Better Crops

WITH PLANT FOOD

November-December, 1959

20 Cents

IT'S A QUESTION OF BALANCE

BALANCED NUTRIENTS IN THE SOIL WHERE YOUR CROP CAN GET THEM AND USE THEM WHEN IT NEEDS THEM TO PRODUCE A SUCCESSFUL GROWTH.

SEE PAGE 3

Better Crops WITH PLANT FOOD

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The Whole Truth—Not Selected Truth

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ON THE COVER

. . . A mere 30 pounds of potash per acre applied to the corn on the left made the difference —40 more bushels per acre.

SEE PAGE 3 FOR DETAILS

We come at last to . . .

OUR CIVIL WAR CENTURY

AS WE come to the full century mark since the Civil War, we are becoming well organized to "pick up the milestones and carry them with us" in the words of a studious historian of that theme in American life.

We have many state observance commissions at work, as well as patriotic societies and the newer Civil War Roundtables.

It was a privilege to hear Adlai Stevenson of Illinois address a Midwest civil war roundtable recently. His theme was the career of his great grandfather, Jesse W. Fell. Fell, a Penn State Quaker, was a Bloomington, Illinois, pioneer, lawyer, builder, town-site developer, editor, and personal friend of both Abraham Lincoln and Senator Stephen A. Douglas. He also founded the farm-minded newspaper at Bloomington, *The Pantograph,* now owned by Stevenson.

Some of you may not have heard of these 68 Civil War Roundtables that represent both North and South in planning special observances of 1860-65. To catch this interest and perhaps get recruits for this nonpartisan, non-sectional educational and social movement, I am happy to present this brief background.

On December 3, 1940, there met at Chicago's Bismarck Hotel a group of browsers at Ralph J. Newman's famed Abraham Lincoln bookstore. They heard P. G. Hart's story of the Valley Campaigns of Stonewall Jackson. Four years later this group incorporated and the first Chicago Civil War Roundtable was born. Shortly, a similar group of "buffs" formally organized at Birmingham, Alabama, led by M. F. McGowan and Rucker Agee, as the Confederate Roundtable. In succession through 1950, these knights of the nightly roundtables set themselves up in business at Milwaukee, Atlanta, New York City, Washington, D. C., and Douglas, Arizona.

Dues vary from $2 to $15 a year and there are known to be at least 68 local roundtables hearing talks, scanning maps, delving in libraries, and touring battlefields—when convenient. By 1959 there were 6,000 active partakers of the evening arguments and dissertations, including appetizing solid and liquid fellowship.

Today's Civil War Roundtables meet regularly—usually once a month —in this country, Canada, England, and Wiesbaden, Germany. The one at Southampton, England, is called the Confederate Research Club, now sending out an expedition to locate the Confederate raider, *Alabama,* sunk off the French coast in 1865. The German roundtable was formed by our military personnel and includes a baron who was a lancer and then a plane pilot in World War I and II.

Aware of the prevailing comradeship and good humor at these sessions, Gov. Gaylord Nelson of Wisconsin (whose grandfather was in the Civil War) speaking in the same session with Stevenson, poked fun at the rivalries of the Republicans and Democrats. He cited a speech by an ancient leader of local Democrats at their victory rally up state awhile ago.

"Let us all rejoice and close ranks together for progress," he shouted. "Let's forget the tricks and lies of the Republicans. They had us going for awhile, but with God's help we beat them at their own game of deceit and perfidy."

Gov. Stevenson said that his grandfather, Vice President Adlai Stevenson, was a good friend of Jesse Fell. Fell at age 24 came on foot most of the journey from his eastern home to the raw towns of Danville, Springfield, and Bloomington. He taught school briefly and then set up the first law shop at Bloomington, in McLean County. Subsequently he surveyed and established several city sites in central Illinois, and at one time he owned 25,000 acres in Iowa, 160 acres in the city of Chicago, and over 300 acres where Milwaukee lies.

On advice of those who saw no future in a swamp, Fell let go of his Chicago real estate, which is described in the present plat as "Fell's addition to Canal port." Later Fell helped organize the Chicago & Alton and the Nickel Plate railways. He also led in the establishment of the first teachers' college in the West, located at Normal, Illinois.

Stevenson said that Jesse Fell first suggested having Lincoln and Douglas debate the Kansas-Nebraska Act and squatter sovereignty. Yet when they finally started their debates, Fell was not present. He was out scouting for Republican sentiment and sensing the voters in four states.

According to Stevenson, President Lincoln often told Fell how disgusted he was with the incessant mobs of job hunters. They squatted and leaned around all the corridors of the White House. On a certain day especially thick with "moochers" Lincoln fell ill. When the doctor hastily diagnosed the feverish condition as the onset of small-pox, Lincoln rousted up his long form and pointed at the door:

"Doc, open that door at once. Let 'em all to come right in. I've got something now I can give to everybody!"

The only arguments worth a spot on any roundtable program are those that squabble about the rival claims of Civil War generals and the true value of their strategy. There are never any political lectures or fusses about the "right and wrong" of cabinets or presidents and the justice and merit of long-gone issues. Personalities are discussed and the marches and maneuvers recounted. Once we had a national park authority on the rostrum. He was one of the best prepared authorities we ever had.

Listening to a brace of good speakers on the War Between the States has been enjoyable to me as the son of a federal soldier. Only a handful of the CWR membership knew any of the "fellows who fit" with the Blue and the Gray. So it is pleasant to relax there behind the remnants of a gorgeous steak and hear old familiar names of men and memories that I learned to venerate at G A R campfires 60 years ago.

I often wish it were possible to have my father and my uncle present to see with what zest these younger fellows trace the trails of sanguine strife.

No other group (outside of academic seminars) provides these warm and penetrating discussions that give us new faith in the future built on our fire-tried past.

THE END

On the Cover . . .

. . . the contrast in growth and potential yield is obvious. A mere 30 lbs. of potash per acre applied to the corn on the left made the difference—40 more bushels per acre. Such response in itself should not be startling. The fact that it took a combination of phosphate and potash—or *balance*—for the highest yield should not startle anyone.

What startles a farmer is to have his yield jump up 40 bushels after he applies only 30 lbs. of one or more elements he didn't think he needed in the first place. On any soil of low fertility, the response to fertilizer can be tremendous. The response shown on the cover could have been predicted from soil test results and would have surprised no one. Although this is an Iowa State University experiment in Northeast Iowa, soil test summaries indicate very similar conditions exist on many farms of Northeast Iowa.

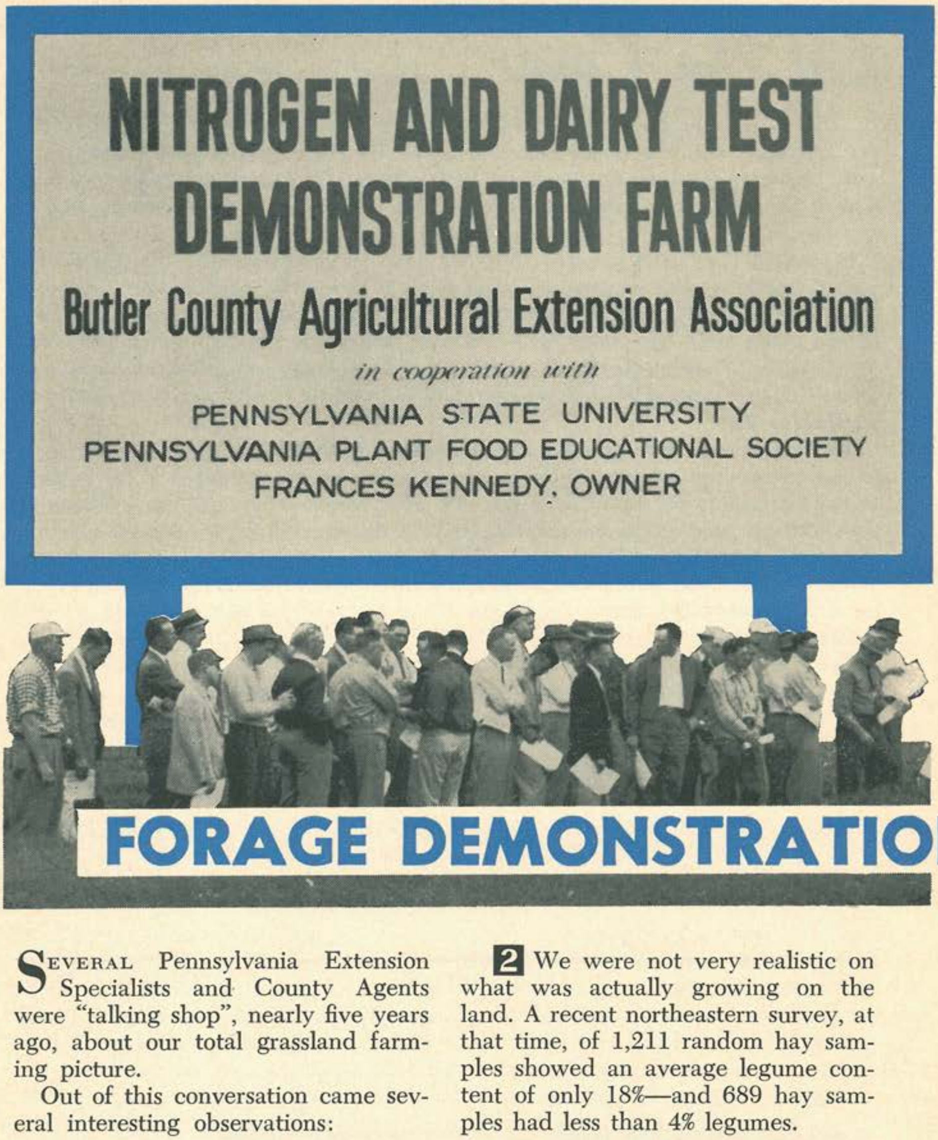
We hear much of the need for a "balanced" fertilizer—an easy, pleasant term to use. But when thinking of balance, we should not forget that it is the balance of the *nutrients in the soil* that counts. To grow a successful crop, you must adjust your fertilizer applications to meet the needs of the soil. For it is from the soil that the crop is fed. One of the best ways to determine the soil's needs is the soil test. When you have this information, and apply the recommended fertilizer, you should be no more surprised at the results than you are over the fact that birth usually follows pregnancy.

The cover picture was taken by Dr. Lloyd Dumenil, of Iowa State University. It shows work done in N.E. Iowa by H. R. Meldrum, also of the University. The soil is a Clyde silty clay loam testing low-medium in phosphorus and very low in potassium. The plots are in a rotation, corn-oats-meadow, with combinations of treatments of 0, 15, and 30 pounds of P_2O_5 and K_2O per acre applied near the hill at planting. The treatments and yields are as follows:

(*George Wickstrom*)

	APPLIED TO CORN		CORN YIELDS - BU/A	
	N P_2O_5 K_2O		1956	AV.-1950-53-56
1.	0 + 0 + 0		44.3	35.8
2.	0 + 0 + 15		73.4	55.3
3.	0 + 0 + 30		78.5	60.3
4.*	0 + 15 + 0	APPROX.	45.4	38.0
5.	0 + 15 + 15	40 Bu.	75.6	61.4
6.*	0 + 15 + 30	INCREASE	85.0	67.9
7.	0 + 30 + 0		40.0	31.4
8.	0 + 30 + 15		78.8	61.3
9.	0 + 30 + 30		86.4	70.6

*TREATMENTS COMPARED IN THE COVER PICTURE



FORAGE DEMONSTRATION

SEVERAL Pennsylvania Extension Specialists and County Agents were "talking shop", nearly five years ago, about our total grassland farming picture.

Out of this conversation came several interesting observations:

1 We had probably spent about 90% of our research and farmer education time on legumes and legume-grass mixtures.

2 We were not very realistic on what was actually growing on the land. A recent northeastern survey, at that time, of 1,211 random hay samples showed an average legume content of only 18%—and 689 hay samples had less than 4% legumes.

3 We had done a fairly good job of educating farmers toward more and better legumes. From 1950 to 1958 our acreage of alfalfa in Pennsylvania

SHOWING . . .

***How* there was no question of which was better—legumes or grass. Legumes are preferable under conditions suitable to legumes. But under conditions not suited for legumes, grass can help supplement a forage program.**

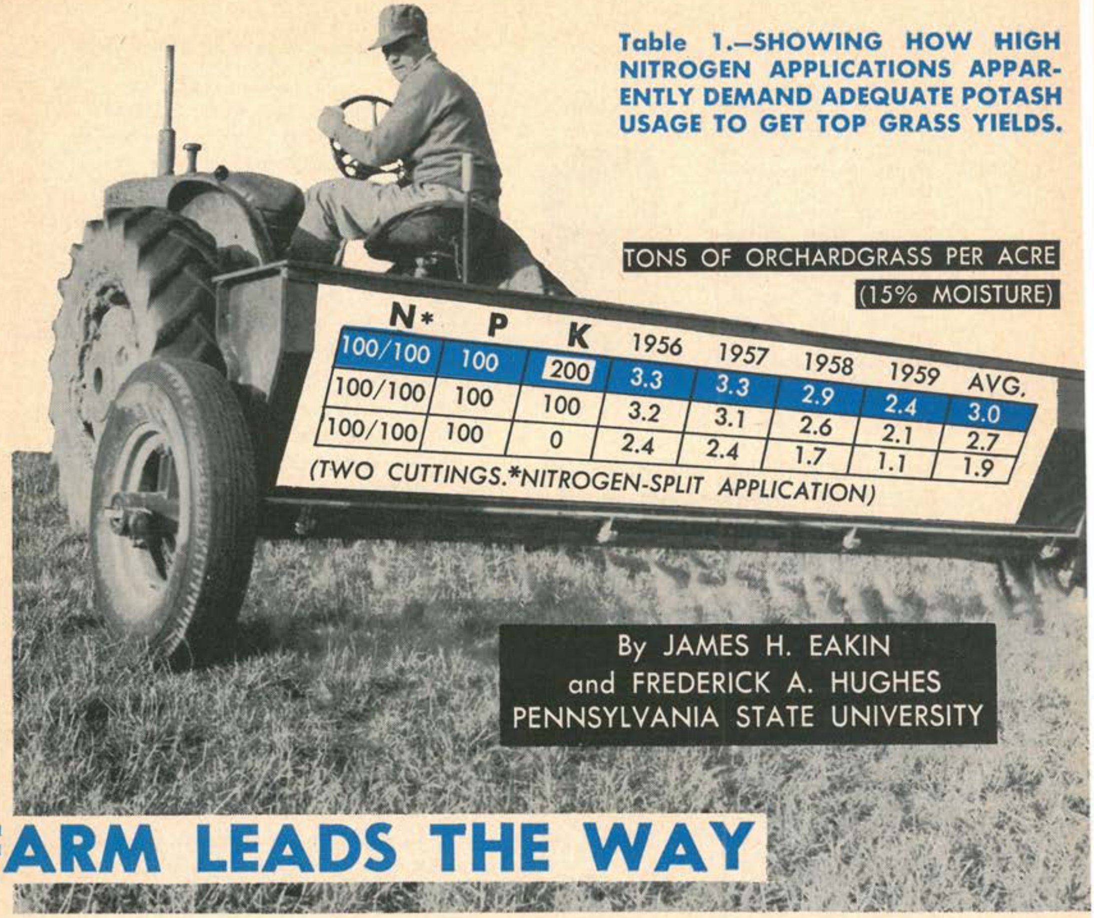


Table 1.—SHOWING HOW HIGH NITROGEN APPLICATIONS APPARENTLY DEMAND ADEQUATE POTASH USAGE TO GET TOP GRASS YIELDS.

TONS OF ORCHARDGRASS PER ACRE (15% MOISTURE)

N*	P	K	1956	1957	1958	1959	AVG.
100/100	100	200	3.3	3.3	2.9	2.4	3.0
100/100	100	100	3.2	3.1	2.6	2.1	2.7
100/100	100	0	2.4	2.4	1.7	1.1	1.9

(TWO CUTTINGS.*NITROGEN-SPLIT APPLICATION)

By JAMES H. EAKIN
and FREDERICK A. HUGHES
PENNSYLVANIA STATE UNIVERSITY

FARM LEADS THE WAY

increased from *339,000* to *865,000* acres. But many farmers were still doing a poor job of managing their legumes—and a decidedly poorer job managing their legume-shy grass fields.

4 In the entire northern and western sections of the state, grass-hay and pasture fields were the rule, not the exception.

5 How much did we know about well managed straight grass fields? Could farmers economically produce milk and meat from grass?

There was no question of which was better—legumes or grass. We needed more legumes. But we also had tens of thousands of acres of legume-shy grass fields out on the farm. When and where possible under conditions suitable to

How high nitrogen usage can soon cause a potash shortage on grass pastures.

How grain ration cost was reduced nearly $18 per ton—saving about $28 per cow—due to the increased nutrient quality of fertilized forage.

James H. Eakin is Professor of Agronomy Extension and head of soil testing at Pennsylvania State University. Chairman of the Extension Service Plant Sciences Division for Program Development, Eakin earned both his B.S. and M.S. at Ohio State. His work at Penn State on birdsfoot trefoil and soil testing methods is well known.

legumes, legumes are preferable. But under conditions not suited to legumes, grass can help supplement a forage program.

With these observations, we went in search of a typical Pennsylvania farm on which to study this problem. We needed a farmer who would be willing to plow down any legumes in order to have grass in every hay and pasture field on his farm.

We contacted H. R. McDougall (1957 National County Agent President) in Butler County located in Western Pennsylvania. He talked to Francis Kennedy who owned two adjacent 90-acre farms near Butler. When Mr. Kennedy said he was willing to try it, we offered to work with him on all phases of his operation, including Agronomy, Farm Management, Dairy, and Agricultural Engineering.

The Pennsylvania Plant Food Educational Society, becoming interested in the project, offered to donate the nitrogen needed for such a demonstration. Kennedy agreed to bear all lime, phosphorus, potash, and other costs.

The following procedure was then initiated:

1 First data was obtained to determine Mr. Kennedy's exact status as to farm organization, including number of livestock, acres of crops, amount of labor, amount of machinery, building facilities, and his crop and livestock production. We needed this information to measure changes in his economic status as the program progressed.

2 Complete soil tests were taken on all fields with lime, phosphorus, and potash applied as recommended by Agronomy Extension Specialists.

3 The best locally adapted grasses were used—such as Lincoln and Saratoga Bromegrass, common Orchardgrass, as well as the new Pennlate variety and Reed Canarygrass. Several timothy and bluegrass fields were left undisturbed.

4 Forage samples, both fresh and stored as hay or silage, were taken on all fields. These were tested at the Penn State Forage Analysis Laboratory by our Animal Nutrition Department. Hay, silage, and grain were fed according to the quality and quantity of forage.

5 Dairy herd health was followed

SHOWING . . .

How the average farmer can produce milk economically on an all-grass program as far as production and potential feed quality is concerned.

closely by Extension Dairy Specialists. Fecal samples were taken at regular intervals for checking parasites. Mastitis prevention was carried out.

6 Extension Agricultural Engineers consulted with Mr. Kennedy on how best to harvest and store the astounding grass yields he eventually produced.

7 Complete Farm Account records have been kept under supervision of Farm Management Extension.

8 Only the 90 acres of farmland near the main building was included in the program.

LIME AND FERTILIZER APPLICATIONS

Lime, Phosphorus, and Potash

Lime was applied according to soil test. Most fields needed an average of two tons limestone per acre to reach a pH value of 6.5 to 7.0.

Phosphorus applications have ranged from 60 to 80 lbs. per acre of P_2O_5 each year. Although potash applications have ranged from 80 to 120 lbs. per acre each year, potash deficiency is still showing up—even though practically all fields in the program receive 10 to 12 tons per acre of manure.

Observations of the potash problem on this farm are similar to research being conducted in other parts of Pennsylvania. High nitrogen usage seems to drain potash reserves rapidly.

Frederick A. Hughes is Associate Professor of Farm Management Extension at Penn State. He earned both his B.S. and M.S. there, managed a 300-acre dairy-hog farm in Chester County, Penn., before joining the Ohio State Farm Management staff. He has been on the Penn State Farm Management staff for 5 years.

For example, in his work on grass fertilization, using nitrogen as a production stimulus, Dr. Lawrence Marriott has illustrated how *high nitrogen applications soon cause a potash shortage.* Table 1 shows this.

Nitrogen

Ammonium Nitrate, Ammonium Sulfate, Anhydrous Ammonia, and Urea were used as nitrogen carriers. *In no case have we been able to determine if one carrier was any better than another.*

Both Urea and Ammonium Sulfate were applied in mid-November and compared against spring applications. Spring applications produced about 500 lbs. of 15% moisture forage per acre *more* than the late fall applications.

The standard application was 100 lbs. per acre of actual or elemental nitrogen with some fields receiving another 50 lbs. after the first crop was cut or pastured. A few areas received up to 300 lbs. of nitrogen,

How total digestible nutrient production (TDN) on 90 acres increased from 195,000 pounds to 385,000 pounds after following soil test findings plus 100 pounds nitrogen on forage crops.

How the cow-carrying capacity of 90 acres increased from 25 cows to 49 cows *after fertilization.*

but this was used mainly to promote a harvesting problem for study.

All fields received lime, phosphorus, potash, and manure according to soil test. However, a no-nitrogen check plot ran the length of each field. Yield increases for the added nitrogen were computed from this check plot. Table II shows how nitrogen stimulated production over and above the manure, phosphorus, and potash applications.

Table II—Average Hay Equivalent Yields, Francis Kennedy Farm, 1958

	lbs. Hay per acre (15% Moisture)
No Nitrogen	3,878
100 lbs. Nitrogen	8,146
Average Increase	4,502

(Based on two cuttings, many fields were cut three times.)

FEED QUALITY

The yield increases meant little without emphasis on quality. The farmer's net return from fertilization of forage crops depends greatly on the quality of his forage. And *date of cutting, weather, method of storage* are all factors influencing quality. In 1958, there were definite problems on the Kennedy farm which helped illustrate problems all farmers have.

DATE OF CUTTING

Harvesting operations began on May 15, with the forage testing 69.6 per cent TDN. By June 24, when the last of the first crop was harvested the average TDN content had dropped to 52.5 per cent. Valuing TDN at 2.5¢ per lb., this is a drop of about $10 per ton in value of forage. The early-cut material would produce about 500 lbs. more milk per ton than the late-cut forage, in addition to maintaining a cow's body weight.

Forage quality on the Kennedy farm did not drop seriously until early June. This indicates that grass forage should be harvested by June 5 to 10 in this particular area. This experience also indicates that *early cutting* is one of the most important and significant phases of a sound nitrogen-grass program.

HARVESTING MANAGEMENT

One reason for starting the Butler County project was to determine if the average farmer could produce milk economically on an all-grass program, as hay, pasture, grass silage, and green feed. It appears to us that he can as far as production and potential feed quality is concerned.

This is a high-powered program which requires intensive management. Would Kennedy be able to stay on top of it, or would he be buried under a mountain of grass?

In 1958, he was buried due to his inability to maintain a close harvesting schedule. The heavy yields were difficult to mow. The machinery problem became acute. At this time the Agricultural Engineers took over and slowly this problem is being ironed out in cooperation with a host of farm machinery companies.

In 1959 the problem was not solved, but Kennedy did maintain his harvesting schedule. In spite of harvesting problems, the average total digestible

SHOWING . . .

How milk production increased 2,440 pounds of milk per acre after fertilization.

nutrient content of forage on the Kennedy farm will average about 60 per cent in 1959 compared to 55 per cent in 1958 and 51 per cent in 1957.

Here is what we have learned about harvesting highly fertilized grasses:

1 Cut early to stay ahead of the problem.

2 Adjust the mower to a high degree of performance.

3 Do not let the tractor wheel or inside guard of the mower run over uncut grass. Leave an unfertilized strip through the middle of the field for the tractor wheels to run on when first opening the field for mowing.

4 Perform a clean-up mowing operation after the forage has been harvested. This will eliminate uncut mummified grass clumps and reduce stops at the next mowing.

5 Develop good driving habits. Don't make fast hair-pin turns when mowing. After mowing the length of a field, raise the cutter bar to clean it, back up and make a square turn.

6 When possible, have a salvage machine on hand for fields that cannot be cut with a conventional mowing machine. A flail type forage harvester is an excellent machine. Rotary bladed mowers can be used in an emergency.

FORAGE UTILIZATION

The end product of any fertilization program is the income received. The increased forage yields from a fertilization program must be converted to milk on a dairy farm. The maximum dollars received depend on (1) the quality of the forage, (2) the production level of the cow. Mr. Kennedy has been emphasizing both of these in his farming program.

In two years, the milk production per cow has *increased by 2,460 lbs.* Much of this increase is due to improved forage quality increasing the nutrient intake by the cows. The analysis of the forage by the Pennsylvania State University Forage Testing Laboratory has made it possible to reduce the cost of the grain ration by about $18 per ton or an *approximate saving of $28 per cow.*

In addition to nutrient intake, an important factor is the per cent of feed nutrients converted to milk by cows at different production levels. An 8,000 lb. producing cow will only use 42 per cent of her nutrients for milk production as compared to 53 per cent for a 12,000 lb. producer. Mr. Kennedy had a production level of 8,900 lbs. of milk in 1957. His production for the present testing year will be about 12,000 lbs. per cow.

ADJUSTMENTS NEEDED

Mr. Kennedy has done an excellent job of producing forage, improving forage quality, and increasing milk production per cow. These are the things most dairy farmers should concentrate on first. However, there are further steps to be taken on the Kennedy farm.

It was mentioned previously that Mr. Kennedy owned two farms with

How milk production per cow increased 2,460 pounds, due greatly to improved forage quality increasing nutrient intake by the cows.

How date of cutting, weather, and method of storage all influence the quality of the forage.

Table III—TDN (total digestible nutrient) Production, Number of Cows and Milk Production Per Acre on 90 Acres of Cropland. Butler County, Pennsylvania, 1958*

	Without Nitrogen**	With Nitrogen**
TDN Production	195,400 lbs.	384,940 lbs.
Cow Numbers per farm	25	49
Milk Production per acre	3550	5990

* TDN was calculated on basis of 55 per cent for forages and 72 per cent for grains.
** Milk production was based on 11,000 lbs. per cow. Lime, phosphorus, and potash applied according to complete soil analysis.

90 acres of tillable land in each farm. Only the farm nearest the main buildings was included in the program. A few acres of corn and oats were grown in addition to the grass varieties mentioned previously.

The total digestible nutrient production on the 90 acres in the program before the fertilization recommendations were started would have been approximately 195,000 lbs. as shown in Table III. The total digestible nutrient production on this same acreage after following soil test recommendations plus the 100 lbs. nitrogen application on forage crops was approximately 385,000 lbs.

The livestock-carrying capacity on this 90 acres before fertilization was approximately 25 animal units compared to 49 animal units *after fertilization.* This increase in animal units would result in an increase of 2440 lbs. of milk per acre.

If Mr. Kennedy is to realize the greatest return from his fertilizer program, he will have to increase cow numbers to utilize his extra production. There is not a good market for excess forage in Western Pennsylvania.

This will require remodeling his present barn. It will also require adjustments in his present labor pattern. It is possible a son may come into this business in the future, since there seem to be definite possibilities for a 2-man income.

Further expansion is possible on the 90 acres in the second farm that has not been fertilized according to soil test recommendations. For the present, this farm is being used to produce feed for young stock. It is doubtful that this farm will remain at its present low production level.

The records indicate that Mr. Kennedy has been losing money on this 90 acres because of low yields and high machine costs. It would be better to farm only half this acreage and get good yields. The balance could be farmed when more feed becomes necessary.

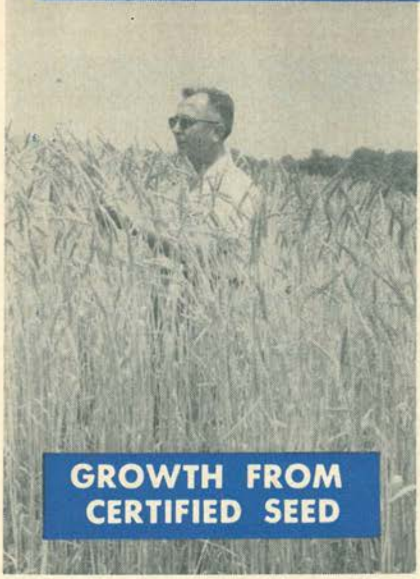
IN SUMMARY

We think there is real promise for many farmers unable to hold legumes to improve their income with a sound fertilizer program on grasses.

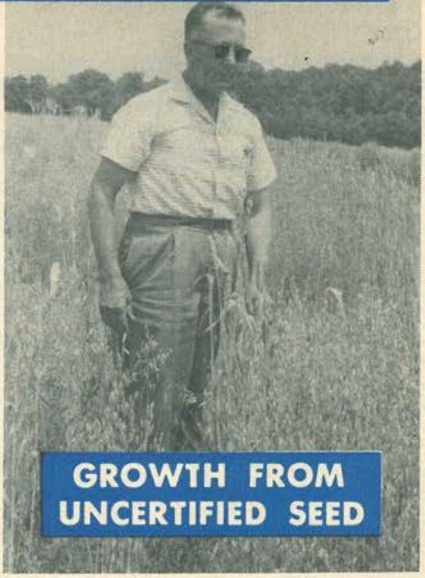
We also feel that any person or agency working with farmers cannot emphasize just fertilization. The harvesting and utilization must go hand in hand with the production of the grasses, *and records are a must to determine future adjustments.*

THE END

DON'T LET IMPROPER SEED LIMIT YOUR PROFITS



Before planting, this seed had been cleaned, treated, and checked for purity and germination.



Before planting, this seed mixed with other crop was not cleaned, not treated, and not tested for purity or germination.

GOOD SEED PAYS HANDSOME DIVIDENDS

Like . . .

4.2 More Bushels of Wheat Per Acre
6.5 More Bushels of Oats
4.1 Bushels Barley

By Robert Garrison **Clemson College**

FARMERS, agricultural workers, and seedsmen should give a lot of thought to the type of small grain seed being planted, for *good* seed does not cost—*it pays handsome dividends.*

Too many farmers are planting seed that has not been cleaned and treated—and with no knowledge of its germination and purity.

Purity, germination, inert matter, the amount of weed and other crop seed—these are all important factors. But there is one more vital point—*the breeding behind the seed.*

Our plant breeders—U.S. Department of Agriculture, Experiment Stations, and Commercial—render a great service by developing new, improved varieties containing superior germ plasm that give higher yields and resist disease more successfully.

Our experiment stations render a real service by testing and making recommendations on small grain varieties. With such a yardstick and background of breeding, every farmer can—and should—use seed of known origin. There is no surer way of knowing the pedigree of your seed than by using *Registered or Certified Seed.*

SPECIAL SEED STUDY LAUNCHED

To understand or define what Registered and Certified Seed are, we should know the four classes of seed recognized by the International Crop Improvement Association:

1 *Breeder Seed* is that small amount developed by the plant breeder and retained under his jurisdiction.

2 *Foundation Seed* is the first step taken to increase breeder seed for the time when a farmer can use it. But Foundation Seed does not enter into commercial trades except in rare cases.

3 *Registered Seed* is the increasing of Foundation Seed into shape for commercial distribution. It always bears a purple tag and is the type seed distributed by commercial plant breeding concerns and some Foundation Seed organizations.

4 *Certified Seed* is the increasing of Registered Seed, provided all standards have been met. Fields where Certified Seed is produced must be inspected and seed standards must be met.

Keenly appreciating high quality seed of known pedigree, the Board of Directors of the South Carolina Crop Improvement Association established a Research Assistantship at Clemson College to study the type of small grain planted by South Carolina farmers, including class, source, cleaning, treating, varieties, purity of seed, inert matter, other crop seed, weed seed, germination, etc.

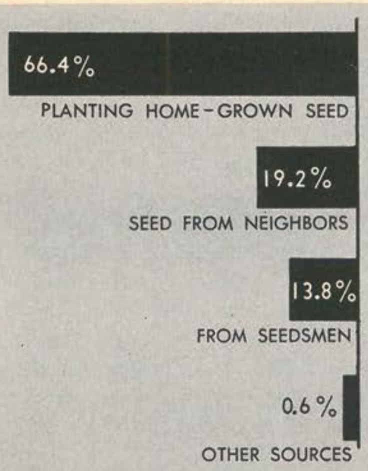


Figure 1.—Survey showed most farmers use homegrown or neighbor seed sources. Only 5.4% were planting registered or certified seed.

The study started in the fall of 1956, included 21 counties with a goal of 100 farmers to each county. County agents, teachers of agriculture, fertilizer inspectors, and personnel from the Seed Certification Department drew samples from the grain drill at planting time and obtained pertinent facts on prepared questionnaires from the farmers relative to the seed being planted.

Final tabulations showed 2,415 farmers were contacted in the 21 counties. They were planting 70,966 acres with the type of seed sampled. The numbers of samples drawn were: Oats—1,525, Wheat—605, Barley—183, and Rye—102.

SOURCES OF SEED

Figure 1 shows the amount of farmers planting home-grown seed, the number securing seed from neighbors, from seedsmen, and from other sources.

Compared with all seed, the sources of Registered and Certified seed were: home-grown, 9.25 per cent; neighbors, 7.69 per cent; and seedsmen, 83.06 per cent.

The study revealed that *only 5.4 per cent were planting Registered and Certified seed.* Those who knew reported their stock was 2.5 years removed from Registered seed. But 635 of the 2,415 farmers had no idea how many years their seed was removed from the breeder.

CLEANING AND TREATING

Many farmers are not aware of seed quality:

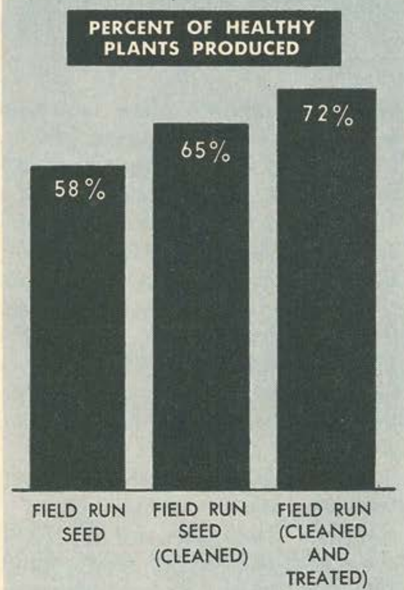


Figure 2.—The number of healthy plants increased as the seed was cleaned and treated. Yet, of farmers surveyed, only 44.5% had seed cleaned, and only 32.3% had their seed treated.

1 *Only 44.5 per cent of the farmers had their seed cleaned before planting.*

2 *Only 32.3 per cent had their seed treated.*

3 *A mere 17.1 per cent had a purity and germination test run.*

Research conducted by Dr. R. W. Earhart, Clemson Plant Pathologist, shows a definite need for all small grain planting seed to be completely processed.

This processing should include both cleaning and treating.

Figure 2 shows how cleaned and treated seed produced nearly 15 per cent more healthy plants than mere field run seed.

The cleaning of small grain increased its value for planting purposes about 12 per cent. When treated, the seed value increased another 12 per cent. So both cleaning and treating increased the seed value 24 per cent.

VARIETY-CONSCIOUS

Farmers are generally conscious of "varieties" and accept improved varieties, though some are still reluctant. We found that 33.4 per cent were planting non-recommended or unknown varieties of barley, 24.4 per cent such varieties of oats, 17.5 per cent wheat, and 25.5 per cent rye.

In many cases, the unknown varieties turned out to be recommended varieties, as determined from laboratory analyses and yield tests.

Unfortunately, 435 of the farmers thought they were planting one variety when they were actually planting another variety.

PURITY—A FACTOR TO WATCH

All of the samples gathered in the Survey were analyzed by the South Carolina State Department of Agriculture. The average purity was 96.74 per cent; inert matter, 2.04 per cent; weed seed, 0.29 per cent; and other crop seed, 0.95 per cent.

We found the farmers surveyed were planting an average of 173.7 common weeds; 132.5 noxious weeds; and 132.4 other crop seed for each pound of grain.

Several farmers were planting grain with *0 per cent germination,* and one farmer planted seed with 8.9 per cent purity.

One sample contained 28.7 per cent inert matter, one had 24.5 per cent weed seed, and another had 90.8 per cent other crop seed.

One farmer was planting grain containing 28,720 noxious weeds per pound, and one used seed containing 63,792 common weeds per pound.

The analyses of Registered and Certified seed compared with non-certified seed showed a purity of *99.15 per cent* compared to *96.61 per cent;* inert matter, 0.77 per cent compared to 2.11 per cent; and weed seed, .01 per cent compared to 0.31 per cent.

TRIAL PLOTS TELL THE STORY

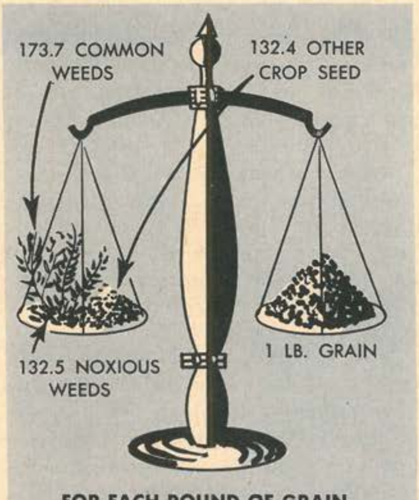
Each sample collected was planted in replicated 40-row plots, ten feet long at the Clemson, Edisto, and Pee Dee Experiment Stations. Field days were held for farmers, agricultural workers, and seedsmen to study the plots and secure first-hand knowledge of the type crop being produced from small grain planted by South Carolina farmers.

At one of the stations, Registered and Certified seed produced more than non-certified seed per acre as follows: Wheat—4.2 bushels, Oats—6.5 bushels, Barley—4.1 bushels. The results of good and poor seed are shown in the two pictures.

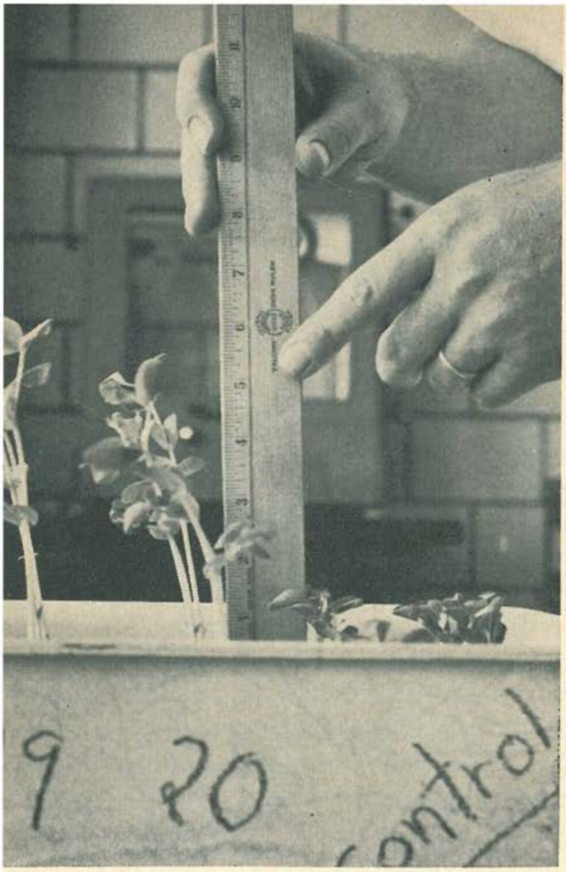
The study has given worthwhile information as a basis for a good seed program in South Carolina. Colored slides of the study have been placed in the hands of all district agents and supervisors of agriculture for use by county agents and teachers.

The Seed Certification Department has presented the results at many Seedsmen's Associations meetings, civic clubs, and other agricultural meetings throughout the South.

THE END



FOR EACH POUND OF GRAIN, THE FARMERS WERE PLANTING 306 WEEDS AND 132 OTHER CROP SEEDS.



Here pea seedlings (left) treated with gibberellic acid—10 to 20 mcgs. per plant—are about five times as large as those not treated on right.

By

John P. O'Keefe

Ames, Iowa

GIBBERELLIC ACID

FOR the past several years, scientists and research men all over the world have been working with a new chemical called GA or gibberellic acid.

Some years ago, Japanese scientists observed that when their rice was infected by Gibberella jujikuroi fungus (which causes a disease in the rice plant) the plants grew much taller than the plants that weren't infected with the fungus.

By 1926, a Japanese investigator found that he could induce rice to grow taller by applying the liquid in which the fungus had grown. Japanese scientists began to isolate gibberellin and found two types . . . *gibberellin A* and *gibberellin B* from cultures.

They found these, too, stimulated plant growth. But not until a few years later did British and American scientists, while trying to isolate the gibberellins, isolate a related substance now known as gibberellic acid.

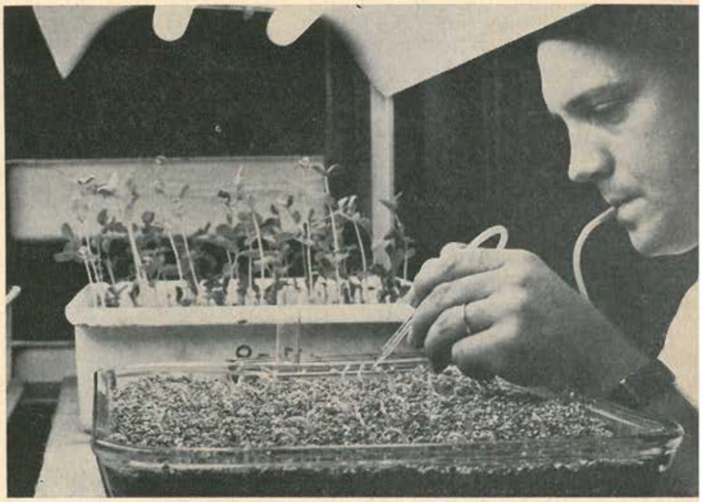
ITS GENERAL EFFECT ON PLANTS

The general effect gibberellic acid has on treated plants is a marked *elongation of the leaves and internodes with little effect on root growth except in isolated instances.*

An experiment was designed to tests the effect of gibberellic acid on Kentucky bluegrass plots, at a time unfavorable to the normal growth of the plant. (*October in Indiana*)

The plots were fertilized with 10-10-10 and sprayed once with freshly mixed solutions of the acid. Within four days the treated plots became greener and developed new shoots. Rainfall had been adequate for

Gibberellic acid is applied by dropping one drop of very dilute solution on the tip of each seedling with a micropipette —producing rapid growth and elongation between nodes and internodes.



—A PLANT HORMONE

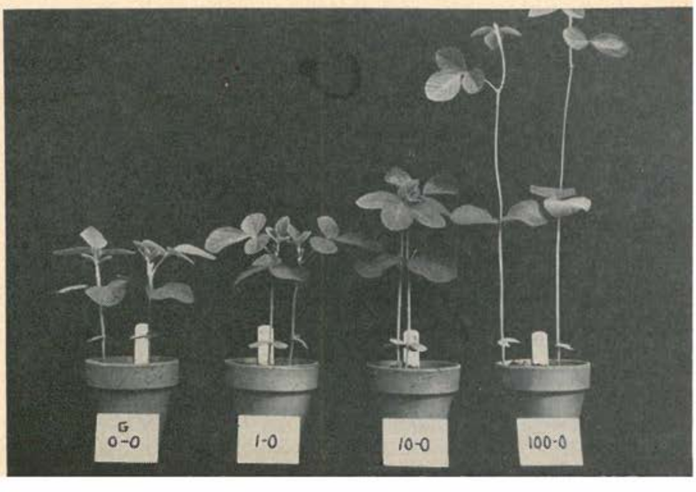
growth. Noticeable growth has resulted from as little as two ounces of the acid mixed with 100 gallons of water per acre.

FERTILIZERS NECESSARY WITH GIBBERELLIC

Where there wasn't any fertilizer used, we noted that the nitrogen content of the grass decreased two per cent after the acid solution was applied. Therefore, the yield of crude protein per acre was not increased at the same rate as the dry weight yield.

It is necessary to mix fertilizers with

These soybean plants got 0, 1, 10, and 100 mcg. of gibberellic acid. Such increased growth is but one factor in the influence of gibberellic acid.



the gibberellic acid or, in the case of grass, after six to eight weeks chlorosis begins as a result of overgrowing.

In one experiment, they found that the dry matter and crude protein of the second cutting of grass was depressed by approximately the amount of increase found at the first cutting. Consequently, the total yield over the second cuttings was not significantly increased. No figures were taken on later cuttings in this experiment.

Other experiments have shown that when gibberellic acid was applied to certain plants it increased the dry and fresh weights in the plant shoots, and also increased the ash, phosphorous, and nitrogen amounts in the shoots but *did not increase the mineral content normally present in the roots.*

A SECONDARY FUNCTION OF THE ACID

Next to stem elongation, flower formation appears to be a secondary function of the acid. Experiments show that some plants treated with gibberellic acid have a faster flowering formation, but in other plants flowering is retarded.

Such plants as asters, geraniums, roses, and sunflowers have responded to gibberellic acid treatments. Red-leafed maples, tulip, and English boxwood trees, as well as bluegrass, fescue and bent grasses have also responded to the acid treatments.

One of the interesting characteristics of gibberellic acid is its reversal of dwarfism in certain plants. Dwarfism has been reversed in peas, beans, and corn.

In one test with six mutant corn plants which were non-allelic to each other, four plants responded to treatment with the acid while the other two plants were not affected.

This experiment showed that the acid affected particular genes in a plant and is therefore quite selective on which plants and genes it works.

Two out of three corn plants treated with gibberellic responded to primary root growth. *Some of the roots increased in size up to 24 per cent.*

Again, the reason given for the one plant that didn't respond was because of the possibility of a direct inheritance in the growth system of the plants which cannot be affected by the acid.

Seed reproduction has been reduced in biennials from two years to six months with the application of gibberellic acid. Annual vegetables such as lettuce, radishes, and spinach grown under long-day conditions, flower and produce viable seed three to five weeks earlier when treated with the acid.

Experiments with wheat show a rapid initial increase in the growth rate. But when the grain and straw were harvested there was no greater yield than wheat not treated with the acid.

When gibberellic acid is applied, stems elongate at a relatively rapid rate and the leaves become slightly lighter in color. This can be partially controlled with a nitrogen fertilization. Large doses of the acid may result in long, thin stems and small leaves.

They have found that as the amount of gibberellic acid increases in application so will the amount of plant growth. The acid is quite potent and is effective in concentrations as low as 1/10 parts per million.

WAYS TO APPLY IT

The acid is applied to plants in many ways:

1 It can be given in nutrient solutions which makes it available more readily to the roots.

2 It can be rubbed on the plant in the form of a lanolin paste.

3 It can also be injected into the

plant or applied as a dry-seed dressing.

4 The most widely used method of application is spraying the acid on the plants. The acid is mixed with water, and this appears to be the most practical and economical method of application.

Gibberellin, closely related to gibberellic acid, has stimulated the germination of barley, wheat, and rice grains in tests conducted by the Japanese.

The practical use of gibberellic acid in increasing crop yields is at present limited but does hold some promise for the future. Further recommendations for the acid's use must await more research in this field.

So far, the acid has been supplied free to researchers by Eli Lilly and Company, Merck and Company, and by the U. S. Department of Agriculture.

THE END

HOW MUCH FERTILIZER STAYS ON THE FARM? HOW MUCH GOES TO MARKET?

Ever wondered how much of the nutrients in the soil a good crop of burley tobacco will take up?

Kentucky Experiment Station researchers checked "good" crops for two years in such a test, analyzing all parts of the plants to see how much fertilizer was in the burley sold on the market and what was left on the farm after the crop year.

Here's what C. E. Bortner and James Hamilton found in the survey:

The plants removed about 199 pounds of nitrogen per acre from the land; of this 199 pounds, 55 percent of the nitrogen was in the marketable portions sold by the farmer, leaving 45 percent "on the farm"; about 33 pounds of phosphate, of which 45 percent was in the marketed portions, leaving 55 per cent on the farm; *340 pounds of potash,* of which 52 percent was in the portion sold, leaving 48 percent on the farm; and 357 pounds of lime (calcium and magnesium carbonate) of which 72 percent was sold, leaving 28 percent on the farm.

These nutrients left "on the farm", however, were not always useful—unless the farmer put it back on the land. Most of the remaining nutrients were in the stalks, a portion of the plant which sometimes is burned or carted off and destroyed. In such cases, the plant food in these stalks is lost to the farm, the researchers said.

CHEAPEST FEED DAIRY OR BEEF FARMER CAN BUY

The cheapest feed a dairy or beef farmer can buy is fertilizer—*applied to his grass.* This has been demonstrated consistently in fertilizer trials conducted in 1956 and 1957 on farmers' fields in various parts of the State (Pennsylvania). Early spring applications of 100 lbs. nitrogen per acre doubled the dry matter yield of 3 commonly grown grasses. The nitrogen-fertilized grass also was more valuable as feed because of the increased protein content.

—*Lawrence F. Marriott, Assistant Professor of Soil Technology, Penn State—in* Science for the Farmer, *Vol. 5, No. 3, 1958*

COSTS AND RETURNS PER ACRE AT VARIOUS LEVELS OF FI

COLUMN 1 N PER ACRE (LBS.)	COLUMN 2 YIELD OF CORN (BU.)[1]	COLUMN 3 NITROGEN COST PER ACRE	COLUMN 4 TOTAL COST PER ACRE[2]	COLUMN 5 TOTAL RETURNS (@1.05 PER BU.)	COLUM NE RETUF PEI ACF
0	$47.1	0	$16.29	$49.45	$33.
20	63.7	$ 2.40	19.10	66.88	47.
40	73.6	4.80	21.75	77.28	55.
60	79.0	7.20	24.29	82.95	58.
80	82.0	9.60	26.76	86.10	59.
100	83.9	12.00	29.22	88.09	58.

When the farmer is interested only in the highest return per fertilizer dollar (column 7), he uses just 20 lbs. of fertilizer (nitrogen) to get $6.09. But if he is after the greatest *total* profit (column 6), he uses 80 lbs. of fertilizer (nitrogen) to realize $59.34 per acre—or $11.56 more net return per acre than 20 lbs. of fertilizer (nitrogen) gives him. On 100 acres that means *$1,156 more profit from 80 lbs. of fertilizer per acre than from 20 lbs. per acre.* (1. Reported by St. Joseph Experiment Station, 1950-54. 2. Production and harvesting costs —labor, fuel, interest, depreciation, etc. Some overhead costs are not included.)

HIGHEST RETURN PER FERTILIZER DOLLAR? OR GREATEST TOTAL PROFIT? WHICH DO YOU PREFER?

THE two are not the same although a lot of people think they are. And it does seem logical. But there is a technical difference—*a difference that can mean more profit for the man who knows about it.*

We'll give the answer first and then show why. The greatest total profit is *not* where you get maximum returns per fertilizer dollar. And it doesn't matter whether you're talking about gross returns or net returns, either. We prefer "the greatest total profit." Let's see why.

The chart (right) and the table (above) illustrate our point. Yields, costs, gross and net returns are shown for various levels of nitrogen added to corn. The basic yields are from a five-year experiment reported by the St. Joseph Experiment Station in Louisiana during 1950-1954. These data are used as a typic sponse.

Let's look first at *net r* 6 of the table. Highest ne at a level of about 80 po profit comes at about 89 N levels for simplicity.

Now look at "net returr 7. We get "returns per fe net returns not due to from each succeeding figu the remainder, which is cost of N in column 3.

For example, to get tl column 7, we subtracted $47.78 in the same colum the $2.40 in column 3 i which represents the retu *lbs. N* per acre is used.

ERTILIZATION

N 6 T NS E	COLUMN 7 RETURNS PER NITROGEN DOLLAR
16	0
8	$6.09
3	4.66
6	3.54
4	2.66
7	2.14

By
Fred H. Wiegmann
and
William A. Patrick

Louisiana State University

al example of fertilizer-yield re-

turns per acre shown in column
t returns *($59.34 per acre)* came
unds of N. Actually the peak in
pounds N, but we left out some

s per fertilizer dollar" in column
tilizer dollar" by subtracting the
rtilizer ($33.16 at O level N)
e in column 6 and then dividing
attributable to fertilizer, by the

e $6.09 per fertilizer dollar in
he $33.16 in column 6 from the
to get $14.62. We then divided
nto that $14.62 and got $6.09,
n per nitrogen dollar when *20*

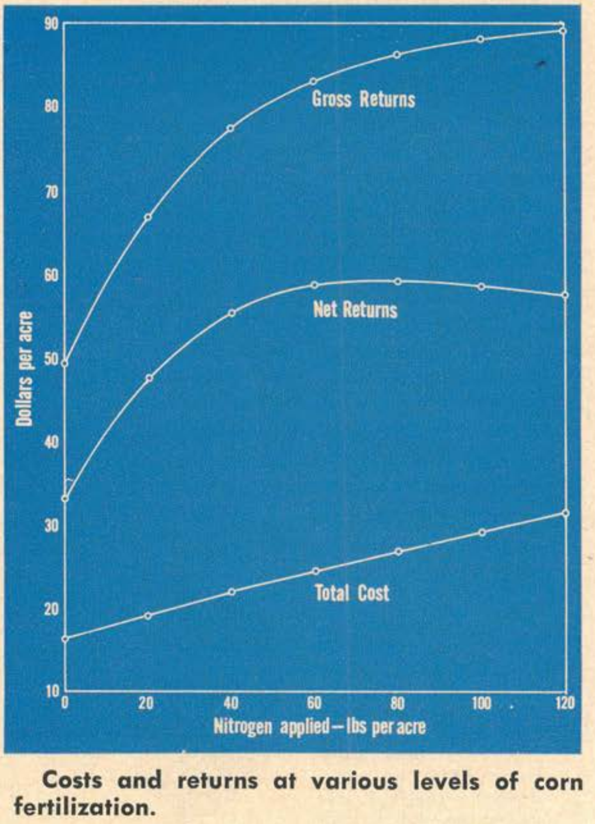
If we wished to call this $6.09 our maximum return, we would stop with the first 20 pounds of N where $2.40 invested in N yields $6.09 per N dollar. Any additional N will bring lower returns *per N dollar*. For example: 80 pounds N, at $9.60 fertilizer cost shown in column 3, yields only $2.66 per fertilizer dollar shown in column 7. But this is still the level of N yielding the highest net profit *per acre*, or $59.34, shown in column 6.

The story would be the same if we used gross returns. *The most profitable level of fertilizer use is not the level of highest return per dollar invested in fertilizer.*

The most profitable level of fertilizer use is the amount that brings you the *highest net return per acre*—or the greatest *total* profit.

Just what does this mean? From these data the difference in net returns between 20 and 80 pounds N is $11.56 per acre, as shown in column 6. On 100 acres this amounts to about $1,156—a "technical difference" expressed in a language we all understand.

THE END



Costs and returns at various levels of corn fertilization.

FORAGE CROPS REQUIRE HIGH FERTILITY

By FLOYD W. SMITH

KANSAS STATE COLLEGE

MORE and better forage crops are needed to aid the livestock industry in low fertility areas. Forage production involves more than producing large amounts of carbohydrate roughage.

The abundance of rainfall in most low fertility areas enables the production of much "bulk" forage if that's all you desire. But *protein production* requires high soil fertility. For protein to be produced through alfalfa and other legumes, plenty of mineral nutrients must be available in the soil. And if protein is to be provided by grassland farming, you must meet the grass's nitrogen needs, as well as its mineral needs.

Soil fertility is often a major problem in humid areas. Such soils are generally low in organic matter, *low in both available phosphorus and potassium and acid in reaction*. Even so, such soils are potentially capable of producing excellent forage crops, with the right kind of fertilization.

Dr. Floyd Smith is Professor of Soils at Kansas State College. A native of Kansas, he earned his B.S. there, his M.S. and Ph.D. from Michigan State University. On the staff of Kansas State since 1946, he is a widely recognized authority on soil fertility questions.

MINERAL COMPOSITION OF FORAGE IS IMPORTANT

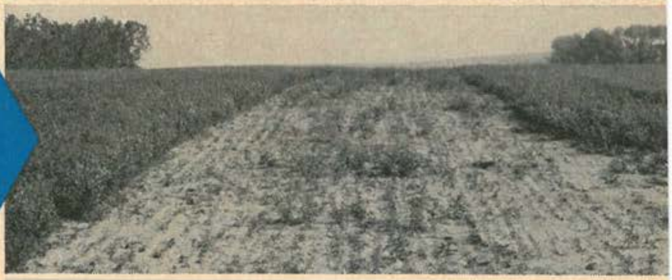
The chemical composition of forage is important in meeting the mineral nutrient requirements of livestock. Young growing cattle need approximately 0.4% of calcium and 0.3% of phosphorus in their ration.

Even fattening cattle need about half these amounts of calcium and phosphorus. Milk cows in production should receive 0.25 to 0.30% calcium and a similar amount of phosphorus.

Forage species growing naturally on depleted soils supply far less than

NITROGEN made the difference on this Bromegrass. Right none. Left 100 pounds per acre.

PHOSPHATE made the difference on this Kansas alfalfa. Both sides had 90 pounds triple superphosphate per acre in row at planting. Center strip had none.



POTASH has boosted average annual yields of alfalfa on three major demonstration farms for many years—meaning 2.5 tons per acre average of this high-protein forage. (Table 2)

TREATMENT	YIELD OF ALFALFA HAY (TONS/A) COLUMBUS 1926-54	THAYER 1939-51	MOUND VALLEY 1951-58
NO TREATMENT	0.57	1.24	.64
LIME	1.71	1.78	1.20
LIME AND SUPERPHOSPHATE	2.33	2.88	1.94
LIME, SUPERPHOSPHATE AND POTASH	2.51	3.08	2.01

these minimum levels of *good animal nutrition* (Table 1). Broomsedge, a species common in low fertility areas of the South, normally contains only about 0.10% each of calcium and phosphorus — well below the amount needed by any type of cattle.

A good clover-grass mixture usually contains sufficient calcium for all types of cattle, enough phosphorus for fattening cattle, and a major portion of the phosphorus needed by young cattle and dairy cows.

Pure alfalfa should provide enough of these for any class of cattle.

While discussing the chemical compositions of forage and pasture species, it is interesting to consider the natural distribution of broomsedge in Kansas. This species is a common sight to everyone who has lived or worked in southeastern Kansas.

As you move northward toward the Kansas River Valley and north of that valley, you seldom see any broomsedge, except on the most infertile soils. In northeastern Kansas, I have used broomsedge as a guide to soil samples for classroom and research purposes. Without exception, broomsedge coincides with low-potassium soil as well as with low phosphorus availability and acid conditions.

Since this species requires only a few pounds of potassium to make luxuriant growth, it is not suprising that it grows while desired species, which may need six times as much potassium, will fail.

Likewise, an excellent forage crop may need 20 times as much calcium and three or four times as much phosphorus as broomsedge does.

PROTEIN—THE KEY TO A SUCCESSFUL FORAGE PROGRAM FOR LIVESTOCK

When deciding what forage species to use, remember the protein needs of your livestock. *Alfalfa is an outstanding producer of high quality protein.* Over a period of 29 years at the Columbus, Kansas Experiment

Table 1.—COMPARATIVE SUITABILITIES OF CERTAIN PLANTS AS FORAGE CROPS

PLANT	YIELD, T/A	PROTEIN, LBS./A	MINERAL NUTRIENT ACCUMULATION, LBS./A			
			Ca	Mg	P	K
GOLDENROD	1.75	148	30.6	5.8	5.4	42
RAGWEED	1.18	149	41.3	10.5	4.2	41
RED SORREL	.55	35	10.6	3.1	2.1	27
CRABGRASS	1.00	88	7.2	4.5	5.6	30
WILD BARLEY	1.27	139	0.4	4.8	6.2	28
BROOMSEDGE	1.93	171	3.6	3.9	3.5	14
TICKLEGRASS	.78	54	2.5	0.2	1.2	7
CLOVER-GRASS MIXTURE	2.98	542	78.1	19.1	11.8	88

[1] Adapted from Missouri Agri. Exp. Sta. Bul. 582, 1952

Note how much more yield, protein content, and mineral nutrition the clover-grass mixture gives than the other species.

Field, alfalfa has produced an average of 2.5 tons per acre of hay (Table 2).

Assuming average feeding value, this crop has produced an average of at least *900 pounds of protein per acre per year.* It would require at least 26 bushels per acre of soybean seed to produce an equivalent amount of protein.

In the same experiment and with the same treatment, *the latter crop* has yielded an average of but 14 bushels per acre. *Obviously whenever your prime concern is protein, you should consider alfalfa.*

Red clover and other legumes are somewhat comparable in this regard. Most of these, however, are subject to the severe droughts that hit southeastern Kansas.

SPECIFIC NUTRIENT REQUIREMENTS OF GOOD LEGUME FORAGES

When you grow alfalfa or red clover to insure large amounts of protein for your livestock, your soil needs plenty of mineral nutrients (Table 3). It requires about 75 pounds of calcium, 13 pounds of phosphorus (30 pounds of P_2O_5) and 75 pounds of potassium (90 pounds of K_2O) to produce 2.5 tons of alfalfa hay—like the annual yields on the Columbus, Kansas Experiment Field since 1926.

On the low fertility soils of southeastern Kansas, alfalfa needs lime, phosphate, and potash (Table 2). Lime primarily to reduce soil acidity rather than to satisfy any nutritional deficiency of this element. Liming is the key to making phosphorus adequately available in southeastern Kansas, even when fertilizer is used.

Phosphate fertilizer is absolutely essential for full production of alfalfa in southeastern Kansas. Superphosphate increased yields by *at least 0.6 ton per acre* at each of the three experimental locations in that area. (Table 2).

Table 3.—SOME FEEDING VALUES OF ALFALFA RED CLOVER, AND TIMOTHY[1]

CROP	PROTEIN[2] %	CAROTENE[3] (ppm.)	CALCIUM %	PHOSPHORUS %
ALFALFA	18	50	1.44	0.24
RED CLOVER	15	30	1.20	0.18
TIMOTHY	10	24	0.28	0.15

[1] Adapted from New Jersey Agri. Exp. Sta. Bul. 788, 1950
[2] Standards for excellent hay
[3] Average values

Alfalfa is an outstanding producer of good protein—one of the major nutrition needs of livestock.

Here red clover responded better to potash than alfalfa — probably because of its shallow-rooted inability to penetrate subsoil for more possible potash.

Table 4.—COMPARATIVE RESPONSES OF RED CLOVER AND ALFALFA TO VARIOUS FERTILIZER TREATMENTS, CRAWFORD COUNTY, KANSAS, 1948

TREATMENT	FIRST CUTTING YIELD, T/A	
	RED CLOVER	ALFALFA
NONE	1.84	1.98
P	2.38	2.08
K	1.99	1.98
PK	2.82	2.08

Response to potash in southeastern Kansas depends on soil conditions and the crops involved. On heavy claypan soil at Columbus, about one-fifth of a ton per acre average increase was achieved for the 33-year period. As the soil became more depleted, the response became greater, about one-third ton per acre.

During the last three years of the study at Thayer, the average response to potash amounted to three-fourths ton per acre.

On the no-potash plots, alfalfa stands failed rather quickly and became very grassy upon this soil which was derived from sandstone parent material.

Red clover was even more responsive to potash than alfalfa. This, no doubt, is due to its shallow-rooted behavior and its inability to penetrate the subsoil where additional potash might be available. Alfalfa and red clover were compared simultaneously in Crawford County (Table 4).

FERTILITY REQUIREMENTS OF NON-LEGUME FORAGES

A successful forage program must include considerable grass to permit complete utilization of land and to extend the grazing season. Excellent forage species invariably demand high fertility levels to be productive (Table 5).

Bromegrass, a highly useful grass forage for Kansas and many other areas, synthesizes considerable protein, has a phosphorus content approximately equivalent to alfalfa, and accumulates about as much potassium as alfalfa. To produce highly nutritious forage with minimum desired qualities as a cattle forage, bromegrass must have plenty of nitrogen and adequate phosphate. *And to endure drought and maintain a good stand, it must have adequate potash on low fertility soils.*

When mixtures of bromegrass and alfalfa are planted, remember that the grass uses potassium more readily and rapidly than the alfalfa. Obviously, when available soil potassium is limited, potash fertilization becomes even more important with mixtures than with pure alfalfa. If not the grass will soon starve the legume and the seeding will revert to only grass.

Adequate potash fertilization was necessary to maintain alfalfa at the Thayer, Kansas Experiment Field during the period 1949-51, inclusive. Plots which did not receive potash or barnyard manure lost their alfalfa

When considering grass for a balanced forage program, it pays to select a species with high feeding and nutrient values.

Table 5.—SOME FEEDING AND NUTRIENT VALUES OF GRASS SPECIES

CROP	PROTEIN %	CALCIUM %	PHOSPHORUS %	POTASSIUM %
BROMEGRASS HAY	10.0	0.20	0.28	2.35
BLUEGRASS HAY	8.2	0.30	0.22	1.26
ORCHARDGRASS	7.7	——	0.17	1.61
REED CANARYGRASS	7.5	——	0.23	1.07
PRAIRIE HAY	5.7	0.49	0.10	0.49

rather completely and became essentially bluegrass plots. Potash maintained good stands of alfalfa which were free of potash deficiency symptoms even when plowed under.

While certain grass species may seem better adapted to low fertility soils because of their lower nitrogen and mineral requirements, forage quality usually declines accordingly. Prairie hay is neither as productive nor as nutritious as well-managed bromegrass.

Large amounts of high quality forage were produced on Labette and Woodson types of soils in Johnson County, Kansas. *Protein production was markedly influenced by fertilizer treatment.* Similar results should be possible upon the more favorable soil sites of these two series and others wherever bromegrass or bluegrass production is attempted. *Potash fertilizer should be included whenever soil tests indicate low availability.*

SUMMARY AND SUGGESTIONS

1 Establishing a successful forage program in southeastern Kansas depends largely on improvement in soil fertility.

2 Lime must be applied to alleviate soil acidity and improve phosphorus availability.

3 Fertilizer phosphorus must be added to increase yields and improve forage quality.

4 Potash is frequently needed. Shallow-rooted species of legumes have been very responsive on Kansas soils derived from sandstone and on soils with marked claypan development. Potash is especially important for maintaining legume stands in mixtures with grass.

5 Large amounts of nitrogen are needed for the grass forages.

THE END

Sweet Potatoes Need Potash

So say . . .

G. W. Thomas

and

N. T. Coleman

In . . .

Research

and

Farming

Published by

N. C. State College

ROOT CROPS need lots of potash—and sweet potatoes are no exception. But it may surprise you to find out how much potash does help, especially on sandy soils where sweet potatoes grow best.

Most of our sandy soils in North Carolina are naturally low in available potash. This means we have to add some as fertilizer. The amount depends on: (1) how much the crop itself needs and (2) how much we lose in the drainage water.

Our experiment was run at the Clayton Experimental Farm on a Norfolk loamy sand. At the beginning of the season there were about 40 pounds of potash per acre. Besides the check plots, there were plots with 150, 300 and 600 pounds of potash per acre. All of the test plots had plenty of phosphate and nitrogen.

Early in the season about the only difference between the no-potash plots and those which had potash applied was in size. Later, however, the plants that had no fertilizer began to show yellowing and burning of their leaves.

When these potatoes were harvested, they showed just how badly potash was needed. Yields varied from less than 50 bushels per acre on the no-potash plots, to over 250 bushels on the highest potash plots.

Besides the higher yields, the quality of the high-potash potatoes was better.

The sweet potatoes which were fertilized heavily with potash removed as much as 350 pounds of potash per acre. So with the 300-pound rate there was not too much lost in the drainage water.

Remember: These results are for soils which are low in available potash. The best way to find out how much potash to use is to have your soil tested.

GOOD DRAINAGE

By
R. H. BLOSSER

OHIO AGRICULTURAL
EXPERIMENT STATION

POORLY DRAINED SOIL, LIKE THIS, CAN CANCEL TOP YIELDS

GOOD drainage is needed to make fertilizer pay on certain soils.

This conclusion is based on a study of Paulding and Hoytville soils which cover about 2,000,000 acres of land in Northwestern Ohio, Southern Michigan, and Northeastern Indiana. Many other poorly drained soils probably respond to fertilizer in a similar way.

Here we shall discuss only the results obtained on Paulding soil which responded better to additional drainage than Hoytville soil. Normally, Paulding is much poorer drained than Hoytville.

Paulding soil is found on flat areas in Northwestern Ohio where more than 42 inches of heavy water-laid clay rests on glacial till which also has a high clay content. Drainage through tile is slow. Surface drainage is also poor because of the level topography. This soil is high in potassium but low in available phosphorus. Usually little or no lime is needed. Organic matter is moderately high.

We collected data on land use, crop yields, fertility practices, drainage and livestock numbers on 92 farms for 1954 and 97 farms for 1955 and 1956. Each farm had more than 90 per cent Paulding soil.

HOW DRAINAGE INFLUENCED RESPONSE TO FERTILIZER

Yields in table 1 show *how drainage affected the response from certain applications of fertilizer applied to corn and oats.* These yields are averages for the three year period, 1954-56.

Fertilizer rates are in terms of *a 3-12-12 analysis,* which was the kind most commonly used. Adjustments to this analysis were made by giving each fertilizing element the same yield increasing value.

Although fertilizing elements are not exact substitutes for each other, this method of adjustment was considered practical in this study because most farmers applied a complete fertilizer.

Drainage ratings for each farm were based on distance between tile

MAKES MORE FERTILIZER PROFITABLE

AND PROFITS FROM FERTILIZER USE

OHIO STUDY SHOWS -

. . . that 200 lbs. of fertilizer per acre will not pay for itself on poorly drained soil, while 300 lbs. of plant food per acre will more than pay for itself on well drained soil.

lines, number and type of surface drains, amount of water that collected in small ponds after rains, and the farmer's estimate of whether his land was better or poorer drained than other tracts in the community.

Average yields for the three-year period showed that over 150 pounds of fertilizer per acre increased corn production only slightly when applied to below-average drained land.

But on the best drained group of farms, 450 pounds of fertilizer per acre increased corn yields six bushels above a 300 pound application.

Poor stands and late plantings are probably the main reasons why fertilizer did not increase corn yields greatly on the poorly drained farms.

Drainage also affected the response from fertilizer applied to oats. On the poorest drained group of farms, 300 pounds of fertilizer increased the average annual yield of oats only five bushels per acre.

But on the best drained group, this same amount of fertilizer increased the average annual yield 13 bushels.

Late plantings of oats on Paulding soil because of poor drainage probably reduce yields more than any other single factor.

Soybean and wheat yields were also correlated with different degrees of drainage and applications of fertilizer.

Wheat yields were correlated with the entire amount applied to this crop.

TABLE 1.—AVERAGE YIELD PER ACRE OF CORN AND OATS FOR PAULDING SOIL WITH DIFFERENT APPLICATIONS OF FERTILIZER AND DEGREES OF DRAINAGE, 1954-56

CROP	FERTILIZER USED PER ACRE POUNDS	DRAINAGE RATING	
		BELOW AVERAGE BUSHELS	ABOVE AVERAGE BUSHELS
CORN	0	45	57
	150	48	64
	300	49	71
	450	—[1]	77
OATS	0	27	34
	200	31	42
	300	32	47

[1] This yield could not be determined because it was beyond the limits of the data obtained.

TABLE 2.—NET INCOME[1] ABOVE ADDITIONAL COST OF USING DIFFERENT AMOUNTS OF FERTILIZER ON PAULDING SOIL

CROP	FERTILIZER USED	DRAINAGE RATING	
		BELOW AVERAGE	ABOVE AVERAGE
CORN	1st 150 lbs.	$ .30	$5.70
	Next 150 lbs.	-2.40	$5.70
	Next 150 lbs.	—	4.35
OATS	1st 200 lbs.	-2.20	.60
	Next 100 lbs.	-$1.80	$1.00

[1] *Prices used in calculating receipts were $1.35 per bushel for corn and 70c for oats. Charges for fertilizer were figures at 2.5 cents a pound for a 3-12-12 analysis.*

Soybean yields were correlated with the amount used on other crops because no fertilizer was applied directly to this crop.

This analysis showed that drainage rating did not change significantly the shape of the fertilizer response curve for soybeans and wheat. In other words, yield response from given amounts of fertilizer was about the same regardless of drainage classification.

This may be largely explained by the fact that soybeans and wheat were normally planted at a time when the soil was drier than was the case with corn and oats.

HOW DRAINAGE INFLUENCED NET INCOME ABOVE FERTILIZER COST

Profits from different applications of fertilizer are shown in table 2. These calculations were made *by subtracting the cost of the additional fertilizer applied from the market value of the additional yield obtained.*

Other costs were not considered because they did not change significantly when more fertilizer was used. Residual effects of fertilizer were omitted from these calculations because no satisfactory estimates could be made to cover the various applications and drainage situations.

On the poorly drained land, about 150 pounds of fertilizer per acre was all that could be profitably applied to corn when the entire application was charged against this crop. *But on the best drained land, fertilizer increased corn yields enough to pay for at least a 450-pound application.*

On below average drained land, fertilizer did not increase oat yields enough to pay for a 200-pound application per acre. *But on the best drained land, 300 pounds per acre increased oat yields enough to slightly more than pay all fertilizer costs.*

On many soils, fertilizer alone cannot do everything that is needed to produce high crop yields. *More fertilizer will increase crop yields only when other growth producing factors are favorable.*

THE END

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THE NEXT ISSUE OF THIS MAGAZINE WILL DISCUSS HOW TO COPE WITH SUCH LIMITING FACTORS.

YOUR 1959 POTASH INSTITUTE REVIEWS . . .

. . . Dealing with Crops Soils Fertilizers

SOILS

"Soil Compaction," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Rpt. 168, April 1958, W. H. Fuller.

"Highest Return Farming Systems for Drummer-Flanagan Soils," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 629, June 1958, E. R. Swanson.

"Physical, Chemical, and Mineralogical Properties of Related Minnesota Prairie Soils," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Tech. Bul. 227, June 1958, H. F. Arneman, A. D. Khan, and P. R. McMiller.

"Magnesium Status of Blackland Soils of Northeast Mississippi for Cotton Production," Agr. Exp. Sta., Miss State Univ., State College, Miss., Bul. 560, June 1958, J. D. Lancaster.

"Newton County Soils, Major Uses and Management," Agr. Exp. Sta., Miss. State Univ., State College, Miss., Bul. 562, July 1958, L. C. Murphree.

"Physical, Chemical, and Mineralogical Characteristics of Important Mississippi Soils," Agr. Exp. Sta., Miss. State Univ., State College, Miss., Tech. Bul. 45, May 1958, R. R. Bruce, W. A. Raney, W. M. Broadfoot, and H. B. Vanderford.

"Greene County Soils," Dept. of Agron., Cornell Univ., Ithaca, N. Y., Soil Assoc. Lflt. 7, March 1957, K. Flach, et al.

"Interpretation of Soil Tests," Agr. Exp. Sta., Oregon State College, Corvallis, Oreg., Cir. of Inf. 587, March 1958, L. A. Alban.

"Birdsfoot Trefoil," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 608, Sept. 1958, K. E. Varney.

"Soils of Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Bul. 203, Rev. March 1958, G. R. Epperson, S. S. Obenshain, H. C. Porter, and R. E. Devereaux.

"Salt Problems in Irrigated Soils," USDA, Wash., D. C., Agr. Inf. Bul. 190, Aug. 1958.

"Soil Conditions That Influence Wind Erosion," USDA, Wash., D. C., Tech. Bul. 1185, June 1958, W. S. Chepil.

FERTILIZERS

"Fertilizer Recommendations for Georgia," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 371, Rev. July 1958, J. R. Johnson.

"Fertilizing with Poultry Manure," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Cir. 330, April 1958, P. N. Mosher.

"Fertilizer Recommendations for Maryland Farms 1959-1960," Agr. Ext. Serv., Univ. of Md., College Park, Md.

"1958 Fertilizer Analyses and Registrations," State Dept. of Agr., Feed & Fert. Control, St. Paul, Minn., R. E. Bergman.

"Calcium—Boron Interaction," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 663, March 1958, R. L. Fox and W. A. Albrecht.

"Commercial Fertilizer Results with Spring Small Grains, 1958," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Neb., Outstate Testing Cir. 73, Dec. 1958, W. E. Lamke, R. A. Olson, and P. H. Grabouski.

"Fertilizer Experiments on Subirrigated Meadows in Nebraska, 1958," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 75, Jan. 1959, E. M. Brouse and H. F. Rhoades.

"North Carolina Fertilizer Report for 1957-1958," State Dept. of Agr., Raleigh, N. C., No. 154, Nov. 1958.

"Lawn and Garden Fertilizers," Agr. Ext. Serv., N. D. Agr. College, Fargo, N. D., Cir. A-294, April 1958, V. L. Weiser.

"Soil and Crop Factors for Fertilizer Recommendations," Agr. Exp. Sta., Okla. State Univ., Stillwater, Okla., Bul. B-511, Sept. 1958, J. Q. Lynd, R. M. Reed, B. B. Tucker, and J. J. Micka.

"Tonnage Distribution of Fertilizer in Oklahoma Counties by Grades & Material for the Period July 1, 1957 to July 1, 1958," State Dept. of Agr., Oklahoma City, Okla., Ann. Rept.

"1959 Fertilizer Recommendations for South Carolina," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 452, Jan. 1959, H. A. Woodle and R. J. Ferree.

"Lime & Fertilizer Recommendations for Corn, Small Grain, Alfalfa, and Gardens," Soils Dept., Univ. of Wis., Madison, Wis., 1958.

"Fertilizer Used on Crops and Pasture in the United States, 1954 Estimates," USDA, Wash., D. C., Stat. Bul. 216, Aug. 1957.

"How Much Fertilizer Shall I Use?" USDA, Wash., D. C., Lflt. 307, Rev. July 1958.

SOILS

Recent publications of the United States Department of Agriculture, The State Experiment Stations, and Canada on Fertilizers, Soils, and Crops. Requests for publications listed should be made directly to the original source.

"Soil Testing," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 441, Nov. 1958, P. J. Bergeaux.

"Protecting Your Soil," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 667, Rev. Sept. 1956, C. A. Van Doren and L. E. Gard.

"Soil Erosion Control in Process in Western Iowa," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Res. Bul. 460, Aug. 1958, R. B. Held and J. F. Timmons.

"Trends in Kentucky Agriculture," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 653, Nov. 1957, R. W. Rudd and D. M. Shuffett.

"Lawn Construction," Agr. Ext. Serv., Univ. of Mass., Amherst, Mass., Lflt. 313, Feb. 1958, E. C. Roberts and J. R. Havis.

"Lawn Weed Control," Agr. Ext. Serv., Michigan State Univ., East Lansing, Mich., Ext. Fldr. F-261, June 1958, B. Grigsby.

"Save Money—Water—Soil with Minimum Tillage," Agr. Ext. Serv., Michigan State Univ., East Lansing, Mich., Ext. Bul. 352, Aug. 1958, R. L. Cook, H. F. McColly, L. S. Robertson, and C. M. Hansen.

"Supplemental Irrigation in Michigan," Agr. Ext. Serv., Michigan State Univ., East Lansing, Mich., Ext. Bul. 309, Oct. 1958, E. H. Kidder and R. Z. Wheaton.

"The Home Lawn," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 165, Rev. April 1958, R. J. Stadtherr.

"Response of Soybeans to Plow-down and Side-dress Applications of Nitrogen on Irrigated and Non-irrigated Soils," Ohio Agr. Exp. Sta., Wooster, Ohio, Res. Cir. 59, Nov. 1958, H. J. Mederski, J. H. Wilson, and G. W. Volk.

"Soil Nitrogen Complexes: 1. Chromatography of Amino Compounds in Soil Hydrolysates," Ohio Agr. Exp. Sta., Wooster, Ohio, Res. Cir. 61, Dec. 1958, J. L. Young and J. L. Mortensen.

"Home Garden Information for Central South Carolina," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Cir. 388, Rev. Jan. 1959.

"Home Garden Information for Coastal South Carolina," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Cir. 387, Rev. Jan. 1959.

"Home Garden Information for Piedmont South Carolina," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Cir. 389, Rev. Jan. 1959.

"The Agriculture of Lancaster County, South Carolina," State Dept. of Agr., Columbia, S. C., AE 156, Aug. 1958.

"The Agriculture of Marion County, South Carolina," State Dept. of Agr., Columbia, S. C., AE 157, Sept. 1958.

"The Agriculture of Richland County, South Carolina," State Dept. of Agr., Columbia, S. C., AE 136, Feb. 1958.

"The Agriculture of Sumter County, South Carolina," State Dept. of Agr., Columbia, S. C., AE 142, May 1958.

"Handbook for Soil Conservation District Supervisors," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 454, Rev. Sept. 1958.

"Soil Losses on Wheat Farms in the Palouse Wheat-Pea Area, 1952-53, A Progress Report," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Cir. 255, Sept. 1954.

"Washington Soils and Related Physiography—Columbia Basin Irrigation Project," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Stas. Cir. 327, April 1958.

Liquid Manure Conservation and Use," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 425, Nov. 1958, A. D. Longhouse, O. J. Burger, and H. O. Henderson.

"Agriculture Extension in Wisconsin, Report for 1957," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 558, March 1958.

"New Methods to Improve Shortgrass Range," Agr. Exp. Sta., Univ. of Wyoming, Laramie, Wyoming, Bul. 353, Sept. 1957, C. F. Becker, R. L. Lang, and F. Rauzi.

"Alaska Handbook, 1959 Agricultural Conservation Program," Alaska ASC State Committee, Box B, College, Alaska, ACP-1959.

"1959 Agricultural Conservation Program for Hawaii," USDA, Wash., D. C., ACP-1959-Hawaii, Sept. 1958.

"The 1959 Agricultural Conservation Program for Indiana," USDA, Wash., D. C., ACP-1959, Oct. 1958.

"The 1959 Agricultural Conservation Program for New Jersey," USDA, Wash., D. C., ACP-1959-N.J., Aug. 1958.

"1959 Agricultural Conservation Program for Puerto Rico," USDA, Wash., D. C., ACP-1959-P.R., Oct. 1958.

"1959 Agricultural Conservation Program for Virgin Islands," USDA, Wash. D. C., ACP-1959-V.I., Nov. 1958.

"1959 Agricultural Conservation Program Handbook for Wyoming," USDA, Wash., D. C., ACP-1959-Wyoming, July 1958.

"Soil Compaction on Forest and Range Lands," USDA, Wash., D. C. Misc. Pub. 768, Jan. 1959, H. W. Lull.

"1959 Agricultural Conservation Program, National Bulletin, for Ala., Ariz., Ark., Calif., Colo., Conn., Del., Fla., Ga., Idaho, Ill., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Mont., Nebr., Nev., New Hampshire, New Mexico, N. Y., N. C., North

Dakota, Ohio, Okla., Ore., Pa., R. I., S. C., South Dakota, Tenn., Texas, Utah, Va., Wash., W. Va., Wis.," USDA, Wash., D. C.

CROPS

"Winter Wheat Improvement in Ontario, 15th Annual Report," Ont. Agr. College, Guelph, Ont., Can., 1956.

"Fruits for Alaska," Agr. Exp. Sta., Univ. of Alaska, Palmer, Alaska, Ext. Cir. 420, Jan. 1958.

"Planning & Managing Greenhouses in Alaska," Agr. Ext. Serv., Univ. of Alaska, Palmer, Alaska, Bul. 804, March 1958, R. Foley.

"Bulbs for Northern Arizona," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 264, June 1958, A. Allen and H. F. Tate.

"The Desert Grassland," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 299, Dec. 1958, R. R. Humphrey.

"Flowers for Northern Arizona," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 242, Rev. April 1958, H. F. Tate.

"Grain Sorghums in Arizona," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 218, Rev. April 1958, G. W. Clark and L. Stith.

"Planting and Pruning Roses," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 237, Rev. March 1958, H. F. Tate.

"Safflower Recommendations for Arizona," Agr. Exp. Sta., Univ., of Arizona, Tucson, Ariz., Rpt. 170, Oct. 1958, D. D. Rubis and D. S. Black.

"1957 Cotton Culture Tests," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series 74, July 1958, C. Hughes.

"Cucumber Fertilizer Studies in 1956 & 1957," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series 72, March 1958, G. A. Bradley.

"1957 Experiments with 32% Nitrogen Solution," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series 73, March 1958, R. L. Beacher, G. W. Hardy, R. Maples, J. E. Keogh, and L. H. Hileman.

"Fertilization and Soil Test Studies on Cotton, 1953-1955," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Rpt. Series 78, June 1958, R. Maples and R. L. Beacher.

"Castorbeans in California," Agr. Exp. Sta., Univ. of Calif., Davis, Calif., Cir. 468, March 1958, L. H. Zimmerman, M. D. Miller, and P. F. Knowles.

"Establishing A Rice Stand," Agr. Exp. Sta., Univ. of Calif., Davis, Calif., Lflt. 99, Feb. 1958, D. C. Finfrock and M. D. Miller.

"Fertilizing Tomatoes, 1958 Recommendations for Alameda County," Agr. Ext. Serv., Univ. of California, Berkeley, Calif., Cir. 59, March 1958, D. Kennedy, et al.

"Growing Cane Berries in Your Garden," Agr. Exp. Sta., Univ. of Calif., Davis, Calif., Lflt. 62, May 1956, L. C. Gibbs and H. M. Butterfield.

"Foliar Analysis of Elberta Peach Leaves in Relation to Potassium Fertilization," Agr. Exp. Sta., Colo. State Univ., Ft. Collins, Colo., Tech. Bul. 64, Aug. 1958, A. M. Binkley, E. Rogers, and F. M. Green.

"Fertilizing Connecticut Tobacco," Agr. Exp. Sta., New Haven, Conn., Bul. 614, March 1958, H. C. de Roo.

"The Fertility Requirements of Ladino Clover and Orchard Grass," Agr. Exp. Sta., Univ. of Del., Newark, Del., Bul. 325, Jan. 1959, W. H. Mitchell and L. J. Cotnoir, Jr.

"A Survey of the Mineral Nutrition Status of Valencia Orange in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 604, Dec. 1958, R. C. J. Koo, H. J. Reizt, and J. W. Sites.

"Emerald—A New Early Blight-Resistant Pascal Celery," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-109, Sept. 1958, E. A. Wolf.

"Flordagrand, A New Blackberry for Home Gardens and Local Markets," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-112, Dec. 1958, J. S. Shoemaker, J. W. Wilson, and R. H. Sharpe.

"The Florida Foliage Plant Industry," State Dept. of Agr., Tallahassee, Fla., Agr. Econ. Rpt. 58-10, April 1958, C. A. Nicholls, C. N. Smith, and D. L. Brooke.

"Florida Pink, A New Gladiolus Variety for Florida," Agr. Exp. Sta., Univ. of Fla. Gainesville, Fla., Cir. s-113, Dec. 1958, R. O. Magie.

"Garden Chrysanthemums," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 182, May 1958, T. J. Sheehan and S. A. Rose.

"Grass Pastures in Central Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 484A, Sept. 1958, E. M. Hodges, D. W. Jones, and W. G. Kirk.

"Irrigation of Whiteclover-Pangolagrass Pasture for Dairy Cows," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 607, Feb. 1959, S. P. Marshall and J. M. Myers.

"Let's Grow A 4-H Garden," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 179, May 1958, J. D. Norton and F. S. Jamison.

"Onion Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 176, Feb. 1958.

"Pecan Growing in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 601, Oct. 1958, R. H. Sharpe and N. Gammon, Jr.

"Terrariums," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 149A, Sept. 1958, T. J. Sheehan.

"Vegetable Garden Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 104A, March 1958.

"Experiments on Culture and Varieties of Annual Larkspur," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Cir. N.S. 11, April 1958, D. V. Sweet.

"The Influence of Fertilization and Variety on Corn Yields in the Georgia Piedmont," Agr. Exp. Sta., Univ. of Ga., Athens, Bul. N.S.

55, Aug. 1958, H. D. Morris, A. A. Fleming, and G. M. Kozelnicky.

"The Influence of Irrigation, Rates of Nitrogen, and Interplanted Crops on Forage Production of Coastal Bermudagrass," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Cir. N.S. 12, Sept. 1958, J. L. Stephens and W. H. Marchant.

"Some Effects of Irrigation, Nitrogen and Plant Population on Corn," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Bul. N.S. 60, Feb. 1959, F. C. Boswell, O. E. Anderson, and S. V. Stacey.

"Sorgo For Silage and Syrup," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Lflt. 19, Aug. 1958, J. P. Craigmiles and J. P. Newton.

"Growing Broccoli in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 375, April 1957, Y. Nakagawa.

"Growing Carrots in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 378, April 1957, Y. Nakagawa.

"Growing Cauliflower in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 370, April 1957, Y. Nakagawa.

"Growing Celery in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 373, April 1957, Y. Nakagawa.

"Growing Lettuce in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 376, April 1957, Y. Nakagawa.

"The Mango in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 388, July 1958, W. Yee.

"Growing Oriental Cabbages in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 372, April 1957, Y. Nakagawa.

"Growing Sweet Corn in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 377, April 1957, Y. Nakagawa.

"Growing Sweet Potatoes in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 371, April 1957, Y. Nakagawa.

"Growing Tomatoes in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 374, April 1957, Y. Nakagawa.

"Watermelon Growing in Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 14, Hawaii, Cir. 386, Sept. 1957, Y. Nakagawa.

"Field Crops From Planting to Harvest," State Dept. of Agr., Springfield, Ill., Bul. 58-4, Dec. 1958, C. E. Rogers and J. A. Ewing.

"Flowering Gift Plants, Their Care and How to Rebloom Them," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 801, Sept. 1958, G. M. Fosler.

"An Easy Method for Germinating Flower Seeds," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 796, June 1958, G. M. Fosler.

"Growing Roses in Kansas," Agr. Ext. Serv., Kansas State College, Manhattan, Kansas, Cir. 268, Oct. 1958, C. R. Roberts and R. A. Keen.

"Garlic, How Louisiana Grows It," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Ext. Pub. 1218, Aug. 1957, J. Montelaro and A. C. Moreau.

"Growing Oats for Grain," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Bul. 465, May 1958, C. R. Blackmon.

"Midland Bermudagrass, A New Forage Grass for Maryland," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. 465, Jan. 1959, A. M. Decker.

"Mineral Nutrient Requirements of Cantaloupes," Agr. Exp. Sta., Univ. of Md., College Park, Md., Bul. A-93, June 1958, F. C. Stark and I. C. Haut.

"Potato Production in Michigan," Agr. Ext. Serv., Mich. State Univ., East Lansing, Mich., Ext. Bul. 351, Oct. 1958, D. L. Clanahan.

"Transplanting Shade Trees," Agr. Ext. Serv., Mich. State Univ., East Lansing, Mich., Fldr. F-250, Nov. 1957, H. Schick.

"Crop Production Guide for Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Pamph. 194, Rev. Feb. 1958, W. F. Hueg, Jr., L. D. Hanson, C. A. Simkins, C. J. Overdahl.

"Maturity Ratings for Corn Hybrids in Minnesota, 1959-60," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 20, Rev. Feb. 1959, E. H. Rinke, R. H. Peterson, N. C. Olmein, and J. C. Sentz.

"Perennials for Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 295, Feb. 1959, C. G. Hard.

"1959 Varieties of Farm Crops," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 22, Rev. Jan. 1959.

"Sources and Rates of Nitrogen," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 575, Feb. 1958, P. H. Grissom.

"Choice of Perennial Grasses for Forage Production and Erosion Control," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., CC 166, April 1958, H. H. Gilman, E. Peterson, and L. C. Newell.

"Corn and Grain Sorghum Fertilizer Experiments in Nebraska, 1958," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 76, Feb. 1959, W. E. Lamke, H. F. Rhoades, and P. H. Grabouski.

"Establishing Pastures in Nebraska," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., CC 165, May 1958, V. Youngman, W. Colville, and D. Lane.

"Lilies in Nebraska," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Sta. Bul. 442, March 1958, C. C. Wiggans.

"1957 Nebraska Corn Performance Tests," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir., 65, Dec. 1957, A. F. Dreier, J. H. Lonnquist, P. H. Grabouski, F. V. Pumphrey, and R. E. Ramig.

"Soil Fertility Practices for Alfalfa Production in the Central Platte Valley," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Sta. Bul. 444, March 1958, R. L. Fox, R. C. Lipps, A. W. Moore, and H. F. Rhoades.

"Using Temporary Pastures," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., CC 164, March 1958, H. Gorz, C. W. Nibler, and L. Peters.

A pretty young girl shocked some of her friends by announcing that she had decided to marry a wealthy widower, many years older than she.

"I think these May and December marriages are the bunk," declared one of her critical friends. "December is going to find in May the youth, beauty and freshness of spring, but what is May going to find in December?" she asked.

The bride-to-be smiled demurely, and answered, "Santa Claus!"

Aunt Nellie: "Well, Bobby, did you see Santa Claus last Christmas?"

Bobby: "No, auntie. It was too dark to see him, but I heard what he said when he knocked his toe against the bedpost."

Moe: "So you graduated from Barber's College? What was your college yell?"

Joe: "Cut his lip, Rip his jaw, Leave his face, Raw! Raw! Raw!"

Burglar—"What are you laughing at?"

Householder—"That you come at night without a light to look for money where I can't find any in broad daylight."

A farmer came home suddenly from town and found one of his hands kissing his wife. The hand let go and began packing up to leave.

"Where you goin'?" inquired the farmer.

"Back to town, I suppose. Guess you don't want me around after what happened."

"Don't you worry about that, Ed," said the farmer vehemently. "We'll both love her, and by golly, if we can't love her enough, I'll hire another man."

Telling some brides what they should know on their wedding night is like giving a fish a bath.

Worse than old and bent is young and broke.

Adversity is sometimes the rain of spring.

Never be boastful; someone may come along who knew you as a child.

A bird can roost on only one branch; a mouse can drink no more than its fill from a river.

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