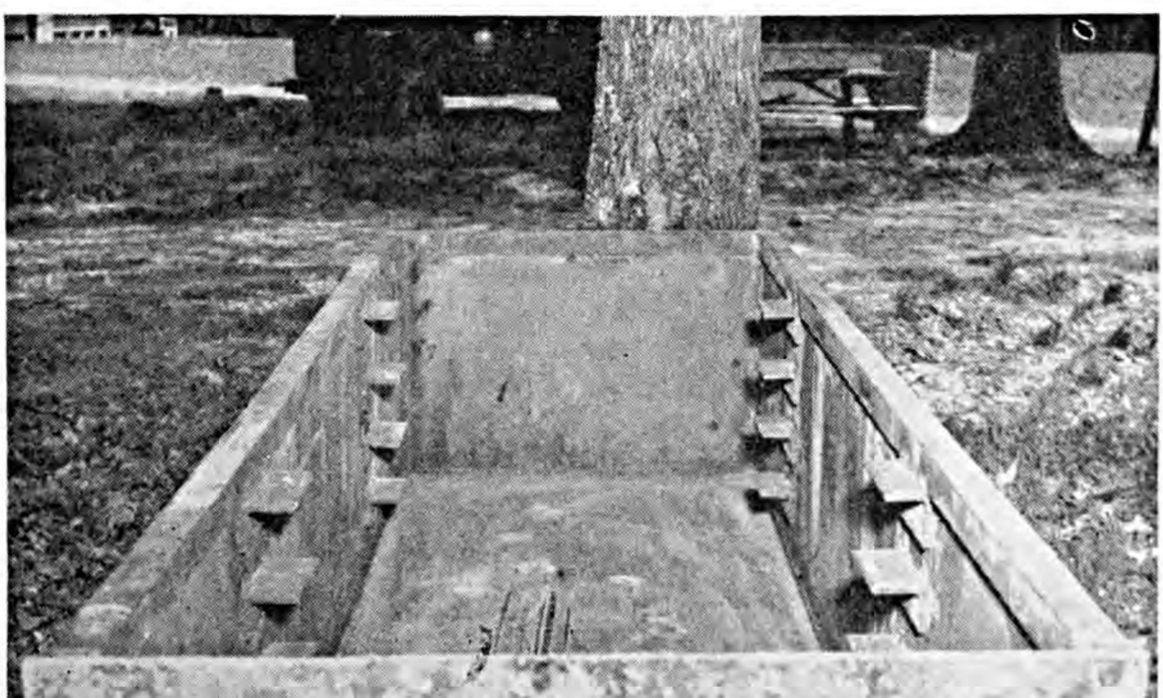

Fig. 4. Flash can often be employed to supplement daylight. In this case the vat was under a large tree in dense shadow. The flash was used to light up the interior of the tank which otherwise would have been completely black.

of glass, carefully made to cut out only a certain portion of the sun's light. They are placed over the lens of the camera while the picture is made. These filters are made in many different colors and are designed for different uses. Probably the only ones that are of interest to us here are the yellow and orange types.

A yellow filter (K2) is useful in bringing out clouds in a scene, and it is necessary to double the time of exposure when using it. The orange filter (G) does about the same thing but to a greater degree. Be sure to triple your exposure for the "G" filter. These filters will often give a nice, pictorial effect to pasture or field scenes. If you are not using a coated lens, you may often get a white halo about white objects in bright sunlight. This is true of white buildings or people in white clothing. Usually a yellow filter will correct this. Filters are important enough so that your kit should contain at least a yellow one and a holder to attach it to your lens.

The Use of Flash

There are two methods of taking pictures in the interiors of buildings. One is by the use of photoflood bulbs in reflectors, and the other is by means of flash bulbs in a flash gun attached to the camera. The latter is by far the most convenient because nothing but the camera and the attached flash apparatus need be carried along. Most news pictures are made by this method. The chief difficulty with the flash is that there is usually little control over the light and in many instances dense shadows are produced in the wrong places. However, taking everything into consideration the flash apparatus is generally the most usable and a good flash gun should be a part of your outfit. Flash bulbs come in different sizes and prices. For average small rooms or for close-ups, the small bulbs with bayonet bases called No. 5 Press are satisfactory. If your flash gun is equipped to take only screw base bulbs, you can obtain an adapter for a few cents. For larger interiors No. 22 Press flash bulbs are satisfactory.

If a great many pictures are to be made at one location, it may be cheaper and better to obtain reflectors and use photoflood bulbs. By this means you have better control over the light

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Fig. 5. Clouds in a picture often add greatly to the scenic effect. In this case the clouds were brought out by means of a K2, Yellow Filter.

Fig. 1. Showing various degrees of potash starvation symptoms on peach leaves (left to right), from a very slight cupping of the leaves to very severe cupping accompanied by marginal yellowing and some reddening of the lower leaf surfaces and twigs.

Potash Tissue Test for Peach Leaves

By H. L. Garrard

Homewood, Illinois

THE nutrient needs of orchard trees are not so readily predicted by soil tests, because the roots penetrate into layers of topsoil and subsoil of variable fertility. To date, the percentage of total potassium (K) in the dry leaf tissues determined by official chemical methods has been the most dependable diagnostic procedure for potash needs of orchard trees. But total potassium determinations, as used in the "leaf analysis" methods, are time-consuming and expensive. Often the data are not available during the growing season concerned. Many have recognized the need for more rapid tests to be used on green leaves in the field.

A modification of the Purdue tissue test for potassium has been made, adapting it for use on peach tree leaves for diagnostic purposes. This tissue test, as originally outlined in Bul. No. 384, Purdue Agricultural Experiment Station (1933), was first designed primarily for use on corn plants, but has been used extensively for diagnosing the nutrient status of many crops. Later the same test was adapted for use on soils as well as plants. This is described in Purdue Agricultural Experiment Station Circular No. 204 (issued 1934, revised 1945), titled "Use of Rapid Chemical Tests on Plants and Soils as Aids in Determining Fertilizer Needs."

Shortly after publication of the Purdue potash tissue test technic, the test was tried out on orchard tree leaves with somewhat unsatisfactory results. This account is intended as a review of some attempts to modify and calibrate the test for use on orchard trees.

Robert Anderson Discovers Potash-deficient Orchard

This story starts September 24, 1941. Robert Anderson of Covert, Michigan, showed the writer a potash-starved peach orchard on the farm of Matt Thar near Hartford, Michigan. Mr. Anderson, who is very observant and familiar with the literature on nutrient deficiencies, already had correctly diagnosed the symptoms as potash starvation.

Among the 2,800 three-year Elberta and Hale Haven peach trees in the Thar orchard were several areas where the leaves were very abnormal. They were cupped upward and inward into bean-pod shapes, the under sides reddish with some yellowing or mottling between veins (see Fig. 1). In severe cases interveinal areas near leaf margins were brown, and sometimes necrotic areas would drop out leaving holes in the leaf. Some trees were less severely affected, so that only leaves on the topmost branches would show some cupping but little abnormal discoloration. Most of these 3-year trees had made plenty of new wood growth these first years, but the diameter of the new wood was small in 1941, especially on those trees showing these severe symptoms.

The symptoms were somewhat suggestive of a possible "virus" disease. Similar symptoms had been found and described on trees whose trunks had been injured by borers or freezing. But the symptoms in the Thar orchard corresponded with the published descriptions of potash hunger, and Mr. Anderson's diagnosis was unquestionably correctly made.

This field had been in alfalfa for 10 years, with all hay sold, no manure returned, and no potash added. When the alfalfa "ran out," crops of wheat, corn, and oats followed just before the setting of the young peach trees. Soil tests in 1941 showed the pH varying from 6.6 to 7.2. The field had been marled heavily in 1924 to grow alfalfa. Here was a fine sandy loam soil, naturally low in available potassium. Then it had been drained of what potash was available by continuous alfalfa.

Experiments Prove Potash Need

A simple experiment was started in the Thar orchard October 10, 1941, applying 4 lbs. K_2O per tree, with and without phosphate. By July 1942, the potash-treated trees had healthy green leaves, while those without potash showed definite potash starvation symptoms, but less severe than in 1941. A proper fertilization program, using 0-9-27 in addition to nitrogen, has resulted in a high-producing peach orchard with good quality fruits since 1943.

Anderson Diagnosis Confirmed by Tissue Tests

Tissue tests by the original Purdue method indicated a "very low" potash in the Thar peach leaves in 1941. Then abnormal leaves from the potash-starved trees and normal leaves from

TABLE I. TISSUE TESTS AND LEAF ANALYSES, 1942: MATT THAR ORCHARD, HARTFORD, MICHIGAN

Treatment	Symptoms, 1941	Symptoms, 1942	Potash Tissue Test	Total K
None	Severe	Moderate	Very low	.50%
8# 0-0-50	"	None	Very high	2.13
20# 0-20-20	"	"	" "	2.48

the potash-treated trees in the Thar orchard were tested by the Purdue method in 1942. These fertilizer results proved that tissue tests could be used for diagnostic purposes. (See Table I.)

Modified Potash Tissue Test

Using the regular Purdue potash test on certain tree leaves, a brownish discoloration of the extracting solution interfered with an accurate estimate of the amount of precipitate. The "very low" readings could be detected because the solution would be clear even though discolored, but it was difficult to estimate the higher readings. The first variation tried was to filter out the plant material from the extracting solution after shaking, before adding the alcohol. This facilitated estimating the amount of precipitate in the discolored solution, but still did not solve the basic problem of the control of the discolored solution.

While at Purdue University, S. F. Thornton used a potassium-free carbon black clearing agent added to the mixture of plant tissue and extracting solution (No. 1) to adsorb such discoloring material. This mixture was then filtered, and alcohol added to the filtrate.

But the introduction of this clearing agent produced other problems. The extracting solution (No. 1) of the Purdue potash test contains the precipitating agent, sodium cobaltinitrite. The carbon black adsorbed some of the sodium cobaltinitrite as well as the discoloring material from the leaves. Where leaves were "very high" in potash content, some precipitation would start without the addition of alcohol. This potassium would be retained on the filter paper along with the plant materials and the carbon black, giving a lower reading than expected after the alcohol was added to the filtrate. Accordingly it seemed necessary to keep the precipitating agent out of the solution until the extraction and filtration were completed.

It was evident that a new extracting solution was necessary. Therefore, a solution of 15% sodium nitrite ($NaNO_2$) acidified to pH 5.0 with acetic acid was used. This is virtually the same as the Potash Solution No. 1, less the sodium cobaltinitrite. With this one extra solution and the carbon black, such as DARCO G60, the modified test gives satisfactory results.

The modified test is not presented as the final word, but only as an improvement over the original method for this particular purpose.

Modified Potash Tissue Test

1 tsp. finely cut peach leaves in vial
10 cc 15% $NaNO_2$ solution. (Part of No. 1)
1/8 tsp. carbon black clearing agent, such as DARCO G60
Shake 1 minute
Filter

(If air temperature is above 75°, then use water bath to control temperatures, preferably 65–70° F, for following precipitation procedure.)

Place 2.5 cc filtrate in clean vial
Add 5 cc Potash Solution No. 1
Mix thoroughly
Add 2.5 cc Potash Solution No. 3, by running down side of tube to get layer of alcohol on top
Let stand 1 minute to start precipitation
Mix in alcohol slowly by rotary motion
Let stand 3 minutes
Read by chart with black lines, as shown in Purdue Cir. No. 204.

Potash Solution No. 1. Dissolve 5 grams of sodium cobaltinitrite and 30 grams of sodium nitrite in distilled water, add 5 cc of glacial acetic acid, make to 100 cc volume, and allow to stand for several days. Add 5 cc of this solution to a solution of 15 grams of sodium nitrite in 100 cc of distilled water and adjust to pH 5.0 with acetic acid. Sodium cobaltinitrite from different sources has been found to vary widely in cobalt content. The directions given here are based on the use of the "Baker's Analyzed" product. Cobaltinitrite concentration is an important factor in determining the sensitivity of the test.

Potash Solution No. 3. Ethyl alcohol (95%). When ethyl alcohol for use as a reagent is difficult to obtain, a mixture of 60 parts anhydrous methyl alcohol, 40 parts anhydrous isopropyl, and 5 parts of distilled water may be substituted. If this mixture becomes turbid it should be filtered. Completely denatured alcohol is not satisfactory.

Special Extractant. Dissolve 15 grams of sodium nitrite in 100 cc of distilled water, and adjust to pH 5.0 with acetic acid.

Modified Potash Tissue Test Proves Satisfactory

The most important contribution toward calibrating this tissue test for potassium in peach leaves was made during 1947 and 1948 by William H. Daniel of the Department of Soil Science, Michigan State College. He used the modified procedure in various ways —(1) comparing tissue test results with total potassium (K) contents of peach leaves, and (2) studying the relation of potash deficiency symptoms to the potassium content as indicated by tissue tests and "leaf analysis." The results of one of these studies are illustrated in Fig 2. For further details, see Michigan A.E.S. Quarterly Bulletin, Vol. 32, No. 2, pp. 199-205, Nov. 1949, "Methods for Determining the Needs of Peach Trees for Potash Fertilizer."

Kerlikowski Orchard Tests

The results reported herewith are based upon tests on peach leaf samples collected from individual trees in a fertilization experiment in the orchard of Eric Kerlikowski near Watervliet, Michigan. The original fertilizer experiment was started in 1944 by T. A. Merrill, Department of Horticulture, and J. A. Porter, Department of Soil Science, Michigan State College.

Severe potash deficiency symptoms had developed in this orchard in 1944, about two years after setting out the peaches following alfalfa. The alfalfa, on a sandy loam soil, had not been adequately fertilized. The severity of deficiency symptoms on the no-potash trees in this orchard decreased gradually from 1945 to 1948, while the average percentage of potassium in the leaves increased graduallv each year from .587 to .753, to .827, and to .993% K respectively. It is assumed that this gradual increase in potassium was due to two factors—(1) the extension of the tree roots into wider and deeper feeding areas, and (2) the natural release of soil potassium into more available forms.

Observations of symptoms on the Kerlikowski trees and the corresponding potassium contents of the leaves confirm the general relationship that peach leaves with less than 1% K usually show some potash deficiency symptoms. When definite symptoms were evident, it was fairly certain that both tissue tests and leaf analysis would indicate "low" to "very low" potassium. There may be small differences in tests between those showing slight and severe degrees of symptoms, but all will be in the "low" range or below. Some leaves which appear healthy contained less than 1% K by ash analysis and "low" by tissue tests.

From observations of different varieties of peaches growing under low potash conditions, it seems that the Red Haven variety often shows more severe potash deficiency symptoms than some other varieties such as Elberta and Hale Haven growing under similar conditions. Further work is needed to determine the relative needs of the varieties for potash to assure both the best yield as well as eating and shipping quality.

Interpretation and Use of Graph

The potassium contents of the leaves were determined by the more exact ash analysis method and compared with readings made by the more rapid modified Purdue tissue test method. These are charted on Fig. 2. Perhaps the details of the development of the graph should be explained more fully to be of practical use. On the vertical axis are graphed the percentages of potassium (K) in the dry leaves by the ash analysis method. The horizontal axis represents the ppm of potassium (K) in the extract of green leaves as in the tissue test. For research purposes the potash precipitates in tissue tests were measured by the use of a photoelectric colorimeter (Cenco Photolometer), calibrated against standard solutions containing up to 400 ppm of K.

For comparative purposes, just above the ppm scale, have been superimposed the ranges of the "very low" to "very high" when these same test precipitates were judged visually by the Purdue potash test chart.

Dotted lines have been extended vertically from between these "very low" to "very high" ranges to bisect lines extending horizontally from certain points on the per cent K axis. Three arbitrary points might be termed the "severe symptom level" (.7% K), "adequate level" (1.5% K), and "maintenance level" (2.0% K), as indicated by a general survey of the literature. That is, when the potassium in peach leaves approximates .7% K, severe potash deficiency symptoms usually develop unless masked by other limiting factors. Some symptoms may appear even up to the 1% K level. When peach leaves contain as much as 1.5% K at fruit harvest time, then the potash supply is considered "adequate" by some authorities.

It is evident that a simple technic as used in this tissue test is far from quantitative, and therefore the readings may not be expected to correlate perfectly with quantitative determinations. There are many possible factors which might cause tissue tests to vary slightly, such as degree of maceration of cells while cutting, length of filtering time, variation in precipitates due to method of adding or mixing in alcohol, or variable temperatures of solutions. The main question is—did the tissue tests classify fairly accurately the tree leaves into groups of low and high potash content?

Note in Fig. 2 that all leaves from trees without added potash were classed in the relatively low potash ranges by both methods of analyses. Leaves from potash-treated trees were mostly in the "very high" range, as might have been expected. A second application of potash was made on these

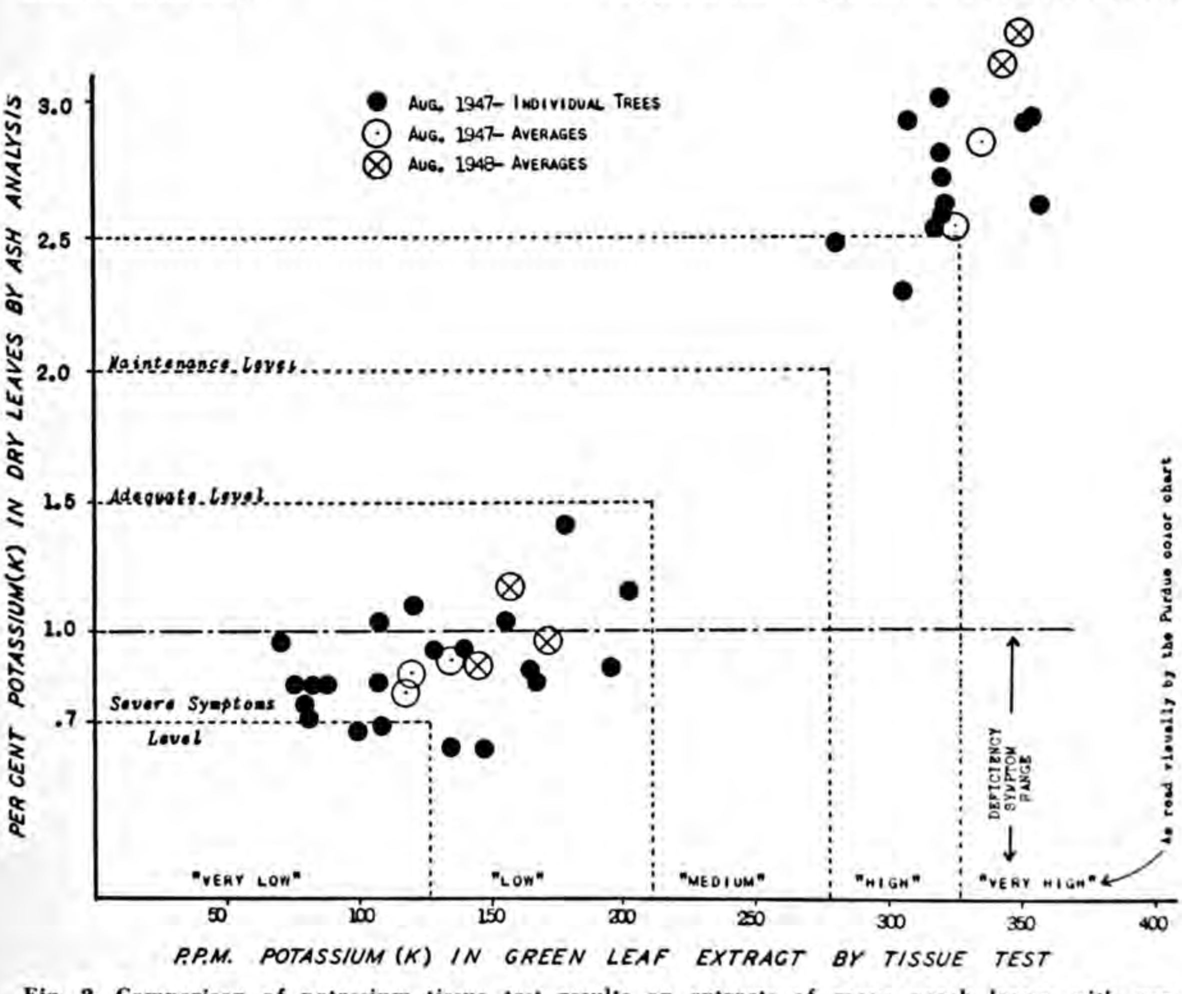


Fig. 2. Comparison of potassium tissue test results on extracts of green peach leaves with percentages of potassium in dry leaves as indicated by ash analyses. Also shows general relation of per cent potassium (K) in peach leaves to the appearance of deficiency symptoms.

trees in the spring of 1948, so it is natural that the 1948 percentages in the potash-treated group should have been higher than in 1947.

Some of the most important conclusions from Mr. Daniel's work as illustrated in Fig. 2:

(1) The results of tissue tests made on green leaves compare very favorably with the percentage of potassium (K) in the dry leaves by the ash analysis method.

(2) The modified tissue test can be used to detect potash-hungry peach leaves, that is, leaves with less than 1.5% K by the ash analysis method.

(3) The visual readings of tests by use of the potash color chart in Purdue Cir. No. 204 compared favorably at lower ranges with indications of potash deficiency by leaf analysis as well as observations on leaf symptoms. But the median between the "medium" and "high" ranges according to the chart may be slightly above the "adequate" potash content of peach leaves by ash analyses.

From our limited experience to date, it seems probable that a different calibration may be necessary for crops other than peaches, such as plums, cherries, apples, etc. The requirements of the various crops may be different. Also, for some reason, higher potash test readings have been obtained with plum leaves than with peach leaves, even though both have the same total potassium by the ash analysis method.

Suggestions for Sampling Trees and Testing Tissues

Potash deficiency symptoms become progressively worse during the latter half of the season, and in some cases symptoms may not be very distinct until after July 1 in Michigan. It is assumed that samples for diagnostic analyses should be taken during the period when symptoms appear on trees growing at starvation levels. This will be during the latter half of the growing season, preferably just before harvest time. However, do not take tree leaf samples for analyses very late in the season, especially after abscission begins.

Samples in Michigan should be taken in August or early September, depending on the variety. At this period there probably will be the greatest relative difference between the K contents of potash-starved leaves and those with adequate potash supplies. There is a tendency for a gradual lowering of the K content toward the latter part of the season even though the leaf may have had 1.5 to 2.0% K at harvest time. Leaves from the mid-portion of the new wood have been used for the tests reported herewith as they showed the most deficiency symptoms.

Mr. Daniel's research has confirmed the adaptability of the original modification of the test, with the exception that in most cases he advises using the smallest amount of carbon black clearing agent necessary to clear the extract. The amount of the clearing agent must be held constant in any series of tests in order that results will be comparable.

Uniform cutting of the leaf sample is necessary, because the extraction depends upon the sap from the ruptured cells. Cut leaves uniformly into ⅛-inch squares or smaller. Of course, a uniform method and period of shaking are also necessary to get comparable extractions.

When adding the alcohol, run it slowly down the side of the vial, so as to form a layer on top of the mixture of extract and Potash Solution No. 1. If alcohol is not added properly, then a lower than normal reading may be obtained, especially in the lower ranges. After adding alcohol, let vial stand for one minute to start precipitation, be-

(*Turn to page* 38)

PICTORIAL

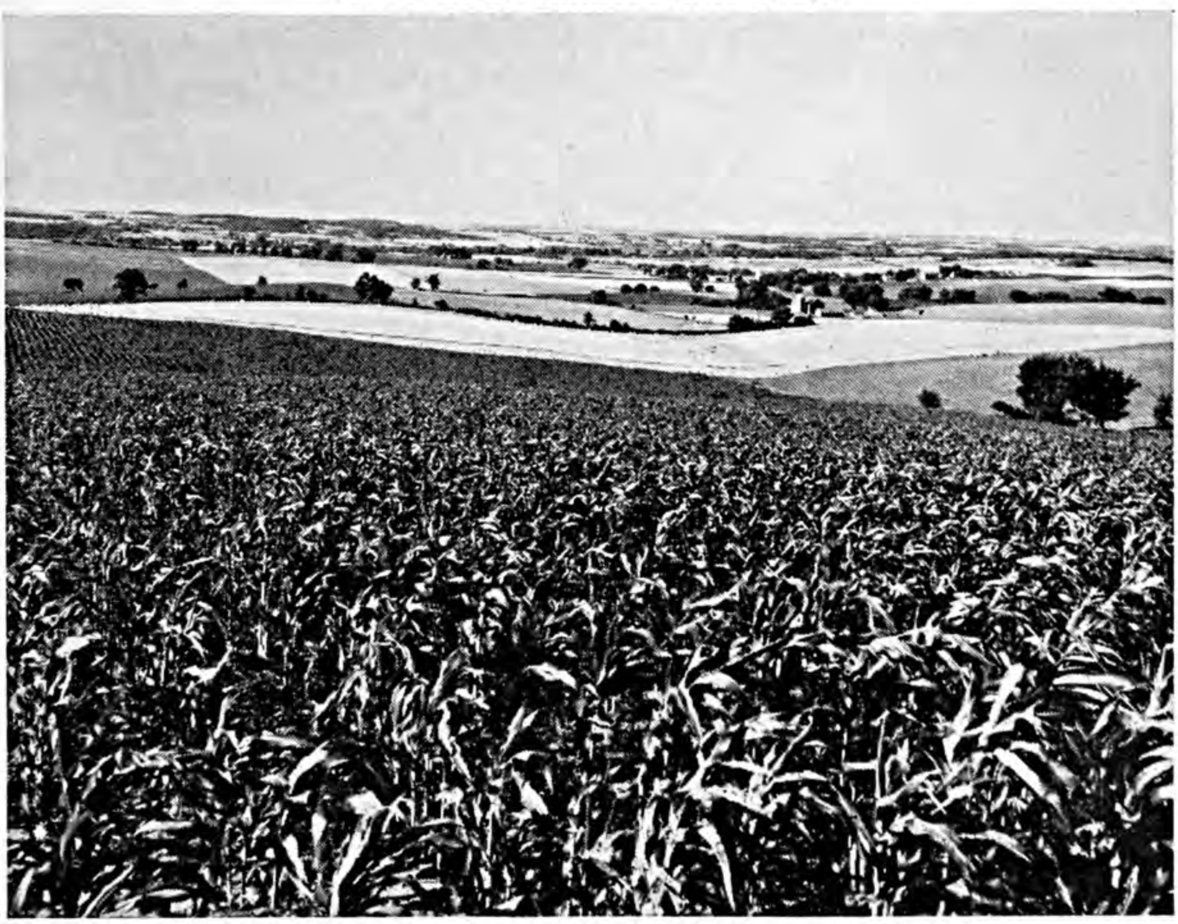
Queen o' Wheat

Above: Harvesting beans in Pennsylvania.

Below: Wheatfields near Moscow, Idaho.

Above: Sweet corn for a Washington cannery.

Below: One of Wisconsin's fertile valleys.



Above: Buckwheat in blossom.

Below: Turnips for seed.

The Editors Talk

Science in Agriculture

"Agriculture cannot afford to remain static in an ever-changing national economy. And science can be enlisted to serve all farm people more effectively. This would involve greater emphasis on research, educational, and other programs that will reduce total costs on farms, facilitate production shifts needed to restore and hold economic balance between production and market outlets, and improve farm living conditions both in the home and the community."

This is the conclusion reached by Sherman E. Johnson of the Bureau of Agricultural Economics, U. S. Department of Agriculture, in his interesting discussion on "Who Benefits from Improved Farm Technology" appearing in the April 1950 issue of the Agricultural Situation. In reaching it, Dr. Johnson takes cognizance of the need for fewer farm workers and their incorporation into other industries, the problems of surpluses, and what determines which farmers benefit and which do not. He logically answers many of the questions constantly coming to mind in a review of our changing agricultural picture.

The most dramatic and widely recognized achievement resulting from the application of science to agriculture, he says, is the rapid increase in the physical productivity. Total output from our farm plant in 1949 was twice as large as at the turn of the century. One farm worker now produces enough for himself and 14 other persons, whereas 50 years ago he produced enough for himself and only seven others. This means that the total income to agriculture is divided among fewer farm people.

The release of workers from agriculture has furnished the labor force for the development of our urban industry, helping provide the basis for our high level of living. The long-time benefits of such shifting perhaps can best be seen in contrasting the situation in this country with the areas of the world in which half or more of the working population is engaged in farming.

Reductions in costs of production have been greater and more widespread than generally is recognized. This has been particularly true when improvements in technology have been adopted in combinations. To illustrate, a Corn Belt farmer adopts mechanical power along with hybrid seed corn, commercial fertilizer, and more legumes in the rotation; all of which result in higher yields of corn and other crops. These, in turn, make more feed available for livestock and better feeding than can be combined with other improvements in livestock practices. As a result of this combination, the farm family is able to do all of the work with little or no hired labor. Investment and current operating expenses for power and machinery are little if any higher than when the farm was operated with animal power and considerable labor was hired to get the work done on time. Production per farm, per acre, and per worker are increased at the same time that operating expenses are being reduced.

Although improved technology has lessened the drudgery on the farm and in the home and provided conveniences and time for better community life, it still has by-passed many farms and farmers. Also, the rapid increase in agricultural production has not been an unmixed blessing, as is being seen in the building up of surpluses relative to production of farm products, especially in the postwar years. Under what conditions are the benefits retained by farmers or are passed on to other groups? What determines which farmers benefit and which do not? Dr. Johnson says the answers to these questions lie in the extent to which a technological change lowers cost of production and increases output of farm products, and on the effect higher production has on prices farmers receive.

Farmers who have lowered their total production costs at the same time that production has been increased are in an excellent position to retain much of the benefits resulting from their improvements. Prices would have to drop enough that total gross income would be lower than before the improvement was adopted to wipe out their gains. Dr. Johnson does not think that price declines resulting from technological changes are likely to be that large.

He finds that the economic effects of such changes in farming during the past do not indicate that we should place any brakes on the development of more efficient farming in the future. Individual farmers who adopt cost-reducing combinations are likely to gain from them, both immediately and over a period of time, whether or not they result in increased output. Although the benefits of technology have been unequally distributed and serious problems have been created, the problems can be solved and the inequities minimized.

That science will continue in this role is assured by the new results of research constantly being put into practice. And the surface of the possibilities has just been scratched.

Farm Safety Week July 23-29

To those of us with farm backgrounds and old enough to remember when the Fourth of July was a *real* "hurrah" day, there may be a special significance to the observance of a National Farm Safety Week in the latter part of July. Countless were the accidents stemming from Fourth celebrations—and finally we have saner Fourths.

Countless have been and still are the accidents on our farms. Perhaps if the majority were confined to one single day, greater progress in their reduction would be made. However, farming is a year-round industry, highly mechanized and intensified. It has moved up from the 4th to the 3rd most dangerous way of making a living, and in 1948 (latest figures available) statistics show that 1,600,000 farm residents were killed or injured. Nearly 900,000 of these accidents happened in the home; another 300,000 while the farmer or his family was at work; and about 230,000 accidents were the result of motor-vehicle smash-ups.

These figures in their summation are startling and call for a greatly stepped-up consciousness of the hazards in country life. It is fitting for the President to issue his proclamation for a National Farm Safety Week, July 23-29, 1950, in which all agencies and organizations, civic groups and individuals are requested to "encourage the study and observance of farm safety rules during the designated week and throughout the year."

Safety is the responsibility of all. Not only do we owe ourselves a keen awareness of it, but we are duty-bound to spread this awareness to those who in the pressure of their work are apt to become forgetful.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941...........	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942...........	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947...........	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948...........	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
June.........	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July..........	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August.......	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September...	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October......	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November...	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January......	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February.....	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March........	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April.........	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....
May..........	29.24	48.5	128.0	228.0	134.0	204.0	17.25	45.20	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay[1]	Cottonseed	Truck Crops
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	89	81	109	74	87	110
1938...........	69	196	80	79	76	64	57	97	88
1939...........	73	154	100	84	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	105	117	107	82	211	129
1942...........	153	369	168	134	143	124	91	202	163
1943...........	160	405	188	235	174	154	125	231	245
1944...........	167	420	214	216	170	160	139	234	212
1945...........	181	366	205	232	198	170	127	227	224
1946...........	263	382	178	248	212	209	141	319	204
1947...........	257	380	232	248	336	259	148	381	249
1948...........	250	387	220	249	212	232	160	301	238
1949									
June.........	243	315	251	301	188	210	138	207	175
July..........	243	565	222	323	195	206	132	166	185
August.......	236	446	221	305	184	202	135	197	174
September...	240	487	198	263	181	212	137	193	205
October......	231	474	187	224	170	214	141	185	170
November...	224	434	192	216	159	215	141	188	213
December....	214	454	188	230	176	218	144	192	196
1950									
January......	213	397	195	245	179	217	144	193	261
February.....	222	341	191	252	181	218	141	193	203
March........	226	320	189	253	185	224	139	191	168
April.........	232	....	192	260	196	227	140	197	205
May..........	236	485	184	260	209	231	145	200	178

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19
May	3.00	2.05	10.74	11.97	10.14	7.59
Index Numbers (1910-14 = 100)						
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233
May	112	72	307	339	301	216

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate, Balti-more, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200
April	.760	3.76	5.47	.375	.720	14.50	.200
May	.760	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83
April	142	104	112	68	76	60	83
May	142	104	112	68	76	60	83

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
June	249	242	223	134	99	304	144	65
July	246	240	225	140	100	349	144	68
August	244	238	222	143	100	372	144	68
September	247	238	225	138	100	334	144	68
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	223	135	96	313	142	72
May	247	244	228	132	91	311	142	72

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Fertilizing Materials, 1949," Calif. Dept. of Agri., Bur. of Chem., Sp. Bul. 236.

"Poultry Manure as a Fertilizer for Vegetable Crops," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 281, Dec. 1949, E. M. Rahn.

"Tomato Yield and Grade as Affected by Variety, Irrigation and Fertilizer," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 277, Dec. 1949, J. E. Kraus.

"Using Fertilizers Right," Agr. Ext. Serv., Iowa State College, Ames, Iowa, Pamph. 154, Feb., 1950, H. B. Cheney, W. H. Pierre, H. R. Meldrum, W. J. Fitts, L. C. Dumenil, M. A. Anderson, and F. F. Riecken.

"Fertilizers Boost Yields of Small Grains, Grasses, and Legumes," Agr. Exp. Sta., Iowa Agr. Ext. Service, Iowa State College, Ames, Iowa, Bul. P100, Nov. 1949, L. B. Nelson and H. R. Meldrum.

"Some Fertilizer Experiments with Deciduous Forest Tree Seedlings on Several Iowa Soils," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Res. Bul. 369, Nov. 1949, A. L. McComb.

"Commercial Fertilizers, 1949," Agr. Exp. Sta., Orono, Me., Offic. Insp. 213, Oct. 1949, J. M. Banton.

"Commercial Fertilizer Report for 1949," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 469, Jan. 1950, A. R. Anderson and P. C. Gaines.

"Commercial Fertilizers," 20th A. R. New Mexico Feed and Fertilizer Control Office, Year ending Dec. 31, 1949, State College, N. M., R. W. Ludwick and L. T. Elliott.

"Ohio Fertilizer Recommendations 1949-50, for Field Crops, Permanent Pastures, and Hay Fields," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Bul. 305, Feb. 1949, E. Jones and G. W. Volk.

"Response of Field Grown Tomatoes to Radioactive Materials," Agr. Exp. Sta., Pa. State College, State College, Pa., P. R. 27, Mar. 1950, R. E. Larson, B. L. Pollack, and H. K. Fleming.

"Efficient Use of Lime for the Farm," Agr. Ext. Serv., Pa. State College, State College, Pa., Cir. 340, Sept. 1949, J. B. R. Dickey.

"Insecticide-Fertilizer Mixtures for Corn," Clemson Agr. College, Clemson, S. C., Cir. 352, Mar. 1950, H. A. Woodle and W. C. Nettles.

"The Inspection of Commercial Fertilizers and Agricultural Lime Products for 1949," Univ. of Vt., Burlington, Vt., Rpt. 13, Nov. 1949, L. S. Walker and E. F. Boyce.

"Commercial Fertilizers—1950," State Dept. of Agr., Madison, Wis., Bul. 300, Mar.-Apr. 1950, W. B. Griem.

"What Fertilizer Should I Use?" Univ. of Wis., Madison, Wis., Sp. Cir. 13, Oct. 1949, E. Truog, C. J. Chapman, and K. C. Berger.

"Boron in Canadian Agriculture," Dept. of Agr., Summerland, B. C., Canada, Sci. Cont. 172, C. G. Woodbridge.

Soils

"The Contour-Check Method of Orchard Irrigation," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 73, Dec. 1949, J. B. Brown and J. C. Marr.

"The Illinois Soil-Testing Program," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AC 1388, Feb. 1949, R. H. Bray.

"A Key to Kentucky Soils," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Cir. 64, Nov. 1949, W. S. Ligon and P. E. Karraker.

"Redwood County Soils Need Fertilizers; Results of Trials 1946-1949," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Soil Series No. 30, Jan. 1950, J. I. Swedberg and E. R. Duncan.

"Fertilizer Trials in Mower County, 1949," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Soil Series No. 31, Mar. 1950, H. F. Arneman and A. C. Caldwell.

"The Effect of Tillage Method on Soil and Moisture Conservation in the Plains Area of Northern Montana," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 468, Dec. 1949, T. S. Aasheim.

"Know Your Soil," Ext. Serv., Okla. A & M College, Stillwater, Okla., Cir. 509, S. Brown.

"An Economic Report on Submarginal Land," Agr. Exp. Sta., Ore. State College, Corvallis, Ore., Info. Cir. 471, Jan. 1950, C. V. Plath.

"Soil Survey, Lee County, Alabama," Series 1938, No. 23, USDA, Washington, D. C., Feb.

1950, C. H. Wonser, M. M. Striker, L. G. Brackeen, C. L. McIntyre, and H. Sherard.

Crops

"1949 Hybrid Corn Yield Tests," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Rpt. Ser. 14, Jan. 1950, W. J. Wiser.

"Green Wrap Tomato Production and Marketing Practices in the Monticello Ridge Area of Drew County, Arkansas," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 492, Jan. 1950, C. A. Moore.

"Irrigation Experiments with Olives," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 715, Dec. 1949, A. H. Hendrickson and F. J. Veihmeyer.

"Grass Silage and Mow-dried Hay," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Fldr. 27, Apr. 1949.

"Summer Feeding of Dairy Cattle," Agr. Ext. Serv. of Conn., Storrs, Conn., Fldr. 28, May 1949, W. R. Walker and B. A. Brown.

"Tree Growth, Soil and Leaf Analysis in Response to Various Soil Management Practices in a Young Apple Orchard," Agr. Exp. Sta., Univ. of Del., Newark, Del., Cir. 24, Aug. 1949, A. L. Kenworthy and G. M. Gilligan.

"Pastures for Georgia," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 304, Mar. 1949, E. D. Alexander, J. B. Preston, and J. R. Johnson.

"Twenty-Ninth Annual Report 1948-1949," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 48, July 1949.

"Ladino Clover in Illinois," Univ. of Ill., Urbana, Ill., Cir. 650, Dec. 1949, R. F. Fuelleman.

"An Illinois Garden Guide, 1950 Edition," Univ. of Ill., Urbana, Ill., Cir. 522, Feb. 1950, B. L. Weaver, W. A. Huelsen, and L. A. Somers.

"Growing and Harvesting Bromegrass and Tall Fescue Seed," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AG1405, June 29, 1949, R. F. Fuelleman and J. J. Pierre.

"Preparation of Specimen Plants for Demonstration Work with Tissue Testing and Nutrient Deficiency Symptoms," Agr. Exp. Sta., Univ. of Ill., Dept. of Agron., Urbana, Ill., AG1419, Oct. 1949, T. Kurtz and S. W. Melsted.

"Helps for the Home Garden," Purdue Univ., Dept. of Agr. Ext., Lafayette, Ind., Ext. Bul. 238, 1949, W. B. Ward.

"Tobacco Tips from Seed to Sale," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 356, G. H. Enfield.

"Performance of Open-Pedigree Corn Hybrids in Indiana 1937-1948," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Bul. 544, 1949, S. R. Miles and Marjorie Freihoffer.

"A Record Year for Indiana Agriculture," Agr. Ext. Ser., Lafayette, Ind., A.R. 1948.

"Louisiana Pastures," La. State Univ., Baton Rouge, La., Ext. Publ. 1937, Feb. 1950, R. A. Wasson and W. E. Monroe.

"Louisiana Home Garden Planting Guide," La. State Univ., Baton Rouge, La., Ag. Ext. Publ. 1044, Mar. 1950, Bertha Lee Ferguson.

"Louisiana Native Iris," La. State Univ., Baton Rouge, La., Ext. Publ. 1017, Jan. 1950, J. G. Richard.

"Possible Adjustments for Potato Farmers," Univ. of Me., Orono, Me., Ext. Cir. 253, Mar. 1949, A. W. Manchester.

"Ladino Clover Pastures for Poultry Production," Univ. of Md., College Park, Md., Ext. Mimeo. 101, Feb. 1949, W. H. Rice and A. O. Kuhn.

"Considerations in Peach Culture," Ext. Mimeo. 15H, Jan. 1949; "Fruit Planting Suggestions," Ext. Mimeo. 16H, Jan. 1949; "Handling Maryland Orchard Plantings," Ext. Mimeo. 18H, Jan. 1949; "Raspberry Culture in Maryland," Ext. Mimeo. 19H, Jan. 1949; "Grape Culture in Maryland," Ext. Mimeo. 20H, Jan. 1950; "Growing Strawberries in Maryland," Ext. Mimeo. 21H, Apr. 1949; Univ. of Maryland, College Park, Md., A. F. Vierheller.

"Maryland Lawn Culture," Univ. of Md., Ext. Serv., College Park, Md., Ext. Bul. 129, July 1949.

"Making the Home Lawn," Agr. Ext. Ser., Univ. of Minn., St. Paul, Minn., Ext. Bul. 130, June 1949, L. E. Longley and R. A. Phillips.

"Fifty-fifth Annual Report, July 1, 1947 to June 30, 1948," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., C. H. Bailey and H. Macy.

"Grow More Corn on Fewer Acres," Miss. Ext. Ser., State College, Miss., I. E. Miles and E. H. Bailey.

"4-H Truck Crops Contest," Agr. Ext. Serv., Miss. State College, State College, Miss., 1950.

"Cotton Variety Trials," Info. Sheet 440; "Corn Varieties For Central Mississippi," Info. Sheet 441; Jan. 1950, Agr. Exp. Sta., State College, Miss., B. C. Hurt, R. C. Eckhardt, and J. F. O'Kelly.

"Growing Fall Tomatoes for Market," C. Hines, K. H. Buckley, Ext. Hort. Fldr. No. 1, May 1949; "Greens for Market," K. H. Buckley, Ext. Hort. Fldr. No. 2, Sept. 1949; "Peppers for Market," K. H. Buckley, Ext. Hort. Fldr. No. 3, Oct. 1949; "Let's Garden," K. H. Buckley, Ext. Hort. Fldr. No. 6, Mar. 1950; "Snap Beans Bush-Pole for Market," K. H. Buckley, Ext. Hort. Fldr. No. 98, Mar. 1950; Miss. State College, State College, Miss.

"New Hampshire Extension Service Looks at Itself," Agr. Ext. Serv., Univ. of New Hamp., Durham, N. H., Ext. Cir. 294, Sept. 1949.

"Pinto Bean Breeding Investigations in New Mexico," Agr. Exp. Sta., State College, N. M., Bul. 354, Jan. 1950, G. N. Stroman, J. Carter, and S. Paur.

"Hay and Pasture Seedings," N. Y. State College of Agr., Cornell Univ., Ithaca, N. Y., Ext. Bul. 781, Jan. 1950.

"Newer Varieties of Vegetables for 1950," N. Y. State College, Cornell Univ., Ithaca, N. Y., Bul. 782, Jan. 1950, P. Work and G. O. Elle.

"Cornell Recommends for Field Crops," Cornell Univ., Ithaca, N. Y.

"Growing Lettuce in North Carolina," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 349, Jan. 1950, J. M. Jenkins and H. M. Covington.

"Cultural and Training Systems for Strawberries," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 336(B), Aug. 1949, E. B. Morrow and H. M. Covington.

"Ladino Clover Pastures for Cattle, Poultry, Hogs," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 301, Aug. 1949, R. L. Lovvorn and S. H. Dobson.

"Small Fruit Production in Ohio," Agr. Ext. Ser., Ohio State Univ., Columbus, Ohio, Bul. 310, Jan. 1950, W. P. Judkins and V. Patterson.

"Putting Soybeans into Permanent Farming," Agr. Ext. Serv., Ohio State Univ., Columbus, Ohio, Bul. 311, Jan. 1950, E. P. Reed, J. A. Slipper, and D. F. Beard.

"A 4-H Manual on Legumes," Okla. A & M College, Stillwater, Okla., Cir. 300, W. Chaffin and R. O. Woodward.

"Peach Varieties for Oregon," Ore. State College, Corvallis, Ore., Ext. Cir. 532, June 1949, Q. B. Zielinski.

"Vegetable Varieties for Pennsylvania," Agr. Ext. Ser., Pa. State College, State College, Pa., Cir. 323, Jan. 1949, J. O. Dutt and J. H. Boyd.

"Evergreen Trees—From Seed to Transplants," Agr. Ext. Serv., Pa. State College, State College, Pa., Cir. 330, Mar. 1949, F. T. Murphey.

"Establishing, Improving, and Renovating Pasture Sods," Agr. Ext. Ser., Pa. State College, State College, Pa., Cir. 338, Sept. 1949, J. B. R. Dickey.

"Potato Cultural Practices in Pennsylvania," Agr. Ext. Ser., Pa. State College, State College, Pa., Cir. 339, Sept. 1949, J. B. R. Dickey.

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Good Farmers Make Good Soils

Whether cropland improves or runs down is mainly a matter of how the farmer—good or bad—manages it, according to Dr. B. T. Shaw of the U. S. Department of Agriculture. The idea of "virgin" soils being good agricultural soils is not always true, says Dr. Shaw, Deputy Administrator of the Agricultural Research Administration. In most cases virgin soil calls for a period of management to bring out and improve its productive possibilities.

Under cropping, Dr. Shaw told a New England audience recently, soils tend to approach a fairly stable level of productivity "which represents a balance between down-grade processes such as removal of nutrients and loss of organic matter, and upgrade processes such as gain in nutrients and organic matter from residues, manure, fertilizers, and rock weathering."

"With a cultivated crop like corn grown continuously without fertilizers or manure for long periods, the yield does not drop to zero but levels off at about 9 or 10 bushels to the acre," Dr. Shaw continued. "This is what has happened in many old countries with dense population and under-developed agriculture. With annual additions of 5 tons of manure, the equivalent yield of continuous corn is raised to about 30 bushels to the acre. When corn is grown in a rotation with clover and the land is limed so that clover will grow, the equilibrium yield is also about 30 bushels to the acre.

"When both lime and manure are used on the rotation, corn yields are raised to about 50 bushels per acre. When fertilizers are used also the equilibrium yield can be pushed still higher. Thousands of farmers have demonstrated that it is possible to produce rather consistently corn yields of 100 bushels per acre in all of the Corn Belt and in many other states."

Alfalfa—Its Mineral Requirements . . .

(*From page* 12)

the fundamental principles of ecology. If such mixtures are not managed so that the alfalfa has the advantage, the legume will ultimately lose out to the grasses. This argues in favor of heavy topdressings of K and none of N.

Fall Root-reserves Highly Important

In certain soils of the humid region, alfalfa roots do not penetrate the subsoil because of such factors as acidity, high water table, or solid rock. Under such conditions, yields during the summer months are dependent upon current rainfall.

For production of this crop, 1 to 1.5 inches of water in a 10-day period has been given as a critical level. The total rainfall greatly exceeded the critical level during the course of the field experiment, yet there were fall periods of 1 to 2 months' duration when lack of water was a seriously limiting factor. These periods were usually after the last cutting had been removed. Such drouths prevent adequate development of root-reserves to tide the alfalfa over during the winter and early spring.

One of the most important factors in determining the longevity of alfalfa in eastern United States is the amount of carbohydrate food reserves that are stored in the roots when winter sets in. If the growth after the last cutting is limited, whether by drouth, disease, insects, nutrient deficiencies, or lack of time for adequate growth, the plants may not be able to survive the winter or to get off to a good start in the spring.

Roots increase progressively in size and in their reserves of food materials to the seed-pod stage of the plants. Once the crop is harvested or the tops are killed by low temperatures, any new growth is at the expense of these reserves until leaves are well developed. The length of life of alfalfa can be shortened by cutting too early during this new period of growth, too frequently, or so late in the fall that there is too little time for restoring the root reserves.

During 1948, the plots were harvested June 10, July 15, and August 30. But small areas in three plots were cut an extra time on August 11. Not

TABLE XII.—EFFECT OF VARYING K APPLICATIONS ON 1948 STAND OF ALFALFA. ACRE YIELD OF TOPS AND ROOTS, WEIGHT PER ROOT, ACRE WEIGHT OF ROOTS IN SUBSOIL, AND K, N, AND NA CONTENT OF ROOTS.

K_2O per A.*	Number of Plants per A.	Yield of Tops	Yield of Roots	Weight per Root	Weight of Roots in subsoil	Elements in Roots		
						K	N	Na
		lb.	*lb.*	*gm.*	*lb.*	*per cent*	*per cent*	*per cent*
0	65,500	4,930	455	3.10	61	0.20	1.65	0.58
60	218,000	7,080	1,638	3.40	348	0.27	1.80	0.37
120	290,600	7,890	2,174	3.39	464	0.31	2.10	0.23
180	370,500	8,570	3,591	4.40	511	0.35	2.50	0.18

* All plots received standard applications of P and B.

a single live alfalfa plant remained on any of these small areas that fall. Removal of the late fall growth after a killing freeze had no effect on survival of the plants, however, and no difference in yield was noted the following spring. If this late-fall crop is removed, additional fertilizer should be applied.

Yellowing a Common Symptom of Deficiencies

Anything that interferes with photosynthesis limits root development and increases the plant's susceptibility to drought and winter-injury. Yellow and diseased leaves do not permit storage of root reserves. Not only time of cutting but nutrient deficiencies, diseases, and insects have important effects. Nutrient deficiencies greatly limit both root and top growth. These have far-reaching consequences in the overwintering of alfalfa (Table XII).

K deficiency in alfalfa is indicated by characteristic spotting around the edges of the leaflets. These spots may disappear in midsummer, but the plants turn yellow. If 15 per cent or more of the plants show such evidence of deficiency, marked response to K treatments is to be expected.

Low pH values also result in yellowing. B, N, and Mn deficiencies, of which yellow foliage is the common symptom, have all been observed in New Jersey. In severe B deficiency, red tends to dominate over yellow. Fe deficiency likewise results in yellow alfalfa. One of the most common causes of alfalfa yellowing is leafhopper injury.

Potash Tissue Test for Peach Leaves

(*From page 22*)

fore mixing in the alcohol. This seems to increase the sensitivity. Then mix in the alcohol by a slow rotary motion.

Summary

The modified Purdue potash tissue test serves well as a simple, on-the-spot diagnostic tool for checking on the potassium content of peach leaves. This procedure is not presented as a perfectly calibrated tissue test even for all varieties of peaches. We believe, however, that it can be used to search out low potash orchards or areas in orchards even before the potash deficiency symptoms appear.

Further Photographic Hints . . .

(*From page* 16)

since you can arrange the lights and obtain a fair idea how the finished picture will look. This type of setup comes in handy where such subjects as potted plants, etc. are concerned. For determining exposure, obtain some Eastman Kodaguides. These are small plastic calculators and are made to be used with flash as well as photoflood. Follow the directions and you will usually get good pictures.

Copying

The agricultural worker runs into almost every type of photography at one time or another, but he is almost sure to need charts, graphs, or pictures copied fairly often. If your camera is equipped with a ground glass, the process is simple. If a picture is to be copied, simply focus upon it and take the picture with ordinary film. For such close-ups you will have to increase your exposure. The closer you focus, the more you will have to increase your exposure time. For light you can use two photoflood lamps, but the writer has found that sunlight is hard to beat. With direct sunlight outside in the open you have absolutely even illumination, which is often difficult to obtain with artificial light. This is especially true when copying line drawings. Some special instructions are needed for copying line drawings made with india ink or black and white drawings in books. If properly done, such photographs of drawings or charts are just as good as the original or even better since the contrast is increased. For this type of work use Process Film. This is a slow film giving great contrast. The makers of the film recommend a special developer and this is best. However, very satisfactory results may be obtained by developing it in ordinary paper developer (D-72) for about four minutes at 75 degrees F. Your exposure for a chart two feet square photographed with a 4 x 5-inch film in bright sunshine should be about 1/25 second at f.16. Now if there are tiny transparent spots on the negative or parts that you wish to remove before printing, this may be done with a fine brush dipped in photographers' opaque.

The following table will aid you in determining the proper exposure for copy work or any other close-up taken in sunlight. First determine the correct exposure for an ordinary picture, then calculate from the table how much to increase it for the close-up.

Picture size on the ground-glass	*Multiply exposure by*
1/8 natural size	1.25
1/4 natural size	1.6
1/2 natural size	2.3
3/4 natural size	3.
Natural size	4.

Darkroom Technique

Actually the whole science of photography centers about the darkroom, and the subject is far too extensive to be covered here. However, there are a few things under this heading that might be mentioned here. One of these is the question of tank-versus-tray development. In tray development the film is placed in a tray and the tray is rocked back and forth to secure even development or, in the case of roll film, the film is "sawed" up and down in the solution. This was standard procedure in the old days of slow film when the process could be watched with a red safelight, but with modern, high-speed films you can't use a safelight bright enough to see anything and so there is no advantage in using tray development. With tank development the film is placed in a tank, developer of a standard temperature is poured in, and development is carefully timed. The point that it is desired to bring out is that there are already too many variables in photography before you get to the darkroom, so try to standardize your darkroom technique. You can't always control the light that you make pictures by but you can use the same time-temperature relationships. This, at least, takes a part of the guesswork out of photography.

One thing that causes more difficulty in a darkroom than almost any other is the sloppy habit of using trays, tanks, and other utensils that are not clean. Photographic chemicals are hard to wash off, but if they contaminate developer you can expect all sorts of strangely colored spots and stains to appear on your pictures. Also, make it a practice to have clean towels easily available and rinse off your hands before you dry them.

Last, but not least, study the directions that come with each package of paper or film. The manufacturer is anxious for his product to show up well and has therefore prepared the directions for its use very carefully. Follow them exactly for best results.

Those Were the Days

(*From page* 5)

act and kept it up forever after, until the last curtain flopped. The roof of the old shack was made of some sheet metal, and it hailed a staccato along with the rolling thunder. I do not think we were able to make the anxious audience catch our words at all, even if they hadn't been busy wondering if their barns were struck or their chickens drowned. It was still raining hard when the great drama ended, so farm folks stuck around for half an hour or more with grim comments over the waste of 50 cents apiece. We of the notable cast curled up on the stage and tried to slumber, using lap-robes and coats for pillows. By morning we pried our eyes open and bundled off homewards without breakfast with all the experience of traveling Thespians. It was my last stage appearance —talent crushed by the elements.

One sometimes goes back along the trails of youth to catch a fleeting glimpse of what used to be. After the mud from the spring thaw receded, I was wont to ramble in my snorting-six over the cement causeway known of old as the tollgate plank road. It leads into the town where I was fetched up by hand, but which possesses other nobler distinctions to stimulate its pride.

Only once in recent years of driving through this town of my schooldays have I met one of the old-timers. She did not look at all like an old-timer is supposed to look. She had retained her beauty and grace much as we boys admired these attributes of hers in other days. She is therefore not a landmark of ancient times, but an ever-lovely reminder that good things improve with age and life's experiences. She was kind enough not to make any too personal comments about myself in contrast to the young parts we shared in the famous theatricals.

Beginning at the head of the avenue there stands the courthouse of dun-colored brick, topped by a squatty dome having an effigy of Justice with her sword and scales. In childhood I lived in a canary yellow cottage trimmed with red oxide barn paint, about three blocks from this seat of judicial dignity. Justice still stands a bit askew like some of the decisions in this and other courts, but for all I can see she is just as stiff, unbending, and blind as ever.

I go in for awhile to visit with the county agent—an official unknown in our rugged days of independent ruralism. I found him ensconced in the still dingy basement, where my father used to preside over the post of the Grand Army. Those shadowy heroes of Manassas and Gettysburg, once robust and jocular, have long since gone from the spot so long alive with repartee and martial music. Perhaps it is fancy, but above the whiff of the county agent's spray dope and chemicals, there seemed to linger a ghostly vestige of fried-cakes and coffee—an aftertaste of those delectable suppers served by the ladies of the Relief Corps during the G. A. R. festivities.

I go out for a moment to the steep stone steps flanked by wrought-iron railings. The steps are worn concave by the footfalls of countless litigants and taxpayers. It was on these old steps that the old soldiers used to assemble for their annual photograph. The operator of the camera stood below and used a wet-plate negative and a long-time exposure. One of those prints shows myself as a kid in plush coat and round straw hat perched beside my Dad prior to the Decoration Day parade—where I also hiked beside the colors held aloft by Comrade Blowers, right behind the silver cornet band.

Today this little city is inhabited by hundreds of heroes—men of the last two world wars, who have their posts and their big parades and their small boys in haste to keep step with an age of atom bombs and machine guns. In due time it also will gather newer and mellower memories, so that the ones which I speak of will vanish and become legendary like a page in the files which is seldom read. Maybe our means of defense have improved in these intervals, but our moods of deference have not. The flags and the flowers and the fortitude—nothing has changed but the cracks in the buildings and the wrinkles on our faces.

It is down this same street of elms and maples that I saw my first horseless carriage, glimpsed Buffalo Bill and Annie Oakley, cheered the minstrel show parades and the circus pageants, and walked to school with young companions. On the elementary school "campus" five blocks beyond the court house, we experienced minor ailments of soul and body, such as wistful heartaches caused by an indifferent miss in pigtails, or hurrying homeward with a green-apple bellyache.

Here I learned to fly kites, play marbles for "keeps," turn handsprings, and play one-old-cat with a string ball; and got my first lectures by sly, older boys about the origin of species and such elementary facts of biology. Here the firemen of the fair city erected a 90-foot pole and tested their pumper by throwing streams of water toward its crest. Here the football teams practiced and we loyally rooted for them at home and abroad, even when it meant a defeat by 56 to 0 from a rival county seat high-school team bent on neighborly mayhem.

OH, naturally, the city fathers have yielded to modernity and higher educational standards since my time—and well they should, if some of us are the specimens of cruder ways. So today there are two big buildings on that city square—the old high school made famous by us who studied there, and the newer structure that elbows the former high school back into secondary rank and devotes its fabled halls to the tutelage of lower graders.

Teaching is swifter, livelier, more direct and forceful, calls on the latent imaginations of the bright young things and shames the laggard into action. It is no doubt a finer science than our old-time instructors ladled out, but believe me some of those teachers of ours had character and stamina—and such things really count for more than technical and factual equipment.

I suppose by new measurements, our precise old principal would be looked upon as a "queer coot." But he had his points and his merits. What he lacked in skill he made up for in honesty and painstaking zeal. And I shall always speak well of him because about 20 years after I graduated and had moved away, he had the grace and kindness to attend my mother's funeral in the old home town. Those old-time teachers were not mere visiting authorities, but they came to be a part of the fabric of the community whose children they "adopted" for moral as well as intellectual advancement.

Our elder generation can match all these rambling observations by recollections of countless towns whose high-school classes have held far too few reunions in a long span of time. Many of the kids have departed the earth, others have proved that their schooling was good by what they have accomplished in rearing good families and performing good work.

Yes, and many of our generation never finished high school. Even they, with ambition, character, and energy, have turned to good account all the fragments of learning they were able to find as far as the "Grammar School." A minority have pushed on to the finishing academies and colleges and universities, taking various letter degrees, and winning coveted scholastic tribute.

YET behind it all lies the ability to think back and concede that America was a great place to grow up in, through those calmer periods of our history. Maybe we former grads of less disturbing times are a trifle to be envied. High schools and colleges did not manufacture so many job-hunters with top level ambitions then. Life was quieter, less complex and contradictory. Yet the same spiritual values persist to be guided by, but too often the classrooms fail to stress them.

It's too late now to shout back to my former high-school mates about holding a get-together. They wouldn't do it. Too many other and more important things come first. Even a round-robin letter is a first-class nuisance and I'll not be guilty of beginning one. So we can take a mental farewell to them and a distant gesture of fraternal feeling. P. S.—I wonder if those plaster casts of Grecian statues still look down upon the kids in the old assembly hall. Or have they been marred and broken, like so many plans we laid in their presence 40 years ago?

TEXAS TABLE MANNERS

A Texas father was dining with his son in a Texas hotel, and in the course of dinner the son got into an argument with a cowboy. The cowboy called the son an offensive name, a very offensive name, and the young fellow grabbed his knife in his fist and started around the table to be avenged.

"Ain't ye got no table manners?" the old man hissed.

"But, pop, ye heered what he called me, didn't ye?"

"Yes, I heered all right, but that ain't no ground for yer forgettin' yer table manners. Put down that there knife and go at him with yer fork."

* * *

Sam: "Dey say dat de parrot am one o' the longest lived birds dere is."

Rastus: "Ah spects de reason fo' dat am, he ain't no good to eat."

* * *

A clergyman and a Scotsman were watching a football game together. The Scotsman continually kept taking nips from a bottle, and the clergyman, no longer able to restrain himself, at last cried out, "Sir, I'm sixty-nine years old, and never in my life have I touched alcohol."

"Well, dinnae worry yourself tae much," replied the Scotsman with a pronounced burr. "You're nae ginna start noo."

* * *

"My husband calls a spade a spade, you know."

"Well, my husband used to before he tried to dig up the garden."

* * *

TOO LATE

A spinster listened to a sermon on St. Augustine, who in his younger days was the most dissolute youth in Rome. Nevertheless he repented and became a noble leader of the church.

"Ah, yes," said the pastor in closing, "the greater the sinner, the greater the saint."

"Humph," muttered the old lady. "I wish I'd known that 40 years ago."

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The teacher was explaining the dolphin and its habits.

Teacher: "And, children, a single dolphin will have as many as two thousand babies."

Pupil: "Goodness! And how many do the married ones have?"

* * *

The other day a young fellow who had just gotten his first job as a truck driver on a highway met a luscious blonde.

"Say," he asked her. "How about a date for tonight?"

She looked at his downless face and said scornfully, "Say, I can't go out with a baby."

"Pardon me," the young man said, "I didn't know."

* * *

Junior: "Pa, the teacher says fertilizer stimulates plant growth like food makes boys and girls grow. Do you think it does, Pa?"

Farmer: "Can't say for sure, Son. I've never been able to understand whether the stuff actually stimulates the plants or whether it's just so downright repulsive that they try to grow away from it."

* * *

"Do you ever long to be a barefoot boy again?"

"Not me, lady. I work on a turkey ranch."

* * *

He: "Baby your eyes fascinate me. They got dew in them."

She: "That ain't do boy, that's DON'T."

A colored minister was telling his congregation about Solomon. "And you know," he said, "he had a thousand wives and every day he fed them on milk and honey!" A slightly-beyond-middle-aged man in the rear of the church interrupted him saying "Pahson, us aint interested in what Solomon fed his women; what us wants to know is what did Solomon eat HISSELF?"

* * *

It was just a week before election and the politician was growing eloquent in addressing a group of farmers. "I'm for soil conservation, too," he shouted. "We must save the soil for posterity."

A farmer in the back row turned to his neighbor and mumbled: "It seems like I'm 'way ahead o' him. Heck, out at my place I got a whole house full o' posterity right now."

* * *

An Italian shopkeeper received a Black Hand letter, reading:

"Leave $500 in cigar box at back door before Sunday night or we will steal your wife."

"No gotta $500 but I like-a your proposish."

* * *

"Did you interview the Congressman?"

"Yes."

"What did he say?"

"Nothing."

"I know that—but how many columns of it!"

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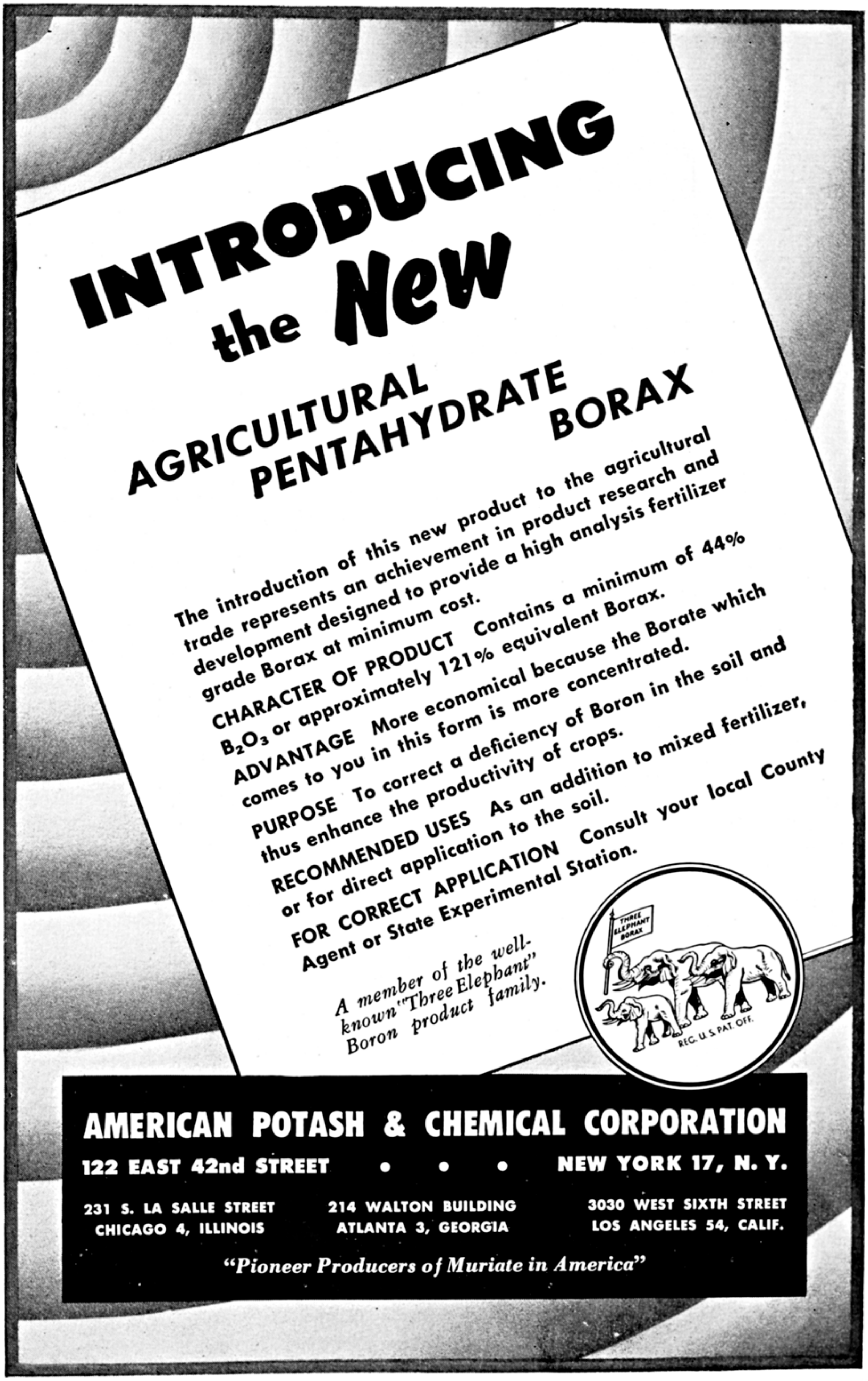
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VOLUME XXXIV NO. 7

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The American Potash Institute, Inc.

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PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

Vol. XXXIV WASHINGTON, D. C., AUGUST-SEPTEMBER 1950 No. 7

Remember It's . . .

Our America

Jeff McDermid

HARDLY any of us native Americans or naturalized citizens rely upon high-toned professional oratory or official orders and controls to stimulate our fervid fund of admiration and devotion to this Republic. Neither are we dependent solely upon the potency of published books and pamphlets or radio dramas respecting the ideals and achievements of the past and the critical urgency of the present and the future. Few of us have been totally blind and indifferent to public affairs or so concerned with making a living as to forget the real basis upon which our success, welfare, and happiness rest.

What is it that has really given us a deep-rooted feeling of pride for our country when acting in the right as it squares with ethical principles, and a contrary sense of personal regret when defense seems to lag and justice is flouted and defeated? If you imagine we don't have such feelings, you've been a hermit rather than a mingler and an observer of the American scene.

If you ask me why, I'll tell you the reason: It's just a family custom, an inbred habit, a treasured tradition. It operates alike for the "old-line" original families, as well as for the families more recently becoming adopted citizens hereabouts. It's not a dictated goose-stepping forced show of ardent nationalism. Our patriotism—if I may use this much-frayed word—is not cruelly branded on our unwilling and shrinking hides. It is bred in the bone and nursed in the marrow. It has little to do with finance or capitalism or trade or commerce or learning or science or power or invention, to each of which it contributes; but it derives its strength from the intangible realms of the spirit and the soul.

You can prove this by studying almost any "family tree" growing in your neighborhood. These trees grew up in the American soil and most of them have thrived on it, or are at least better off here than they might have been elsewhere.

MY wife's grandfather and my own father were born within about 60 years after the birth of the United States as the Thirteen Colonies. We ourselves were born hardly more than one hundred years after the first president took the oath of office. In our two merged family trees flow the sap of English, Scotch, Irish, German, French, and Alsatian lineage — all grafted finally on the American rootstock and bearing their fair share of blossoms and fruits, as well as having off-periods of barren years and failures. Yet we do not blame the soil entirely for the latter.

Our kids with those six strains combined married in their turn and thereby acquired sap from the Scandinavian peninsula and some hybrid Yankee mixtures of several sorts too numerous to guess at, from whence new shoots will spring from the American earth in years to come.

Let's take a look at my wife's grandpa and grandma, both green rural immigrants from Bavaria, who arrived in the wave of overseas urgency which followed the revolutions and uprisings and unrest of 1848 in Europe. Aside from their church devotions, which do not matter as to creed, their main motive for risking all they had or hoped to be by sailing a voyage of two months in angry seas was to get their tree roots into a free soil. Young, unacquainted with the language or the land, strong and eager for the test of the life ahead, these fine young patriots of progress settled in a German community in a Midwest state. They arrived here in steerage amid cooking pots, family washings, crying infants, and hopeful companions. They put their trust in the times and found opportunity to learn and labor as hired hands for German rustics only a score of years ahead of them in this adopted country.

From the start these immigrant kids had trials and tribulations that only cemented them more firmly to the new country. Sickness, long and hard tasks to do at not much above "board and keep," and finally in less than ten years a war broke out.

Now this same war likewise involved the lives and fortunes of thousands of rustics in another region south of them. In that remote area, too, there were a few fresh immigrants, although the most were just about as close to "original" white stock as you could locate anywhere. Enough to say, that this struggle proved in the last analysis to be one that ended in mutual respect on both sides, wherein the loss and the sorrow and the pain came through like a bright rainbow after a summer storm —assuring a kind of bond and unity which comes to all who suffer together for what each thinks is right.

Right here I thread on another sprig from the family tree. My own father became a raw recruit, too, and marched with the banner of the same state as did my wife's immigrant grandpa. They never met or knew of each other's existence, but they shouldered arms and left the small farms for four years and lived to attend reunions and clasp the strong hands of the boys in gray when the glories of both armies blended into the greater traditions of America.

THERE was not much difference between these two northern soldier lads, except that one was a "Dutchman" and the other happened to be born in Polk's administration in a tiny Vermont hamlet where his Dad was a blacksmith. His family had rooted its shrub in New England soil shortly after the original Puritans, but confidentially they were far from Puritans—being rough-and-ready, adventure-seeking, and restless to go West and beyond. So lo and behold! My father's folks

and that brave Bavarian crew arrived in the Midwest in almost the same exact year, to neighbor with the "Injuns" and set traps and plow sod and try out the new fangled reapers.

After the War of the Sixties, things began to hum and take up speed in this new and raw America, especially in the North and West. Yet while many of the transplanted rustics of the Midwest followed the wagon trains and made campfires along the Oregon Trail, a larger number—among them our two sprigs—remained in the state where they had cast their fortunes, to branch out and grow their family trees.

For a good while these boys and their sons were busy building a new country—too intent upon what tasks their hands might perform to notice that the country they had adopted was itself growing into a mighty huge and deep-rooted tree itself. By dint of all the good stock it had absorbed and the fresh fertility of the soil and the big things that called out for an answer and the challenge to men's enterprise—because of these changes, America was outgrowing its short pants, sometimes feeling "too big for its breeches."

It wasn't very long before the older countries began to notice how strong this America was becoming, getting so much of its adolescent vim from the best sap that the foreign forests provided. It stood up proudly for the Monroe Doctrine and fought a war with Spain, and later became the peacemaker for older warring nations. In those formative proving years of America as witnessed by our two relatives (now middle-aged men) there was a mysterious force alive and at work, which was just a symbol of the attitude that stirred the discoverers and the refugees from tyranny. That symbol was the dignity of man and the right to live in free self-government.

But other things were soon added. America developed mammoth and unbelievable resources of power and mechanical might, which came naturally in a land open to imagination and enterprise. The tools and the methods of farming changed for our two citizens and their kinfolk. The German grandpa shifted over into a growing line of urban industry and succeeded on his merit—a fair day's work and a fair day's pay for well-treated workmen. The Yankee that was my father was never so prosperous, staying on the farm.

Those were pretty fine years—back at the time my wife and I arrived as buds on the family tree and started out to flutter and grow in the sunshine of security. Except for that Spanish affair in Cuba and the Philippines, America had not emerged as yet into the full flower of international importance.

LIFE in town and country was sort of slow, peaceful, and live-and-let-live. Expenses were not high and incomes were modest to match them. Relatively few tried to "keep up with the Joneses." The height of fashion was the buggy with the fringe on top,

(*Turn to page* 40)

Alfalfa—Its Mineral Requirements and Chemical Composition*

By Firman E. Bear and Arthur Wallace

Soils Department, Agricultural Experiment Station, New Brunswick, New Jersey

AFTER some years of study of alfalfa in relation to the ratios of exchangeable cations in the soil on which it is growing, an ideal soil was suggested. The exchange complex of this soil contains about 65 per cent Ca, 10 per cent Mg, 5 per cent K, and 20 per cent H, expressed as milliequivalents. The pH of such a soil would be approximately 6.5. If the cation-exchange capacity were 10, there would be 6.5 me. exchangeable Ca, 1.0 me. exchangeable Mg, 0.5 me. exchangeable K, and 2.0 me. exchangeable H per 100 gm. dry soil. These values correspond to about 2,600 pounds Ca, 245 pounds Mg, and 390 pounds K per 2 million pounds soil, the approximate weight of the plowed acre.

An ideal soil yielded alfalfa which, at the early blossom stage, contained 2 per cent K, an almost ideal value. Such a plant should contain about 1.40 per cent Ca and 0.35 per cent Mg. It should also contain about 3 per cent N (18.75 per cent protein), 0.27 per cent P, and 0.20 per cent S. These values can be used to advantage in determining the nutrient levels at which alfalfa should be maintained.

The cation milliequivalent sum of alfalfa from 31 locations in New Jersey varied between 100 and 200[5]. The mean was 141. The mean of the anions was 255. These values are considerably lower than those obtained for alfalfa growing in the best nutrient solutions. Yields increased in solution culture up to 3 per cent K in the alfalfa. Decreasing the concentration of the nutrients, but leaving the salts in the same proportions as those present in the standard culture solution, resulted in alfalfa that contained cation and anion milliequivalent sums similar to those of field-grown alfalfa, but the yield was greatly reduced.

Nutrient-element Balance Important Factor

The equivalent sum of the K, Ca, Mg, and Na in alfalfa, for a particular cutting, tends to be a constant under uniform environmental conditions, except as to the nutrient supply. An increase or decrease in one of these cations results in equivalent increases or decreases in the others. K, an expensive element, tends to replace Ca and Mg, which are not only much less costly but much more likely to be deficient in livestock feeding.

The equivalent sums of N, P, S, Cl, and Si for any given cutting, expressed as anions, are as constant as those of the cations. Interrelationships similar to those of the cations have been noted for the NO_3, H_2PO_4, SO_4, Cl, and SiO_3 anions. Finally, the ratio between the cations and anions in alfalfa tends to be constant for all cuttings. In the field experiment, this ratio tended to be about 0.54.

This general relationship of cations and anions was found to apply to a wide variety of plants. Those that were low or high in cations were correspondingly low or high in anions. According to present knowledge, the best expression for the cation-anion relationship in

* The last installment of a reprint of New Jersey Agricultural Experiment Station Bulletin 748, January 1950.

[5] All milliequivalent values are per 100 gm. dry matter, whether of soils or plants.

plants at any given pH value is as follows:

$$\frac{K + Ca + Mg + Na}{N + S + P + Cl + Si} = \text{constant}^{6}$$

A change in the supply of any one cation induces a change in the uptake of all the other cations in a plant. The same is true for any one anion. If the total cation content of the plant increases, that of the anions rises accordingly. Elements like Na and Cl have important influences in this connection. There are limits to the absorption of any one element, but within these limits, substitutions of great importance may be effected.

Critical Nutrient Levels for Plants and Soils

A critical nutrient level is defined as an intermediate point between poverty adjustment and luxury consumption. In poverty adjustment, increasing yields are obtained in proportion as the limiting factor is supplied. In luxury consumption, an excessive accumulation of nutrient elements occurs beyond the plant's need for them, but without reduction in yield. The critical level is the optimum level for any nutrient element below which a yield response is to be expected and above which yields will not increase. The critical levels in plants vary, and the optimum must be redefined for each set of conditions of growth. Limiting factors, whether in the form of deficiencies or toxicities, are unavoidably multiple, overlapping, and interacting. Overcoming any one limiting factor in the growth of plants may not result in increased growth if other limiting factors are also operating.

On the basis of the studies reported in this publication, it is possible to set down approximate critical levels for the several nutrient elements, both for the alfalfa plant and for the soil on which it is growing. For the plant, the critical level for K is about 1.4 per cent; for Mg, about 0.24 per cent; for P, about 0.27 per cent; for Mn, about 10 ppm.; and for B, about 20 ppm. For the soil, the pH value should not fall below about 6.5; exchangeable K, below 80 pounds in the plowed acre; and water-soluble B, below 0.35 ppm.

[6] Other cation and anion elements are usually present in too small amounts to influence the results.

Feeding Value of Alfalfa Can Be Improved

Alfalfa occupies a leading position among forage crops. A large proportion of the factors considered essential in nutrition are concentrated in its leaves, and harvesting and feeding procedures with this crop should be such as to make the most of the leaves.

Alfalfa has lower feeding value in summer than in spring or fall. This is correlated with low protein and phosphorus in the forage. Plants grown in midsummer contain relatively high amounts of fiber, which dilute the mineral, vitamin, and protein portions. The feeding value of summer forages can be improved by use of fertilizers, by use of mixed plant species, and by supplemental irrigation.

High-K plants tend to be low in Ca and in protein. But they contain less lignin and they have higher concentrations of vitamins than do low-K plants. Ca is more important quantitatively to animals than is K. The critical level of Ca in forage for milking cows has been set at 0.35 per cent. Fortunately it never falls below this level in alfalfa. But the cost of Ca in the form of $CaCO_3$ is only about one-twentieth that of an equivalent amount of K in fertilizer form. Consequently, it would seem advisable to make the conditions in the soil such that the alfalfa is able to take up as much Ca as it can use to advantage.

The percentage ash in alfalfa increases with the K content of the plant. This is because the equivalent weight of K is higher than that of Ca or Mg. Thus the percentage ash alone cannot be used as a criterion of the mineral feeding value of the alfalfa. The composition of the ash must be known.

Co is of importance in feeding live-

TABLE XIII.—INFLUENCE OF K AND B ON ORGANIC COMPOSITION OF ALFALFA.

Treatment	Ether Extract	Alcohol Extract	Fiber		Ash	Crude Protein	Starch and Hemi-Cellu-lose	Total	Leaf to Whole Plant
			Lignin -like	Cellu-lose					
ppm.	%	%	%	%	%	%	%	%	%
				Culture-solution samples					
0.001 B	2.2	20.1	8.2	22.5	10.5	26.1	11.6	101.2	52.3
0.5 B	2.4	20.0	8.1	24.6	10.1	25.0	11.1	101.3	47.0
5.0 B	2.2	21.3	7.4	23.8	11.0	25.4	10.5	101.6	46.2
10.0 K	2.2	19.0	9.3	24.1	8.1	25.1	12.8	100.6	49.0
195.0 K	2.2	21.6	6.6	23.6	11.7	25.7	10.6	102.0	48.3
468.0 K	2.4	20.8	7.8	23.3	11.9	25.6	9.9	101.7	48.1
				Field samples					
Low K*	2.0	15.9	11.4	23.8	5.8	17.5	22.5	98.9	60.8
Normal K*	1.6	18.1	12.2	25.3	6.4	15.3	20.1	99.0	42.2

* Field samples from second cutting, 1948. Low-K sample contained 0.55 per cent K and normal-K sample 1.63 per cent.

stock. Some forages are too low in this element for safe feeding. A value of 0.07 ppm. has been given as a minimum. An application of 5 pounds of cobalt nitrate [$Co(NO_3)_2$] per acre increased the Co content of the alfalfa from 0.07 to 0.50 ppm.

Proximate analyses were made of eight samples of alfalfa, six of which were obtained from plants grown in culture solutions and the other two from field-grown alfalfa (Table XIII). The samples were extracted with ether for "ether extract." The residue was extracted with 80 per cent alcohol (C_2H_5OH) for the "alcohol extract," a correction being made for the ash. A portion of the residue from the

TABLE XIV.—INFLUENCE OF K DEFICIENCY ON LEAF PERCENTAGE AND ON CHLOROPHYLL, CAROTENE, AND RIBOFLAVIN IN RANGER ALFALFA.

Deficiency	Plot	Leaves	Chlorophyll	Carotene	Riboflavin
June 7, 1948		%	%	*ppm.*	*ppm.*
Severe	23	53.6	0.83	159	6.1
Moderate	4	47.2	1.06	227	9.9
None	8	45.0	1.12	252	13.0
July 12, 1948					
Severe	23	61.7	0.82	162	14.0
Moderate	4	44.4	0.92	178	16.4
None	8	45.6	0.95	187	16.6
August 23, 1948					
Severe	23	61.5	0.82	160	7.2
Moderate	4	57.4	0.94	257	13.2
None	8	50.2	0.94	257	11.4

TABLE XV.—VARIETY, STAGE OF BLOOM, AND HARVESTING DATES OF SECOND-CUTTING ALFALFA IN 11 STATES FROM WHICH SAMPLES WERE COLLECTED, AND SOIL SERIES ON WHICH THEY WERE GROWN.

State	Soil Series*	Alfalfa Variety	Bloom Stage	Cutting Date 1947
California	Yolo (a)	Ranger	¼	May 30
Minnesota	Waukegan (b)	Ladak	¼	Aug. 26
New York	Dunkirk (c)	Ranger	⅓	Aug. 27
Wisconsin	Miami (b)	Ranger	¼	Aug. 13
Utah	Salt Lake (c)	Ranger	1/10	July 28
New Jersey	Nixon (d)	Ranger	1/10	July 18
Kansas	Wabash (b)	Buffalo	1/10	July 29
Colorado	Fort Collins (e)	Hardistan	1/10	July 18
Michigan	.... (f)	Ranger	¼	Aug. 21
Oklahoma	Yahola (a)	Ranger	1/10	June 27
Nebraska	Wabash (c)	Ranger	1/5	July 31

* (a) = fine sandy loam, (b) = silt loam, (c) = silty clay loam, (d) = loam, (e) = sandy silt loam, and (f) = sandy clay loam.

alcohol extraction was hydrolyzed with 80 per cent sulfuric acid (H_2SO_4), leaving the lignin-like materials. A correction was made for ash and protein. Another portion of the residue was hydrolized with 2 per cent hydrochloric acid (HCl), leaving the cellulose-like materials. A correction was again made for ash and protein. The HCl-soluble portion, minus ash and protein, constitutes the starch and hemicellulose fraction. Ash and protein were determined in the usual manner.

The ether extract was in no way related to the mineral content of the plant. It was lower in the field-grown samples than in those grown with nutrient solutions. The alcohol extract, which includes sugars, dextrins, and some fat-like materials, tended to increase with increasing K.

K-deficient field alfalfa, which had 60 per cent leaves, contained 11.4 per cent lignin, whereas normal field alfalfa, with only 42 per cent leaves, contained 12.2 per cent lignin.

Crude protein tended to be much lower in field-grown alfalfa than in that grown with nutrient solutions. It tended to be slightly higher in K-defi-

TABLE XVI.—CATION, ANION, AND ASH CONTENT OF ALFALFA COLLECTED FROM 11 STATES AND CATION-ANION RATIOS.

State	Cations*					Anions*					Cation Anion Ratio	Ash
	K	Ca	Mg	Na	Sum	N	P	S	Cl	Sum		
	me.	*me.*	*me.*	*me.*	*me.*	*me.*	*me.*	*me.*	*me.*	*me.*		%
California	39	64	85	6	194	210	7	17	29	263	.73	6.6
Minnesota	32	106	46	2	186	229	8	20	9	266	.71	7.9
New York	36	83	26	3	148	206	10	14	11	241	.62	7.1
Wisconsin	30	83	46	3	162	200	10	25	15	250	.65	6.4
Utah	62	75	23	1	161	193	7	19	14	233	.78	5.7
New Jersey	32	62	22	1	117	158	7	17	12	194	.60	5.7
Kansas	44	94	24	3	165	192	8	17	8	225	.73	7.3
Colorado	59	76	22	2	159	200	8	15	19	242	.66	7.8
Michigan	16	108	45	1	170	188	5	19	7	219	.79	7.9
Oklahoma	34	87	33	1	155	237	8	24	5	274	.55	6.2
Nebraska	62	67	17	2	148	183	8	12	9	212	.69	9.0

* See footnote 4 for factors to translate me. values into percentages.

cient than in normal plants. Alfalfa that was low in K contained higher percentages of starch and hemicellulose-like material.

Alfalfa grown with nutrient solutions contained higher percentages of both total and nonprotein N than did field alfalfa. Deficient plants, especially those low in B, tended to contain larger percentages of nonprotein N.

More than 80 per cent of the carotene and riboflavin in Ranger alfalfa (Table XIV) was in the leaves. Variations in leaf percentage, either those occurring naturally or resulting from defoliation, were an important factor in the vitamin content. Slight deficiencies of nutrient elements had little influence, but severe deficiencies, resulting in abnormal foliage discoloration, were associated with vitamin decreases. In spite of increased leaf percentage, extremely deficient plants were stunted and had a low vitamin content. A higher riboflavin content was found in the second cutting than in the first and third, but the reverse was true for carotene.

Alfalfa from 10 States Analyzed

Samples of alfalfa were collected from 10 important producing states (Table XV), and their composition was compared with that of New Jersey alfalfa (Table XVI). Seven of the samples were of the Ranger variety and the remaining three of the Buffalo, Hardistan, and Ladak varieties. All represented the second cutting.

Soil samples were obtained from the fields in which the alfalfa had been grown (Table XVII). The soils from Colorado and Utah contained considerable free lime. The pH values of the soils from the midwestern states were relatively low, but acidity may not be so critical in these states as in New Jersey, since the soils have higher cation-exchange capacities and usually overlie calcareous subsoils. The exchangeable K content of most of the out-of-state soils was higher than that of New Jersey soils, with the exception of one sample from Michigan. The available P contents were higher in the out-of-state soils. No correlation existed between the available soil P and the P content of the alfalfa. There was no consistent relationship between the water-soluble B of the soil and the B content of the plants.

The critical level for K in the field alfalfa has been set at about 35 me. per 100 gm., or 1.4 per cent. The samples obtained from east of the Mississippi

TABLE XVII.—pH, EXCHANGEABLE K, AVAILABLE P, AND WATER-SOLUBLE B IN SOILS COLLECTED WITH ALFALFA SAMPLES FROM 11 STATES.

State	pH		Exchangeable K		Available P		Water-Soluble B	
	Soil	Subsoil	Soil	Subsoil	Soil	Subsoil	Soil	Subsoil
			*me.**	*me.**	*lb.*†	*lb.*†	*ppm.*	*ppm.*
California....	7.8	7.8	.46	.34	32	33	0.75	0.75
Minnesota....	5.6	6.3	.21	.33	24	10	1.25	....
New York....	6.2	5.5	.19	.12	15	10	0.85	0.35
Wisconsin....	6.3	5.7	.26	.35	26	9	0.35	0.25
Utah.........	7.2	7.5	1.53	.96	43	38	0.45	0.35
New Jersey...	6.6	7.0	.18	.26	12	12	0.50	....
Kansas.......	5.8	5.6	.46	.35	26	22	0.75	0.35
Colorado.....	7.3	7.3	.91	.43	39	24	1.05	1.05
Michigan.....	6.6	6.3	.14	.17	19	20	0.65	0.65
Oklahoma....	5.8	5.7	.21	.22	26	16	0.65	0.55
Nebraska.....	5.3	5.6	.81	.48	19	19	0.75	0.75

* Per 100 gm. dry soil or subsoil. To translate me. values into pounds per plowed acre, m by 780.
† Per acre to plow depth.

TABLE XVIII.—MINOR-ELEMENT CONTENT OF ALFALFA FROM 11 STATES.

	B	Fe	Mn	Mo	Cu	Co	Zn	Relative Concentrations*					
								Al	Cr	Pb	Ni	Sr	V
	ppm.	*ppm.*	*ppm.*	*ppm.*	*ppm.*	*ppm.*	*ppm.*						
Out-of-state samples													
State													
California	60	186	16	1.1	14	0.17	26	M	M	S	S	S	0
Minnesota	52	125	39	0.4	...	...	...	...	...	...	...	...	...
New York	28	320	26	0.4	...	0.21	49	M	S	S	S	S	0
Wisconsin	32	110	32	0.3	18	0.04	41	M	M	S	S	S	0
Utah	56	117	19	1.0	13	0.12	13	M	M	0	S	S	0
Kansas	68	122	30	1.7	23	0.02	21	M	S	0	S	L	0
Colorado	60	187	10	2.8	...	...	...	...	...	...	...	...	...
Michigan	24	204	20	4.0	...	...	...	...	...	...	...	...	...
Oklahoma	44	136	30	1.3	...	...	...	...	...	...	...	...	...
Nebraska	46	152	26	0.8	...	...	...	...	...	...	...	...	...
New Jersey samples													
Soil Series													
Collington	63	675	14	2.1	23	0.07	20	M	S	S	S	S	0
Washington	18	260	48	2.0	27	0.14	24	M	S	S	S	S	0
Hunterdon	33	190	43	0.1	31	0.16	...	M	S	S	S	S	0
Keyport	48	112	34	0.2	44	0.24	23	S	S	S	S	S	0
Copake	63	164	33	4.6	31	0.15	15	M	S	S	S	S	0
Harvest†													
1946	36	160	21	0.8	24	0.12	58	M	S	S	S	S	S
1947	38	155	31	0.7	61	0.08	33	M	S	S	S	S	0
1948	53	149	35	0.5	...	0.07	...	M	S	S	S	S	S
Plant Parts													
Leaves	...	...	...	0.7	22	0.05	28	M	S	S	S	S	S
Stems	...	...	...	0.4	...	0.09	...	M	S	S	S	S	S
Leaves and stems‡	...	...	...	0.2	25	0.07	24	S	S	S	S	S	0

* L = large, M = medium, S = small, and 0 = absent. These samples were also examined for Sb, As, Ba, Be, Cd, Ce, Ga, Ge, Au, Ag, Li, Hg, Pt, Ra, Rh, Ru, Se, Te, Tl, Th, Sn, and U. None of these elements were found.

† Samples chosen from same plots and same cuttings for 3 successive years.

‡ Plants grown in sand culture.

River were near this limit. Those from west of the Mississippi were considerably higher, except for the sample from Oklahoma. The K content of alfalfa from states where this crop persists for a number of years was between 1.5 and 2.5 per cent.

Michigan, Wisconsin, and Minnesota have about 3 million acres of alfalfa, or more than 20 per cent of the entire acreage in the United States. The samples from these states contained the lowest amounts of K of all those examined. The K content of the samples from Michigan was considerably below the critical level, and the P content of these samples was seriously low.

The B content of all alfalfa samples was above the critical level. The samples from the western states contained three to four times the suggested 20 ppm. water-soluble B, but those from the eastern states were just over the critical level. This indicates that many eastern soils are potentially B-deficient.

The minor-element content of alfalfa grown in other states was compared with that from New Jersey (Table XVIII). Some of the minor elements were determined by colorimetric procedures and others by the use of the spectrograph. Other than B, Fe, Mn, and Mo, there were no indications that the minor elements are of major importance in the culture of alfalfa.

Analyses of samples representing 3 consecutive years of growth from the field-plot experiment at New Brunswick indicated increasing B and Mn and decreasing Mo and Zn contents year by year, and the same applied to Co. The samples from New Jersey were the only ones containing vanadium (V). Cu and Zn appeared to be lower in plants from soils of the west that were high in lime. Small quantities of nickel (Ni), strontium (Sr), and lead (Pb), were indicated for most samples.

Summary and Conclusions

Alfalfa is growing in popularity in the eastern and southern states.

Lack of fertility is largely responsible for the failure or short life of this plant in New Jersey.

A field experiment, covering a 4-year period and involving a considerable number of variations in fertilizer topdressings, was undertaken to study the requirements of this important crop. The test was conducted on Nixon loam, which is closely related to Sassafras loam but overlies red shale.

The land received 1½ tons pulverized calcitic limestone and 600 pounds of a 5-10-10 grade of fertilizer an acre in 1944, but the crop failed to get started because of drouth.

A 2-ton application of limestone and another 600-pound application of 5-10-10 were made in 1945, and a good stand of Ranger alfalfa was established.

Except for plot 5, no topdressings were applied until 1947.

The most important variables in the topdressing tests were the dates of application of fertilizer and the rate of application of the potassium.

The dates of application compared were early spring, after the first cutting, and after the second cutting.

The potassium topdressings varied between 0 and 180 pounds K_2O an acre annually, in 60-pound increments.

A number of other soil amendments, including some of the minor elements, were used as topdressings.

Three cuttings were harvested every year for 4 years.

Studies were also made of alfalfa in culture solutions and in pots of soil.

The highest field yields were obtained by topdressing with 180 pounds K_2O an acre annually, together with 60 pounds P_2O_5 and 20 pounds borax.

Applications in early spring were more effective than those made after the first crop had been removed.

Nitrogen applications tended to encourage weeds, whereas potassium applications discouraged them.

Topdressings of magnesium sulfate, limestone, and sodium molybdate, although not markedly effective, tended to increase yields.

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Trends in Soil Management in Peach Orchards

By Harry K. Bell

Department of Horticulture, Rutgers University, New Brunswick, New Jersey

ABOUT two decades ago, it became apparent that there was a need for a re-evaluation of soil-management practices in peach orchards in many parts of the United States. Some sort of soil cultural system which reduced cultivation to a level below that formerly practiced was evidently needed. A need for a change from a nitrogen-only fertilization program for peach trees was evidenced by the increasing occurrence of various nutritional troubles.

Peach orchard soil-management problems received but little attention prior to World War I. Severe cultivation was considered a necessity, and in dry years the better orchardists sometimes cultivated their peach orchards 20 to 25 times. The value of cover crops for controlling erosion and "catching" snow, rain, and nutrients was recognized by a few orchardists. Most were slow in adopting their use, however, and severe cultivation was the rule during this period. Fertilizers, when applied, were usually a by-product material, such as bone meal, wood ashes, or barnyard manure.

Early sentiment in favor of intense cultivation for peaches appears to have been largely upon grower-observation. Most of the research on soil cultural problems in orchards during the first quarter of the present century dealt with fruits other than the peach. It wasn't until attention was focused on the ultimate detrimental effects of ero-

Fig. 1. Severe dieback, induced by overliming, on a New Jersey peach tree. The pH of the soil here was near 7.0., too high for peaches on light soils such as this.

sion to all types of agriculture during the early 1930's that serious attention was given to research on various soil cultural systems for peaches.

Nearly all recent soil cultural experiments, as well as the observations of growers, lend support to the belief that some cultivation is needed yearly in peach orchards. When cultivation is carried on too intensely, however, such a system is not only detrimental to the soil structure and its fertility, but often results in lower yields of fruit. The value of cover crops, sods, and mulches in improving soil tilth, retarding erosion, and conserving moisture and nutrients in peach orchards has been demonstrated several times in recent years. As a consequence, there is a definite trend toward less cultivation in peach orchards. In many places it has reached what is considered to be a bare minimum of two or three spring and early summer diskings.

Contour Planting

Much soil erosion on sloping land can be stopped by planting orchards on the contour. Terraces are suitable on land having no more than a 12 per cent slope. Their presence practically eliminates soil erosion. Several states now recommend that most peach orchards be contour-planted.

While the possibility of permanent sods in commercial peach orchards has been considered from time to time, there doesn't appear to be any outright recommendation for their use in any state. In experimental plots, sod-grown peach trees have almost always made poorer growth and produced lower yields than similar trees under cultivation. It is generally believed that lack of soil moisture and soil nitrates are the two main limiting factors for sod-grown peach trees.

Newly-set peach trees appear to require rather intensive cultivation during their first two or three years. More rapid early growth, with correspondingly earlier commercial production, is the result. If cover crops, such as soybeans, or intercrops, such as tomatoes or strawberries, are grown in a young peach orchard, they should be kept five or six feet from the tree rows. Extra fertilizer should be added to take care of the needs of these crops.

Summer cover crops are now grown in many peach orchards. In New Jersey, crops such as soybeans or cowpeas are sown during the first two weeks in June and disked into the ground in late summer in preparation for a winter cover crop. Sudan grass, buckwheat, and other crops are also used in some areas.

Winter Cover Crops

Winter cover crops are usually needed in practically all peach orchards. Rye, wheat, and ryegrass have been found suitable for most New Jersey conditions. Hairy vetch is sometimes sown in a mixture with one of these crops.

In young orchards in New Jersey, the summer cover crop should be sown by the first week in July. In bearing orchards, the size of the peach crop usually determines the time of sowing the winter cover. If there is but a light fruit crop, or none at all, it should be sown by the middle of August. The growing cover then competes with the trees, thus slowing down their growth and permitting the new wood to harden-up for the winter. If there has been a heavy crop of peaches, the cover crop should not be sown until the middle of September. This permits the trees to replace food reserves used up in producing the fruit crop.

Any cover crop, regardless of its type or its purpose, usually needs fertilization if it is to perform its function well. On sandy soils, such as are found in South Jersey, 200 to 300 pounds per acre of 7-7-7, or its equivalent, usually result in good cover crop response. If straight legumes are used, about 200 pounds per acre of 0-10-10 give good response.

The use of sods with mulches in peach orchards is a system of soil culture which is receiving increased attention in various states. Experiments

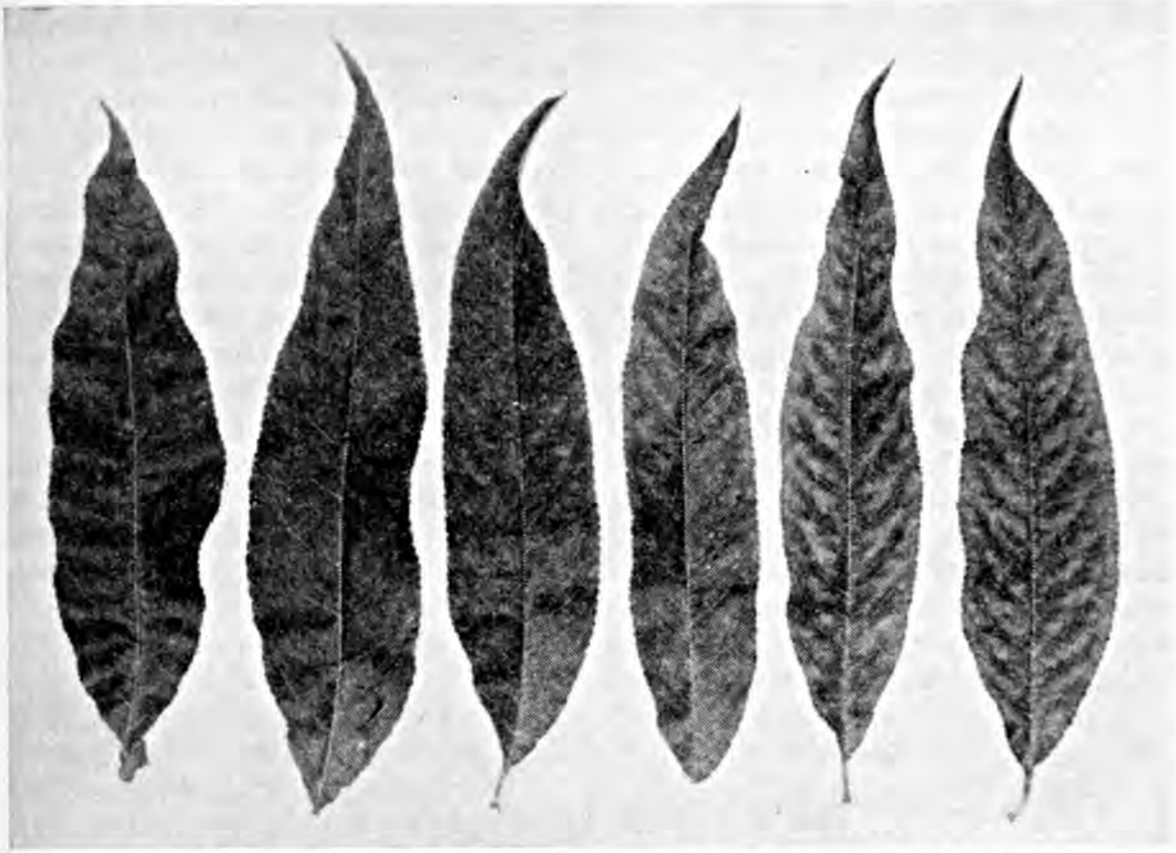

Fig. 2. Leaves from manganese-deficient peach trees in New Jersey. The leaf on the extreme left is from a healthy tree. Severity of the symptoms on the other leaves increases from left to right.

with this system have been conducted in New Jersey, Ohio, Indiana, Missouri, Kentucky, and Maryland. When mulches are used, two main points should be kept in mind: (1) the depth of the mulching material should be maintained at six to eight inches, or deeper; (2) two or three times more nitrogen fertilizer will have to be applied, at least during the first two or three years, than is applied under a clean cultivation system. Furthermore, pests, such as mice, curculio, oriental fruit moth, tarnish plant bug, and buffalo tree hopper, are often more prevalent in a mulched orchard.

The cost of mulching materials appears to be the main factor limiting their use in peach orchards. They afford several advantages, in addition to conserving moisture, which are often overlooked by orchardists. Thus, (1) soil structure is maintained or improved; (2) soil erosion is greatly reduced; (3) soil organic matter is maintained or increased; (4) the mulch, itself, is a source of plant nutrients; (5) plant nutrients, such as potassium, are released from the soil complex at a more uniform rate under mulches; (6) the cost and time involved in cultivation are eliminated; (7) the costs of cover crop seed and the sowing of the seed are eliminated; (8) a good footing is provided on the orchard floor for the travel of heavy equipment.

Fertilizers used by early peach growers really deserved the term "complete" more so than those used by orchardists in later years. Before the turn of the century, materials such as lime, manure, bone meal, and wood ashes, were used by orchardists. Nutrient deficiencies were not very common in peach soils. Nutritional diseases, such as little-leaf, due to zinc deficiency; leaf-scorch, caused by a lack of potash; and leaf-mottle, a result of manganese deficiency, were all uncommon. Troubles such as these have become more apparent in recent years and seem to be due, in part at least, to unbalanced nutrition resulting from the use of only nitrogenous fertilizers.

The trend toward the use of only nitrogenous fertilizers for peaches began at about the time of the first World War. Experimental evidence in several states had usually shown a marked response to nitrogen by peach trees. A response to other materials was usually not as evident nor as striking as that to nitrogen. This was probably due to several reasons. Data were often collected for only a year or two and the long-range effect of the fertilizers was not considered. The amount of tree growth and total yield of fruit were often the only criteria noted. Fruit quality was not as important then as now, and this factor was usually overlooked. Nitrogen generally gave larger yields, but the fruits were often smaller and more poorly colored than those where mineral fertilizers were used.

Use of Complete Fertilizer

Most authorities agree that nitrogen is the element most often needed in the peach-orchard fertilization program. Some states still recommend only nitrogenous fertilizers for peaches. There is a definite trend, however, toward the use of complete fertilizers for peach trees. Chemical analyses have clearly shown that peach trees and fruits use fairly large amounts of several common minerals found in the soil. For example, a 20-year-old peach orchard will remove from the soil during its lifetime approximately the following amounts of materials per acre: 200 pounds of P_2O_5; 1,300 pounds of K_2O; 80 pounds of CaO; 90 pounds of MgO; and 900 pounds of N. These figures, of course, will vary somewhat, depending on soil fertility, fertilizer practice, the variety of peach grown. Certain minor elements, such as boron, zinc, manganese, copper, and iron, are also used by peaches. When only nitrogen is used in the fertilizer program, it seems logical to assume that peach orchards in such locations will sooner or later become deficient in one or more of these other materials.

Usually, non-bearing peach trees that make about 18 inches of terminal growth annually are receiving enough nitrogen. Trees that produce a good crop make about 12 to 15 inches of terminal growth when they are receiving enough nitrogen. The practice of applying one-fourth to one-third pound of nitrogen fertilizer per year of tree age is a fairly good guide to follow. This should be considered merely as a guide, and individual tree attention should be given. This is especially important when applying nitrogen, and some growers go through their plantings after the over-all fertilization and give their weak trees an extra application of fertilizer.

Split applications of nitrogen have proven to be beneficial in some areas. This has been especially true on very light soils, such as are found in some of the southern states where severe leaching is a factor. Late fall applications of nitrogen have been successful in some states. Even on sandy soils, the loss of nitrogen due to over-winter leaching appears to be rather small. The roots of peach trees will absorb nitrates as long as the soil temperature remains a few degrees above freezing. The main advantage of fall applications, especially in the southern states, is the early vigorous start made by the trees in the spring. This appears to be due to the presence of relatively large amounts of nitrates in the twigs as a result of absorption of the material during the winter.

Potash Deficiency

Potassium is the mineral element most likely to be found deficient in peach soils. The peach appears to be a heavy feeder on this material. Many cases of potassium deficiency in peach orchards have been reported in recent years. Usually, these orchards have been found on light soils in New Jersey, Delaware, Virginia, Maryland, Indiana, South Carolina, Georgia, and Michigan. It is true, however, that a majority of our peach orchards are on light soils similar to these. Therefore, when considering fertilizer programs for peach orchards, especially on very light soils, the potash application should equal that of nitrogen.

Phosphorus, for some reason or other, has not usually produced noticeable response in peach trees. This holds true for practically all tree fruits. Peaches contain relatively small amounts of this material, but so do many of the annual crops which give marked response to phosphates. California data have shown that certain annual field crops markedly increased in both growth and yield under phosphate fertilization. Yet no response was noted from applications of the same material to adjacent nursery fruit trees, which included the peach. It may be the fruit trees are able to "forage" for this element better than are annual crops. Response by peaches to applications of phosphate has been obtained in two or three states, but these cases, in experimental work, have been the exception rather than the rule. It probably is a good idea to apply some phosphate to the peach orchard, especially where good cover crop growth is needed. The use of large annual amounts of the material, especially on sandy soils, does not appear to be justified. High phosphorus in peach trees, as well as in other plants, retards the intake of nitrates, and in some situations it has appeared to reduce growth and yield. There is evidence, too, which indicates that over-fertilization with phosphate on sandy soils may induce a zinc deficiency in peach trees.

Cases of magnesium deficiency in peach trees appear to be few in number. The requirements of the peach for this element seem to be low, when compared with the apple. It is probable that the use of dolomitic limestone in the peach orchard fertilization program should take care of the trees' needs for this element.

Calcium deficiency appears to be a rare occurrence in peach orchards. As long as lime is used to maintain the soil at a pH of about 5.5, there should be no trouble from a deficiency of this element.

The problem of soil acidity for peach trees, as well as for most other tree fruits, has never been solved. Peaches have been grown and have produced

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Fig. 3. Potassium-deficiency symptoms on peach leaves. Note the marginal scorching on the three lower leaves and the necrotic blotches on all leaves. Upper leaf has symptoms in the beginning stage. Crinkling of leaves is often present in advanced stages as in the two end leaves.

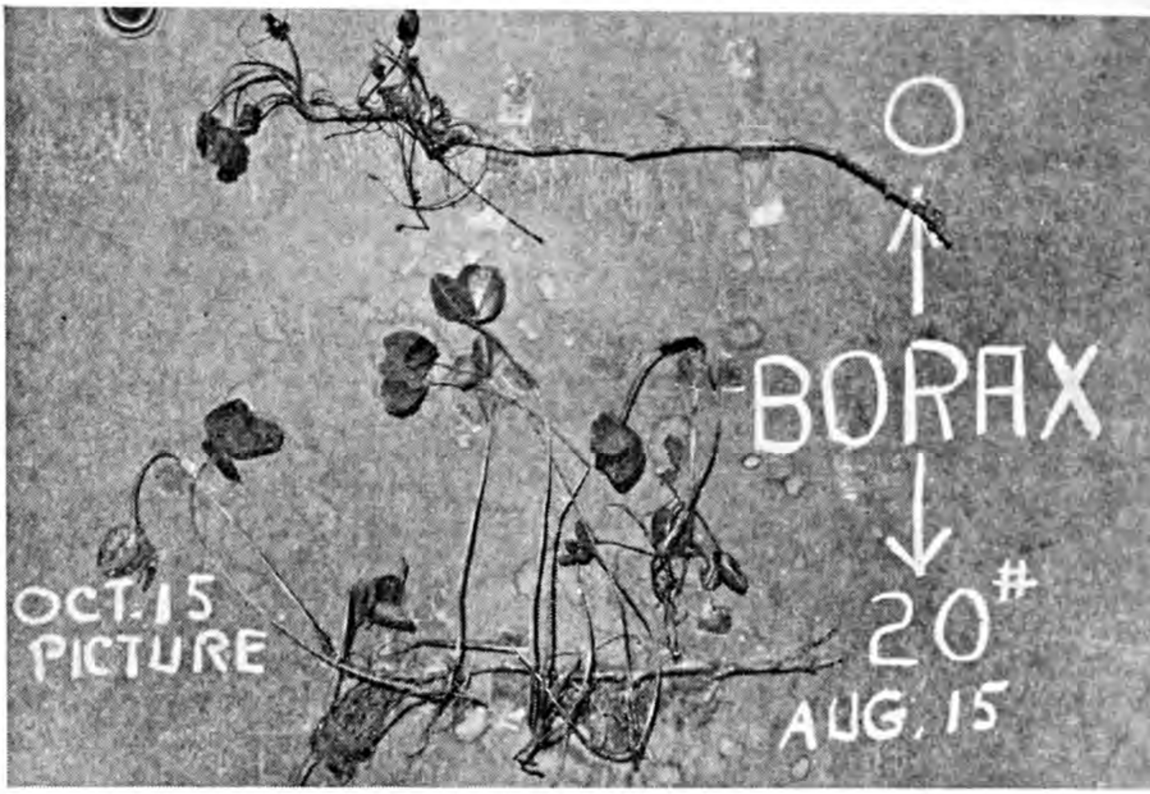

Fig. 1. The ladino clover plant at the bottom was treated two months previously with borax. The plant at the top is from an untreated area. Note the longer internodes, fuller tops, and better roots on the treated plants.

Boron Improved Meadow

By W. D. Bashore

Farm Editor, Journal Gazette, Fort Wayne, Indiana

FOR three long years, Dick Reynolds, Noble County, Indiana, farmer, worked against seemingly hopeless odds to get some meadow established on his farm. Despite everything he did—liming, heavy fertilization, good seedbed preparation—his 1947 seeding of alfalfa, ladino, and timothy was a dismal failure.

Reynolds operates a 141-acre farm which he owns jointly with his brother, Hugh. They bought the farm four years ago and are trying to build up their registered Guernsey herd. Good hay and pasture are essential, of course.

"Our hay was a bunch of sticks," he said. "Short, dry alfalfa doesn't make good feed. And we had to get down on our knees to hunt for the ladino. Even though we have plenty of acreage, we've had to buy hay every year since we bought the farm."

Last October the picture changed. Reynolds' worried frown was replaced with a hopeful, almost unbelieving smile. "I can expect some good hay from my own farm next year," he said.

What changed his outlook?

Borax. Only 20 pounds to the acre. He discovered that his land was deficient in boron, a minor, but nevertheless essential element.

It was Milfred Richman, Noble County Soil Conservation Service farm planner, who helped him solve his

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Bermuda Grass Can Be Used In Corn Rotations[1]

By Glenn W. Burton and E. H. DeVane[2]

SOD crops have been an important part of crop rotations in the northeastern United States for many years. Increased yields of both cultivated and sod crops and conservation of soil resources have been some of the benefits derived from such rotations.

In the southeastern United States, where there would seem to be an even greater need for such rotations, very little use has been made of them. Limited acreages of cultivated land, lack of livestock and facilities to convert sod crops into cash, and the lack of suitable sod crops and equipment to handle them in a rotation are probably the main reasons that they have not been used. Increased size of farm units, acres made idle because of crop control, and increased demands for livestock feed are changing this picture. Modern tractor equipment now available on most farms will handle sod crops that the plow hand with one mule could never cope with.

Resistance to Bermuda

Many people are of the opinion, however, that only certain kinds of sod crops can be used in rotations successively. The years of fighting Bermuda grass in cultivated fields with a mule and a plow stock have convinced them that Bermuda grass has no place in rotation with cultivated crops. Some farmers, probably because all of their cultivated land was infested with Bermuda grass, have in reality grown cultivated crops in rotation with it. Usually they have allowed the Bermuda sod to grow thin and have tried to destroy most of it before planting the land to the cultivated crop. A number of them have observed that crop yields were better in those parts of the field where Bermuda grass had grown. In most instances, however, the cost of destroying the Bermuda sod probably exceeded the value of the increased yields.

Georgia Began Study in 1949

A study of some of the problems associated with the growing of corn in rotation with a heavy Bermuda sod was begun at the Georgia Coastal Plain Experiment Station in 1949. In order to study the effects of Bermuda grass strains and the residual effect of fertilizer applied to them, an acre of Tifton sandy loam that had been in the following experiment was chosen: Five fertilizer treatments had been applied for seven years across duplicate tenth-acre plots of five strains of Bermuda grass grown alone and with crimson clover. Crimson clover growth had been very good one year and fair to poor during the other years of the test. During the seven-year period totals of 0, 436, and 872 pounds of nitrogen had been applied to the three fertilizer treatments considered here. All above-ground growth had been removed as hay. The check strip mentioned later in this paper cut the field in half, lengthwise. The weeds and the small amount of Bermuda grass that had

[1] Cooperative investigations at Tifton, Georgia, of the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, the Georgia Coastal Plain Experiment Station, and the Georgia Experiment Station.

[2] Senior Geneticist and Agent, U. S. Department of Agriculture, Tifton, Georgia. The assistance of Dr. P. M. Gilmer and D. W. LaHue in making the lesser cornstalk borer counts is gratefully acknowledged.

TABLE I.—VARIATIONS IN THE SOD OF DIFFERENT BERMUDA GRASS SELECTIONS AND THEIR EFFECT UPON THE CORN GROWN UPON THEM IN 1949.

Strain number	Density of roots and rhizomes	Ease of turning and preparing soil	Number of plants per acre		Bushels of shelled corn per acre
			Free of lesser cornstalk borer damage on May 25	Bearing ears at harvest	
1	Heavy	Difficult	2,270	8,660	44.9
3	Very heavy	Difficult	5,050	10,800	49.4
13	Light	Easy	5,770	12,300	62.6
Coastal	Medium	Easy	6,180	11,300	52.6
99	Medium	Easy	3,510	10,900	50.9
Check strip	None	Very easy	9,110	9,800	51.0

grown in this strip during the course of the test were removed in the fall of 1948.

On April 15, 1949, the undisturbed Bermuda sod with a light growth of crimson clover on the crimson clover plots was turned about seven inches deep with a tractor-drawn turning plow. Sixty pounds of nitrogen per acre were applied and thoroughly disked in on April 20. Dixie 18 corn (always planted in furrows in this section) was planted with a surface planter in three-foot rows on April 25. Five hundred pounds of 4-8-8 per acre were applied at planting time. Only disks were used to cultivate the corn. When it was about five inches high they were set to throw the soil away from the plants. Half of each plot received an additional 80 pounds of nitrogen per acre as a sidedressing on June 2. The corn was then laid by with the cultivator disks set to throw the soil back to the corn.

Results

The data in Table I show that the five Bermuda strains were very different in density of roots and rhizomes and also in the ease with which they could be turned. Plowing sod of strains like Coastal required more power than the check strip but a rea-

TABLE II.—THE EFFECT OF CRIMSON CLOVER, PAST, AND CURRENT FERTILIZATION UPON THE YIELDS OF CORN GROWN ON BERMUDA GRASS SOD IN 1949.

Past fertilization treatments	Bushels of corn per acre following:			
	Crimson clover+Sod		Grass sod—No clover	
	2N**	N**	2N**	N**
No treatment	52.5	41.6	51.6	33.1
PK+Low N*	64.1	54.0	52.4	33.0
PK+High N*	68.5	66.3	61.4	34.4

5% L S D = 8.1 bushels.
Check strip yields for 2N = 59.7 bushels per acre; for N = 42.3 bushels per acre.
* Totals of 436 and 872 pounds of N per acre were applied to the low N and high N plots respectively during the past seven years. All top growth had been removed as hay.
** Totals of 80 and 160 pounds of N per acre were currently applied to the N and 2N plots respectively in 1949.

sonably smooth job of turning resulted. Considerably more power was required to turn strains one and three and the land on which they grew was much rougher after turning.

It became apparent in early May that the lesser cornstalk borer was damaging corn on the Bermuda grass plots more than on the check strip. Counts of uninfested plants made by Station Entomologists on May 25 revealed that the number of uninfested plants was influenced by the strain of Bermuda grass that grew on the land. See Table I. Generally the lesser cornstalk borer female deposits her eggs at the base of the young corn plant. Since the young corn plants appeared to be making equally good growth on all plots before the borers attacked, it is difficult to explain the variations in infestation that were recorded. It seems quite probable, however, that the eggs must have been laid on the Bermuda grass plants before the sod was turned and that the infestation counts actually show variations in the attractiveness of these Bermudas to the female borers. In most years the Bermuda grass sod would be turned before the lesser cornstalk borers would be laying eggs. In those years when plowing would have to be delayed, however, the Bermuda strain used in the rotation might make quite a difference in the lesser cornstalk borer damage to the corn.

That many of the borer-infested plants were able to recover is shown in the counts of the number of stalks per acre bearing ears shown in Table I. Many of these stalks were actually suckers and probably did not do as well as the original stalk would have done. Nevertheless the yields of corn on most of the plots compared favorably with the yields from the check strip where the Bermuda grass had been removed and where the borer damage had been insignificant.

The effects of some of the past and current fertilization treatments upon the yields of corn growing on these Bermuda plots are shown in Table II. The 500-pound application of 4-8-8 fertilizer per acre at planting time would seem to exclude phosphorus or potash as elements responsible for the yield differences shown in this table. It is believed, therefore, that variations in available nitrogen are largely responsible for the differences in yield obtained. The very poor growth made by the crimson clover planted on the no-treatment plots explains the lower corn yields obtained on those plots. Table II indicates that high nitrogen fertilization of a Bermuda grass hay, meadow, or pasture may be expected to result in increased yields of the corn grown in rotation with it.

Conclusions

The observations reported here, although very preliminary in nature, seem to warrant the following conclusions: Corn can be easily and successfully grown on a heavy Bermuda grass sod following the methods used in this study. Deep turning, surface planting, adequate fertilization, and cultivation with tractor equipment appear to be essential features of the practice. The desirability of having a legume like crimson clover or blue lupine growing on the Bermuda sod before and at the time that it is turned is evident.

There is good reason to believe that Coastal Bermuda will be better suited to corn rotations than common Bermuda. Coastal Bermuda is an excellent hay plant and might fit into a strip-cropping system with corn on the steeper slopes in the South. Such a system should permit the production of corn and hay, two basic livestock feeds, on land now considered too steep for the growing of clean-cultivated crops. Past experience would indicate that enough Bermuda grass would generally survive the cultivations to replant the strips in which corn was grown. This characteristic of Bermuda grass would seem to make it superior to many other grasses that must be seeded in the cultivated strips in order to maintain them in the strip-cropping system.

Fig. 1. Roscoe Fraser, right, Purdue Tomato Specialist, presenting watches to Reserve U. S. "Won" Champion Glen McCain, left, and U. S. "Won" State Tomato Champion Charles Austin.

1949 Tomato Champions

By Roscoe Fraser

Vegetable Specialist, Agricultural Extension Service, Purdue University, Lafayette, Ind.

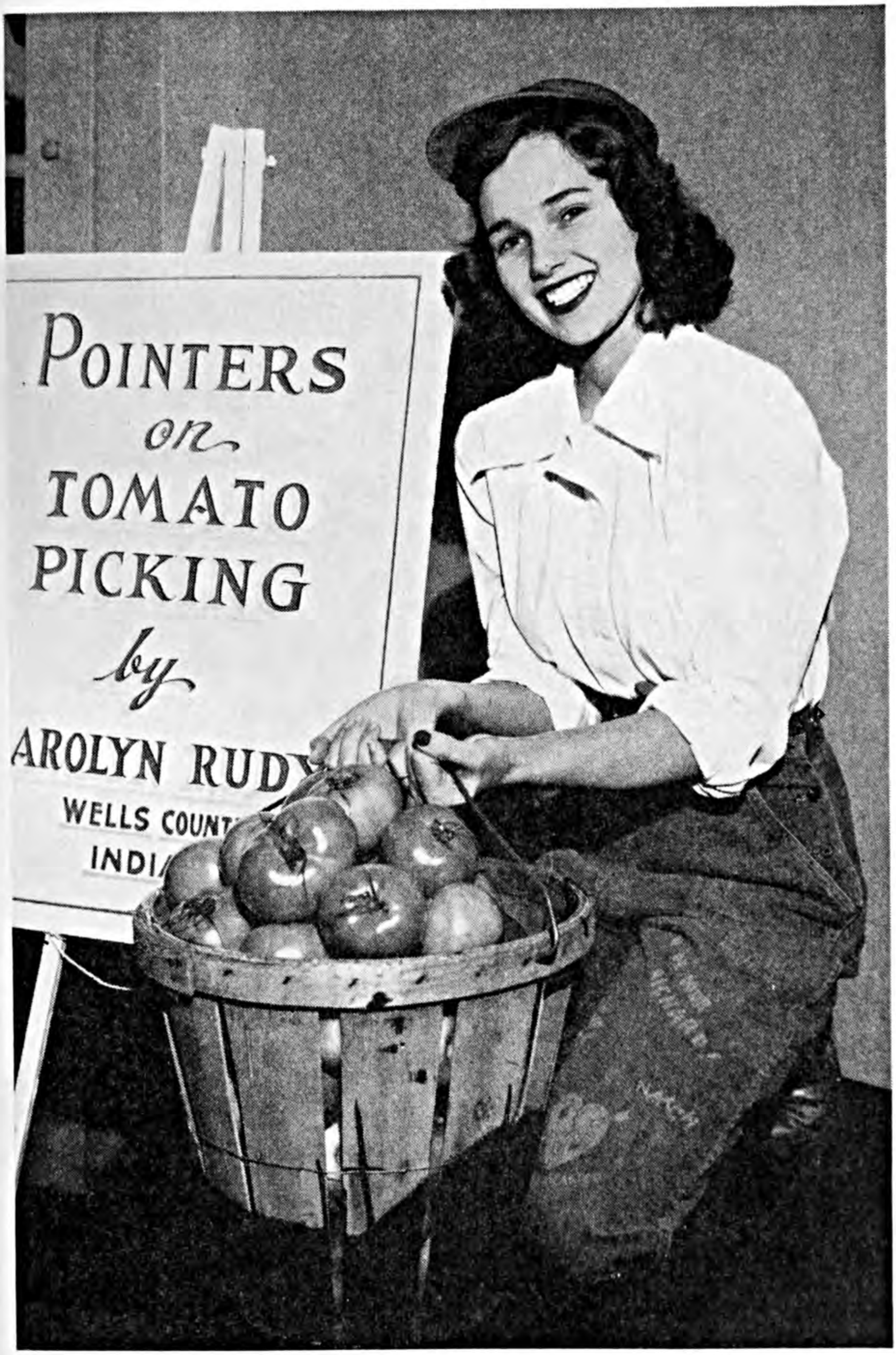
CHARLES AUSTIN, 18-year-old Clinton county Indiana farm youth, was named 1949 State champion in the U. S. "Won" Tomato Club contest by Roscoe Fraser, Purdue University Extension Horticulturist and State Tomato Project Leader. Austin produced 16.495 tons of tomatoes per acre on a plot of 5.87 acres. The yield, grown for Kemp Brothers Packing Company, Inc., Frankfort, graded 80.56 per cent U. S. No. 1.

The son of Mr. and Mrs. William Austin, R. 1, Frankfort, young Austin is a former 4-H Club member and holds the Hoosier Farmer degree in the Future Farmers of America. He was graduated from Rossville High School last spring as the top man scholastically in his class. This year's tomato crop was his second, the first having been grown two years ago in a 4-H Club project. That crop produced about nine tons per acre.

The winning crop was grown on the Austin's 100-acre farm situated 10 miles north of Frankfort near the Carroll county line. The field used was a clover and timothy pasture in 1948. Before plowing last spring, the ground was covered thoroughly with about 10 loads of manure per acre. About 350 pounds of 0-12-12 fertilizer per acre were plowed under, and 250 pounds of 4-12-8 fertilizer per acre were used in the rows at planting time.

Austin grew the Rutgers variety and used direct seeding instead of setting plants. Seeding was done April 20. When the plants were far enough along, he blocked them out with a hoe,

(*Turn to page* 35)



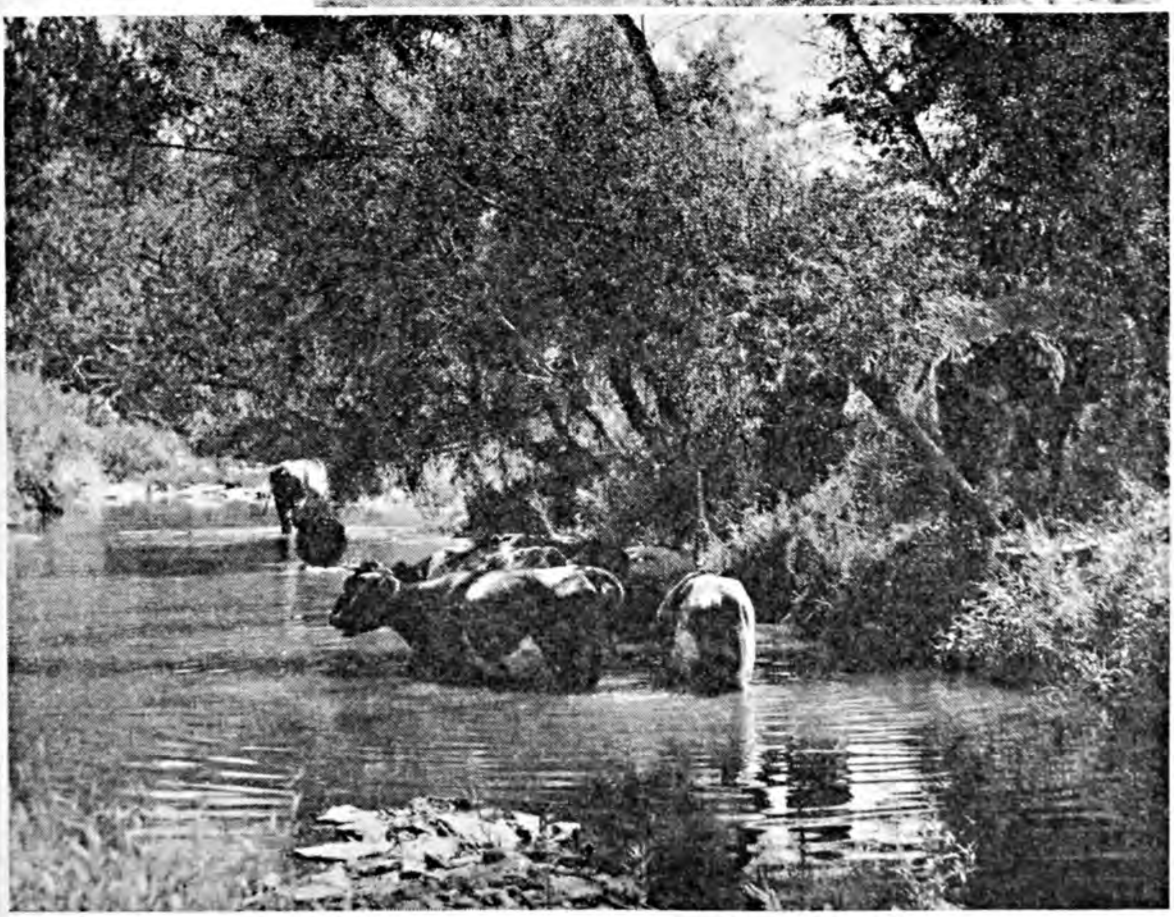
Carolyn Rudy, among other pointers, is demonstrating fingernail polish the color of a minimum U. S. No. 1 tomato. This polish was developed several years ago by Mr. Fraser to aid pickers in getting the highest percentage of No. 1 tomatoes. Miss Rudy, incidentally, is a U. S. No. 1, having been awarded the 1949 Junior Miss America title at Pittsburgh, Pa. At the National Junior Vegetable Demonstration Contest in the Marketing Division, Washington, D. C., last December she placed fourth.

Above: **Idle drifting!**

Left: **Making time!**

Right: **Shoving off!**

Below: **Cooling Milk?**



Above: **Farm families enjoying a Sunday picnic.**

Below: **Indiana corn framed in a pretty setting.**

The Editors Talk

Supply and Demand

Some interesting figures on the supply and demand of farm products were given by Byron T. Shaw, Deputy Administrator, Agricultural Research Administration, during a recent meeting of the National Association of Radio Farm Directors. In referring to the great changes in agriculture which have taken place within our lifetime, Mr. Shaw pointed out that in the last 20 years the per-acre yield of corn has been increased 36 per cent. Cotton is up 58 per cent; potatoes, 68; soybeans, 59; and oats, 17 per cent. Along with increased yields, we have learned how to grow better crops and better livestock—tailor-made for specific uses. We have developed new methods of processing which give us new uses for some agricultural commodities and many entirely new types of products.

"Although not so striking as changes in production, we have seen some marked changes in consumption," Mr. Shaw said. "We're shifting from high caloric foods and eating more of the protective foods such as meat, fruits, vegetables, eggs, and milk. For instance, in 1949 we ate 17 per cent more dairy products other than butter and 26 per cent more eggs than we ate during the period 1935-39. We ate 19 per cent less of potatoes and 12 per cent less of grain products. Over-all, we ate about 5 per cent more food."

In further explanation, he stated that up until 1935 all our improvements in crop production practices were only able to hold national yields per acre at somewhere near existing levels. This was not due to a lack of scientific progress but because soil deterioration was proceeding at a rate sufficient to offset all the improvements. We have been making gains since 1935. We're beginning to slow down soil deterioration and in some cases stop it and start on the up-grade.

Mr. Shaw believes that if we ever get around to setting a ceiling on crop production, it will probably be set by the amount of water available for crop growth. As we get better varieties of crops, improved methods of fertilization, better insecticides, and other improved practices, water will become even more important. We still have a lot to learn on the problems of conserving soils and water, but we are stabilizing and improving our soil and water base.

There is much more that might be said about this soil and water base, and Mr. Shaw's emphasis is well placed. The spread of irrigation with subsequently more efficient use of plant food is well known. The excellent work of the Soil Conservation Service, particularly in its land capability and use studies, is effectively directing production into channels of best procedure. The Extension Service is interpreting for those with specific problems the results of research and experiment. Tillage practices and rotations to conserve soil moisture, together with well-proved fertilizer recommendations to build up and maintain soil fertility, are being put into more general use. With them will come crops and livestock products of better quality and nutritional value, to stimulate the demands for our increasing supplies.

Fertilizer Technology

On August 21-25 at the University of Maryland, College Park, Maryland, the Fertilizer Committee of the Soil Science Society of America sponsored a Short Course in Fertilizer Technology. This was the outgrowth of many discussions among soil scientists, agronomists, and fertilizer technologists in the Industry, State, and Federal services concerning the need for exchange of information on advances in the technology and processing of fertilizers and fertilizer materials.

States were invited to send one or more members of the college staffs who were interested in the subject. In order to present the material, technical men from producing organizations were asked to present papers covering various phases of the over-all subject. In this way excellent material was collected from many sources and presented in concentrated form.

Each speaker prepared his talk in mimeographed form so that all participants could take away with them the complete subject matter. This was supplemented with interesting and valuable discussions at the end of each paper. The lack of any one source for material of this nature made the course all the more valuable, and it is planned that all the papers will be printed together as a monograph of the American Society of Agronomy. Some of the information probably had never been presented in printed form. The papers were rounded out with trips to plants and motion pictures so that those attending the meetings took away with them knowledge gained by ear and eye.

This was the first course of this type ever held. The University of Maryland acted as host, with Dr. Werner L. Nelson of the North Carolina Department of Agronomy acting as chairman and Dr. K. D. Jacob of the U. S. Department of Agriculture taking care of the details of organizing the program and collecting the papers. A great number of states were represented by one or more delegates.

It was felt that all benefited by a better knowledge of the problems involved in the manufacture of fertilizers. This in turn would be a help in arriving at recommendations, in teaching fertilizer usage, and in formulating policies with reference to the various aspects of the fertilizer field. In the final analysis, the benefit will accrue to the American farmer who is now using each year more than 18 million tons of fertilizer.

You Work Too Hard?

"We work mighty hard for what we get," said a woman delivering eggs from house to house.

So do a lot of other people in this old world, and not alone farmers. Consider the chap who runs a grocery store, or a drugstore, or a restaurant—long hours if the business is to pay out, and on edge much of the time, dealing with a percentage of unreasonableness in customers. What a drain on patience it sometimes is for the butcher to sell a woman a cut of meat for her Sunday dinner! And maybe the hardest job of all is the church janitor—buffeted from all sides by a multiplicity of those who think they should be his boss. More chairs here, fewer chairs there, put the tables up, take them down, the church is too hot, or too cold, open windows, shut 'em, pick up after a children's party, and did you find Johnny's rubbers, and if not, why not?

Yet, you know, some way, those who work hardest and longest, whether waiting on a bunch of hens (feathered hens), or milking a bunch of cows 730 times a year, or waiting on trade in a store, or driving miles out into the country in a blizzard to tend a sick child, some way those are the people who keep well, live long, and get the most satisfaction out of life.

If you are looking around for somebody to feel sorry for, don't overlook the poor cuss with nothing to do.—*The Corn Belt Farm Dailies.*

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
August	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....
May	29.24	48.5	128.0	228.0	134.0	204.0	17.25	45.20	....
June	29.91	49.7	127.0	211.0	136.0	193.0	16.05	46.20	....
July	33.05	45.5	127.0	208.0	144.0	199.0	15.15	52.00	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay[1]	Cottonseed	Truck Crops
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	89	81	109	74	87	110
1938	69	196	80	79	76	64	57	97	88
1939	73	154	100	84	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	105	117	107	82	211	129
1942	153	369	168	134	143	124	91	202	163
1943	160	405	188	235	174	154	125	231	245
1944	167	420	214	216	170	160	139	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	178	248	212	209	141	319	204
1947	257	380	232	248	336	259	148	381	249
1948	250	387	220	249	212	232	160	301	238
1949									
August	236	446	221	305	184	202	135	197	174
September	240	487	198	263	181	212	137	193	205
October	231	474	187	224	170	214	141	185	170
November	224	434	192	216	159	215	141	188	213
December	214	454	188	230	176	218	144	192	196
1950									
January	213	397	195	245	179	217	144	193	261
February	222	341	191	252	181	218	141	193	203
March	226	320	189	253	185	224	139	191	168
April	232	...	192	260	196	227	140	197	205
May	236	485	184	260	209	231	145	200	178
June	241	497	182	240	212	218	135	205	182
July	267	455	182	237	224	225	127	231	200

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19
May	3.00	2.05	10.74	11.97	10.14	7.59
June	3.00	1.71	10.55	10.79	9.41	7.36
July	3.00	1.71	11.53	10.71	9.35	8.74

Index Numbers (1910-14 = 100)

1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233
May	112	72	307	339	301	216
June	112	60	301	306	279	209
July	112	60	329	303	277	248

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14.........	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925............	.600	2.44	6.16	.584	.860	23.72	.483
1926............	.598	3.20	5.57	.596	.854	23.58	.537
1927............	.525	3.09	5.50	.646	.924	25.55	.586
1928............	.580	3.12	5.50	.669	.957	26.46	.607
1929............	.609	3.18	5.50	.672	.962	26.59	.610
1930............	.542	3.18	5.50	.681	.973	26.92	.618
1931............	.485	3.18	5.50	.681	.973	26.92	.618
1932............	.458	3.18	5.50	.681	.963	26.90	.618
1933............	.434	3.11	5.50	.662	.864	25.10	.601
1934............	.487	3.14	5.67	.486	.751	22.49	.483
1935............	.492	3.30	5.69	.415	.684	21.44	.444
1936............	.476	1.85	5.50	.464	.708	22.94	.505
1937............	.510	1.85	5.50	.508	.757	24.70	.556
1938............	.492	1.85	5.50	.523	.774	15.17	.572
1939............	.478	1.90	5.50	.521	.751	24.52	.570
1940............	.516	1.90	5.50	.517	.730	24.75	.573
1941............	.547	1.94	5.64	.522	.780	25.55	.367
1942............	.600	2.13	6.29	.522	.810	25.74	.205
1943............	.631	2.00	5.93	.522	.786	25.35	.195
1944............	.645	2.10	6.10	.522	.777	25.35	.195
1945............	.650	2.20	6.23	.522	.777	25.35	.195
1946............	.671	2.41	6.50	.508	.769	24.70	.190
1947............	.746	3.05	6.60	.432	.706	18.93	.195
1948............	.764	4.27	6.60	.397	.681	14.14	.195
1949............	.770	3.88	6.22	.397	.703	14.14	.195
August.......	.770	3.60	5.47	.353	.679	13.63	.188
September....	.770	3.65	5.47	.353	.679	13.63	.188
October.......	.770	3.75	5.47	.375	.720	14.50	.200
November....	.770	3.76	5.47	.375	.720	14.50	.200
December.....	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January.......	.762	3.76	5.47	.375	.720	14.50	.200
February.....	.760	3.76	5.47	.375	.720	14.50	.200
March........	.760	3.76	5.47	.375	.720	14.50	.200
April.........	.760	3.76	5.47	.375	.720	14.50	.200
May..........	.760	3.76	5.47	.375	.720	14.50	.200
June.........	.760	3.76	5.47	.336	.647	12.77	.176
July..........	.760	3.76	5.47	.368	.704	13.98	.193

Index Numbers (1910-14 = 100)

1925............	110	68	126	82	90	98	74
1926............	112	88	114	83	90	98	82
1927............	100	86	113	90	97	106	89
1928............	108	86	113	94	100	109	92
1929............	114	88	113	94	101	110	93
1930............	101	88	113	95	102	111	94
1931............	90	88	113	95	102	111	94
1932............	85	88	113	95	101	111	94
1933............	81	86	113	93	91	104	91
1934............	91	87	110	68	79	93	74
1935............	92	91	117	58	72	89	68
1936............	89	51	113	65	74	95	77
1937............	95	51	113	71	79	102	85
1938............	92	51	113	73	81	104	87
1939............	89	53	113	73	79	101	87
1940............	96	53	113	72	77	102	87
1941............	102	54	110	73	82	106	87
1942............	112	59	129	73	85	106	84
1943............	117	55	121	73	82	105	83
1944............	120	58	125	73	82	105	83
1945............	121	61	128	73	82	105	83
1946............	125	67	133	71	81	102	82
1947............	139	84	135	70	74	78	83
1948............	143	118	135	67	72	58	83
1949............	144	108	128	67	74	58	83
August.......	144	100	112	65	71	56	82
September....	144	101	112	65	71	56	82
October.......	144	104	112	68	76	60	83
November....	144	104	112	68	76	60	83
December.....	144	104	112	68	76	60	83
1950							
January.......	142	104	112	68	76	60	83
February.....	142	104	112	68	76	60	83
March........	142	104	112	68	76	60	83
April.........	142	104	112	68	76	60	83
May..........	142	104	112	68	76	60	83
June.........	142	104	112	63	68	53	80
July..........	142	104	112	67	74	58	82

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
August	244	238	222	143	100	372	144	68
September	247	238	225	138	100	334	144	68
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	223	135	96	313	142	72
May	247	244	228	132	91	311	142	72
June	247	245	230	126	85	293	142	66
July	263	247	236	128	85	301	142	70

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Copper In Tobacco Production," Bul. 535; "Granite Stone Meal as a Source of Potash for Tobacco," Bul. 536, Apr. 1950, Conn. Agr. Exp. Sta., New Haven, Conn., T. R. Swanback.

"Fertilizers, Fertilizer Materials and Rock Phosphate Sold in Illinois, July 1, 1949 to December 31, 1949," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., May 1950, T. Kurtz, N. G. Pieper, and E. E. DeTurk.

"Fertilizer Recommendations for Indiana Field Crops," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Cir. 162, Feb. 1950, G. H. Enfield and A. J. Ohlrogge.

"Value of Phosphate on White Clover-Dallis Grass Pasture," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 439, Dec. 1949, R. H. Means.

"More Efficient Use of Fertilizer," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 531, Dec. 1949, A. W. Klemme and W. A. Albrecht.

"Commercial Fertilizers for Sugar Beets in Nebraska," Outstate Testg. Cir. 3, Jan. 1949, H. F. Rhoades and W. Johnson; "Commercial Fertilizers for Winter Wheat," Outstate Testg. Cir. 4, Feb. 1949, J. J. Hanway, R. A. Olson, F. V. Pumphrey, P. Ehlers, and R. E. Luebs, Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb.

"Fertilizers, Manures and Limes—1949," N. J. Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Insp. Series 37, Mar. 1950, S. R. Randel.

"Fertility Levels in Pasture Land," N. J. Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Bul. 749, Mar. 1950, C. Eby, C. B. Bender, and F. E. Bear.

"Report of Analyses of Commercial Fertilizers and Lime Materials Sold in New York State, January 1 to December 31, 1949," Dept. of Agr. & Markets, Albany, N. Y., Bul. 371, Mar. 1950.

"Rules, Regulations, Definitions and Standards of the North Carolina Department of Agriculture," Dept. of Agr., Raleigh, N. C., Chapt. VIII, Insp. Services, Rev. Jan. 1950.

"Nitrogen Fertilizers," Oreg. Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 699, Feb. 1950, L. E. Warner and A. S. King.

"Effect of Fertilization and Cultural Practices on Growth and Yield of Concord Grapevines," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 523, Mar. 1950, H. K. Fleming, R. B. Alderfer, and D. E. H. Frear.

"County Fertilizer Data, Mixed Goods and Materials, July 1 through December 31, 1949," Ofc., State Chemist, Texas Agr. Exp. Sta., College Sta., Texas.

"Effect on Yields of Rice of Different Nitrogenous Fertilizers Applied as Topdressings," P. R. 1218, Jan. 25, 1950, R. W. Wyche and R. L. Cheaney; "Effect of Fertilizers on Yield of Lint Cotton on Miles Fine Sand at Chillicothe, Texas," P. R. 1219, Jan. 27, 1950, J. R. Quinby and J. C. Smith; "Distribution of Fertilizer Sales in Texas, July 1—December 31, 1949," P. R. 1222, Feb. 15, 1950, J. P. Fudge; "Time and Rate of Application of Various Fertilizers on Yield of Rice Varieties of Different Maturity," P. R. 1226, Mar. 4, 1950, R. L. Cheaney, R. H. Wyche, and H. M. Beachell; "Effect of Sulphur, Nitrogen and Phosphorus Ammendments on Cotton Production at the Blackland Station, 1949," P. R. 1228, Mar. 10, 1950, E. N. Stiver, R. J. Hervey, H. E. Hampton, and J. R. Johnston; "Cotton Fertilizer Tests in the El Paso Valley, 1949," P. R. 1230, Mar. 14, 1950, O. E. Anderson and P. J. Lyerly; "Effect of Fertilizer on Yield and Quality of Sweet Potatoes in Central East Texas, 1949," P. R. 1233, Mar. 23, 1950, H. C. Hutson and J. C. Smith; Texas Exp. Sta., College Station, Texas.

"Nutrient Deficiencies in Utah Orchards," Utah Agr. Exp. Sta., Logan, Utah, Bul. 338, Apr. 1950, D. W. Thorne and F. B. Wann.

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"Soil Survey of Franklin County, Indiana," Series 1938, No. 24, May 1950, O. C. Rogers, G. M. Brune, T. E. Barnes, and A. T. Wiancko; "Soil Survey of Morgan County, Indiana," Series 1937, No. 24, Feb. 1950, H. P. Ulrich, T. E. Barnes, A. P. Bell, S. Myers, L. E. Alli-

son, T. E. Nivison, and P. T. Veale, USDA, Purdue Univ., Lafayette, Ind.

"Tilth of Corn-belt Soils Cannot Be Maintained without Legumes and Grasses," Univ. of Ill., Urbana, Ill., Cir. 655, Apr. 1950, R. S. Stauffer.

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"Soil Survey of the Astoria Area, Oregon," Oreg. Agr. Exp. Sta., Corvallis, Oreg., Series 1938, No. 20, June 1949, E. F. Torgerson, J. McWilliams, and C. J. McMurphy.

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"Titration Curves and Buffering Capacities of Hawaiian Soils," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, Tech. Bul. 11, May 1950, Y. Matsusaka and G. D. Sherman.

Crops

"Summaries of Results from Some Experiments at the Tennessee Valley Substation," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Feb. 1949, F. Stewart, J. K. Boseck, and C. Johnston.

"4-H Corn Production," Agr. Exp. Serv., Univ. of Ark., Fayetteville, Ark., Cir. 124, Jan. 1949, W. R. Perkins.

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"Thirty-Second Annual Report, State of Illinois," Ill. Dept. Agr., 200 State Capitol, Springfield, Ill., R. E. Young and J. P. Stout.

"1949 Illinois Tests of Corn Hybrids in Wide Use," Bul. 536, J. W. Pendleton, G. H. Dungan, J. H. Bigger, B. Koehler, A. L. Lang, R. W. Jugenheimer, and G. E. McKibben; "Experimental Corn Hybrids Tested in 1949," Bul. 538, R. W. Jugenheimer, L. F. Bauman, D. E. Alexander, and C. M. Woodworth; Agr. Exp. Sta., Univ. of Ill., Urbana, Ill.

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1949 Tomato Champions

(*From page* 22)

leaving about one plant every three feet in 40-inch rows. They were cultivated three times and hoed twice. First delivery to the factory was made on August 12.

Reserve champion of the State contest was Glen G. McCain of Howard county.

Clifford Bulach of Sunman, in southeastern Indiana, carried off the 1949 blue ribbon in the Double Tonnage Club with an average yield of 14.5 tons per acre. Young Bulach had never grown tomatoes before, but his father, Joseph Bulach, had been a repeating Double Tonnage winner, and Cliff used this "bank" of "tomato knowhow."

The Bulach 1949 tomato field was well-drained clay loam. In 1946 eight tons of manure and 250 pounds of 3-12-12 per acre had been applied previous to planting corn. In 1947, before the wheat crop was planted, 300 pounds of 3-12-12 along with another topdressing of four tons of manure were applied. The wheat was seeded to clover which was cut for hay in 1948. Early in the spring of 1949, three tons of lime and ten tons of manure per acre were applied.

Before plowing in late April, 1,200 pounds of 3-12-12 fertilizer per acre were applied. The field was disced and harrowed three times and 300 pounds of 3-12-12 were applied in the row. Tennessee plants (Rutgers) were set on June 2 and 3, thirty inches apart in the row. It began raining a week after the plants were set and by replanting several times, a 100 per cent stand was obtained. Due to wet weather continuing, it was the last week in June before they were cultivated for the first time. This was followed the first week in July by hand hoeing, and a week later they were gone through with a one-horse cultivator. The tomatoes were picked once a week from August 9 until September 29.

Some Recent Books

THE CHEMICAL FORMULARY, Vol. VIII, Edited by H. Bennett (Chemical Publishing Company, Inc., Brooklyn, New York, 1948. $7.00). If you want to prepare or mix up any kind of soap, ink, polish, insecticide, weed killer, paint, glue, lipstick, tooth paste, wart remover, chicken feed, baking powder, leather belt dressing, welding flux, and many other products ranging from diamond dust abrasive to zein dispersion, you probably will find it explained in the Chemical Formulary. It is designed for industrial and home use and gives careful directions on kinds and amounts of ingredients and methods of preparation. A valuable list of over 1,200 firms and laboratories that can supply the chemical ingredients, conversion tables, and a good index add to the value of this volume in a well-known series.

FUNDAMENTALS OF SOIL SCIENCE, by C. E. Millar and L. M. Turk (John Wiley & Sons Inc., New York, 1943. $3.50). A textbook which covers the origin, formation, properties of soils and their management, and lime and fertilizer production and use. A practical approach is used by the authors and this broad field is covered clearly and concisely. Technicalities are not avoided but are reduced to a minimum and clearly explained. While this is written primarily as a textbook, it is well indexed and can serve as an excellent reference.

COMMERCIAL FERTILIZERS, by Gilbeart H. Collings (Blakiston Company, Philadelphia, Pa., 4th Edition, 1947. $4.50). This new edition of Commercial Fertilizers follows the same arrangement and form of the previous edition. New data and references have been added, and the section on ammonium nitrate fertilizers has been expanded to a full chapter, reflecting the increased importance of this fertilizer material in American agriculture. The sources, production methods, and usage of fertilizer materials found on the market including many of minor importance are discussed. Attention is given to the secondary and minor as well as the major nutrients. Chapters are devoted to fertilizer purchase, usage including mixing of fertilizer and methods for determining fertilizer requirements, and fertilizer application methods. This is the most widely-used book on fertilizers in the country and the frequent revisions keep it up to date. It is excellent as a reference as well as a textbook.

Boron Improved Meadow

(*From page* 18)

problem. Reynolds took his problem to Richman in July and after a walk over the fields, Richman strongly suspected a boron shortage.

The alfalfa was stunted, dry, sparsely-leaved, and rosetted, or bushy-topped. Some of the tops were yellow; some were reddish. The internodes, or spaces between joints where the roots and leaf stems emerge, on the ladino runners were short, indicating slow growth. Root growth was lacking and leaves on the older nodes were drying up. The symptoms showed up most during the dry periods of the summer.

Since all the symptoms pointed to a boron deficiency, which he had seen in other parts of the county, Richman suggested that Reynolds try about 20 pounds of borax on some acres in the meadow. In August, they broadcast the borax, plus 300 pounds of 0-15-15 per acre, on all except one acre in a 12-acre meadow. That one acre received only the 0-15-15. On another meadow, they covered only one acre with borax alone.

"I was astonished at the results,"

Reynolds exclaimed in October. "And the doggone stuff is so cheap. I paid only $4.35 a hundred for it. After seeing what it did to those fields, I covered 50 more acres with it."

The difference between the treated and untreated fields was the difference between day and night. In early October the untreated acres, along with the acre that received only the 0-15-15, were a dead brown of "poverty grass" and alfalfa stems.

But on the treated acres, the ladino was a lush green carpet. "It was even creeping out into the quackgrass at the edge of the field and killing it," Reynolds said. The treated alfalfa was a juicy green and full-leaved, a sharp contrast to the dry, stunted, stemmy growth on the untreated fields.

Richman suggested broadcasting rather than drilling because borax kills seeds it comes in contact with. He said broadcasting over meadow at rates up to 50 pounds, and in some cases more, has been found to be safe. Overdosing, however, can kill all the vegetation in a field.

He observes that similar symptoms have been cropping up increasingly often in northeastern Indiana. They show up particularly on sandy, droughty soils that are hard hit in dry periods; but also show up on heavier soils, such as the silty clay loam on Reynolds' farm. Alkaline soils are also more subject to the deficiency.

Fig. 2. Reynold's nephew, Hugh, Jr., holds some treated and untreated alfalfa against his shirt to show the difference borax made in the same 1947 seeding.

Alfalfa—Its Mineral Requirements

(*From page* 12)

Borax, though highly necessary in alfalfa production in many parts of New Jersey, did not increase yields materially, since the soil was relatively high in this element at the start of the test.

One of the highest-yielding plots received five times the standard application of fertilizer or 300 pounds each of K_2O and P_2O_5, at seeding time, and none afterward.

Some confirmation of the concept that the exchange complex of the ideal soil for alfalfa should contain about 65 per cent calcium, 10 per cent magnesium, 5 per cent potassium, and 20 per cent hydrogen was obtained. Such a soil would have a pH value of about 6.5.

The principle of the tendency toward cation constancy was further developed to include anions and the still greater constancy of the cation-anion ratios.

The following critical levels are suggested for alfalfa plants: 1.4 per cent potassium, 0.27 per cent phosphorus, 10 ppm. manganese, and 20 ppm. boron.

Critical levels suggested for alfalfa soils are: 80 pounds exchangeable potassium in the plowed acre, a pH value below 6.5, and a water-soluble boron content below 0.35 ppm.

Proximate analyses of alfalfa indicated an increase in sugars, dextrins, and fat-like materials with increased potassium applications.

More than 80 per cent of the carotene and riboflavin in Ranger alfalfa was in the leaves. Anything that interfered with leaf development tended to lower the content of these constituents.

Analysis of alfalfa from 11 states indicated that the potassium content associated with the longest life of the plant lies between 1.5 and 2.5 per cent.

A minor-element survey made of alfalfa from the 11 states, with special emphasis on that from New Jersey, indicated the presence in the plants of a considerable number of elements of no known value to them.

Small amounts of nickel, strontium, and lead, in addition to boron, manganese, iron, cobalt, and molybdenum, were found in most samples.

Vanadium was found only in New Jersey alfalfa.

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Trends in Soil Management in Peach Orchards

(*From page* 17)

good crops on soils with pH's ranging from 4.5 to 7.0. The optimum pH for this crop has never been determined, and it probably varies with soil type and other environmental conditions. There is evidence accumulating, however, which indicates that sandy peach soils should be maintained at a lower pH than has usually been recommended in recent years. Certain minor elements may be inactivated as the pH approaches 7.0. If too much lime is applied, either in one application or in regular annual applications, some of these nutrient elements may become unavailable to peach trees. A case of manganese deficiency, apparently induced by overliming, was found in a New Jersey peach orchard during the past summer. The soil in this orchard ranged from 6.0 to 7.0 down to the three-foot level.

Zinc deficiency, which may also be induced by overliming, has been a limiting factor in both Florida and California peach orchards for many years. During recent years, cases of zinc deficiency have been found in peach and apple orchards in at least three states of the eastern Coastal Plain.

Cases of boron deficiency in northeastern apple orchards have been known for 10 or more years. The symptoms are not nearly as clear-cut in the peach as are the symptoms for some of the other nutrients. It is usually first evidenced as a dying-back of terminal twigs, very much like Oriental fruit moth injury. In fact, these two injuries are so similar that one can be mistaken for the other on peach trees. Low boron often limits crop production without showing any definite "hunger sign." The only symptom which it may produce is "reduced yield," and this often is attributed to a multitude of sins other than boron deficiency. New Jersey and several other Coastal Plain states are conducting field experiments with borax on peaches. More information concerning its needs by this fruit should be forthcoming in the near future.

Iron deficiency in peaches has usually been limited to alkaline regions, such as are found in areas of Colorado and California. It is difficult to correct. Capsules containing iron citrate have been placed in holes in the trunks of peach trees with satisfactory results, and nutritional sprays have been used in some cases.

Copper and molybdenum are two essential elements which have not, to date, been known to be limiting in peach production in the United States. Field tests with these elements are now under way in several New Jersey peach orchards.

Most of the minor elements can be furnished to peach trees through foliar sprays. Such sprays, however, often need to be repeated three or four times during the growing season if satisfactory response is to be maintained. The use of urea sprays as a source of nitrogen for peach trees is still in the experimental stage. New Jersey, as well as other states, has an experimental program under way with this material on peach trees.

Whenever possible, nutrient elements should be applied through soil fertilization. In some soils, though, especially in alkaline regions, some nutrients become unavailable almost as quickly as they are applied. When such conditions are present, foliar sprays or capsule injection into tree trunks may be the only way in which trees can obtain proper nutrition.

Our America

(*From page* 5)

or the silk parasol, or the derby hat. Travel abroad was only for a few of the richest, or for a colony of art students or literary hacks. Country folks went to town once a week or less often and relied on themselves for pleasures and pastimes. Urban dwellers were fresh from the country, too, and seldom bothered much about kings and conquests and tripartite agreements. Life was local.

MEANWHILE this national tree of ours became a veritable Sequoia of the Redwood variety. Its roots plunged through the rock of time and its sheltering branches swung far out above the surrounding seas of our continent.

From its brace roots sprang up a myriad of new industries arising from new inventions. Many of the inventions were hatched abroad and got the capital to develop them in America. In our youth, the airplane and the electric dynamo set the stage for world adventure, while the farms were gradually supplied with tractor-powered implements and bolder and more vigorous organizations to match the organizations built up by industry and commerce. We got tariff-minded and foreign-investment-minded at the same time and we pull-hauled both ways and saw the world getting smaller and our nation looming larger. So the quiet days of our youth in the early 1900's vanished too soon for us, and distant booming of the guns in France called us to the colors again. I often think back to that summer of 1914, and so do you who lived it with me. It was the end of an era of isolation.

Mark you, I do not say it ended "isolationism." The nation had one charted and necessary course to follow as best it might in a world made smaller by science; but individuals differed much about this new thing that was happening to their America.

I for one am not going to scorn them or say unkind words about my Midwest friends and others elsewhere who honestly believed that President Washington meant to lay down a lasting motto when he spoke about "entangling alliances abroad." But it took as long to hear from England in his day as it took to grow a good crop of tobacco, and there was a century of toil ahead of us before we even connected the eastern seaboard with the Golden Gate. When we did just that; when we came to the end of the continent and the limits of our physical endeavor were found to exist in a new realm of science and expanding mass power rather than in acquiring more land, it was then that we had to hitch up with the rest of the universe or else stagnate.

SO THE offspring of those two once-youthful zealots of Bavaria and Vermont, like the kindred of countless more, had to face a complex and varied and shifting picture. What was once the household vine and fig tree of scriptural reverence had loomed up like Jack's fabulous beanstalk, always demanding to be fertilized and nourished lest it crash down and carry with it all the hopes of the spirit that planted it.

What has happened to America is without parallel in the world's history. But it is not enough to claim that the strength and the vigor of that mighty tree are caused by mass power or mechanical skill or armed might. My father and my wife's grandpa used some armed might—such as it was—and so did their offspring, but it had no pleasant flavor to their taste and they quickly spewed it out to quench their thirst on the real spring of human hope—a decent regard for others and the ways of peace.

It seems that the thing that bothers us most nowadays is being misunderstood. Other smaller saplings look up at our great trunk and mighty branches and imagine we are a parasite and a deceiver. Lots of big men are envied and feared unjustly, regardless of how kind-hearted and well-intentioned they may really be.

WHAT with outright liars and those who don't know for sure, we are surrounded in too many places in the world by envious and fearful neighbors. In spite of all we can do in lending them some of our native fertility which is useful, if well used, to grow as equally big trees as ours, we often fail to supply them with the spirit of good will toward man that has usually marked our growth.

I don't know any more about what attitude the aforesaid ancestors of ours would hold about this matter than I know about the way General Washington would react. My father and her grandpa were pretty much of the original American, of course; and they probably would be aghast at the money and credit we have been pouring into the world's development and protection. But they had to live their own lives and we have to live ours just as boldly. Yet I can almost bet on a certainty that her grandpa and my dad would favor any attempt to let other less favored nations in on some of the good fortune and happiness that only come with the dignity of man and the right of free self-government.

I don't think they would insist to the last jot and tittle on using and enforcing the American brand of republic everywhere to gain those desirable goals. It's a pretty good pattern, however, if you rub out some of the brutality and the drabness here and there which comes from making such a quick growth. Underneath you'll usually find that these Americans are sentimental to a fault and always ready to help a friend in need or rescue some individual from danger. I've done just a little traipsing abroad, and most of the folks I met would also make excellent citizens of a republic that upheld human dignity and free self-government.

We can all recall that when we were little folks the thing that impressed us a lot was the friendly tone between the citizens of our community. My father was a poor man, but he suffered none in his personal reputation or dignity from a lean purse. The head banker and the mayor and the biggest merchant always spoke kindly to him and respected his opinion. They would stop and ask him about the family and listen to his ideas about what needed to be done around the town; and he was a speaker on "patriotism" appointed by the school board to lead exercises on Decoration Day. It wasn't clothes or bank accounts or pedigrees that counted as America was growing up. Come to think of it, it isn't much different today when you get right out where the real citizens live.

The real test is decency and honesty.

BUT our greatest hazard is our lack of interest in voting. When only 52 per cent of the qualified voters help decide who is to run this republic for good or ill, as happened in 1948, then we had better knuckle down and start some home missionary work. Maybe some of us need it worse than the Europeans. Even in Korea last year 85 per cent of those who were qualified cast their ballots.

It seems to be as hard to get people to the polls regularly as it is to cut down the casualties on the holidays. That's surely part and parcel of our dignity just as it is the foundation of free self-government.

All our young men have to register for the draft. Maybe we should ask for a compulsory registration for the ballot. Maybe we should tax a fellow for *not* voting, instead of taxing him for doing it. Yet just the minute you talk about compelling somebody to do something in public affairs, you run right up against the theory of a true democracy—which is to have folks want to do things right themselves.

We can be thankful that aside from that bad voting record, we are doing pretty well as humble citizens to reflect the value of life in a great free nation. Sure, we have made lots of mistakes and men in charge of events have blundered and had better hindsight than foresight.

The main thing is not to lose sight of the reasons why our tree stands up so tall in the world's forest. And then to rally around and keep the hoot owls out of it and the bark disease and chewing bugs away from it—so that when we saw off a log from it to send abroad it won't be full of worm holes or too green and sappy to build with. Paul Bunyan and his tremendous crew of loggers and foresters are long gone to limbo, but it's his magic and his good humor and pep that hold us to the line, let the chips fall where they may.

Foreigners often fail to grasp these fairy tales and traditions, or do not understand our way of cussing and making light of things we respect the most. For America is young and its family tree shelters people who like to be jolly and agreeable and friendly, who extend their hands to grasp the foreign visitor in welcome, and who want lots of other nationalities to grow trees of their own to have a picnic under. But if the clouds come up over that picnic place, these hearty Americans can get busy in a jiffy, lest the flood waters drown the hopes of those who believe in the dignity of man and the right of free self-government.

"Where are you going, my pretty maid? Why do you pass me by?"

"I'm on my way to gymnathtic thcool," she lithped as she heaved a thigh."

* * *

A TOSS-UP

Sambo: "Mose, what am de best breed o' chickens?"

Mose: "Al kinds is got merits. De white ones is de easiest to find but de black ones is de easiest to hide."

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What is the Matter with Your Soil?
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
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ZZ-12-46 Alfalfa — A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
I-2-47 Fertilizers and Human Health
P-3-47 Year-round Grazing
T-4-47 Fertilizer Practices for Profitable Tobacco
AA-5-47 The Potassium Content of Farm Crops
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VV-11-47 Are You Pasture Conscious?
R-4-48 Needs of the Corn Crop
X-6-48 Applying Fertilizers in Solution
AA-6-48 The Chemical Composition of Agricultural Potash Salts
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OO-11-48 The Use of Soil Sampling Tubes
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B-1-49 Hardening Plants with Potash
E-1-49 Establishing Bermuda-grass
F-2-49 Fertilizing Tomatoes for Earliness and Quality
J-2-49 Increasing Tung Profits with Potassium
L-3-49 The Development of the American Potash Industry
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LL-10-49 We Turn to Grass
MM-11-49 Things Learned From 1949 NE Green Pasture Program
QQ-11-49 Some Fundamentals of Soil Building
RR-11-49 Alfalfa as a Money Crop in the South
SS-12-49 Fertilizing Vegetable Crops
TT-12-49 Grow Lespedeza Sericea for Forage and Soil Improvement
UU-12-49 Pacific Northwest Knows How to Grow Strawberries
A-1-50 Wheat Improvement in Southwestern Indiana
B-1-50 More Corn From Fewer Acres
C-1-50 Fertilizer Trends in South Carolina
D-1-50 Know Your Soil I. Delanco Sandy Loam
E-1-50 More Fish and Game
F-1-50 A Simplified Field Test for Determining Potassium in Plant Tissue
G-2-50 Fertilizer Placement for Vegetable Crops
H-2-50 Put the Bee on Southern Agriculture
I-2-50 Boron for Alfalfa
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K-3-50 Metering Dry Fertilizers and Soil Amendments into Irrigation Systems
L-3-50 Food For Thought About Food
M-3-50 Extension Education in Soils in Wisconsin
N-3-50 Can We Afford Enough Fertilizer to Insure Maximum Yields?
O-4-50 Birdsfoot Trefoil—A Promising Forage Crop
P-4-50 Potash Production a Progress Report
Q-4-50 Economic Agriculture a Reality at Last
R-4-50 Know Your Soil. II. Evesboro Loamy Sand. III. Sassafras Sand
S-4-50 Year-round Green
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THE AMERICAN POTASH INSTITUTE

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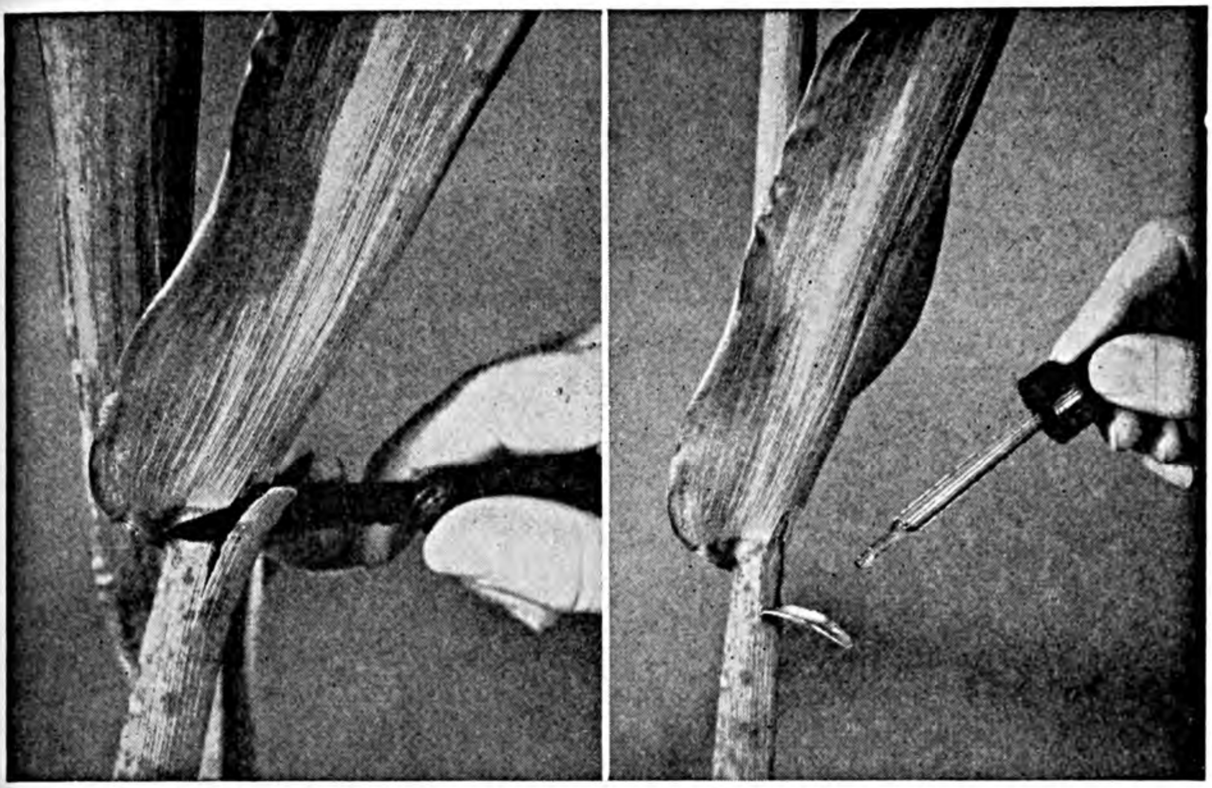
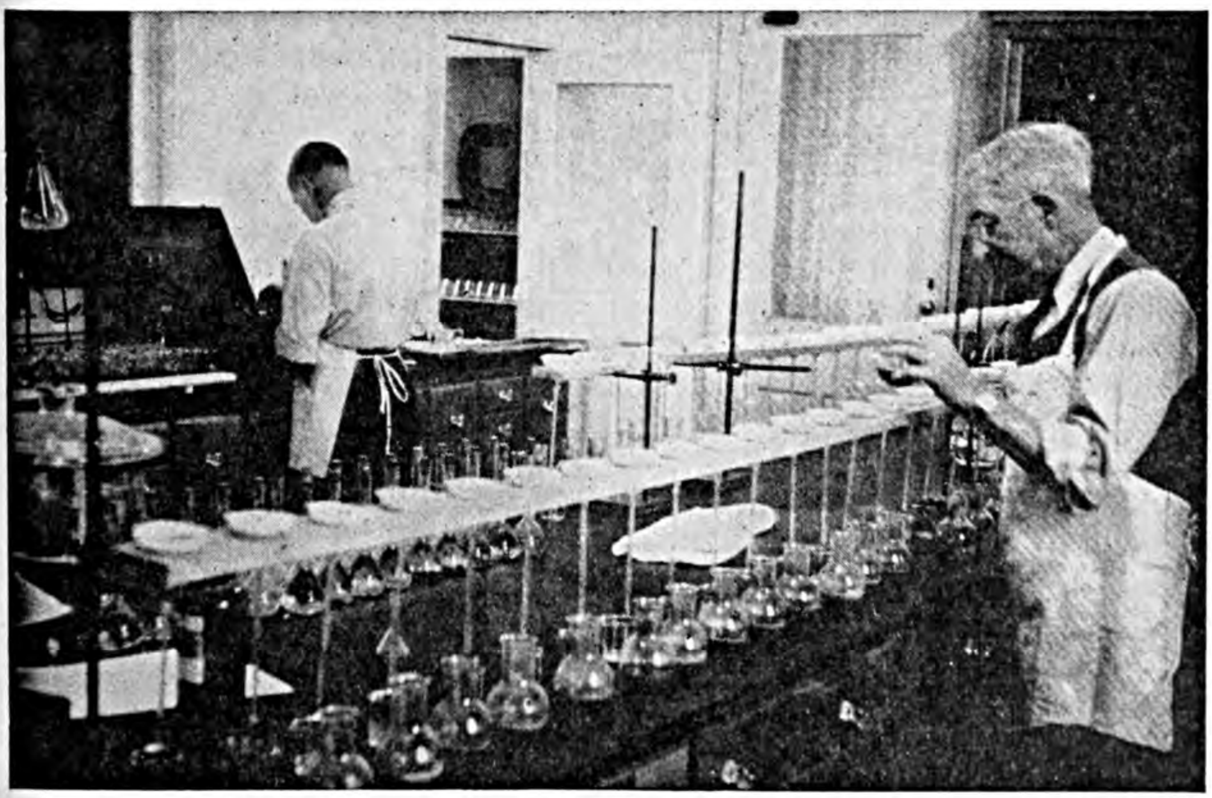


Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

It was the first vaudeville performance the old woman had ever seen and she was particularly excited over the feats of the magician. But when he covered a newspaper with a heavy flannel cloth and read the print through it she grew a little nervous. He then doubled the cloth and again read the letters accurately.

This was more than she could stand and, rising in her seat, she said: "I'm goin' home. This ain't no place for a lady in a thin calico dress!"

* * *

YEAH, USE YOUR NOODLE!

The stranger ambled into the farmyard and was greeted by the farmer. The visitor produced his card and remarked: "I am a government inspector and am entitled to inspect your farm."

Half an hour later, the farmer heard screams from his alfalfa patch, where the inspector was being chased by a bull. Leaning over the gate as the inspector drew near, the farmer cried: "Show him your card, mister—show him your card!"

* * *

"I've got my husband where he eats out of my hand."

"Saves a lot of dishwashing, doesn't it?"

* * *

GOOD DEAL

"So you got a divorce, Mandy. Did you get any alimony from your husband?"

"No, but he done gimme a fust class reference."

A newcomer to the town was looking for a church to attend. He happened into a small one in which the congregation was reading with the minister. They were saying: "We have left undone those things we ought to have done, and we have done those things which we ought not to have done."

The man dropped into a seat and sighed with relief as he said to himself: "Thank goodness, I've found my crowd at last."

* * *

A nine-year-old girl back from a birthday party told her mother that the boys had all huddled together and ignored the girls. "But I got one of them to pay attention to me, all right," she added.

"How?" asked her mother.

The young lady replied, "I just knocked him down."

* * *

DEFINED

Politician: "I'm for the greatest good to the greatest number."

Ditto: "And what is the greatest number?"

Politician: "Number one."

* * *

"How are you getting on with your new boy friend?" asked the brunette.

"Oh, he's all washed up," replied the blonde. "I think he's been deceiving me and that he's really a married man."

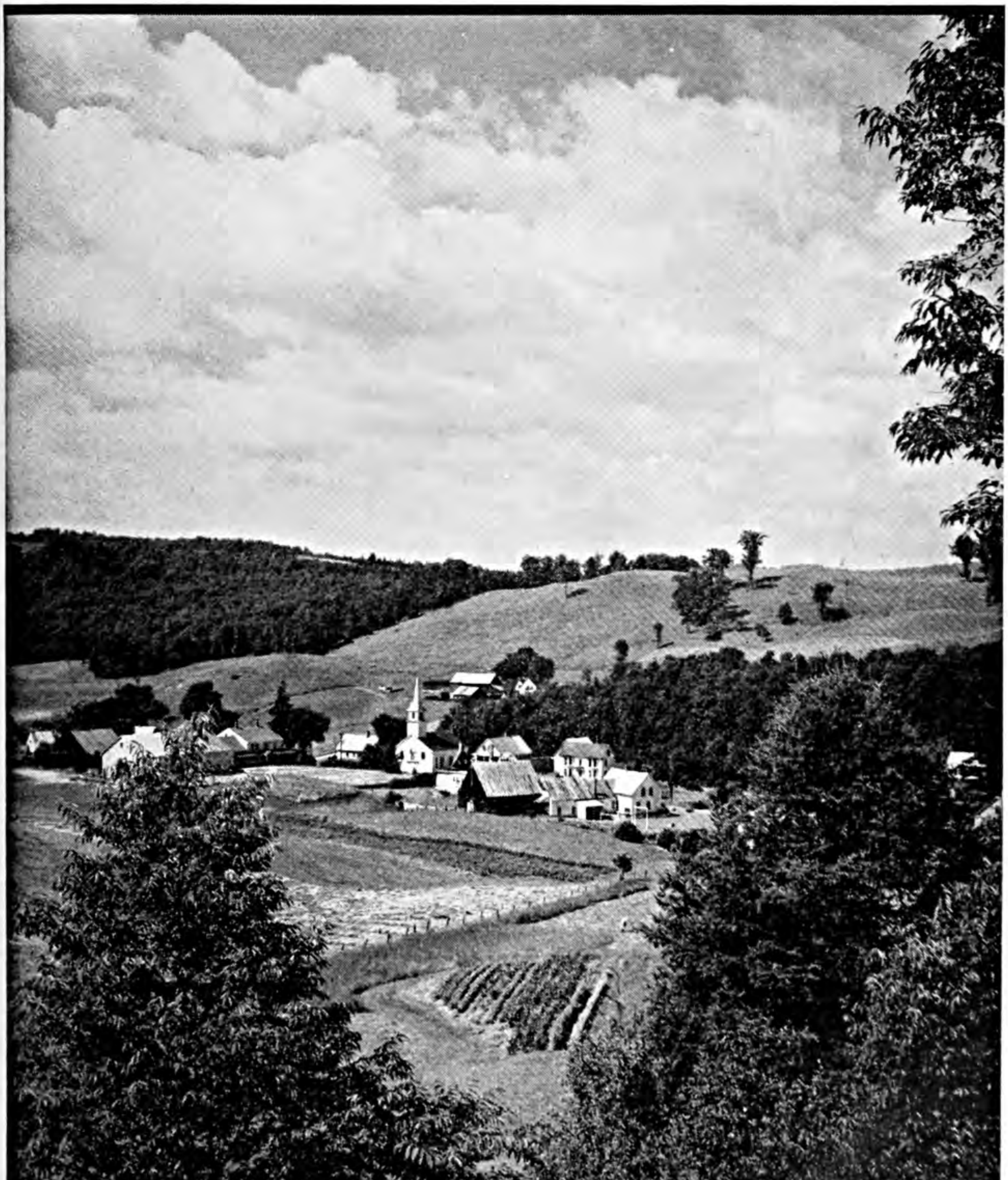
"Do you, dear? Whatever makes you think that?"

"Well, last night I was sitting on his knee and he gave me his watch to play with."

Better Crops WITH PLANT FOOD

October 1950

10 Cents



The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: **1155 16th Street, N. W., Washington 6, D. C.**

VOLUME XXXIV NO. 8

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Something to Smile About

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PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIV WASHINGTON, D. C., OCTOBER 1950 No. 8

In Consideration of . . .

Fall Maneuvers

Jeff McDermid

AGRICULTURAL fall maneuvers find our foresighted farmers plowing under bad insects, spraying waste borders where pestiferous varmints lurk, mending fallen fences and farm machinery, disinfecting grain storages, and finally, reseeding well-tilled land to restorative and protective crops, always mindful of the next year's harvest. Such preparedness is an old story. Followers of the ancient food and fiber craft have always lived and planned and delved and denied themselves in a twilight zone betwixt two different worlds—one of rural serenity and apparent peaceful calm and snug content, and the other one of constant watchfulness and bitter warfare, of attack and defense against hordes of natural enemies. Farmers have always known that success and achievement are purchased with terrific pressure and eternal vigilance—like democratic freedom and liberty itself.

Of late all citizens of this good country have been living like embattled farmers—between two fronts, living strangely double lives made up of our own humdrum duties and responsibilities on the one side, and the tension and the foreboding set forth in daily headlines and alerting radio broadcasts on the other. Like the farmers, too, we are getting a late start toward the necessary and advisable fall maneuvers which prudence and a common welfare dictate. This is all very disquieting and disrupting to our brave hopes for our children and our overmastering habit of good will to mankind. It's pretty galling and embarrassing to be lied about and misunderstood, yet we have faith enough and unity enough to make flags and ring church bells on October 24 in recognition that we do not stand alone in the program for peace.

Nevertheless this era of national vigilance may have its value, to bring us back along the trail of our history to remember times when our own founders of liberty fought against inertia and greed in the colonies while trying to put forth a strong front to a distant power that was crushing freedom and representative government. Maybe some of us have forgotten the lessons of those colonial struggles, when so few faced so many and leaders were divided as to the right course of action.

AS the first Continental Congress met at Philadelphia the patriots communicated often by means of Committees of Correspondence and County Resolves. Paul Revere rode down to the Congress carrying in his big coat pocket the attested copy of the Suffolk county resolves, written in Boston by a besieged group of citizens. To quote a few sentences from this document brings one into close harmony with the times and shows us how much alike were their dilemma and ours today.

"Our enemies have flattered themselves that they shall make an easy prey of this numerous, brave and hardy people, from the belief that they are unacquainted with military discipline. . . . On the fortitude, the wisdom and the exertions of this important day is suspended the fate of this new world, and of unborn millions. To us our venerable progenitors bequeathed the dear-bought inheritance of liberty, to our care and protection they consigned it; and the most sacred obligations are upon us to transmit the glorious purchase, unfettered by power, unclogged with shackles, to our innocent and beloved offspring.

"We recommend that by a steady, manly and persevering opposition we shall convince our enemies that in a cause so solemn our conduct shall be such as to merit the approbation of the wise, and the admiration of the brave and free of every age and of every country."

I doubt if in all our history you will find a better statement to use alongside the pronouncements of valor and resolve which animate the sentiments of the citizens of our nation in 1950.

Meanwhile there are folks who spend too much time and effort pointing to the laxity of our people and the quick demobilization from war to peace in 1945. There may be some grain of truth behind it, but on the whole that period of five years has not been spent in vain; and we have testified our peaceful intent by mobilizing for helpful production rather than for selfish conquest or imperial designs. Mistakes have been made, but largely ones of the head rather than of the heart. From this time onward we fervently hope that it will be a different story. We may have been "suckers" sometimes, but never "sneakers." From this time onward let's hope we shall be neither.

Our major efforts, as one youth leader of rural America says, "have been spent in endeavoring to promote a peaceful world settlement of differences; in producing new and useful goods in greater quantities than ever before thought possible; in providing considerably increased educational opportunities for the youth of this and other lands; in bringing a sense of greater security to the average workingman; in making extraordinary strides in scientific fields to ease pain and to prolong life; in assuming leadership in restoring the suffering peoples of the world, as well as in strengthening our national defense facilities."

"Whom the Lord loveth, He chasteneth." Adversity often makes a people stronger. If we stand firmly by our over-riding principles to spread the good things of life to less fortunate people, it is possible that our goal may be part of a Divine plan—the achievement of which will be much greater and nobler than the establishment of liberty here in the first place.

BUT in all this dedicated purpose we must not forget that we cannot do all these fine things alone by ourselves. Without the "decent opinions of mankind" supporting the program through United Nations and

similar hopeful movements, one lone country with a small portion of the world's population and rapidly diminishing resources cannot be a Savior and a Santa Claus combined. We are not in this joust to show off, like Don Quixote.

Let's remember there are several other nations with ideals as high and as noble as ours—even though a few of them do not have governments quite like ours. Many of them are small nations, mere spots on the world map, but each one is a maker of opinion and a partner in the future. To such brave and devoted nations defeat is unthinkable and surrender but temporary, at the worst.

When a writer accustomed to the everyday flow and placid stream of the seasons attempts to set down some thoughts for perusal a month ahead in these critical hours of swift change and sudden tragedy, his task is not a simple one. What is a fact today may be a fact tomorrow, but other new facts and forces eclipse the former ones and alter the action deemed best fitted to the hour. I recall how the former Arizona Senator Ashurst used to say in oratorical periods, "A strong man is never consistent. I do not treasure the jewel of consistency."

I like to recall the words of Rev. Peter Marshall, once pastor of a church in Washington, D. C., and for a time chaplain of the Senate. He was a poor, friendless immigrant from Scotland in the first place, but his power and poetry took him into high places before his early death three years ago. He was an ardent patriot of American ideals and repeatedly said that this country gave him a helping hand when he was lonely and bereft. Listen to this little creed of his in prayer:

> "Our Father, when we long for life without trials and work, without difficulties, remind us that oaks grow strong in contrary winds and diamonds are made under pressure.
>
> "With stout hearts may we see in every calamity an opportunity, and not give way to the pessimism that sees in every opportunity a calamity."

Like Edwin Markham, Rev. Marshall also believed that "Defeat may serve as well as victory to shake the soul and let the glory out."

Winston Churchill stated in his memoirs that right after Dunkirk was the time of Britain's finest hour. Likewise, Valley Forge and Pearl Harbor were symbolic of the turning point of hope and valor.

In these wonderful autumn days when you ride out across the fields and witness the glory of the tree and landscape color, you take in the peaceful villages and the happy homesteads, each busy making all shipshape and snug for the coming winter. In none of their hearts lurk the seeds of suspicion or fear or the blight of ruthless government. They are free men able to go their ways in peace and cooperation. We who have lived most of our lives with these country-minded, honest, and courageous folks are aware as few others are of their grit and valor when aroused in defense of liberty and decency.

(*Turn to page* 49)

Planned Forage Production and Fertilization Pay

By Lester H. Binnie

Soil Conservation Service, Vincennes, Indiana

A WELL-planned pasture program has helped level the hills and valleys of milk production on the Anton Bittner farm near Evansville, Indiana. Only a few years ago he found it impossible to maintain uniform production during the late summer months. Many other producers in the Evansville milkshed had the same problem. Recognizing that each might have a part in solving this problem, representatives of the Soil Conservation Service, Extension Service, and the Milk Producers Association met to consider a logical solution.

Most dairymen were depending on bluegrass and annual lespedeza for their pasture program. This program left big gaps in the supply of succulent forage in both early spring and late summer. Prolonged barn feeding was costly and inefficient. Mr. Bittner readily agreed to try another system. He now turns his herd out of the barn early and gets nearly a month's grazing from Balbo rye.

In 1949, eleven acres of rye supplied three weeks of early spring grazing for his herd of 27 Holstein cows. As soon as the Balbo rye began to fail he turned the cows into a permanent pasture of Kentucky bluegrass-birdsfoot trefoil-ladino mixture. This was followed by second growth alfalfa-brome combination from which a hay crop had been harvested. Alternate mid-summer grazing between the alfalfa-brome combination and the birdsfoot trefoil permanent pasture was supplemented with ladino-grass night pasture near the farm buildings.

The wide fluctuation in milk production from a low in late fall to a high in May has bothered Evansville milkshed producers and distributors alike, according to Byron A. Field, manager of the Evansville Milk Producers Association. Fluid milk consumption drops off in May at the peak of production, perhaps because of garlic or other objectionable flavors. Consumption picks up again in September just after production begins a steep decline to reach the bottom in November.

From the standpoint of the producer, a uniform supply of high quality milk 12 months out of the year has value in a price-bargaining program. Excessive production of milk in spring and summer over the market requirements must be sold in the surplus classification and causes the blend price to be reduced quite rapidly.

Low production in the fall and winter on the part of average producers causes the market to carry more shippers in order to meet the market requirements at this season. This increased number causes huge surpluses in May and June to further depress the blend price, according to Mr. Field.

The accompanying graph shows a comparison between the production of the average milk producer in the milkshed and the production on the Bittner farm when May production represents 100 per cent. It is based on the years 1948 and 1949. While the average producer reaches the low point in November, Mr. Bittner's herd reaches a low in January. This low point is 8 per cent higher than the low for the average producer. Even more significant is the 24 per cent higher production from the Bittner herd in November as compared to the average producer.

Fig. 1. An area on Mr. Bittner's farm after he started working with his farm plan. Part of the Bittner herd is shown grazing on an alfalfa-brome mixture in 1945.

While production from the Bittner herd is fairly constant during the last seven months of the year, it does tend to increase slightly from July through October at the time when average producers are in a rather severe decline. This decline on the part of the average producers has been attributed to the use of annual lespedeza which seems to be much better for producing fat on beef animals and sheep than for producing milk from dairy animals.

The relatively low production of the Bittner herd during January, February, and March can be attributed to at least two causes. First is the lack of silage for winter feeding. At present the herd receives good quality legume hay and 3½ pounds of grain mixture two times a day during the winter season.

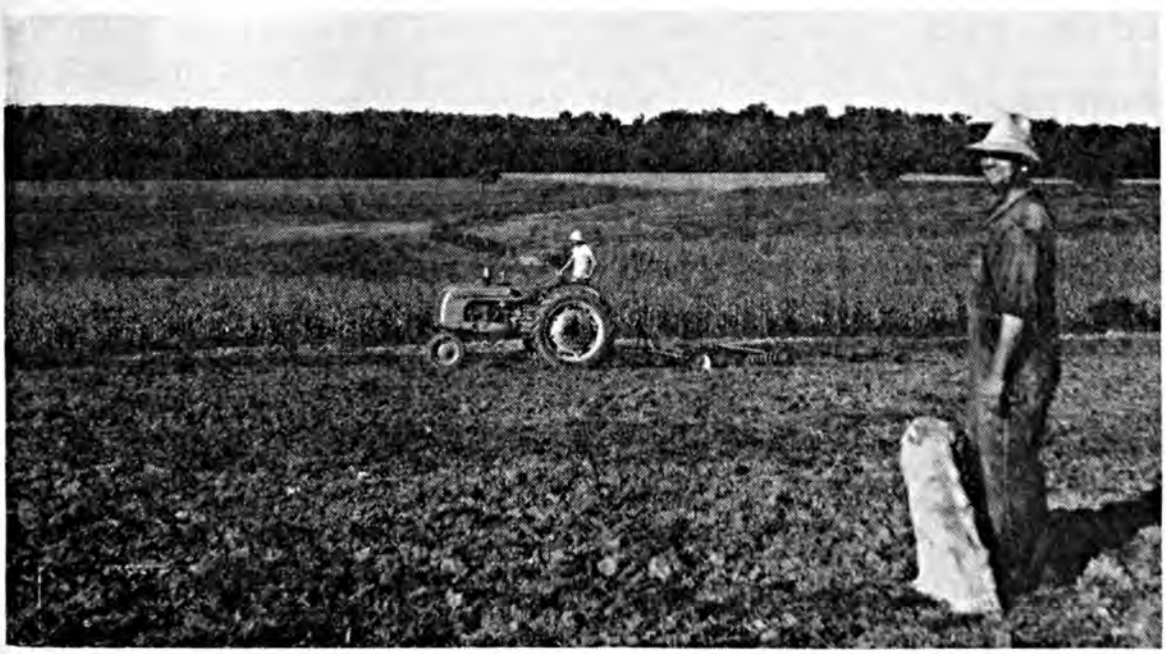

Fig. 2. The same area as shown in Fig. 1 in the fall of 1949 when being prepared for a new seeding using the trash-mulch system. Five hundred lbs. of 0-15-15 fertilizer were supplied at seeding time.

The grain mixture consists of 1,500 pounds of corn, 400 pounds of bran, and 100 pounds of soybean oil meal. The second factor has been the difficulty of arranging the breeding program so that cows freshen in the fall. While this aim is always kept in mind it has been difficult to achieve.

Bittner says the pasture and roughage program has been a distinct advantage to him in several ways. Besides supplying an abundance of high quality feed it has enabled him to make the best use of land not well suited to regular rotation crops. The land now in bluegrass-birdsfoot trefoil-ladino clover mixture was steep and rather severely eroded, as is the land now in alfalfa-brome combination.

These forage crops can make good use of phosphorus and potash in spite of low humus supplies and can produce high yields of quality feed when compared to the production of corn or wheat on the same land. Soil is protected from washing and the lime and fertilizer applied stay at home. For his program, Mr. Bittner thinks that potash is perhaps the most important plant food needed. He uses fertilizer containing equal amounts of potash and phosphate and returns all residues and manure to the land.

Mr. Bittner's pasture program is no accident. It began with the purchase of an 88-acre tract which was added to the 88 acres that made up the original farm. The new purchase included land which he knew was subject to severe erosion, and so he requested help from the Southwestern-Indiana Soil Conservation District. In working out his farm conservation plan he received help from the U. S. Soil Conservation Service technician loaned to the District. The Extension Service helped in planning his pasture program. His farm was one of several selected in this and neighboring counties upon which the latest findings in improved forage production were tried and demonstrated.

Mr. Bittner's plan is based upon an inventory or careful survey of his soil. It combines the various practices necessary to conserve his soil and moisture resources and at the same time provide the kind and amount of forage required for uniform dairy production.

He says some of the ideas, particularly those of giving up corn on the steeper land, moving fences to have fields fit good land-use, the use of diversion terraces, and a trash-mulch seedbed for alfalfa-brome combinations seemed a little strange in the beginning. Now that he has been operating according to this modified grassland system he and his family are enthusiastic about its possibilities. He believes that if applied to other farms of average producers this kind of conservation farming would do a good job of controlling soil loss and at the same time would increase farm income.

COMPARISON OF MONTHLY MILK PRODUCTION

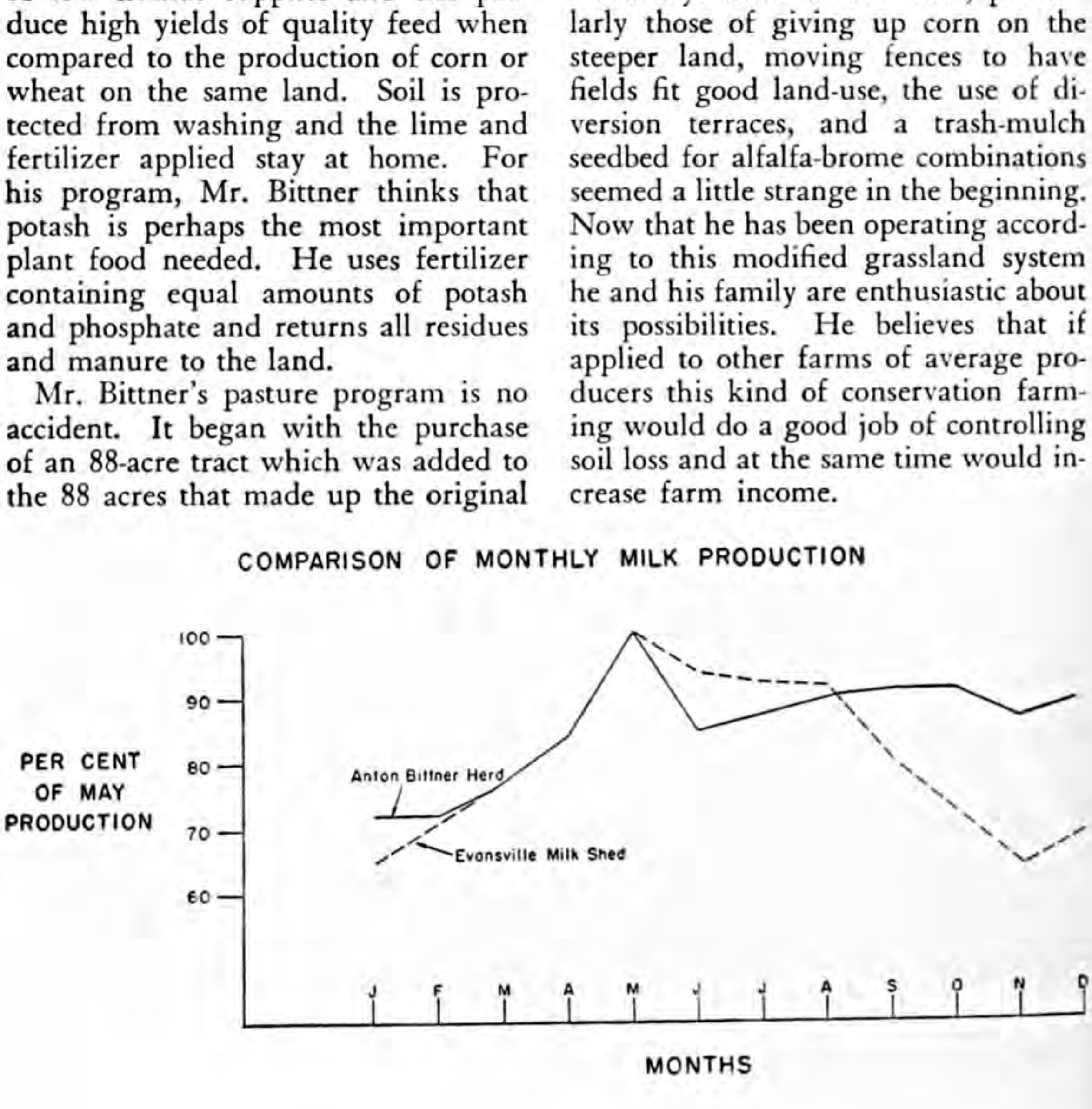

Fig. 1. Where cornstalks had been removed, the soil lost 1.95 inches of runoff and 10.14 tons of soil per acre. The bare land lost nearly 4 times as much water and 19 times as much soil as that with a mulch of cornstalks.

Keep Crop Residues on Surface of Ground

By J. H. Stallings

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RESEARCH data show that any form of crop residue is more effective in reducing runoff and soil loss by erosion when kept on the surface of the ground than when turned under. The data also indicate that leaving the crop residue on the surface is a more effective way of building up the organic-matter content, of improving the aggregation, and of maintaining a high infiltration rate of the soil than turning it under. In many cases residue on the ground surface is equally satisfactory in maintaining a high level of crop production.

Vegetal covers, whether living or dead, accomplish these objectives. Likewise, residue material, whether left on the surface or turned under, is superior to no crop residue. The use of crop residue on the surface offers a satisfactory means of supporting those places in crop rotations where the rotation crops themselves do not provide adequate protection for the soil against the action of the raindrop during hazardous periods of high impact storms. The vegetal cover absorbs the energy of the falling raindrops and prevents the destructive action of their beating on bare land.

Duley and Russell found that where water was applied artificially to 0.005-acre plots at the rate of about 1.5 inches per hour to simulate rainfall, wheat straw stubble left on the surface almost completely eliminated erosion and reduced runoff about 95 per cent over that of a bare cultivated Marshall silt loam with a 4 per cent slope. Out of a total of 15.33 inches of water applied to the bare cultivated soil 6.27 inches entered the ground and the other 9.06 inches ran off taking 3.44 tons of soil per acre with it. At the same time 15.54 inches, out of 15.96 applied to a similar soil covered with combine wheat stubble, entered the ground leaving only 0.42 inch to run off, which carried 0.03 ton of soil with it.

The foregoing results compared favorably with results obtained under field conditions during the fallowing seasons of 1939-41, inclusive. The average annual rainfall for the three fallow seasons, which included the periods of April-September, was 12.43 inches. The average annual runoff for the period was 1.97 inches for a disked plot which received no organic matter, 1.39 inches for a similar plot receiving two tons of wheat straw disked in, and 0.60 inch for a plot receiving two tons of wheat straw and subtilled. The soil losses per acre were 13.04 tons for the disked plot, 6.24 for the straw disked in, and 0.97 ton for the plot subtilled.

During this period the plot with the straw disked in lost more than twice as much water by runoff and six times as much soil as where the straw was on the surface. Bare disked land lost three times as much water and 13 times as much soil as an adjoining stubble plot with residues on the surface.

After Cultivation

Woodburn found that two tons of straw, applied as a mulch after the land had first been cultivated, reduced erosion to 0.1 ton per acre and the runoff to six per cent. During the same period a bare soil lost 21 tons of soil and 44 per cent of the rainfall as runoff. The experiment was conducted on Houston clay. The time extended from July 1 to December 31, 1942, during which a total of 14.83 inches of rain fell.

Peele found that oat hay and crimson clover used at the rate of 2.5 tons per acre as mulching material reduced runoff and soil loss on four different soil types during the period of June 16 to November 23, 1944. The average runoff for the four soil types was 18.04 per cent for bare land, 1.25 for oat hay mulch, and 0.33 for crimson clover mulch. The soil loss was 2,428 pounds per acre for the bare land, 61 for the oat hay mulch, and 20 for the crimson clover mulch. An average of 14.5 inches of rain fell during the period.

The use of five tons per acre of crimson clover and Kobe lespedeza as a mulch on Cecil clay reduced runoff from 48.4 per cent of the total rainfall of 94.43 inches to 3.5 per cent, and the soil loss from 178,300 pounds per acre for an unmulched plot to 1,500 pounds per acre for the mulched plot. The period covered was August 1939 to January 1942.

Hendrickson, Carreker, and Adams report soil loss of 12.57 tons per acre and runoff 32.74 per cent of a total rainfall of 25.27 inches for unmulched soil for the period of April to September 1940, compared with corresponding losses of two tons of soil and 1.43 per cent of rainfall as runoff for soil mulched with three to four tons straw per acre.

Primary Effect

The primary effect of vegetal cover in reducing runoff and soil loss was generally conceded to be due to the impediment it offered to overland flow until Borst and Woodburn showed it to be due to the de-energizing of the rain drop instead. They applied artificial rain to three series of plots at the rate of approximately 2.25 inches per hour. The plots were left bare and exposed to the action of natural rains for some weeks. During this period the surface soil became crusted or "sealed." Two of these series of plots were then covered with straw at the rate of two tons per acre. In one series, the straw was placed directly on the ground and in the other it was supported one inch above the surface of the ground on chicken wire. The third series was left bare. Artificial rain was then applied at the above rate. It was found that 92.7 per cent of the water applied ran off the bare plot compared with 65.0 per cent for the plot with the mulch placed directly on the soil and 83.2 per cent for the plot where the mulch was supported one inch above the ground. The corresponding soil losses for the three plots were 5.62 tons per acre for the bare, 0.42 ton for the first mulched plot, and 0.26 ton for the mulched plot where the straw was supported one inch above the ground.

These figures show that the mulch was not very effective in controlling runoff when applied after the surface of the soil had become sealed, but did materially reduce the rate of soil loss. Had surface flow been the chief factor in bringing about erosion, the rate of soil loss should have been much higher on the plots where the mulch was supported one inch above ground than on the plot where the mulch was placed directly in contact with the soil.

Manure Topdressing

Further light was shed on this point by use of two additional series of plots on which the surface of the soil was broken to a depth of about one inch and straw mulch applied at the rate of two tons per acre. In one series the mulch was placed directly on the surface of the ground and in the other it was supported one inch above the surface on chicken wire. Water was applied at the usual rate of 2.25 inches per hour.

The mulch in this instance almost completely eliminated both runoff and erosion. The plot with the mulch resting directly on the surface of the ground lost 1.7 per cent of the water applied as runoff and 0.10 ton of soil per acre. The other plot lost 1.2 per cent of the water applied as runoff and 0.12 ton of soil.

These studies show that the chief function of the straw was energy absorption or protection from raindrop impact and not the impediment of overland flow.

Lamb found that 10 tons of manure used as a topdressing after planting consistently saved much more soil and water than did 20 tons plowed under during the period 1943-48, inclusive, and produced as satisfactory crop yields. At the end of the sixth year of the experiment the level of organic matter of the soil appeared to be more closely related to the method of application and the amount of erosion that occurred than to the amount of manure applied.

Effect on Yields

Lamb, Andrews, and Gustafson reduced the loss of water to less than one-half and the loss of soil to less than one-fourth by leaving 750 pounds of buckwheat straw per acre on the surface as a mulch. Records for two years show that plots with residues plowed under lost an average of 2.4 inches of water and 2.2 tons of soil an acre for the period June 10 to December 1 of each year 1942 and 1943.

Six tons of straw mulch per acre on Groton soil with a slope of 35 to 45 per cent reduced runoff on the average from 1.93 inches for fallow to 0.16 inch and soil loss from 9,132 pounds per acre to only a trace during the period May through October during each of the three years, 1940-42. Soil mulched with an average of 12 tons of straw per acre per season for 1939-40 produced an average acre yield of 7,125 pounds of grapes compared with 5,325 pounds for a similar area clean cultivated. In 1941 there was little difference in yield, and some evidence of late growth and winter injury caused by an over-supply of nitrogen was noted.

Van Doren and Stauffer found that soil losses ranged from 14 to 149 times greater from unmulched plots than from plots protected by straw mulch. Wheat straw, corn stover, and soybean residue were the materials used. Alderfer and Merkle found that mulches composed of manure, straw, sawdust, corn stover, oak leaves, and pine needles completely eliminated runoff on Hagerstown silt loam where water was applied at the rate of 1.5 inches per hour. Three and four years of mulching with these materials resulted in complete control of surface runoff and effected an infiltration capacity equal to, or in excess of, three inches per hour.

In addition to controlling runoff and erosion more effectively when left on the surface than when turned under, crop residue on the surface builds up the organic-matter content of the soil at a faster rate than when turned under. Moser found that by turning under four tons of crimson clover per acre the organic-matter content of the soil was increased from 1.75 per cent, where no residue was applied, to 2.52 where the crimson clover was turned under. When applied to the surface as a mulch the organic-matter content of the soil increased to 2.54 per cent. Under similar conditions where lespedeza residue was allowed to accumulate to form a natural mulch the organic-matter content of the soil increased to 3.74 per cent.

Peele found that by using four tons of Kobe lespedeza hay per acre as a mulch the runoff was held to 3.4 per cent of a total rainfall of 94.43 inches during the period under study. The soil loss was 1,500 pounds per acre. An adjoining plot which had four tons of Kobe lespedeza hay turned under lost 42.7 per cent of the total rainfall as runoff and 107,700 pounds of soil per acre.

Alderfer and Merkle found important differences in the organic-matter content of the soil at three different depths at the end of the fourth year in favor of leaving crop residue on the surface rather than turning it under. The organic matter content was determined for 0-1 inch depth, 1-3 inch depth, and 3-6 inch depth in each case. The mulched plot had 3.72 per cent organic matter for the 0-1 inch depth compared with 2.71 per cent for the plot where the crop residue was turned under. Corresponding figures for the 1-3 inch depth were 3.11 per cent for the mulched plot and 2.89 for the plot where the residue was turned under, and 2.75 and 2.55 per cent, respectively, for the mulched and incorporated plots for the 3-6 inch depth. These figures are the averages for six different kinds of organic materials used.

Van Doren and Stauffer found that soil aggregation was very definitely favored by mulching with straw. Alderfer and Merkle found that the

Fig. 2. Fall disking of wheat stubble in preparation for stubble-mulch fallow.

Fig. 3. View of cover left on erosion clover plot after planting the clover following a stalk cutter and one disking.

average stability index of the soil was definitely higher in each depth, namely, 0-1 inch, 1-3 inches, and 3-6 inches where the crop residue remained on the surface than where turned under. The stability index for the 0-1 inch depth was 57.9 on the mulched plot compared with 54.2 on the plot where the residue was turned under. Corresponding figures for the 1-3 inch depth were 59.0 and 55.9, and for the 3-6 inch depth, 60.7 and 58.8.

Havis found that Wooster silt loam soil reached a relatively high state of aggregation under straw mulch such as that often applied around fruit trees. This condition is reached quickly if the mulch is of unleached wheat and alfalfa. Bluegrass sod treatment over a long period is of value in increasing and maintaining a high percentage of the aggregates of the larger size but is not as effective as mulch. Cultivation, even with such cover crops as can be produced in a mature apple orchard, is very destructive of soil aggregate structure. Mulch has a value in the formation of aggregates which is out of proportion to differences in organic matter present.

Kidder, Stauffer, and Van Doren found that total infiltration was greatly increased by the presence of wheat straw mulch on three different occasions. Tests were made in June 1941, October 1941, and again in April 1942 on soybean and corn land. The average total infiltration for the first 60 minutes for the three different dates and the two crops was .56 inch on the bare land and 1.67 on the mulched soil. Findings of other investigators verify these results.

Crop yields are also higher in some instances where residue material is left on the surface than where turned under. Hendrickson and Crawley obtained as high or higher yields of lespedeza hay during 1939 and 1940 from eroded abandoned land that had been mulched as from ordinary farm land in the vicinity which was cultivated the conventional way. A complete failure was experienced where lespedeza was planted on eroded abandoned land that was not mulched, however. These mulched eroded abandoned areas produced 282 pounds of lespedeza seed per acre in 1942. This equaled or exceeded the seed yields obtained on the best of the cropland fields. Peele secured higher corn yields on four different soil types where mulches were used than where no mulching material was used. The average acre yield for the four soil types where no mulch was used was 17 bushels. Comparable plots mulched with oat hay produced 21.3 bushels and other plots mulched with crimson clover produced 28.4 bushels per acre. Copley, Britt, and Posey found that flue-cured tobacco produced greater yields when mulched than when not mulched, during years of normal or below normal rainfall. However, the yields on the mulched plots were lower than those of unmulched plots during seasons of excess rainfall. Duley and Russell report an average annual acre yield of 28.3 bushels of corn on unmulched land for the three-year period 1939-41, compared with a yield of 36.8 bushels for land mulched with two tons straw per acre. They also found that corn yields were higher on land where the straw was left on the surface than where it was turned under. Corn following small grain with the stubble plowed under produced 21 bushels per acre compared with a yield of 27.3 bushels per acre where the stubble was sub-tilled.

Need for Fertilizer

Van Doren and Stauffer reported that the use of two tons of wheat straw per acre as mulch depressed corn yields, increased soybean yields slightly, and did not affect the yield of hay materially. Mulched corn land produced an average annual acre yield of 76.5 bushels of corn for the three-year period 1941-43 compared with a yield of 92.7 bushels for unmulched land. During the same period soybeans produced 31.5 bushels per acre on the mulched land and 29.2 bushels on the unmulched land. The corresponding yields of hay were 3.17 and 3.19 tons per acre.

Van Doren, Land, and Waggoner stated that the depressing effects of mulch on corn yield were overcome when the soil was fertilized. The average acre yield of corn on unmulched land on four farms in 1943 was 65 bushels per acre compared with 64 bushels for mulched land. Similarly the average acre yield of unmulched land on five farms in 1944 was 79.6 bushels per acre compared with a yield of 77.9 bushels per acre for mulched land.

Whitfield, Van Doren, and Johnson found that sub-tilled stubble mulch wheat out-yielded moldboard plowed and one-wayed wheat where wheat was grown continuously during the period 1942-48, inclusive, and that sub-tilled wheat out-yielded one-wayed wheat where wheat alternated with fallow during 1943-48, inclusive. Pullman silty clay loam was used in both sets of tests.

Sub-tillage Benefits

The moldboard plowed wheat produced an average annual yield of 12.5 bushels per acre on the continuous wheat plots compared with 13.2 bushels for the one-wayed and 15.1 for the sub-tilled. The yield was 18.8 bushels per acre for the one-wayed and 21.6 for the sub-tilled plots where wheat alternated with fallow. The beneficial effects of sub-tillage were accumulative and the spread between the yields on the sub-tilled and moldboard and one-way plowed plots became progressively greater with time.

The stubble mulch plots also were slightly higher in organic matter content in 1948 than the one-way tilled plots.

Borst and Yoder found that alfalfa could be grown successfully on severely eroded, abandoned land without preparing the seedbed the customary way but by utilizing the poverty grass and broomsedge growth on such land as a mulch. The land was limed, fertilized, and disked so as to cut up the sod cover in such a way as to leave it on the surface as a mulch. Alfalfa grown by this method produced as large, or larger, yields of hay per acre as alfalfa grown on good land and cultivated by conventional methods.

Kurtz, Appleman, and Bray used

growing plants for surface protection in growing corn. Second-year red clover and sweet clover were turned under in narrow strips where corn rows were to be placed, and the clover between the rows was clipped close to the ground when the corn was planted. The sweet clover was killed by this clipping and remained as a mulch on the unplowed strips between the rows. A modification with oats as the intercrop was also included. In the red clover areas the clover grew tall enough to necessitate clipping, a month and again six weeks after the corn was planted. All plots under this corn-clover association were paired with adjacent plots which were spaded and cultivated to simulate the conventional seedbed preparation and management.

Three series of plots were used in connection with both red clover and sweet clover. One series was untreated, one received nitrogen fertilizer, and the other received nitrogen fertilizer and water. The corn yields for the different treatments are given in the following table:

YIELD OF CORN UNDER DIFFERENT MANAGEMENT SYSTEMS (BU. PER ACRE).

Intercrop	Slit-crop system	Conventional system	Oats system	Intercrop	Slit-crop system	Conventional system	Oats system
Red clover........	69	126		Sweet clover....	116	132	
Red clover+N....	102	125	110	Sweet clover+N	116	130	120
Red clover+N+ water...........	130	135		Sweet clover+N +water......	131	140	

Very limited trials with soybeans in the slit-cropping system were inconclusive. Although the yields were lower under the slit system, possibilities for good soybean yields were indicated whenever proper management techniques are developed. The corn yields doubtless would have been much higher on the slit-crop plots with red clover had the clover been clipped more often and the nitrogen and water applied at the proper time.

The advantages of a slit-cropping system may be great enough to warrant its use even though somewhat smaller yields may be obtained. This is particularly true for situations where erosion control and soil conservation are primary considerations. The possibility of reducing the plowing and cultivation currently necessary for corn production is sufficiently along to warrant further trials with a slit-cropping system.

The data presented here indicate that the most effective way to utilize crop residues and other vegetal covers is to keep them on the surface of the ground, rather than turn them under. The data also show that the proper use of these materials offers the most effective single measure of reducing erosion and runoff, and bringing about other desirable conditions in cultivated soils leading to continued high production.

Crop residues and other vegetal covers are more effective in building up the organic matter content of the soil when left on the surface than when turned under. They are also more effective in improving the aggregate structure and infiltration capacity of the soil when left on the surface. Surface utilization of these materials leads to substantial increases in crop yields in many instances. Further investigation doubtless will reveal satisfactory methods of overcoming the depressing effects of mulch covers on crop yields, where they occur, and lead to even greater increases under those conditions producing superior yields now. They offer an exceptional opportunity for bridging the gaps existing in crop rotations where the covers from the rotation crops themselves do not furnish adequate protection from the destructive action of the falling raindrop.

The chief function of crop residues and other vegetal covers in reducing erosion is energy absorption or protection from raindrop impact, and not the impediment of overland flow. When left on the surface, vegetal covers deenergize the falling raindrop, thereby eliminating the destructive action of raindrop splash. This in turn prevents the chain of damaging reactions which the splashing raindrop sets in motion. To be sure, we do not have the final answer or answers to the correct use of crop residues, nor of other vegetal covers, in this capacity. We do have enough information, however, to indicate that these hold the key to the erosion control problem on cultivated land.

Our present situation in this connection may be compared with the Wright Brothers' first attempt to fly an airplane. The research data available to them indicated it was possible to build a machine that would fly. Once they proved their point research engineers busied themselves with building better machines. We now have found a practice that will control raindrop splash. Since our objective is to save our soil we have a far greater incentive for going ahead with a program which has for its aim more complete knowledge of the proper ways of utilizing crop residues and other vegetal covers in conserving our soil and water.

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Fig. 4. Mulched wheat stubble on terraced, contour-cultivated field. The loosened soil readily accepts moisture and the stubble, shading the soil, helps prevent evaporation.

Band the Fertilizer for Best Results with Row Crops in Western Washington

By Karl Baur and J. J. Tremblay

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INVESTIGATORS[1] working with soils and fertilizers in western Washington have known for years that many western Washington soils were low in available phosphorus. Yet when phosphate fertilizers were broadcast on the land the increases in yield often were very small. The response was much lower than they had a right to expect on the basis of soil tests. It was not until they began to apply the phosphate fertilizers in bands that the application of phosphates really began to pay off, particularly with row crops.

The work of investigators in many parts of the country has shown that the banding of fertilizers for good results is of great importance on some soils but of relatively little importance on other soils. The need for banding the fertilizers depends principally on the "phosphorus-fixing" capacity of the different soils. The mechanism of this "fixation"[2] is not thoroughly understood. The general opinion seems to be that iron and aluminum, which may be present in soluble forms in small amounts in acid soils, combine with the phosphate to form complex compounds of iron or aluminum phosphate which are quite insoluble and largely unavailable to rapidly growing plants. It is also believed by many that the phosphorus compounds are "adsorbed" or tightly held by the clay particles in the soil. There are a number of other ideas as to what takes place in phosphate fixation. Whatever the mechanism involved, plants often fail to utilize much of the phosphate that is applied broadcast on certain soils.

The problem of phosphate fixation appears to be of particular importance with short-season, annual crops under the soil and climatic conditions of western Washington. Although studies have not been completed, there is some evidence to indicate that the problem of phosphate fixation may not be as important with perennial crops such as fruit trees as it is with vegetable crops.

An attempt is made in the following paragraphs to explain what may happen to broadcast phosphate and why banded phosphate gives better results. We must keep in mind that when several hundred pounds of phosphate fertilizers are applied broadcast per acre, the phosphate particles are spread rather thinly; and when these are mixed with the surface three inches of soil as a result of discing, the phosphate applied is yet further diluted with soil. When 500 pounds of superphosphate are applied per acre, dilution with three to four inches of soil would mean that 500 pounds of superphosphate are mixed with almost a million pounds of soil. If the idea that iron and aluminum combine with phosphate to form rather insoluble phosphates is correct, it can be seen that these elements need not be present in large amounts for this chemical reaction to take place.

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[1] All studies on fertilizer application in cooperation with G. A. Cumings, Sr., Agricultural Engineer, U. S. D. A., Beltsville, Maryland.

[2] For a detailed discussion of phosphate fixation the reader is referred to the book "Advances in Agronomy" Fixation of Soil Phosphorus, pp. 391-409.

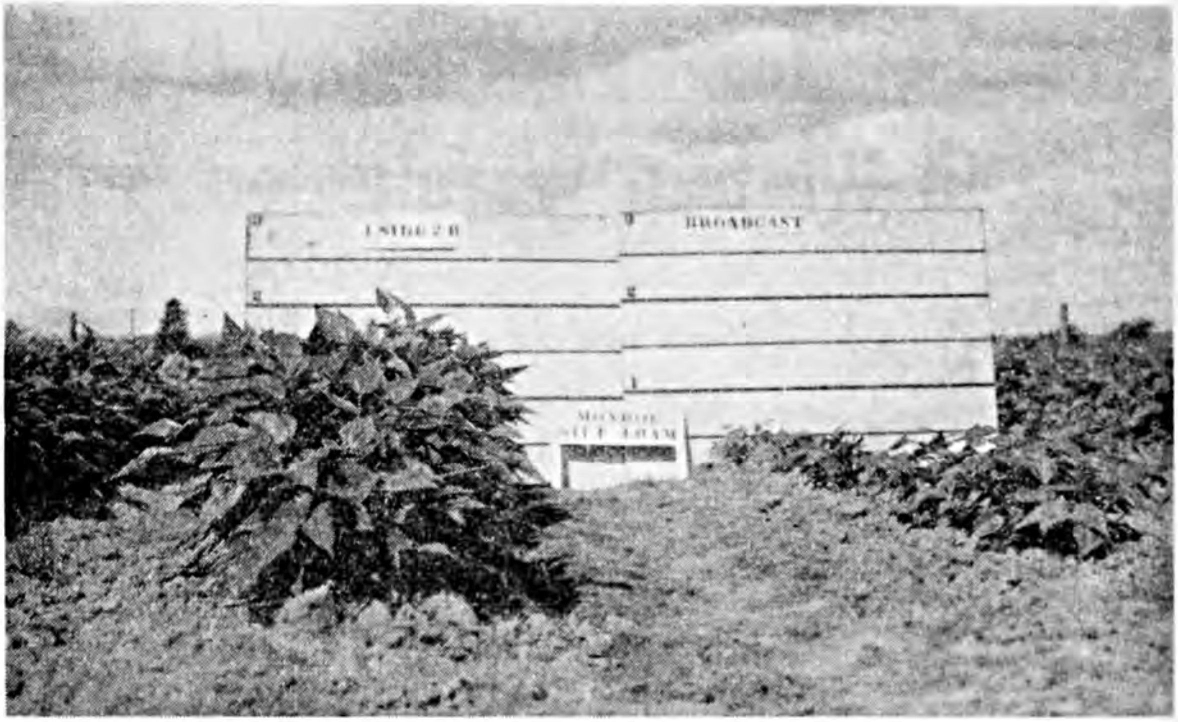

Fig. 1. The response of Idaho Refugee beans from the application of 500 lbs. per acre of 5-15-10 placed in a band one inch to the side of and two inches deeper than the seed (left) and applied broadcast (right).

We have attempted to illustrate what might happen to the broadcast phosphate (Figure 2). The phosphorus in each little particle could rather rapidly be combined with and coated with the insoluble or slowly soluble iron or aluminum compounds, or it could also be converted rapidly to the rather insoluble, slowly available tricalcium phosphate compound. Each particle of phosphate fertilizer in the broadcast treatment is completely surrounded by soil particles from which these "phosphate - fixing" solutions might come. There is experimental evidence to show that the finer the phosphate particle, the more intense the fixation may be. Granular phosphate fertilizers are said to be somewhat superior to the very fine phosphates on high "phos-

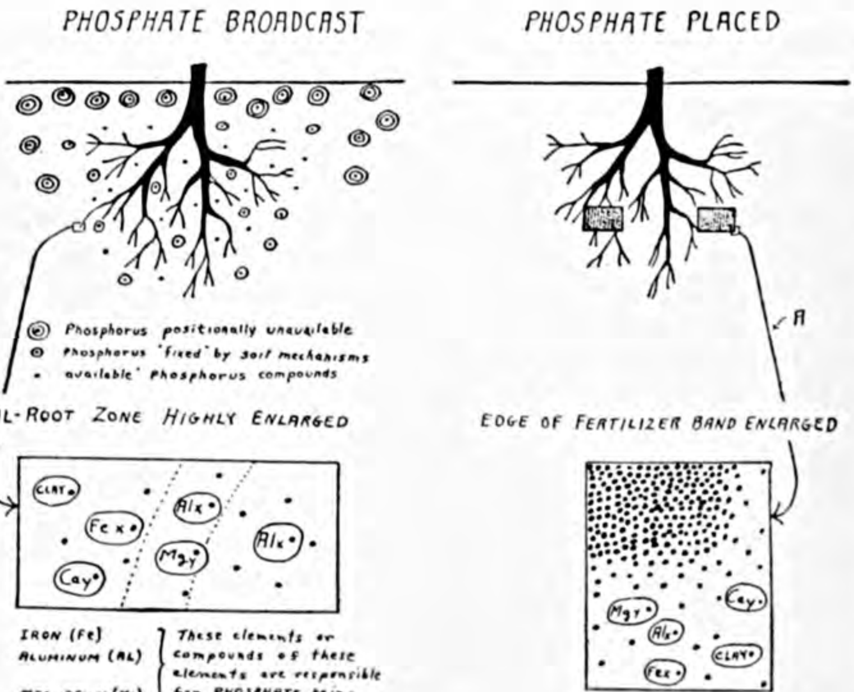

Fig. 2. What might happen when phosphate is broadcast and when it is placed.

phorus-fixing" soils. The factors which may influence the comparative availability of fine and granular phosphates when applied to the soil are discussed in the next paragraph on band application.

When the phosphate fertilizers are applied in bands, the situation is quite different than when applied broadcast. A great part of the phosphate particles are not in contact with the soil particles, hence the phosphate cannot be "fixed" until it is carried in solution from the band out into the soil. The phosphate fertilizer in the band will partially decompose or go into solution in the soil water. This phosphorus-laden water will then move out into the soil surrounding the fertilizer band. The first of this water-soluble phosphorus that moves out of the band into the surrounding soil is probably fixed, but soon all of the free or soluble iron and aluminum has been used or tied up with phosphorus. Then the next quantity of phosphorus solution that moves into the soil is left in a form available to plants. We have reason to believe that this zone of soil surrounding the band and that has been saturated with phosphorus is the area from which plants obtain much of the phosphorus for their needs from the band-applied fertilizer.

Let us assume that we have a fertilizer band (Figure 2) in which heavy applications of phosphorus have been made. Let us assume further that this band of phosphate fertilizer has been in the soil for some time and that soil moisture has been present. The center core (A) in Figure 2 would represent the band-applied phosphate fertilizer, a part of which has broken down, and a part of which is still much as it was when it was originally applied. The dots within circles around the core represent the precipitated or combined iron and aluminum and tricalcium phosphates. The dots represent monocalcium and magnesium, potassium and ammonium phosphates, all of which are quite available to plants. As the distance from the core increases, the quantity of available or soluble phosphorus decreases and the insoluble forms increase in proportion.

There is another thought regarding the matter as to how the phosphorus is "fixed" or made unavailable. There is reason to believe that some of the phos-

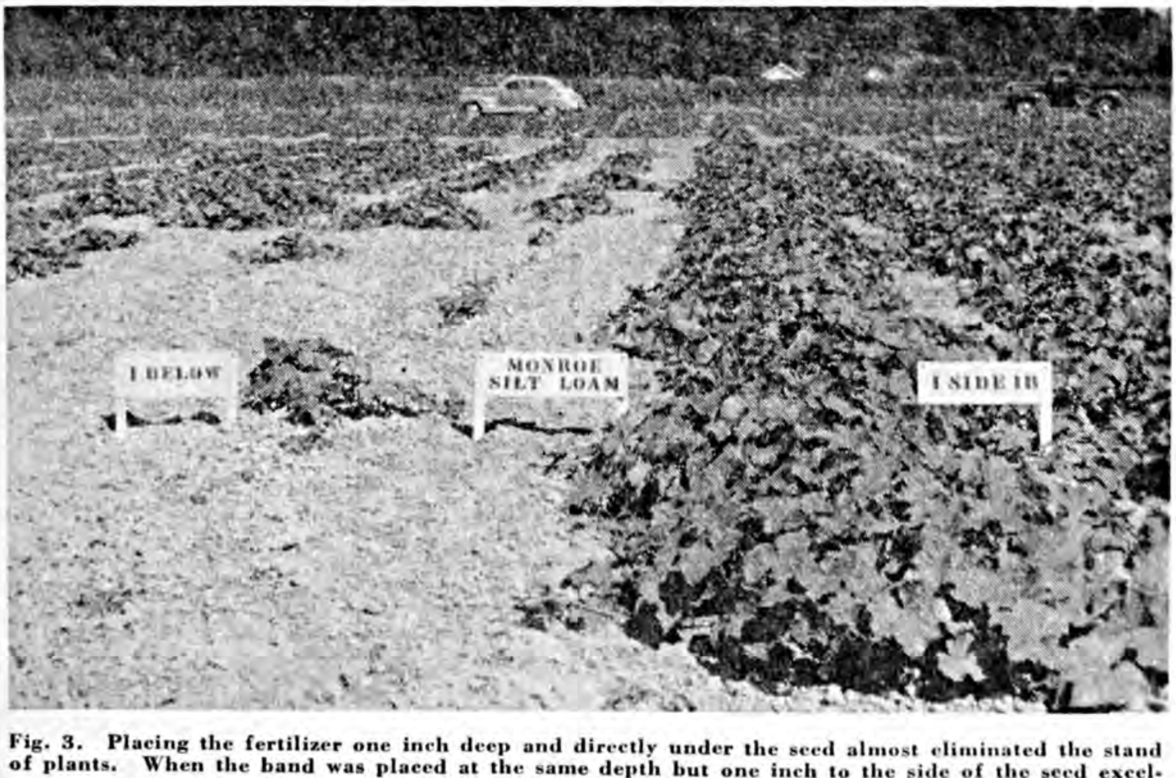

Fig. 3. Placing the fertilizer one inch deep and directly under the seed almost eliminated the stand of plants. When the band was placed at the same depth but one inch to the side of the seed excellent results were obtained.

phorus is "adsorbed" or attracted to the very fine clay particles in the clay soil (Figure 2). This attraction may be so strong that the phosphorus is very difficult to remove by normal soil or soil plant-root processes. The amount of phosphorus fixed by "adsorption" apparently depends on the amount and kind of clay in the soil. In general it may be said that the greater the clay content, the more serious is phosphate fixation.

Broadcast phosphate may also be "positionally" unavailable to plants. When phosphate is disced into the soil some of the particles remain near the surface. The surface inch or two of soil dries very rapidly in regions of low summer rainfall. Roots obtain very little nourishment in the dry soil, therefore, the phosphorus in it is of little value to plants. Stirring the soil by cultivation also prevents the development of feeder roots in the surface soil so that the phosphate mixed with it is said to be "positionally" unavailable, since plant roots are not in contact with it.

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TABLE I.—DOLLAR VALUE OF FERTILIZER PLACEMENT FOR VEGETABLE CROPS IN WESTERN WASHINGTON.

Crop	Year	Location and Soil series	Fertilizer		Yield pounds per acre		Pounds increase due	Value of per crop	Dollar value of increase due to band placement
			Kind	Pounds per acre	Fertilizer broadcast	Fertilizer placed	To fertilizer placement	Pounds in cents	
Beans, bush	1944	Puyallup Sultan	5–15–10	500	7,300	11,000	3,700	5	$185
Beans, pole	1949	Puyallup Sultan	5–15–10	500	11,657	15,919	4,262	5	213.10
Beets, cannery	1944	Puyallup Sultan	5–15–10	600	45,280	48,800	3,520	1	35.20
Beets, seed	1943	Puyallup Sultan	5–15–10	600	2,286	3,565	1,279	20	255.80
Broccoli	1949	Puyallup Sultan	10–10–10	600	7,864	9,589	1,725	6	103.50
Cauliflower	1949	Puyallup Sultan	10–10–10	600	16,647	19,628	2,981	2	59.62
Cucumbers	1946	Puyallup Sultan	10–20–20	400	7,120	22,300	15,180	3	455.40
Peas, market	1948	Sequim Sequim	5–20–20	300	9,700	12,500	2,800	10	280.
Peas, freezing	1945	Chehalis Chehalis	0–20–20	300	2,274	2,656	382	5	19.10
Spinach, cannery	1943	Puyallup Sultan	10–20–20	400	4,812	8,126	3,314	2	66.28
Sweet corn	1948	Puyallup Sultan	5–20–10	400	8,320	10,440	2,120	1	21.20
Swiss chard	1943	Puyallup Sultan	10–20–20	400	59,150	65,980	6,830	15	1,024.50
Potatoes	1948	Puyallup Sultan	10–20–20	750	24,303	29,605	5,302	1	53.02

Know Your Soil

IV. Conestoga Silt Loam
V. Collington Sandy Loam

By J. B. Hester, F. A. Shelton, and R. L. Isaacs, Jr.

Department of Agricultural Research, Campbell Soup Co., Riverton, New Jersey

FIVE years ago in cooperation with the American Potash Institute and the American Cyanamid Company a plan was instituted to apply a ton of 5-10-10 fertilizer, carrying 10 pounds of borax and 20 pounds of manganese sulfate per ton, each year on an acre of ground regardless of the crop grown. This was to be compared with the farmer's regular treatment. The plan was to make a complete analysis of the soil at the end of this period as well as to evaluate the fertility of the soil through greenhouse pot culture work to see what improvement had been made through the use of the fertilizer.

Two of these experiments, one near Lancaster and the other near New Providence, Pa., were located on Conestoga silt loams of similar analysis and characteristics. The rotation on the first soil was tomatoes, wheat, mixed hay, timothy, and corn. The other rotation was tomatoes, wheat, clover, potatoes, and tomatoes. The fertilizer was applied broadcast previous to plowing. The yields of all crops on the fertilized area were substantially higher than the grower's yields.

At the end of the five years, by means of a posthole digger, bulk samples of soil were taken from the plowed depth and the area immediately beneath it and brought to the greenhouse for pot culture work.

The chemical analyses of these soils at the end of the five years are shown in Tables I and II. Table I represents the soil with the two years of sod in the rotation. The original organic matter content of the topsoil was 2.1 per cent. This was increased to 2.9 per cent in the fertilized area and 2.8 per cent on the farmer's area as a result of the rotation. The organic matter content of the subsoil was increased from 0.8 to 1.1 per cent. On the basis of 2,000,000 pounds of soil in each horizon, that would be an increase in organic matter of 8,000 pounds per acre or an increase in nitrogen content of approximately 400 pounds per acre. Actually, 500 pounds of nitrogen per acre were applied during the five-year period.

It was noted that animals feeding on the grass concentrated their grazing in the fertilized area. Obviously, from this standpoint, the animals were getting better quality hay. Chemical analysis of the hay showed an increase in nitrogen, phosphorus, and potash. Data show that the calcium, phosphorus, potash, and manganese contents of the soil were substantially increased. It is possible that the fertilizer carried too much manganese for this soil. However, there was no indication of manganese toxicity. Data support the fact that the soil should analyze between one and five pounds of manganese per acre for best results.

The second rotation was located on a soil that analyzed 2.3 per cent organic matter in the plowed horizon in the beginning of the test. With only one sod crop in the five-year rotation, the

TABLE I.—SOIL TEST FOR FIRST CROP ROTATION.

		pH	Pounds per acre							% Organic matter	Ohms Resistance
			CaO	MgO	Al	N as NO_3	P_2O_5	K_2O	Mn		Salt concentration
Experiment	Top soil	6.7	1,650	270+	0.8	25	60+	219	1.5	2.9	1,150
	Sub soil	6.3	756	214	1.0	14	35	25	8.2	1.1	1,550
Farm Acre	Top soil	6.3	480	270+	1.5	30	37	91	1.4	2.8	1,500
	Sub soil	6.3	146	214	2.1	24	40	16	0.4	0.8	1,550

grower only maintained his organic matter content with his method of fertilization, whereas both the top and subsoil in the fertilized area analyzed 0.3 per cent more organic matter. This amounts to 12,000 pounds of organic matter or approximately 600 pounds of nitrogen per acre. The plant debris from each crop returned considerably more organic matter on the fertilized area. The clover made a substantially larger growth and undoubtedly accounts for a large part of the nitrogen fixation. On the potato crop, the grower used an additional 1,500 pounds of 5-10-10 fertilizer across the fertilized area and an additional 1,000 pounds on the tomatoes, meaning that 625 pounds of nitrogen were actually added to this area during the five-year period. Here again, the calcium, phosphorus, potash, and manganese contents of the soil were substantially increased over the farmer's area, Table II.

When these soils, at the end of the five-year period, were placed in three-gallon coffee-urn-liner pots and planted with tomatoes, the fertilized soil gave

TABLE II.—SOIL TEST FOR SECOND CROP ROTATION.

		pH	Pounds per acre							% Organic matter	Ohms Resistance
			CaO	MgO	Al	N as NO_3	P_2O_5	K_2O	Mn		Salt concentration
Experiment	Top soil	6.1	1,180	232	1.1	16	60	240	6	2.6	1,500
	Sub soil	5.7	280	232	1.6	68	23	360+	11	0.8	160
Farm Acre	Top soil	5.9	812	270	0.4	18	35	102	1	2.3	1,150
	Sub soil	6.2	636	270	2.1	11	52	52	2	0.5	1,200

Hester extraction method.

substantially better yields than the soil from the farmer's area even when additional fertilizer was added to both.

Figure I shows the results of tomatoes grown under greenhouse conditions on the soil from the first crop rotation. Pot 1 represents the grower's area and pot 11 represents the fertilized area without additional fertilizer. Pot 10 represents the grower's area with additional fertilizer for pot culture and the pot on the extreme right represents the fertilized area with the same additional fertilizer treatment as pot 10. The improvement of the soil is evident from this work. The yields of tomatoes on these pots were 596, 795, 1244, and 1404 grams per pot, respectively.

It is clearly brought out by these data that on this particular soil type with these rotations the addition of commercial fertilizer had substantially increased the fertility of the soil.

Fig. 1. Pots 1 and 10—grower's area without and with additional fertilizer. Pot 11 and one on extreme right—fertilized area without and with additional fertilizer.

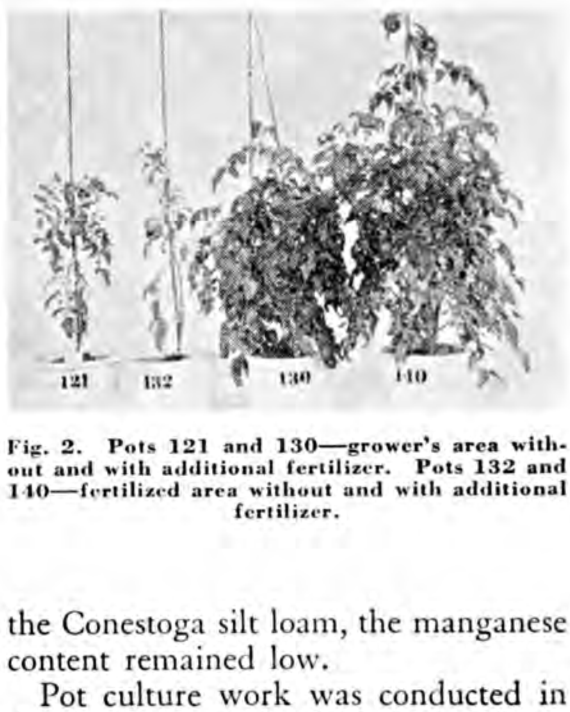

Fig. 2. Pots 121 and 130—grower's area without and with additional fertilizer. Pots 132 and 140—fertilized area without and with additional fertilizer.

Collington Sandy Loam

Located near Marlton, N. J., is a Collington sandy loam on which a ton of 5-10-10 fertilizer per acre has been applied broadcast previous to plowing each year for five years. This soil has been in a rotation of continuous cash crops, namely, tomatoes, tomatoes, sweet corn, rye, and tomatoes. The fertilized acre has yielded substantially increased yields over the grower's acre on all crops.

The analysis of the soil at the end of the five-year period is given in Table III.

With a continuous cash crop program, as followed on this particular soil, the fertilizer did not increase the organic matter content of the soil in either the top or subsoil. The phosphoric acid and potash contents were increased, but because of the heavier growth made on the fertilized area, the magnesium content was decreased. The pH of the soil was increased from 5.5 to 6.2 by the addition of lime. Undoubtedly the lower pH value in the subsoil was due to the leaching of nitrate nitrogen into this area. Unlike the Conestoga silt loam, the manganese content remained low.

Pot culture work was conducted in the greenhouse using both top and subsoil from the fertilized area and the farmer's acre. Figure 2 illustrates the fact that this soil was not built up very greatly by the fertilizer treatment. Pot 121 represents the farmer's acre and pot 132 the fertilized area without any additional treatment. Pot 130 represents the farmer's acre and 140 the fertilized area, both with additional fertilizer. The relative yields of tomatoes were 106, 197, 672, and 812 grams per pot, respectively.

This work, along with that on the Conestoga silt loam, indicates that in order to properly fertilize and farm a soil, it is essential that one understands

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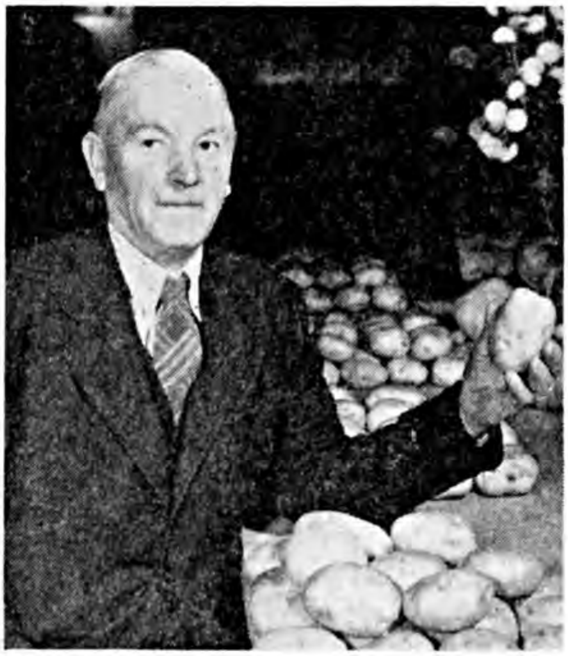
Indiana Muck Crop Champions

By Roscoe Fraser

Vegetable Specialist, Agricultural Extension Service, Purdue University, Lafayette, Ind.



Henry W. Emme—762.55 bu. per A.

Fred Fraser—591 bu. per A.

IN the last 15 years there has been a great development in the 300,000 acres of muck land in northern Indiana.

Not too long ago most of this muck soil was wasteland. Loan companies would not loan money on farms which had very much muck soil on them, and muck farming did not rate very high as an agricultural enterprise. In fact, Indiana's Gov. Schricker says he can remember when bullfrogs were legal tender for the farmers in this area when he was a boy. Some of the farmers gathered bullfrogs in the muck swamps and shipped them by the sackful to Chicago. They then took their express receipts to the local grocer who gave them groceries on these receipts.

Today these muck fields (organic swampland deposits ranging from three to ninety feet deep) are being used to produce high yields of quality potatoes, onions, corn, peppermint, sweet corn, carrots, cabbage, and other vegetables. Many of these comparatively new muck farmers are completely sold on this type of farming and they are anxious to get the newest scientific information on farming muck soil.

Champion 400-bushel Potato Club Grower

Champion potato grower, Henry W. Emme of Butler, Indiana, produced the highest official yield of potatoes ever recorded in the Indiana 400-bushel Potato Club when he grew 762.55 bushels on the best acre of his 17 acres in 1949.

A. & M. Ruderman, Huntertown, were second with a yield of 729.23 bushels; and Gerald Schlictmeyer, Kendallville, was third with a yield of 680.62 bushels.

To win the potato championship,

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Royce Mitchell Succeeds with Complete-farm Plan

By Gordon Webb

Soil Conservation Service, Spartanburg, South Carolina

FOR generations the orators and the editors have been telling us about the New South, a promised land just beyond what we had at the moment. And we've read fine prose about the beauty and beneficence of grass. Agriculturally, today you'll find the New South on Royce W. Mitchell's farm near Tylertown, in South Mississippi. You'll also find grasses and clovers at their best, giving year-around green grazing to top-quality grade and registered Herefords.

Seven years ago, this tall, tanned young farmer with the "smile wrinkles" around his deep-set brown eyes started planned grassland farming. Then, he was a cotton farmer, with a few cattle on native pastures and field gleanings in the fall and winter.

Today he's a livestock farmer. Cotton is gone from his 232 acres, even from the field where he used to pick a bale of cotton to the acre. And it's happened in Walthall County where 10 years ago few people believed you could grow improved pastures. Today, there are more than 32,000 acres of good pasture sods in the county.

Mitchell's farm is in the Knoxo community, where some of the county's first really good pastures were "made." On my first trip to the farm in 1946, the pasture work was getting off to a good start. His pride then (and now) was a 15-acre Dallis grass-white clover pasture. That's his first pasture, now seven years old and as productive as ever.

After going over that lush pasture in 1946, I asked what kind of pasture they had before they began soil conservation farming with help from the district. Royce Mitchell or his brother Gene who farms and also runs the Knoxo community store answered this way: "Well, before we got these good pastures, our cows had to cooperate to make a living on our woods pastures. One cow would bend over a blackjack oak tree while her partner ate off the leaves. Any cow without a partner stood a chance of starvation!"

When I went back to see Royce Mitchell last June, I reminded him of that story.

Maybe the grazing was a little better than that, he told me with a grin. But his present-day pastures of improved grasses and legumes do put the old native pastures "in the shade." And, on a hot day, you'll find his fat Herefords hunting the shade of pines or scattered oak trees by 9 A. M., after grazing their fill.

A Pasture Formula

Mitchell's formula for good pasture sod runs like this:

First, put the right legume or grass or combination of grasses and legumes on the right land. A complete-farm soil and water conservation plan made that possible.

Second, prepare the land well and use plenty of minerals.

Third, use good seed in adequate quantities.

Fourth, maintain the pastures by mowing, fertilizing, and rotation grazing. That, he told me, is the secret of keeping a heavy pasture sod seven years. And he wants to see how long that pasture will stay there without plowing or reseeding.

His grazing plants now include, in addition to Dallis grass and white clover: Pensacola Bahia and Kentucky 31 fescue grasses, sericea lespedeza, Alyce and crimson clover, kudzu, and oats.

When I asked Mitchell how these plants fit into a year-around green grazing program, he thought a minute and decided to start with the oats and the fescue.

"We have the oats and fescue for grazing from about December 1 to March 15," he said. "Crimson clover on the sericea will provide grazing from about February 1 to May 1. Dallis grass-white Dutch clover, Bahia grass, and sericea fill in from about March 15 to about December 1. If we need it, the Alyce clover can be grazed in September and October."

Mitchell's kudzu is young. It is planted mostly on steep slopes cleared last year of brush and scattered trees. How will it fit into the grazing schedule?

"There will be dry years when we need a little more grazing in August and September," Mitchell replied. "It gets a little dry then. I think the kudzu will fill the gap."

The hard-working farmer saves "a little hay" just in case it's needed. Last year he had 1,100 bales of annual lespedeza hay. "We put out about half of the hay during the winter, but most of it was just wasted," he said. "Our cattle walked off and left it."

Maintenance Fertilization

After looking over the seven-year-old pasture, I asked Mitchell about maintenance fertilization. That 15-acre pasture, he said, receives the following minerals every year: One ton of calcium silicate slag, 400 pounds of 20 per cent phosphate, and 100 pounds of muriate of potash to the acre.

I then asked him about maintenance fertilization of the Pensacola Bahia grass, the white clover, the sericea, and the oats. They get exactly the same fertilization, except when he wants to harvest grass seed or grain. That calls for nitrogen, too.

He is giving his five-acre Bahia pasture a heavy shot of nitrogen, hoping to get 200 pounds of seed to the acre. Early in the spring he spreads 150 pounds of ammonium nitrate to the acre. When I talked with him late in June he was planning to remove cattle from the grass, clip it to let all the seed heads come at the same time, apply another 150 pounds of ammonium nitrate, and wait for a seed crop.

Later Mitchell took me to see the Bahia. It was planted in January or February 1945, with white clover.

"Bahia makes such a dense sod that the white clover is almost gone," he pointed out. The knee-high grass, in almost a pure stand because it has crowded out practically everything else including most weeds, already was sending up a few seed spikes. R. Y. Bailey, Management Agronomist for the Soil Conservation Service in the Southeast, believes that reseeding crimson clover is the legume to grow with Bahia. The grass will have to be grazed or clipped closely in the late summer to permit the clover to volunteer.

"Until this year I wasn't enthusiastic about Bahia," Mitchell told me. That was before he put on the ammonium nitrate. "I've just begun to realize that I have something valuable here."

Mitchell was one of the first farmers to receive some muriate of potash through the Walthall County District. He used it in 1945 in planting the five acres of Bahia and white clover and five acres of Dallis grass and white clover.

"That's when I began to realize that we had to have potash for our clovers," he told me. "For one thing, my cows just stayed on the pasture where I used the potash. Then I got some more potash through the district, and put it on half of my older Dallis grass-white Dutch clover pasture in 1945. You

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Above: Royce Mitchell and his 14-year-old son William in their 20-acre pasture of first-year Kentucky 31 fescue (Suiter's grass). Here is winter grazing.

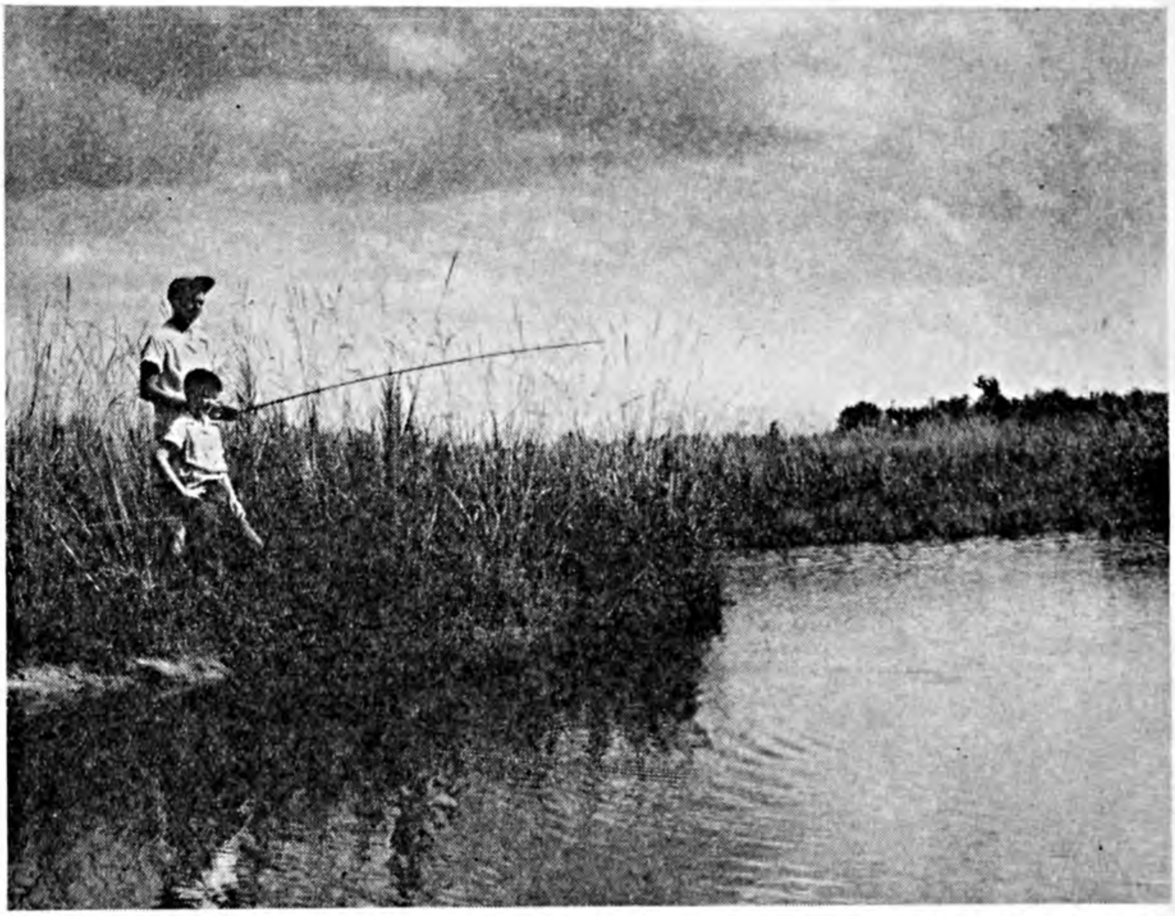
Below: Mitchell's oldest pasture, a seven-year-old sod of white clover and Dallis grass, is kept good by mowing, regular and liberal use of minerals, and rotation grazing.

Above: This is volunteer white clover, a part of 23 acres where oats were grown last fall and winter for grazing.

Below: Mitchell keeps some bees to insure a better clover and seed crop and for honey for the table.

Above: Pastures are mowed two to four times a year to keep them producing forage high in protein.

Below: Good pastures have to be made and kept that way. Here manure is being spread on galled spots.



Above: And there is fun right at home. Bass and bream abound in the two livestock and fish ponds on the farm.

Below: The Mitchell's new home—the payoff in better living on better land.

The Editors Talk

An Important Anniversary

On September 28-29 the Connecticut Agricultural Experiment Station celebrated its 75th anniversary. This was more than "just another birthday" for it commemorated the establishment of the first agricultural experiment station in America and the oldest institution of its kind in the Western Hemisphere.

More than 200 delegates, representing agriculture and science in this country and abroad, attended the two days of fitting ceremonies. Talks and a symposium on "The Research Institute in Modern Society" paid tribute to the march of science not only in agriculture but in allied industries. Arnold Nicholson, Managing Editor of the Country Gentlemen, in tracing the history of the agricultural experiment station movement since the establishment of the first station in Connecticut in 1875, said, "It would be hard to find, in history's pages, a development as perfectly matched to the times as the flowering of the agricultural experiment station idea in the last quarter of the 19th century. That was when we built the foundation for the industrial might that makes this nation great today; and our complex of iron and steel, steam power and transportation grew on the release of manpower from the land. Science and mechanical invention were the means for that release."

He pointed out that in 1875 there were eight Americans employed directly in agriculture for every ten in other pursuits. By 1917, only one American in four was engaged in farming and today the figure is one in fourteen and a half. Along with the industrial revolution and the movement of workers from the farms to the cities came specialization in farming, beginning in New England and spreading across the continent. Specialization brought problems unknown before. With the concentration of crops and animals in given areas, new questions about fertility and disease arose, and the discovery of breeds and varieties to meet special market needs grew in importance. Not only did the experiment stations keep pace, but in many instances their discoveries determined the futures of whole regions. Today, the findings of the stations influence and benefit nearly every farm family in the land, and the farmer's faith has been won by the experiment stations for their answers to his production problems.

Looking ahead, Mr. Nicholson is of the opinion that the next great task before the stations is that of bending their efforts to aid the farmer in his problems of processing and distribution. "There is gloom in the marketing field," he said, "and farmers would prefer the light of science to political tampering with our economic system. While some work is already under way through the provisions of the Research and Marketing Act, more needs to be accomplished to meet the needs of the situation."

Will another 75 years of agricultural experiment stations mean as much to American agriculture as the past 75-year period? Our guess is—yes. With science playing an ever-increasing role in the well-being of our daily lives, we have as much or more need for "proven results" today as we did in 1875. And we wish we might be around when the Connecticut Station celebrates its 150th anniversary!

Weeds? As Soil-builders?

The dictionary defines a weed as any plant growing in cultivated ground to the detriment of the crop or to the disfigurement of the place; an economically useless or unsightly plant. Now comes a release from the New Jersey Agricultural Experiment Station stating that some day you may be proud of the weeds growing in your garden or on your farm.

The statement is based on the fact that Dr. Firman E. Bear, Head of the Soils Department at Rutgers University, is not so sure that all weeds are the villains they have been made out to be. He thinks there is reason to believe that many weeds make highly important contributions in mobilizing minor elements in the soil.

For example, ragweed and lamb's quarter, two common weeds, are excellent accumulators of zinc. Dr. Bear holds that they might be deliberately grown for the purpose of restoring that element to a zinc-deficient soil. He mentioned weeds in pleading the cause of more organic material in the soil at the annual conference of fertilizer manufacturers and dealers at the New Jersey College of Agriculture on September 28. There is need, he said, not only for getting more organic matter into the soil, but a variety of kinds of organic matter. Certain weeds may provide this variety.

We personally hope that a necessity for the cultivation of weeds may be a long way off. And we liked his emphasis on the fact that right now the most important thing to be done toward maintaining organic matter and good soil structure is to plant a mixed grass and legume crop once every third or fourth year. Then fertilize it liberally and keep it on the land at least one full year.

Foundation Seed Program

Organized by the State Agricultural Experiment Stations and the U. S. Department of Agriculture, the Foundation Seed Program bids fair to become a very important aid in the conversion to grassland farming so greatly needed on millions of acres of our croplands. One of the chief obstacles to farmers who have wanted to grow more forage has been the scarcity and high prices of grass and legume seed.

The objective of the program is to make available and maintain adequate supplies of foundation seed stocks of superior varieties of grasses and legumes and to preserve their identity through seed certification. Too often after expensive and laborious preparation for grassland farming, growers have experienced failures because of unreliable or unadapted seed.

The program is now well under way with 30 states cooperating. Local seed certification agencies and qualified specialists visit seed-producing areas to study improved selections which may prove useful in other sections of the country for feeding and for soil improvement. Last year, under the program, the production of foundation seed stocks of Tift Sudan grass, Kenland red clover, and Atlantic alfalfa, which originated in New Jersey, was begun. It is hoped that by this fall there will be enough seed of Tift Sudan grass to keep it in adequate supply. Supplies of about 50,000 pounds of Kenland red clover and 2,500 pounds of Atlantic alfalfa are expected. Other new varieties are being brought into the program as it develops, against the goal that within the next few years all the improved varieties of forage crops will be available to farmers at reasonable prices.

It is planned activity such as this which helps keep the future of our agriculture looking bright.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
October	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....
May	29.24	48.5	128.0	228.0	134.0	204.0	17.25	45.20	....
June	29.91	49.7	127.0	211.0	136.0	193.0	16.05	46.20	....
July	33.05	45.5	127.0	208.0	144.0	199.0	15.15	52.00	....
August	36.95	53.1	122.0	218.0	144.0	197.0	15.45	70.90	....
September	39.98	55.4	105.0	192.0	144.0	194.0	15.55	78.80	....

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

Crop Year	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	89	81	109	74	87	110
1938	69	196	80	79	76	64	57	97	88
1939	73	154	100	84	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	105	117	107	82	211	129
1942	153	369	168	134	143	124	91	202	163
1943	160	405	188	235	174	154	125	231	245
1944	167	420	214	216	170	160	139	234	212
1945	181	366	205	232	198	170	127	227	224
1946	263	382	178	248	212	209	141	319	204
1947	257	380	232	248	336	259	148	381	249
1948	250	387	220	249	212	232	160	301	238
1949									
October	231	474	187	224	170	214	141	185	170
November	224	434	192	216	159	215	141	188	213
December	214	454	188	230	176	218	144	192	196
1950									
January	213	397	195	245	179	217	144	193	261
February	222	341	191	252	181	218	141	193	203
March	226	320	189	253	185	224	139	191	168
April	232	...	192	260	196	227	140	197	205
May	236	485	184	260	209	231	145	200	178
June	241	497	182	240	212	218	135	205	182
July	267	455	182	237	224	225	128	231	200
August	298	531	175	248	224	223	130	314	164
September	322	554	151	219	224	219	131	349	126

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19
May	3.00	2.05	10.74	11.97	10.14	7.59
June	3.00	1.71	10.55	10.79	9.41	7.36
July	3.00	1.71	11.53	10.71	9.35	8.74
August	3.00	1.71	11.44	11.06	10.62	9.87
September	3.00	1.71	11.44	10.85	10.85	10.32

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233
May	112	72	307	339	301	216
June	112	60	301	306	279	209
July	112	60	329	303	277	248
August	112	60	327	313	315	280
September	112	60	327	307	322	293

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate, Balti-more, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200
April	.760	3.76	5.47	.375	.720	14.50	.200
May	.760	3.76	5.47	.375	.720	14.50	.200
June	.760	3.76	5.47	.336	.647	12.77	.176
July	.760	3.76	5.47	.368	.704	13.98	.193
August	.760	3.76	5.47	.368	.704	13.98	.193
September	.760	3.75	5.47	.368	.704	13.98	.193

Index Numbers (1910-14 = 100)

	Super-phosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash in bags	Sulphate of potash magnesia	Manure salts
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83
April	142	104	112	68	76	60	83
May	142	104	112	68	76	60	83
June	142	104	112	63	68	53	80
July	142	104	112	67	74	58	82
August	142	104	112	67	74	58	82
September	142	104	112	67	74	58	82

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949								
October	242	237	222	138	98	331	144	72
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	223	135	96	313	142	72
May	247	244	228	132	91	311	142	72
June	247	245	230	126	85	293	142	66
July	263	247	238	128	85	301	142	70
August	267	248	243	131	85	321	142	70
September	272	250	247	131	85	324	142	70

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Response of Crops to Various Phosphate Fertilizers," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Bul. No. 270, Feb. 1950, L. E. Ensminger.

"Fertilizer Recommendations for Alabama," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., July 1950, M. J. Funchess.

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended June 30, 1950," State Dept. of Agr., Sacramento, Calif., Bur. of Chem. Announcement No. FM-200, Aug. 18, 1950, A. B. Lemmon.

"Production and Value of Poultry Manure," Agr. Exp. Sta., New Haven, Conn., Spec. Bul. Soils VII/250, June 1950, H. G. M. Jacobson and C. L. W. Swanson.

"Fertilizer Analysis—Spring 1950," Kans. State Brd. of Agr., Control Div., Topeka, Kans., Aug. 1950.

"Fertilizers For Sugar Cane," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., W. G. Taggart.

"The Control of Some Soil-Borne Diseases of Plants by Fungicides Applied to the Soil in Fertilizer," Agr. Exp. Sta., Amherst, Mass., Bul. No. 455, Mar. 1950, W. L. Doran.

"Fertilizer Inspection and Analysis; Spring, 1949," Agr. Exp. Sta., College of Agr., Univ. of Mo., Columbia, Mo., Bul. No. 538, Apr. 1950, J. H. Longwell.

"Selecting and Using Fertilizers in Utah," Agr. Exp. Sta., Logan, Utah, Cir. 126, June 1950, D. W. Thorne, E. M. Andersen, and D. W. Pittman.

"Crop Response To Phosphate Fertilizer in Virginia," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 115, June 1950, C. I. Rich and J. A. Lutz, Jr.

"20 Questions and Answers on Orchard Fertilization," Ext. Serv., Wash. State College, Pullman, Wash., Ext. Bul. 426, July 1950, N. R. Benson, R. M. Bullock, R. C. Lindner, F. L. Overley, L. P. Batjer, A. H. Thompson, T. W. Embleton, and C. O. Stanberry.

"Effect of Fertilizers on the Chemical Compositions of Plants and on Their Value as Feeds," Agr. Exp. Sta., Wash. State College, Pullman, Wash., Sta. Cir. 103, June 1950.

"Distribution of Boron in the Tissues of the Apple Tree," W. Va. Univ., Morgantown, W. Va., Sci. Paper 375, G. Clulo and A. Berg.

Soils

"Soils of the Different Regions in Kentucky," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Cir. 67, Mar. 1950, P. E. Karraker.

"Some Physiological Effects of Excess Soil Moisture on Stayman Winesap Apple Trees," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 694, June 1950, N. F. Childers and D. G. White.

"4-H Club Soil and Water Conservation," Ext. Serv., Okla. A & M College, Stillwater, Okla., Cir. 518, E. Roberts.

"Economic Land Classification of Spotsylvania County," Agr. Exp. Sta., Blacksburg, Va., Bul. 429, Jan. 1950, G. W. Patteson and A. J. Harris.

"Economic Land Classification of Isle of Wright County," Agr. Exp. Sta., Blacksburg, Va., Bul. 430, Jan. 1950, G. W. Patteson, Z. M. K. Fulton and A. J. Harris.

"Cover Crops in Apple Orchards on Arsenic-toxic Soils," Agr. Exp. Sta., Wash. State College, Pullman, Wash., Bul. 514, Mar. 1950, F. S. Overley.

"For Insurance Against Drought, Soil and Water Conservation," USDA, Wash., D. C., Farmers' Bul. 2002, Mar. 1950, T. Dale.

"Soil Survey, St. Joseph County Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Series 1938, No. 27, June 1950, H. P. Ulrich, A. P. Bell, S. Myers, L. E. Allison, B. A. Kranz, and P. T. Veale.

"Soil Survey," Agr. Exp. Sta., Ames, Iowa, Series 1938, No. 22, Feb. 1950, A. R. Aandahl, R. W. Simonson, T. H. Benton, E. Riley, J. A. Elwell, R. R. Finley, K. H. Hansen, and R. E. Henderson.

Crops

"Year-Round Use of Land for Grazing Grade Steers in the Tennessee Valley," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Prog. Rpt. Series No. 43, Mar. 1950, F. Stewart, C. H. Johnston, and J. K. Boseck.

"The Alabama Farm Program," Agr. Ext. Serv., Ala. Poly. Inst., Auburn, Ala., Ext. Cir. 337, Nov. 1946.

"Grass Seed Production," Agr. Exp. Sta.

Univ. of Ariz., Tucson, Ariz., Bul. 228, July 1950, L. P. Hamilton and W. M. Wooton.

"Sixtieth Annual Report for the Year Ending June 30, 1949," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz.

"Growing Begonias in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 162, Jan. 1950, H. M. Butterfield.

"The Water-Culture Method for Growing Plants without Soil," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 347, Jan. 1950, D. R. Hoagland and D. I. Arnon.

"Annual Report of the Director for the Fiscal Year Ending June 30, 1949," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 283, Jan. 1950.

"Agricultural Experiment Stations, Annual Report for the Fiscal Year Ending June 30, 1949," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla.

"Garden Chrysanthemums For Florida," Agr. Ext. Serv., Gainesville, Fla., Cir. 94, July 1950, J. V. Watkins.

"Report Florida Agricultural Extension Service for the Fiscal Year Ended June 30, 1949," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla.

"Avocado Production in Florida," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Bul. 141, Dec. 1949, H. S. Wolfe, L. R. Toy, and A. L. Stahl.

"Sixty-first Annual Report, July 1, 1948—June 30, 1949," Agr. Exp. Sta., Univ. of Ga., Experiment, Ga.

"Deficiency Symptoms in Plants," Agr. Exp. Sta., Univ. of Ga., Experiment, Ga., Cir. 165, June 1950, L. C. Olson.

"Fruit Growing," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Bul. 518, Nov. 1948, G. H. Firor.

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Some Recent Books

The Production of Tobacco, by W. W. Garner (Blakiston Company, Philadelphia, Pa., 1946. $4.50). This is the most complete book available on the subject of tobacco growing and handling. The author has spent nearly 40 years conducting and directing investigations on tobacco in the United States. The book is divided into three main parts covering the industrial, production, and scientific aspects of tobacco. The origin of tobacco growing, the commercial classifications, the culture of the various types, domestic and foreign, harvesting, curing, marketing, and scientific investigations of physiological, chemical, biological, and genetic relationships are discussed. Practical agricultural, scientific, and commercial aspects of the tobacco industry are well covered.

Vegetable Crops, by H. C. Thompson (McGraw-Hill Book Company, Inc., New York, 4th Edition, 1949. $6.00). The Fourth Edition of this well-known book on vegetable crops is similar to the previous editions. The subject matter, especially with reference to fertilizer recommendations, varieties, insecticides, and herbicides, has been brought up to date. New material on marketing and canning vegetables also has been added. This is one of the most complete books on vegetable crops and is an excellent reference as well as textbook.

A young Augusta (Kansas) mother was discussing with an older woman the arrangement "worked out" with her husband about feeding the baby in the wee-small hours. "Who in your family got up to feed the baby at night?" she asked the elder.

"Well, she paused, "it certainly wasn't my husband. You see, young lady, we didn't have bottles then."

His health wasn't any too good, so the Eastern city-dweller went looking for a place to live in the Southwest. In one small town in Arizona, he approached an old-timer sitting on the steps of the general store. "Say," he asked, "what's the death rate around here?"

"Same as it is back East, bub," answered the old fellow, "one to a person."

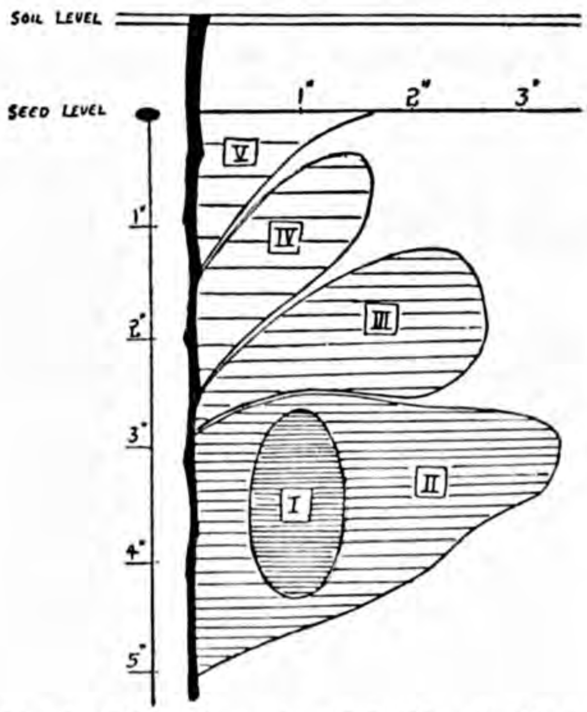
Band the Fertilizer for Best Results . . . .

(*From page* 20)

Such phosphate is shown as double circles ◎ in Figure 2.

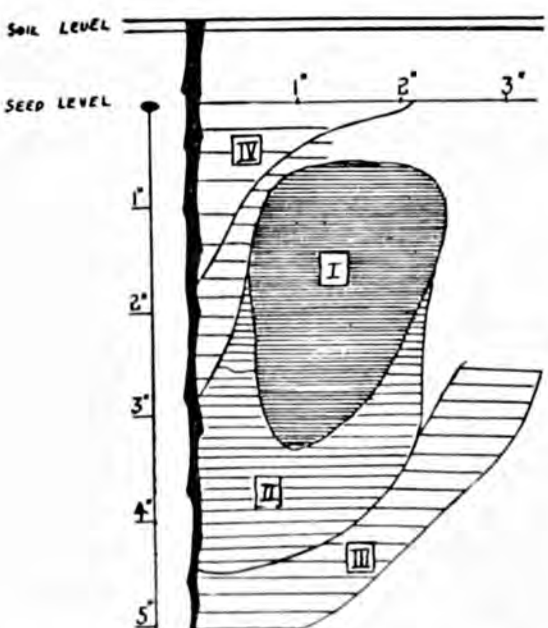
Whatever the mechanism involved may be, phosphorus is not available in sufficient quantities in most western Washington soils for good growth of crops. Furthermore, only a little of the broadcast-applied phosphate fertilizer is utilized by crops. A great number of measurements comparing the relative response from broadcast and band-applied fertilizers have been made in many sections of western Washington. The fertilizers on the broadcast plots were worked into the soil with a spring-tooth harrow or a disc just previous to planting. The fertilizers in the band treatments were applied during the seeding operation. The information in Table I indicates the dollar value of band application over the broadcast application.

There are other benefits that may be derived from the band applications of fertilizers. Weed control for example has usually been easier in the plots in which the fertilizers were banded. When fertilizers were broadcast and disced into the soil, the weeds as well as the crop over the entire area were fertilized and stimulated. When the fertilizers were banded, the effect of the fertilizer was mostly on the crop planted, since



AREA	YIELD PER ACRE TONS
I	5
II	4½-5
III	4-4½
IV	3½-4
V	1½-2

Fig. 4. Effect of position of fertilizer band on yield of Idaho Refugee bush beans.



AREA	YIELD PER ACRE TONS
I	17-20
II	14-17
III	11-14
IV	5-11

Fig. 5. Effect of position of fertilizer band on yield of pickling cucumbers.

the area between the row received no fertilizer.

Band application of fertilizer has speeded up the maturity of sweet corn from 10 to 18 days when compared to plots in which the fertilizer was applied broadcast. This is an extremely important factor in western Washington where the season is short for sweet corn production. The same effect has been noted on certain other crops.

The position of the fertilizer band for best results varies with the crop, (Figures 4 and 5). In general it may be said that, under ideal moisture conditions, placement of the band from two to five inches directly under the seed is best for taprooted crops. Carrots, for instance, have responded best when the fertilizer was placed five inches deep directly under the seed. Unfortunately, injury may occur from placement directly under the seed in years or areas in which droughts occur during germination and early growth of the plants, (Figure 3). Because of the possibility of injury during unfavorable seasons, the band should be placed an inch or two to the side of the seed as well as below the level of the seed. Fibrous-rooted plants for the most part gave best results when the fertilizer was placed one or two inches to the side of the seed and an inch or two deeper than the seed. The recommended position of the fertilizer band or bands in respect to the seed or plants for western Washington conditions is listed in Table II.

Machinery for proper placement of fertilizer is available for some crops. Most potato planters which have fertilizer attachments may be adjusted so that the fertilizer may be placed in the desired positions. Certain planters commonly used for seeding beans in western Washington have satisfactory fertilizer distribution attachments. These bean planters may also be used for the planting of pole peas and cucumbers. In such cases the fertilizer openers are mounted on the cultivator bars of the tractor and so spaced to line up with the seeding equipment which is either mounted on the rear of the tractor or is pulled by it. When this cannot be done perhaps the next best bet is to apply the fertilizer as a sidedressing, as close to the plants as possible when the plants are large enough for the first cultivation.

TABLE II.—SUGGESTED POSITION OF FERTILIZER BAND OR BANDS

Crop	Number of bands	Position of fertilizer band or bands in relation to seed or seedpiece
Sweet or field corn	1	1″ to side, 1″ deeper than
Pole beans	2	2″ to side, 2–3″ deeper than
Pole peas	1 or 2	2″ to side, 2–3″ deeper than
Potatoes	2	2″ to side, ½″ deeper than
Bush beans	1 or 2	1–2″ to side, 2–4″ deeper than
Carrots	1	1″ to side, 3–5″ deeper than
Broccoli	1 or 2	2″ to side, 3″ below topsoil
Cabbage and seed cabbage	1 or 2	2″ to side, 3″ below topsoil
Peas, freezing and canning	1	½″ to side, 1″ deeper than seed (or predrill in bands before seeding)
Raspberries and blackberries	2	12″ to side of, 3–4″ deep; distance from plants will be determined somewhat by root growth.
Spinach	1	½–1″ to side, 2–3″ below soil
Red beets	1	½–1″ to side, 2–3″ below soil
Red beets for seed	1	Directly below center of beet
Cucumbers for pickles	2	2″ to side, 2″ below topsoil

Season-Long Pasture

A SEASON-LONG pasture program requires the use of high-yielding forage crops in New England, according to Herbert O. Allbritten, Extension Agronomist and the Rhode Island judge in the regional team for the Green Pastures contest last year. "I saw the top pastures of New England the last two weeks of August under severe drought conditions," he says. "In every case the men who had their soil in a high state of fertility had better pastures and hay crops than those using fertilizer on a limited scale."

The 18 leading farmers, three top men in each of the six New England states, used a total of 1,430 tons of lime, slightly more than a half ton for each acre of improved land, or more than a ton of lime per animal unit on these farms. No doubt, these men have been using lime as a part of their soil fertility program for many years. They bought 815 tons of fertilizer within the year, an average of 600 pounds of fertilizer per acre of land in feed crops, or a total of 1,250 pounds of fertilizer per animal unit on the farms.

To produce from three to five tons of dry forage or 12 to 20 tons of green weight as silage or pasture feed per acre, the soil must be well fertilized. With the New England leaders seeding more acres of ladino clover and alfalfa in grass mixtures, they are using fertilizer grades high in potash and phosphoric acid. Ladino and alfalfa need a medium to high level of fertility for the minerals—phosphorus, potassium, and calcium—for persistence of stand and high acre yields. Mr. Allbritten points out that potash is the fertilizer most likely to be deficient on ladino and alfalfa fields, and remarkable responses to liberal applications may be expected.

He reports that "several of the men bought potash and applied it direct or with manure and superphosphate. Others bought fertilizer with an 0-1-1 ratio, such as 0-14-14 or 0-20-20, for topdressing pastures and hay fields largely in clover and alfalfa." For ladino, 600 pounds of an 0-20-20 fertilizer or any fertilizer furnishing 120 pounds of P_2O_5 and K_2O each per acre should be adequate for the year. When the forage becomes mostly grasses and the legumes thin out, a common fertilizer ratio used was a 1-2-2, such as a 5-10-10 or an 8-16-16 grade. Some went so far as to use a high-nitrogen fertilizer such as found in a 1-1-1 ratio.

All these men ranking high in pasture improvement work believe in the need for annual topdressing of pastures and hayfields. As to the best time of year, it doesn't matter too much whether the fertilizer is applied in the fall or spring, and the timing should depend largely on the seasonal labor and the draining pattern of the farm. Some of the fertilizer may be applied after the first cutting of hay or silage to stimulate a second growth. Where a heavy annual topdressing is practiced, two applications of the fertilizer would give better results than one application of all of it.

"Farmers and agronomists differ as to the wisdom of applying nitrogen fertilizers to legume grass mixtures," Mr. Allbritten says. "Some believe the persistence of ladino is threatened by the stimulated growth of the grasses and withhold the nitrogen until the ladino thins out for other reasons. But some had topdressed with manure or complete fertilizers without any apparent damage to the legumes in the stand. Perhaps the most common practice would be to omit nitrogen for the first two years while ladino predominates the total forage growth. It is suggested, though, that all legumes should have the seed inoculated before seeding to insure good nodule formation and the promotion of nitrogen fixation from the air."

Irrigation of pastures brings additional fertilizer problems. With highest moisture conditions, pastures and hay land will need several light applications of fertilizer per year. Irrigation should and will increase the acre rates of fertilizer needed for pasture land, Mr. Allbritten believes. . . *H. M. Hofford, Extension Editor, Rhode Island State College, Kingston, R. I.*

Tung Trees Triple Oil Yield Through Research

Five hundred thousand improved tung trees in the Gulf Coast region provide a clear-cut example of the value of varied research in increasing the efficiency of a crop. From a few seeds brought from China less than 50 years ago, the industry has increased until the growers actually turn out $5,000,000 worth of nuts containing more than 50 per cent high-grade drying oil. This is small compared with the value and production of major crops. But according to Dr. Felix Lagasse, Tung Specialist of the U. S. Department of Agriculture, and cooperators at the Florida Experiment Station, the domestic crop sometimes assumes high importance and in the future will no doubt fill more of the industry's needs. During World War II, he says, tung oil, because of very special uses, "was considered a strategic material."

The half million improved trees are the result of the growers' readiness to set out trees of seedling progenies which the research men have found and tested. These trees yield three times as much oil as the early untested seedling trees. But, according to Lagasse, research has brought in other improved factors besides those of selections.

For example, it is now possible to tell what kind of soils are best suited to tung trees. Mineral deficiencies—such as copper, manganese, or potash—have been plainly revealed by certain patterns in the leaves and by careful leaf analysis.

They have learned the fertilizer needs of trees of different stages and what time of year to put it on; what cover crops cut production costs; a sure-fire way to germinate the seed; found what pre-emergence 2,4-D spraying is a practical method of weed control; a more accurate and cheaper method of oil analysis to check up on new varieties and methods; and engineers have devised better tung nut drying equipment. But there is more payoff from research than from the tung industry itself. Lagasse says that results from soil, nutrition and cultural studies with tung nuts are apt to prove useful on any number of other crops. Already the new oil determination method is being tried on peanuts and orange and grapefruit seed meals. And it is possible that corn and crotalaria will benefit from the same mineral treatment.

"You know, politicians don't have it so easy."

"Why not?"

"You try straddling a fence and keeping both ears to the ground."

* * *

Football season: The time of year when you can walk down the street with a blonde on one arm and a blanket on the other and no cop gives you a funny look.

An exchange tells of overhearing a woman shopping for a pair of pants for her little boy in a large department store recently.

"Do you want knickers with a zipper?" asked the clerk.

"No," she replied, "Johnnie has a sweater with a zipper and he's always getting his tie caught in it."

Know Your Soil

(*From page* 23)

the problems connected with the soil. It is not known whether or not a sod rotation in the Collington sandy loam would have resulted in a build-up in organic matter content similar to the Conestoga silt loam, but the continuous cash crop rotation did not result in a great improvement.

TABLE III.—SOIL TEST FOR COLLINGTON SANDY LOAM.

		pH	Pounds per acre							% Organic matter	Ohms Resistance
			CaO	MgO	Al	N as NO_3	P_2O_5	K_2O	Mn		Salt concentration
Experiment	Top soil	6.2	192	126	1.1	11	60+	166	0.8	1.2	2,150
	Sub soil	5.3	230	186	3.8	26	14	91	0.9	0.6	850
Farm Acre	Top soil	5.5	86	270+	3.1	8	18	86	1.0	1.2	2,900
	Sub soil	5.5	125	270+	6.7	9	24	16	1.0	0.6	1,600

Hester extraction method.

Royce Mitchell Succeeds . . . .

(*From page* 26)

could look at that pasture and tell to the exact line where I put the potash."

With a grin, I asked Mitchell if he always had fertilized grass and clover as liberally as he does now.

"I used to put it out this way," he said, swinging his arm and rubbing his fingers like he was sprinkling a little fertilizer. "But we haven't lost any money on seed and fertilizer so far," he added.

The "we" includes Mr. and Mrs. Mitchell's 14-year-old son, William. A 4-H Club member, William has won first place in the Walthall County fat calf show for club boys every year beginning in 1945. And the calf he showed in the county in 1944 placed first in the district show at Hattiesburg, ahead of the Walthall winner. Assistant County Agent N. J. Taylor helps William with his calf club work.

William put in savings bonds his 1944 winnings—$800, a dollar a pound for his district champion. He has turned other winnings into savings bonds. His goal—a degree in animal husbandry from Mississippi State College.

"I hope he'll get some courses in business administration and soils, too," the father said. "Of course, I'd like to have William come back and be a partner with me in beef cattle farming, but I'm leaving that up to him."

You can see many other benefits of grassland-soil conservation farming on the Mitchell place. Since I first went to this farm, Mitchell has built a modern home, a large barn, and a tool shed.

Last June, I saw an almost-new tractor and mower clipping weeds in the pastures. A truck was being used to haul manure to a few galled spots on a hillside. Under the tool shed were a combine, a fertilizer distributor-seeder, and other modern equipment.

Pasture Summary

After walking over the pastures we cooled in the shade of a pecan tree near the house and began to summarize the pasture acreages this year:

30 acres of Dallis grass-white clover.

20 acres of Kentucky 31 fescue planted last fall and grazed only three weeks because Mitchell's cattle have plenty to eat elsewhere.

15 acres of white clover growing in a stand pure enough to harvest seed. The cattle spread the clover seed to this land while grazing small grain or Alyce clover.

10 acres of white clover planted in 1945.

15 acres of sericea, overseeded with crimson clover for winter grazing.

12 acres of young kudzu, yet to come into grazing.

23 acres of oats for grazing. This land has such a good volunteer stand of white clover that it could be classed as white clover pasture.

30 acres of oats for grazing and for grain. In June, Alyce clover following the oats was just coming up. All the oat stubble had been returned to the soil, and it was filled with organic matter. The Alyce clover can be used for grazing, for seed, or for hay, depending on the needs of his cattle.

Row Crops

With this summary before me, I thought of two questions.

The first was, "What about row crops?"

"Five acres of corn," he said. "We need some corn for feed around the farm, and for meal. The rest of my land is in protected woods including six acres of planted pines, in two farm ponds, and in the house and barn sites."

Later we saw the corn patch — hybrid and open-pollinated corn that looked like it should be in the Midwest, not in the deep South.

The second question was, "How about the oat yields?"

"We got between 1,000 and 1,100 bushels from 20 acres of Victor grain oats," he replied. "That's more than 50 bushels an acre. I think the clover crops and fertilization are the secret of the good yields we made."

Seed Crops

Seed crops are more than a by-product on this livestock farm, yet, as the owner explained, "We never save a crop of seed if we're short of grazing." Ten acres of white clover, across the road east of the house and above the big farm pond, averaged more than 100 pounds of clean seed to the acre this year. This same land has yielded as many as 400 pounds of Alyce clover seed to the acre. This year's seed crops of crimson clover and fescue were light. It was Mitchell's first experience with them. He said he believed he might have saved more than 50 pounds of fescue seed to the acre if his cattle had grazed it longer.

When I saw the fescue, it was soon after he had combined seed. It was the densest, rankest, first-year fescue I've seen. There was reason: Seeding on a well-prepared seedbed, a ton of calcium silicate slag, 100 pounds of muriate of potash, 600 pounds of 20 per cent phosphate, and 200 pounds of ammonium nitrate at seeding time in October 1949 plus 200 more pounds of ammonium nitrate this spring. Some of the fescue seed will be planted in the brush-covered hollows—the only idle land now on the farm. Mitchell said he believes the fescue sod will hold up his cattle on the wet-natured land.

The farm now is carrying 87 grown and young cattle, with a surplus of grazing at most seasons of the year. Mitchell has 40 brood cows, hopes to have 60 eventually. He sells grass-and-milk-fat calves when they weigh between 500 and 600 pounds.

Two registered Hereford bulls are on the farm. The old herd sire is of Domino breeding. The young bull, yet to be placed with the herd, is of the Baldwin line. County Agent Ansel Estess helped Mitchell select the young bull. The herd now includes 11 registered cows, 5 registered heifers, and 5 young bulls selected to be sold as registered animals.

Looking back to the time when the Soil Conservation Service helped him make a complete-farm soil and water conservation plan, Mitchell told me:

"I never did any real farming until I got a farm plan."

Indiana Muck Crop Champions

(*From page* 24)

Mr. Emme planted 33 bushels of certified Prince Edward Island Katahdin seed potatoes to the acre with a planter which put the fertilizer in two bands on each side of the seed pieces. He used 1,000 pounds of 0-9-27 fertilizer in which 100 pounds of sulphur had been mixed. He thinks sulphur helps prevent potato scab.

The potatoes were planted on May 11, two to four inches deep in 36-inch rows, and the seed pieces were placed 10 inches apart in the rows. The crop was sprayed seven times with Diathane and DDT using 100 to 150 gallons per acre at each application.

Champion Onion Grower

In 1949, Indiana had the poorest onion crop in the last 17 years. Most growers had less than half a crop.

The winner was Fred Fraser of Rochester, with a yield of 591 bushels to the acre. He planted Southport Yellow Globe seed on April 30 in 12-inch rows, using 5½ pounds of seed per acre. A green manure rye crop 18 inches high was turned under and the field was fertilized with 1,000 pounds of 0-9-27 fertilizer per acre.

Mr. Fraser was also named State Muck Crop Champion because the yields of his three muck crops were higher than those of the other contestants. His potatoes yielded 401 bushels to the acre and the cabbage 15 tons to the acre.

He planted certified Prince Edward Island Sebago seed potatoes on May 27, using 25 bushels of seed to the acre. One thousand forty (1,040) pounds of 0-9-27 fertilizer per acre were used, and he dusted five times using COCS and DDT dust.

The Racine Market cabbage was direct seeded May 5 and 6 in 28-inch rows. The plants were thinned to 20 inches apart in the rows. He used 1,000 pounds of 0-9-27 fertilizer to the acre, and the cabbage was dusted twice with five per cent DDT dust.

Keep Crop Residues . . . .

(*From page* 16)

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Fall Maneuvers

(*From page* 5)

IN every little crossroads school you find this same American dream bearing fruit, and rural churches and farm cooperatives uphold the dignity of man and the principles of fair play. The sad thing is that we cannot really "beam" this true situation by radio to those who never saw it or who have never known what America is like. Like religion, those who need it most never get it. Fanatic deception is no substitute for what we enjoy—and I must admit, often fail to fully appreciate until somebody threatens to rob us of it.

How simply but plainly General Ike Eisenhower said it when he stated: "We instinctively trust nations in which the power resides in the hands of the people, because we believe that the people do not want wars. For that reason we are against dictatorships."

In the midst of the world fever there are also internal efforts we must make to accomplish things that armed force alone can't easily do. Most of these efforts the humblest of us can work for without using up the scarce materials or running up against priorities.

We elder observers can refrain from whining about "them good old days" and stop preaching moss-grown doctrines to modern ears. Nostalgia is great stuff, like history, but we don't rely on flintlocks, corduroy roads, the pony express, and beacon signal fires any longer. Time marches on!

Education should not be neglected. Reports show how overcrowded many of our schools have become and what a burden is placed upon those who administer facilities and do the classroom work. Getting a sound education of mixed practical and classical subjects remains a leading need. Our youth must step into the breach left by young members of the armed forces—some of them never to return.

Local communities must organize and find good leadership in first aid and nursing technique, because modern warfare has a nasty habit of landing on the innocent bystanders.

Country groups are going to set up relief centers and provide the hospitality in cases where urban communities suffer possible air attack which drives refugees out into the open roads seeking shelter and food.

Take good care of our health meanwhile. Epidemics and bacterial diseases are a bad setback at any time, but more so in times of war, or "half-war" defense periods.

Many mothers and fathers will be away from homes in some kind of defense effort. What are we going to do about the children? Will they be left to wander into woe and wickedness?

Restore those welcome rest places for service people and give of your talent and strength to cheer the kids so far from home.

See that all the overseas recruits and those in training here receive messages when the sergeant passes out the mail. I met a soldier in Stuttgart last fall who lived in my town. Upon asking him if I might take a message to his mother, he replied that he was an orphan and never heard from home.

Continue to encourage research. Unlike some kinds of business and petty politics, it is indispensable. Farm and food research can be as essential as the elements of direct defense. A letdown here might prove costly in a pinch.

Farm folks never like to see war in this country or in any other. The hardest part we have to play and the worst contradiction we must swallow are to stand for bombing and killing and demolishing foreign countrysides as a necessary move to victory. We fall back upon the only solace we have, that such cruelty is done for defense or to guarantee freedom elsewhere, which is always bought at a terrible price. That we know such behavior is not of our own choosing but is forced upon us because we are now the world's best hope for security and liberty does not always make it easy to take along with our spiritual beliefs.

This gradual achievement of the No. 1 spot in a damaged world has been rather hard to realize. Many of my old chums out in the Midlands and beyond have remained champions of isolationism through two world struggles, although the majority now have changed their minds on that issue.

Many of us came naturally by that instinct. America was a haven for the oppressed and grew strong by its own initiative and invention to such a great degree that we grew up convinced that entangling alliances with foreigners were a delusion and a snare. We finally broke through and did it in World War I, but I recall how vehement some farm fathers were in 1939-40 against going back there again to "settle Europe's mess."

As I walk the streets of those old comfortable towns again, many of the landmarks remain unchanged, mementoes of a time when our country was very young and unsophisticated, bent solely upon its own progress—if any—and deaf to the clamors and crowns and dynasties abroad. But the leaders of the same towns are men with experience in two world struggles, officers of veteran lodges, tough and practical fellows like the Paul Reveres and Sam Adamses and Thomas Paines of yore. In a couple of months or less, proof of their prowess will be seen in a revitalized National Guard and willing and trained Reservists.

Some of them may be a little extreme and excitable in their zeal and make speeches that give Old Man Malik a cue for hollering "war-mongers." But you can trust them in a pinch to come through with flying colors and a straight bead on the target. The old-timers also were excitable extremists sometimes, like Ethan Allen at Ticonderoga and Admiral Perry at Lake Erie.

From all I can learn here and there from old pals in the hinterlands, America is going to do at last what Teddy Roosevelt urged back in my youth: "Speak softly, but carry a Big Stick!" From what they tell me out yonder where the manpower grows there isn't going to be any more whittling down that big stick for spearing cocktail olives with either. If there's going to be a party, it won't be a soft parlor game if and when the bully-boys invite themselves over.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What is the Matter with Your Soil?
J-3-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
ZZ-11-45 First Things First in Soil Fertility
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa — A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
I-2-47 Fertilizers and Human Health
P-3-47 Year-round Grazing
T-4-47 Fertilizer Practices for Profitable Tobacco
AA-5-47 The Potassium Content of Farm Crops
TT-11-47 How Different Plant Nutrients Influence Plant Growth
VV-11-47 Are You Pasture Conscious?
R-4-48 Needs of the Corn Crop
X-6-48 Applying Fertilizers in Solution
AA-6-48 The Chemical Composition of Agricultural Potash Salts
GG-10-48 Starved Plants Show Their Hunger
OO-11-48 The Use of Soil Sampling Tubes
TT-12-48 Season-long Pasture for New England
B-1-49 Hardening Plants with Potash
E-1-49 Establishing Bermuda-grass
F-2-49 Fertilizing Tomatoes for Earliness and Quality
J-2-49 Increasing Tung Profits with Potassium
L-3-49 The Development of the American Potash Industry
N-3-49 Are You Shortchanging Your Corn Crop?
CC-8-49 Efficient Vegetable Production Calls for Soil Improvement
EE-8-49 Why Use Potash on Pastures
GG-10-49 What Makes Big Yields
HH-10-49 Sesame—New Oilseed Crop for the South
KK-10-49 An Approved Soybean Program for North Carolina
MM-11-49 Things Learned From 1949 NE Green Pasture Program
QQ-11-49 Some Fundamentals of Soil Building
RR-11-49 Alfalfa as a Money Crop in the South
SS-12-49 Fertilizing Vegetable Crops
TT-12-49 Grow Lespedeza Sericea for Forage and Soil Improvement
UU-12-49 Pacific Northwest Knows How to Grow Strawberries
A-1-50 Wheat Improvement in Southwestern Indiana
B-1-50 More Corn From Fewer Acres
C-1-50 Fertilizer Trends in South Carolina
D-1-50 Know Your Soil I. Delanco Sandy Loam
E-1-50 More Fish and Game
F-1-50 A Simplified Field Test for Determining Potassium in Plant Tissue
G-2-50 Fertilizer Placement for Vegetable Crops
I-2-50 Boron for Alfalfa
J-2-50 Use Crop Rotations to Improve Crop Yields and Income
K-3-50 Metering Dry Fertilizers and Soil Amendments into Irrigation Systems
L-3-50 Food For Thought About Food
N-3-50 Can We Afford Enough Fertilizer to Insure Maximum Yields?
O-4-50 Birdsfoot Trefoil—A Promising Forage Crop
P-4-50 Potash Production a Progress Report
R-4-50 Know Your Soil. II. Evesboro Loamy Sand. III. Sassafras Sand
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U-5-50 Reseeding Crimson Clover Adds New Income for the South
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CC-8-50 Bermuda Grass Can Be Used in Corn Rotations

THE AMERICAN POTASH INSTITUTE

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A Few Whinnies

"There," said the medical examiner, unrolling the eye chart, "read the fourth line down from the top."

"Read it?" chortled the patient. "Why, I know the guy personally. He used to play football at my school."

* * *

Old Lady: "Are you a little boy or a little girl?"

Young Child: "What else could I be?"

* * *

Joe: "I'm going to bring my girl a corsage tonight."

Bill: "I suppose you know your girl well enough to do that but I'm just going to bring mine flowers."

* * *

And then there was the sailor who treated all his girls with wine. He wanted a little port in every sweetheart.

* * *

He: "Shall we go to the movies?"

She: "We don't have to; the folks are going."

* * *

The plain, prim little old lady who stood beside a male customer at a department store counter was nervous and embarrassed; finally she said:

"Please Miss, I'd like two packages of bath room stationery."

1st Grade Boy—"How did you like that movie?"

2nd Grade Boy—"It was okey. I shut my eyes during the kissing scene and made believe he's choking her."

* * *

Political Orator—"All that I am or ever will be, I owe to my mother."

Heckler—"Why don't you send her 30 cents and square the account?"

* * *

Sambo—"Boy, what does you-all think 'bout dis heah sex busines dey's argufyin' 'bout?"

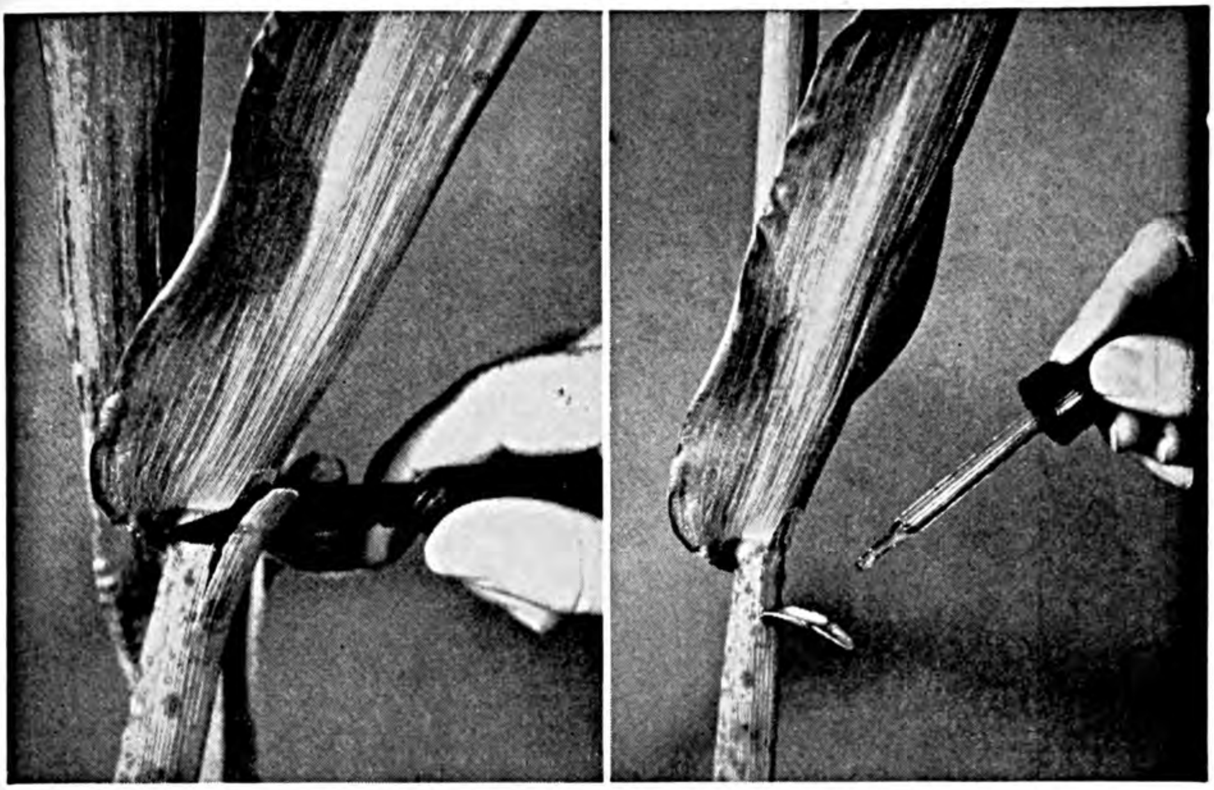
Mose—"Son, Ah thinks a man has got a puffick right to belong to any sex he wish."

* * *

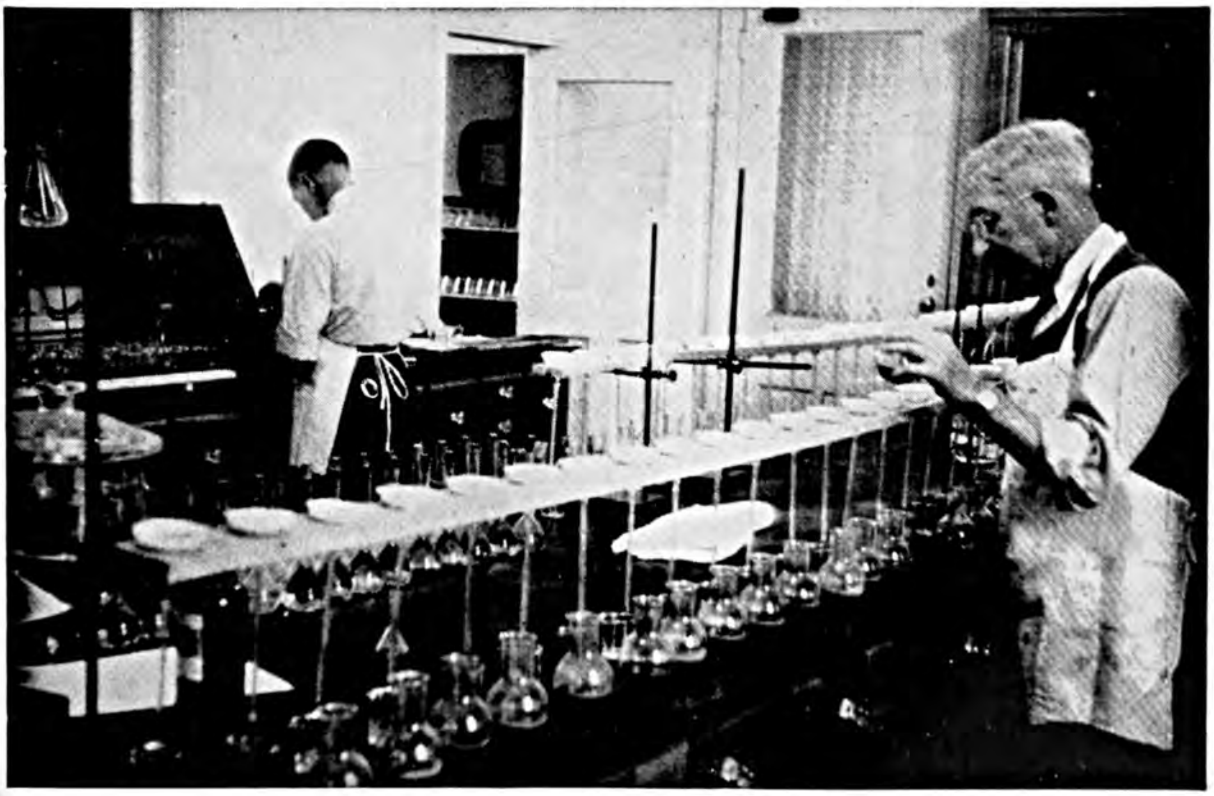
A salesman who obviously didn't know little boys very well rapped on the screen door at a house where, just inside and plainly visible, was an eight-year-old painfully practicing his music lesson on the piano.

"Sonny," he inquired pleasantly, "is your mother home?"

The boy gave the salesman a murderous look over his shoulder, then growled, "What do you think, mister?"



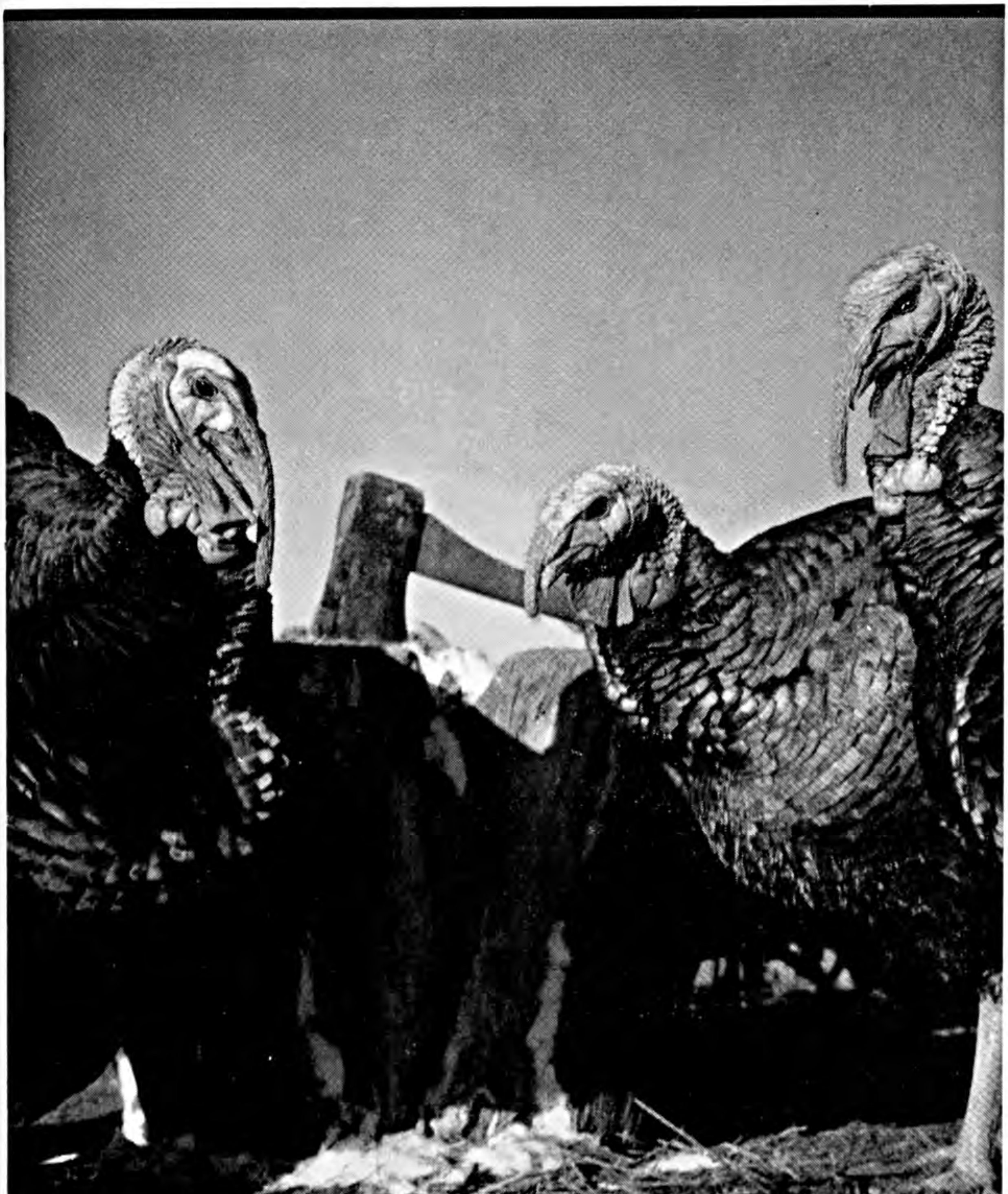
Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.



Equipment used in a well-developed laboratory for soil analyses.

Better Crops WITH PLANT FOOD

November 1950 10 Cents



The Pocket Book of Agriculture

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. Stinchfield, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

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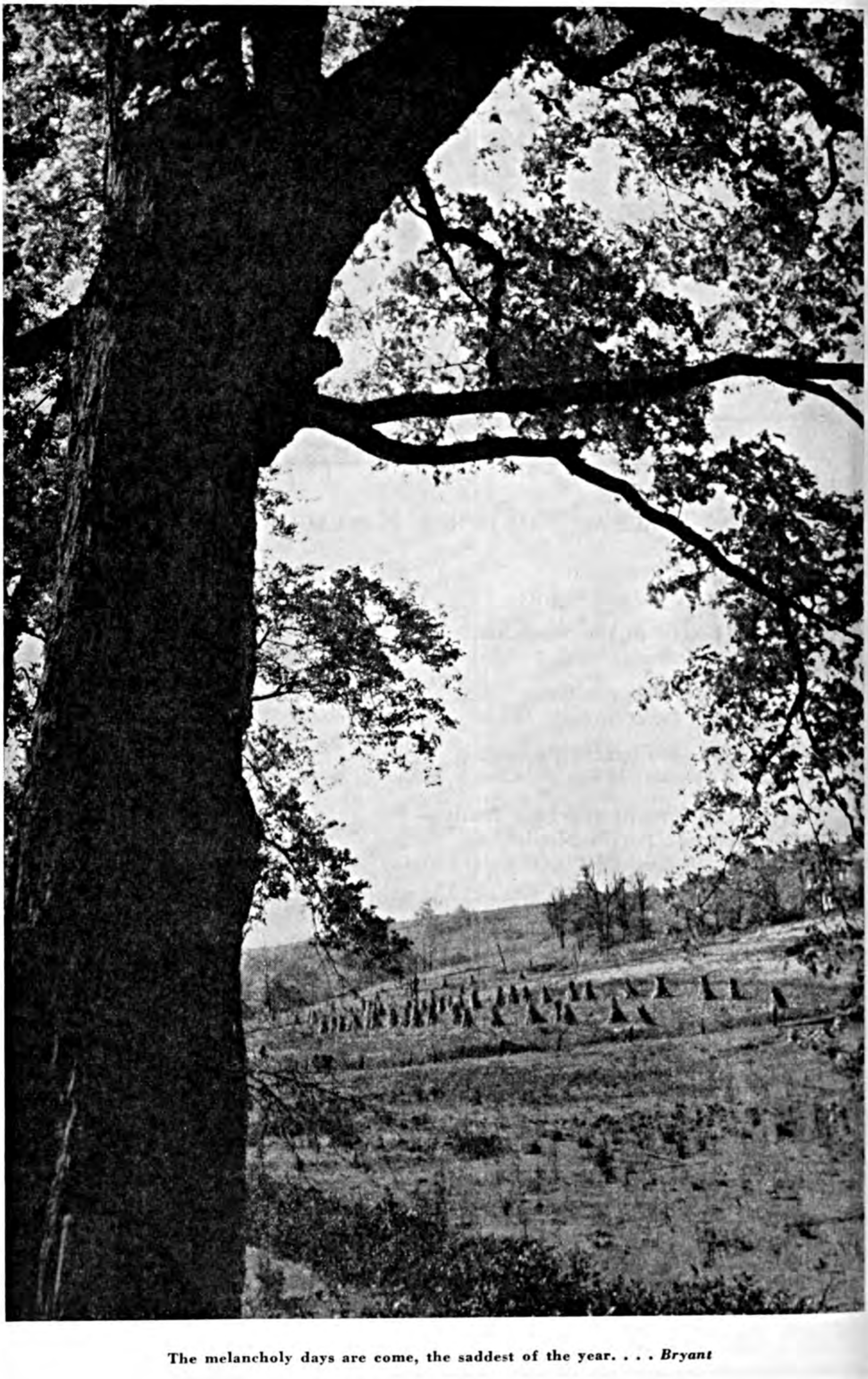

The melancholy days are come, the saddest of the year. . . . ***Bryant***

Better Crops with PLANT FOOD

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VOL. XXXIV WASHINGTON, D. C., NOVEMBER 1950 No. 9

Our Ideals in . . .

Hope and Promise

Jeff McDermid

ANY ordinary thinker who leans toward being an idealist with future plans of a nebulous kind based on a square deal for masses of the underprivileged is in a dilemma these days. He can stick tight to his philosophy and claim that events move fast, and that the idealist of today becomes the realist of tomorrow. Or he can keep silent and be shy about his hopes, for fear his associates will regard him as tinged with pink bordering on the red.

However hard it may be to retain certain inward ideals in the face of criticism and ridicule, there is a chance for all of us to pay more than lip-service to what we think is a call to duty. As one great spiritual leader once said, "The will of God is expressed in the needs of the time in which we live." There are many folks around us who would buck up and get ahead faster if they got a word of good cheer or a little lift, and we don't need to hunt far to find places where some organized idealism can be put to instant practice.

Our country has established many associations of forces led by ardent idealists. Some of them have bungled, of course, like we all do often, and a few of the outfits have been misunderstood and labeled cranks and radicals. But the Bible is full of cases like that, where the best minds and hearts have been stepped upon, stoned, and banished. Maybe some of us tossed a few rocks and called a few names ourselves, because the time did not seem ripe for opinions contrary to the main theme or for imaginations beyond the realm of reason. And besides, it is a tough job and a thankless one to launch a boat in a swift current running in the opposite direction.

Rural America is wise to all the hardships attendant upon the launching of a new enterprise which aims to alleviate the lot of the farmer and his community. We ourselves lived in the formative years of cooperatives and rural social groups whose early efforts were much misunderstood—frequently because the pioneer farm leaders and their organizers were not diplomatic or even sincere sometimes. But in time, as the underlying good became manifest and the practical benefits of the "reformers" widened and deepened, the bitterness ceased and the enterprises were taken right into the warp and woof of the living loom and set the pattern for rural achievement and stability. That which critics and enemies of rural unity and progress were wont to call "red" has come to be a part of our national well-being. In other words, those "red" blends really turned out to be the same bright color that we are so proud to see waving along with the white and the blue.

THUS on every hand, in rural as well as in civic and industrial circles, countless germs of idealism have fused into realism. This has happened many times, and even with our state governments and public policies and more recently—since 1945—with the whole vast field of world affairs. But if those original idealists had suddenly hid themselves and quit talking and writing and spending dreary, barren years in lonely compaigns before skeptical audiences—where would our privileges be and what progress would we have made?

So this preface brings me down finally to the Food and Agriculture Organization of United Nations. We saw it organized, read its first ambitious screeds, and figured that maybe in a million years something might come of its hopeful but altogether altruistic principles. A few of us grumbled and jibed about it, as a place to provide jobs for "pinks." But a mere mild tolerance and bemused awareness of its existence was the rule. It was looked upon as harmless and hopeless.

Its deliberations and documentary output at first were not what could conceivably wean the public from its zest for athletics, bridge, or television. It had no power to go at grassroots troubles in anything but a studious and advisory fashion, nor does it yet to any extent. To be sure, it hired some good men and true out of foreign and domestic agricultural agencies and borrowed others to make up personnel of various investigating "missions" abroad, including Greece and Poland among others. They deliberated and returned, and later well-illustrated and footnoted bulletins were added to our library shelves. But truth and fact today often turn into mere historical background tomorrow under the iron heel of conquest and repression, leaving well-meant recommendations under the rubble.

Only insofar as member nations in a compact can agree on positive action will there be any noteworthy results. They do not generally agree on any decisive or unusual procedure until the governments are backed by an awakened and determined citizenship. Without the majority of the taxpayers and responsible supporters of governments showing an inclination to rid the world of unfair and vicious situations, it will not be feasible for any specialized group to accomplish real objectives in the international scene.

FAO was therefore hamstrung. It had to await the "glory day," if and when it arrived. Meanwhile all it might hope to do was to keep the spark of resolution and factual knowledge alive. Its sphere of action was very limited to a few useful, "pottering" tasks, adding to statistics like the forerunner agency, International Institute of Agriculture in Rome, and trying to recruit more sympathy for its cause and appreciation of its aims.

By its charter, FAO is expected to shoot two ways—on more and better production of food, fiber, fish, and forests; and on the raising of the nutritional level of those two-thirds of the hungry world's people. Lack of suitable currency exchange to buy the food surplus where it could be found limited the opportunity to feed many of these distressed masses. Meanwhile,

our country had to continue its price-support effort.

Twice FAO tried to break the jam. It tried to get the United Nations through its own agency to create a world food board, and later attempted to set up the international commodity clearinghouse. The latter was to be a method of general acceptance which would bring food to countries which need it but cannot buy for lack of hard currency. Since our dollar is the main form of hard currency, the plan would (in theory) have provided a way to move surplus stocks then piling up at great expense here—and which to some extent have been donated in order to send them abroad at all. But last year the member governments of FAO thumbed down this proposal as being too fantastic and perhaps unworkable —mostly because it was "idealistic." Our own government rejected the plan before the vote was taken and, of course, few other governments were willing to test it under the circumstances.

We have heard FAO called the "world's county agent or extension system." This is all right for a hasty nickname, but it can't work on anything like our own agricultural extension system because of at least two very cogent reasons: (1) FAO has no authority to proceed like the U. S. extension system, and a woeful lack of funds if it had the chance. (2) Very few foreign countries are equipped with extension facilities, and their farm people cannot get the money to buy the equipment, seeds, and fertilizer, even if they had all the know-how that we possess.

MORE than half of the world is in such a plight that the reform of land tenure and living conditions becomes one of the "great needs of our times." If we could put even equal effort and expense into production goods that we must divert to destruction, it might then be possible for FAO and its allies to unroll those blueprints and start building.

Some vague light in this murky atmosphere is furnished by the way in which 50 nations have pledged themselves to contribute over twenty million dollars toward matching the pool which our country has promised in Point Four technical assistance projects. It may turn out to be a slow but sure entry into the way out of this maze of unending misery. It will, unless the fund is frittered away on junkets and experiments and becomes tangled in red tape and embroidered with high-sounding slogans and tiresome reports.

This is a challenge to the skill and management of FAO, inasmuch as it will probably have to handle a large share of the funds for this technical work through the United Nations. Down-to-earth, dirty, everyday troubles must be tackled direct—disease, filth, unsanitary areas, waste, taboos, fear,

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Fig. 1. Tall fescue was seeded in the fall of 1945 on this wet land where only two crops of corn had been produced in 25 years on the farm of E. L. Morton, Trenton, Ky. This grass made more than 600 pounds of seed per acre the first year. (Photo April 29, 1948)

Tall Fescue in the Southeast

By R. Y. Bailey

Regional Agronomist, Soil Conservation Service, Spartanburg, South Carolina

TALL fescue has excited more interest than any other grass or legume introduced into the Southeast in recent years. It has been planted on almost a million acres in the nine Southeastern States. A roundup of some of the things we have learned about tall fescue on farms appears to be desirable.

Two varieties—Kentucky 31 and Alta—have been the two most extensively planted in the Southeast. These varieties are so similar in appearance and growth habits that the average layman cannot tell them apart. It remains to be seen whether either will ever show any marked superiority over the other under the climatic conditions in this part of the country.

Soil Conservation Service workers who help farmers in soil conservation districts with the preparation of farm soil and water conservation plans are ever on the lookout for plants that will be useful in this kind of planning. They are attracted to tall fescue because of its strong root system and the heavy sod it makes. They also like this grass because it will grow on a variety of soils, ranging from wet lowlands to steep uplands. Fescue is growing satisfactorily on many areas of wet land where we formerly did not have well adapted grasses that we felt safe in recommending to farmers. Fescue makes a sod that is dense enough to support animals on wet land where they would mire on lighter sods.

Fescue makes effective ground cover on uplands and has shown much promise as a grass for use in soil-conserving rotations on sloping cropland. Good stands of fescue and ladino clover have come in several places where the seed was sown and covered lightly immediately after fall-sown small grain was planted. The sod that developed after small grain was harvested in the late spring completely protected the land from erosion during the following winter. This sod would have furnished good winter pasture for livestock.

Results of several such seedings indicate that we can use tall fescue in rotations as short as three years and get about a year and a half of pasture from the grass. Grazing that could be taken from such rotations would reduce very greatly the amount of stored roughage needed for wintering cattle. The sod may be managed in such a way that almost any desired amount of plant material can be returned to the land. This stemmy grass with its coarse roots decays slowly. This slow-decaying material should greatly reduce erosion losses during the summer while the land is under cultivation for a row crop. Unfortunately, we have not had this kind of sod in studies on runoff plots, but plans are under way for starting some research along this line.

Tall fescue has been used in a number of drainageways into which water from terraces was emptied. It has given excellent protection against erosion. It also has been used along roadsides, and on several other erosion-control jobs.

Seed Production

Fescue is a better-than-average seed producer, and the seed is rather easy to harvest. This is an important factor in any new grass that is to be planted on very extensive acreages. As an example of the rate at which seed can be produced, the Soil Conservation Service bought 70 pounds of seed from B. F. Suiter of Frenchburg, Ky., in the fall of 1940 and planted it at their Chapel Hill, N. C., nursery the next spring. A small amount of seed was harvested in 1943 and the acreage for seed production was increased there and at other Service nurseries. Seed distributed to soil conservation districts from Soil Conservation Service nurseries since 1943 has totaled 126,000 pounds. This seed was distributed to almost 700 counties in the nine Southeastern States for 5-acre observational plantings.

The acreage planted with seed produced in these observational plantings on farms is an important part of the total that has been planted to this grass. For instance, Rutland Cunningham, Route 1, Killen, Ala., planted five acres in the fall of 1946 with nursery seed that he received through the Northwest Alabama Soil Conservation District. This grass was planted on good land that had been prepared and fertilized for alfalfa. Mr. Cunningham harvested 2,400 pounds of clean seed in 1947, 1,800 pounds in 1948, and 2,000 pounds in 1949. He has seeded an additional 135 acres to a mixture of fescue and clover and plans to seed fescue on 50 acres of sericea. He pastured the grass except for a few weeks before seed harvest, and topdressed it with nitrogen fertilizer each spring. Numerous similar examples could be given.

Adaptability

Space will not be taken here to give detailed instructions for growing fescue. In summary, it has produced best stands on well-prepared seedbeds, has grown more vigorously the first year when planted early in September in the Upper and Middle South and about October 1 in the Lower South. Near the coast, about November 1 appears to be the best date of seeding. This grass has grown most vigorously when well supplied with nitrogen, either from direct applications or from legumes in association with it. Close grazing and heavy trampling during the first winter have retarded root development and weakened the stands of this grass.

After it has been proved that fescue will grow on a wide variety of soils, that it remains green enough for grazing whenever it has adequate moisture, and that it makes a heavy sod that holds animals up on poorly drained

Fig. 2. Hereford cattle on fescue and ladino clover pasture on the farm of Lilly Brothers, Hopkinsville, Ky. (Photo August 17, 1948)

soils, several questions about its value as a forage plant need to be answered. Is it palatable? Is it nutritious? Will it grow satisfactorily in mixtures with legumes? Is it susceptible to disease? How long will a stand last under grazing? We have partial answers to all of these questions, but tall fescue is too new to most of the Southeast for anyone to know the final answers.

The question about palatability usually brings answers that are based on the conditions under which the grass was grazed. Stock have readily eaten green, succulent fescue that was grown in mixtures with legumes such as

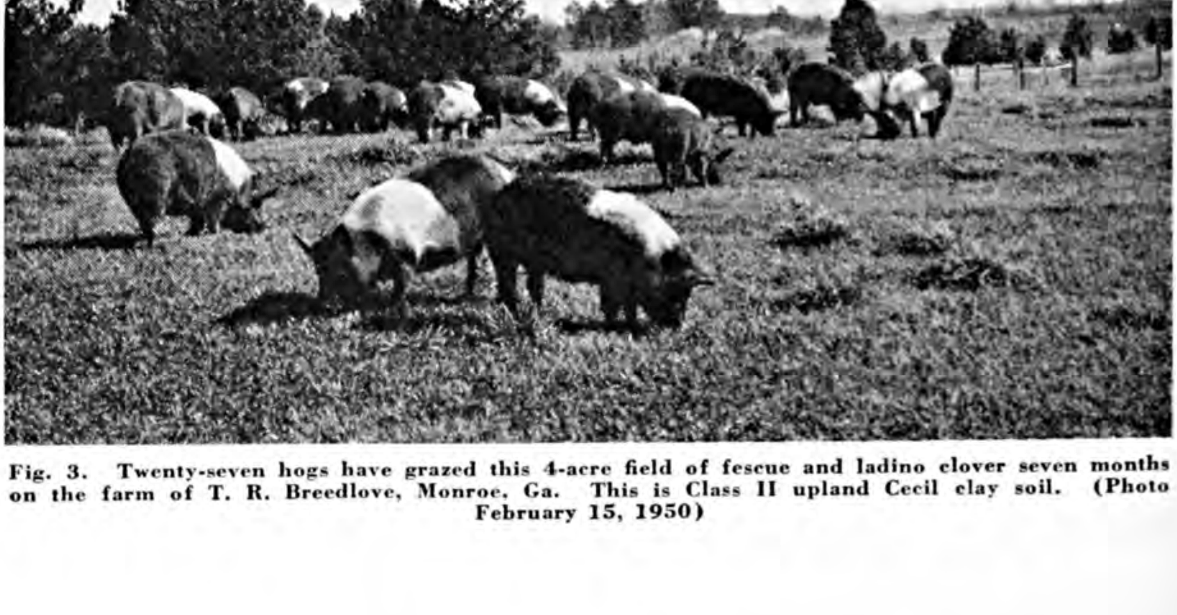

Fig. 3. Twenty-seven hogs have grazed this 4-acre field of fescue and ladino clover seven months on the farm of T. R. Breedlove, Monroe, Ga. This is Class II upland Cecil clay soil. (Photo February 15, 1950)

ladino or other white clover. On the other hand, stock have not grazed coarse fescue that was left after seed was harvested, if they could get other feed that was more succulent.

We called on farmers in each of the nine Southeastern States for reports of their experience in pasturing fescue. Reports were received from 208 different farmers who pastured stock on a total of about 3,200 acres of it. This included 150 who had pastured beef cattle, 63 with dairy cows, 13 who pastured sheep and milk goats, and 13 who had pastured hogs. In most cases, the fescue was in mixtures with one of the white clovers or some other legume. In other cases, the grass was grown in pure stands for seed production, but was mowed after seed harvest and stock were turned on it after succulent new growth was produced. The grass was green and succulent in practically all cases. Pure stands were fertilized with nitrogen.

Palatability

We had only one unfavorable report on palatability. This was on a farm where a small patch of fescue was protected from grazing until summer after seed was ripe. Cattle that were turned on the coarse, tough grass refused it. This was exactly what should have been expected with fescue or most any other perennial grass. A good many of the farmers said their stock ate fescue in preference to other pasture grasses. On one Virginia farm, cattle grazed smooth brome grass in preference to fescue, but grazed fescue in preference to several other pasture grasses commonly used in that section of the State.

The question of palatability may be summed up as being one of management. When fescue has been grown with legumes that made vigorous growth, or where the grass was fertilized with enough nitrogen to make it green and succulent, stock have grazed it as well as they have other pasture grasses. Where fescue in pure stands has been left ungrazed until the leaves were coarse and fibrous, stock usually have not grazed it readily.

The nutritive value of fescue is not well known. Several state agricultural experiment stations are making studies, but very little has been published on the subject. Again going to farmers for their experience, we found that where fescue was grown in mixtures with legumes, or was well fertilized with nitrogen, stock made good gains on it.

Singletary Brothers of Blakely, Ga., pastured four steers on 3½ acres of fescue and white clover sod from November 8, 1948, to April 13, 1949. The grass and clover mixture was well fertilized. The steers were fed $12.50 worth of feed while on the grass, and they gained a total of 780 pounds. Singletary Brothers planted an additional 500 acres to fescue and clover.

Henry Vann of Clinton, N. C., pastured beef cattle for a period of 11 months on 45 acres of fescue and ladino clover. He reported that his grass and clover carried one and a half animal units per acre during this period and that the beef yield per acre was 450 pounds. Mr. Vann planted 85 more acres to fescue and ladino clover.

J. Harris Smith, Route 1, Jackson, Tenn., pastured 50 sheep on five acres of fescue from the time seed was harvested in June 1948 until the next February. He also pastured sheep again after the 1949 seed crop was harvested. The sheep grazed fescue very closely and were in good condition when they were taken off in the spring for the grass to make seed.

Dairy Forage

What about dairy cows? They are more delicate than beef cattle and are more sensitive to the quality of feed. Dairy cows might not produce a normal amount of milk on this coarse grass. Joe Strickland of Pheba, Miss., gives the following interesting report of his experience with dairy cows on fescue and white clover pasture: "I half-heartedly planted 10 acres of my worst land to fescue and white clover.

It is now the best pasture on my place. I put nine cows on this grass and clover on December 10. On March 20, I took them off so I could save seed, but in three days milk production had dropped five gallons a day, so I put them back. I took the cows off again in April and the same thing happened, so I decided it would be cheaper to let the cows eat the grass and then sell the milk and buy fescue seed. I am sold on this grass for I have seen what it does."

Mr. Strickland limed the land and applied a liberal amount of phosphate before the grass and clover were seeded. He topdressed with 300 pounds of complete fertilizer when the plants were up. He applied 200 pounds of muriate of potash on one acre. He says his cows grazed more on that acre than on any other part of the field. These results convinced him that he must apply potash along with lime and phosphate if he is to maintain a good stand of clover that can furnish nitrogen for his fescue.

E. B. Mack, a dairy farmer of North, S. C., pastured 71 dairy cows on fescue during September and October 1949. This fescue was on Norfolk and Ruston sandy loam and loamy sand. Most of the acreage of fescue was seeded with ladino clover, but part of it was in a mixture with crimson clover. Lime and liberal amounts of fertilizer were applied to stimulate vigorous growth. Mr. Mack said, "My cows pick up in milk production when I put them on fescue and drop off when I take them off fescue."

Further Evidence

Other dairy farmers have reported increases of from 15 to 40 per cent in milk production when cows were moved from other pastures to fescue. These have included herds of from a few cows to large herds. They have included high-producing cows on test. Without exception, these fescue pastures were well fertilized. There is a probability that in some cases differences between fertilizer treatment of fescue and other pastures accounted to some extent for the better results when cows were on fescue and clover pastures. In almost every case that has been reported, farmers who have pastured fescue have increased their acreage substantially.

Tall fescue has been grown in mixtures with a wide variety of legumes. Ladino clover has grown very well with this grass. A few management principles that have proved to be important in keeping these two plants in a mixture are: Selection of land on which ladino is well adapted; adequate liming and fertilizing to maintain a vigorous stand of ladino; and a rate of grazing that keeps the two plants from competing unduly with each other.

Rate of Seeding

The rate of seeding of each plant appears to be rather important. Very heavy rates of grass seeding sometimes result in overcrowding and a thin stand of clover. Excessive rates of seeding clover frequently result in thin stands of fescue. Our experience on a large number of farms has shown that under average conditions 10 pounds of fescue and 2 pounds of ladino clover seed per acre give plenty of plants for a good sod by the time the plants are a year old. Good stands have resulted where 6 to 8 pounds of fescue and 1 pound of ladino seed were planted with a cultipacker seeder on a well-prepared, firm seedbed.

Farmers who have had good results with extremely heavy rates of seeding crimson clover, ryegrass, and small grain for winter pasture have sometimes been inclined to use too much seed of fescue and either ladino or other white clovers. The perennial plants grow off somewhat more slowly than the annuals the first few months. This has led to the idea that stands from normal rates of seedings of the perennial mixture were too thin. Those who have used very heavy rates of seeding to get stands

Fig. 4. Hereford cattle on an upland fescue pasture on the farm of W. C. Camp, Gaffney, S. C. (Photo March 10, 1949)

that were comparable to their annual mixtures are likely to have trouble keeping the sod in balance after the first year. Both fescue and ladino plants spread considerably after the first year. The normal development of these plants will force a good deal of natural thinning. This thinning may sometimes be at the expense of either the clover or the grass, rather than being a uniform thinning of both. The final result may be an unbalanced sod.

Regular applications of lime and fertilizer to keep clover and other legumes that are grown in mixtures with fescue in strong, vigorous condition are ab-

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Fig. 5. Fescue seed being harvested by direct combining in Shelby County, Tenn. (Photo June 3, 1948)

Corn is a Superior Crop

By H. J. Snider

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A FIELD of corn at maturity presents to the casual observer an enormous bulk of plant growth. The height of the plant along with the large leaf spread may give an erroneous impression as to the actual proportion of grain to stalk growth. Corn under good soil conditions produces as much grain by weight as stalks and cobs. This is a more favorable proportion than that of other principal crops grown in the Midwest corn belt. It is one characteristic of corn which distinguishes it as a superior crop and may serve as another basis for comparison with other grain and seed crops.

Result of Science

This superiority in corn apparently did not just happen. It had to be sought after and studied by ingenuous men and trained scientists through many years. There is at least one paragraph in Richard Crabb's book, "The Hybrid Corn Makers," which in this connection bears repeating. "The experience of the corn breeders through the years has revealed what a remarkable job of development the selectionists of open-pollinated corn had done. The great majority of our good inbreds, the ones upon which hybrid corn rests today, were derived from open-pollinated corn. It has been from such open-pollinated varieties as Reid, Funk, Leaming, Kansas Sunflower, Lancaster Sure Crop, and other famous strains that most of the good inbreds today have come. The experience of hybrid corn breeders, searching for good inbred lines, revealed dramatically how greatly present-day American agriculture is indebted to the sturdy early settlers, corn-minded farmers and seedsmen who, by patient and painstaking selection for a century or more, had produced these outstanding open-pollinated varieties."

It is rather significant also that no outstanding inbreds have originated from corn outside the United States, as pointed out by Mr. Crabb. These facts are evidence which shows that the midwestern, the eastern, and southern farmers, seedsmen, and corn breeders have developed a superior crop. Now that the selectionists have done their good work and the corn breeders have taken over entirely there will probably be even greater progress than in the past.

A corn crop will produce as much and frequently more grain by weight than stalks and cobs. This is not generally true of other Midwest crops—oats, wheat, and soybeans. Corn on experiment fields in central and northern Illinois has averaged 50% grain, oats have averaged 48% grain, wheat 43% grain, and soybeans averaged 35% seed or beans (Table I).

TABLE I.—PERCENTAGES OF GRAIN AND BEANS IN CROPS OF CORN, OATS, WHEAT, AND SOYBEANS. AVERAGES UNDER CONTROL AND NORTHERN ILLINOIS CONDITIONS.

	Grain or Beans %	Stalks—Cobs or Straw %
Corn	50	50
Oats	48	52
Wheat	43	57
Soybeans	35	65

Fertility of Soil Causes Grain to Vary

Crop rotation and soil treatment on the Morrow Plots caused a very wide variation in the proportion of grain to stalks and cobs. With red clover in the rotation and manure, limestone, and rock phosphate added to the land, the grain made up 52.6% of corn crop. Where corn was grown every year on untreated land, the grain made up only 38.3% of the crop (Table II). The same hybrid was used throughout this test. This represents a wide variation and perhaps is an extreme example, but it serves to indicate that corn has the ability to produce grain somewhat in preference to stalks. A fertile soil gives a heavy growth of stalks, but this fertility does not grow stalks out of proportion to grain.

TABLE II.—PROPORTION OF GRAIN, STALKS, AND COBS IN THE CORN CROP GROWN ON THE OLD MORROW PLOTS 1949.

Part of plant	Untreated		Treated MLrP	
	%	bu.	%	bu.
Continuous corn				
Grain	38.3	16	46.9	57
Stalks	54.6		45.9	
Cobs	7.1		7.2	
Corn—Oats rotation				
Grain	44.8	25	47.1	104
Stalks	46.9		43.8	
Cobs	8.4		9.1	
Corn—Oats—Clover rotation				
Grain	47.6	68	52.6	104
Stalks	42.1		38.8	
Cobs	10.3		8.6	

M—manure L—limestone
rP—rock phosphate

Fig. 1. The corn on the left, grown on the Morrow plots in 1949, was from untreated land and produced 38.3% grain and 61.7% stalks and cobs. The corn on the right grew on treated land in a legume rotation and was made up of 52.6% grain and 47.4% stalks and cobs. The same hybrid was used on both plots.

Corn has been long selected and bred to produce grain with only enough stalks to support the ears and supply enough water and elements necessary for the development of grain.

Adapted hybrids are so geared to soil conditions that they will utilize large amounts of nitrogen fertilizers and give a large proportion of grain along with a high acre yield. It is true that nitrogen fertilizers usually grow a good vigorous stalk, but as a rule the stalk growth does not run wild and produce out of proportion to grain. This is demonstrated by some results on the Dixon Springs Station in 1949 where nitrogen was applied in the form of 200 pounds of 8-8-8 and in addition 837 pounds of calcium cyanamide. Here the grain was 51.4% of the crop compared to only 34.9% grain where no nitrogen was added to the corn (Table III). This Dixon Springs field is lo-

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Fig. 1. A 20-pound application of borax increased the yield of alfalfa one ton per acre on this field. That in the foreground received no borax. (Photo by Eldrow Reeve)

The Minor Element Problem

By Firman E. Bear

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WHEN chemists report analyses of plants, microbes, animals, and man, they may include as many as 15 elements. These normally constitute more than 99 per cent of the total dry matter. In many cases, however, the limiting factor in plant and animal life is a lack of one of the more than 80 other elements that make up the remaining fraction of one per cent. This latter group contains a considerable number of what are known as the "minor-elements." Among these, the most commonly mentioned in animal and plant nutrition are iodine, cobalt, copper, manganese, zinc, molybdenum, and boron. A considerable number of other minor elements are believed to be of value for at least some species of plants and animals.

The soils of some regions are naturally deficient in one or more minor elements. The earliest example of such a deficiency in the United States was in an area around the Great Lakes, where the incidence of goiter and of the birth of hairless animals was found to be related to the iodine content of the soil. The situation is now being remedied by the use of iodized salt.

More recently, widespread deficiencies of other minor elements have been observed. Some of these occur naturally, as in the coastal plain soils along the Atlantic Ocean and the Gulf of Mexico. Others are related to erosion and consequent loss of organic matter. Still others were caused by crop removal and have become intensified with increasing agricultural age of the land. Substitution of the automobile and tractor for the horse has played a part. Higher acre yields resulting from the use of improved seed have made greater demands on the soil's supply of these elements. Ever-greater purification of the materials that go into the manufacture of fertilizers has added the final touch to the trouble.

Minor elements may be considered either in relation to the specific needs of plants or to the requirements of the animals that consume these plants. Plants need boron, molybdenum, copper, manganese, and zinc. Animals need copper, manganese, zinc, iodine, and cobalt. It will be noted that the minor-element requirements of animals are not exactly the same as those of plants. This means that they are not necessarily met by growing high acre yields of crops. In fact, as yields of crops are stepped up their minor-element contents tend to be diluted. This applies not only to iodine and cobalt but to the others as well.

Boron

Symptoms of deficiency of minor elements in plants are now well known. Boron deficiency is evidenced by such abnormalities as brown discoloration in cauliflower heads, cracked stems in celery, black spots on beet roots, water-soaked areas in turnips, corky areas in apples, and dwarfing of alfalfa. At least 12 per cent of the land in New Jersey is known to be deficient in this element.

Molybdenum

Molybdenum deficiencies have only recently come into the picture. Large areas of land in Australia were found to be incapable of growing clover until molybdenum was applied. This element operates as a catalyst in the reduction of atmospheric nitrogen to ammonia by the bacteria in the nodules on the roots of legumes. It is also essential in the reduction of nitrates to ammonia in non-legume plants.

Fertile soils contain only between 0.2 and 0.6 pound total molybdenum in the plow depth of an acre, of which only a mere trace is soluble in water. In culture solutions, the need for this element can be met by one part molybdenum in one billion parts of water. The amount required to be applied under conditions of deficiency in the field is of the order of one ounce molybdic oxide an acre. This may be applied directly to the seed or it may be added to the soil. Field tests in New Jersey in which sodium molybdate was applied at the rate of one pound an acre to alfalfa resulted in yield increases averaging a little over 13 per cent.

In acid soil areas, the solubility of most of the minor elements is reduced by liming. Molybdenum differs from most of the other minor elements, however, in that liming increases its solubility. There is reason to believe that, in some cases, one of the most important effects of liming is that of making soil molybdenum available. It is conceivable that one ounce of molybdenum could be substituted for one ton of limestone in some cases.

Fig. 2. Only one part molybdenum per billion parts nutrient solution made the difference in this alfalfa. (Photo by Harold J. Evans)

Molybdenum in excess of the plant's requirements tends to be toxic to animals. Most forage plants contain one or two parts per million molybdenum on a dry-weight basis. But pastures are known in which the molybdenum content of the forage is 20 parts per million or more. On such pastures, the disease known as "teartness" develops. The affected animals have severe scours, their coats become rough, they lose weight, and, unless the situation is corrected, they die. The antidote for molybdenum poisoning is copper sulfate, fed at the rate of two grams daily for mature cattle. If the forage contains sufficient copper, no toxicity effects may be noted.

Manganese

Manganese is required by both plants and animals. Its deficiency in plants is indicated by dark green veins in the newer leaves and fading of the interveinal tissues. Most soils, if well farmed, release enough manganese to meet the requirements of plants. In New Jersey, most of the manganese deficiency noted to date has been in connection with over-liming. In certain market-gardening areas, deficiency of this element is so widespread as a result of the excessive use of lime that farmers regularly apply 50 pounds manganese sulfate an acre as a part of their standard fertilizer program.

The manganese content of plants may range from five parts per million to several thousand parts. Analyses in our laboratory of over 200 samples of vegetables from 10 states showed that those grown in the West had much lower manganese contents than those from the more acid soils of the East and South. It is conceivable that some foods and feeds contain too much manganese. The amount required by animals is very small, perhaps of the order of six parts per million of dry weight of feed. The manganese requirements of man are not known.

Manganese deficiency in animals is best known in "perosis" or "slipped tendon" disease of poultry. This is characterized by enlargement of leg joints and displacement of tendons and by arrested growth of leg and wing bones and of those of the spinal column. Eggs of manganese-deficient hens hatch slowly. Pigs fed a ration low in manganese tend to develop enlarged hocks and crooked legs. Wheat bran is a good source of manganese.

Copper

One of the most easily recognized copper-deficiency symptoms in plants is dieback in citrus. This is characterized by death of new growth and formation of many side branches below the dead portions. Gum pockets develop between bark and wood and the fruit shows brown excrescences. Tomatoes growing on copper-deficient soils are dwarfed, the edges of the leaves roll inward, and the plants have a bluish-green appearance. In onions, copper deficiency is evidenced by pale yellow bulbs that lack solidity. Most plants contain less than 10 parts per million copper, on a dry-weight basis, and they normally show copper toxicity at 30 parts per million or more.

Copper deficiency in animals is characterized by a form of anemia. In copper-deficient areas in Australia, new-born lambs and young sheep suffer from paralysis, which can be prevented by feeding the ewes copper sulfate. In the absence of copper, iron can be absorbed and stored but it cannot be utilized. The copper functions as a catalytic agent or as a necessary part of an enzyme system. The livers of new-born animals normally contain more copper than those of older animals. The daily requirement for humans is set at from one to two milligrams copper a day.

Zinc

Zinc deficiency in plants was first observed on pecan trees over a wide area in the Southern States. The tops of the trees died. Similar deficiencies were noted in tung trees. The most easily recognized symptom of zinc deficiency is shown by corn, which, in the absence of adequate amounts of zinc, produces what is known as "white bud." Plants vary considerably in their zinc requirements, corn, pecans, and citrus having a greater need for this element than alfalfa. The zinc content of plants is usually between 25 and 75 parts per million dry weight. Some weeds, notably ragweed and lamb's quarter, appear to be accumulators of this element. Such weeds may have value as cover crops for plowing-under purposes on zinc-deficient soils.

The human body contains something like two grams zinc, more than of any other minor element. Zinc-deficient animals tend to develop hyperkeratosis, or thickening of the skin, with loss of hair. It has been suggested that X-disease of cattle might be due to a deficiency of this element. Vegetation from several farms on which animals were affected by the disease were found to range between 13 and 25 parts zinc per million dry matter. The evidence is entirely too limited, however, to permit drawing any very definite conclusions.

Although manganese, copper, and zinc are essential to animals, any deficiency in the food or feed would normally be met by way of the soil, since plants also require these elements. Nevertheless it is now common practice to add about six ounces manganese sulfate to every ton of poultry feed as a protective measure against perosis, and small amounts of copper sulfate or carbonate are added to hog feeds. Occasionally manganese and copper sulfates are put in dairy-cow feeds and zinc sulfate or carbonate as well. It has been shown that pigs with no opportunity to root in the soil often suffer from deficiencies of one or more of these elements. The remedy is found in painting the sow's teats with a solution of their salts.

Cobalt

The cobalt content of plants is normally less than 0.1 part per million dry matter. Insofar as is known, the element is not an essential plant nutrient. But it is conceivable that more careful work with this element will show that the quantities contained as impurities in nutrient-solution chemicals and in the containers in which the plants are grown are adequate to meet

Fig. 3. Too little, just enough, and too much manganese for soybeans. Those on the left received no manganese, and those to the right were supplied with manganese at the rates of 0.1, 2, and 5 part per million nutrient solution, respectively. (Photo by Paul D. Christensen)

all their needs. Extreme care is necessary to avoid contamination with the mere traces of this element that may suffice to meet the needs of plants.

Cobalt deficiency in animals is widespread. It is known variously as "pine disease," "Morton's Main disease," "bush sickness," "salt sickness," "Burton ail," and "Grand Traverse disease." The common symptoms are depraved appetite, progressive emaciation, anemia, retarded sexual development, and muscular atrophy. The spleen shrivels. The hair or wool becomes harsh. Sheep are affected more than cattle, and young stock more than old. In some cases, the only evidence of the disease may be the very slow growth of animals or their failure to gain weight.

The passing point for cobalt in soils is of the order of two parts per million, or about four pounds an acre to plow depth. Good forage should contain 0.07 part per million cobalt, on the dry-matter basis, for sheep, but somewhat smaller amounts apparently suffice for cattle. The evidence indicates that legumes are higher in cobalt than grasses and that they seldom contain less than 0.07 part per million cobalt. In proportion as legumes are contained in the forage, cobalt deficiency is less likely to occur.

The point here raised is as to whether it is better to add cobalt to the soil so that it may become an organic part of the plant, or whether it can be fed directly to animals. The normal rate of application of cobalt sulfate to pastures is two to four ounces an acre annually, in comparison with about two grams of the salt that is being added to each ton of grain feed for cows. The economy of putting it in the feed is apparent, the cost being of the order of ¼ cent a ton.

Insofar as cows and other ruminants are concerned, direct addition of the mineral salt to the feed is entirely satisfactory. The cow's rumen is a living factory where feed is digested and new products are synthesized. In this environment, vitamin B12, of which cobalt is an essential constituent, is produced. In the case of man and other non-ruminants, the bacteria of the lower intestine may accomplish much the same purpose as those in the rumen of the cow. Some of the antibiotics, by reducing the activities of the microorganisms of the intestinal tract, have been shown to lower the synthesis of certain vitamins, with resulting faulty nutrition. It is of interest in this connection that, by adding cobalt, streptomyces griseus produces not only streptomycin but vitamin B12 in commercial quantities as well.

Variety

One of the best means of preventing minor-element deficiencies in man is through the eating of a variety of foods from a variety of origins. When one considers the many kinds of plant products that find their way to the table, it would seem that all man's minor-element requirements would be adequately met. It must be admitted, however, that this is a hit-and-miss system and that, for the poorer classes, the careless, and the uneducated, it may not work.

Fortunately we consume large amounts of meat, eggs, and milk, all of which have protective value in terms of these elements. Animals effect a screening process by which non-essential and injurious elements may be eliminated and needed elements concentrated. The animal serves as an "official taster" for man, and it may lose its life in the process. If meat, eggs, and milk are to be produced economically, all the needs of the animals must be met, and their mineral needs are quite similar to those of man.

The livers of animals serve as storage agents for minor elements, and this no doubt accounts in large part for the fairly widespread practice of eating liver regularly once a week. The same applies to the weekly eating of fish. Salt-water fish would certainly have

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Tree Symptoms and Leaf Analysis Determine Potash Needs

By G. D. Worswick

Farm Adviser, Santa Clara County, San Jose, California

A GOOD annual crop of fruit tends to remove permanently more potassium from the soil than do most of the common field crops.

There is usually more nitrogen than potassium in the leaves and wood of fruit trees, but all leaves and some of the wood are returned to the soil. The fruit, however, may contain much more potassium than nitrogen, and a bearing orchard is apt to deplete the potassium supply more than it depletes the nitrogen supply or the supply of any other element.

Although fruit crops deplete the potassium supply in the soil as fast, or faster than they deplete the nitrogen supply, there are, in America at least, many more orchards in which trees will show response to fertilization with nitrogen than there are in which they will show response to fertilization with potassium. This is partly because the supply of potassium, a constituent of the rock from which the soil was formed, is apt to be the larger and partly because the loss of potassium from the soil by leaching is slower than the loss of nitrogen by leaching and denitrification.

In a considerable number of soil areas, however, trees will respond to fertilization with potassium, and more orchard areas are constantly developing potassium deficiencies because of the fairly rapid rate at which potassium is removed from the soil.

The most severe and obvious potassium deficiencies are apt to be in soils containing exceptionally large quantities of other cations (positive ions), especially calcium and magnesium. Excessive amounts of calcium and magnesium will reduce the uptake of potassium. Poorly aerated soils with large percentages of fine clay particles also may be unable to supply enough potassium even though they contain large quantities.

Fig. 1. Potassium-deficient French prune tree —Gilroy, California, area. Note sparse foliage and dieback in upper part of tree.

Most helpful information concerning the potassium supply of trees has been obtained by study of visual symptoms of potassium deficiency, especially leaf symptoms. Trees that make good growth in the spring and early summer may show a leaf crinkling, and in midsummer to late summer serious leaf injury. The most general of these symptoms is a dying (scorching) at the margins or along the mid-rib or veins. On trees of some varieties, a creamy yellow shading into yellow-green may precede this scorching.

Dying-back of shoots in late summer or autumn is, in some orchards, another important symptom of potassium deficiency. In some soils trees that show in late summer rather serious leaf injury from lack of potassium may make good spring and early summer growth; in others there may be a serious dwarfing much like that from copper deficiency. In fact, sometimes in some species, deficiency symptoms of copper, manganese, and potassium are not easily distinguished by mere orchard observation.

It must also be noted that other factors, such as crown gall, crown rot, sour sap, oak root fungus, and excess

Fig. 2. Twig showing leaf curling and scorching, and small size of leaves typical of potash deficiency on prunes—Morgan Hill, California, area.

sodium, may cause dieback. Trees so affected will also carry chlorotic (yellowing) mottled leaves in varying degrees of intensity.

Fruiting tends to accentuate potash injury in leaves and branches. Trees of some species tend to drop nearly all the blossoms and young fruit, but trees of others, such as Agen prune, may set rather heavy crops. Potassium moves to the fruit to such an extent that on a soil not too deficient in potassium for excellent growth of young trees, a heavy crop may cause severe potassium-deficiency symptoms in the leaves and dying-back of the shoots or even larger parts of the branches.

Slender, peaked, short growth, with short internodes and needle-like points, and chlorotic leaves having interveinal mottling, a convex rolling, and a buckskin to bronze color on the upper side are characteristic symptoms of potassium deficiency in French prunes. Where an extreme deficiency exists, dieback of shoot wood and marginal scorch of the leaves may be present with sub-normal crops of poor quality fruit.

It was not until recently that vegetative symptoms in apricots suspected of being potasium deficiency were reported. This recent discovery in Santa Clara County has lead to the detection of low potassium areas in two additional widely separated locations in the County and another in San Mateo County.

These apricot trees showed severe dieback in the tops and short, spindly growth throughout the tree, the leaves being chlorotic and mottled with severe marginal scorch and irregularly shaped necrotic spots (dead spots). The outstanding symptom was evidenced by a cupping of the leaf which appeared much like an excess sodium characteristic with the exception that the potassium-deficient leaf retained its pointedness whereas the leaf affected by sodium generally shows little or no point. In these instances, yield was impaired and quality of fruit poor.

It is much more difficult to recognize potassium deficiency in the pear, although symptoms may be found by close and careful examination. The pear makes little new growth and the leaves become yellowish-green with brownish discolorations around their margins. In some cases, leaves roll and a grayish-green discoloration appears around the margins, while others have a reddish tinge.

Where the potassium deficiency is acute, a marginal scorch may be found and the yield will be below normal, the greater portion of which will be sub-standard in size. Chlorotic effects and marginal scorch must not be confused with somewhat similar symptoms where lime-induced chlorosis (iron deficiency) is present. The latter occurs in high-calcium soils, such as soils of the Sorrento series, Bowers clay, and Sunnyvale clay loam.

An abundant nitrogen supply tends to accentuate a potassium deficiency, possibly in part because nitrogen increases growth and thereby increases the potassium requirement of the tree. This condition developed in one prune orchard in Santa Clara County where a heavy application of nitrogen on low-potassium soil resulted in increased leaf scorch and very severe dieback the following year.

In the endeavor by soil scientists and pomologists to determine the causes of erratic tree behavior with respect to soil fertility, it is quite logical to turn to an analytical method that will give some measure of the chemical elements that the tree is able to take from the soil.

It has very properly been said that "The Plant Speaks," which is just what happens when fruit-tree leaves are subjected to chemical analysis. The results of such an analysis are expressed in percentages on a dry-weight basis and by correlation with the known visual symptoms serving us as a guide to locate the disturbing factor, whether it be a chemical deficiency or excess.

Recognizing these important facts, the Pomology Division has set up a leaf-analysis laboratory with the most modern and highly developed equipment for the purpose of making state-wide studies. This work is under the guidance of Dr. Omund Lilleland, Pomologist of the Agricultural Experiment Station, Davis, California.

Fig. 3. Scorched leaves on new growth of apricot trees which have run short of potash—Eastside area, Santa Clara Valley.

Fig. 4. Making a heavy application to potash-deficient apricot trees—Eastside area, Santa Clara Valley.

After a great volume of leaf-analysis work in various tree fruits and nuts, certain standards have been determined for normal trees bearing average crops of good quality. By comparing the report of analyses of leaves from trees suspected of too low an uptake of plant food for best growth, or excessive uptake of harmful chemicals, an interpretation can be made. From this information a fertilizer test can be made in the orchard concerned to actually prove the efficacy of the treatment indicated by the leaf analysis. We have recommended that all growers having potassium-deficiency symptoms in their orchards put in small test plots for observation, and a few have done so with striking results.

It is recommended that potassium be applied in massive amounts in the order of 25-30 pounds sulfate of potash per tree, as generally fruit trees are slow in their uptake. However, two pear growers and two French prune growers obtained a satisfactory response the first crop following the potassium application made during the dormant season. Leaf color was corrected or improved, shoot growth was normal, and fruit yield and sizes were increased to normal.

French prune trees in a Santa Clara Valley orchard showing severe symptoms of potash deficiency showed this analysis (dry basis) with samples taken in July: Potassium in the leaves—0.38%.

Two years after one massive treatment of 25 pounds sulphate of potash per tree, the trees made a very good recovery in foliage and growth condition and, of course, an equal recovery in size and quality of fruit. At this time the analysis (dry basis) on a comparable leaf sample was: Potassium in the leaves—0.89%.

We do not feel that the optimum build-up of potassium has yet occurred in these trees, even though the improvement was remarkable. The orchard is still in a zone of potassium deficiency, in our opinion, until the leaf level reaches 1.5% potassium.

Hardy pear trees in an orchard in this Valley were exhibiting severe symptoms such as those described for potassium deficiency, and a leaf sample collected in late July showed this analysis: Potassium in the leaves—0.14%.

A block of these trees was treated with 15 pounds sulphate of potash per tree and an outstanding recovery has

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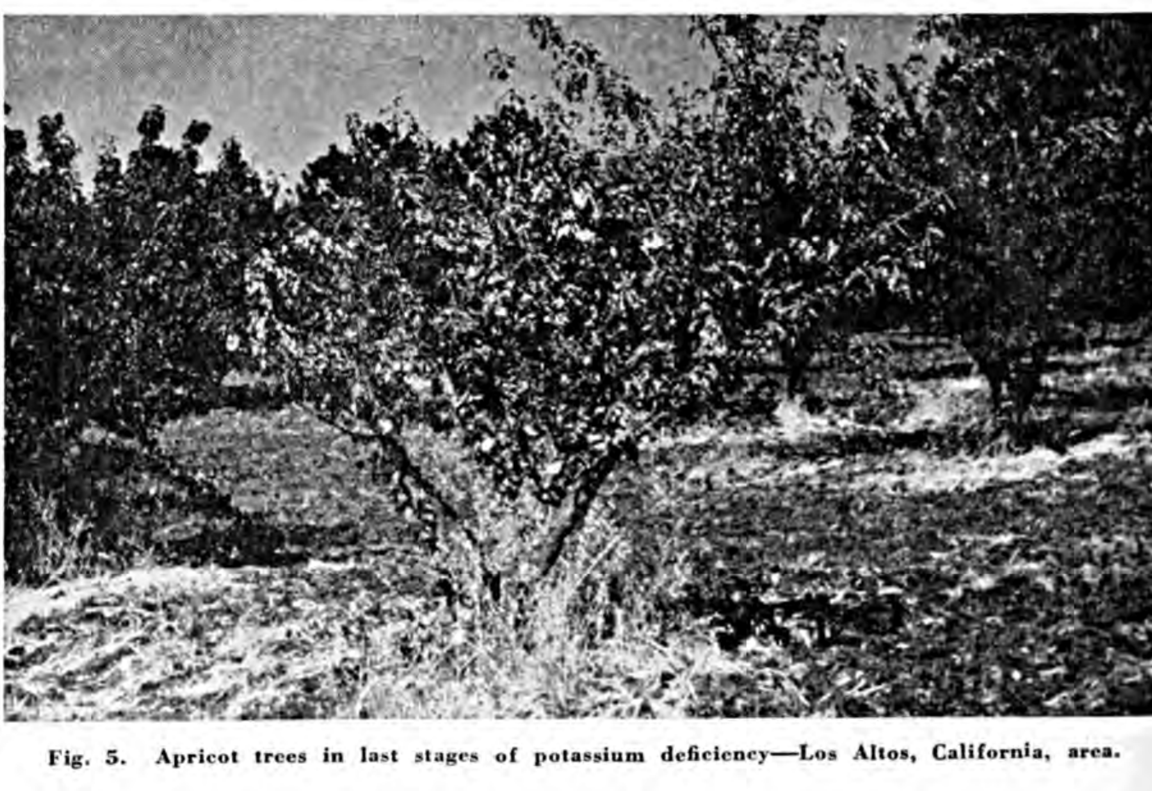

Fig. 5. Apricot trees in last stages of potassium deficiency—Los Altos, California, area.

Insect Control Goes With Cotton Fertilizer Plan

By Roy H. Anderson

Agronomist, North Texas Supply Co., Paris, Texas

IT has become increasingly important to consider insect control when planning for maximum cotton production. Through a cooperative F.H.A. farmer cotton dusting, fertilizing demonstration in 1948, twelve farmers in Lamar County, Texas, averaged 422 pounds of lint cotton per acre as compared to a 174-pound average yield on their check plots. The entire County had an average of 166 pounds of lint per acre in 1949.

These twelve farmers each had five acres that had the fertilizer applied as recommended for the specific farm by N. A. Cleveland, F.H.A. County Administrator. In addition, these five-acre plots received two applications of the organic poisons, 3-5-40 or toxaphene, at a stage just before the cotton plants put on squares. This is what is known as presquare dusting, just as the name implies. The theory behind this method of dusting is based on the fact that the over-wintering weevils, fleas, and thrips can be very easily killed before there are any squares to lay their eggs in. This assures the setting of a cotton crop, since there are relatively no insects present to damage them. Our farmers have found that if they can save that first crop of squares and grow them to maturity, they can be pretty well assured of a fairly profitable cotton crop.

This was the experience of these demonstrator farmers, with five of the twelve making over 500 pounds of lint per acre on their five acres. In checking the results of the other farmers, late planting and poor stands seem to have affected the majority and probably were

Fig. 1. Fertilizer response but poor insect control.

the main contributing factors in their not making the bale per acre that some of the others did.

Sidney S. Clark topped the Lamar County group and also the State with his 681.7 pounds of lint per acre. Compare this with his check plot that was not fertilized and received no poison until late July. He did not pick the check plot.

His treatment on the five-acre demonstration plot included the application of 100 pounds of 5-10-5 and 100 pounds of 4-8-8 on land that had previously been in a phosphated cover crop. Clark dusted as the other demonstrators did,

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Farming With Green Manures

(A Review of an Old Book)

By George R. Cobb

Salisbury, Maryland

A BOOK printed in 1880 and written by C. Harlan on the subject "Farming with Green Manures" not only provides an interesting and instructive discussion of that topic but includes suggestions of many other worthwhile practices related to life on the farm. This book is the 6th edition revised and enlarged. Mr. Harlan owned and operated a large farm near Wilmington, Delaware, and most of his advice is based on his experiences on this farm although he includes quotations from old-time writers and experiences of farmers of his time.

Mr. Harlan anticipated Faulkner's "Plowman's Folly." He warns us that when we plow under a great mass of vegetation that we must be careful that we do not "roof" over the subsoil. If we do, he continues, we must plow it again and harrow and pulverize it well before seeding a crop. He, like Faulkner, is opposed to too much plowing of land as he says, "It is the too frequent breaking up of poor land that keeps the farmer poor." Whether it would be better to plow the mulch under in the spring, or only disturb the friable and crumbling mould enough to receive the seed and young plants from the hotbed must be a matter of one's own or another's experience, he believes, but he prefers the latter method.

It would seem that he "stole some of the thunder" from present-day agronomists when he advises having the soil in such condition that air can get to the roots of the plants. The more we introduce air into the roots of growing plants, he says, the less need we will have to send to South America for guano. It is the oxygen of the air that supports combustion and the roots of all growing plants must absorb oxygen or they cannot grow. He, like agronomists in Nebraska and elsewhere, is an advocate of trash farming for he writes, "If we are satisfied upon careful examination that the clover is dense and deep enough to prevent all weeds from growing, we may put in the corn in the following manner—open a space in the mulch the size of your hand and with a hoe scrape a hole less than two inches deep, then let an assistant drop in three or four grains of corn, cover it one inch and tred the hill as you leave. After this you will have nothing to do till the crop is ready to cut."

Shallow Cultivation

At the present time farmers are advised to cultivate corn as little as possible—just enough to control weeds in the early part of the season. This would seem to be another old story, for back in 1841 the Cultivator tells of a Mr. Williams who grew 158 bushels of corn per acre without cultivation. His method was to plant the corn and then with sharp hoes and with a scraping motion cut the weeds—no other cultivation. And he attributes much of his success to the fact that the roots of the corn were not disturbed during the growing season.

As a further indication that perhaps Mr. Harlan was in advance of his time is his advice to apply fertilizer to the cover crop. In this he agrees with Dr. Wolf and other soil men and agronomists.

In the olden days, apparently, a farmer who made money spent this hard-earned cash for more land. Mr. Harlan quotes Alderman Mechi, who is cited as England's "Model Farmer," as saying, "I have noticed a very money-getting farmer in my neighborhood who never keeps any livestock, except a couple of cows, and who never buys any feeding stuffs or manures. He keeps his land clean and fertile by plowing in green crops. I know that he makes money for he often purchases land."

To say that Mr. Harlan was enthusiastic regarding manures would be putting the case mildly, as he might be considered a fanatic on the subject and it might be well if there were more such fanatics in our country. He writes that green crops have a manurial power equal, if not superior, to every other mode of improvement. Their roots penetrate the earth and open millions of channels which permit the air with all of its rich constituents to act upon the subsoil and improve it not only by compelling the decay of vegetable matter but by entering into new compounds and thus becoming available food for plants. The deep roots of the green manures change the color, the texture, and the quality of the subsoil which stable manures cannot do. Green manures supply organic matter and poor land is the result of a lack of organic matter, not of minerals. The ash of agricultural plants consists of the phosphates, sulphates, silicates, and carbonates of potash, soda, lime, and magnesia with small amounts of oxide of iron and manganese and alkali chlorides.

Many Values

Low production on the farm, Mr. Harlan claims, is caused by a lack of organic matter. Humus, he says, is more than four horses to a plow. It makes the earth mellow, it loosens up its texture so that the air and roots can penetrate, it changes the color of the soil, it converts the nitrogen of the air into nitric acid and ammonia, it absorbs and retains moisture better than anything else, it holds the constituents of plant food in its millions of capillary vessels, and it makes the soil so friable that it is never too dry or hard to plow and seldom too wet to till.

Another fact in favor of green manures is the cost. Writing of red clover as a green manure, he says that here we have a green manure that costs but a trifle over three cents per ton and which is more valuable, ton for ton, than stable manure. It will take 360 tons of stable manure, for example, on 20 acres to supply as much nitrogen as we have in a single crop of clover and not a cart nor horse nor fork of any kind was required to spread it evenly over the whole field. The time-saving factor is important, since with green manures there is no labor spreading manure or fertilizer. All vegetation, according to Mr. Harlan, has its nitrogen in the form of albuminoids and nothing but the decay or the complete decomposition of these protein bodies and the conversion of their nitrogen into nitric acid and ammonia will render them available as plant food.

Based on his statement that "were all the merits of red clover emblazoned in letters of gold on a large canvas they would fail to convey to the mind a full estimate of its true value" one would believe that Mr. Harlan had only one crop in mind as a green manure. But although he does consider clover one of the best, he also considers corn, buckwheat, white mustard, rye, and even turnips as very valuable green manures.

Corn Best Crop

One requisite of a green manure is bulk or quantity and he, like many present-day agronomists, considers corn as one of the best crops to furnish bulk and quantity of green matter. If seeded thickly and two crops grown in a season, corn will furnish a large amount of green matter. He has grown and turned under from 30 to 45 tons per acre. S. E. Todd in his Farmer's Manual writes in the early '80's, "Some farmers contend that clover plowed under is the cheapest manure that can be made. It is a great fertilizer, but I believe that a soil can be renovated sooner and at less expense with Indian corn than with clover because a much larger quantity is turned under yearly."

Mr. Harlan states that one ton of green corn contains 6 pounds of nitrogen, 2½ pounds of phosphoric acid, 9 pounds of potash and 1,600 pounds of water and that two crops a year, each containing in tops and roots about 20 tons per acre, will manure the land well. The second crop may be allowed to stand over winter and then be rolled down in the spring or better yet it may be cut in the fall and let lie where it falls to be turned under in the spring. When seeding corn for a green manure there is some question as to the number of grains to sow per foot of row. Some old-timers advise from 20 to 30 while others would drop 50 or more per foot. The Genesee Farmer in 1865 says that a Mr. Peters contends that the amount of corn fodder one can grow on an acre is truly fabulous as it is not unusual to grow 200 tons and he thinks it possible to produce 250 tons with "care and a good season."

Other Crops

There are many farmers and agronomists today who are wondering if we have not "missed the boat" in not using more buckwheat as a green manure. Mr. Harlan would agree with them fully in that they have failed to realize the value of this crop as a green manure or even as a hay. The American Agriculturist in 1867 stated that buckwheat affords one of the most valuable green manures to be used on light, leachy land. Colman, in his European Agriculture, 1846, feels that buckwheat is certainly the most economical and convenient manure that the farmer can employ. The Editor of the Theatre of Agriculture says, "We cannot too much recommend, after our old and constant practice, the employment of this precious plant (buckwheat) as a manure."

According to Mr. Harlan, three crops of buckwheat can be grown on the same piece of land in one season and these three crops will yield 45 tons per acre. And as usual he figures on a field of 20 acres so that on 20 acres you will have 900 tons of green matter. Applying his figures that one ton of green buckwheat contains 8 pounds of nitrogen, 3 pounds of phosphoric acid, and 11 pounds of potash these 900 tons would furnish 7,200 pounds of nitrogen, 2,700 pounds of phosphoric acid, and 9,900 pounds of potash which translated into terms of stable manure would mean that you would have to apply around 720 tons of manure to supply the same amounts of N, P, and K. Again we have no labor costs for spreading the green manure or removing it from the stables as we do with stable manure.

Apparently rye was considered just as valuable a green manure in 1847 as in 1947, for Mr. Harlan writes very highly of it as one of the best crops for that purpose. According to him, one ton of green rye contains 11 pounds of nitrogen, 4½ pounds of phosphoric acid, 12½ pounds of potash, and 1,400 pounds of water. In 1843 the Cultivator carried a story of a farmer who wrote: "Were my only object the rapid improvement of my soil within the shortest space of time, I would first sow down thick with rye which I would plow under just before time of ripening and would then sow 1½ bushels of corn per acre thus plowing under in the same season a heavy coat of rye and corn which in this short space of 12 months will equal, if not surpass, any benefit which can be derived from clover in two years."

According to Mr. Harlan, rye in the green state is equal, ton for ton, to stable manure with one small exception —the latter has a half pound more of phosphoric acid than the former. The rye crop is growing when no other crop except wheat could occupy the land, it protects the field from washing during the winter, and it absorbs the soluble minerals and the ammonia and nitric acid that might under other conditions be lost. The crop may be plowed down for a crop of corn or it may be cut down just as it blossoms and left as a mulch on the ground. A second crop will then grow up through it nearly

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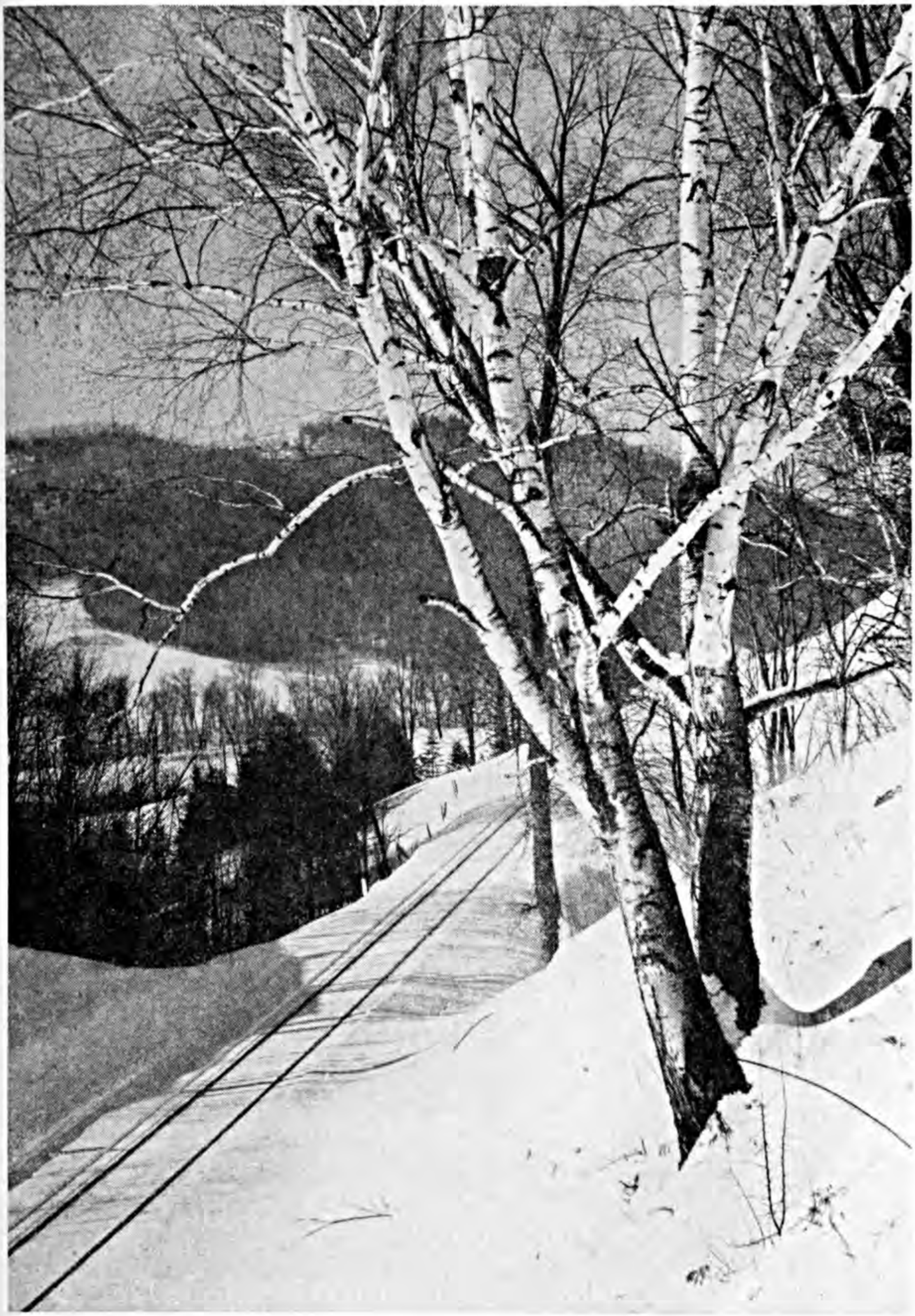
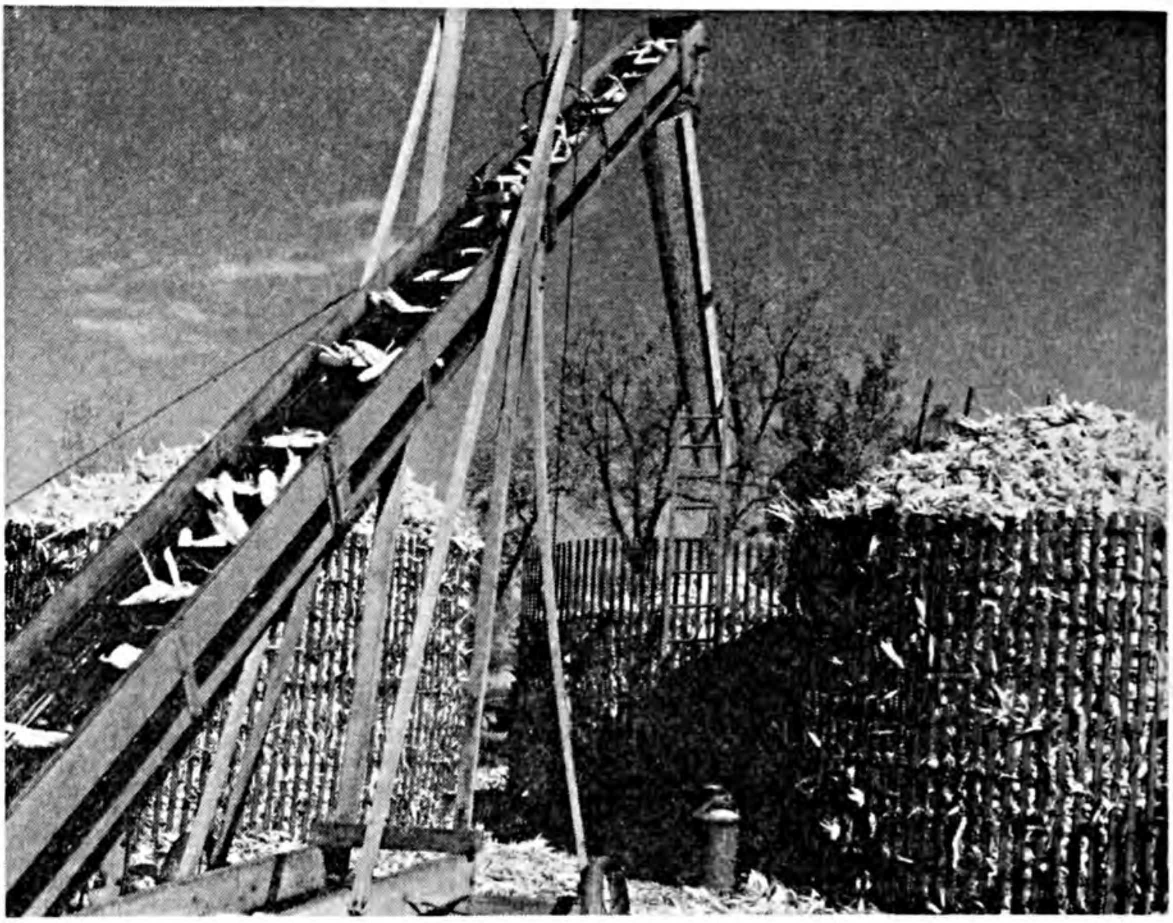
PICTORIAL



Snow—It Can Happen Anytime Now!

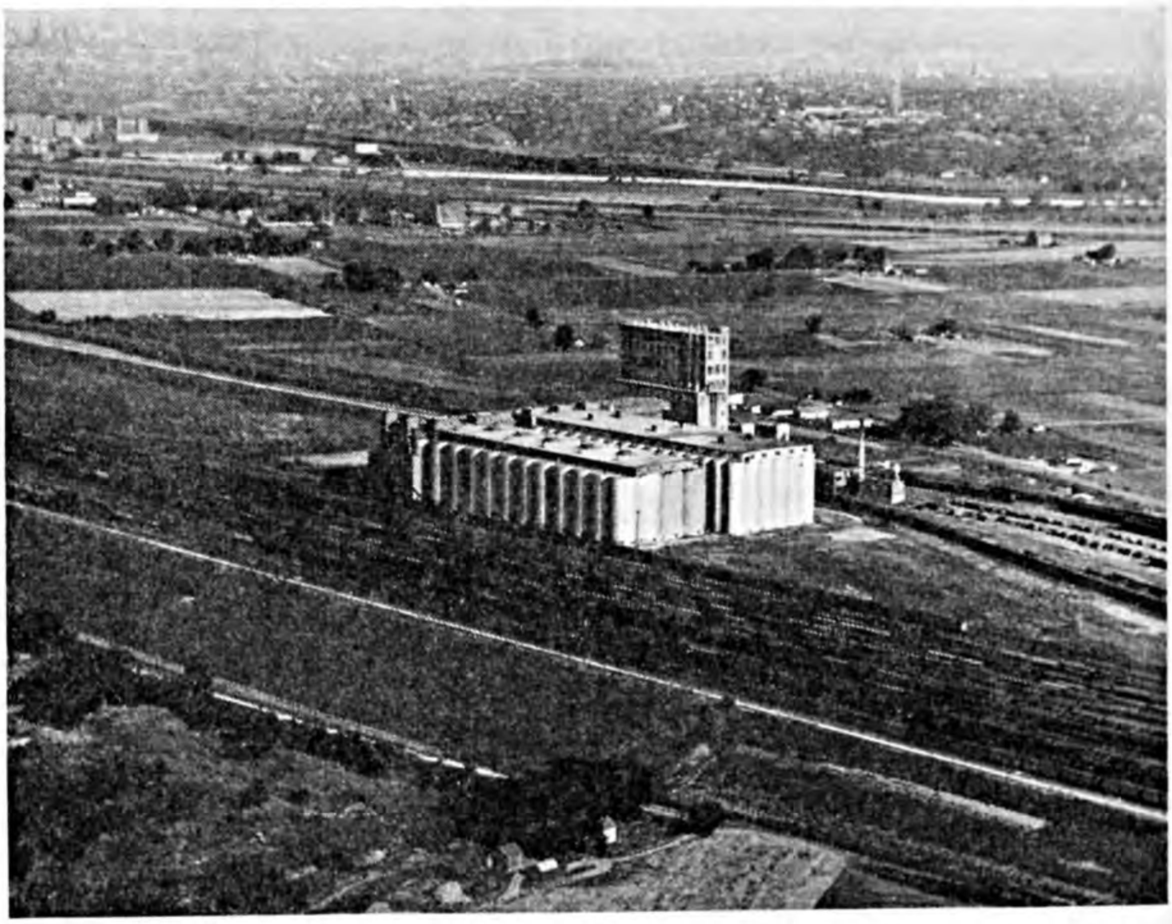
Among the

Be Harvested



Above: Storing corn in temporary cribs is being repeated again this year.

Below: Grain terminal, Turner, Kansas, said to be largest in the world.



The Editors Talk

The Science of Farming

In Cincinnati, Ohio, October 30 through November 4, nearly 1,100 highly trained agriculturists and research men gathered to discuss and digest the latest problems in profitable soil and crop management. The occasion was the 42nd annual meeting of the American Society of Agronomy and the 15th of the Soil Science Society of America. Faced with the demands which may be made upon our agriculture in the event of another international emergency, these men appeared more than ordinarily serious in their consideration of ways and means for getting the results of research into practical application—into the science of farming.

To bear out this observation and in evidence of the tremendous interest in grassland farming developing on the part of farmers throughout this country, the first day of the convention was devoted to a general session on this subject. This was a new feature and the large audience listened to such practical discussions as "Fertilization and Nutrition of Grasslands," by Firman E. Bear, New Jersey Agricultural Experiment Station; "Building Soil Tilth with Grasslands," by G. N. Hoffer, American Potash Institute; "Grass and Legume Mixtures Essential for a Grassland System," by D. F. Beard, Bureau of Plant Industry, U. S. Department of Agriculture; "Grassland Farm Management," by D. Howard Doane, Doane Agricultural Service; "Grassland Mechanization," by F. W. Duffee, University of Wisconsin; "The Economics of Grassland Farming," by Herrell DeGraff, Cornell University; and "Observations in a Recent Grassland Survey," by D. R. Dodd, Ohio State University. It also listened to two "dirt" farmers—Paul Strickler, Waterford, Virginia, and Willis Stout, Louisville, Kentucky—who told how they had applied science in "My Grassland Program and How I Built It."

Other features of this year's meeting included programs for two new divisions of the societies—the Plant Nutrients Division and the Agronomic Application Division. In one session of the former, a look into the future was presented in "What Problems Should Plant Nutrient Research During the Decade of 1950 Be Designed to Solve?" by Richard Bradfield of Cornell University. A panel following put special emphasis on minor element needs of soils, plants, animals, and man; adequate consideration of the influence of soil organisms on the functioning of roots; high fertilization of crops, high yields, and nutritive value; and fundamental and applied research in soil fertility. At the close of this panel, Dr. Bradfield made a strong plea for coordination and cooperation in all fields of agricultural research in order to attack more efficiently the problems facing agricultural scientists, thus permitting their more rapid solution and the putting of the results into actual usage. The Agronomic Application Division spent two full afternoon sessions on pasture management, in deference to the trend to put more and more of our acreage into grasslands.

One of the drawbacks to progress in agriculture always has been the reluctance of farmers to adopt new practices. What father did was good enough for son. The successful farmer today is a new type, for farming has become a complex science and the scientist not only is versed on the well-known ways of doing things but is looking for new means of accomplishment. It is fortunate that we have national organizations of research workers who in their large annual meetings as well as in sectional meetings can keep ahead of the problems which confront the successful farmer—the farmer who wants to apply more and more science to his farming.

Soil Conservation Is National Defense

"Soil conservation is an indispensable part of our first line of national defense. The other indispensable part of our first line of national defense is, of course, strong soldiers, guns and bullets. The two—adequate food from productive land for adequate defense—are mutually sustaining; one cannot exist without the other. If we lose our soil, there will be little to defend, and only hungry soldiers for defense."

Thus, does Dr. Hugh Bennett, Chief of the Soil Conservation Service, place due emphasis on the fertility of the soil, from which all of our strength, personal and national, must come. Although this concept has long been realized by thinking people, its repetition over and over again is most commendable in these times. National defense, involving tremendous costs and resulting sacrifices, is uppermost in everyone's mind. In the pressure to build it up as quickly as possible, the basic principles must not be forgotten. By nature of its vast coverage, the Soil Conservation program has taken time and is years from completion. However, the progress has been steady and satisfactory.

In a recent report, Dr. Bennett states that the rate of progress is very much greater per dollar spent today than it was in the earlier years, and the trend is steadily upward. While we admittedly are not moving fast enough, we are, nevertheless, moving ahead at a rate that is anything but discouraging. At the end of the first seven years of work, in 1941, the Service had directed the conservation treatment of 26,600,000 acres, an average of 3,800,000 acres annually for the first seven years. The total soil conservation job, in 1941, comprised all lands classified as "in farms," or 1,098,000,000 acres (Census 1945). This does not include areas occupied by roads, lanes, farmsteads, etc.

During 1942 the principal conservation measures were applied to approximately 5,000,000 acres (in soil conservation districts); in 1949 the same kind of treatment was applied to 22,000,000 additional acres. This was an increase of 340 per cent—yearly 4½ times as much work done—with operating facilities increased during this second seven-year period by only 43 per cent.

But there is still a long way to go, Dr. Bennett says, and we are still losing great quantities of soil. However, we have learned to control erosion on practically all kinds of land, and we are controlling it at a much faster rate than the public realizes. He sees no reason why we can't continue to build up momentum and believes, given adequate facilities, that we can get the job of applying the basic conservation measures to the land completed by about 1970—around 20 years from now. As to finishing the job, actually there is no end to it, because when the basic conservation measures have been applied to the land there will be the continuing task of maintenance. This is true of all the works of man. If not maintained, they eventually disappear through neglect.

This, then, is a national defense program looking well into the future. It must not be overlooked, and the importance of conserving and maintaining the fertility of their soils should constantly be kept before our American farmers. In this is a considerable measure of assuredness that we shall be able to meet emergencies as they befall us.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925...........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926...........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927...........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928...........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929...........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930...........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931...........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932...........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933...........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934...........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935...........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936...........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937...........	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938...........	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939...........	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940...........	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941...........	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942...........	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943...........	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944...........	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945...........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...........	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947...........	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948...........	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949...........	28.6	46.3	128.0	214.0	119.0	186.0	16.55	43.40	....
November...	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January.....	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February....	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March.......	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April........	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....
May........	29.24	48.5	128.0	228.0	134.0	204.0	17.25	45.20	....
June........	29.91	49.7	127.0	211.0	136.0	193.0	16.05	46.20	....
July.........	33.05	45.5	127.0	208.0	144.0	199.0	15.15	52.00	....
August......	36.95	53.1	122.0	218.0	144.0	197.0	15.45	70.90	....
September...	39.98	55.4	105.0	192.0	144.0	194.0	15.55	78.80	....
October......	38.90	55.1	85.8	154.0	137.0	191.0	15.85	81.50	....

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

	Cotton	Tobacco	Potatoes	Sweet Potatoes	Corn	Wheat	Hay	Cottonseed	Truck Crops
1925...........	158	168	245	188	109	163	108	140	143
1926...........	101	179	189	134	116	138	112	98	139
1927...........	163	207	146	124	132	135	87	154	127
1928...........	145	200	76	134	131	113	95	152	154
1929...........	135	183	189	133	124	117	92	137	137
1930...........	77	128	131	123	93	76	93	98	129
1931...........	46	82	66	83	50	44	73	40	115
1932...........	52	105	55	62	50	43	52	46	102
1933...........	82	130	118	79	81	84	68	57	91
1934...........	100	213	64	91	127	96	111	146	95
1935...........	90	184	85	80	102	94	63	135	119
1936...........	100	236	164	106	163	116	94	148	104
1937...........	68	204	76	89	81	109	74	87	110
1938...........	69	196	80	79	76	64	57	97	88
1939...........	73	154	100	84	88	78	67	94	91
1940...........	80	160	78	97	96	77	64	96	111
1941...........	137	264	116	105	117	107	82	211	129
1942...........	153	369	168	134	143	124	91	202	163
1943...........	160	405	188	235	174	154	125	231	245
1944...........	167	420	214	216	170	160	139	234	212
1945...........	181	366	205	232	198	170	127	227	207
1946...........	263	382	178	248	212	209	141	319	182
1947...........	257	380	232	248	336	259	148	381	226
1948...........	245	482	222	253	201	226	155	298	214
1949...........	231	463	184	244	210	210	139	192	201
November...	224	434	192	216	159	215	141	188	213
December....	214	454	188	230	176	218	144	192	196
1950									
January.....	213	397	195	245	179	217	144	193	261
February....	222	341	191	252	181	218	141	193	203
March	226	320	189	253	185	224	139	191	168
April.	232	...	192	260	196	227	140	197	205
May	236	485	184	260	209	231	145	200	178
June........	241	497	182	240	212	218	135	205	182
July.........	267	455	182	237	224	225	128	231	200
August......	298	531	175	248	224	223	130	314	164
September...	322	554	151	219	224	219	131	349	126
October......	314	551	123	175	213	216	134	361	138

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19
May	3.00	2.05	10.74	11.97	10.14	7.59
June	3.00	1.71	10.55	10.79	9.41	7.36
July	3.00	1.71	11.53	10.71	9.35	8.74
August	3.00	1.71	11.44	11.06	10.62	9.87
September	3.00	1.71	11.44	10.85	10.85	10.32
October	3.00	1.71	11.86	10.63	10.62	10.32

Index Numbers (1910-14 = 100)

	Nitrate of soda	Sulphate of ammonia	Cottonseed meal	Fish scrap	Tankage	High grade ground blood
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233
May	112	72	307	339	301	216
June	112	60	301	306	279	209
July	112	60	329	303	277	248
August	112	60	327	313	315	280
September	112	60	327	307	322	293
October	112	60	339	301	315	293

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200
April	.760	3.76	5.47	.375	.720	14.50	.200
May	.760	3.76	5.47	.375	.720	14.50	.200
June	.760	3.76	5.47	.336	.647	12.77	.176
July	.760	3.76	5.47	.368	.704	13.98	.193
August	.760	3.76	5.47	.368	.704	13.98	.193
September	.760	3.75	5.47	.368	.704	13.98	.193
October	.760	3.73	5.47	.386	.704	13.98	.193

Index Numbers (1910-14 = 100)

	Superphosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83
April	142	104	112	68	76	60	83
May	142	104	112	68	76	60	83
June	142	104	112	63	68	53	80
July	142	104	112	67	74	58	82
August	142	104	112	67	74	58	82
September	142	104	112	67	74	58	82
October	142	103	112	70	74	58	82

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949	249	240	226	137	99	319	144	70
November	237	236	221	136	96	321	144	72
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	223	135	96	313	142	72
May	247	244	228	132	91	311	142	72
June	247	245	230	126	85	293	142	66
July	263	247	238	128	85	301	142	70
August	267	248	243	131	85	321	142	70
September	272	252	247	131	85	324	142	70
October	268	253	246	131	85	323	142	73

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

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

Fertilizers

"Summary Report of Fertilizer Materials Consumed in Florida for Fiscal Year July 1, 1949, Thru June 30, 1950," Fert. Stat. Div., Bur. of Insp., Tallahassee, Fla.

"Tonnage of Commercial Fertilizer Reported by Manufacturers as Shipped to Kansas in the Spring of 1950, by Counties," Kans. State Brd. of Agr., Control Div., Topeka, Kans., Jan. 1, 1950 to June 30, 1950.

"Analyses of Official Fertilizer Samples Semi-Annual Report, January-June 1950," Agri. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 84, Aug. 1950.

"Maryland Inspection and Regulatory Service," Univ. of Md., College Park, Md., Control Series No. 215, (Aug. 1950).

"Commercial Fertilizer Results With Winter Wheat and Rye," Univ. of Nebr., Lincoln, Nebr., Outstate Test. Cir. 10, Aug. 1950, G. W. Lowery, R. A. Olson, A. F. Dreier, and P. L. Ehlers.

"Fertilizer Analyses for July 1, 1948-June 30, 1949," N. C. Dept. of Agr., Raleigh, N. C., Bul. No. 118.

"Fertilizer Possibilities in North Dakota," N. D. Ext. Serv., Cir. A-141, Fargo, N. D., Jan. 1950.

"Suggestions for Fertilizer Use in North Dakota," Ext. Serv., N. D. College of Agr., Fargo, N. D., Cir. A-142, Jan. 1950.

"Fertilizers for Early Cabbage, Tomatoes, Cucumbers and Sweet Corn," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 697, June 1950, John Bushnell.

"Rotation Fertilization for Pennsylvania," Agron. Extension and Exp. Sta., Pa. State College, State College, Pa., Sept. 1950.

"Fertilizer Recommendations for Virginia," Agr. Ext. Serv., Va. Poly. Institute, Blacksburg, Va., Bul. 183, July 1950.

"Boron, Copper, Manganese, and Zinc Requirement Tests of Tobacco," USDA, Washington, D. C., Tech. Bul. 1009, 1950. W. C. Bacon, W. R. Leighty, and J. F. Bullock.

Soils

"Testing Missouri Soils," Agr. Exp. Sta., Univ. of Mo. College of Agr., Columbia, Mo., Cir. 345, Mar. 1950, E. R. Graham.

"Progress Report, 1950 Soil and Water Conservation Research at the Red Plains Conservation Experiment Station, Guthrie, Okla.," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Mimeo. Cir. M-195, Apr. 1950, H. A. Daniel, H. M. Elwell, and M. B. Cox.

"Progress Report, 1950 Soil and Water Conservation Research at the Wheatland Conservation Experiment Station, Cherokee, Okla.," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Mimeo. Cir. M-196, Apr. 1950, H. A. Daniel, H. M. Elwell, and M. B. Cox.

"Terraces to Control Run-off," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 386, Mar. 1950, O. R. Zeasman and A. J. Wojta.

"Suitability of Various Soils for Tung Production," USDA, Wash., D. C., Cir. No. 840, July 1950, M. Drosdoff.

"Soil Survey of Union County, Georgia," USDA, Wash., D. C., Series 1938, No. 28, June 1950.

Crops

"Arizona Range Resources, II. Yavapai County," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 229, July 1950, R. R. Humphrey.

"Mechanized Production of Cotton," Agr. Exp. Sta., Univ. of Ark., College of Agr., Fayetteville, Ark., Mimeo. Series No. 3, Apr. 1950, K. Engler, W. F. Buchele, and J. C. Newell.

"Progress Report 1934-1948," Div. of Hort., Central Exp. Farm, Ottawa, Ontario, Canada.

"Progress Report 1937-1948," Div. of Forage Plants, Central Exp. Farm, Ottawa, Ontario, Canada.

"Spring Oats for Illinois Variety Trials 1945-1949, Disease Hazards 1949," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 659, Apr. 1950, J. W. Pendleton, W. M. Bever, G. H. Dungan, and O. T. Bonnett.

"Results of Research in 1949," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., 62 A. R., 1949.

"Effect of Cover Crops and Tile Drainage on Growth and Yield of Peaches," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 547, May 1950, A. J. Olney, S. J. Lowry, and L. M. Caldwell.

"Summary of Results of Experiments at Western Kentucky Substation 1927-1949," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., P. R. July, 1950.

"Grass Seed Production in Nebraska," Ext. Serv. Univ. of Nebr., College of Agr., Lincoln, Nebr., Ext. Cir. 188, Apr. 1950, L. G. Wolfe and H. H. Wolfe.

"Nebraska Outstate Varietal Tests of Fall-Sown Small Grains 1950, Winter Wheat—Winter Barley—Rye," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Test. Cir. 9, Aug. 1950, A. F. Dreier and P. L. Ehlers.

"Grassland Farming," Univ. of Nebr. Extension Work, Lincoln, Nebr., E. C. 190, 1950, D. L. Gross.

"Birdsfoot Trefoil," N. Y. State College, Cornell Univ., Ithaca, N. Y., Ext. Bul. 797, May 1950, L. H. MacDonald.

"Grow Quality Sweet Potatoes," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Ext. Cir. 353, Apr. 1950, F. D. Cochran, E. R. Collins, H. M. Covington, H. M. Ellis, H. R. Garriss, G. D. Jones, W. D. Lee, L. W. Nielsen, and P. Ritcher.

"Grass Seed Production," Ext. Ser., College of Agr., Fargo, N. D., Cir. A-139, Jan. 1950, I. T. Dietrich.

"Good Hog Pastures," Ext. Serv., N. D. Agr. College, Fargo, N. D., Cir. No. A-149, Mar. 1950, G. E. Strum and R. B. Widdifield.

"Soybean Variety Tests, 1926 to 1949," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Bul. No. B-356, Aug. 1950, C. L. Canode and J. E. Webster.

"Research for the Farmer," Agr. Exp. Sta., R. I. State College, Kingston, R. I., 62nd A. R., June 1950.

"The Influence of Crop Plants on Those Which Follow V," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Bul. 309, Aug. 1950, T. E. Odland, R. S. Bell, and J. B. Smith.

"Sixty-First Annual Report," Exp. Sta., College of Agr., Clemson, S. C., May 1950.

"Pastures for South Carolina," Agr. Ext. Serv., College of Agr., Clemson, S. C., Bul. 99, Rev. Aug. 1950.

"Fall Tomatoes," Agr. Ext. Serv., College of Agr., Clemson, S. C., Cir. 354, May 1950, R. J. Ferree, A. E. Schilletter, and W. C. Nettles.

"The Vegetable Garden," Agr. Ext. Serv., Univ. of Wis., Madison, Wisc., Cir. 372, Rev. Jan. 1950, O. B. Combs.

"Growing Grapes at Home," Agr. Ext. Serv., Univ. of Wis., College of Agr., Madison, Wis., Sten. Cir. 235, Feb. 1944, Rev. Feb. 1950, J. G. Moore.

"When Pastures and Hay Crops Fail," Ext. Serv., Univ. of Wis., Madison, Wis., Sten. Cir. 310, Apr. 1950, H. L. Ahlgren, G. M. Briggs, and L. F. Graber.

"Barley," Ext. Serv., Univ. of Wis., Madison, Wis., Sten. Cir. 307, Feb. 1950, R. G. Shands and H. L. Shands.

"Preventing Black Rot Losses in Sweetpotatoes," USDA, Wash., D. C., Leaf. No. 280, June 1950, J. S. Cooley and R. J. Haskell.

"The Importance of Pasture and Roughage in the Dairy Program," USDA, Wash., D. C., BDIM-Inf-93, June 1950, R. E. Hodgson.

Economics

"1949 Agricultural Statistics for Arkansas," Agr. Exp. Sta., Univ. of Ark., College of Agr., Fayetteville, Ark., Rpt. Series No. 18, June 1950.

"Farming in Canada," Inf. Serv., Dept. of Agr., Ottawa, Ontario, Canada.

"Handbook of Facts about North Dakota Agriculture," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 357, June 1950, B. H. Kristjanson and C. J. Heltemes.

"What About Our Large Farms in North Dakota?" Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 360, July 1950, B. H. Kristjanson.

"Keeping Up on the Farm Outlook," Agr. Ext. Serv., Wash. State College, Pullman, Wash., Ext. Cir. No. 161, Aug. 31, 1950, K. Hobson.

"Cotton Production in the United States, Crop of 1949," Supt. of Documents, U. S. Govt. Printing Office, Wash., D. C.

"1951 Agricultural Conservation Program National Bulletin," USDA, Prod. & Mktg. Adm., Wash., D. C., 1061 (51)-1, September 1950. (Reprinted from Federal Register of Sept. 12, 1950.)

The Good Old Days

Grandmother, on a winter's day, milked the cows and fed them hay, slopped the hogs, saddled the mule, and got the children off to school; did a washing, mopped the floors, washed the windows, and did some chores; cooked a dish of home-dried fruit, pressed her husband's Sunday suit, swept the parlor, made the bed, baked a dozen loaves of bread, split some firewood, and lugged in enough to fill the kitchen bin; cleaned the lamps and put in oil, stewed some apples she thought would spoil; churned the butter, baked a cake, then exclaimed, "For heaven's sake, the calves have got out of the pen"—went out and chased them in again; gathered the eggs and locked the stable, back to the house and set the table, cooked a supper that was delicious, and afterward washed up all the dishes; fed the cat and sprinkled the clothes, mended a basketful of hose; then opened the organ and began to play, "When you come to the end of a perfect day."—Kalends.

Insect Control Goes With Fertilizer Plan

(*From page* 23)

twice before the square formed. He did not dust again until the bollworms hit; however, it was not followed through in its entirety since the tractor harmed his crop of grown bolls. It appeared that the dust he put on did more harm than good, since the excessive late July rains assured excellent weather for the bollworm. Actually, the build-up of beneficial insects helped more than poison in controlling these worms, especially since the weather prevented five-day intervals of dusting. Cleveland reported positive evidence of beneficial insect build-up.

His neighbor, Richard Redus, who was runner-up to Clark in the State contest with 613.8 pounds of lint per acre, followed the same pre-square dusting schedule but used a different amount and grade of fertilizer. He used 300 pounds of 8-8-8 per acre on land following cotton. Last year he made 3¾ bales of cotton on 23 acres. He did not follow the complete fertilizer, dusting program as that in 1949 on the five-acre demonstration. He made 23 bales on 28 acres in 1949, dusted it all pre-square, but did not use fertilizer on all of this cotton.

These two demonstrations and all the others except one were on soils normally considered marginal cotton-producing soils of the County. They are light-textured soils overlying a dense claypan and tend to be droughty. They are inherently low in fertility and require annual applications of fertilizers to make any kind of profitable crop. Normally these soils are considered potash-deficient and cotton develops what is locally called "greyland rust." The leaves scorch along the outer edges and finally fall off along about maturity time. This prevents the bolls from filling out and causes a reduction in yield and grade.

The 8-8-8 and 4-8-8 fertilizers are becoming increasingly popular with these farmers as a fertilizer that helps relieve this "rust" situation. Soil tests have shown that this shortage exists and as a result more and more farmers are going to these grades high in potash. Many acres that have never before received any applications of fertilizer will be fertilized next year. These twelve farmer demonstrators have shown that insect control is a must in achieving maximum yields with these fertilizers.

Tall Fescue in the Southeast

(*From page* 11)

solute essentials. In a great many cases, legumes have starved out of the mixture, and fescue has been said to have crowded the legumes out. Tall fescue and reseeding crimson clover were seeded together on poor, cherty upland near Dalton, Ga., in the fall of 1947. In checking the volunteer stand of clover in December of 1949, it was observed to be patchy. A natural assumption was that the fescue was crowding the clover out, but on closer examination it was found that the thick patches of clover were where the fescue was most vigorous. This indicated that the greater fertility in these patches was an important factor in keeping the clover in the mixture.

Grazing has appeared to be an important factor in maintaining a balance between fescue and ladino or other legumes. At seasons when either plant tended to dominate, grazing appeared to reduce competition and helped to keep the sod in balance. Examples have been observed where annual lespedeza in mixtures with fescue was not grazed during the summer. The lespedeza grew so vigorously that it overtopped the fescue in mid-summer and reduced the vigor of the grass stand. In a few cases, grass stands were severely thinned by this competition.

Fescue has been seeded on a good many old stands of sericea and this mixture has looked promising on uplands where shallow-rooted plants usually are severely damaged by summer drought. This mixture appears to be best adapted under pasture conditions where both plants are grazed down so that neither can dominate. Sometimes sericea has been mowed for hay in the summer and the fescue pastured during the winter. Where sericea was left uncut and ungrazed during the entire summer and harvested for seed in the fall, fescue stands were severely thinned during the latter half of the summer. Likewise, where fescue was fertilized heavily with nitrogen in the spring and left for a seed crop, the very heavy grass turf has weakened the stand of sericea.

Other Mixtures

Wild winter peas (also called Caley or Singletary peas), sweet clover, and several other legumes have shown promise in mixtures with fescue. A principle that has become more evident as we have gained further experience with this new grass has been that legumes to be grown with fescue must be selected on a basis of their adaptation to the soil. In one part of a state, or even a county, soils may be of limestone origin and well-adapted to ladino clover. In another part of the county, soils may be derived from sandstone and either annual or sericea lespedeza may be the best legume for use with fescue.

It is doubtful whether anyone can tell how long a stand of tall fescue is going to last on a particular soil. The very old sod that has been on the Suiter farm in the mountains of eastern Kentucky for 50 or more years would lead to the assumption that a fescue sod may last almost indefinitely. Under different soil and grazing conditions, a sod may be much less permanent. All that we have seen to date indicates that a sod will last a good many years if fescue is grown with an adapted legume and the soil is treated adequately to maintain the legume in vigorous condition. The rate of grazing also appears to be quite important. A few cases have been observed where good stands of fescue on well-adapted soils were grazed so closely that almost every plant was killed.

Disease Injury

Disease may be a more serious problem in the Lower South than it has been in Kentucky and other parts of the Upper South. A recent report from Louisiana of severe damage to fescue by helminthosporium is the first time very serious disease injury has been reported. Most of the leaf diseases that have been observed appeared to be much less severe on good land where fescue was well supplied with nitrogen than on poor land where the grass was starved for nitrogen. L. L. Patten of Lakeland, Ga., has noted that fescue he planted following a manure crop such as crotalaria or hairy indigo was more vigorous and less affected by helminthosporium and other diseases than it was on similar land where the manure crop did not precede the fescue.

Our experience to date has led to the opinion that fescue for winter pasture must be protected from grazing from late summer until winter grazing is to begin. Fescue remains green enough during cold weather to be eaten readily by livestock, but it makes almost no growth when the temperature is below about 65 degrees. If stock are removed in late summer, grass in a mixture with a good stand of clover, or with an application of nitrogen fertilizer, should have 8-10 inches of leafy growth by the time cold weather begins. Sample areas in a field of fescue and Louisiana white clover were harvested for yield in west Tennessee in the late fall of 1948. The yield in terms of cured hay was a little more than 1½ tons per acre.

We need more information about the use of nitrogen fertilizer where fescue is grown in mixtures with legumes. The white clovers and other legumes supply enough nitrogen to keep the fescue green, but not enough for maximum growth. Further experience must be gained before we can tell whether applications of nitrogen will stimulate the grass to such vigorous growth that the legumes will suffer more severe competition.

Those of us who have had an opportunity to study tall fescue in Soil Conservation Service nurseries and on hundreds of farms believe it is a good grass. Farmers likewise believe it is a good grass. They have shown this by expanding their acreage as rapidly as seed was available. Many of them started with five acres or less for observation and have increased their plantings to several hundred acres. Tall fescue is not a "wonder grass" that is going to replace all others. It promises to be very useful in the land-use phase of soil and water conservation planning. It will do several conservation jobs on both grazing land and cropland. We have not had well-adapted, perennial grasses to do these jobs in most parts of the Southeast. Several other kinds of pasture will be needed, in addition to fescue, before we reach the desired goal of year-round green pastures. It is our hope that this progress report may be helpful to others who are studying the tall fescues.

Tree Symptoms and Leaf Analysis

(*From page* 22)

been effected in two years, although there are still plenty of potassium-deficiency symptoms apparent. However, foliage color and new growth were greatly improved and most of the crop sized up uniformly to No. 1 fruit. Analysis on a comparable leaf sample now shows: Potassium in the leaves—0.43%.

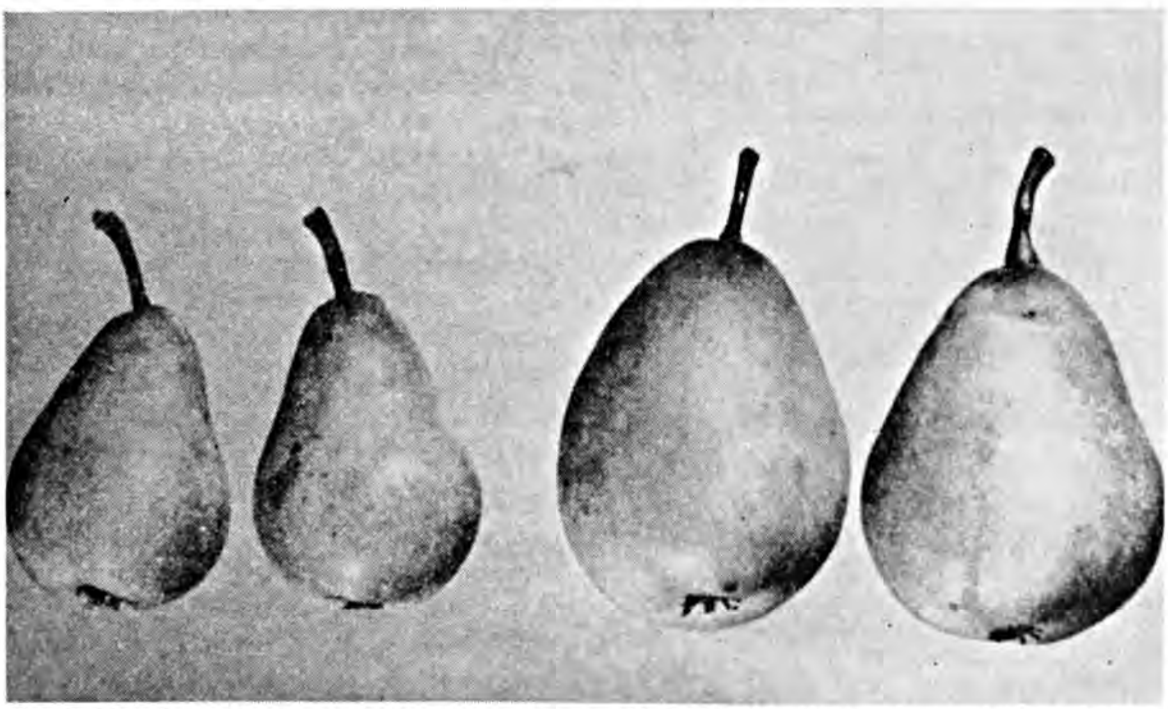


Fig. 6. Pear fruits showing typical size comparison. (Left) Potash-deficient trees. (Right) Potash-treated trees—Agnew, California, area.

While this does not show a large figure for potassium, it is still a 200% increase and in our experience with other kinds of trees, notably almonds, this much of an increase is enough to effect a great improvement. Although we have not had as much experience with the pear as with other fruits, we feel that potassium optimum may be at a lower level than for the prune, probably .75 to 1% K in leaves collected late in July.

Where potassium is deficient, a massive application will be sufficient for at least five years. This brings the cost per annum down to that of most fertilizer applications and lower than some.

The amount of each element which might be found in a leaf will vary during different portions of the growing season. For this reason, samples for accurate comparison must be collected at approximately the same time each year.

The percentage of potassium, phosphorus, and nitrogen increases to a point of time in relation to crop maturity and then decreases with the age of the leaf. Calcium, magnesium, sodium, and chlorine increase with the age of the leaf. There is a period during the summer when these changes are at a minimum. This generally occurs between June 15 and August 15, and is the most desirable period for leaf sampling. Roughly, leaf samples are best taken about one month previous to crop maturity of each species being sampled.

Sampling of Leaves

In general 100 leaves of the deciduous fruits will supply sufficient material for all analyses. More leaves may be desirable where they are small, as in the case of almonds. It should be carefully noted that the leaves which are selected to make up the sample for comparison should be as near the same age as possible.

In the case of prunes, apricots, almonds, apples, and pears, the leaves should be collected only from the spurs. Peach and nectarine leaf samples should be collected from the basal portion of the current season's growth.

The number of trees to be sampled will depend on the nature of the study and the number of trees involved.

Where a study of potassium is of primary interest, a sample made up of 10 spur leaves from 10 trees affected, or a sample of 20 leaves from 5 trees should be taken. A sample of 100 scorched leaves from one or more trees is advisable. It is most important that a sample from known good trees be taken to serve as a check. All leaves should be of the same age and taken from the same location throughout the sampling.

Growing Demand

There is a growing demand for leaf-analysis service by commercial laboratories to be run for a nominal fee. This is as it should be, and as a result, there are a number of laboratories making chemical leaf analyses in California.

Any leaf tests, however, that do not conform to proper timing and uniform selection of leaves and uniform laboratory procedure will be of little value to growers for comparison in determining their trees' need for supplemental potassium.

Unless leaf-sampling practice is standardized by all commercial laboratories, a confusion of information will result. It has been suggested by the Division of Pomology, University of California, Davis, that if all commercial testing laboratories would adopt standard methods of analysis and a uniform system of reporting, the interpretation of reports of analyses would be greatly clarified and simplified.

Exploratory Work

As far back as February 1946, the Division of Pomology had completed the analyses of 23,000 leaf samples in the process of establishing critical leaf values which can be associated with the nutritional status of fruit trees. These levels are now used as a comparative reference in the interpretation of current leaf analyses, which emphasizes all the more the importance of uniform sampling and reporting methods.

"Formally we supplemented our soil analyses with leaf analyses; today, we supplement our leaf analyses with soil analyses," according to Dr. Lilleland. He continued by saying, "Both are necessary for a complete understanding of nutritional problems, but leaf analyses together with tree symptoms are today the best criteria for studying nutritional problems in deciduous orchards in California."

Corn Is a Superior Crop

(*From page* 13)

cated in extreme southern Illinois in the rolling Ozarks Hill region. The general soil classification is yellow hill land. No limestone or additional organic matter was added to the land. The good corn yield on this land in 1949 might be in part attributed to favorable rains at just the right time during the growing season.

TABLE III.—PROPORTIONS OF GRAIN, STALKS, COBS, AND GRAIN YIELD AT THE DIXON SPRINGS STATION 1949.

Fertilizer	Part of crop	%	Grain bu/A
0–20–20 200 lbs.	Grain	34.9	26
	Stalks	57.8	
	Cobs	7.3	
0–20–20 200 lbs.	Grain	51.4	85
8–8–8 200 lbs.	Stalks	39.1	
Cyanamide 837 lbs.	Cobs	9.5	

0–20–20 plowed under
Cyanamide, plowed under
8–8–8 put on at planting time.

On the Dixon experiment field in northern Illinois the corn grain made up 51.6% of the crop in 1948 with an acre yield of 109 bushels. On this field the soil organic matter had been replenished by nearly 40 years of crop rotation, residues added along with limestone, rock phosphate, and muriate of potash (RLrPK). To this land were added 400 pounds of ammonium sulphate and here the percentage of grain was 49.2% and the acre yield went up a few bushels to 115. This additional nitrogen under these conditions gave only a slight decline in the percentage grain and a corresponding small increase in the percentage of stalks and cobs. This soil on the Dixon field is mainly Muscatine silt loam, one of the best corn soils in Illinois. (Table IV).

TABLE IV—PROPORTION OF GRAIN, STALKS, COBS AND GRAIN YIELD ON THE DIXON EXPERIMENT FIELD 1948.

Soil treatment	Part of crop	%	Grain bu/A
RLrPK	Grain	51.6	109
	Stalks	39.7	
	Cobs	8.7	
RLrPK	Grain	49.2	115
Ammonium Sulphate 400 lbs.	Stalks	41.7	
	Cobs	9.1	

R—crop residues, L—limestone, rP—rock phosphate, K—muriate of potash.

Where everything is considered, American hybrid corn represents a remarkable agricultural development. The object of the crop is to produce grain with the minimum of stalk and cob growth. This it does very effectively. Apparently corn is adapted to variations in soil conditions better than other Midwest crops and grain production is not thrown out of balance by an oversupply of fertility.

The Minor Element Problem

(*From page* 18)

considerable value as sources of minor elements, since the sea contains traces of all the elements. In this connection, it would seem desirable that more study be given to the possibility of substituting sea salt for the highly refined product now in common use.

Within recent years a great deal of publicity has been given to organic farming as distinct from the type in which use is made of chemical fertilizers. In such a system, dependence is placed on manures and composts. In proportion as these organic materials can be accumulated and used, the available supply of minor elements in soils can be maintained at higher levels than would be possible without specific additions of salts of these elements to the soil. This is especially true in connection with the use of garden composts and sewage sludges that contain residues of plant products from all over the earth. The refuse of Brazilian coffee, Yucatan bananas, Florida oranges, Rio Grande Valley grapefruit, California carrots, home-state crops, and home-garden produce all meet in the backyard compost pile. Sewage sludges contain minor elements in the form of medicinals and by-products of chemical industries, sometimes in concentrations so high as to be injurious to plants growing on the soil to which they are applied.

Lengthened Life Span

It would seem that the people of the United States of America are not in dire need of minor elements, since our life-expectancy at birth is now over 65 years. Yet if all man's nutritional and other needs were met, his span of life might well be more than a century. Certainly a great many of the ills of man can be traced to food deficiencies of one sort or another. This no doubt could be remedied by giving more attention to balance and variety in the diet. In the absence of this, supplemental use of both the major and minor mineral elements has helped in many cases.

Most agricultural experiment stations now have one or more research projects that involve minor elements. In our soils department at New Jersey, seven of our graduate students are devoting themselves entirely to iodine, manganese, zinc, copper, molybdenum, cobalt, and nickel, respectively. Use is being made of radioactive forms of five elements. Similarly the several bureaus of the U. S. Department of Agriculture are concerned with this problem. The U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, New York, is engaged primarily in the study of minor elements in relation to plant and animal nutrition. Johns Hopkins University recently received a grant of $500,000 for this purpose. A number of commercial laboratories are being financed by industry in the study of minor elements. Producers of pharmaceuticals are carrying on studies of these elements as constituents of medicines and the same applies to the manufacturers of feeds.

It is apparent that a great many people are concerned with one or another phase of the minor-element problem. The most complete picture of the undertakings in this field of research is contained in a 1087-page volume entitled "Bibliography of the Literature on Minor Elements and Their Relation to Plant and Animal Nutrition, Fourth Edition," published by the Chilean Nitrate Educational Bureau in 1948. That volume contains abstracts from some 10,000 papers covering 45 elements that had been published as of that date.

Spectographic Laboratory

Recently there has been widespread discussion about having a large central spectographic laboratory, operating on a mass-production basis, to which anyone who desired could send samples of soils, plants, and animal parts for analysis as to their minor-element content. There are many very attractive features in this. Among these might well be listed the rapidity with which the analyses could be made, the accuracy that should go with the best of equipment and with much practice, and the relatively small cost per analysis on such a large scale.

It would seem that anyone who wants such analyses made should have access to such a laboratory. It is conceivable that many educated farmers would like more definite information about their soils and crops than their agricultural experiment station can provide for them. A considerable number of research workers themselves would make use of such a service.

But there are several weaknesses in this procedure. The problems involved in choosing dependable samples are so great that even the best research men are troubled by it. Spectrographic analyses of soils for minor elements are very difficult because of the mass of other mineral constituents in them, and they provide no clue as to the availability of the supplies found. Interpretation of minor-element data is often very difficult because of the dearth of factual information concerning the quantities of minor elements required by plants and animals.

For satisfactory results from such an enterprise, it would be necessary to have a highly capable director in charge. He would need some well-qualified assistants to keep in touch with research laboratories dealing with minor elements and to follow up all abnormal results to the end that dependable clues were developed. At best, however, such a laboratory would be of value only as a supplement to the vast amount of research required to determine the functions of these elements and the quantities required for normal growth and health of plants and animals.

Farming With Green Manures

(*From page* 26)

as large as the first which then may be plowed in and corn, buckwheat, or some other crop may be seeded to be turned under for a fall crop such as wheat.

The suggestion of Mr. Harlan's that the rye be cut and let lie where it falls hints at his method of handling green manures. Perhaps a combination mulch and green manure would describe his method more clearly as he favors cutting a crop when in blossom, letting it lie where it falls, then a second crop will grow up through it to make additional green matter when the whole mass may be turned under or disked. This method of cutting the crop when in blossom and letting it lie he calls "surface mulching" and gives many reasons to support such a practice.

In the first place, he writes, when green crops are raised to improve the land it is not indispensable that they should be plowed in to accomplish this object. The quickest way to convert the green crop into money is to cut it down while in blossom and let the rains leach out the albuminoids and soluble materials. While the ground is thus shaded and while decomposition is going on, a second crop will spring up and add additional material. He also warns farmers not to waste time by mixing green manures deeply with the soil as combustion is the rapid condition of decay, and when green or other material is buried in the soil it may exclude oxygen and thus combustion may stop or be slowed up materially. A piece of soil heavily shaded, he continues, by surface manuring actually decomposes like a manure heap; that is, it undergoes a sort of putrefaction or chemical change which sets free its chemical constituents, unlocks, as it were, its locked-up manurial treasures, and fits its natural elements to become the food of plants. Another advantage of cutting a crop and letting it lie is that it will check every weed that "might be concealed among it."

It was a very common practice among agricultural writers in those olden days to advise all persons having large farms in poor condition to sell one-half or two-thirds of their land and apply all of the money they received in manuring and improving the balance of their property. Mr. Harlan disagrees as he says that the poor land would bring no price and that a better way would be to seed the whole farm to clover, cut it when in blossom, and repeat this practice for several years until the land was improved, or better still to select a few acres and make those acres rich and productive first and then select a few more acres and do the same thing.

If you have a field of 20 acres, and Mr. Harlan likes to use this size field for his illustrations, select 5 acres to be improved. First, seed entire acreage to clover—next, cut clover on the 20 acres when in blossom and rake it onto the chosen 5 acres. The remaining 15 acres will have a second crop of not less than 10 tons per acre which should be cut and also raked onto the same 5 acres. This second cutting should be made about the first of August when the whole field should be given an application of fertilizer (plaster) and you will have at least 5 tons per acre by the middle of September which should also be cut and raked onto the same 5 acres. These three dressings of clover will make altogether 525 tons of green manure concentrated on the 5 acres.

Costs Involved

Now as to costs, assuming that it will cost $1.50 per acre to cut and spread the clover, the total cost will be $30 for the 20 acres for the first cutting. The remaining 15 acres cut twice would bring the total to $75 and then adding the interest on the land $120 to that would make a grand total of $195. Some of these costs would seem very low based on present wages but these are Mr. Harlan's figures. Let us compare this rich deposit of plant food, he continues, with purchased stable manure at only $3 per ton for the manure and for the labor of spreading it on the land. The 525 tons of green clover contain 6,300 pounds of nitrogen, 1,312½ pounds of phosphoric acid, and 4,725 pounds of potash, which is about twice as much nitrogen and about the same amounts of phosphoric acid and potash as in 375 tons of stable manure. The 375 tons of stable manure would cost $1,125 for the 5 acres as compared with the cost of the clover, leaving a balance in favor of the clover of $930 which is a significant difference even to the statistical experts.

In improving the land with buckwheat, he advocates somewhat the same method except that he would seed the entire 20 acres to buckwheat and rye as soon as any grain crop is off in July. He would let these two crops remain on the land during the winter as one crop will act as a mulch for the other and both together will protect and improve the soil. By the middle of May the rye will be in blossom and should be carefully cut down. Then a second crop will spring up and in 6 to 8 weeks may be as large as the first. Plow all together and by the first of August put in corn as a mulch for wheat. Thus we have four green crops and wheat.

Favoring Surface Mulch

Summarizing the points brought out by Mr. Harlan in favor of surface mulching we find that by leaving the mulch on the ground the soil will lose nothing by evaporation and one rain in May will ensure the crop against drought; green manures by their ability to collect and preserve moisture on the surface render an immense assistance in the growth of the organic world; surface mulching shades the ground; the rains leach out the albuminoids and soluble solids and they are carried into the soil; the land is more easily worked, that is, it is easier to plow or disk; weeds will be checked and the soil will be vastly improved.

Mr. Harlan stresses firming the seedbed and offers many examples confirming the benefits to be derived from rolling or in some way firming the seedbed. He relates one instance which occurred during the Civil War when a Northern army of 18,000 men encamped on a Southern field of growing wheat. When they left there was hardly a blade of wheat showing and the ground was packed so solidly that it resembled a public road. Yet when spring came, the wheat came forth with vigor and produced such a crop that the good people in the neighborhood declared that Providence had taken special care of it because it had been trodden down by unrighteous feet.

Another interesting illustration he cites had to do with a retired sea captain who tried to grow some tobacco for "home consumption." Right after he had sown the seed, a gang of youngsters held a dance on the field one night. They not only danced all over the field but they tramped and tramped so that the ground was packed as hard as a surfaced road. What the captain said the next morning when he saw what the kids had done is not stated, but to his astonishment every seed seemed to sprout and grow and he had a fine crop. Every year thereafter the old sea dog tramped the field himself.

Manure Expensive

For a farmer to keep livestock for the manure is mighty poor business according to Mr. Harlan and he minces no words in condemning the practice. He is helped out by that Model Farmer of England, Alderman Mechi, who says that "if stock is too dear or you are short of capital, plow in green and root crops." However, Mr. Harlan advises the careful handling and applying of manure if one does have livestock and he says that it should be applied on the surface of the ground and not plowed under. If one does keep livestock, Mr. Harlan advises the soiling system rather than pastures and in that he is in accord with Horace Greeley who condemned pastures to the nth degree. Green plants can be converted into plant food without undergoing the process of digestion in the stomachs of cattle. Neither is the conversion of vegetable matter into manure necessary.

One year for many miles around Wilmington the pasture fields were brown and bare. The grass was nearly dead due to a lack of rain as no "deep wetting rain" had occurred for two months. Yet the corn that had been sown for soiling still showed signs of growth and, although its growth might have been shortened, there was still plenty of fodder. Sudan grass sown also for soiling was in fair to good condition.

In regard to soiling versus pasture Mr. Harlan says that with green crops and no grazing one does not need fences and in his opinion fences are an abomination. In the Yearbook of Agriculture, he does not say what year, a Mr. Wells writes, "The amount of capital employed in the construction and repair of fences in the United States would be deemed fabulous were not the estimates founded on statistical facts which admit of no dispute." Burknap, a writer on farming topics, says, "You will scarcely believe me when I say that the fences of this country cost more than 20 times the amount of specie that is in them."

Proper Diet

Included in this book on Green Manures are chapters on a proper diet for humans, a discussion on the necessity of preserving bird life to control the insects, and a chapter on orchards. Harlan advises that fruit trees of every kind should be set in a rich field well set with clover, and in June the clover should be cut and spread around the trees as a mulch. Leave a space around each tree so as to prevent the mice from establishing a nest. This mulch should last for three or four years and during this time the clover should be cut and let lie where it falls.

In discussing proper eating, a subject which he says he has been studying for 40 years, Harlan is very definite that people eat too much bread in proportion to other foods. The proportion of minerals and carbohydrates should be carefully observed. Too much bread causes many ills as it introduces too much carbon and hydrogen into the blood; so bread, butter, lard, sugar, and fat must bear a wise proportion to the lean meats and to the fruits and vegetables one eats.

Very little mention is made by Mr. Harlan regarding fertilizers in his book, but his favorite fertilizer seems to be plaster. He quotes Mr. Lawes in that "potash is generally found in sufficient quantity in the soils and the artificial supply is not required," but he is not in agreement with this statement. He, Mr. Harlan, advises us to use all the wood ashes we can procure at a reasonable price, particularly on sandy land, for potash is greatly needed on that kind of soil. He brings out the point that when a farmer employs green manures and also applies fertilizer that the increased crop, which could have been secured with green manures without any fertilizer, would be credited to someone's "nitrogenized superphosphate of lime" or some other fertilizer.

A rather unique method of estimating the cost of green manure is employed by Mr. Harlan in that he says in computing the cost of raising green crops for manure we must not deduct the cost of plowing and harrowing from the value of the green dressing because tillage is a manure and often the very best manure we can apply to many fields especially to heavy clays. Mechi also agrees that "frequent tillage is our best and cheapest manure."

Perhaps a concluding statement could be this: After a farmer has learned the advantages to be derived from green manures, Mr. Harlan says, "With this knowledge accepted as a great truth the careful farmer will always employ a trustworthy collector of Nature's manurial treasures and among these he will find by long experience that red clover stands in the highest rank."

Hope and Promise

(*From page* 5)

traditions and customs, prejudice and poverty. Technical assistance may mean a hand hoe and a good shovel and a disinfecting crew rather than a course in tractor operation or a seminar in economics. That is, we can be too strict in the way we interpret this assistance, and allow the technique to outrun the practice. We can easily load up with more "professors" than we have progressors getting their benefit. Beware of letting American enthusiasm run too loose with panaceas! Especially if we operate in a foreign land.

But here we must halt by the roadside and remember that up ahead there may be some nasty doings with guns and bazookas. All this planning for technical aid to raise human-living hopes is mainly set up to work in peaceful times. I should perhaps say "relatively" peaceful times. What about the outlook for all these brave programs if the world plunges back into the abyss of war? What will FAO do then?

If the conflict were bad and widespread and the struggle should be prolonged, then many nations now paying part of the cost of FAO might be obliged to use all their resources for defense, or become impotent to contribute because of being conquered and overrun. I really have some doubt that FAO would be fully endorsed by our own munificent Congress in case of outright global engagement.

Another alternative is that FAO might get enough money from us and a few of the old stand-bys to hobble along with a skeleton staff, including the janitor, the messenger to ECA and USDA, and the director-general and the bulletin editor. But nobody in FAO could do much research or visit the underprivileged or plan for tomorrow. All the work done hitherto would get moldy and a new start might be hard to make in your day or mine.

NOW there is still one more possibility to consider in wartime. The war-torn world would need to establish food pools and resources, set up priorities, keep food moving where needed, prevent waste, and, in short, perform a job like that of the International Emergency Food Council. The brass-hats might direct things, but the spade work would have to be handled by food experts. Maybe this is where FAO fits into the war picture.

Postwar desolation and hunger would be so great that some big and capable organization would be necessary. Whether that duty would devolve upon FAO is purely conjectural.

Returning to the field of present facts, it strikes me that when we spend so much funds and time on overseas propaganda in behalf of the democratic way of life and the advantages of existence in a land of plenty—and of waste—we may be sadly overlooking a basic point where FAO and its allies might afford a goodwill demonstration. We point with vocal pride in these overseas broadcasts to our superlative possessions and happy families and full larders. Now it would seem likely that when those who don't have a fractional part of such advantages listen in on such speeches they could become bitter and envious. Envy breeds hate.

What are we doing, on the other hand, to prove that there is a way for the ones who do not have these things to get them—good food, enough clothing and shelter, and a little hope? Time was when foreigners without a decent chance to improve their lot could pack up and sail over here to get that chance. Those immigrants who came here established themselves firmly and some of them are our own ancestors. But the doors are no longer open so wide for the beaten and discouraged foreigners, even though the metal tablet on the statue of liberty says so. Yet they are closer to us in terms of distance and time than ever and are therefore part of our community. Unless they get help and gradually lift themselves out of chaos and fear, we are not going to dwell safely in this snug little corner alone.

So we have to do things differently. We have to show them how it may be possible to develop skill and resourcefulness on their own hook, using some of the methods we have used—technical, mechanical, maybe political. To set up these information agencies now is not going to be so hard as though we had no international setups with which to reach out and get to these people on their own terms and with their own language.

I BELIEVE that the Voice of America and such overseas efforts might do themselves proud and be a lot more effective if they tried to tell these bewildered folks that Uncle Sam is endorsing FAO and all it stands for—short of that trade scheme we mentioned; and that this nation wants to see a square deal and more productive power in the small, impoverished, and backward lands. It would not be enough just to say that we believe in these things that make for better human dignity and hope. It must be followed up with action. Maybe not just appropriating a lot more billions, but in making a few millions already provided go further and faster and more effectively than they do now.

It's always so easy here to think that when the money is provided by Congress then the average citizen need do nothing until the scheme falls through or peters out—and then it's his cue to holler and throw dead cats around. We are great beginners, but we often fail on the follow-up.

There are stones in the path to be

smoothed away. Many folks here, as well as in the member nations of the UN organization, wish to see improvements carried out by separate nations themselves instead of by concerted international machinery. The hard and soft currency divisions make realistic reform more tedious to negotiate and bring to pass. There are also diverse opinions between countries who are really contributing financially to the picture and others who merely get the grants and benefit by them.

Fortunately, the stronger position of the United Nations since the Korean tide has turned things more toward eventual peace has helped the position of FAO in many respects. It has not settled its budget vexations or decided the location of the official headquarters entirely, but these matters will probably be worked out fairly well after the November meeting of the delegates in Washington.

Whatever opinion we retain as to the future of FAO and whatever plans we discuss pro and con about succor for the weak and weary, at least we know that a closer unity and a better "big-team hitch" has been arranged than we ever had before in world affairs.

FAO has sent a doughty, resolute, elderly, bronze-faced Oregon ranchman into the far corners of the universe to look into the weazened face of want and step across the ditches of despair and ignorance. He has had first-hand contact with the sufferings and the maladjustments due to war, neglect, greed, indifference, and cruelty. This prophet of FAO has no secret aims to promote and no ruthless aggression to foster. He is an example of a thoughtful, practical idealist, such as we breed in large numbers in America—contrary to the Moscow theme. He has both firm feet on the ground. Although over three score and ten, he is vigorous and alert. He can sit out as many "conferences" as the younger chaps and come forth jaunty and ready for more argument.

Some of his friends of the old days

refer to this leader of the FAO as "Almighty Dodd." Some of the followers of ancient leaders looked to their prophets and elders as one would toward a representative of the Divine plan. If work for the best interests of mankind and the real needs of our times is any criterion, then leaders of such single and devoted purpose do really stand for something beyond the routine affairs of life. If they are tough, hard-bitten, rocklike men who know the false from the workable and can sift the chaff out of all the grist and keep the kernels—we feel safer about the movements in their trust.

If FAO should change leaders and elect some unknown and untried personality, it might be a temporary setback. But the movement itself needs to be made so practical and effectual that the absence of any one element of its spiritual force or personal leadership need not cut its power for good. The only way we can see to that is to mix into the business ourselves. If we just leave it all to a few economists and travelers and experts who hover around Washington or Paris or Hong Kong, and do not come to adopt the FAO as a vital leg of our farm progress, it may fritter away and never be replaced.

Fortunately, the major American and most of the foreign agricultural societies in the western nations have put themselves behind the aims and purposes of FAO. This makes it easier for ordinary individual farmers to join in and take some part, however humble. This is not a short, temporary attack on the enemy. It is a long grind of persistent activity. It will take patience and wise counsel and careful avoidance of pitfalls and blunders. It is not a hullabaloo of noise and fireworks, but a steady sweep of silent but hopeful power.

Let's change the meaning of FAO to spell "forward against obstacles." If it falters and dies, the farmers of Iowa, Kansas, and all the rest of rural America will have lost as much as those who have never used a tractor or filled a silo or ridden in a brand new car.

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The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

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THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. WASHINGTON 6, D. C.

A pessimist is a man who wears a belt and suspenders at the same time.

* * *

A sensible girl is not as sensible as she looks because a sensible girl has more sense than to look sensible.

* * *

"And what are your grounds for divorce?"

"Joe snores, Your Honor."

"How long have you been married?"

"A week."

"Divorce granted; you shouldn't know whether he snores or not."

* * *

Two negroes were talking about a recent funeral where there had been a profusion of floral tributes.

Said one: "When I die I don't want no flowers on my grave. Jes' plant a good old watermelon vine; and when she get ripe you come dar, and don't eat it, but jas' bust it on de grave, and let de good old juice dribble down through the ground."

* * *

Collector—"Will you give something to the Old Ladies' Home?"

Citizen—"With pleasure — I'll send my mother-in-law right over."

* * *

A little boy boarded the streetcar wearing long pants. The conductor charged him full fare. At the next stop a little boy boarded the streetcar wearing short pants—half fare. Next stop, a young lady entered the streetcar and the conductor collected no fare. No! No! She had a transfer.

We leave a good party reluctantly and get up the next morning even more reluctantly, wondering what there was about the party that made us so reluctant to leave.—Bagology

* * *

Blonde: "Sorry, soldier, but I never go out with perfect strangers."

Soldier: "Don't worry about that, babe, I ain't perfect."

* * *

A man was driving in the country one day, and he saw an old man sitting on a fence rail watching the automobiles go by. Stopping to pass the time of day, the traveler said:

"I never could stand living out here. You don't see anything. You don't travel like I do. I'm going all the time."

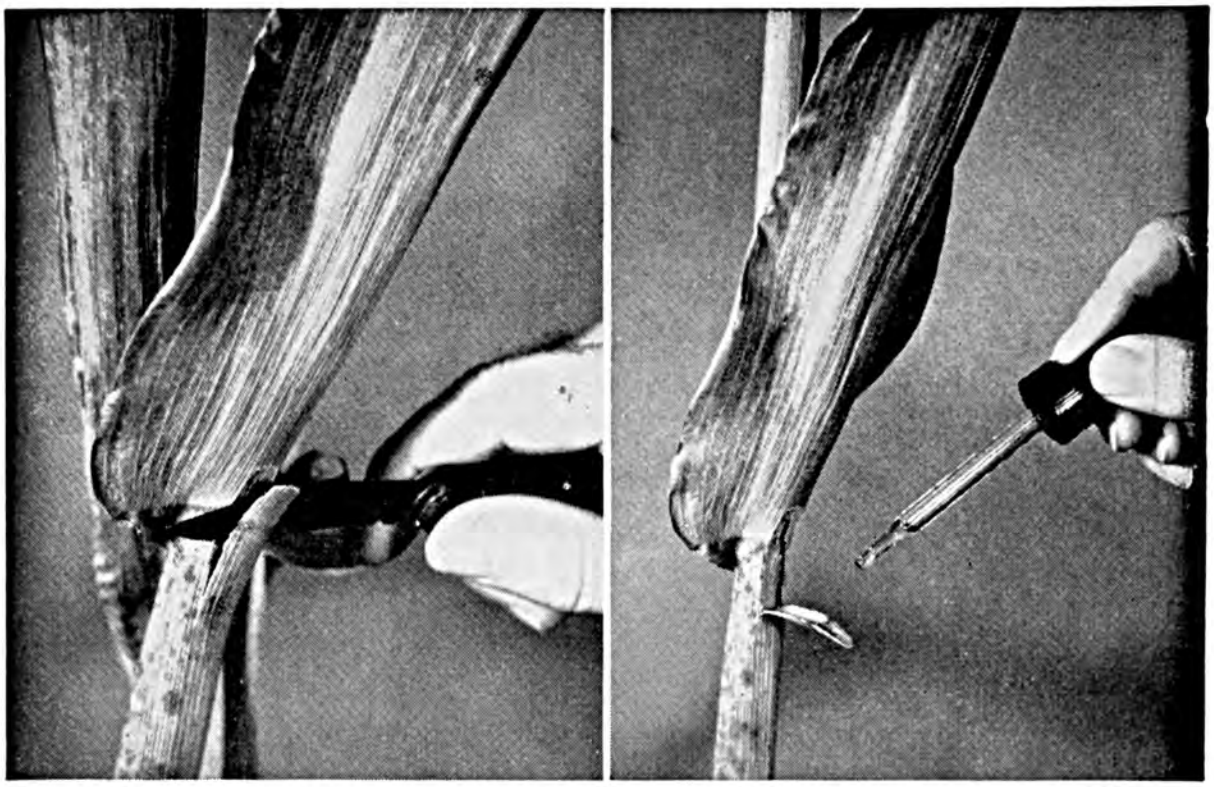
The old man on the fence looked down at the stranger slowly and then he drawled:

"I can't see much difference in what I'm doing and what you're doing. I sit on the fence and watch the autos go by, and you sit in your auto and watch the fences go by. It's just the way you look at things."

* * *

"And now, children," inquired the Sunday School teacher, in a review of the day's lesson, "who can tell me what we must do before we expect forgiveness of sin?"

There was a moment's pause, and then little Wilbur made his logical contribution: "Well," he said, "first we have got to sin."



Nitrate tests can be made at the base of the leaf midrib without destroying the entire plant. This is an important consideration in making numerous tests on small experimental plots. The height of the plant at which nitrates are present as well as the intensity of the blue color gives an indication of the nitrate status of the plant.

Equipment used in a well-developed laboratory for soil analyses.

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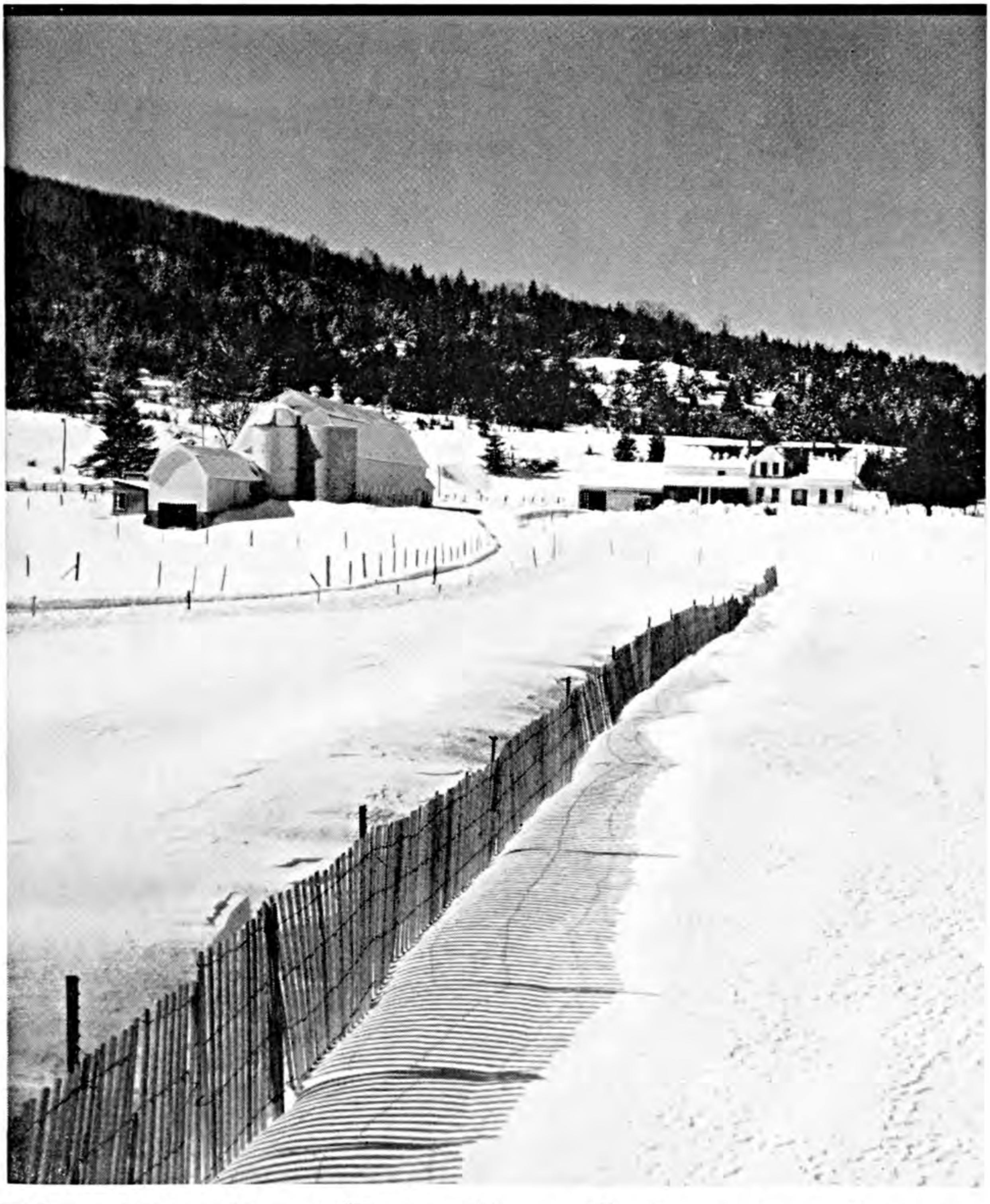

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The Whole Truth—Not Selected Truth

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Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXIV — NO. 10

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PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY.

VOL. XXXIV WASHINGTON, D. C., DECEMBER 1950 No. 10

Let's All Give . . .

A Toast to the Holidays

Jeff McDermid

CHRISTMAS "at the turn of the century"! What a queer, long-ago sound that is to the younger generation we try to enliven with a few ancient anecdotes and rusty reminiscences as the precious holiday tide rolls in once more. When we were fresh-visaged and joyous away back then, pursuing customary whims and pleasures, and doing allotted chores about the snug household, that portentous phrase—"the turn of the century"—held little of the nostalgic sadness and mellow memory which its cadences call forth today.

Things were vastly different in material and physical ways from the things we have become accustomed to through the intervening years; and for the most part, this is just as it should be. It's in the intangible realm of the spirit and the emotions that the split with the old days seems hardest to accept and understand.

None of the winter holidays at the turn of the century were so apt to seem like a lull in the midst of a terrific, world-engulfing hurricane. Life in our small towns and in the open countryside was relatively calm and quiet. Boys and girls looked forward to a certain degree of destined normal expectancy and reasonable hope. Social security as a problem for federal or professional regulatory solution was unknown. The only pensions paid out were doles of small dimensions made to veterans of our own nearby wars—and then only after taking each case to congress, plus fees to a stuffy pension advocate. No case of velvet living on taxpayers' charity shocked the daylights out of our serenity.

So I say, we hanker not after the so-called "comforts" and near-luxuries that were the gaslit boast of an era which is laid to rest in reverence along with the family buggy and the parlor heater. Here and there reminders of its existence come to light in the freakish revivals inspired by a roving and canny clan of antique merchants. Their days are spent collecting and dusting off faded and forgotten "pretties" to be sold at a wide margin to curio hunters and seekers after unusual gifts. But as I stand in their mucksy and jumbled emporiums and scan this loot, I recoil. It all looks embalmed and spiritless. I myself would look the same if I tried to grow the beard and sideburns so essential to masculine adornment when this century was "turning."

In other words, after a session amid their wares I wonder if perchance all of us who were beginners in the 1900's are not awful examples of the Early American—fit mostly for a place on the shelf. At least we are genuine and not a factory-made imitation.

OF course, the snow still falls, the seasons come and go, the birds sing as well as they ever did before for those who listen, boys and girls hasten too fast into men and women, kids are born and raised as usual (with extra frills), and the holly berries and mistletoe are as charming and provoking in their symbolism as ever. Folks still enjoy the privileges of toasting each other in tom-and-jerry, and pass their china plates too many times for more of that festive goose and gravy.

When daily cares "cark" us and the hours seem long and dull, it is still our privilege to partake of a "little slumber, a little folding of the hands in sleep." We know the thrill of getting warm after frost-bites and the joy of rising and stretching for a vigorous and purposeful day of doing. Yes, the main experiences have not changed with time.

By and large, the little mid-country towns and farmsteads are rousing spots for our holiday observances, without much inward alteration. Outwardly, though, something "has been added." The wood blocks in the village paving are now concrete highway. The seasonal light and color are seen in streamlined show windows and in glittering electric signs and street-lighting effects. The closest resemblance to the evening darkness of my old home-town's environment is a number of the alleyways in our largest cities. Rural America is on her way.

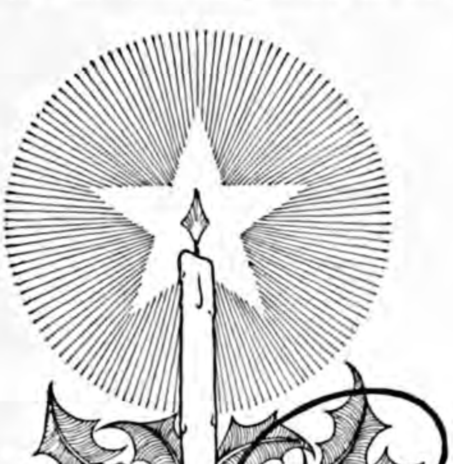
Inwardly, as I said, things are the same. Our hearts are as warm and good will is as rampant now as it was in the era that is ended; in some ways, even more. Take our attitude toward all manner of financial and community assistance to victims of misfortune—to say nothing of the generosity unknown in the life of fifty years ago—generosity toward people we have never seen and countries we have never visited.

You can make quite a contrasty case out of that idea. Away back in 1900, America was scarcely emerging from a lone outpost of experiment to a position of world power. Much was left to do before we had a secure foundation on which to blazon forth with all the new marvels and inventions which have been discovered or perfected in our time. Thus our leaders had little chance, if they wished, to become chummy and lend-leasy with our small, new bank balances. Charity began at home, although it was a differently run affair than that we operate today.

Unfortunates and the disabled economic wrecks had but few choices. They either went to fraternal lodge homes, camped out in some odd room with their kids, or packed their few possessions and bundled off to the drab and stark environs of the county poor farm and asylum combined. Besides, folks grew older faster and gave up quicker than they do now.

Being so practical about the relief cases at our doorsteps, and very searching indeed about war pensions, it could hardly be expected that American democracy could afford to waste its initial substance to send dried eggs, skim milk powder and technical know-how to the Chinks, the Micks, the Dagoes, and the Hottentots.

There were always notable exceptions. Our sympathy and timely succor went abroad several times to salvage victims of flood and famine, even as far away as China and Japan. Our ardent church missionaries proved to be our



best ambassadors in many ways, bringing medical and sanitary aid to far-off spots seen rarely even in our tiresome geographies.

IT'S always been a wonder to me that our pioneer country church was able to find any surplus funds to outfit and support these foreign missions. It probably traces to the ladies auxiliaries and the like do-good outfits, who did more with less than seems believable. The individual worshipers in most of the rural churches had small and uncertain incomes. Few of them were commercial farmers. Self-sufficiency and live-at-home methods in agriculture meant dull days and small profits for the country tradesman. I recall the dime that my Dad placed in the plush bag on a stick shoved under his nose between the prayer and the sermon. When wages were a dollar a day of twelve hours, tithing was tough. So you couldn't be blamed much for skimming the milk of human kindness a little, or counting the coppers carefully. Sure, you trusted Providence, but you also had to be provident yourself or lose your shirt.

What the heads of families did was skimp on money matters and act freely and fully in putting their shoulders to the wheel round about them. It was like the difference between forking over cash for taxes on one hand, or doing as they used to—driving team or handling shovels in road repair. You hesitated with your purse but "histed" with your muscles and your time. Nowadays folks prefer to buy themselves out of a corner in charity and let the hired dispensers represent them. I'm sorry money is cheaper than cooperation, but it can't be helped.

Perhaps this is one reason why we fail to get the same old kick out of Christmas and New Years as we used to when so much muscular work and outdoor zestful exposure sharpened our sense of home comforts and the tip of an evening toddy. We had to make our own pleasures and conveniences the hard way. If you lacked what it took for anything nice and comfortable, no handy store or service shop was within easy hiking or motoring distance.

Sometimes I get into a dither wondering what I would do and how I would act if suddenly it were possible for me to be translated back there bodily to the home town of yore, returning to help them celebrate Christmas. Going back through those dim times again, all too aware of what progress had brought, and accustomed to the modern whirl and complexity, how could I tell them what had transpired or make them understand the viewpoints and the acquired prejudices of an unknown era?

I'll be bound that I'd seem like a snob, unless I kept my mouth shut. Otherwise I'd put both feet into it every time I started to yawp advice or make suggestions to those dear, old-fashioned people. I know one or two actual, existing towns in my vicinity this very year where progress has been slow and

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Courtesy Univ. of N. H. Visual Service

Fig. 1. Harold Bodwell farm, Kensington, N. H., 1950 Green Pastures winner in New Hampshire, on the day of the New England judging. This field was cut early for hay and later used for young stock pasture.

Surveying the Results of a Green Pastures Program

By Ford S. Prince and George B. Moore

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THE Green Pastures Program, which was conceived in New Hampshire in 1947, spread to all of New England in 1948, and which has since been adopted in many other states, has developed into a program of prime importance for teaching good pasture management practices. Nor does it stop with the pasture program, for in most regions of the United States the pasture program and the whole roughage program are so inseparably linked that one cannot be well developed without the other being affected.

This statement is particularly true of the Northeast region, since much of the pasturing here is done on tillage land. When a farmer seeds a field, he may not know whether he will use it for hay or pasture. In fact, we have stopped talking about hay mixtures and pasture mixtures in most cases unless a field is too rough to plow frequently, in which case a pasture mixture might be advised. Or, if a field is too far from the barn to pasture conveniently, a hay mixture is usually seeded; but by and large, hay-pasture mixtures are now the rule rather than the exception.

Pasturing field land has involved many changes in the farm management program, changes which take some time to put into operation on any individual farm. For this reason, and because farmers are often slow to make drastic changes, particularly those in the older age groups, not all those who have embarked upon this new pattern of hay-pasture production have the program in full swing. The new pattern places less dependence upon permanent pasture areas and more on hay-pasture production on field land. Furthermore, those farmers who have achieved the highest success with the new pattern are placing more emphasis upon maintaining a high level of fertility, supplementing farm-produced manure with relatively large quantities of commercial fertilizers. Besides these factors, more dependence is being placed upon legumes, particularly upon those of a perennial nature, notably ladino clover and alfalfa.

These changes in hay-pasture production have been forcibly emphasized by the Green Pastures Program. The men who stood at the top of the program, and whose practices have been developed to a high point of efficiency, have been written up in various magazines and their methods have been widely publicized at meetings, in motion pictures, and in other ways.

Here in New Hampshire, we have been much interested in the methods of these top men, but we have been interested also in those farmers who have not developed their programs so that they get a high score when their farms are judged. We have been attempting to find out how the practices of the low scoring men differed from those whose scores were high, and to find out as well whether the methods of these high scoring farmers result in lower feed costs and a greater net return to the farmer.

To this end, during the spring of 1950 a survey was made of an equal number of farmers in each of the three score groups which we have used in our State, those whose scores according to the judges ranged from 85 to 100, which was our top score group, those whose scores ranged from 70 to 84, or the intermediate group, and those whose scores fell in the 60 to 69 range. None of those farmers whose scores were below 60 were included in this survey. When completed, 79 farm records were available for study. The survey was made by the County Agricultural Agents of New Hampshire, and the data therefrom were summarized in the Agronomy Department of the University of New Hampshire.

The data in Table I gives a picture of the farm enterprise, including the number of cows and the total number of animal units, together with the amount of tillage and permanent pasture land the average farmer in each group had at his disposal.

It will be noted that the farmers in the top score group were keeping more cows than those in the other two groups. Likewise, the farmers in the top score group had a larger total acreage, although in point of total feed crops per animal unit the farms in the 85 to 100 score group had a lower acreage than those in the lower score groups.

Table I

	Score Groups		
	85–100	70–84	60–69
Number of cows	30.11	20.41	19.40
Total animal units	43.01	28.12	26.56
Tillable acres per farm	96.2	68.65	62.67
Tillable acres per animal unit	2.24	2.44	2.36
Acres feed crops per animal unit	2.10	2.25	2.32
Permanent pasture per animal unit	1.09	1.13	1.50
Improved permanent pasture per animal unit	.30	.35	.25

This reflects the opinion of several close observers that, by and large, the men with a limited acreage per animal unit are doing a better job and growing more roughage per acre than those with a larger acreage for each animal unit on the farm. These data indicate, too, that the farmers in the lower score groups have a larger relative acreage of permanent pasture than those men who had a higher score, indicating that they are still placing more dependence upon this kind of pasture than the higher scoring farmers.

Since all of the men in the survey had been enrolled in the 1949 Green Pastures Program in New Hampshire, it was to be expected that farmers who were improving their permanent pasture as well as the productivity of their field land would be found in all the groups. This fact is brought out by the data in Table I.

One might judge from Table I that there isn't much difference among the farmers in the three score groups. All of them, no doubt, are working for better pastures and all have taken some steps to improve their roughage situation. While the differences, aside from size of business, are slight, they do indicate a significant trend which becomes clearer in the succeeding data.

In the judging program, which was done on all these farms, considerable attention was paid to the mixtures in the hay and pasture fields. The acreage of ladino clover a farmer had and how it looked when the judges came to the farm, whether it was divided up for rotational grazing, etc., all had some influence on a farmer's score. One reason why these farms were arranged as they were in the various score groups, then, depended upon the acreage of ladino or alfalfa, or a mixture of the two, in grass associations, of course. The figures in Table II are highly significant, showing as they do an acre of ladino-alfalfa per animal unit on the top farms, about three-quarters of an acre on the farms of the intermediate group, and just under a half-acre on the farms of the low scoring group.

It wouldn't be surprising if the farms in the low and intermediate score groups were forging ahead and that they hadn't yet reached at the time of

TABLE II

	Score Groups		
	85–100	70–84	60–69
Acres ladino per animal unit	.55	.33	.28
Acres alfalfa per animal unit	.06	.06	.07
Acres alfalfa and ladino mixed per animal unit	.39	.34	.12
Total acres per animal unit	1.00	.73	.47

TABLE III

	Score Groups		
	85–100	70–84	60–69
Tons fertilizer per acre	.19	.07	.07
Tons fertilizer per animal unit	.42	.17	.16
Tons lime per acre	.33	.22	.29
Tons lime per animal unit	.74	.54	.70

Courtesy Univ. of N. H. Visual Service

Fig. 2. Discussing the Bodwell pasture program. Left to right: Stanley Owens, Conn. judge; Guy Angell, N. H. judge; Jimmy Purington, county agent; Harold Bodwell, N. H. pasture winner; and Seeley Reynolds, Vt. judge.

the survey the peak of perfection which the farmers in the top score group had achieved. Ladino clover is relatively a new crop, and it is the acreage of ladino which makes the big difference in these figures.

The use of fertilizer and lime, too, indicates that the farmers in the top group are paying more attention to the fertility of their soils to bring them larger yields and to maintain a higher percentage of legumes in the stand.

Here again, the biggest difference in fertilizer usage was between the top group and the other two groups, with very little difference between the intermediate and low scoring groups. Actually, the amount of lime used by the average man in the low group was greater than that for the intermediate group.

In respect to other practices, some of the factors seem to be significant, while others do not. One of the things usually considered important in dairy farming

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TABLE IV

	Score Groups		
	85–100	70–84	60–69
Corn silage per animal unit, tons	2.04	1.76	1.08
Grass silage per animal unit, tons	1.00	1.06	.36
Total silage per animal unit, tons	3.04	2.82	1.44

Fig. 1. Here is a field of Clinton oats on the Green County Hospital farm, Monroe, Wisconsin, where with 33 pounds of nitrogen the 0-20-20 plot yielded 124.6 bushels per acre and no lodging occurred.

Higher Fertilizer Applications Recommended in Wisconsin

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

A new series of fertilizer demonstrations was started in Wisconsin in 1948. These trials were carried out in cooperation with county agents in some 50 counties. I called them "Rate-per-acre" demonstrations on small grain and seedings of alfalfa and clover.

Last year (1949) and again this year (1950) we checked the residual effect on the hay crop of fertilizer applied with the grain nurse crop in 1948 and 1949. Just as we had hoped would be the case, the actual values of increases in yields of hay when added to increases of grain and straw and calculated over to a profit-per-acre basis have been greatest in most cases on the plots which received the double rate, 500-pound-per-acre treatments.

Further evidence to show that Wisconsin farmers can profitably apply fertilizers at heavier rates than are common to present farm practice has been gathered from our "whole farm" type of demonstration set up on some 400 farms and carried out over a period of the past 10 years in cooperation with the Tennessee Valley Authority. The yield data secured from these hundreds of large-scale demonstrations have given us some rather conclusive information. It has been shown that 500 pounds per acre of high-potash fertilizer will produce fine crops of alfalfa;

Fig. 2. This is the same field as shown in Fig. 1, but here we see the residual effect of the fertilizer on the hay crop.

and in the wake of good crops of alfalfa and clover have come better crops of corn and grain.

Still further evidence that farmers can profitably apply fertilizers at heavier rates per acre has been gathered in recent years from the experimental plots set up by Professor Emil Truog and his research assistants in Barron, Clark, and Dodge Counties.

And so my first positive statement based on the yield data from all these field demonstrations and experimental plots is: "Wisconsin farmers can afford to apply commercial fertilizer at somewhat heavier rates per acre than are now being used."

My second positive statement based not only on our recent work but on the results of several hundred demonstrations carried out over a period of the past 17 years is as follows: "Wisconsin soils need potash in increasing amounts for maximum yields of clover and alfalfa."

Let's look up some of the evidence.

TABLE I.—AVERAGE YIELDS FOR 30 PLOTS (29 COUNTIES) WHERE RATE-PER-ACRE DEMONSTRATIONS WERE SET UP IN 1948 AND 1949 AND WHERE THE RESIDUAL CARRY-OVER BENEFIT TO THE HAY CROP IN 1949 AND 1950 WAS CHECKED.

Treatment	Average yield grain '48–'49 [1]	Average yield straw '48–'49	Value of increase grain & straw	Average yield hay '49–'50	Pounds increase hay	Value of incl. grain, straw & hay [2]	Cost of ferti-lizer [3]	Net profit per acre
250# 0-20-0....	59.9 bu.	2612#	$10.14	5429#	858	$20.86	$ 6.24	$14.62
500# 0-20-0....	65.5	2691	14.30	6064	1493	32.96	10.62	22.34
250# 0-20-20...	65.3	2632	13.96	6099	1528	33.06	9.62	23.44
500# 0-20-20...	65.2	2653	13.99	6769	2198	41.46	17.37	24.09
No Fertilizer....	48.1	1984	....	4571	....	....	....	....

[1] These are average yields for all plots, both with and without nitrogen.
[2] Oats figured at 70 cents per bushel, straw at $6.00 per ton, and hay at $25.00 per ton.
[3] Represents the average cost of treatments, both with and without nitrogen.

The data shown in Table I indicate that the benefits of potash show up more on the clover or alfalfa crop the second year than on the grain crop the year that seedings are made. Furthermore, it will be observed that the double-rate (500 pounds per acre) treatments of 0-20-20 gave substantial increases in legume hay yields over the 250-pound treatments. There was a gross value of $41.46 for increases in the yields of hay, grain, and straw for the double-rate treatment versus a value of $33.06 where the fertilizer was applied at 250 pounds per acre.

I know you will say, "Wouldn't it be a good idea to topdress alfalfa fields where the light-rate applications were made at the time of seeding down?" My answer is yes, by all means. In fact we have been recommending the topdressing of these old, established fields of alfalfa with high-potash mixtures for several years. And this brings up the question of just how far we can go with heavy-rate applications at the time of seeding down. It may be wise to limit the amount of fertilizer which we apply when seeding down legumes. We know there is some "luxury" consumption of potash by the grain crop and even by first-year alfalfa hay where very heavy-rate treatments of high-potash fertilizers are made at the time of seeding. And too, there is considerable "fixing" of both phosphate and potash in certain soils.

But again, one thing I'm sure of, and that is: The present conventional 250-pound-per-acre treatments should be stepped up to at least 400 or 500 pounds per acre. Furthermore, I am convinced that more potash should be used in our fertilizer mixtures at the time of seeding down to alfalfa. Table II tells the story regarding the need for potash.

But now, what about nitrogen fertilizers for small grain? There is no question in my mind about the profitableness of using some nitrogen on at least a part of our small grain acreage in Wisconsin. On soils where there is little or no danger of lodging, we are recommending up to 33 pounds per acre of nitrogen (equivalent to 100 pounds of ammonium nitrate). But treatment with liberal amounts of phosphate-potash fertilizer and the liming of soils up to a pH of 6.5 (slight acidity) are prerequisites to our recommendations of nitrogen for grain where seedings of clover and alfalfa are made. Why do I make this statement? Because there is danger of smothering the seedings of clover and alfalfa due to the heavy growth of straw resulting from the nitrogen treatment. However, I am convinced (and my statement is backed up by actual field trials) that where the soil is abundantly supplied with minerals (lime, phosphate, potash) the seedling alfalfa or

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TABLE II.—RESIDUAL CARRY-OVER BENEFIT TO HAY CROP (18 YEARS INCLUDING 1950) SHOWING TOTAL AVERAGE VALUE OF HAY, GRAIN, AND STRAW, AND PROFIT OVER COST OF FERTILIZER (226 PLOTS). FERTILIZER APPLIED AT THE TIME OF SEEDING.

Treatment and rate per acre	Average yield grain [1]	Average yield straw	Value of increase grain & straw	Average yield hay	Pounds increase hay	Value of incl. grain, straw & hay [3]	Cost of fertilizer	Net profit per acre
1. 263# 0-20-0	55.5 bu.	2574#	$12.86	4921#	1304	$29.16	$4.37	$24.79
2. 263# 0-20-20	59.8	2746	16.95	5665	2048	42.55	7.89	34.66
No Fertilizer...	42.0	2018	....	3617	....	....	....	....

[1] Includes plots for 1948 and 1949 both with and without nitrogen.
[2] Includes some plots receiving 0-20-10, also the 1948 and 1949 plots, both with and without nitrogen.
[3] Grain figured at 85 cents per bushel, straw at $5.00 per ton, hay at $25.00 per ton.

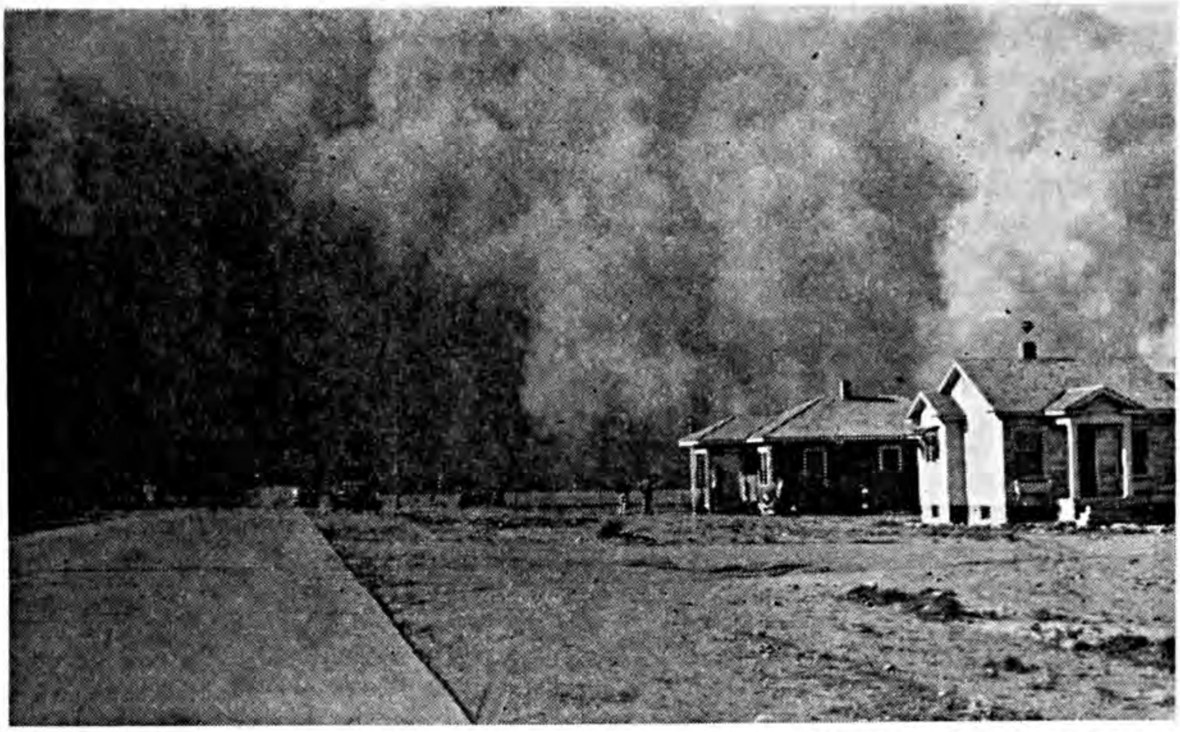

Fig. 1. High winds are capable of lifting and transporting great distances large quantities of dust composed of the organic matter and silt and clay fractions of the soil—the life-giving substances of the soil. This sorting process adds to the general sandiness and depletion of the soil productivity of the area.

Erosion Removes Plant Nutrients and Lowers Crop Yields

By J. H. Stallings

Research Specialist, Soil Conservation Service, USDA, Washington, D. C.

VAST improvements have been made in the science of crop production during the last 60 to 75 years. Inorganic fertilizing materials have been and are being constantly improved both as to the content and availability of nutrients and the physical properties of the product. Rates of fertilizer application have been increased enormously in many areas, and the number of farmers using fertilizer has increased many times over. Better adapted and higher-yielding varieties of crops have been developed through plant breeding and other work in the plant sciences. Improved methods of crop and soil management have been made available. Better materials and equipment for control of insect pests and diseases have been developed.

These and other related developments would have brought about large increases in per-acre crop production if the fertility of the soil had been maintained. If the productivity of the Nation's soils that prevailed when they were first put under the plow had been maintained at or near its former level, the average per-acre crop yields should have shown steady and consistent increases. It has been estimated that acre yields for most of our principal crops should have increased as much as 40 to 60 per cent during the last 50 years. Actually, the increase of some crops has been much less than this. The national average acre yield of corn and cotton, for example, increased but very little up to 1938 as shown in Table I. Since then there has been some increase in the average acre yields of these crops.

TABLE I.—NATIONAL AVERAGE ANNUAL ACRE YIELD OF COTTON AND CORN BY 10-YEAR PERIODS BEGINNING WITH 1869 AND ENDING WITH 1948.

Period	Average annual acre yield	
	Cotton lint	Corn
	Pounds	*Bushels*
1869–78	171.6	25.9
1879–88	172.5	25.8
1889–98	191.3	26.0
1899–08	187.7	27.4
1909–18	183.3	25.8
1919–28	162.6	27.0
1929–38	198.0	23.0
1939–48	256.0 [1]	33.0

[1] Average for the 9-year period ending with 1947

The recent increases coincide with a combination of agricultural advances which were greatly stimulated as a result of the war effort—increased spread of conservation farming and, for corn, the advent of hybrid varieties.

Cotton acreage was greatly curtailed in the old cotton-growing area and expanded into new territory in the Southwest. In the Southeast, better lands were selected for cotton production and the rate of fertilization was stepped up appreciably along with a tremendous expansion in the planting of legume cover-crops and in other improved soil-conserving practices. Perhaps the advent of hybrid corn was the greatest single factor contributing to the recent increase in corn yield. As with cotton, the amount of fertilizer used on the crop during this period was greatly increased and efforts toward the adoption of better farming practices in general were intensified.

A more or less steady decline in soil fertility has largely, sometimes entirely, offset the many advances and improvements made along the line of agricultural production. This is illustrated by the average per-acre yields of eight of the more important crops grown in Michigan during the period 1871 to 1940 (Table II).

With the exception of wheat and potatoes there was no appreciable trend of increase in the yield of any of these crops in the 70-year period, whereas an actual decline occurred in some of them.

Analyses of old cropped or eroded Willamette Valley soils in Oregon, when compared with native sod land, have shown definite reductions in plant nutrients and an increase in soil acidity (14)[3]. The decreases in nitrogen, cal-

[3] Figures in parentheses refer to literature cited.

TABLE II.—AVERAGE ANNUAL YIELDS OF EIGHT CROPS IN MICHIGAN FOR 70 YEARS BY 10-YEAR PERIODS, IN BUSHELS PER ACRE.[1]

Crop	1871–80	1881–90	1891–1900	1901–10	1911–20	1921–30	1931–40
Wheat	15.0	14.9	14.0	15.6	16.9	19.5	20.4
Corn	33.4	27.5	30.0	32.2	33.3	30.4	32.6
Oats	21.9	31.9	29.7	31.3	34.0	31.0	31.0
Rye	14.4	12.2	13.6	15.0	14.4	12.9	12.3
Buckwheat	16.1	12.9	14.2	14.4	14.1	12.0	14.2
Barley	22.9	22.7	22.0	25.0	25.2	23.9	24.8
Potatoes	86.0	73.0	80.0	89.0	90.0	97.0	97.0
Tame hay [2]	1.21	1.22	1.21	1.33	1.28	1.12	1.27

[1] Data from L. M. Turk, Department of Soil Science, Michigan State College.
[2] Yield expressed in tons per acre.

cium, and sulphur were as much as 50 per cent, and the lime requirement increased about one-half to three-fourths ton an acre. It is estimated that the soils of the Willamette Valley sustain a net annual loss of 29,000 tons of nitrogen and a heavy loss of potassium, sulphur, calcium, and magnesium, ranging from 2,500 to 106,000 tons annually. The annual loss of nutrients is from 2 to 17 times the amounts returned to the land, depending on the kind of nutrient.

The immensity of plant-nutrient losses due to erosion is indicated by the amount of silt and nutrients carried in the water of the Tennessee River system. For example, on the assumption that this silt came entirely from the row crop, idle, and other land subject to severe erosion, it has been estimated that the loss from each acre of such land during 1939 would average 5.2 tons of silt, 84.6 pounds of CaO, 97.9 pounds of MgO, 212.2 pounds of K_2O, 13.0 pounds of P_2O_5, and 23.8 pounds of nitrogen (6). Calculated on the basis of the total acreage of the watershed, the average acre losses of the three bases, as oxides, carried in solution were 167.0 pounds of calcium, 31.7 pounds of magnesium, and 7.1 pounds of potassium.

The estimated losses from the land in the entire Mississippi River basin during the same period averaged 1.9 tons of silt, 43.6 pounds of CaO, 53.8 pounds of MgO, 55.6 pounds of K_2O, 5.08 pounds of P_2O_5, and 6.46 pounds of nitrogen per acre of open farm land. On the basis of the total acreage in the watershed the average acre losses were .6 ton of silt, 13.6 pounds of CaO, 16.9 pounds of MgO, 17.4 pounds of K_2O, 1.59 pounds of P_2O_5, and 2.03 pounds of nitrogen.

The amount of mineral nutrients contained in the drainage waters of the Tennessee River watershed varies with the nature of the stratum from which the waters flow. The water draining the limestone areas contains the greatest amount of total mineral matter and that from the sandstone areas the least. However, the drainage waters from the sandstone areas contain more than twice as much potassium as the drainage waters from the limestone areas (11). The amount of phosphorus in the drainage waters varied with the amount contained in the soils from which the water flowed.

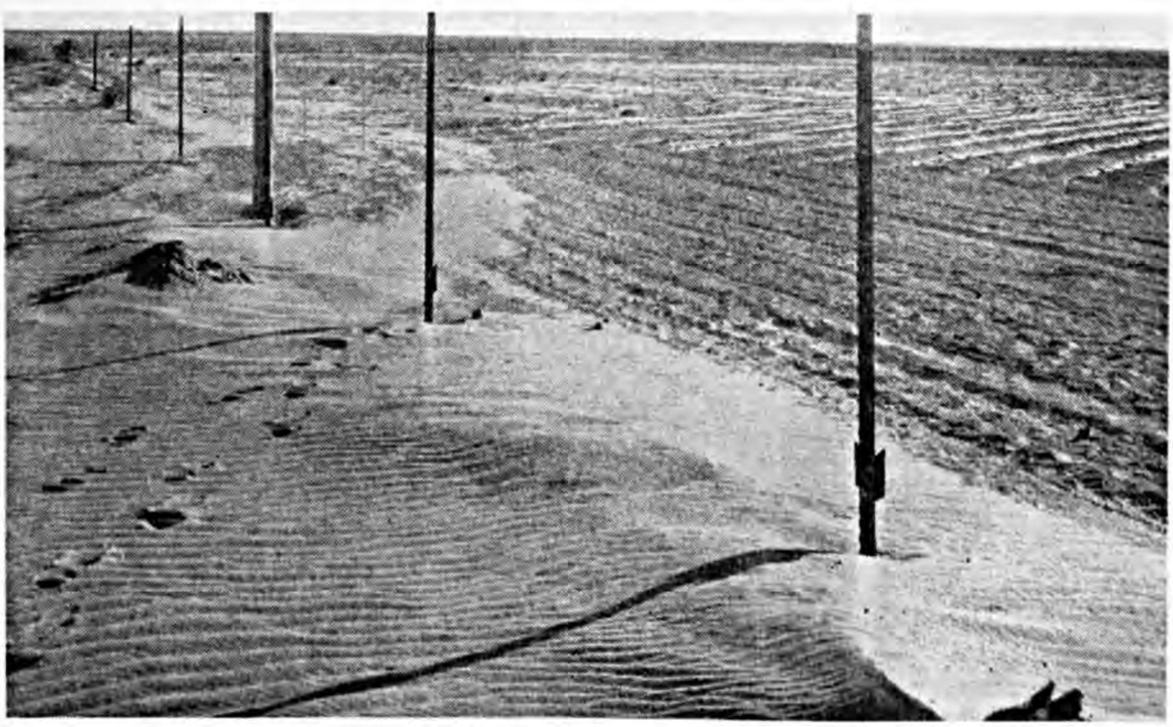

Fig. 2. The portion of the field in the foreground was blown out to a depth of more than 12 inches. Sand and coarser materials were blown into drifts and dunes.

The waters draining the highly phosphatic soils of the bluegrass area contained the greatest amount of phosphorus. The greatest amount of nitrate nitrogen was found in drainage waters containing the largest amount of soluble phosphorus, thus indicating the close relation between soluble-phosphorus and nitrate-nitrogen content.

The amounts of nutrients carried annually in solution by the Mississippi and Ohio Rivers are shown in Table III (11).

TABLE III.—AMOUNTS OF PLANT NUTRIENTS CARRIED IN SOLUTION ANNUALLY IN THE OHIO AND MISSISSIPPI RIVERS.

Element	Ohio River [1]	Mississippi River [2]
	Tons	*Tons*
Phosphorus	17,199	62,188
Sodium	119,446	630,720
Potassium	396,521	1,626,312
Calcium	6,752,222	22,446,379
Magnesium	1,629,319	5,179,788
Sulphur	2,229,544	6,732,936

[1] At confluence with the Mississippi River.
[2] At Baton Rouge, La.

In addition to the mineral nutrients carried in solution by the Mississippi River, this stream carries in suspension 7,469 million cubic feet of soil annually.

Erosion removes large quantities of plant nutrients from the soil, and much larger amounts of nutrients are lost by this means from certain productive soils than from less productive ones (18). For example, Muscatine soil in Illinois lost 311.4 pounds of calcium per acre in 3 years and 8 months, or a little more than 27 times as much as Cowden soil which lost 11.5 pounds in the same time. The nitrogen loss during this period was 280.9 pounds per acre on Muscatine soil as compared with 14.2 for Cisne soil. Magnesium losses were not as high as those of nitrogen or calcium but showed the same general relation to soil types. There was only a slight loss of potash from any of the 10 soil types studied. The greatest loss was 5.0 pounds from Muscatine soil and the smallest was 1.8 pounds from Osceola soil.

Soil erosion has played, and continues to play, a major role in impairing the productive capacity of the Nation's soils. Organic matter, nitrogen, and the clay and silt fractions of the soil, which contain the life-producing nutrients, are removed by the erosive action of wind and water. The selecting and sorting action of these agencies separates the lighter materials from the coarser and heavier sand particles and carries them off, leaving the more inert and less productive material behind. If erosion is severe the body of the soil itself is carried off.

Depletion of fertility in crop land is brought about by the combined action of many factors. Annual cropping removes large amounts of nutrient materials. Soluble constituents are lost through leaching processes. Organic-matter decomposition as a result of microbial activity proceeds at a rapid rate in cultivated soils. In addition to these and many other factors, the process of erosion is now recognized as one of the most serious forces in the rapid depletion of fertility and productivity of cultivated lands.

Much experimental evidence is available to show the extent to which erosion carries away the life-producing part of the soil—the part that contains the nitrogen and mineral plant nutrients essential to plant growth.

The light-weight particles of soil are the important ones in the great new dry land winter-wheat belt of the Southern High Plains (5). It was the loss of such particles during the dust storms of the 1930's that opened the way for serious inroads on the fertility reserves of the soils in this area. The first soil drift of 1933 to lodge in a fence row on the Panhandle Experiment Station at Goodwell, Oklahoma, contained 24.6 per cent of organic matter. The drifted soil had been separated by wind from the surface of topsoil averaging less than 2 per cent organic matter. Removal of the rich topsoil lowered crop

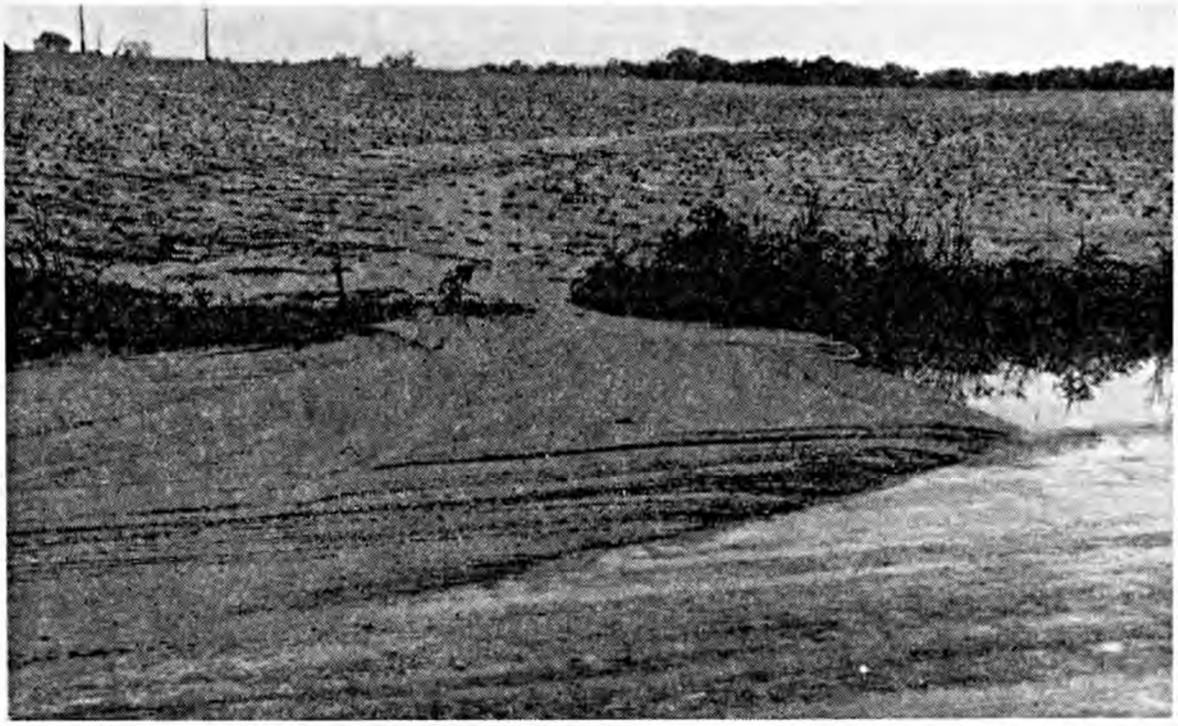

Fig. 3. Much of the topsoil was removed from this field by a heavy rainstorm. The deposit in the foreground consists of the sandier and coarser portion of the soil eroded.

yields 4.5 times as fast as did later removals of surface and subsoil material.

Each shift of soil by the wind serves to remove more plant nutrients. After the soil is shifted a large number of times, the remaining soil that forms the dunes is mainly sand, regardless of the original texture (3). In Oklahoma, after the heavy wind storms of the early 1930's, the organic matter-nitrogen ratio in the cropped soil was 22.47, that in the virgin soil 23.30, and the average of the drifts was 24.44. As a result of cropping and wind erosion, the organic matter in the cultivated soils was decreased 18 per cent and the nitrogen was decreased 15 per cent. Very little difference occurred in the nitrogen and organic matter content of the cropped and virgin subsurface soils.

The wind tends to change the soil texture through removal of the silt fraction and may deplete the total fertility of the soil by sifting out the lighter and more fertile portion and carrying it away (5). Samples of dust collected in Oklahoma during the dust storms of 1930 contained on the average 62.5 per cent silt and 14.3 per cent sand. The original soil, Richfield silt loam, contained 42 per cent silt and 35.4 per cent sand, whereas the drift soil contained 58.2 per cent sand and only 15 per cent silt.

The dust contained 1.77 times as much combustible matter as the field soil and 1.47 times as much as the drift soil. The total nitrogen content of the dust was 2.15 times that of field soil and 1.88 times that of drift soil. The dust contained 1.95 times as much phosphorus as the field soil and 2.04 times as much as the drift soil, and contained 1.99 times as much base-exchange calcium as the field soil.

Samples of dust laid down on snow and ice in Iowa by a dust storm originating in the Texas-Oklahoma Panhandle early in 1937 were collected and compared with samples taken from a small dune formed by the same wind disturbance at Dalhart, Texas (1). The dust contained roughly 10 times as much organic matter, 9 times as much nitrogen, 19 times as much phosphoric acid, and about 1½ times as much potash as the dune material. Analyses indicated a similar sorting effect with respect to removal of both soil particles and chemical constituents. The unaffected grass-covered soil contained 79.2 per cent coarse materials (total sands)

TABLE IV.—ORGANIC MATTER AND PARTIAL CHEMICAL CONTENT OF SOIL OF UNPLOWED GRASSLAND, DUNE SAND, AND DUST.

Element	Unplowed grassland, near Dalhart, Tex.	Dune sand, Dalhart, Tex.	Dust	
			Hays, Kans.	Clarinda, Ia.
	Per cent	*Per cent*	*Per cent*	*Per cent*
CaO	0.34	0.31	3.15	1.98
K_2O	2.05	1.77	2.46	2.58
P_2O_5	0.04	trace	0.14	0.19
Nitrogen	0.06	0.02	0.20	0.19
Organic matter	1.06	0.33	3.34	3.35

as compared with no sand in the dust, and 19.6 per cent of fine material (silt and clay) as compared with 97 per cent in the dust. The dust contained more than three times as much organic matter and nitrogen, respectively, as the virgin soil; nearly five times as much phosphoric acid; and one and one-fourth times as much potash.

Samples of dust originating in the 1937 Panhandle storm and deposited at Hays, Kansas, and Clarinda, Iowa, were compared with samples of soil of unplowed grassland and with dune sand collected near Dalhart, Texas (1). The results of the analysis of the samples are shown in Table IV.

The data show that the original unplowed soil was much higher in essential plant nutrients and organic matter than the dune sand but much lower in these materials than the dust collected at Hays and Clarinda.

Much fertile material in the soil is lost through erosion. Material eroded from Collington sandy loam in New Jersey from June 12, 1938, to December 31, 1941, contained 4 times as much organic matter, 1.5 times as much phosphorus, 1.4 times as much potassium, and 2.3 times as much calcium as there was in the soil before erosion occurred (13). The loss per acre due to erosion was 1.149 pounds of organic matter, 67 pounds of nitrogen, 154 pounds of P_2O_5, 575 pounds of K_2O, and 141 pounds of CaO. There were more than 3.5 times as many particles averaging less than 50 microns in diameter in the eroded material than in the surface soil from which the material came. The eroded material contained 58 per cent of materials of this size-class compared with slightly less than 16 per cent in the original soil.

The material eroded from Dunmore silt loam cropped to corn was 16 per cent richer in total nitrogen and 11 per cent richer in phosphorus than the original soil (15). Water-soluble phosphorus in water extracts of eroded material from corn land contained six to eight times as much organic phosphorus as was contained in extracts of the parent soil.

A study of 48 depleted soils and the corresponding virgin soils in Michigan showed that the virgin soil had a greater rate of solubility, as measured by the freezing point method with moisture content somewhat above saturation (12). A decrease in rate of solubility is one of the important changes a soil undergoes in passing from a virgin to a more or less depleted condition. This is important since most crop plants feed primarily in the surface or plowed stratum of the soil, and the solubility of subsoils is usually very low compared with that of the surface soils.

The total amount of salts in runoff water from soil erosion plots at Columbia, Missouri, during the year May 1, 1924, to April 30, 1925, ranged from 166.8 pounds per acre for a plot in wheat and clover to 380.1 pounds per acre for a plot that was spaded four inches deep in the spring and fallowed throughout the season (4). Calcium and sulphur were lost in larger amounts than any of the other elements determined. Although the loss of potassium was rather small, the loss of this element from several plots was much greater than the amount that would ordinarily be applied in commercial fertilizer.

Soil type and cover had a marked effect on both the amounts and concentrations of the solubles lost in runoff at Geneva, New York, during the 13-month period, March 1938 to March 1939, inclusive (2). These effects appeared to be related to variations in soluble concentrations at the soil surface and to the relative rates of infiltration and runoff. The concentrations tended to be higher in the summer months. The proportional losses of the separate soluble constituents in runoff varied considerably. Although losses of solubles reported in runoff were small, an analysis of the factors that produce variability in runoff losses indicates that appreciable losses may be incurred where poor soil management practices are employed.

The annual nitrogen losses from land in Missouri planted to intertilled crops on slopes averaging 200 feet in length have been found to range from 3.8 per cent of the total amount contained in the surface 7 inches of soil for a 2-per-cent slope to 11.1 per cent for a 12-per-cent slope (19). The annual losses on 2-per-cent slopes ranged from 3.8 per cent for slopes averaging 200 feet in length to 10.9 per cent for slopes that averaged 1,200 feet in length. Corresponding losses on a 12-per-cent slope were 11.1 per cent for the 200-foot slope and 18.1 per cent for the 1,200-foot slope.

The loss of nitrogen declined with the introduction of sod-producing crops into the rotation and disappeared altogether on well-sodded meadows or pastures.

Numerous important depletions of organic matter, formerly attributed to oxidation, may have resulted from erosion (16). Depletion of organic matter appeared to be a linear function of erosion. The calculated organic matter percentage of the soil dropped 0.002 per cent at both Clarinda, Iowa, and Bethany, Missouri, for each ton of soil lost by erosion. The amount of or-

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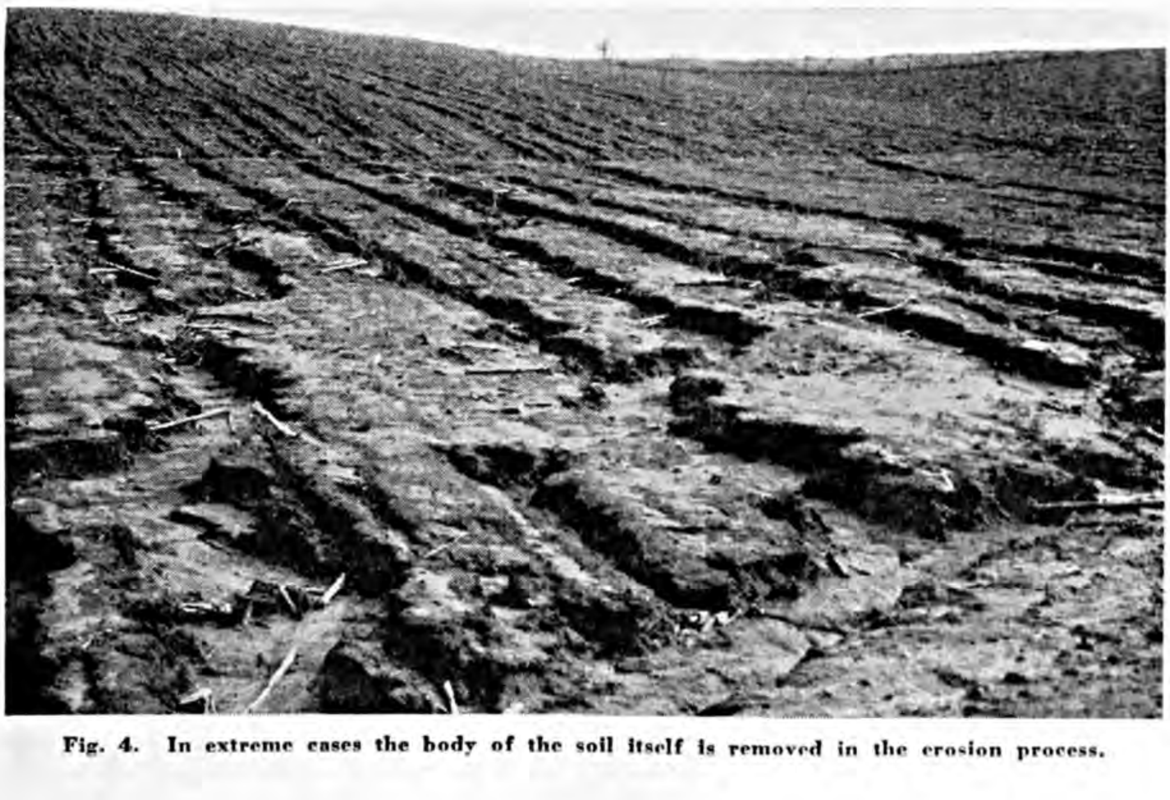

Fig. 4. In extreme cases the body of the soil itself is removed in the erosion process.

Plenty of Moisture, Not Enough Soil Fertility

By Wm. A. Albrecht

Soils Department, University of Missouri, Columbia, Missouri

THE weather records of 1950 for Missouri, and for the rest of the Corn Belt, report the distribution of rainfall during the corn-growing season as very favorable. No period longer than 12 days without significant rainfall during June, July, and August is the record of the weather station at Columbia, Missouri. For June the total rainfall there was 4.87 inches, for July it was 3.04 inches, and for August it was 5.76 inches.

However, in spite of the favorable distribution of rainfall during the summer months, and of the generous total supply of it, the corn crop examined in the fields and in the wagons this fall is disappointing in too many cases for us to be complacent about it. Examination of the corn in many fields in going across not only Missouri, but also Illinois on the east, and Kansas on the west, gives a similar report. Kansas announced "Corn yield per acre best since 1889," to suggest that even with big yields we are just now winning back. Even though this was a "banner year," it is disturbing to many folks still looking for "nice, big ears" when more of them—of less size—per acre and per stalk make bigger production. The ends of the ears are not filled, grain counts per row or per cob reveal as much as 20 per cent of the potential grains unfilled on the small end. The shelling percentage is correspondingly low. Something failed to carry through to finish out the ear. Something was running short, apparently, before the finish.

Such facts suggest that the fertility delivered by the soil was not enough to balance the moisture contributed by rainfall. The latter was equal to more corn but the fertility supplied by the soil was not.

Such a condition in which the tips of the ears fail to fill suggests a potassium deficiency. Treatments of potassium on the soil which gave well-filled ears this year verify that suggestion. Poor tips of ears are common even where ammonium nitrate and sulfate have been used. It is clear, therefore, poor tips are not due to nitrogen shortage. Poor tips are also common this fall on soils that had received generous amounts of phosphorus for some years past.

Nor can these defective ears be ascribed to a calcium shortage in the soil when they were so common on soils properly limed. Whether a magnesium deficiency in the soil and in the plants is responsible is still an open question.

Insufficient potassium supply seems the most likely cause of these defective ear tips, since experiment fields have well-filled ears of corn where potassium was generously applied.

When the surface soil is constantly moist, the roots drink and feed in the topsoil. When the rainfall is less and the surface soil dries out, the roots go more deeply into the soil ahead of the drying effects. Penetration into the heavier clay layers of the soil makes contact with the untapped potassium reserves. Deeper rooting brought about by occasional shortages of rainfall means

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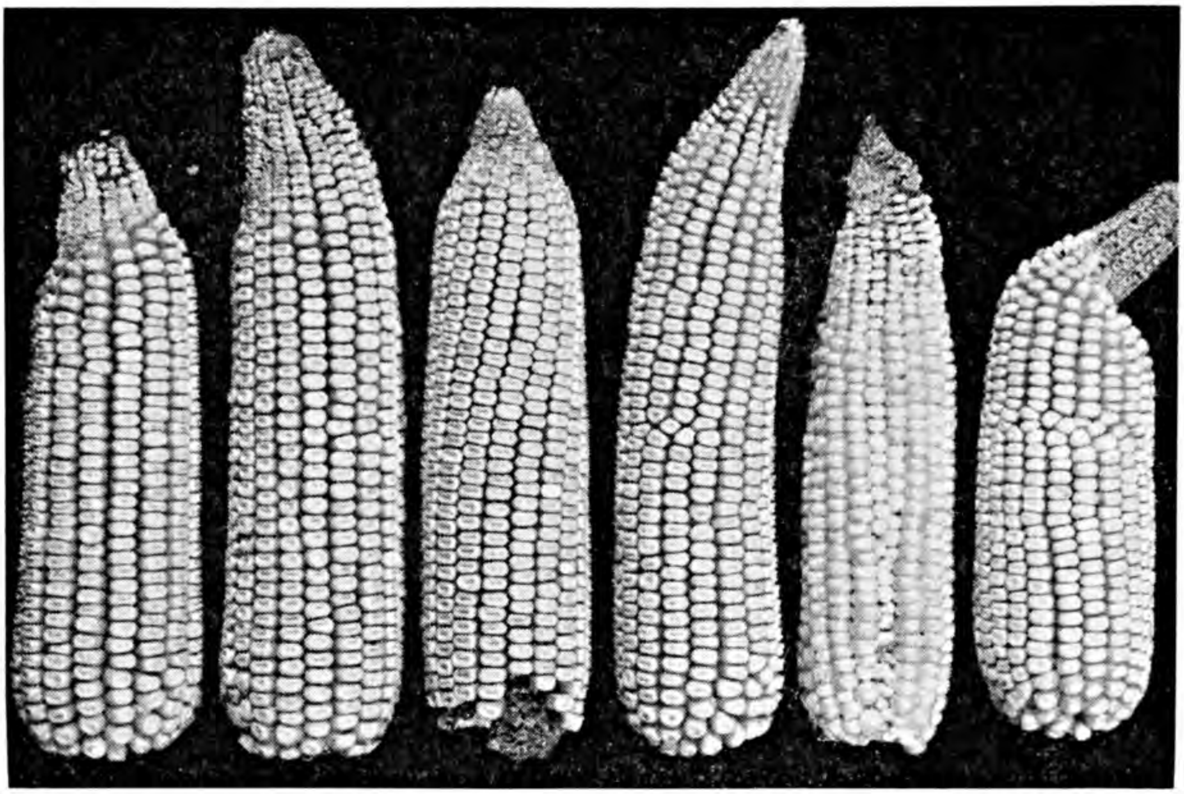

No potassium was applied for the corn above. These poorly filled ears from the 1950 plantings at the Missouri Experiment Station indicate a case of wet-weather deficiency of potassium.

Potassium was applied for the corn below. Both plots had the same frequent, well-distributed rainfall to encourage shallow rooting and shallow feeding by the corn plants. Both plots had phosphorus, nitrogen, and calcium.

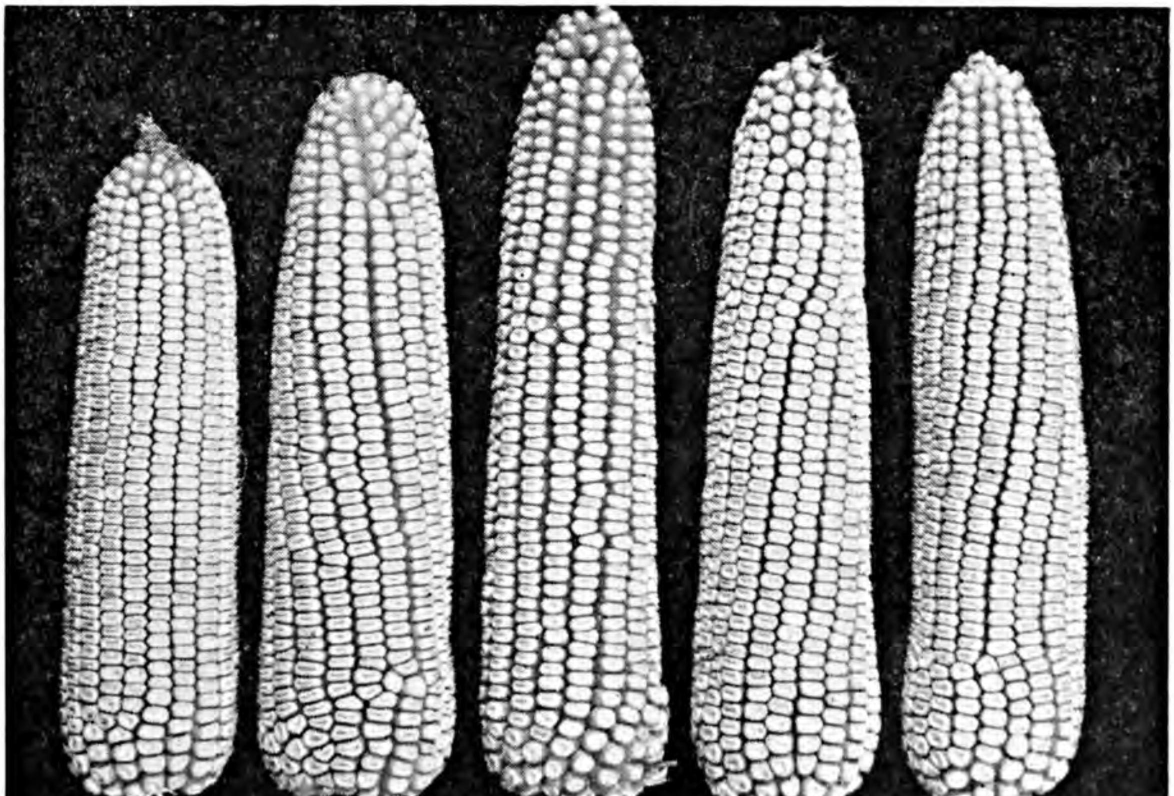

Fig. 1. Hogging-off corn, a practice which is growing in popularity in the Southeast.

The Southeastern Farmer Makes the Change

By George H. King

Georgia Coastal Plain Experiment Station, Tifton, Georgia

FOR the past several years, the agriculture of the Southeast has been in a stage of change, and this transitional period will continue. While this change would possibly have occurred in time, acreage allotments imposed on the major cash crops, cotton, peanuts, and tobacco, have accelerated it. Reduced acreage allotments meant that the farmer had to cast about in other directions to utilize his acres to the best advantage in order to maintain his income level. This is being done in several ways.

First, the farmer is producing with greater efficiency on those acres of allotted crops. Using Georgia as a typical example, we know that the average yield of lint cotton per acre ranges between 200 and 300 pounds. Good farmers following approved practices, involving better varieties, higher fertilization, and more adequate insect control, are producing during normal years 500 pounds or more of lint per acre.

The average yield of peanuts in Georgia is about 700 pounds per acre; yet in 1949, a Sumter County farmer won a peanut contest with a yield of 2,700 pounds per acre, and none of the 12 leading contestants fell below 1,800 pounds. These yields have been brought about by better varieties, more fertilizer, seed treatment, closer spacing, and disease and insect control.

Tobacco yields average about 1,100 pounds per acre, but improved practices in the use of fertilizer and control of insects and diseases enable many

TABLE I. INCREASE IN VALUE OF CORN THROUGH HOGGING-OFF

Corn yield per acre	Protein supplement fed per acre	Live-weight gain per acre	Gross value gain	Cost protein supplement	Returns per bu. corn	Prevailing local corn price
57 bushels	312 lbs.	762 lbs.	$137.16	$12.50	$2.16	$1.00

farmers to produce yields of 1,500 to 2,000 pounds of good quality tobacco per acre.

Second, the farmer is turning into major enterprises some crops, such as corn and sweetpotatoes, heretofore regarded as minor sources of income or as supply crops. Here again, efficiency of production means the difference between success and failure. The Southeastern farmer has made tremendous progress in his ability to produce corn. Georgia in five years has increased its average corn yield from 12 to 18 bushels per acre. The potentialities may be seen, however, when more than 300 Georgia farmers produced over 100 bushels of corn per acre. This increase is due to increased fertilizer, closer spacing, more efficient cultivation, and the use of better varieties and hybrids. Farmers have learned that what they once termed "firing" and attributed to lack of water was really fertilizer deficiency. They have learned that to produce high yields they must have a large number of plants per acre. In 1950, approximately 30 per cent of the Georgia corn crop was in hybrid corn. These farmers have learned that a few quick, shallow cultivations make more corn. Increased yields due to these improved practices are being obtained in all of the Southeastern states.

When yields are increased, corn may change from a "supply" enterprise to a cash enterprise. When used for "hogging-off," its income-producing power may easily be seen. In 1948, at the Georgia Coastal Plain Experiment Station, hogs produced 762 pounds of pork per acre on corn yielding 57 bushels per acre. Even though 312 pounds of protein supplement per acre were fed in addition to the corn, from Table I it may be seen that the value of the corn crop was more than doubled when fed through hogs at the then prevailing (corn-hog) price ratio. In addition, the cost of harvesting and the hazards of storage were eliminated. Also not to be overlooked, is the fact that "hogging-off" corn is a good soil-

TABLE II. FEEDING DEHYDRATED SWEETPOTATOES TO STEERS

	Group 1 Cracked shelled corn	Group 2 Dehydrated sweetpotatoes	Group 3 50% Cracked shelled corn 50% Dehydrated sweetpotatoes
Number of steers	60	60	60
Average initial weight	660 lbs.	660 lbs.	670 lbs.
Average final weight	990 "	962 "	1,031 "
Average daily gain per steer	2.36 "	2.16 "	2.58 "
Total cost per steer and feed	$154.03	$143.74	$161.14
Gross return per steer	$181.07	$162.10	$188.16
Profit per steer	$ 27.04	$ 18.36	$ 27.02

Supplementary feeds: Cottonseed meal, peanut hay, mineral mixture.
(*Bulletin 45, Georgia Coastal Plain Experiment Station*).

improvement practice, while harvesting corn cannot be so regarded.

The average yield of sweetpotatoes in Georgia is about 85 bushels per acre, yet individual farmers are producing from 300 bushels to 600 bushels per acre by using better varieties, closer spacing, and high fertilization. Sweetpotatoes not used for human consumption are left in the field for "hogging-off" or dehydrated and mixed with corn to provide an excellent feed for beef cattle. Table II gives the summary of four years' results in the feeding of dehydrated sweetpotatoes to beef cattle.

It can be seen from the tests that sweetpotatoes may replace as much as 50 per cent of the corn in the ration for fattening steers. Sweetpotatoes used for livestock feed as well as food for table consumption will in many cases graduate from the "supply" category to a major source of cash income on many Georgia farms.

Third, the farmer during this transition period is turning to livestock production. To efficient production of such feed crops as corn, peanuts, sweetpotatoes, and small grains, he must add the establishment and maintenance of good pastures. Pastures are developing by leaps and bounds over the Southeast. Many farmers are meeting the demands of good pastures by preparing the land, planting adapted grasses and clovers, and fertilizing heavily. This change to livestock is possibly the greatest that is taking place in this period of transition. It has been aided by the development of such grasses as coastal Bermuda, the adaptation of the tall fescues to Southern conditions, the development of the Bahia grasses in the coastal areas of the South, the development of reseeding crimson clover under a variety of names, and the refinement of practices with all grasses and clovers in use. For a number of years the Southern farmer was, due to long years of fighting grass, opposed to fertilizing it. This feeling has gone, and the pastures of the South owe much of their new look to adequate fertilization. Yields and food value of the grasses and clovers are increased in a phenomenal way. Coastal Bermuda, for example, when highly fertilized has produced as high as 10 tons of dry hay per acre per year analyzing 14 per cent protein. Through the use of

(*Turn to page* 43)

Fig. 2. Twelve steers were maintained on three acres of Coastal Bermuda grass throughout the summer months with a total of 1,707 pounds gain. In addition 1¼ tons of hay per acre were cut.

Sugar Cane and the Soil

By George Samuels[1]

VERY few plants of economic importance have as interesting a soil-plant relationship as sugar cane. Sugar cane, a member of the important family of flowering plants, the Gramineae, is grown for its juices from which sugar is produced. In the leading sugar cane areas of the world (British West Indies, Cuba, Hawaii, India, Java, Louisiana[2], and Puerto Rico), this crop forms a major part of the agricultural economy. Yet, despite years of continuous growth on the same land, sugar cane cannot be considered as a major soil-depleting or deteriorating crop, as are many of our cash crops. The reasons for this are due to certain inherent qualities of the crop itself and the way in which it is normally managed.

Aside from the legumes and pasture grasses, one should not consider most economic agricultural crops as builders of soil organic matter. However, despite the continuous cropping of sugar cane in certain Puerto Rican soils for over 100 years without any green-manure or cover crop, the organic matter content of these soils has shown no evident serious depletion. In fact, increases in the organic matter content of the lower part of the top foot of soil have been shown as a result of deep plowing. This is clearly revealed in Table I where the comparison of a virgin (not cultivated in the last 25 years) and a cultivated sugar cane profile of the same soil type is presented. Except for a decrease in the 0-3 inches due to the disturbance of the accumulation or organic matter in the virgin state, the cultivated sugar cane soils show no decided decrease in organic matter in the 0-6-inch horizon and an increase in organic matter content in the 6-15-inch horizon. The average for the entire 15-inch profile was 2.48 per cent for the virgin and 2.08 per cent for the cultivated, showing only a decrease of 0.40 per cent in the entire 15 inches due to cultivation of sugar cane. Considering the lower volume weight of the surface of the virgin soil, the average loss of organic matter for the 15 inches becomes only 0.25 per cent for the cultivated soil.

TABLE I.—A COMPARISON OF THE ORGANIC MATTER CONTENT OF A VIRGIN AND CULTIVATED PUERTO RICAN SUGAR CANE SOIL PROFILE, OF THE SOUTH COASTAL AREA.*

Depth inches	Organic matter content, per cent	
	Virgin (Woodland)	Cultivated
0–3	4.28	2.16
3–6	2.95	2.12
6–9	2.12	2.31
9–12	1.82	2.12
12–15	1.22	1.67
0–15 (average)	2.48	2.08

* Data supplied by cooperative research project R.M. #74 (Puerto Rico Agricultural Experiment Station; Soil Conservation Service, and B.P.I.S.A.E., both of the U. S. Department of Agriculture.)

Why doesn't the soil organic matter content decrease sharply with continued intensive soil cultivation devoted to a one-crop system? The answer can be realized when we consider the amount

[1] Plant Physiologist, University of Puerto Rico, Agricultural Experiment Station, and Cooperative Soil Specialist with Soil Conservation Service Research and Bureau of Plant Industry, Soils and Agricultural Engineering of U. S. Department of Agriculture on the R. M. Project, "Erosion Control and Stable Crops Production in P. R." of which this is a cooperative paper.

[2] Because the geographic location of Louisiana makes it necessary that sugar cane be managed differently than in tropical areas, the discussion in this article will be limited to the tropical areas.

of organic matter returned to the soil each year by the sugar cane crop. For every 40 tons of cane removed per acre, 10 tons of organic material are left behind in the soil.

An average 40-ton crop of sugar cane stalks leaves behind as trash 20 tons of leafy material consisting partly of dry trash, senescent freshly stripped leaves, and fresh green leaves and tops. Assuming this material contains 50 per cent moisture, we now have 10 tons of dry organic material. This organic material is of best service only when converted to colloidal humus. For 10 tons of organic material with a nitrogen content of 0.6 per cent we will get 2,150 pounds of humus with a C:N ratio of 10:1. Similarly, the roots of the sugar cane crop produce 3,500 pounds of dry material per acre which gives 1,000 pounds of humus. In an acre of soil, 6⅔ inches deep consisting of 2,000,000 pounds of soil, this means a contribution of 0.176 per cent organic matter for every 40 tons of harvested cane.[3]

The contribution of the organic matter to the sugar cane soils has served to keep them in a good physical state despite the continuous cropping. The trash left after the cutting of the sugar cane serves as an effective mulch and ground cover until the crop is tall enough to produce adequate ground coverage. Experiments on 45 per cent slopes in Puerto Rico have shown that trash-covered sugar cane slopes gave a loss of only 0.6 tons of soil per year as compared to 7 tons where the trash was removed by burning.[4]

Of course, sugar cane cannot be grown continuously on the soil without the proper use of fertilizers. Most sugar cane soils are now heavily fertilized. Although sugar cane may contribute to the soil organic matter, it does not add sufficient plant nutrients to the soil. However, let us see just what nutrients are removed from the soil by the sugar cane. In Table II are given representative values of the elements removed by 40 tons of sugar cane.

TABLE II.—POUNDS OF NUTRIENTS REMOVED IN A 40-TON PER ACRE CROP OF UBA SUGAR CANE.*

Part	Plant material pounds	NH^3	P^2O^5	K^2O	CaO	SO^3
Canes	80,000	57.4	20.0	12.0	29.6	32.0
Tops	12,701	33.8	9.9	15.9	8.8	20.6
Dry leaves	4,850	20.8	5.5	8.7	23.6	19.7
Total	97,551	112.0	35.4	36.6	52.0	72.3

* Calculated from information supplied by Dr. J. A. Bonnet, Soils Department, Agricultural Experiment Station of the University of Puerto Rico.

The largest single item removed by the sugar cane is nitrogen. The nitrogen removed by the 40 tons of cane is 57.5 pounds of NH_3, equivalent to 235 pounds of sulfate of ammonia fertilizer. The entire crop removes 113 pounds of NH_3 but 54.6 are returned in the tops and dry leaves. The phosphorus removed by the cane amounts to 20 pounds as P_2O_5 or an amount equal to 100 pounds of 20 per cent superphosphate. The amount of potassium removed as K_2O is 12 pounds, equivalent to 20 pounds of potassium chloride. The potassium value given here, however, is lower than is generally obtained for cane in Puerto Rico under normal fertilization. A value of 48.7 pounds of K_2O [5] or 81 pounds of potassium chloride removed by the 40 tons of cane is more representative. The ratio of NH_3, P_2O_5, and K_2O removed by the cane is approximately 15:5:12 if we use the NH_3 and P_2O_5 values of Table II and the corrected K_2O value. This ratio is quite similar to the

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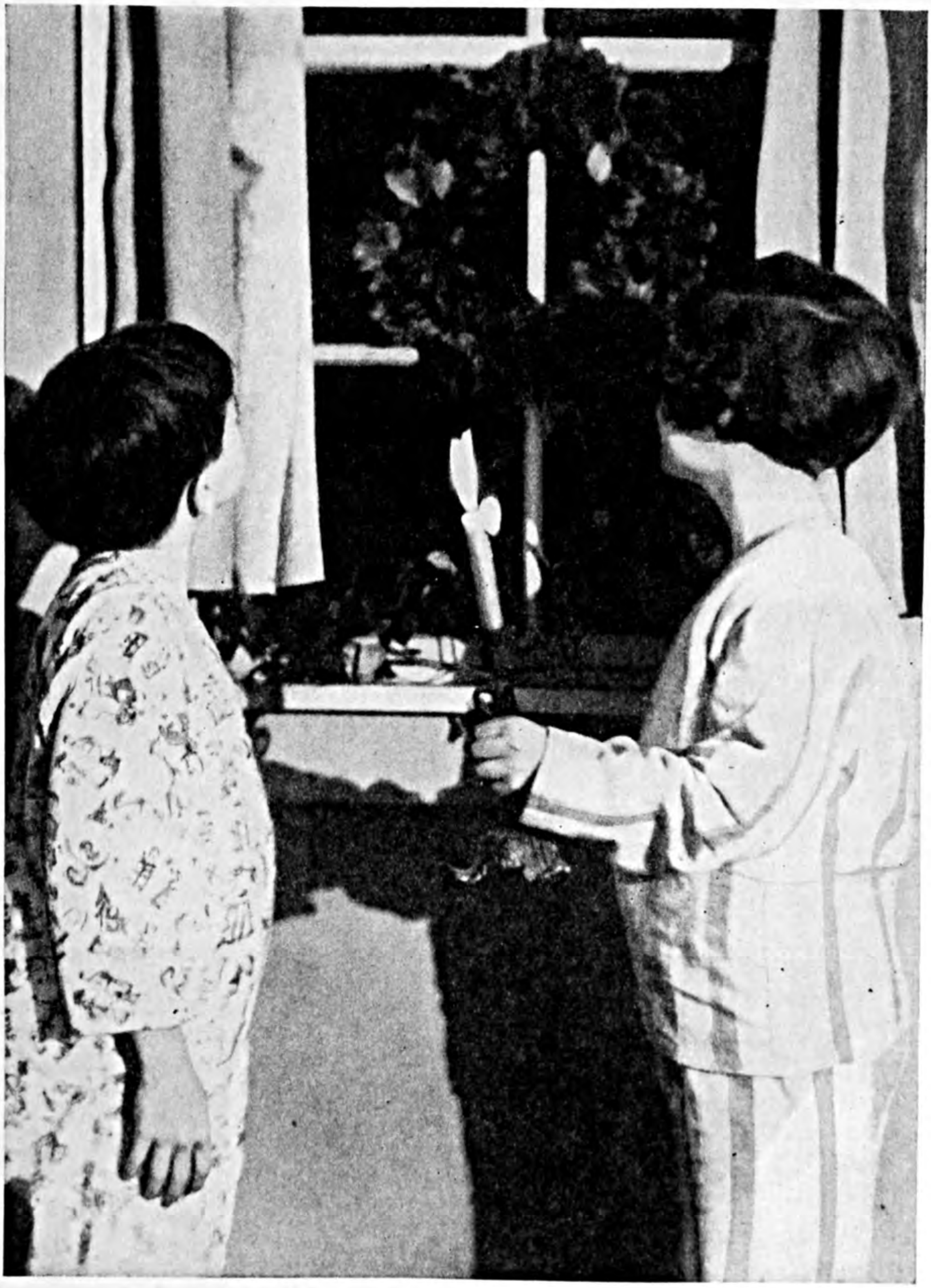
[3] Calculated from data by F. Hardy in Tropical Agriculture, Vol. 21:203-209 (1944).

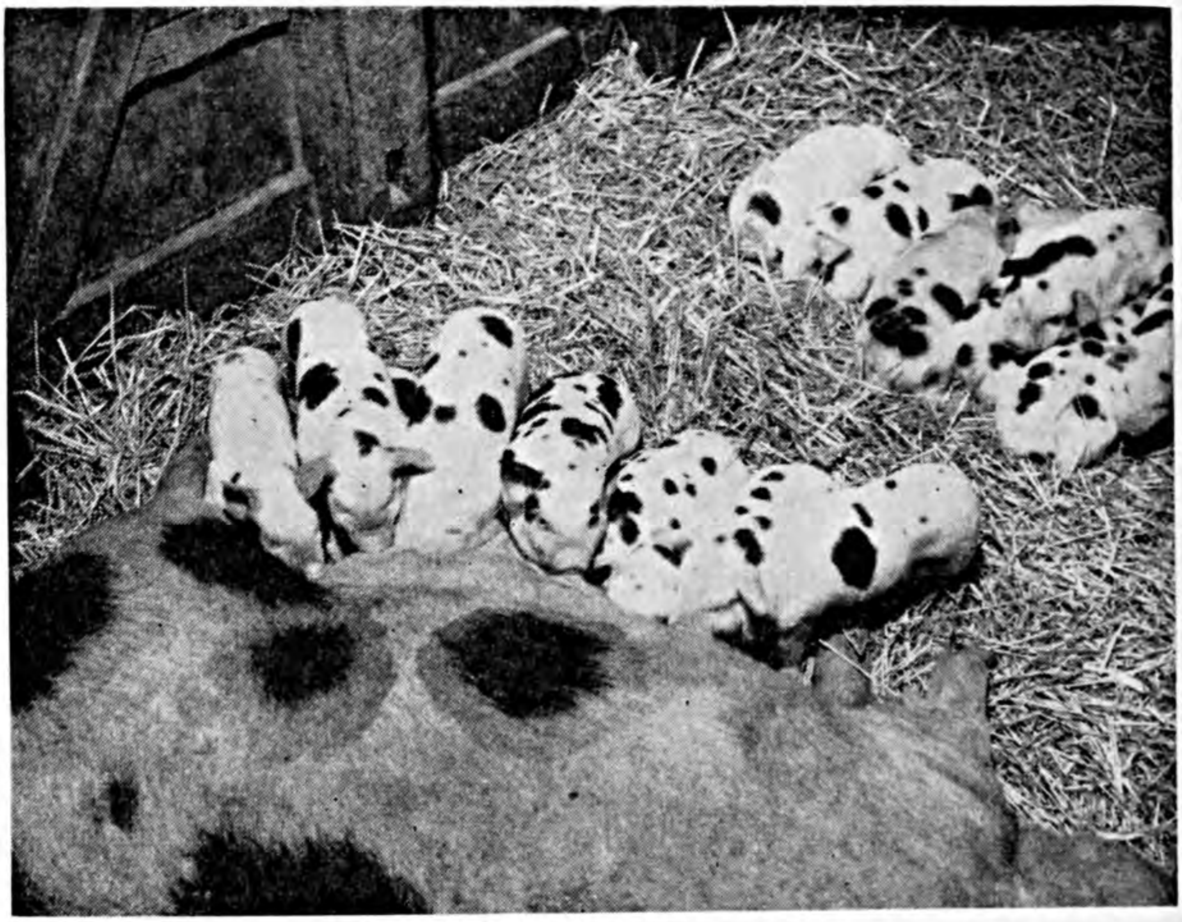
[4] Data supplied from the Cooperative Research Purnell Project #17 of the Puerto Rico Agricultural Experiment Station and the Soil Conservation Service of the U. S. Department of Agriculture.

[5] Calculated from Van Slyke's values, U. S. Department of Agriculture Yearbook of Agriculture, 1938, p. 399.

PICTORIAL



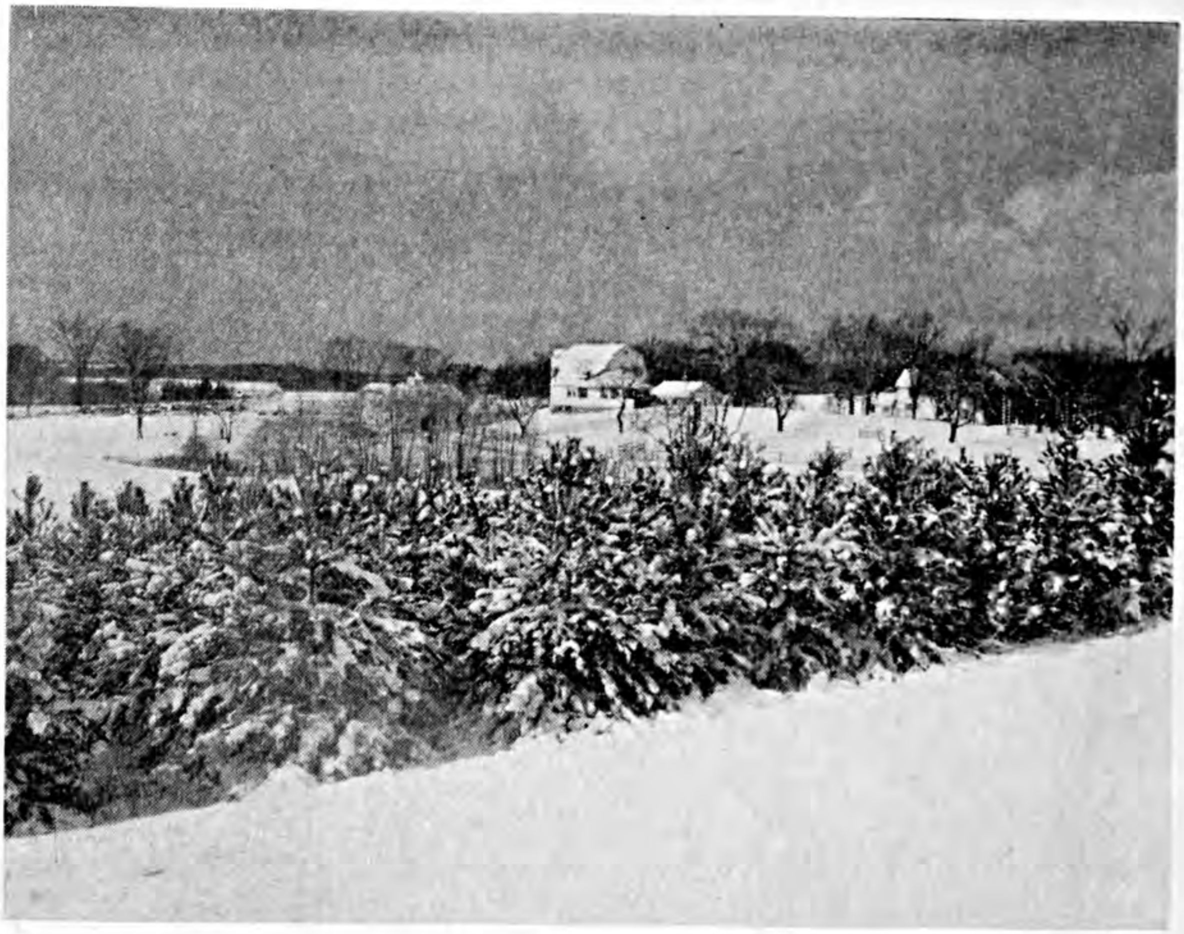
Looking for—Peace on Earth, Good Will Toward Men.



Solid Contentment

Below. Courtesy WJZ Farm News Program

Winter Odd Jobs



Evergreens—North and South

The Editors Talk

Backward and Forward

As a year ends and a new one dawns, it is well to summarize the old one and very important to look as far as possible into the new one. Hindsight is always easier than foresight. This never was more true than now when the future of all of us is so closely tied in with the uncertainties of the world situation. Yet several factors for American agriculture in 1951 are now apparent.

Turning to a summarization for 1950, there is every indication that the year has been a favorable one for the majority of farmers. At the beginning of the year it was thought that farm income might drop as much as 5 or 10 per cent under 1949. A stiffening of prices the latter part of the year coupled with a high level of production enabled farmers to overcome the reduced income of the earlier months and wind up with receipts that will almost equal those of 1949.

Production expenses increased. This resulted in an unfavorable ratio of expenses to income during the earlier part of the year, so that the farmers' purchasing power dropped. This situation also improved in the later months and as a result the year ends with a ratio of prices received to those paid 5 or 6% above normal.

The favorable agricultural situation that developed during the latter part of the year, together with an increased demand for agricultural products, has resulted in increased land values over many parts of the country. Some of this demand has been from city people who wished to purchase agricultural land as a hedge against inflation. Some of it was due to farmers wishing to expand their production.

The strengthening demand for agricultural products turned the worry over surpluses into concern over building stockpiles to meet a national emergency.

1951

Turning now to a look into 1951, it is believed that most farmers will receive higher incomes despite higher costs for production goods, family living, and taxes. Total farm income for 1951 is estimated at from 10 to 15% higher than in 1950—a record high. With normal weather, a new peak in production is expected. This will be met with a strong consumer demand resulting from full employment at high wages. With this urban income limited in the purchase of durable goods, more of it will be spent upon food and clothing. Military spending will greatly increase as our armed forces are stepped up to the 5 million in uniform expected by the end of 1951. Uncle Sam feeds his services well.

Secretary of Agriculture Charles F. Brannan has called for all-out production with promise of price support where necessary to encourage output. Farmers are being urged to purchase early the supplies which they will need. Particularly is this true for fertilizers, insecticides, and machinery. While supplies are adequate now, shortages may develop later due to storage and transportation difficulties.

In planning for 1951, the possibility of an acute labor situation must not be overlooked. It is expected that around 225,000 farm boys will be drafted for military service and about an equal number of full-time farm workers will be lured by higher wages to industrial employment in towns and cities. Some of this shortage, as in past emergencies, will be made up by importing foreign workers and seasonal recruiting from urban centers. However, there will be a necessity for more production with less work.

According to Reuben W. Hecht of the Bureau of Agricultural Economics, U. S. Department of Agriculture, the cut in labor used per acre of crops has been due chiefly to increased use of mechanically powered machines. The list of these machines is long. Small grain combines, corn pickers, field forage harvesters for both hay and row crops, mowers and other haying machines, and cultivators and other tillage implements are important items. Greater use of automobiles and motor trucks have reduced time for farm-hauling jobs.

The list of factors that have raised crop yields also is long. Weather has been very influential during recent years, but over the long pull, other factors are more important. These include the use of new hybrids and varieties of crops—of which hybrid corn is an outstanding example—increased application of fertilizers and lime, adoption of soil- and moisture-conserving practices, more effective control of pests and diseases, and irrigation and drainage. In recent years, productivity of labor used in production of livestock products has increased at a rate more nearly in line with the productivity of labor used in crops.

Let us repeat that the look ahead is most important. With the threat of a third world war upon us and with the advantage of a hindsight on 1950, every individual connected with agriculture should bend his brain and back to make the records of 1951 materialize. We can do it and will.

Good Advice

A University of Illinois soils man is strongly urging farmers to order their spring fertilizer supplies now and to apply the plant foods to the soil this winter. He is A. L. Lang, who says there is plenty of fertilizer on hand now and supplies should be adequate if they are evenly distributed. But if most folks wait until next spring to order, supplies are almost sure to tighten up and many men will be disappointed.

Advantages of ordering now are that demand next spring is likely to be unusually heavy and the price is more likely to go up than down. Farmers will also get better quality now and the kind and grade they want. There may be freight car bottlenecks next spring too, since military supplies will move first.

Lang believes the best place to store fertilizers is in the soil. Limestone, rock phosphate, superphosphate, and potash can be put on any time this winter. Nitrogen, of course, must wait until next spring, since it is quickly available and would leach out of the soil during the winter.

Another advantage of winter application is the time and labor saved against the rush of spring work. This may be especially important this year with the expected shortage of farm workers.

Where fertilizer must be stored in buildings, it should be kept dry, up off the floor, and stacked no more than six or eight bags high, Lang advises.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925..........	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926..........	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927..........	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928..........	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929..........	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930..........	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931..........	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932..........	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933..........	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934..........	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935..........	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936..........	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937..........	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938..........	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939..........	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940..........	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941..........	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942..........	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943..........	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944..........	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945..........	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946..........	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947..........	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948..........	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949..........	28.6	46.3	128.0	214.0	119.0	186.0	16.55	43.40	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	..
1950									
January.....	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February....	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March.......	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April........	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....
May.........	29.24	48.5	128.0	228.0	134.0	204.0	17.25	45.20	....
June........	29.91	49.7	127.0	211.0	136.0	193.0	16.05	46.20	....
July.........	33.05	45.5	127.0	208.0	144.0	199.0	15.15	52.00	....
August......	36.95	53.1	122.0	218.0	144.0	197.0	15.45	70.90	....
September...	39.98	55.4	105.0	192.0	144.0	194.0	15.55	78.80	....
October......	38.90	55.1	85.8	154.0	137.0	191.0	15.85	81.50	....
November....	41.13	52.5	87.8	148.0	137.0	194.0	16.45	98.40	....

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

1925..........	158	168	245	188	109	163	108	140	143
1926..........	101	179	189	134	116	138	112	98	139
1927..........	163	207	146	124	132	135	87	154	127
1928..........	145	200	76	134	131	113	95	152	154
1929..........	135	183	189	133	124	117	92	137	137
1930..........	77	128	131	123	93	76	93	98	129
1931..........	46	82	66	83	50	44	73	40	115
1932..........	52	105	55	62	50	43	52	46	102
1933..........	82	130	118	79	81	84	68	57	91
1934..........	100	213	64	91	127	96	111	146	95
1935..........	90	184	85	80	102	94	63	135	119
1936..........	100	236	164	106	163	116	94	148	104
1937..........	68	204	76	89	81	109	74	87	110
1938..........	69	196	80	79	76	64	57	97	88
1939..........	73	154	100	84	88	78	67	94	91
1940..........	80	160	78	97	96	77	64	96	111
1941..........	137	264	116	105	117	107	82	211	129
1942..........	153	369	168	134	143	124	91	202	163
1943..........	160	405	188	235	174	154	125	231	245
1944..........	167	420	214	216	170	160	139	234	212
1945..........	181	366	205	232	198	170	127	227	207
1946..........	263	382	178	248	212	209	141	319	182
1947..........	257	380	232	248	336	259	148	381	226
1948..........	245	482	222	253	201	226	155	298	214
1949..........	231	463	184	244	210	210	139	192	201
December....	214	454	188	230	176	218	144	192	196
1950									
January.....	213	397	195	245	179	217	144	193	261
February....	222	341	191	252	181	218	141	193	203
March.......	226	320	189	253	185	224	139	191	168
April........	232	...	192	260	196	227	140	197	205
May.........	236	485	184	260	209	231	145	200	178
June........	241	497	182	240	212	218	135	205	182
July.........	267	455	182	237	224	225	128	231	200
August......	298	531	175	248	224	223	130	314	164
September...	322	554	151	219	224	219	131	349	126
October......	314	551	123	175	213	216	134	361	138
November....	332	525	126	169	213	219	139	436	188

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per Unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per Unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19
May	3.00	2.05	10.74	11.97	10.14	7.59
June	3.00	1.71	10.55	10.79	9.41	7.36
July	3.00	1.71	11.53	10.71	9.35	8.74
August	3.00	1.71	11.44	11.06	10.62	9.87
September	3.00	1.71	11.44	10.85	10.85	10.32
October	3.00	1.71	11.86	10.63	10.62	10.32
November	3.00	1.68	11.96	10.63	10.85	10.62

Index Numbers (1910-14 = 100)

1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233
May	112	72	307	339	301	216
June	112	60	301	306	279	209
July	112	60	329	303	277	248
August	112	60	327	313	315	280
September	112	60	327	307	322	293
October	112	60	339	301	315	293
November	112	59	342	301	322	302

Wholesale Prices of Phosphates and Potash * *

	Super-phosphate, Balti-more, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200
April	.760	3.76	5.47	.375	.720	14.50	.200
May	.760	3.76	5.47	.375	.720	14.50	.200
June	.760	3.76	5.47	.336	.647	12.77	.176
July	.760	3.76	5.47	.368	.704	13.98	.193
August	.760	3.76	5.47	.368	.704	13.98	.193
September	.760	3.75	5.47	.368	.704	13.98	.193
October	.760	3.73	5.47	.386	.704	13.98	.193
November	.760	3.73	5.47	.386	.732	14.72	.193

Index Numbers (1910-14 = 100)

	Super-phosphate	Florida land pebble	Tennessee phosphate rock	Muriate of potash	Sulphate of potash	Sulphate of potash magnesia	Manure salts
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83
April	142	104	112	68	76	60	83
May	142	104	112	68	76	60	83
June	142	104	112	63	68	53	80
July	142	104	112	67	74	58	82
August	142	104	112	67	74	58	82
September	142	104	112	67	74	58	82
October	142	103	112	70	74	58	82
November	142	103	112	70	77	61	82

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

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949	249	240	226	137	99	319	144	70
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	223	135	96	313	142	72
May	247	244	228	132	91	311	142	72
June	247	245	230	126	85	293	142	66
July	263	247	238	128	85	301	142	70
August	267	248	243	131	85	321	142	70
September	272	252	247	131	85	324	142	70
October	268	253	247	131	85	323	142	73
November	276	255	250	132	85	328	142	74

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

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

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

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

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

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

Fertilizers

"Fertilizer Sales, By Grades 1949-1950 Season," Ala. Dept. of Agr. & Ind., Montgomery, Ala., Sept. 11, 1950.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 361, Apr. 1950, F. W. Quackenbush, O. W. Ford, A. S. Carter, R. Serro, B. Tripp, R. R. Hagelberg, M. F. Bodkin, C. M. Cohee, S. H. Hall, H. C. Kennedy, and F. H. Wilcox.

"Soil Fertility Practices for Cotton Production in the Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 473, May 1950, P. H. Grissom.

"Effects of Fertilizers Upon the Yield, Grade and Marketability of Cabbage," Agr. Exp. Stat., Texas A&M College System, College Station, Tex., P.R. 1255, June 20, 1950, C. C. Burleson, J. S. Morris, P. W. Leeper, W. R. Cowley, and G. Otey.

"Know Your Fertilizers," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 160, Oct. 1950.

Soils

"Physical Land Conditions in the Fredonia Soil Conservation District Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 231, July 1950, M. S. James, R. D. Headley, H. V. Smith, and W. G. Harper.

"Crop Rotation and Fertilization for Soil Improvement," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 497, June 1950, R. P. Bartholomew.

"Does Your Soil Need Lime?" Soils Dept., Ontario Agr. College, Guelph, Ontario, Canada, Bul. 477, June 1950.

"Soil Survey Report of Southeastern New Brunswick," Exp. Farms Serv., Dominion Dept. of Agr. in Co-op. with the New Brunswick Dept. of Agr., 3rd Rpt. of the New Brunswick Soil Survey, Fredericton, N. B., H. Aalund and R. E. Wicklund.

"Soil Survey of Soulanges and Vaudreuil Counties in the Province of Quebec," Exp. Farms Serv., Canada Dept. of Agr. in Co-op. with the Quebec Dept. of Agr. and Macdonald College, McGill Univ., P. Lajoie and P. Stobbe.

"The Morgan Soil Testing System," Agr. Exp. Sta., New Haven, Conn., Bul. 541, May 1950, H. A. Lunt, C. L. W. Swanson, and H. G. M. Jacobson.

"Characteristics of Saline and Alkaline Soils in the Emmett Valley Area, Idaho," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Res. Bul. 17, May 1950, M. Fireman, C. A. Mogen, and G. O. Baker.

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Know Your Soil: VI. Elkton Sandy Loam

By J. B. Hester

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THE recent storm that occurred in the Northeast has emphasized forcefully the importance of soil conditions, particularly in regard to the ability of magnificent trees to withstand heavy wind storms.

The Elkton sandy loam belongs to a group of soils that are imperfectly drained. They are not so poorly drained, however, that short-season crops will not produce satisfactorily on odd dry years. When the rainfall is poorly distributed or concentrated during the harvesting season, crops often fail.

This soil does not belong to the poorly drained soils in which organic matter accumulates and makes the

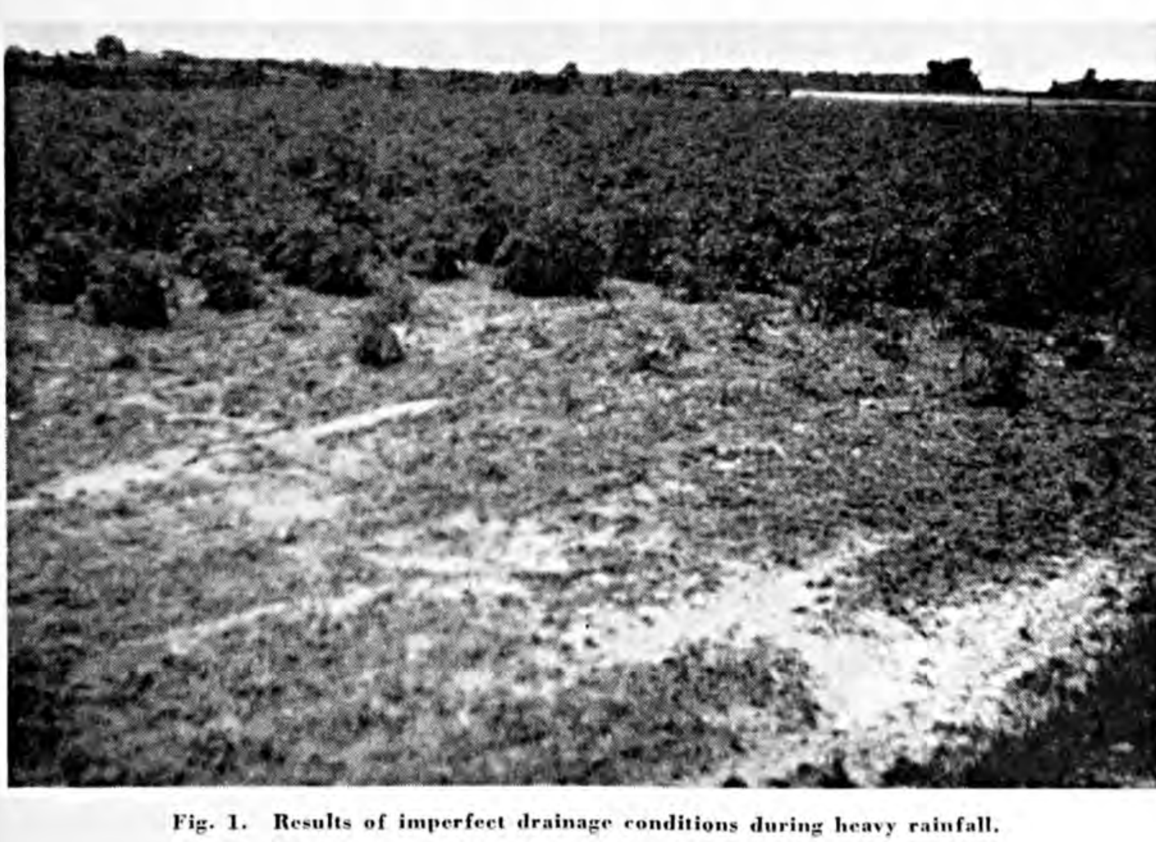

Fig. 1. Results of imperfect drainage conditions during heavy rainfall.

Courtesy E. W. Hobart

Fig. 2. Uprooted tree showing shallow root system developed on imperfectly drained soil.

soil black. It belongs to the group of soils wherein the surface soil is gray to whitish gray in color. Immediately below the surface soil appears a mottled white, light gray, and rustic brown condition. This mottling is indicative of imperfect drainage which results in producing conditions favorable to certain organisms capable of living where free oxygen is limited. This is the reason for the development of the mottled condition.

A typical Elkton sandy loam analyzes pH 4.9, 575 pounds of replaceable calcium, 206 pounds of replaceable magnesium, and 94 pounds of potassium oxide by the ammonium acetate method. It analyzes less than a pound of phosphorus per acre and very high in soluble aluminum, iron, and particularly manganese by the sodium acetate method. The organic matter analyzes 2.1 per cent. These analyses, of course, show the great need for lime; and because of the low calcium content, the soil has a tendency to become compacted and resistant to penetration by water. It is often spoken of as a droughty soil even though it is poorly drained and soggy most of the year.

Figure 1 shows the results of excessive rainfall on the growth of tomatoes on an Elkton sandy loam. Tomatoes and other vegetable crops can withstand poorly drained conditions and excessively hot weather for not more than 24 hours.

The Elkton sandy loam, because of its poor drainage and sub-oxidation condition, has a very strong affinity for phosphates. The phosphates applied to this soil are readily precipitated in the form of ferrous compounds. Work [1] done at the Virginia Truck Experiment Station showed that ferrous phosphate

[1] Hester, J. B., Blume, J. M., and Shelton, F. A. 1937. Rapid chemical tests for Coastal Plain soils. Bul. 95. Va. Truck Exp. Sta.

was practically unavailable to most crops. Because of the fact that the organic matter content is low on this soil and the aerobic decomposition of the organic matter is slow, phosphates are the first limiting factor. In the lower depths of this soil these conditions become increasingly worse. Nitrate formation is very low particularly during the winter and early spring. Even though the soil is well supplied with total potash, the availability is low because of the lack of activity of carbonic acid, nitric acid, etc.

Root penetration of these soils by certain plants is very limited. Therefore, certain trees growing upon these soils have a very shallow root system and when they reach considerable size, drastic wind storms up-root them. Figure 2 shows a typical example of a fine tree which was up-rooted by a storm because of its shallow root system. There are thousands of similar examples in the Northeast. It is very desirable for people landscaping for homes, planning reforestation, parks, etc. to give consideration to the type of soil and to plant the type of trees and plants that are capable of growing satisfactorily on these soils. The use of such trees as the sweet gum for shade trees in landscaping has received almost no attention on these poorly drained soils, yet they do very well on them. The improper use of plantings in landscaping on these soils often results in considerable expense due to property loss when these plantings are uprooted.

Plenty of Moisture . . .

(*From page* 20)

root-clay contacts with greater soil masses of fertility.

The corn crop this season indicated that the surface soil was not deep enough and was insufficiently stocked with fertility, at least with potassium, to balance the good supply of water. The weather was ample but our provision of fertility was not enough to make most use of that good weather.

When the yields as bushels per acre, and the shelling percentages of the present corn crop as a whole are summarized, we shall in all probability conclude that during the season of 1950 there was plenty of soil moisture but not enough soil fertility. We must then confess that we have not made maximum use of the opportunities naturally given us.

Sugar Cane and the Soil

(*From page* 26)

general one recommended by the Agronomy Department of the Agricultural Experiment Station after conducting statistically significant field experiments.

The limiting element in sugar cane fertilization is usually nitrogen. This fact is apparently true for all sugar cane areas of the world. Considering the fact that sugar cane is not grown for fruit or seed, but rather for its plant juices, the high demand for nitrogen is not too surprising. Nitrogen is essential for the production of the succulent meristematic tissue where the synthesis of sucrose from CO_2 and H_2O takes place.

The demand for phosphorus by sugar

cane is not too great, for the synthesis here is one of a growing plant and not of a plant having reached maturity and devoting its energies to the production of fruit or seed. This low phosphorus demand of sugar cane has been noticed many times by the lack of response to phosphorus fertilizers in almost all Puerto Rican soils.

The demand for potassium is next to that of nitrogen. Here again the particular purpose for which sugar cane is grown dictates this demand. The potassium is needed in the synthesis of the sucrose. Although not an actual constituent of sucrose, it is believed by many plant physiologists to be essential in the translocation of plant foods, especially starches and sugars.

Not to be overlooked is that not all of the plant food is being taken away by the harvested sugar cane. Although the cane is removed, the trash and the roots are left behind. The organic material from the sugar cane trash and roots as it undergoes humification and finally mineralization gives a steady, readily available supply of both major and minor plant nutrients. An examination of Table II shows that for every 40 tons of cane harvested, there are returned to the soil by the trash alone about 55 pounds of NH_3, 15 pounds of P_2O_5, and 25 pounds of K_2O. This is equivalent to 500 pounds of a 15:3:5 fertilizer and here the phosphorus is in the organic form and is more available than as superphosphate.

The need of special attention to minor element fertilization for sugar cane has not arisen as yet. There seems to be no noted general demand of this crop nor any marked deficiencies of any minor element. In view of the extensive root system developed and the long period of its growth (one to two years), the lack of response to minor element fertilization is not too surprising. The fine extensive root system mingling intimately with the mineral and colloidal soil particles extracts from the soil body the small but necessary amounts of minor elements needed for satisfactory growth.

In summarizing this brief glimpse at some of the relationships between sugar cane and the soil, the following items are outstanding:

1. Sugar cane does not deplete the soil of its organic matter content if the cane is well fertilized, and all plant residues are returned to the soil. The constant addition of sugar cane trash to the soil has apparently maintained a good equilibrium level with the soil organic matter content in many situations.

2. The incorporation of the sugar cane trash and the sugar cane roots serves to preserve or improve the physical condition of the soil by improving aeration, preventing erosion, and increasing the water-holding capacity.

3. Nitrogen is the largest single element removed by the harvested sugar cane. Nitrogen is also the major limiting factor for yields in sugar cane fertilization.

4. The demand for phosphorus by sugar cane is low. The potassium requirement for cane is above that of phosphorus in Puerto Rican soils.

5. The vigorous root system and length of growing season prevent any readily noticeable minor element deficiencies in sugar cane.

6. The mineralization of the large amounts of organic material contributed by the trash and roots provides a very available form of phosphorus, nitrogen, potassium, and minor elements.

Sugar cane, in return for proper fertilizer application and management will provide a highly remunerative cash crop of sugar, add organic matter to the soil, and help maintain good soil structure. It is no wonder, therefore, that this crop is one of the leading economic crops of the tropics.

* * *

Bootblack: "Shine your shoes, mister?"

Businessman: "No."

Bootblack: "Shine 'em so you can see your face?"

Businessman: "No."

Bootblack: "Don't blame you."

The Southeastern Farmer . . .

(*From page* 24)

fertilizers, grasses and clovers once thought unadaptable now flourish, and combinations of both new and old grasses and legumes are giving many farmers practically year-round grazing.

Strangely enough, most of the progress has been made during the past 10 years. Again using Georgia as an example, the average increase in acre production of the major crops has taken place only recently. The average acre yield of corn for Georgia in 1900 was 10 bushels; in 1925 it was 10.7 bushels; in 1940 only 9.8 bushels; but in 1949 it had increased to 18 bushels. Tobacco had an average yield of 500 pounds per acre in 1900 and 716 pounds in 1925. Fifteen years later, 1940, it had increased to only 761 pounds; but in 1947 it was 1,178 pounds per acre. Peanuts tell the same story. In 1925 the per-acre yield was 475 pounds; in 1940 only 525 pounds; while in 1947, although the acreage was more than doubled during the war years, the average was 695 pounds.

The progress in efficient production that has been made in the past few years is due to several factors. First, the farmer is taking advantage of the findings of research both old and new. These findings have already been reflected in his increased yields of crops, pastures, and livestock.

Second, more attention has been given to soil conservation. The soil conservation program started in 1937 is beginning to show in increased yields. The establishment of terraces and outlets for water control, the planting of soil-improvement crops, and proper land use have to a large measure retarded erosion and added new vigor to the soil.

Fig. 3. A regional grass conference tour on which farmers and others view the results of improved practices.

Third, the increased use of farm machinery has enabled the Southeastern farmer to do a better job. The number of tractors in Georgia has increased from 9,327 in 1940 to approximately 40,000 in 1949. The use of machinery is increasing livestock production. The corn and small grains which formerly were fed to mules are now going into beef cattle, hogs, and dairy cows.

Fourth, the increased yields of crops and pastures have been due in a large measure to the increased use of fertilizer. In 1940, Georgia used 768,000 tons of fertilizer; in 1947 this had increased to 1,000,000 tons; while in 1949 Georgia farmers used 1,200,000 tons of commercial fertilizer.

Fifth, tied in closely with the four factors already listed is the improved economic condition of the farmer. Too often in the past, limited finances have prevented putting into effect improved practices requiring additional capital. With higher income and more liberal credit policies, the farmer has been able to use the findings of research; he has been able to practice soil conservation measures, to buy machinery, and to buy more fertilizer. These investments have enabled him to secure more income through more efficient production.

Thus, the Southeastern farmer is increasing the production on his allotted acres. He is turning what were formerly regarded as "supply" crops into major sources of income, and he is increasing his livestock holdings. The changes made during the past 10 years, significant as they have been, will in all likelihood be dwarfed by those in the next decade.

Erosion Removes Plant Nutrients . . .

(*From page* 19)

ganic matter removed by erosion is greater than the corresponding depletion indicated by analyses of the plot soils; consequently, restoration of the original organic matter level does not compensate for losses of "reserve" organic matter.

It was estimated that erosion removed the organic matter 18 times as fast as did oxidation from a fallow plot on which the greatest erosion occurred, and that to have maintained the organic matter at the original level it would have been necessary to apply as much as 9.2 tons of clover hay annually.

Marked and significant differences in erodibility occurred in New York under a uniform treatment, following treatments which permitted great differences in the rate of erosion (8). The calculated percentages of organic matter in the soil to plow depth were found to have dropped about 0.002 per cent for each ton of soil lost by erosion.

The losses of organic matter caused by erosion in New York vary both in amount and character. They tend to be high in proportion to the total amount of soil and the proportion of fines that are lost (17).

The depth of topsoil has been found to be less important than the selective removal of certain parts of the soil by the raindrop splash process (10). An 11-year study on four soil types at Ithaca, New York, showed that soil was lost at rates varying from a trace to 138 tons per acre. Only 29 per cent of the remaining plow layer passed through a 2-millimeter screen, whereas approximately 95 per cent of the soil that was washed off passed through such a screen.

Studies in Wisconsin showed that a severely eroded soil was not only lower in organic matter and nitrogen, but lost more rainfall by runoff than did less eroded soils (9). Severely eroded Fayette silt loam had only one-third as much organic matter and one-half as much nitrogen as moderately eroded Fayette silt loam. The severely eroded soil, when planted to grain, lost through runoff about twice as much rainfall during the growing season as moderately eroded soil. A severely eroded soil planted to corn allowed 1.3 times as much runoff as moderately eroded soil, and severely eroded soil planted to hay allowed 2.8 times as much runoff as moderately eroded soil.

Under severe erosion, eroded materials tend to approximate the composition of the uneroded soil, and the process in this case is in effect "removal layer by layer" (17). With more moderate runoff there is a selective removal of the finer particles. Small local deposits of sand on the soil surface may be swept off by later rains, but if frequent cultivation constantly presents a fresh surface to the sorting action of raindrop splash and running water, a continued removal of the finer particles may be expected.

Summary

The potential increase in agricultural output resulting from the vast improvements made in the science of crop production in past years has been offset in large measure by the damage to the soil resulting from the action of wind and water in the erosion process. The sifting and sorting action of wind and water separates the organic matter and silt and clay fractions from the soil mass and carries them from the field. The parts lost contain most of the essential plant nutrients and other life-giving substances.

Large quantities of these valuable materials may be removed from a field by the erosion process without entailing a corresponding loss of soil volume from the surface of the land. In extreme cases the soil is removed bodily. These life-giving substances usually constitute the first portion of the soil to be removed by erosion. The removal of the soil and the accompanying organic matter and plant nutrients by either wind or water erosion results in lowering the production potential of the soil.

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Surveying the Results

(*From page 9*)

is whether or not a farmer has silage. Lately, the matter of grass silage has received considerable emphasis because it is believed that for the highest success in the new pasture pattern the first crop, if not pastured, must be cut early for hay. To get this crop off at the proper time often means making grass silage if the weather is bad. Otherwise, if the crop isn't cut on time, the ladino will be shaded out and the second crop will be seriously interfered with; or if it is cut during poor haying weather, it may be partially spoiled during the curing process. Knowledge of these facts has brought a tremendous upsurge in the tonnage of grass silage which is being made on our farms.

It will be noted from Table IV that much more emphasis was placed upon silage by the high and intermediate score groups than by those in the low score group. Actually, the amount of silage available for each animal unit in the two higher scoring groups was twice as great as in the low score group. Furthermore, the average man in the two high scoring groups made about three times as much grass silage as the farmers in the 60-69 score group. This fact alone might account for differences in farmers' scores, since judging is done in mid-July when fields harvested early for grass silage would have second crops that showed up well for midsummer pasture or for second cuttings of hay. If taking off the first crop had been delayed by poor haying weather, second crops on those farms would not look so well. The success of the whole improved pasture program with ladino hinges on getting the first crop harvested early, at a time when its feeding value is at its height, and in time so that a good second crop will be produced.

It is interesting to note that in these groups the men having the highest scores had more silos and made more grass silage. Out of the top group, all but four farmers made silage, whereas in the second and third groups, seven and thirteen farms, respectively, were without silos. In the top group, of those making silage, ten men made corn silage exclusively, four made grass silage exclusively, while six made both corn and grass silage. In the intermediate group, twelve made corn silage, and five made grass silage exclusively, while two made both corn and grass silage. In the low scoring group, ten men made corn silage, three made grass silage, while two men made corn and grass silage. It was in this group that almost half of the men were without silos. This fact alone undoubtedly had a bearing on the grain to milk ratio and upon the returns to the farmer, as further data will show.

All of the farmers in all of the score groups made new seedings, pastured nurse crops, pastured new seedings, used field land for pasture to a greater or lesser degree, and all of them did a good deal of topdressing. Farmers in the top score group did more topdressing after the first crop had been removed than the farmers in the lower score group.

What we really have been trying to determine, aside from differences in practices, is the relation between these practices and the feeding program on the farm, as well as the relationship between grain costs and milk sales, or shall we say, the profitability of the venture.

These factors are portrayed in Table V, which indicates a direct relationship between the score the average farmer received and the amount of grain he fed not only during the pasture season but for the year as a whole. The data indicate that farmers in the top group produced 5.97 pounds of milk for each pound of grain fed during the summer, those in the intermediate group produced 5.62 pounds of milk for each pound of grain, and those in the lower group got but 4.51 pounds of milk for their pound of grain.

For the season as a whole, the differences are not quite so wide as might be expected, averaging 3.97, 3.78, and 3.34 pounds of milk for each pound of grain in the respective groups.

This is the first time that we have tried to find out the differences in the practices and methods among the different score groups in the Green Pastures Program. Naturally, we have been vitally interested in the impact of the program on the feeding practices and particularly upon how profitable such a program is to the farmer. New England is a region in which dairying for the production of market milk is an important enterprise. Very little grain is produced in the area so that it is necessary for each farmer to purchase the concentrates which are necessary to feed to supplement the roughage he grows on his farm. Quality roughage, which includes good pasture and silage and high quality hay, can cut the amount of grain that it is necessary for a farmer to buy. That, apparently, is being done as evidenced by the returns in milk sales for each dollar invested in grain (last line Table V). Farmers in the high scoring group sold $3.86 worth of milk for each dollar spent for grain, those in the intermediate group received but $2.92 for their grain dollar, and those in the low score group got back only $2.58 for each dollar spent for grain. These figures cover the entire year's operation and not just the pasture season alone.

This, then, is the pay-off. Whether a farmer has almost $3 over and above

Courtesy Univ. of N. H. Visual Service

Fig. 3. Examining the quality of hay on the Bodwell farm: Ray Moser, Mass. judge and Guy Angell, N. H. judge.

each dollar he spends for grain ($2.86 for the top group) or whether he has only a little over $1.50 ($1.58 for the low score group) may mean the difference between a highly profitable business or one in which the farmer is just "getting by." It should be remembered, too, that a relatively large group of farmers who enrolled failed to make a "passing grade" of 60 in the Green Pastures Program. Furthermore, large numbers of dairymen for one reason or another did not enroll. We suspect that many farmers did not enroll because they believed their present pasture and roughage practices would not

TABLE V

	Score Groups		
	85–100	70–84	60–69
Av. grain-milk ratio on pasture	1:5.97	1:5.62	1:4.51
Av. grain-milk ratio for year	1:3.97	1:3.78	1:3.34
Ratio of grain costs to milk sales	$1:$3.86	$1:$2.92	$1:$2.58

qualify them for a high score, although this was not true in all cases.

Results obtained by the survey method are often criticized, especially when they are reduced to averages. We do not hesitate to admit that these data are open to criticism on that score. We do believe, however, that the data serve to emphasize a trend toward steps which farmers can take to make their dairy business more profitable. These differences which seem to prevail between the different score groups, such as the greater dependence of the high scoring group upon increased use of fertilizers and upon more ladino clover and alfalfa, appear to be significant. Likewise, the greater use of silage in the top two groups of farms as compared with the low scoring group probably made a difference not only in the score but also in the financial returns these low scoring farmers received.

These are ways in which the Green Pastures Program can be made to have some influence on the dairy business of New England in the future. And, we believe it will result in sounder farm operations if these significant points are followed.

Higher Fertilizer Applications . . .

(*From page* 12)

clover plants will make a strong, vigorous start in the early part of the growing season and thus withstand considerable competition by a rather heavy growth of straw. Isn't it true that on virgin land you can grow straw shoulder high and still your seedings of clover or alfalfa usually come through in good shape? Table III tells the story for nitrogen.

I know that there are a lot of experiment station workers who still think it's dangerous to recommend the use of nitrogen fertilizers. They argue that once a farmer gets a taste of what nitrogen will do, he will forget about the more fundamental approach via the route of abundant legume production. But how many farmers in Wisconsin or any other state have arrived at this long-time objective where every acre of his cropland will produce top yields of corn and grain? Not many, and the smart farmer isn't going to wait from 5 to 10 years to get that "back 40" up to the 100-bushel-per-acre level of production by the long route of lime, phosphate-potash, and

Table III.—Average Yields for 210 Grain Plots (Mostly Oats)—1945, '46, '47, '48, '49, and '50 Where a Comparison Was Made of 0-20-0 with 0-20-20, with and without Ammonium Nitrate. (Ammonium Nitrate Applied as a Top-Dressing at Average Rate of 95 Pounds per Acre After Seeding).

Treatment (average for all plots) (mostly oats, some barley & wheat)*	Yield per acre grain	Yield per acre straw	Bushels increase grain	Pounds increase straw	Value of increase grain & straw	Cost of fertilizer	Net profit per acre
340# of 0-20-0	54.2 bu.	2321#	8.4	316	$7.67	$5.44	$2.23
340# of 0-20-0+95# am. nitrate	63.1	2899	17.3	894	16.52	9.16	7.36
340# 0-20-20	57.5	2519	8.7	514	8.50	9.34	−.84
340# 0-20-20+95# am. nitrate	66.9	3192	21.1	1187	20.44	13.06	7.38
No fertilizer	45.8	2005	....	....	....	....	....

* Grain figured at average value of 80 cents per bushel; straw at $6.00 per ton.

legumes. Rather he is going to take a short cut to high yields by applying some nitrogen fertilizer on his grain, corn, grass hays and pasture.

I'm not worried at all that our farmers will "sell out" to a program of nitrogen only. The dairy farmer will continue to grow legumes as his chief source of protein feed—and in the wake of bigger crops of alfalfa, clover, and ladino will come better crops of corn, small grain, and truck crops.

A Toast to the Holidays

(*From page* 5)

improvements nil. But they have the radio and the picture show, the telephone and the motor car, electricity and fancy tax bills. A returning native couldn't startle them much, even if he had been on a government mission to Mars. No, to get a real picture of the privations and simplicities of 1900, you'd have to go back and roust out some of the men who bossed our community in the days of William McKinley and Tama Jim Wilson. You might have a real time finding them, but if you drank the right article frequently, dreams of other years and other leaders would briefly return for your holiday edification. Never mind the headache later on.

Well, let's be off. When the "fast mail" drew into the seedy old station built in civil war days, I'd grab my bag and hunt hard for a taxi. All I could see in the blizzard would be a row of hotel hacks ruefully waiting to catch some unlucky holiday wayfarer doomed to spend Christmas away from his family. So I'd have to walk or else seek the dubious comfort of the village hotel until Dad got into town with the horse and cutter.

No matter how long I'd sit there in the queer old lobby, with its big walnut archways and huge desk where you signed up on a whirling register, Dad wouldn't come while the drifts piled up along the narrow, rutted roads. I'd have to stay there and partake of a solitary meal in the cold, gas-lit dining room, with nary a happy drummer to keep me company in the holidays. I couldn't even telephone out home to say hello and best wishes, it being the whoop and holler days.

Maybe next morning—Christmas day and a white one—Dad would finally hove into sight coming down the lumpy street, the bells on the cutter shafts tinkling cheerily under the patient motion of shaggy old Pike, the white gelding I learned to cultivate with. I'd wrap up snug in the old buffalo robe and take that hour's slow jingle-bell journey through alabaster fields of unbroken extent. At last the smoke signals and the familiar roofs would tell us we had arrived at the paternal home haven. Isolated yet majestic, remote but ever remembered.

There every task would be done by hard handwork. Mother's big kitchen would smell of all the tasty recipes she knew so well that we loved and enjoyed. She would come to meet us smoothing her hair and fumbling at her apron strings. She would apologize about being behind in her preparations, owing to her helping a young neighbor lady birth a boy. Doc Kellogg, you see, was unable to play the stork because no word could be sent to him in such a heavy storm, and anyhow the roads were blocked for miles.

After we thawed the pump and fetched in enough water, Dad and I would struggle through the snow to the barn to feed the stock, chuck down the hay, and toss out the accumulated manure. It would be dark by late afternoon, so that lanterns would be used in the stable to help us grope around and back in the house Mother would clean and refill the kerosene lamps so she could see to wash the dishes with water heated on the range.

During this session with daily tasks I wouldn't dare remark about all the electric gadgets and handy phones we had at our place, or the radio we could turn on—or off—or about television showing us how the President looked or how Santa Claus hitched up his reindeer. All we could do in the evening would be to read Dickens' famous Scrooge story again under the hanging lamp that drew down on a chain close to Dad's easy chair. Then we'd stop to recall old holidays with those who'd never spend them with us again. Finally we'd throw some more bucksawed oak chunks through the heater door, sweep up the bark and chips on the zinc, and get ready for repose in a clean but clammy bed in those chilly upstairs quarters.

TO while away the hours in the community, some conversation would be necessary. Maybe you'd be interested in organizations. So you'd just ask Dad how the Grange was getting along. He'd reply that they were just keeping alive and that's all and that some of the members were shouting for a state cooperative law and urging the Grange to stir up a ruckus about new farm marketing associations. The neighboring farmers would drop in and say that agriculture was getting the short end. What really happens in the dark, with middlemen's margins growing? There would be signs of unrest.

Downtown the blacksmith, the tinker, the depot agent, and the drayman would all be discussing the growth of these here new labor unions. They'd heard tell about their doings and all they promised to do with wages and shorter working hours—a kind of continuous Christmas. But they'd be danged about joining yet, because the dues were too stiff.

Many farmers would jump the government for neglecting agriculture. All the attention the ruralites got, they'd argue, was to get post-office packages of free seeds and envelopes with circulars on cattle ticks and bovine tuberculosis. Why should a stockman fuss about normal losses anyhow? Science wouldn't work well on a farm. What we need are ways to make more net income and get ahead with less hard work and debt, they'd exclaim. Experts from the state, snooping around our barns and privies, are of no blasted value to farming, they'd conclude.

Would it be sensible and diplomatic for me to break in right there and carefully inform and instruct these backward farmers about the power and the prestige of so many organizations you couldn't even keep track of them? Could I tell them about the influence on state and federal affairs held by strong farm organizations, some in rival camps? How could I begin to explain about the large-scale processing and marketing co-ops that dominate many regions and numerous commodities? How describe to them the widespread labor union setup, reaching down to the hired man and the truck driver? Would they believe that elections and laws would easily be decided by the membership in these organizations, reached daily by movies, by radio, and by television?

Going further, pray in what way could I go into the devious and complex sections and amendments to the domestic allotment and price-support law for agriculture? How could I keep a straight face or risk a fight in trying to tell these incredulous folks about the taxpayers' losses with potatoes, powdered eggs, and butter? How to introduce them to government crop insurance, or guaranteed loans to build grain bins? I'd rate as a fancy dan with need of more steam in the cylinders and less in the exhaust.

Verily, saith the preacher, these long years have brought us some innovations which are not simple to justify or defend before a practical jury as unbiased and open-minded as those farmers at the turn of the century would be—if they'd listen without thinking me insane. Such mixed blessings of the present era would be balanced off, of course, by a multitude of changes and improvements that make for better thinking, better farming, and better living. As it is with all of life's destiny, you take the good with the bad—and when you simmer it down you'll usually find the former more frequent than the latter, in America anyhow.

WELL, it's a "fur piece" to go, back there in memory to the holidays with their holly ways. As I get along myself in the scroll of experience, I find it harder to visualize all that we underwent and undertook, which made each year's Christmas eventful and meaningful. We did not have to halt and pause in preparations to listen for the crash of a possible bomb laid on the necks of homebodies, or scan each newspaper with dread of some new and entangling alliance or face-saving necessity. The sad part of our reactions these days lies in the fact that all this open-handed generosity and good will we have exhibited seems to have come home to roost as buzzards, not doves.

We honestly wanted to see the doves again. We had not a single hanker for the company of buzzards. That was not what we settled for with the foreign world we are trying to understand and "brother with." We'd rather spend our Christmas pin-money for useful and helpful gifts, instead of having it frittered away for shooting irons.

But it's not our fault and not your fault that we must divide our Christmas devotions with thoughts of alarm and dismay. If peace on earth and good will towards all men must be purchased with the sorrow and loss of three generations since the turn of the century, its ultimate attainment will be worth the suffering, the pain, and the glory.

And now, once more, the bells, the toys, and the prayers—dreams of a world as serene as the world of long ago. For all this we have come far to seek, and with God's help, we shall find it.

Young Hubby (helping arrange new furniture): "There, that twin bed looks fine over in the corner. Now I'll see if I can get one of the neighbors to help me put the other one where I want it."

Young Wife: "Why, where do you want it, dear?"

Hubby: "In the attic."

* * *

We like a party on New Year's Eve
Which has an informal tone;
A merry group of our warmest friends
At any house but our own.

* * *

Said a teacher in South Dakota: "I wonder if any of you children have Indian blood?" "I have," answered little Johnny. "That's very interesting," said the teacher, "What tribe?" "Oh," answered Johnny, "it wasn't exactly a tribe, just a wandering Indian."

* * *

Two old maids went for a tramp in the woods. The tramp escaped.

* * *

A farmer's barn was burned down and the agent for the insurance company told him that his firm would build another exactly like the one destroyed instead of paying the claim in cash.

The farmer was furious. "If that's the way you do business," he roared, "you can cancel the insurance on my wife!"

"Yes sir," he said, "the morning glories are so bad in that south corn field of mine that I can take hold of one corner and shake the whole field."

* * *

The waitress watched as the customer put eight spoonfuls of sugar in his cup of coffee and proceeded to drink it without stirring it first.

"Why don't you stir it?" she asked.

The customer regarded her coldly and said, "Who likes it sweet?"

* * *

A man was perched atop one of Atlanta's highest buildings, contemplating suicide, and a policeman had made his way to the roof to try and persuade the man not to jump. "Think of your mother and father," pleaded the officer.

"Haven't any."

"Think of your wife and children."

"Haven't any."

"Well, think of what your girl friend might think."

"I hate women."

"All right, think of Robert E. Lee."

"Who's he?"

"Go ahead and jump, you damn Yankee!"

* * *

Physician: "Lady, if you want a health examination you'll have to remove your blouse."

Kitty: "Oh, no, doctor!"

Physician: "Come, come! Don't make mountains out of mole hills."